TVA

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Kingston Ash Recovery Project
Groundwater Flow and Transport Model Report

Prepared for:
the Tennessee Valley Authority

Revision	Description	Date
00	Groundwater Model Report for TVA Team Review	June 29, 2011
01	Groundwater Model Report for Regulator Review	July 25, 2011

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List of Acronyms

˚F	degree Fahrenheit
µg/g	microgram per gram
µg/L	microgram per liter
ALD	anoxic limestone drain
ASTM	American Society of Testing Materials
CCP	coal combustion product
CERCLA	Comprehensive Environment Response, Compensation, and Liability Act
COC	constituent of concern
cm/s	centimeter per second
cy	cubic yard
DBS	Daniel B. Stephens & Associates, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EQuIS	Environmental Quality Information System
ERM	Emory River Mile
ft	foot
ft^3/d	cubic foot per day
FML	flexible membrane liner
Geosyntec	Geosyntec Consultants, Inc.
gpm	gallon per minute
HELP	Hydrologic Evaluation of Landfill Performance Model
in/yr	inch per year
Jacobs	Jacobs Engineering Group Inc.
K	hydraulic conductivity
Kd	partition coefficient
KIF	Kingston Fossil Plant
L/kg	liter per kilogram
Law	Law Engineering, Inc.
LIDAR	Light Detection and Ranging
MACTEC	MACTEC Engineering and Consulting, Inc.
meq	milliequivalents
mg/kg	milligram per kilogram
mg/L	milligram per liter
msl	mean sea level
mV	millivolt
NWS	National Weather Service
ORP	oxidation-reduction potential
pCi/g	picocurie per gram
pCi/L	picocurie per liter
PMET	Pittsburgh Mineral & Environmental Technology, Inc.
PVC	polyvinyl chloride
PWS	Perimeter Wall Stabilization
RECON	Remedial Construction Services, L.P.
SAP	Sampling and Analysis Plan
Singleton	Singleton Laboratories, Inc.
Stantec	Stantec Consulting Services, Inc.
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation

TDS	total dissolved solids
TVA	Tennessee Valley Authority
USGS	U.S. Geological Survey
VMOD	Visual MODFLOW

1. INTRODUCTION

1.1 BACKGROUND

On Monday, December 22, 2008, a Dredge Cell dike failure occurred at the Tennessee Valley Authority's (TVA's) Kingston Fossil Plant (KIF). The failure allowed a large amount of bottom ash and fly ash to escape into the adjacent waters of the Emory River and Swan Pond Embayment. On January 12, 2009, the Tennessee Department of Environment and Conservation (TDEC) issued an Order requiring action be taken as necessary to respond to the emergency. The TDEC Order required a plan for the comprehensive assessment of soil, surface water, and groundwater; remediation of impacted media; and restoration of all natural resources damaged as a result of the coal ash release. On May 11, 2009, an Administrative Order and Agreement on Consent was signed between the U.S. Environmental Protection Agency (EPA) and TVA providing the regulatory framework for the restoration efforts. EPA's Administrative Order directed the restoration work to be conducted under the Comprehensive Environment Response, Compensation, and Liability Act of 1980 (CERCLA) and more specifically, under the removal program. A significant portion of the recovery effort was completed in 2010 as a non-time-critical removal action. In accordance with Section IX.30 of the EPA Administrative Order, the *Kingston Fly Ash Recovery Project Non-Time Critical Removal Action Scope and Engineering Evaluation/Cost Analysis (EE/CA) Work Plan* (Jacobs Engineering Group Inc. [Jacobs] 2009) was prepared for performing one or more non-time-critical removal actions at the Kingston Ash Recovery Project site, hereinafter referred to as "the site". The EE/CA Work Plan concluded that significant data uncertainties exist in characterizing the river system, so that more study and time were needed for comprehensive assessment of ecological risk in the river system. It was agreed that two separate non-time-critical removal action decisions were appropriate, one for the Swan Pond Embayment/Dredge Cell area and the other for residual ash in the river system.

The *Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan (SAP)* (Jacobs 2010a) was approved by EPA and TDEC and specified the data-gathering efforts to support an EE/CA for the river system. The SAP addresses sampling and analysis of biotic and abiotic media, results of which will be used to assess potential human health and ecological risks, and support decision-making for the restoration of impacted areas. Contiguous ash deposits within the former Dredge Cell, the active Ash Pond, and the Lateral Expansion Area at the site will be closed under CERCLA as a single ash landfill. Based on a historical knowledge of groundwater flow patterns at the site, TVA indicated that groundwater in contact with ash in the closed landfill could be transported with shallow groundwater to the Emory River and Swan Pond Embayment. In addition, groundwater in contact with other ash deposits beneath the Settling Basin (Stilling Pond) and the Ash Processing Area (hereinafter referred to as the "Ball Field") ultimately discharges to the Emory River and the Plant Intake Channel. Therefore, the SAP includes provisions for subsurface sampling and groundwater modeling. Appendix C of the SAP provides the approach for development of the groundwater flow and transport model.

1.2 PURPOSE AND SCOPE

The goal of groundwater flow and transport modeling is to quantify ash-related constituent concentrations and mass loadings entering the Emory River and Swan Pond Embayment via groundwater seepage from ash source areas. These predictions will subsequently be used in evaluating potential long-term risks to human and aquatic receptors. The SAP (Jacobs 2010a) identifies constituents of concern (COCs) selected for transport modeling. These selected COCs include arsenic, mercury, chromium, selenium, radium-226, and thorium-228. Table 1-2.1 provides risk-based screening levels for COCs as prescribed in the SAP.

Before detailed calculations were performed, COC screening level evaluations were performed to assess their potential occurrence and mobility in the site groundwater. In 2011, Geosyntec Consultants, Inc.

(Geosyntec) prepared a white paper (Appendix G) to show that certain COCs (e.g., mercury, chromium, selenium, and thorium-228) are subject to natural attenuation at the site or occur at negligible concentrations such that transport modeling is unwarranted. These constituents are subject to natural attenuation by adsorption, ion-exchange, and chemical precipitation or exist at concentrations less than applicable risk-based screening levels. Geosyntec (2011) included an evaluation of historical and current laboratory analytical data for ash and ash leachate samples to assess the presence, frequency of detection, and concentration range of these constituents; an evaluation of ash porewater and groundwater concentrations of these constituents in recent samples (Jacobs 2011) collected within ash and underlying native media; an evaluation of historical analytical data for COCs from compliance groundwater monitoring; and geochemical modeling to assess the mobility and solubility of these constituents. Geochemical modeling used site-specific ash solids and porewater data, groundwater composition data, mineralogy, and hydraulic parameters. Based on this evaluation, mercury, chromium, selenium, and thorium-228 were screened out due to presence in ash at negligible concentrations, insufficient mobility in site groundwater, or both. Of these four constituents, selenium was carried forward in groundwater transport modeling considering its potential for bio-magnification by aquatic organisms.

Ultimately, COC fate and transport model simulations were for performed for arsenic, selenium, and radium-226. Initial development of a comprehensive three-dimensional groundwater flow model was necessary for calibration to 2010 known and measured field conditions using all available data. Because 2010 groundwater conditions at the site do not reflect potential long-term constituent flux to receiving waters following closure of ash disposal facilities (i.e., former Dredge Cells, Ash Pond, Stilling Pond, and Ball Field), concentrations of selected COCs (arsenic, selenium, and radium-226) in groundwater are predicted based on fate and transport model simulations. The groundwater flow model for future conditions is predicated on calibration of the flow model under 2010 conditions. Detailed transport modeling results of predicted COC mass fluxes to receiving waters have been developed for use in evaluation of long-term risks to human and ecological receptors exposed to either surface water or sediment porewater.

1.3 SITE LOCATION AND HISTORY

The site is located just off Swan Pond Road at the confluence of the Emory and Clinch Rivers on Watts Bar Reservoir in Roane County, near Kingston, Tennessee (Figure 1-3.1). Plant construction began in 1951 and was completed in 1955. The KIF plant has nine coal-fired generating units and the plant consumes some 14,000 tons of coal a day.

Ash, a by-product of a coal-fired power plant, is stored in unlined containment areas, including a former Dredge Cell (Figure 1-3.2). Failure of the Dredge Cell dike released about 5.4 million cubic yards (cy) of coal ash. At the time of the failure, the area contained about 16.2 million cy of ash and associated dikes. The dike failure caused about 60 acres of ash in the 127-acre containment area to be displaced (Figure 1-3.3). The released ash covered about 300 acres. Fly ash filled the Swan Pond Embayment on the north side of the site adjacent to the failed Dredge Cell. A temporary dike was constructed in the eastern portion of the Swan Pond Embayment to contain the fly ash to the west of the dike until a response action plan could be developed and implemented. Fly ash also entered the channel and overbank areas of the riverine section of the Emory River. AECOM (2009) provides a detailed chronology (origin to failure) of ash disposal operations at the site.

The fly ash that was released to the Emory River originates from the coal burned in boilers for power production at the KIF plant. The coal, in its natural state, contains various inorganics that can be retained with the ash after burning. The ash itself is primarily composed of fine silica particles similar to sand. Trace amounts of metals and naturally occurring radionuclides remain in the ash after coal combustion. These metals and radionuclides are typically sorbed to the ash.

2. RELEVANT SITE INVESTIGATIONS

The hydrogeologic data used in the present evaluation are partially based on numerous previous investigations conducted at the site from 1951 to 2009 (Section 2.1). These results were used in conjunction with other site field and laboratory data in developing model geometry and input parameters.

Current investigations specifically designed for developing geochemical and groundwater model input parameters are described in the SAP (Jacobs 2010a). Summaries of current investigations are provided in Section 2.2 with detailed results presented in Appendices A to H. Descriptions of laboratory analyses associated with the closed Ash Landfill Perimeter Wall Stabilization (PWS) are included in Section 2.2 and Appendices F and G since the groundwater model includes a boundary condition to represent the wall.

2.1 PREVIOUS INVESTIGATIONS

2.1.1 Siting Study

In 1951, Benziger and Kellberg performed the first subsurface investigation at the site which involved a siting study (Benziger and Kellberg 1951). This study was primarily focused within the area currently occupied by the KIF plant. In this area, alluvium does not overlie the Conasauga shale. Forty-one exploratory boreholes (Figure 2-1.1) were primarily used to identify top of bedrock and to visually classify the character of bedrock (e.g., weathering). Detailed boring logs were not produced. An exploratory trench and test pit were excavated as part of the investigation.

The 1951 investigation described the Conasauga as blue-gray shale with lenses of siltstone, limestone, and a few conglomerates. The ratio of shale to limestone in the area of the KIF plant site is 4:1 (80% shale). Limestone lenses were observed to vary in thickness from an inch to several feet. Bedrock dips to the southeast at an average of 45 degrees.

2.1.2 Soils Investigation Reports, Perimeter Dikes

In 1975, Singleton Laboratories, Inc. (Singleton) prepared a soils investigation report (Singleton 1975) for raising the perimeter ash storage area dikes. Borings (SS-1 through SS-20) were advanced around the perimeter of Dike C and North Dike as part of this exploration (Figure 2-1.1). Standard penetration test borings and undisturbed tube samples (US-1 and US-7) were taken for development of plans and profiles to raise Dike B and Dike C perimeter dikes. The laboratory testing program included geophysical tests on Dike C fill and foundation soils. In 1984, due to a seepage outbreak on Dike C slopes, Singleton completed 17 supplemental shallow auger holes (AH-1 through 17) and four test borings (SS-35 through SS-38) in the ash ponds and along Dike C (Singleton 1984). Soil gradation tests were performed on samples.

2.1.3 Groundwater and Ash Leachate Investigation

In 1980, as part of an EPA-sponsored study, Milligan and Ruane performed the first groundwater investigation at the site to examine the effects of coal ash leachate on groundwater quality. This study was initiated in 1976 with core sampling and monitoring well construction at eight locations, J1 to J8 (Figure 2-1.2). The “J” nomenclature was subsequently dropped and wells are referred to as 1 to 8. Soil samples were collected using a 2-inch diameter split-spoon sampler through a 12-inch outer diameter hollow-stem auger. Fourteen, four-inch diameter polyvinyl chloride (PVC) wells, screened over the lower 1.5 ft, were installed through the auger following core sampling. Wells were installed either singly or in staged multiple-well clusters. In addition, laboratory permeameter measurements of the horizontal and vertical components of hydraulic conductivity (K) were performed on selected core samples. Geochemical characterization of ash and natural media were conducted and column studies were performed to examine the potential for geochemical attenuation of ash-related constituents, particularly trace metals.

2.1.4 Site-Wide Groundwater Assessment

In 1991, Velasco and Bohac performed a site-wide assessment of groundwater conditions at the KIF reservation. In 1988, Law Engineering, Inc. (Law) installed single-well or multiple-well clusters at eight locations (wells 9 through 16) (Figure 2-1.2) as part of the investigation. Wells were constructed with 2-inch PVC casing and were screened over the lower 10 ft. These wells, and those installed in 1976, were sampled six times between 1988 and 1990 to examine spatial and temporal trends in groundwater quality at the KIF plant site. Constant-rate injection tests were performed at eight wells to determine bulk hydraulic conductivities of the overburden and shallow bedrock materials. These data were used in development of a groundwater flow model of the site. In addition, their investigations included an evaluation of the potential of geochemical attenuation of ash-related constituents.

In 1990, Pittsburgh Mineral & Environmental Technology, Inc. (PMET) conducted geochemical and mineralogical analyses on 20 soil samples collected adjacent to monitoring wells J1 through J6. Bulk X-ray diffraction analysis of eight samples indicated that clay minerals predominantly consist of kaolinite and illite with trace amounts of other minerals, all of which tend to adsorb cations present in groundwater. Iron oxides were detected at contents of 0.33 to 0.60%, and are also known to adsorb several metals (e.g., arsenic, chromium, and zinc). Soil cation exchange capacities ranging from 6.6 to 34 milliequivalents (meq)/100 grams were reported. Application of the MINTEQ geochemical speciation model using site soils data and representative chemical data for ash leachate indicated significant adsorption of arsenic, lead, and zinc. Attenuation of barium, chromium, and iron were predicted to occur by precipitation reactions (Velasco and Bohac 1991).

2.1.5 Ash Characterization Study

In 1993, Young et al. performed laboratory analyses of KIF plant fly ash for coal combustion product (CCP) characterization as part of an Electric Power Research Institute (EPRI) study (Young 1993). Lab analyses included particle size distribution, particle density, dry bulk density, saturated K, moisture retention characteristic curves, and diffusivity. Laboratory-derived properties were compared with field measurements to provide some degree of validity.

2.1.6 Soils Investigation Report, Expansion of Dredge Cells

In 1994, Singleton installed ten additional test borings (Figure 2-1.1) at the Site (SS-1 to SS-10), two undisturbed sample borings (US-1 and US-9), and four shallow auger holes (A-1 to A-4) as part of a vertical expansion of the former Dredge Cells (Singleton 1994). Singleton also performed laboratory geotechnical tests on fill and ash. Top-of-rock and groundwater level elevations were established at each location.

2.1.7 Characterization of TVA Fossil Plant Coal Combustion Products

In 1995, TVA retained Law to sample and test fly ash and bottom ash from fossil plant sites that included the KIF plant (Law 1995). Measurement of gradation, specific gravity, compaction, consolidation, strength, permeability and other physical properties of sluiced ash was completed on samples from Dredge Cells 1 and 3, and bottom ash from the flume that emptied into the Ash Pond. This work was done to aid vertical expansion design efforts.

2.1.8 Hydrogeologic Evaluation, Closure of Coal Combustion Product Facilities

In 1995, Boggs et al. performed a hydrogeologic evaluation for closure of the Ash Pond, three former Dredge Cells, and Stilling Pond (Boggs et al. 1995). The evaluation focused on the long-term impacts of the disposal area on local groundwater and surface water resources following facility closure. The study was initiated with an examination of local hydrogeologic conditions, groundwater quality, and groundwater use in the site vicinity. Hydrogeologic and water quality data were derived from previous groundwater investigations at the KIF plant site. Local groundwater use was established by a survey of residents within a two-mile radius of the disposal site. A water budget simulation of the closed facility was performed using the Hydrologic Evaluation of Landfill Performance-2 (HELP2) code (Schroeder et al. 1989) to quantify ash leachate production rates during a 30-year post-closure period (post 2015). The ultimate impact of the closed facility was evaluated using the predicted leachate discharge in conjunction with leachate chemical characteristics and groundwater flow patterns in the site vicinity.

2.1.9 Soils Investigation Report, Ammonia Receiving Facility

In 2001, Law performed a subsurface investigation at a proposed Ammonia Receiving Facility located near the Plant Intake Pumping Station (Law 2001). Five shallow (10.0 to 13.9 ft deep) exploratory borings (B-1 to B-5; Figure 2-1.1) were installed and falling-head permeability tests were performed on four shallow fill soil samples (two undisturbed and two remolded samples). Geophysical testing was also performed to evaluate foundation loading.

2.1.10 Soils Investigation Report, Arsenic and Selenium Attenuation Study

In 2004, S&ME, Inc, in support of a collaborative study between TVA and EPRI, installed six borings (A to F) within and perpendicular to Dike C of the Ash Pond (Figure 2-1.1). The study was designed to evaluate the natural attenuation of arsenic and selenium. Ash samples were collected from three boring intervals and all borings were completed as 2-inch PVC monitoring wells screened over the lower 5 ft. TVA subsequently elected to rescind participation in the study and the wells were abandoned.

2.1.11 Hydrogeologic Evaluation, Expansion of Coal-Combustion Byproduct Facilities

In 2004, Boggs and Julian performed a hydrogeologic evaluation for proposed expansion of KIF CCP disposal facilities within the three former Dredge Cells and Ash Pond for two possible disposal options (developed entirely on 2004 ash deposits). The first option considered future co-disposal of coal ash and gypsum derived from flue-gas desulfurization. The second option considered only coal ash. Evaluations addressed effects of proposed disposal facilities on local groundwater and surface water resources during both the operational and post-closure periods. To support the hydrogeologic evaluation, additional investigations were performed by MACTEC Engineering and Consulting, Inc. (MACTEC) and included 12 soil borings (Figure 2-1.1), installation and monitoring of three piezometers (Figure 2-1.2), field K testing at two locations, and laboratory K testing of two ash samples.

The evaluation focused on the effects of ash and gypsum leachate on stream water quality, since leachate from proposed disposal facilities would ultimately discharge to the Emory River. Estimates of maximum in-stream concentrations were performed for selected CCP-related constituents under plant-controlled low flow (84 cy ft/second) conditions. HELP and MODFLOW model simulations were employed to predict steady-state leachate seepage for both operational and closed conditions. Maximum cumulative COC stream loadings predicted for the Emory River during low flow conditions were not predicted to produce in-stream concentrations exceeding the drinking water standards (maximum contaminant levels) or aquatic life criteria except for ammonia under one disposal option. Worst-case ammonia concentrations were estimated to possibly exceed the criteria continuous concentration under coincident conditions of extreme pH, temperature, and low flow in the Emory River.

2.1.12 Soils Investigation and Aquifer Testing, Dredge Cells

The systematic upward progression of the former Dredge Cells was interrupted on November 6, 2003 when the west side perimeter dike developed seepage and there was a shallow slide near the base of former Dredge Cell 2 (Dike B) adjacent to Swan Pond Road. The TVA stopped dredging into Cells 1 and 2. To supplement the analysis, MACTEC installed 16 monitoring wells at nine locations (MW-1 to MW-9; Figure 2-1.2) for the purposes of water level monitoring and single-well aquifer testing. Wells were screened within fly ash, bottom ash, soil fill, and alluvium across two different cross sections of Dike B. In January 2005, TVA performed 13 slug tests and three pump tests to estimate bulk hydraulic conductivity for media intersected by the 16 wells. Results were supplied to TVA consultants for subsequent seepage analyses. Geotechnical analyses by Parsons Energy and Chemical Group, Geosyntec, and MACTEC were performed.

2.1.13 Geotechnical Evaluation and Design, Dredge Cells

On November 1, 2006 seepage and a surface slide occurred just south of the 2003 slope instability area on the west facing dike of former Dredge Cell 3. In response to this event, TVA stopped dredging into Cells 1 and 2 and continued to only fill the Phase 1 Emergency Dredge Cell. Geosyntec performed analyses and prepared designs that were implemented by TVA. Twenty-six shallow well points (WP01 to WP26) were installed by November 2006 with daily readings up to the date of Dredge Cell failure. In addition, 55 piezometers were installed along the west toe of the Dredge Cells to monitor groundwater levels (Figure 2-1.2). These piezometers were also monitored until the date of Dredge Cell failure. The majority of these well points and piezometers were destroyed by Dredge Cell failure.

2.1.14 Root Cause Analysis, Dredge Cell Failure

In 2009, AECOM performed a Root Cause Analysis of the December 22, 2008 Dredge Cell failure to determine the most probable cause(s) and location of failure at the site. AECOM conducted interviews, reviewed project files, performed site reconnaissance, drilled test borings, advanced piezocone probes, collected undisturbed samples, observed test pits, logged test trenches, performed laboratory testing and conducted seepage and stability analyses to define the probable failure mode leading up the sudden failure. Boring and well locations are shown on Figures 2-1.1 and 2-1.2, respectively.

Field investigations by AECOM included:

– 59 Standard Penetration Test borings
– 8 of the 59 borings included rock coring
– 25 of the 59 borings included inclinometer installations
– 21 piezometer locations with installation of 54 piezometers
– 48 vane shear with Shelby tube test borings
– 40 each 3-inch Osterberg tube sampling holes
– 87 Cone penetrometer test probes
– Cross-hole geophysical test borings
– Located, surveyed, and logged identifiable relics associated with the Dredge Cells
– Test trench on the south side of the Dredge Cell 1 dike

Field and laboratory analyses by AECOM (2009) were extensive. Where applicable, results were incorporated with other representative site data during model development.

2.1.15 Stability Evaluation, Dike C

In 2009, Stantec Consulting Services, Inc. (Stantec) performed an assessment of Dike C to evaluate geotechnical stability under static, long-term, steady-state conditions (Stantec 2009a). Seepage and slope stability were evaluated using engineering analyses to quantify factors of safety. In spring of 2009, subsurface data was collected to support analyses. In total, 54 soil borings and 21 cone penetrometer tests (STN-1 to STN-71) were advanced at locations along Dike C (Figure 2-1.1). Most of these borings were advanced from the crest of the dike or from a bench on the lower downstream face (crest of the original starter dike). Nine borings were completed on interior divider dikes within the Ash Pond. Instrumentation, consisting of six slope inclinometers and 20 piezometers, were installed in selected borings (Figure 2-1.2). Soil and ash samples collected during boring were tested in the laboratory to establish key index properties, as well as permeability and strength properties.

Stantec (2009b) documents engineering and construction observation efforts for emergency monitoring and stabilization of Dike D and an adjoining segment of Dike C. In addition to design and construction efforts, field tasks included the installation of eight piezometers (PZ-1 to PZ-8) and four slope inclinometers. Soil and ash samples collected during boring installation. Bottom ash (from the Bull Run Fossil Plant) and soil fill bulk samples were collected at approximately 5,000 cy intervals. Laboratory testing of ash and soil samples was targeted toward construction properties (i.e., soil classification, moisture content, Atterberg Limits, soil classification, grain size, and density).

2.1.16 Suitability Evaluation, Ash Processing Area (Ball Field)

In early 2009, Geosyntec was requested to evaluate the suitability of the Ash Processing Area (Ball Field) for temporary ash dewatering and storage. Field investigations included 47 borings (B-1 to B-47) to refusal (bedrock) across the Ball Field (Figure 2-1.1). The borings were installed by MACTEC in January 2009. Cone penetrometer exploratory probing was conducted by ConeTec to supplement site boring data.

2.1.17 Seepage and Stability Evaluation, East Dike

In 2010, Geosyntec performed a seepage and stability study to evaluate the current stability of the East Dike's southern end of the Ball Field (Geosyntec 2010a). As a part of the study, MACTEC personnel advanced six standard penetration test borings (A-1 to A-3, and B-1 to B-3) along two cross sections of the East Dike. Continuous split spoon samples were obtained during drilling. The borings were advanced to auger refusal depths to determine the general engineering characteristics of the subsurface conditions. Six 2-inch PVC wells (PZ-A1 to PZ-A3, and PZ-B1 to PZ-B3) were installed adjacent to each boring for the collection of groundwater level data (Figure 2-1.2). Selected split-spoon samples and Shelby tube samples were subjected to consolidated-undrained triaxial shear testing (four samples) and permeability testing (five samples) by MACTEC. Media tested included dike fill soil, alluvial clay, and ash.

The seepage and stability evaluation was later extended to include the north end of the East Dike (Geosyntec 2010b). Boring and monitoring well installation included the installation of six more standard penetration test borings and wells (C1A, C1B, C2, D1A, D1B, and D2; Figure 2-1.2) across two additional East Dike cross sections. MACTEC performed laboratory testing on selected split-spoon samples and Shelby tube samples. Because the previous South End Study included a broad laboratory testing matrix, the North End Study testing matrix was intended to determine whether subsurface materials encountered were of similar characteristics. The testing matrix for the North End Study included natural moisture content, Atterberg Limits, soil classification, grain size, and consolidated-undrained triaxial tests.

2.2 SAMPLING AND ANALYSIS FOR NON-TIME-CRITICAL REMOVAL ACTION

2.2.1 Ash Leaching Study

Sequential batch extractions and column leaching tests were performed by TVA to quantify arsenic, chromium, and selenium concentration variations as a function of ash leaching. Detailed results of the leaching tests are reported by Jacobs (2010b) and TVA (2011) in Appendix A. Control of moisture content in the ash is critical to successful dry ash stacking operations during closure of the Dredge Cell and Ash Pond. The addition of approximately 6% lime to the ash was considered as one method to assist in controlling the moisture content and drying out the ash. Although leaching tests were also performed for lime-treated ash, only the results for untreated ash were evaluated in the development of model transport parameters (e.g., partition coefficients).

EPA has proposed four new methods (Methods 1313 to 1316) for determining the leaching characteristics from coal ash and other landfilled materials. Although, the proposed new EPA leach tests are alternate leaching procedures that are under development in EPA research studies and have not yet been formally adopted, they were considered applicable for this study. Leaching tests described in Appendix A were as follows:

- Batch (Shake) Tests with Varying pH (Method 1313)
- Batch (Shake) Tests with Varying Liquid-Solid Ratio (Method 1316)
- Column Tests (Method 1314)
- Monolith Tests (Method 1315)

Batch (Shake) Tests with Varying pH (Method 1313)

Site-specific pH conditions at the site do not vary over a large range, with a mean of 6.7 and a range of 4.5 to 8.7. Therefore, leaching characteristics were tested at pH values of 5, 7, and 10. Each sample was prepared at a single liquid:solid ratio of 10:1. A composite sample of both untreated ash and ash mixed with lime (at 6% by weight) were tested. Because results of initial testing showed significant change in arsenic leaching behavior at pH of 10, an additional test was conducted on untreated ash at pH values of 7, 8, 9, 10, and 11 for arsenic and selenium.

Lab results (Appendix A) indicate that arsenic concentrations increase significantly at pH > 9.0 for untreated ash. Arsenic concentrations ranged from 18.2 micrograms per liter (ug/L) (pH of 5) to 702 ug/L (pH of 11). Results for selenium similarly show an increase at pH levels greater than pH 10 for untreated ash. Selenium concentrations ranged from 48.7 ug/L (pH of 5) to 134 ug/L (pH of 11).

Batch (Shake) Tests with Varying Liquid-Solid Ratio (Method 1316)

Batch testing via Method 1316 included a range of five liquid:solid ratios: 0.5, 1, 2, 5, and 10. Unbuffered deionized water was used as reagent water for each test. Results for untreated ash (Appendix A) indicate that arsenic concentrations increase by a factor of two as the liquid:solid ratio increases from 0.5:1 (34.7 ug/L) to 10:1 (58.2 ug/L). Results for selenium show a decrease in selenium concentrations with increasing liquid:solid ratio. For untreated ash, selenium concentrations dropped 10-fold as the liquid:solid ratio increased from 0.5:1 (305 ug/L) to 10:1 (21.8 ug/L).

Column Tests (Method 1314)

Leaching characteristics of ash from the site were tested by passing reagent water (unbuffered deionized water) through prepared columns of ash in an upflow configuration. Water was bubbled with nitrogen before use to remove dissolved oxygen. Flow rate through the columns was set at 1.3 milliters per hour (31.2 milliters per day) using syringe pumps order to simulate flow through ash in the closed Dredge Cell. The duration of column testing was forty days which resulted in an equivalent water flux of four pore volumes. This provided a cumulative liquid:solid ratio of 2.0 and a total of 10 samples collected from each column for analyses. Detailed results of column tests are provided in Appendix A.

Monolith Tests (Method 1315)

TVA (2011) prepared a supplemental report presenting results of monolith leaching tests. Construction of the foundation stabilization around the perimeter of the former Dredge Cell and Ash Pond may involve deep soil mixing of cement with the subsurface and native soil materials. A monolith leaching test was conducted on core samples taken from soil-cement columns constructed during a Deep Soil Mixing Pilot Test. The soil-cement columns were prepared using 10% Portland cement by weight and using in-place field mixing techniques. Two core samples were collected for testing: Column Core 1A (depth 30 ft; 10% Portland cement by weight), and Column 10 Run 9 (depth 40 to 45 ft; 7.5% Portland cement by weight).

Cumulative leaching time was 63 days. Leachate was analyzed for metals, including all COCs except mercury. Arsenic leachate concentrations for Column Core 1A reached the highest levels for the 7 to 28 day leaching period, up to 58 µg/L; concentrations then decreased down to 25 µg/L for the final leaching period ending at 63 days. Arsenic concentrations for Column 10 were approximately 5 to 10 times lower than for Column Core 1A. Selenium leachate concentrations were similar for both Column Core 1A and Column 10. Leaching concentrations were highest for the 7 to 28 day period, with concentrations decreasing for the later leaching periods.

Based on results of the monolith leaching test, TVA (2011) indicates that addition of cement may increase arsenic concentration in leachate, although results were inconsistent between the two tests. The higher arsenic concentrations initially observed in the Method 1315 test should not be environmentally detrimental, since these concentrations were transitory and subsequent arsenic levels decreased. TVA (2011) concludes that soil-cement mixed at up to 10% Portland cement by weight is acceptable for use in constructing soil-cement columns. Results indicate that there is no effect on leaching of selenium from soil-cement.

2.2.2 Field Hydraulic Testing

Appendix B describes field testing and in-situ results collected by TVA for assisting in the designation of model properties and calibration. Test results allow application of site-specific data and verification of historical site and regional data. Data types collected during field testing include site-wide temporal water level measurements, vertical gradient measurements, in-situ hydraulic conductivity measurements, and laboratory-based hydraulic properties of undisturbed samples. The planned testing design is outlined in Jacobs (2010a) and modified by the field change notices listed in Jacobs (2011).

Appendix B includes methods and results associated with well pump and slug testing, electromagnetic borehole flowmeter surveys, and water level and vertical gradient measurements across all hydrostratigraphic units. Sampling locations and methods for laboratory-based hydraulic properties of undisturbed samples are provided in Appendix B and analytical results are given in Appendix D. Sampling locations and methods for mineralogical characterization and geochemical analyses are also provided in Appendix B with analytical results residing in Appendix C.

2.2.3 Mineralogical and Chemical Characterization of Native Soils

In 2010, TVA collected nine samples of native soils for mineralogical and geochemical characterization by PMET to support geochemical modeling. Detailed characterization results are provided in Appendix C. Soil samples were obtained from five locations during the installation of wells for groundwater sampling as described in Appendix E. The soil samples were representative of alluvial clay, alluvial sand, and residuum. However, the two samples of residuum were noted to contain ash, which limited the use of results for this media type. Laboratory analyses of soil samples included the following:

Mineralogical Characterization

- Quantitative bulk mineralogy by x-ray diffraction and Rietveld whole pattern refinement
- Polarized light microscopy of polished sections

Chemical Characterization

- Percent free iron oxide per Chao & Zhou
- Cation exchange capacity
- Exchangeable cations
- Calcite equivalent soluble salts
- Soil pH

Mineralogical and geochemical data are summarized in later sections of this report.

2.2.4 Laboratory Characterization of Native Soils and Ash

In 2010, TVA collected 12 samples of native soils and three ash samples for laboratory analysis by Dan B. Stephens & Associates, Inc. (DBS 2010a,b,c) to support parameterization of the groundwater flow model. Detailed characterization results are provided in Appendix D. Soil samples were obtained during the installation of wells for groundwater sampling as described in Appendix B. The soil samples were representative of alluvial clay, alluvial sand, and alluvial gravel. However, one soil sample was noted to consist primarily of bottom ash. Laboratory analyses of soil samples included the following:

- Gravimetric moisture content
- Volumetric moisture content
- Saturated hydraulic conductivity
- Total porosity
- Effective porosity
- Specific gravity
- Dry bulk density
- Wet bulk density

Laboratory data are summarized in later sections of this report.

2.2.5 Porewater and Groundwater Sampling

In 2011, to support development of the groundwater transport model (e.g., source term development), porewater and groundwater sampling for COCs and other analytes was performed at 25 permanent monitoring wells and direct-push sampling locations. Sampling locations were selected to obtain a reasonable spatial distribution in the horizontal and vertical. Sampling depths were selected to target ash, alluvium, bedrock, and residuum. A detailed report describing the installation and location of wells, temporary well points, and direct push sampling is provided by Jacobs (2011) in Appendix E. Appendix E also includes a summary of sampling methods and results. Sampling locations are shown in Figure 1 of Appendix E.

Results of porewater and groundwater sampling conducted to support this modeling effort are provided in later sections of this report.

2.2.6 Mix Design Evaluation, Perimeter Wall Stabilization

As previously mentioned, construction of the PWS around the perimeter of the former Dredge Cell and Ash Pond initially considered use of deep soil mixing of cement with the subsurface and native soil materials. To evaluate cement-soil mixes that might be used for design, Remedial Construction Services, L.P. (RECON 2010) performed a series of lab analyses on mixes of ash, alluvial clay, and alluvial sand (Appendix F).

Portland cement was added at 7.5, 10, and 12% by dry weight of each mix. Lab analyses included unconfined compressive strength after 7, 14, and 28 days per American Society of Testing and Materials (ASTM) D1633. Selected samples were also subjected to laboratory analyses that included moisture content, grain size, Atterberg Limits, and wet and dry density. Hydraulic conductivity testing (ASTM D 5084) was performed on samples after 28 days.

2.2.7 Natural Attenuation of Chromium, Mercury, Selenium and Thorium-228

In 2011, as part of this project, Geosyntec (2011; Appendix G) prepared a white paper is to show that certain COCs (e.g., mercury, chromium, selenium, and thorium-228) are subject to natural attenuation at the Site or occur at negligible concentrations such that transport modeling is unwarranted. These constituents are subject to natural attenuation by adsorption, ion-exchange, and chemical precipitation or exist at concentrations less than applicable risk-based screening levels. The Geosyntec white paper included an evaluation of historical and current laboratory analytical data for ash and ash leachate samples to assess the presence, frequency of detection, and concentration range of these constituents; an evaluation of porewater concentrations of these constituents in recent samples (Jacobs 2011) collected within ash and underlying native media; an evaluation of historical analytical data for COCs from compliance groundwater monitoring; and an geochemical analyses to assess the mobility and solubility of these constituents at site conditions.

Mercury has never been detected in aqueous samples (porewater or groundwater) at the site. Results of historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, ash porewater, and groundwater illustrate that mercury almost always occurs at concentrations less than analytic detection levels. In recent sampling and analyses associated with the SAP, mercury concentrations were always less than analytic detection levels. Geochemical modeling indicates that conditions within ash are not favorable for dissolution and leaching of minute concentrations of mercury that might exist on ash. Furthermore, geochemical conditions of groundwater in the natural media underlying ash are not conducive to the dissolution and migration of mercury.

Results of historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, ash porewater, and groundwater illustrate that chromium groundwater concentrations almost always occur at less than the risk-based human health screening level (100 ug/L; Table 1-2.1). In recent groundwater sampling and analyses associated with the SAP, dissolved chromium concentrations were always less than the risk-based screening level and not detected (< 0.33 ug/L) in underlying alluvium and residuum. Geochemical modeling indicates that conditions within ash are not favorable for dissolution and leaching of chromium from ash. Furthermore, geochemical conditions of natural media underlying ash are not conducive to the dissolution and migration of chromium. Therefore, chromium is not a constituent evaluated in this modeling study.

Although ash samples from the failed Dredge Cells, embayment, and river contained thorium-228, porewater samples did not exhibit thorium-228 above the risk-based human health screening level of 0.159 picocuries/liter (pCi/L) (Table 1-2.1). The low solubility and mobility of thorium-228 at site pH and nondetection in ash porewater show that the thorium-228 can be expected to attenuate in groundwater.

Although selenium has been measured on ash solids at the site, historical groundwater concentrations at compliance wells have always been less than the risk-based screening level of 5 ug/L (Table 1-2.1). Recent sampling (Jacobs 2011) shows that dissolved selenium was not detected in the groundwater of underlying alluvial clay, sand or bedrock. Selenium concentrations in ash porewater suggest concentrations well below the risk-based screening level of 5 ug/L. Although two anomalous selenium concentrations were observed (GP13 and GP18), results suggest influences from an alkaline additive such as lime. Geochemical modeling of selenium at the site predicted selenium to be precipitated as elemental selenium with site geochemical conditions favoring natural attenuation.

3. SITE CONDITIONS

3.1 CLIMATE

According to the National Weather Service (NWS 2006), climate in the Kingston, Tennessee, region is warm during summer, when average daily temperatures tend to be in the 70's ºF, and cold during winter, when temperatures tend to be in the 30's ºF. The warmest month of the year is July with an average maximum temperature of 87 ºF, while the coldest month is January with an average minimum temperature of 25 ºF. Temperature variations between night and day tend to be moderate during summer with a difference that can reach 23 ºF, and moderate during winter with an average difference of 22 ºF.

The annual average precipitation at Kingston is 53.23 inches (NWS 2006). Rainfall is fairly evenly distributed throughout the year. The wettest months of the year occur between November and April, with highest average monthly precipitation in March of 5.70 inches. The driest months of the year occur in August through October.

In the absence of long-term precipitation records for the site, modeling efforts by Boggs and Julian (2004) utilized precipitation data from the National Oceanic and Atmospheric Administration station in Oak Ridge, Tennessee, located some 20 miles northwest of the site. A continuous 20-year period (1968-87) of daily precipitation data was selected. Annual precipitation for the period ranged from 38.8 to 76.3 inches and averaged approximately 52.9 inches.

3.2 TOPOGRAPHY AND BATHYMETRY

The KIF plant and the area affected by the ash release lie within the Valley and Ridge physiographic province, a region characterized by narrow, subparallel ridges and valleys trending northeast-southwest. Physiographic boundaries of the site are Pine Ridge to the west of the site, Swan Pond Creek drainage to the north, and the Emory River/Watts Bar Reservoir to the east and south. Ground surface topography varies from elevations of approximately 1,100 ft mean sea level (msl) along Pine Ridge to 735 ft msl at Watts Bar Reservoir. Early maps of the area indicate that the ash disposal area was formerly a flood plain of the Emory River.

3.2.1 Historical Topography (1924 and 1951)

Figure 3-2.1 shows a 1924 topographic survey of the flood plain area between Swan Pond Embayment and the original Emory River channel. The map shows 5-ft contour lines for the flood plain area in red. The river level at the time of the 1924 survey is below elevation 710, reported approximately six miles upstream of the site on the former Emory River, just downstream of Harriman, Tennessee. The Emory River floodplain elevations before construction of the site varied between approximately 725 and 735 ft msl (Figure 3-2.1).

Construction of the KIF plant began in 1951 and the first unit went on-line during February 1954. Figure 3-2.2 depicts a portion of TVA design drawing 10N400 showing topographic contours and layout of initial disposal area dikes. Originally, ash slurry discharged directly to the slack water area created by Watts Bar Reservoir via the gap between the East and North Dikes that formed the initial ash pond storage area. The gap allowed ash to commingle with waters of the reservoir. It was reported by TVA that by 1958 the northern 275-acre ash pond containment dike was completed. The initial ash pond dikes had a reported crest elevation of 748 ft. During the period of 1942 to 1954, the slack water embayment collected runoff silt and clay as bottom sediments over the permanently inundated flood plain. From 1954 to 1958 ash, river silt, and Dike C clay runoff was deposited over the slack water embayment. The pre-failure ash disposal area at site occupied the original flood plain and erosion surface depicted in Figure 3-2.2. Descriptions of disposal operations over time are provided by AECOM (2009).

3.2.2 2010 Topography and Bathymetry

Ground surface topography and bathymetry representing 2010 site conditions (Figure 3-2.3) are based on data from four different surveys. The vast majority of surface topography data were obtained from a high resolution aerial Light Detection and Ranging (LIDAR) survey performed on May 19, 2010 (Tuck 2010). LIDAR coverage did not include a relatively small area on the western portion of Pine Ridge situated within the model domain. For this area, TVA supplied high resolution ground topography from a survey performed on December 28, 2008. Bathymetry of the Emory River was obtained from a hydrographic survey performed on June 30, 2010. Plant Intake Channel bathymetry was derived from a hydrographic survey performed June 11 to 15, 1992. Merged data from the surveys was imported into the model to define ground topography and bathymetry for existing (2010) conditions.

Bottom elevation of the pre-failure Swan Pond Embayment area varied between 735 and 737 ft msl. After the failure, ash and intermixed soil filled much of the embayment to depths of more than 20 ft; 2010 top of ash elevations vary between 750 and 760 ft msl, although piles of ash up to elevation 790 ft msl are present. Within the former Dredge Cell, top of ash elevations vary between 740 and 820 ft msl.

3.2.3 Future (Closure) Topography and Bathymetry

Future plans for facility closure include the Ash Landfill, Ball Field, Ash Pond, and Stilling Pond as described in Section 4.1. Future geometry and ground surface topography (Figure 3-2.4) for the closed Ash Landfill was obtained from Stantec in the form of AutoCad files. As shown, the footprint of the closed Ash Landfill extends across the existing Ash Pond and upper elevations are anticipated to be near 790 ft msl. Future ground surface elevations for the closed Ball Field and Stilling Pond are based on discussions with TVA, Stantec, and Jacobs. For modeling purposes, assumptions of ground surface elevations for the closed Ball Field and Stilling Pond are 770 and 750 ft msl, respectively. An additional assumption is that these elevations are continuous horizontally across the extent of each facility.

Final design for Swan Pond Embayment area immediately north of former Dredge Cell 2 (Figures 1-3.2 and 1-3.3) has not been finalized. However, TVA indicated that planning considerations for the area involve restoration to pre-failure conditions. For the purposes of modeling (i.e., domain and boundary conditions), it was assumed that the Swan Pond Creek channel will be restored to its pre-failure location as shown on Figure 3-2.5. This is also referred to as the Diversion Channel on Figure 3-2.2.

3.3 SURFACE WATER HYDROLOGY

The Emory, Clinch, and Tennessee Rivers are waters of the United States and waters of the State of Tennessee. “Waters of the State” are defined by T.C.A. §69-3-103(33) and are classified by the Tennessee Water Quality Control Board for suitable uses. The three rivers have been classified for the following uses: domestic water supply, industrial water supply, fish and aquatic life, recreation, irrigation, livestock watering and wildlife, and navigation. The Tennessee River is the source of drinking water for the city of Kingston, Tennessee. The downstream Watts Bar Reservoir is used by several municipalities as a source of drinking water (Jacobs 2010a).

3.3.1 Emory River

The ash restoration area at the site is located on the west bank of the Emory River (Figures 1-3.2 and 1-3.3), 2.6 river miles above the confluence of the Clinch and Tennessee Rivers. Emory River flows are routinely measured at the U.S. Geological Survey (USGS) gauging station 03540500 at Oakdale, Tennessee located approximately 16 miles upstream of the site. The Emory River drains a watershed area of approximately 865 square miles with average flow rates between 700 and 1,300 cy ft/second (Jacobs 2010c). The river transitions from upstream riverine (river-like) reaches to more lacustrine (lake-like) conditions found in the impounded portions of Watts Bar Reservoir. The reservoir pool extends upstream to above Harriman, Tennessee near Emory River Mile (ERM) 11. The river reach most affected by the ash release extends from ERM 1.5 to 3.5 (Jacobs 2010b).

3.3.2 Clinch River

In accordance with the TVA Watts Bar Operating Guide, normal summer pool within Watts Bar Reservoir is maintained between 740 and 741 ft msl; normal winter pool is maintained between 735 and 737 ft msl. TVA River Operations indicated that Clinch River water level data obtained from the staff gage at the Kingston, Tennessee Water Treatment Plant Intake are more representative for the site than the TVA gage at Watts Bar Dam. Figure 3-3.1 shows the range and average of Clinch River water elevations at the Kingston Water Treatment Plant for the period from March 5, 1994 to September 8, 2010. Highest reservoir elevations (summer pool) extend from approximately May 15 to November 1, 2010 at the site. The average of mean daily summer pool elevations (1994 to 2010) exhibited in Figure 3-3.1 is 740.55 ft msl.

3.3.3 Swan Pond Creek/Embayment

The former Swan Pond Embayment (ERM 2.2) was a backwater slough of Watts Bar Reservoir (in the floodplain of Swan Pond Creek) during high reservoir elevations. The original channel of Swan Pond Creek and its rerouting (depicted by the Diversion Channel note) is shown on Figure 3-2.2. Swan Pond Creek is planned to be restored to its pre-failure conditions as shown on Figure 3-2.5.

3.3.4 Plant Intake Channel

The Plant Intake Channel (Figures 1-3.2 and 1-3.3) is a significant water feature at the site. The Plant Intake Channel allows withdrawal of water from the Emory River via the Plant Intake Pumping Station. Prior to the Dredge Cell failure in December 2008, a skimmer/diversion wall was located at the mouth of the Plant Intake Channel to divert cooler, deeper water into the channel. The skimmer wall was destroyed during the failure and has been reconstructed. Water levels in the Plant Intake Channel correlate with those of the Emory River.

3.3.5 Other Surface Water and Drainage Features

In 1987, TVA constructed an aerobic wetland to treat acidic water at the site. Three treatment cells (Cells 1 to 3) were installed along the northern portion of the East Dike as shown on Figure 3-3.2. In 1988, Cell 3 was converted to a compost-type marsh. In 1991, a 10 acre area immediately upgradient of the wetland was treated with a bactericide and reclaimed, an anoxic limestone drain (ALD) was installed parallel to the East Dike, and Cell 1 was converted to an oxidation basin. TVA (1998) describes of remediation of the anoxic limestone drain which discharges to the constructed wetland. According to TVA (1998), it appeared that the ALD was constricted between two test wells used in the investigation. This constriction caused the phreatic surface in the ALD and its surrounding clay to rise on the south side (i.e., the upgradient half of the ALD), creating nearly artesian conditions in the upgradient portion of the ALD. Exploratory auger holes were drilled to refusal (presumably shale bedrock) or to 6.5 ft below the bottom of the ALD. Drill cuttings were logged geologically and thickness of ALD limestone estimated using field logging techniques. Results were used to determine the extent and nature of the constriction, which was determined to be primarily a rise in the shale bedrock that was not excavated during construction and resulted in inadequate depth of the ALD. The ALD was repaired in 1994 and is the primary subject of this TVA (1998) report. Approximately 400 ft of the ALD were replaced to bypass the constriction. Stantec (2010) describes results of a stability analysis and buttress for Dike C (Segment A) in the immediate vicinity of the constructed wetland.

The railyard originally consisted of 21 tracks with a total length of 48,790 linear ft and temporary storage for 854 cars. TVA (1965) describes an extensive drainage system for the railyard (Figures 1-3.2 and 1-3.3). The railyard is described to cover an area of over 15 acres and is flat for operational purposes. For drainage, the subgrade was corrugated longitudinally with troughs on 28 ft centers, or between every other track. At approximately 300-ft intervals, concrete catch basins were placed in the troughs and connected with 18-inch diameter concrete piping. The catch basins were covered with cast iron grates and ballast material was shaped to provide for both open drainage and percolation. Initial ballast for the railyard consisted of blast furnace slag applied at a rate of 0.5 cy/ft of track. The yard is currently covered with limestone cobble, presumably added at a later date.

Temporary shallow drains, diversion ditches, and small impoundments have been installed at the site as part of restoration efforts. These features are included as model features as described in later sections of this report.

3.4 WELL AND BORING NETWORK

Near 400 soil/rock borings have been installed at the site since the 1951 construction. The earliest soil/rock borings were drilled at the current power plant site associated with the power plant construction (Benziger and Kellberg 1951). Subsequent soil/rock borings have been installed at the ash disposal ponds and along the dikes in associated with ash pond construction and expansion, geotechnical investigations, and groundwater quality studies (Milligan and Ruane 1980; Law 1988 and 1992; Velasco and Bohac 1991; Singleton 1994; Boggs et al. 1995; and Boggs and Julian 2004).

Numerous soil/rock borings were installed after the December 2008 ash release. The majority of these borings were associated with failure root cause analyses (AECOM 2009), stability studies (MACTEC 2009 and 2010), ash landfill design studies (Stantec 2009a,b and 2010), and background and risk assessment studies (TVA 2010).

3.4.1 Boring Network

A detailed lithological analysis was conducted for this modeling study. All available new and historical boring data were assembled and interpreted to construct a three-dimensional hydrogeologic model of the site.

Figure 2-1.1 shows the boring data used for the lithological analysis. The soil borings are grouped according to its data source. As shown in the figure, the majority of the borings are in the ash disposal areas. Boring log information, including coordinates, depths, elevations, and data sources, is provided in Appendix I. Interpretations of boring data are provided in ensuing sections of this report.

3.4.2 Well Network

Some of the site borings were converted into temporary and long-term monitoring wells. These wells have been used for groundwater level monitoring, water quality assessment, and other hydrologic studies. Among these wells, six are used for routine compliance monitoring. Several new wells were installed by TVA in 2010 (Appendix B) for hydraulic testing, to obtain information on geochemistry, and for water level monitoring.

Figure 2-1.2 shows known wells that have been installed within the study area. Some of the wells may have been abandoned or destroyed due to ash cell expansions, Dredge Cell failure, or by choice. The wells are also identified according to the data source and installation date. Most of the existing monitoring wells are located at the perimeters of the ash disposal areas.

3.5 GEOLOGY

3.5.1 Physiography and Regional Geology

The site is located near the western margin of the Valley and Ridge physiographic province of the Appalachian Mountains (Figure 3-5.1), which has developed on thick, folded beds of sedimentary rock deposited during the Paleozoic era. The regional northeast-southwest trending folded bedrocks control the shapes and orientations of a series of long, narrow parallel ridges and broader intervening valleys. The differing degrees of resistance to erosion of the shales, sandstones, and carbonate rocks comprised in the lithology determine local relief. In East Tennessee, this Valley and Ridge physiographic province is bounded by the Unaka Mountains of the Blue Ridge province to the southeast and by the Cumberland Plateau of Appalachian Plateau province to the northwest.

The rocks of the Valley and Ridge Province, ranging in age from Cambrian to Pennsylvanian, have been folded and faulted repeatedly by pressure from the southeast that built the Appalachian Mountains and a number of predecessor ranges (Figure 3-5.2).

Local physiographic boundaries of the site are Pine Ridge along the northwest margin of the site, Swan Pond Creek drainage to the north and the Emory River (Watts Bar Reservoir) to the east and south. Early topographic maps of the area (Figures 3-2.1 and 3-2.2) indicate the KIF plant ash disposal area was formerly a flood plain of the Emory River.

3.5.2 Bedrock and Structure

Bedrocks at the KIF ash storage area are the early Cambrian Rome Formation (beneath Pine Ridge) and middle to late Cambrian Conasauga Group that underly the ash disposal facilities (Moore et al. 1993). The Rome Formation consists of variegated shale, interbedded with siltstone, sandstone, and minor amounts of dolomite. The Conasauga Group is composed of a sequence of primarily shales with some interbedded limestones and dolomites. Although the Conasauga group has been subdivided into six formations based on mainly the dominant lithology in nearby Oak Ridge, Tennessee (Hatcher et al. 1992), the group has not been divided at the site.

The KIF ash storage area is underlain mostly by the Conasauga Group. The Rome Formation forms Pine Ridge to the northwest (Figure 3-5.3). These geologic units generally dip to the southeast at angles averaging 45 to 50 degrees (Benziger and Kellberg 1951).

A major structure, the Chattanooga Fault, traverses the area to the northwest of the ash disposal site, on the far side of Pine Ridge west of Swan Pond Road. The Chattanooga Fault trends southwest to northeast and is a low to moderate angle thrust fault with rocks of the Rome Formation thrust over the top of Knox Group. Rocks beneath the thrust fault have been overturned, resulting in complex stratigraphy beneath the site. The KIF ash storage area is located on the overthrust block (Figure 3-5.3). The Conasauga Group attains a thickness of over 800 ft toward the eastern side of the site.

Small-scale geologic structures, such as bedding fractures and solution features, are a major factor in the likely groundwater movement through the Conasauga Group underlying the KIF ash storage area. These bedrock features provide the pathways for groundwater flow through geologic formations that have little primary porosity and permeability. Fractures are well developed in all stratigraphic units and are the most pervasive structure based on the extensive studies at nearby Oak Ridge Reservation (Hatcher et al. 1992). The orientations of well connected fractures or solution conduits are predominantly parallel to geological strike and enhance the effect of anisotropy caused by layering, resulting in dominance of strike-parallel groundwater flow paths. Fracture aperture width and frequency generally decreases with depth in all formations and thus restricts the depth of active groundwater circulation.

At the ash disposal area, the color of the Conasauga shale near surface has been described mostly as gray, red, light green and dull purple. Conasauga shale observed in core recovered from borings ranged from dark green and greenish-gray, to black (AECOM 2009). Most recovered shallow shale samples are soft to moderately hard, fissile, and thinly bedded to finely laminated, with bedding dipping approximately 10 to 30 degrees from the horizontal. The shallow bedrock is highly fractured and permeable. AECOM (2009) corings (44 holes) indicated Conasauga bedrock weathering thickness that ranged from 0 to 11.5 ft and averaged 2.1 ft. Benziger and Kellberg (1951) corings (41 holes) indicated bedrock weathering thickness that ranged in thickness from 4.0 to 39.8 ft and averaged 16.6 ft.

3.5.3 Soils and Sediments

Because the KIF ash disposal area was formerly a seasonal flood plain of the Emory River, a mantle of predominantly alluvial soils and sediments resides above bedrock. The original soil beneath the ash disposal site consists of alluvial silts, clays, and sands deposited from frequent flooding. The soils are derived from weathering and runoff of inter-bedded sedimentary rock such as those found beneath and surrounding the site, and possible upstream areas.

Soil and alluvial sediment thickness is highly variable across the site, depending on the original landform and surface drainage features. The alluvial deposits are unconsolidated and heterogeneous mixtures of clay, silt, and sand that typically grade coarser with depth. The alluvial deposits can be divided into upper alluvial clay and lower alluvial sand/silt layers. Detailed discussion, based on available boring data at the site, is provided in Section 3.6.

3.5.4 Ash Disposal Chronology

Ash disposal activity at the area began in 1954 when the first unit at the KIF plant was operational. The initial ash disposal was to the initial ash pond storage area near the power plant at the current Ball Field area (AECOM 2009). The ash disposal activities since then expanded gradually to the pre-failure ash disposal area to the north of the site with construction of many ash pond dikes across the area. The ash and ash-soil fill present above alluvial soils are variable in thickness. Ash deposits consist of variable amounts of fly ash and bottom ash. Original ash pond dikes were typically constructed of combinations of fly ash, bottom ash, and silty clay soil.

3.6 HYDROGEOLOGY

Relevant hydrostratigraphic units underlying KIF ash disposal facilities include, in descending stratigraphic order: ash deposits, alluvial clay, alluvial sand, and Conasauga Shale bedrock. Residuum, fill soils, and the Conasauga Shale bedrock underlie areas southwest of the Ball Field. Pine Ridge (northwest of Swan Pond Road) is developed in the Rome Formation and is mantled by a relatively thin veneer of residual soil.

3.6.1 Hydrogeologic Units

A detailed three-dimensional mapping analysis was conducted to estimate the elevations of hydrogeologic units throughout the site. This involved the application of kriging interpolation techniques and historical topographic analysis to estimate the limits and elevations of these layers. Appendix I1 lists all the lithological data and interpolated elevations of units at the boring locations.

<u>Ash</u>

Ash is the dominant medium in the study area. However, detailed analyses of boring logs and examination of the historical reports associated with disposal activities indicates a heterogeneous mixture of ash types. Ash is distributed in the disposal areas as either fly ash, bottom ash, or a variable mixture of the two.

TVA indicated that stockpiling of bottom ash occurred for several years prior to installation of a 200-ft step-back from Dike C. The stockpiled bottom ash was likely used to develop a working platform for vertical expansion of the former Dredge Cell (elevation 740 to 770 ft msl) and interior dike construction. To represent the spatial distribution of the ash, a detailed analysis was conducted to map the fly ash-bottom ash relationship in three dimensions. Each applicable boring log was examined to obtain the vertical distribution (thicknesses) of fly ash and bottom ash, followed by interpolation of thicknesses for three intervals of ash deposition; 740 to750, 750 to 760, and 760 to 770 ft msl. Detailed data for this study is presented in Appendix I2. Figure 3-6.1, 3-6.2, and 3-6.3 shows the fly ash-bottom ash distribution at the 740 to 750, 750 to 760, and 760 to770 ft msl intervals, respectively. The contours shown on these figures represent the thickness of bottom ash within each of the 10-ft intervals.

<u>Alluvial Clay</u>

Alluvial clay underlies the ash in the disposal area. The alluvial clay layer includes a range of alluvial sediments composed primarily of clay and silt with minor sand content. Figure 3-6.4 shows the top of the alluvial clay based on results of the lithological analysis. The 1924 and 1951 pre-construction topographic maps were used to further define the extents of the alluvial deposition in areas where limited data were available.

<u>Alluvial Sand</u>

Alluvial sand layer generally occurs above the bedrock in the disposal area. The alluvial sediments are composed primarily of sand and lesser amounts of silt with minor clay content. Figure 3-6.5 illustrates the top of the alluvial sand underlying alluvial clay.

<u>Residuum</u>

Residuum is soil material formed from in-situ rock weathering. At the KIF ash disposal area, the residuum primarily occurs where the original surface elevations of the site were above the Emory River flood plain as shown in Figure 3-6.6. In these areas, the surface and shallow subsurface soils are products of weathered bedrocks of Conasauga Group shale and gently sloping portion of the Rome Formation based on available boring information and topographic map analysis. The residuum is mostly silty clay, typical weathering residue from shale interbedded with siltstone and limestone units. Along Pine Ridge, the weathered Rome Formation is directly exposed at ground surface.

Bedrock

The bedrock surface underneath the site is identified based on the boring data. Figure 3-6.7 shows the top of bedrock. Because of the relatively high permeability that might be associated with the bedrock weathered zone, it is expected that only the top portion of the bedrock may have some significant contribution to the local groundwater flow. The weathered bedrock zone is identified at some rock borings; however, documentation of the thickness of this zone is lacking in most boring logs. Hence, no separate weathered bedrock zone was included in model development. The bedrock is treated as single unit in the model.

3.6.2 Recharge and Net Infiltration

In undisturbed natural (vegetated) areas of East Tennessee such as the Pine Ridge portion of the site, Moore (1988) has improved the perception of groundwater recharge, indicating that the most important factor is the total time in which there is a perched water table in the stormflow zone. In natural areas, precipitation and infiltration first replenish any soil moisture deficit within the root zone of vegetation. After reaching field capacity, continued infiltration produces a saturated layer and a perched water table near the base of the stormflow zone. At this time, both lateral groundwater movement through the stormflow zone and vertical percolation through the vadose zone begin. A majority of water that enters the stormflow zone during the growing season is consumed by evapotranspiration, but virtually all deeper percolation reaches the water table and recharges the groundwater zone (Moore 1988).

A majority of groundwater recharge occurs during the non-growing season and soon thereafter (from about November to May). During periods of intense precipitation in the growing season, some recharge reaches the water table, and water levels rise in regional wells or show a slower rate of decline for a few days. However, the water levels in regional wells decline, although at a variable rate, throughout the growing season because most precipitation is captured by vegetation during this period. Annual low water levels in regional wells are reached in the fall, commonly between September and early December. Annual high water levels follow periods of prolonged or intense precipitation and normally occur sometime between December and early June.

The current level of data available for the site prohibits accurate quantitative evaluation of recharge across the ash disposal area. The primary problems include: (1) accounting for large water flows (i.e., pipelines and sluice channels) that are used to convey ash to temporary storage areas, (2) influence of ash dewatering in certain areas (e.g., Ball Field); (3) unknown flow rates of discharge sumps and ponds, (4) lack of streamflow data; (5) influence of surface drains and subdrains; and (6) effects of leaky underground water supply pipelines.

Boggs and Julian (2004) note shallow groundwater levels observed in local monitoring wells are largely controlled by reservoir stage and by recharge from adjacent ash-related impoundments. Consequently, natural variability of groundwater levels produced by seasonal differences in precipitation and evaporation is generally not discernable in temporal groundwater level records. Under present conditions, groundwater is derived from infiltration of precipitation, seepage from ash-related impoundments, and from lateral inflow along the western margin of the reservation.

3.6.3 Groundwater Occurrence

Prior to failure of the Dredge Cell, Boggs and Julian (2004) developed site potentiometric maps from water-level measurements in shallow monitoring wells primarily located outside of ash disposal areas. Based on these data, groundwater movement was described as generally eastward from Pine Ridge toward Swan Pond Creek Embayment, the Emory River and the Plant Intake Channel. Radial movement of groundwater away from surface impoundments was noted, including movement from former Dredge Cell 2 toward Pine Ridge. Continuous recharge by ash sluice water in the active ash pond and dredge cells produced local mounding of the water table that was largely undetected by peripheral monitoring wells.

Groundwater and surface water levels from 180 wells and piezometers were collected to support groundwater flow model calibration (Table 3-6.1). The measured data are based on a single, site-wide water level measurement event performed from July 28 to 30, 2010. These data were supplemented by surface water level measurements at the 34 locations shown on Figure 3-6.8 and provided in Table 3-6.2. Water level data were grouped according to screened media (i.e., ash, fill, residuum, alluvial sand, alluvial clay, and bedrock) and potentiometric plots were constructed.

The first occurrence of groundwater below ash disposal areas (i.e., Former Dredge Cell, Ash Pond, Stilling Pond, and Ball Field) is generally within the existing ash fill. Figure 3-6.9 depicts shallow groundwater levels at the site residing in ash, residuum and fill materials. Note that surface water data and boundaries were also used in the production of Figure 3-6.9. As shown, groundwater gradients trend easterly in areas of the Ball Field, Ash Pond, and Stilling Pond toward surface water features. In southern portion of the former Dredge Cells, shallow groundwater elevations are highest (near 766 ft msl) in the relict portion of Dredge Cell 1. Ground (ash) surface elevations in this vicinity are relatively high compared to other ash disposal areas (Figure 3-2.3). Potentiometric heads in this area exhibit a pseudo-radial configuration. The northern portion of the former Dredge Cell displays northerly hydraulic gradients. The lower groundwater elevations (near piezometer 502) are associated with surface drainage features (lower topography).

Figure 3-6.10 depicts potentiometric heads in alluvial clay beneath the site. Groundwater gradients in this unit are a subdued reflection of shallow groundwater gradient trends with a dominant easterly flow field. This is further illustrated on Figure 3-6.11 which includes higher spatial resolution in the monitoring network. Of interest in all three plots (Figures 3-6.9 to 3-6.11) is the overall agreement in hydraulic gradient trends and higher potentiometric heads associated with the relic portion Dredge Cell 1. Potentiometric mapping was not performed for bedrock (Conasauga shale) due to insufficient data.

Appendix B describes vertical gradient data that was collected in July 2010 from across the site to investigate potential groundwater exchange between the bedrock and natural (non-ash) overburden materials. Data to support vertical gradient calculations was collected from paired wells/piezometers in and around the proposed Ash Landfill with at least one well screened in the upper bedrock and one well screened in the lower section of the (non-ash) overburden.

Results suggest mostly upward vertical gradients at the foot of Pine Ridge, the primary source of lateral groundwater inflow to the shallow aquifer beneath the proposed Ash Landfill study area. Most of the well/piezometer pairings within the proposed Ash Landfill exhibit downward vertical gradients, probably associated with seepage from plant-related impoundments currently active in this area. Locations along the Plant Intake Channel, downgradient of the proposed Ash Landfill, show upward gradients from the bedrock to the overburden. Vertical gradient within the Ball Field facility are generally downward, as expected considering the processing of wet ash in this area.

3.6.4 Soil Chemistry and Mineralogy

Two chemistry and mineralogical characterization studies have been performed for site soils. Mineralogical testing of soil samples was performed by PMET (1990) for use in an attenuation evaluation by Velasco and Bohac (1991) as described in Section 2.1.4. Geochemical and mineralogical analyses were conducted on 20 soil samples collected adjacent to monitoring wells J1 through J6 (Figure 2-1.2).

Bulk X-ray diffraction analysis of eight soil samples (Table 3-6.3) indicated that soils consist of quartz-rich, micaceous silty to clayey materials which contain kaolinite, illite, chlorite and potentially interstratified smectite-illite minerals which tend to adsorb cations present in groundwater.

Chemical characterization data from PMET (1990) are provided in Table 3-6.4. Iron oxides were detected at contents of 0.33 to 0.60%, and are also known to adsorb several metals (e.g., arsenic, chromium, and zinc). Soil cation exchange capacities (Table 3-6.5) ranging from 6.6 to 34 meq/100 g were reported by PMET (1990). Table 3-6.5 also provides analytical results for major exchangeable cations (e.g., sodium, calcium, potassium, and magnesium).

To support geochemical modeling, nine soil samples of native soils were collected by TVA for mineralogical and geochemical characterization by PMET (2010) as described in Section 2.2.3. Sampling locations are shown in Figure 1 of Appendix E and included five locations (GP-16, GP-23, TWP-04, TWP-05, and TWP-06). Detailed characterization results are provided in Appendix C. The soil samples were representative of alluvial clay, alluvial sand, and residuum. However, the two samples of residuum were noted to contain bottom ash which limited the use of results for this media type. X-ray diffraction analysis of the nine samples (Table 3-6.6) indicated that soils consist of mostly quartz with trace amounts of feldspar and plagioclase in micaceous silt to clay matrix. The clay contains small amounts of crystalline kaolinite and mica with large amounts of non-crystalline amorphous clay material.

A mineralogical analysis of the sample material was also conducted using optical microscopy of polished cross sections. The sample material was de-slimed and mounted in epoxy to obtain polished sections. The sections were examined using an ore microscope with reflected light and an air objective with a polarizer. Images of opaque materials were recorded with a digital camera and are shown in Appendix C. The optical microscopy analysis found that ash particles were present in most samples. In particular, glassy ash was observed at 80 and 11% (by volume) in samples 5575-1 and 5575-8, respectively. These samples were initially collected to represent residuum.

Chemical characterization data from PMET (2010) are provided in Table 3-6.7. Iron oxides were detected at contents of 0.02 to 0.14%, lower than soil samples analyzed during 1990. Soil cation exchange capacities (Table 3-6.7) ranged from < 0.1 to 0.4 meq/100 grams, lower than soil samples analyzed during 1990. Table 3-6.7 also provides analytical results for exchangeable cations and soluble salts.

3.6.5 Geochemistry

To support development of the groundwater transport model, porewater and groundwater sampling for COCs and other analytes was performed at 25 monitoring wells and direct-push sampling locations. In the context of this report, porewater refers to those sampling results associated with ash horizons. Sampling locations and depths were selected to target ash, alluvium, bedrock, and residuum and to obtain a reasonable spatial distribution. A detailed report describing the installation and location of wells, temporary well points, and direct push sampling is provided by Jacobs (2011) in Appendix E. Sampling locations are shown in Figure 1 of Appendix E. For the purposes of geochemical modeling, groundwater data from bedrock wells GW-01 and GW-03 were excluded due to their upgradient locations.

<u>Ash</u>

Ash solids could potentially affect the pH of groundwater, thus enhancing or limiting the solubility and mobility of COCs. Arsenic and selenium form oxyanions that are more soluble at high pH and their sorption to metal oxides is limited at higher pH. Radium is generally less soluble and mobile at higher pH. Oxides represent the main constituents of fly ash. Ash oxide data collected at the site in December

2001 are provided in Table 3-6.8. Fly ash collected from the plant hopper (Table 3-6.8) is most representative of fresh, unweathered ash.

The alkaline portions of ash (Table 3-6.8) are the earth oxides (calcium oxide, magnesium oxide, and strontium oxide) and alkali metal oxides (sodium oxide and potassium oxide), with acidic components represented by the non-metal oxides (phosphorus oxide and sulfuric oxide) and major constituents of the ash (silica dioxide, aluminum oxide, and iron III oxide) being inert with respect to pH. Based on the relative amounts of these constituents in unweathered (i.e., hopper) ash, the ash has the potential to increase the pH of groundwater, but pH increases are limited due to buffering by aquifer solids and formation of secondary minerals. Contact of the fly ash with atmospheric carbon dioxide (an acid) and/or water during storage has the potential for neutralizing some of the ash alkalinity and enhancing the leaching of more soluble constituents.

Milligan and Ruane (1980) describe the first comprehensive ash and leachate sampling study performed at the Kingston site. Ash sampling included a single sample for arsenic (48 micrograms per gram [ug/g]) and three samples for selenium (<2 and 2.0 ug/g). Radium-226 was not a target analyte in their analyses.

Table 3-6.9 shows results of analyses performed by TVA's Environmental Chemistry Laboratory based on Toxicity Characteristic Leachate Procedure (TCLP) extracts of fly ash samples from the site in 1995 and 2002. The TCLP method is designed to determine the mobility of both organic and inorganic compounds present in liquid, solid and multi-phase waste under acidic conditions and to classify waste streams (hazardous or nonhazardous) for purposes of disposal in a landfill. As shown in Table 3-6.9, arsenic ranged from 320 to 920 ug/L and selenium ranged from < 1 to 67 ug/L for KIF plant fly ash samples under low pH (TCLP) conditions. Recent ash porewater sampling at the site indicates pH ranging from 4.4 to 11.5. However, three of these samples show elevated pH values (11.2 to 11.53) suggesting that lime (or other alkaline material) was admixed with ash in the immediate vicinity of the wells. Excluding these three outliers, the average pH from ash porewater sampling was circumneutral at 6.9. Hence, analytical results based on TCLP methods are not representative of actual field conditions and are expected to over-state the leaching potential of ash.

TVA, TDEC, and EPA performed soil and ash sampling in the former Dredge Cell, in the embayment, and at several private residences following the release. The objectives of the soil and ash sampling were to characterize the chemical nature of the ash, determine if the released ash resulted in residual impacts to native soil, and evaluate the potential threat of the released ash to human health and the environment. In addition, characterization of recovered ash was done to assess disposal options and to guide potential remediation activities. A summary of sampling locations, methods, and results is provided by Jacobs (2010a). Table 3-6.10 summarizes results for COCs. Additional sampling of ash (2009 to 2010) has been conducted prior to ash loading and offsite shipment by rail. A summary of these results for COCs is provided in Table 3-6.11.

Recent leaching studies performed for KIF ash are described in Section 2.2 and results are provided in Appendix A. As part of this study, total ash concentrations of target analytes were measured in the laboratory (Method SW846 6010B). Table 3-6.12 summarizes the results of those laboratory analyses for arsenic (58.5 milligrams per kilogram [mg/kg]) and selenium (not detected; <6.69 mg/kg); radium-226 was not a target analyte.

Figure 3-6.12 shows column leaching results for ash as a function of cumulative pore volumes eluted through the column. Boron is included for comparison since it is considered a conservative constituent (i.e., does not readily attenuate). As shown, arsenic concentrations in leachate from untreated ash increased from 2.9 μg/L in the first sample, to concentrations near 10 μg/L after approximately two pore volumes. Concentrations remained at this level through the final sample period, indicating that an equilibrium leaching rate had been reached near two pore volumes (cumulative liquid:solid ratio of 1.0). Leaching of selenium from untreated ash showed initial high concentration of 800 μg/L that decreased to 40 μg/L after two pore volumes. Concentrations continued to decrease slightly to a concentration of 33 μg/L.

It is important to note that pH values observed during the column leaching test ranged from 7.0 to 10.91 (Figure 2-2.1). Excluding data from three outlier samples, the pH of recent ash porewater sampling exhibits an average value of 6.9. Because the recent porewater data represent actual conditions within the ash, this circumneutral pH is expected to be most representative of field conditions within the ash fill. Although ash solids data collected during leaching tests are useful for geochemical modeling to estimate COC partition coefficients, the disparity in column leaching test conditions (Jacobs 2010b) and field conditions limits the application of test results for alternative reactive transport modeling. Application of all column leaching test results (e.g., COC concentrations with time) for development of sorption isotherms or reactive transport modeling could overestimate COC solubility and mobility.

Porewater concentrations of the constituents of concern in ash are useful because they provide a site-specific measure of ash leachate source term for transport modeling. Porewater concentrations from eleven ash samples are summarized in Table 3-6.13. Porewater concentrations of arsenic ranged from 3.9 to 915 ug/L, exceeding the risk-based human health screening level criterion for arsenic (0.018 ug/L). Section 3.7 describes use of porewater results in developing initial arsenic concentration distributions and the transport model source term.

Chromium concentrations in ash porewater (<0.33 to 0.51 ug/L) are well below the risk-based human health screening level for chromium of 100 ug/L (Table 1-2.1) for all eleven samples. As indicated in Appendix G, historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, porewater, and groundwater illustrate that chromium groundwater concentrations almost always occur at less than the risk-based human health screening level (100 ug/L). As shown in Table 3-6.13, dissolved chromium concentrations were always less than the risk-based screening level and not detected (< 0.33 ug/L) in underlying alluvium and residuum. Geochemical modeling described in Appendix G indicates that conditions within ash are not favorable for dissolution and leaching of small concentrations of chromium that might exist on ash. Furthermore, geochemical conditions of natural media underlying ash are not conducive to the dissolution and migration of chromium.

Mercury was not detected in the ash porewater samples (Table 3-6.13) in excess of analytic detection levels (0.15 or 0.2 ug/L). This value near the risk-based human health screening level for mercury of 0.05 ug/L (Table 1-2.1). As indicated in Appendix G, mercury has never been detected in aqueous samples (porewater or groundwater) at the site. Results of historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, porewater, and groundwater illustrate that mercury almost always occurs at concentrations less than analytic detection levels. Porewater sampling indicates that mercury concentrations were always less than analytic detection levels in ash and underlying media. Geochemical modeling (Appendix G) indicates that conditions within ash are not favorable for dissolution and leaching of minute concentrations of mercury that might exist on ash. Furthermore, geochemical conditions of groundwater in the natural media underlying ash are not conducive to the dissolution and migration of mercury.

Radium-226 was detected above analytic detection levels in 3 of 11 ash porewater samples (Table 3-6.13). Concentrations of radium-226 ranged from < 0.352 to 2.35 pCi/L. Section 3.7 describes the use of porewater results in developing initial radium-226 concentration distributions and the transport model source term.

Selenium concentrations in ash porewater ranged from nondetect (<0.33 ug/L) to 19.6 ug/L. Only two of the eleven samples (GP13 and GP18) were above the risk-based ecological screening level of 5 ug/L, with the remainder of the samples below 1 ug/L. Field parameters were available for the GP18 sample but were not collected for GP13. These data suggest that lime (or other alkaline material) was admixed with ash in the immediate vicinity of the GP18 sample location. GP18 exhibited a pH of 11.5, compared to the average ash pH of 6.5. High pH enhances the solubility of selenium and other data suggest that the elevated pH originated from non-ash sources. The GP18 sample had a calcium /magnesium ratio of >896, compared to the ash porewater ratio range of 3.8 to 11 and a calcium /sodium ratio of >210, compared to the ash porewater ratio range of 11 to 70. The GP18 oxidation-reduction potential (ORP) was 129 millivolt (mV), similar to the ash average ORP of 177 mV, so the GP18 pH increase is attributable to an alkaline material that is not redox active, such as lime, admixed into the ash. ORP and pH data are not available for the other well with an elevated selenium concentration (GP13), but it also exhibited depleted magnesium and sodium concentrations, suggesting a similar cause for the elevated selenium concentration. Because these elevated pH data were localized, natural buffering is expected to neutralize the elevated pH within short distances. As described in Appendix G, selenium concentrations at compliance wells have always been less than the risk-based screening level of 5 ug/L. Dissolved selenium was not detected in the groundwater of underlying alluvial clay, sand or bedrock (Table 3-6.13). Geochemical modeling of selenium at the site predicted selenium to be precipitated as elemental selenium with site geochemical conditions favoring natural attenuation. Section 3.7 describes the use of porewater results in developing initial selenium concentration distributions and the transport model source term.

Radium-226 was detected in 3 of 11 ash porewater samples as shown in Table 3-6.13. Ash porewater concentrations ranged from 0.617 to 2.35 pCi/L. Detections of radium-226 were also observed in single samples of alluvium (1.02 pCi/L) and bedrock (0.283 pCi/L). Two samples of residuum exhibited radium-226 above analytic detection levels (0.941 and 1.58 pCi/L). Considering the very low risk-based human health screening level for radium-226 (0.000816 pCi/L), this COC was included in groundwater transport simulations. Section 3.7 describes the use of porewater results in developing initial radium-226 concentration distributions and the transport model source term.

As shown in Table 3-6.13, thorium-228 was not detected above analytic detection levels which were below the risk-based human health screening level of 0.159 pCi/L. As described in Appendix G, the low solubility and mobility of thorium-228 at site pH and nondetection in ash porewater show that the thorium-228 can be expected to attenuate in groundwater.

Native Media

Groundwater at the site is present in several different geologic media: **ASH,** alluvial sand, alluvial clay, residuum, and bedrock. Because the geochemistry of each of these zones can vary due to different minerals present, each is considered separately in geochemical evaluations. Table 3-6.14 lists the groundwater compositions used for each zone in geochemical calculations and modeling. Composition data were derived from PMET (1990 and 2010).

Based on available data for groundwater in alluvial sands, the groundwater is calcium-magnesium bicarbonate water with a total dissolved solids (TDS) concentration of approximately 500 to 700 milligrams per liter (mg/L). Based on iron concentrations and pH data, the groundwater is saturated with iron oxide (hematite, iron III oxide). This means that there is iron oxide present in the aquifer solids. Analysis of alluvial sand samples (Tables 3-6.4 and 3-6.7) showed a range in free iron oxide from 0.05 to 0.6% free iron oxide, a potentially sorbing surface (Dzombak and Morel 1990).

Available groundwater data for the alluvial clay is similar to the alluvial sand data because wells often sample both. The alluvial clay groundwater is calcium-magnesium bicarbonate water with a TDS concentration of approximately 500 to 700 mg/L. The water is saturated with respect to iron oxide (hematite), so iron oxide is a component of the aquifer minerals in the alluvial clay. Analysis of seven alluvial clay samples (Tables 3-6.4 and 3-6.7) showed a range of 0.02 to 0.2% free iron oxide.

Groundwater in residuum is calcium sulfate-bicarbonate type water with a TDS concentration of approximately 400 to 600 mg/L. Based on iron and pH data, it is saturated with respect to iron oxide, so iron oxide is most likely a component of aquifer minerals in the residuum. Analysis of nine residuum samples showed a range of 0.0 to 0.238% free iron oxide.

Based on available data, the bedrock groundwater is sodium bicarbonate type water, with a TDS concentration of approximately 450 to 650 mg/L. Based on iron oxide concentrations and pH data, the groundwater in bedrock is saturated with respect to iron oxide, this suggests that iron oxide is most likely a significant component of aquifer minerals in the residuum derived from bedrock weathering. Site specific data for free iron within the Conasauga bedrock were unavailable. Jardine et al. (1989) used the dithionite-citrate-bicarbonate extraction method to measure free iron oxide (25.8 grams per kilogram) within saprolite of the Conasauga at Oak Ridge, Tennessee.

Potential geochemical interactions of the COCs were evaluated under aquifer geochemical conditions to screen the constituents and aquifers for conditions that could limit constituent solubility/ mobility. Such conditions would include potential pH-induced immobilization processes for constituents with low solubility (hydr)oxides, such as mercury and thorium-228; potential redox-induced immobilization processes for some constituents, such as arsenic, chromium, and selenium; and sorption to iron oxides, as can occur with arsenic. This was considered especially important for potential redox-induced processes in ash because the batch leaching tests of ash used ash and extractants that were aerated and the redox potential was not controlled to represent aquifer conditions during the tests. This could have enhanced the leaching of arsenic, chromium, and selenium from the ash relative to actual field conditions at the site.

The discussion below summarizes potential immobilization processes for COCs under site groundwater conditions. Appendix G presents a detailed discussion for chromium, mercury, selenium, and thorium-228.

Arsenic can undergo both redox-induced immobilization and immobilization due to sorption to iron oxide surfaces. At redox potentials where sulfate is reduced to sulfide, arsenic can be immobilized as the arsenic sulfides orpiment and realgar. Arsenic is also known to be strongly sorbed to iron oxide surfaces, and desorption of sorbed arsenic is a process thought to contribute to high natural arsenic concentrations in groundwater in Bangladesh (Nickson et. al. 2000). The redox potential of groundwater in the alluvium, residuum, and bedrock is not sufficiently low for sulfate-reducing conditions so that immobilization due to formation of arsenic sulfides is not likely. However, because the groundwater data are consistent with the presence of iron oxide in aquifer minerals in all groundwater zones, immobilization by sorption to iron oxides is a realistic immobilization process for arsenic at the site.

The surface of iron oxide tends to sorb elements that commonly exist as oxyanions, such as arsenic and phosphorous. Dzombak and Morel (1990) present equilibrium expressions that relate the amount of arsenic sorbed to the dissolved arsenic concentration, the pH, the amount of iron oxide, and other parameters. These data are commonly used in calculations and geochemical modeling (HydroGeoLogic, Inc. 1998). Because the fraction of the total arsenic that is immobilized by sorption is not controlled by one or two simple intensive variables like pH or ORP, evaluation of the degree of immobilization requires geochemical modeling calculations. However, sorption of arsenic to iron oxides remains a realistic immobilization process at the KIF plant.

Manganese and aluminum oxides are also known to sorb arsenic (Deschamps et al. 2005), but characterization data associated with these processes have not been developed for use in geochemical calculations.

Selenium can be immobilized by redox-potential induced processes. Selenium is commonly present in groundwater as selenite (SeO3). At ORP values below approximately 250 to -50 mV (between pH 5 and 10), selenite is reduced and insoluble selenium minerals are formed, immobilizing the selenium. This process is commonly used to treat water for selenium in artificial wetlands and in situ remediation (Powicki 1997). Groundwater ORP values at the site are consistently below 100 mV, so site groundwater is conducive to this process. The geochemistry of selenium is discussed in more detail in Appendix G.

3.7 CONSTITUENT OF CONCERN SPATIAL DISTRIBUTION

These six original COCs are naturally-occurring and have been concentrated in the ash through the coal combustion process. Ash solid concentrations of these constituents were obtained from the KIF Environmental Quality Information System (EQuIS) database and are summarized in Table 3-7.1. The average detected concentrations are 56.37 mg/kg for arsenic and 4.936 mg/kg for selenium. Radium-226 (gamma) exhibits an average concentration of 4.032 picocuries per gram (pCi/g). These data are not location-specific; however they provide an average composition of ash over the site.

To support development of the groundwater transport model (e.g., initial concentration distribution), porewater and groundwater sampling for COCs and other analytes was performed at 25 permanent monitoring wells and direct-push sampling locations. Sampling locations were selected to obtain a reasonable spatial distribution in the horizontal and vertical. Sampling depths were selected to target ash, alluvium, bedrock, and residuum. The complete data set is tabulated in Appendix J. Based on geochemical studies discussed above, only arsenic, selenium, and radium-226 are carried forward in transport modeling. The spatial distribution of the three COCs will be discussed in detail below. Table 3-6.13 provides results of porewater/groundwater sampling.

Natural background concentrations of the three COCs were determined from sampling of bedrock wells KIF-AD1, GW-01, GW-02, and GW-03 upgradient of the ash disposal areas. The background value for arsenic is 0.45 ug/L, 0.33 ug/L for selenium, and 0.941 pCi/L for radium-226.

The porewater and groundwater data were evaluated based on its sampling media and location. Due to uncertainties in well screen intervals and screens penetrating both alluvial clay and alluvial sand, it is impossible to distinguish results between alluvial clay and sand. Therefore, analytical results for these two units are identified as the composite “alluvium”. The distribution within each media (ash, alluvium, and bedrock) was evaluated individually as described below.

3.7.1 Arsenic

The porewater concentration distribution of arsenic in ash is shown in Figure 3-7.1. Porewater concentrations of arsenic ranged from 3.9 to 915 ug/L, exceeding the risk-based human health screening level criterion for arsenic (0.018 ug/L). The highest ash porewater concentration was 915 ug/L at sampling location GP-15. The highest arsenic concentration observed in alluvium groundwater was 594 ug/L. There was a very low detection of arsenic in the bedrock (Table 3-6.13). Figure 3-7.2 shows the arsenic distribution in alluvium. The data suggests that the arsenic groundwater concentration is primarily in the ash strata and its downward migration to the bedrock seems to be limited likely due to the presence of alluvial clay beneath the site.

3.7.2 Selenium

Selenium is detected only in the ash strata where it exhibits concentrations above the detection limit of 0.33 ug/L. Selenium concentrations in ash porewater ranged from nondetect (<0.33 ug/L) to 19.6 ug/L. Only two of the eleven samples (GP13 and GP18) were above the risk-based ecological screening level of 5 ug/L, with the remainder of the samples below 1 ug/L. Figure 3-7.6 shows the distribution of the selenium in ash.

3.7.3 Radium-226

Radium-226 was detected in 3 of 11 ash porewater samples as shown in Table 3-6.13. Ash porewater concentrations ranged from 0.617 to 2.35 pCi/L. Detections of radium-226 were also observed in single samples of alluvium (1.02 pCi/L) and bedrock (0.283 pCi/L). Two samples of residuum exhibited radium-226 above analytic detection levels (0.941 and 1.58 pCi/L). Figures 3-7.3, 3-7.4, and 3-7.5 show the radium-226 distribution in the ash, alluvium, and bedrock, respectively.

4. CONCEPTUAL MODEL

A conceptual model is an interpretation of the characteristics and dynamics of an aquifer system based on an examination of all available hydrogeologic data for a modeled area. This includes assumptions on the hydrostratigraphy, material properties, dimensionality, and governing processes. The development of a proper conceptual model for a particular problem is one of the most important steps in a modeling study. The key to proper conceptualization of a real-world system is to avoid oversimplification or undersimplification (Zheng and Bennett 1995). An oversimplified conceptual model fails to capture essential features of the real-world system, leading to a numerical model that is incapable of simulating observed field conditions. On the other hand, an undersimplified conceptual model tends to make the numerical model too complex and too computationally demanding to be useful as an effective tool.

To develop a groundwater flow and transport model, the first step is to define the hydrogeologic framework for the flow component of the model. Once a robust and reliable groundwater flow model is established, the transport component of the model can be developed. The subsections below discuss the site-specific conceptual model development for the Ash Landfill.

4.1 2010 VERSUS FUTURE CONDITIONS

Calibration of the steady-state groundwater flow model encompasses site conditions during 2010. During this period, active dredging of the river system was just completed and the Rim Ditch/Sluice Trench ash recovery system was still present in the Ball Field (TVA 2009). Ash was being recovered from the ditches and windrowed for dewatering to appropriate moisture levels for transport and disposal via rail. A frame-and-filter dewatering system was also employed for ash dewatering. Supernatant water generated during the dewatering process was routed through the Ash Pond and Stilling Pond for additional settling of solids and discharged through an existing outfall. Initial efforts were beginning for retrieval of ash located in areas of the Swan Pond Embayment.

The groundwater flow model representing future (closed) site conditions includes the closed Ash Landfill, leveled and capped Ball Field area, and leveled and capped Stilling Pond. In addition to capping of the closed Ash Landfill, a foundation stabilization wall is to be installed. There are distinct differences between model simulations under 2010 and future conditions. These primarily relate to the geometry of ash fill areas, recharge, and model boundary conditions as described in the following paragraphs. Model cells falling within receiving waters (i.e., Swan Pond Embayment, Emory River, and Plant Intake Channel) are assigned hydraulic boundary conditions that allow prediction of cell-by-cell inflow rates and COC concentrations for groundwater emerging through the reservoir bottom sediments.

4.2 2010 CONDITIONS

4.2.1 Overview

The steady-state groundwater flow model based on 2010 site conditions includes detailed topography and bathymetry data as described in Section 3.2.2. The ground surface at this time includes relic ash features in both failed and non-failed portions of the site. The Swan Pond Embayment is infilled with ash and a temporary diversion channel exists to route stream flow to the Emory River. The rim-ditch/sluice channel, Ash Pond, and Stilling Pond are operational under 2010 model conditions. The ground surface is recipient to direct recharge from precipitation and seepage from water bodies (e.g., Ash Pond and Stilling Pond) under 2010 model conditions with no reductions in recharge due to capping.

4.2.2 Geometry

Figure 4-2.1 illustrates three-dimensional geometry based on the 2010 site conditions. The model domain is depicted by the red line and significant site features are labeled. Boundaries of the model domain generally follow natural hydrologic boundaries, including Pine Ridge and the reservoir. These boundaries represent hydrologic divides across which no shallow groundwater flow occurs. As shown, the model boundary is conceived as: the top of Pine Ridge along the northwest; the Swan Pond Creek diversion channel to the north; the Emory River thalweg along the east, the Plant Intake Channel thalweg along the southeast (from the Emory River to the Plant Intake Pumping Station); and a straight line from the top of Pine Ridge to the Plant Intake Pumping Station along the southeast.

The hydrogeologic framework incorporates the following distinct media types based upon boring logs at the site:

- *Fly Ash*: exists in failure ash flow areas to north and non-failed areas of ash disposal facilities;
- *Bottom Ash*: exists in non-failed areas of ash disposal facilities
- *Alluvial Clay*: resides beneath all ash disposal facilities and is incised by the Emory River and the Plant Intake Channel
- *Alluvial Sand*: resides beneath all ash disposal facilities and is incised by the Emory River and the Plant Intake Channel
- *Conasauga Bedrock*; resides beneath all ash disposal facilities
- *Rome Bedrock*; underlies Pine Ridge
- *Residuum*; overlies bedrock along gentle slopes of Pine Ridge and in a region southwest of the Ball Field

Detailed spatial distributions of these media within the model are provided in Sections 3 and 6 of this report. An arbitrary thickness of 50 is assigned to bedrock in order to keep the lower model boundary below the expected penetration depth of ash-related constituents in accordance with the SAP (Jacobs 2010a).

4.2.3 Relevant Features

Relevant site features important to model calibration under 2010 conditions are shown in Figures 1-3.2 and 4-2.1. Significant features containing fly ash and bottom ash include:

- Former Dredge Cell
- Ball Field
- Ash Pond and Phase 2 Lateral Expansion Area
- Stilling Pond
- Swan Pond Embayment

Important site features requiring hydraulic boundary conditions under the 2010 model scenario are shown in Figures 1-3.2 and 4-2.1 and are further described in Section 6 of this report. These features include:

- Emory River
- Plant Intake Channel
- Stilling Pond
- Ash Pond
- Sluice Trench
- Swan Pond Creek Diversion Channel
- Red Water Channel

– Constructed wetlands
– Temporary ponds and dewatering features
– Shallow drains

4.3 FUTURE CONDITIONS

4.3.1 Overview

To predict future conditions and impact of the proposed landfill design at the site, a site conceptual model was developed that represents the future site conditions. The site conceptual model was constructed based on proposed ash landfill design, finished topography, surface drainages and surface bodies, and other engineering features that may impact the groundwater and surface movement at the site. Figure 4-3.1 illustrates three-dimensional geometry of future site conditions.

4.3.2 Closed Ash Landfill

The closed Ash Landfill information is based on preliminary design provided by Stantec in 2010. The components of the landfill consist of re-contoured ash, a PWS system, and a final cover system.

Geometry

Future geometry and ground surface topography for the closed Ash Landfill was based on preliminary design by Stantec in 2010 as shown in Figure 3-2.4. The footprint of the closed Ash Landfill will cover the former Dredge Cells and Ash Pond. The northern extent of the landfill will follow the former perimeter dike prior to the December 2008 Dredge Cell failure. The landfill surface will be sloped at 2 to 5% and the top elevation will range from 760 to slightly above 790 ft msl. Shallow ditches will be installed surrounding the landfill to convey storm water to the river. A maintenance road will be built along the perimeter of the landfill.

Perimeter Walls

Perimeter walls are proposed to be used to stabilize the foundation beneath the dikes around the perimeter of the closed Ash Landfill as part of a perimeter containment system. The wall system is composed double-wall (inner and outer) design that uses in-situ soil mixing and grouting method from the regraded surface to the competent bedrock. Each wall is 3 ft inside thickness and separated by 150 ft inside. Figure 4-3.2 shows the proposed locations of the PWS.

Geotechnical analysis of the soilcrete tests provided hydraulic conductivities for the treated ash, alluvial clay, and alluvial sand (Stantec 2010). The hydraulic conductivities are 5.0E-06, 2.0E-08, and 1.0E-07 centimeters per second (cm/s), respectively. These K values were used for the wall properties during the modeling of future conditions.

Final Cover System (Capping)

The landfill will be capped using a flexible membrane liner (FML) composed of low density polyethylene with a 2-ft vegetative soil cover above the liner. The cover system will extend outside of the Perimeter Wall. The EPA's HELP model (Schroeder et al. 1994) was used by Stantec (2010) to calculate the infiltration rate through the final cover. A best estimate of 0.372 inches per year was obtained assuming a good installation of the cover system. This infiltration rate is used for future conditions groundwater modeling through the landfill cover. The fate and transport simulation assumes that the FML cover will be maintained throughout the life of the landfill and that no degradation of the FML will occur.

4.3.3 Ash Processing Area (Ball Field)

The future conditions for the closed Ball Field were based on discussions with TVA and its contractors. It is assumed that all the current ash processing activities at the site cease and the site will be closed.

It is assumed that the ground surface elevation for the closed Ball Field will be 770 ft msl and will be flat across the extent of the facility. All the surface features will be moved and filled with similar ash material. Similar to the closed Ash Landfill, a FML cover is assumed to be installed over the Ball Field. The same infiltration rate (0.372 inches per year [in/yr]) is used for future conditions modeling.

4.3.4 Stilling Pond

Future conditions for the Stilling Pond were also based on discussions with TVA and its contractors. The Stilling Pond will be backfilled with ash-like materials and capped.

It is assumed that the ground surface elevation for the closed Stilling Pond will be 750 ft msl and will be flat across the extent of the facility. The Pond will be filled with similar ash material. Similar to the closed Ash Landfill, a FML cover is assumed to be installed for the facility. The same infiltration rate (0.372 in/yr) is used for future conditions modeling.

4.3.5 Swan Pond Creek/Embayment

The area will be restored to the pre-failure conditions. For the future conditions site conceptual model, it is assumed that the Swan Pond Creek channel will be restored to its pre-failure location and topography will be as shown on Figure 3-2.5. The western portion of the Swan Pond Creek will form a surface water embayment at the same elevation as the Emory River. The assumption assured that the discharge from the closed Ash Landfill will be into the Swan Pond Creek along the northern model boundary.

4.3.6 Groundwater-Surface Water Interaction and Discharge Zones

Because of the site location and topography, the groundwater-surface water interaction is complex. The groundwater system receives most recharge from surface infiltration of precipitation and lateral inflow from the Pine Ridge. The groundwater discharges to the surface water bodies (river and other surface water drainage features).

Based on the risk analysis needs, groundwater discharges from the closed Ash Landfill, closed Ball Field, and Stilling Pond would be subdivided into three segments due to differences in geography, hydrology, and receptors. Figure 4-3.2 illustrates aerial coverage of each segment:

- Swan Pond Creek Embayment
- Emory River
- Plant Intake Channel (eastern portion)

It is important to note that the Plant Intake Channel segment only includes the eastern portion to evaluate constituent contributions from the closed Ash Landfill and Stilling Pond area for modeling purposes.

5. MODELING APPROACH AND CODE SELECTION

5.1 APPROACH

Because 2010 groundwater conditions at the site do not reflect potential long-term constituent flux to receiving waters (Section 4.3.5) following closure of ash disposal facilities (i.e., former Dredge Cell, Ash Pond, Stilling Pond, and Ball Field), concentrations of selected COCs (arsenic, radium-226, and selenium) in groundwater are predicted based on fate and transport model simulations. Results of this modeling will be used in evaluating long-term risks to human and ecological receptors exposed to either surface water or sediment porewater.

The SAP (Jacobs 2010a) describes the planned methodology for groundwater transport modeling of the site. Version 2010.1 of the Visual MODFLOW (VMOD) suite of coupled numerical groundwater flow and transport codes (Schlumberger Water Services, http://www.swstechnology.com/) was used for groundwater flow and transport modeling in accordance with the SAP. VMOD includes the widely-applied MODFLOW code developed by USGS (McDonald and Harbaugh 1988; Harbaugh et al. 2000) for simulating three-dimensional saturated groundwater flow. As indicated in the SAP, MODFLOW was used to estimate the three-dimensional groundwater velocity field required for constituent transport simulations.

The SAP indicates that multispecies reactive groundwater transport codes supported by VMOD (e.g., PHT3D or RT3D) would be used for modeling. However, mercury, chromium, and thorium-228 were removed from consideration for transport analysis as previously described (Section 2.2.7 and Appendix G) and as discussed in further detail below. Additionally, geochemical modeling described below and in Appendix G predicted that dissolved selenium would precipitate (by reduction) and selenium minerals in contact with groundwater would not dissolve to increase aqueous selenium concentrations. Finally, certain data necessary for reactive transport modeling were problematic (e.g., column leaching results) or unavailable (e.g., COC speciation data). Therefore, MT3DMS (Zheng and Wang 1999) was selected for transport modeling using an approach based on the partition (or distribution) coefficient (Kd), as described below and in Section 8. In addition, geochemical modeling involved the application of Geochemists Workbench - React Model (Bethke 2008; Bethke and Yeakel 2009) to predict equilibrium states and distributions of aqueous species with respect to site-specific groundwater composition (e.g., minerals). Furthermore, results from EPA’s HELP hydrologic water budget model (Schroeder et al. 1994) were used for estimating groundwater recharge rates by precipitation over various sub-regions of the model domain.

5.2 GEOCHEMICAL MODEL

5.2.1 Overview

Geochemical modeling was performed to evaluate the magnitude of COC attenuation in ash, alluvial sand, alluvial clay, residuum, and bedrock. Before detailed calculations were performed, COCs were screened to evaluate their potential mobility in the site groundwater. Geochemical modeling used site-specific ash solids and porewater data, groundwater composition data, mineralogy, and hydraulic parameters. Based on this evaluation, chromium, mercury, selenium, and thorium-228 were screened out due to their presence in ash at negligible concentrations, insignificant mobility in the site groundwater, or both. Appendix G presents a discussion of these constituents and the basis for their exclusion from detailed geochemical modeling. Of these four constituents, selenium was carried forward in groundwater transport modeling considering its potential for bio-magnification by aquatic organisms.

Arsenic, radium-226, and selenium were included in transport modeling using Kd values to characterize their adsorption/retardation behavior during groundwater transport. Geochemical modeling predicted that dissolved selenium would precipitate (by reduction) and selenium minerals in contact with groundwater would not dissolve to increase aqueous selenium concentrations (Appendix G). Hence, geochemical modeling could not be applied to produce a plausible Kd for selenium. Because radium-226 is an isotope and the geochemical software does not compute isotope-specific interactions, porewater and solid radium-226 concentration data were used to compute empirical Kd values. Section 8 describes Kd calculations for selenium and radium-226. For arsenic, geochemical modeling software (Geochemists Workbench - React Model) was used to compute arsenic sorption at several concentrations for the measured amounts of iron oxide in each medium (i.e., ash, alluvial sand, alluvial clay, bedrock, and residuum). From these results, arsenic Kd values could be computed for each medium at different dissolved arsenic concentrations.

Sorption was considered because it can be a major factor influencing arsenic concentrations in contact with solids. In the laboratory tests of ash leaching (Jacobs 2010b), concentrations of arsenic and selenium were observed to increase drastically at pH above 9. This behavior is attributable to desorption of arsenic at high pH. At a pH above the point of zero charge, the oxide surface has a net negative charge due to deprotonation, and negatively charged ions (e.g., $HAsO_4^{2-}$ or $HAsO_3^{2-}$) are repelled and rather than sorbed (Sun and Jaffe 1996). The point of zero charge for iron and aluminum oxides occurs at pH of approximately 9.1 (Ilwon et al. 2007; Sun et al. 1996).

Thermochemical datasets describing sorption to aluminum oxides or manganese oxides (e.g., todorokite) are not available, although some metalloids such as arsenic are known to sorb to those oxides (Deschamps et al. 2005; Sun and Jaffe 1996). Omission of manganese and aluminum oxides in calculations of sorption represents a conservative approach that understates sorption.

The sorption calculations were performed in several steps. Simulations were run at different initial dissolved arsenic concentrations, with the appropriate amount of iron oxide present for ash and native media under consideration. Output from the React Model (Appendix H) lists the fraction of the total arsenic in the system that is sorbed to iron oxide and the total arsenic mass. When no arsenic minerals are present, sorbed arsenic and dissolved arsenic are the only forms of arsenic present. The sorbed concentration (mg/kg) is equal to the total moles of arsenic multiplied by the sorbed fraction and divided by the mass of solids present in that groundwater. The dissolved concentration is then equal to the total arsenic present less the sorbed mass divided by one liter of groundwater. Table 5-2.1 lists the parameters used in these calculations.

As noted above, these calculations were performed at multiple arsenic concentrations. This was done to evaluate the arsenic concentration(s) that could result in decreased sorption (lower Kd value) for the amount of iron oxide present.

5.2.2 Input Data

The input data for major ions and basic parameters is summarized for each medium at the site in Table 3-6.14. Table 5-2.1 shows the aquifer properties used in the calculations, including the quantity of hematite corresponding to 1 Liter of groundwater, based on the percent free iron oxide and solid density.

The calculation for iron oxide (grams per liter of groundwater) = ρ x (1/n) x % free iron oxide, where ρ is the aquifer solids' density (kilograms per liter), n is effective porosity, and % free iron oxide is the measured free iron oxide content of the medium.

The React Model was used to assess sorption, along with the thermochemical dataset provided with the software and the iron-oxide sorption dataset was from Dzombak and Morel (1990). The surface charge used was 5.13 Coulomb/m^2. The simulations were run to allow the system to equilibrate with one liter of water and the appropriate amount of iron oxide to react with one gram of water. Table 5-2.2 lists the user-specified input for the model.

Geochemical model outputs are provided in Appendix H. In order to be complete, each output provides the input parameters, initial basis species, major aqueous species, major sorbed species, gas fugacities, mineral saturation indices, and sorbed fractions. The output parameters used in the Kd calculations as described above are the total moles of arsenic and the sorbed fraction of arsenic.

5.2.3 Results and Limitations

Predicted Kd values for arsenic are provided in Table 5-2.3. For ash, a predicted Kd value of 180 liter per kilogram (L/kg) was consistent at arsenic concentrations up to approximately 100 ug/L. Predicted Kd values fell gradually from 125 L/kg at an arsenic concentration of 530 ug/L to 90 L/kg at an arsenic concentration of 1,000 ug/L. The maximum arsenic concentration in ash porewater was 915 ug/L (Table 3-6.13).

For alluvial clay, the predicted Kd value was consistent at 14 L/kg for arsenic concentrations ranging up of 100 ug/L. The calculated Kd value declined gradually at higher concentrations to reach 12 at approximately 1,000 ug/L. For alluvial sand, the predicted Kd value of 17 L/kg was determined for arsenic concentrations up to approximately 100 ug/L. The calculated Kd values decrease gradually at higher concentrations, declining to 11 at approximately 3,000 ug/L. Alluvium groundwater samples exhibited a maximum arsenic concentration of 549 ug/L.

For residuum, the predicted Kd value was consistent at 450 L/kg for arsenic concentrations ranging to 1 ug/L and declined to 250 L/kg at an arsenic concentration of approximately 10 ug/L. The maximum arsenic concentration observed in residuum porewater was 1.64 ug/L.

For bedrock, the predicted Kd value was consistently 2,774 L/kg between arsenic concentrations of 0.003 and 30 ug/L. The maximum arsenic concentration observed in bedrock groundwater samples was 2.72 ug/L. Geochemical modeling predictions for bedrock Kd were based on free iron oxide data from a study performed on Conasauga saprolite at Oak Ridge, Tennessee (Jardine et al. 1989). The resulting Kd values were considered too high for model application. The arsenic Kd value of 9.2 L/kg for bedrock was the lowest value obtained from geochemical modeling and relied on alluvial clay as a surrogate. For conservatism, subsequent transport modeling used the lowest calculated value of 9.2 L/kg from the residuum.

Appendix H presents more detailed information on the Kd calculations and presents geochemical modeling outputs. These calculations were performed using an equilibrium model. That means that the model assumes that thermodynamic equilibrium is achieved. Thermodynamic equilibrium is not always the case and there are well-known situations that are stable but not at thermodynamic equilibrium. However, because the free energy changes associated with sorption of arsenic to iron oxides are not large and the activation energy for this process should be small, it is likely that localized equilibrium would be achieved between dissolved arsenic and arsenic sorbed by iron oxide. In addition, by restricting the sorption of arsenic to iron oxide and not considering other oxides known to sorb arsenic, the attenuation of arsenic concentrations by sorption is most likely understated.

5.3 FLOW AND TRANSPORT MODELS

5.3.1 MODFLOW

MODFLOW (McDonald and Harbaugh 1988) is a three-dimensional MODular finite-difference groundwater FLOW Model, originally developed by USGS and released to the public domain in 1983. MODFLOW is widely viewed as the industry standard for groundwater flow modeling of layered porous media. The numerical engine MODFLOW-2000 (Harbaugh et al. 2000), which incorporates several improvements from predecessor versions of the code (e.g., Layer Property Flow Package replaces the Block-Centered Flow Package), was utilized for flow simulations.

5.3.2 MT3DMS

The transport model was solved using the MT3DMS code (Zheng and Wang 1999). MT3DMS is a modular three-dimensional multi-species transport model for simulation of advection, dispersion, and chemical reactions of constituents in groundwater systems. Advection refers to the process by which constituents are transported by the bulk motion of the flowing groundwater, and dispersion describes constituent spreading due to heterogeneities in the groundwater system. The MT3DMS model includes capabilities for both standard advection-dispersion and dual-domain mass transfer. MT3D is linked with MODFLOW to specifically handle advectively-dominated transport problems without the need to construct refined models for constituent transport.

6. 2010 CONDITIONS FLOW MODEL CONSTRUCTION AND CALIBRATION

A three-dimensional groundwater flow model for 2010 site conditions was developed for the site to support subsequent risk analysis of the proposed landfill design. This initial flow model is necessary for calibration to known and measured field conditions where data is available. Thus, the objectives of developing the 2010 condition groundwater flow model are twofold: (1) refine and quantify components of the site hydrogeologic conceptual model and media parameters; and (2) form a base model that can be used for developing a second model representing future conditions. Groundwater modeling provides a tool for quantifying components of the conceptual model that are difficult to be directly measured in the field (e.g., groundwater flux rates). Groundwater modeling also provides a tool for quantitatively evaluating risk and engineering design.

6.1 DOMAIN AND DISCRETIZATION

The site-specific groundwater flow model domain covers an area from top of the Pine Ridge in the northwest to the middle of the Emory River/Plant Intake Channel in the southeast and Swan Pond Creek Diversion channels of 2010 condition in the north to the line that connect top of Pine Ridge to the east of the plant in the southwest (Figure 6-1.1). The entire model domain covers approximately 8.1 square miles.

Model discretization refers to the assignment and alignment of the numerical cells in the model and the relationship of those cells to actual natural and engineered conditions. A three-dimensional, uniformly-spaced, vertically variable spaced finite-difference grid was used for the site model. The model consists of 8 layers, 860 columns, and 680 rows. The horizontal spacing of the finite-difference cells is 10 ft across the model domain while the vertical spacing of the cell varies based on site-specific lithological data. A 10 ft horizontal grid spacing allow the model to precisely represent the surface topography, surface water features, engineering features, and other specific interest (i.e., ash cell). There are a total of 4,080,000 cells in the 2010 condition flow model; 2,261,144 of the cells are active.

The site is modeled as a single unconfined aquifer, with 8 layers in the vertical direction to simulate the vertical distributions of the media and changes of hydraulic parameters with depth of bedrock hydrogeologic units (Figure 6-2.1). The vertical discretization also allows the model to represent the 45 degree dip associated with the bedrock hydrogeologic units as discussed in Section 3.5.

6.2 MODEL LAYER GEOMETRY

The upper boundary of the model is represented by the 2010 surface topography and river bathymetric surface (Figure 3-2.3). The bases of the subsequent model layers are constructed used the results of lithological analysis as discussed in Section 3.6. Figure 6-2.1 illustrates the profiles of model vertical representation in the west-east and south-north cross sections. Table 6-3.1 summarizes the model discretization and boundary condition.

The top 5 model layers were used to represent the ash and its variable content in the ash storage area. The base of the layer 5 is bottom of the ash (top of the alluvial clay) in the ash storage area. The base of the uppermost model layer (model layer 1) was assigned at an elevation of approximately 770 ft msl in the remaining ash storage area. The base elevations of the model layers 2, 3, and 4 were assigned at approximately 760, 750, and 740 ft msl in the same area. The selection of the model intervals is based on the vertical discretization as defined by fly ash and bottom ash lithological analysis as discussed in Section 3-6.

The model layer 6 was used to represent the alluvial clay in the ash storage area. The base of the alluvial clay was constructed used the contours as show in Figure 3-6.4. The alluvial sand in the area is represented in model layer 7 as the base of the model was shown in Figure 3-6.5.

The bottom layer of the model (layer 8) was used to represent the Conasauga Shale in the ash storage area. The base of the model was set at a constant elevation of 650 ft msl, provided a layer thickness of approximately 50 ft. The upper portion of the bedrock is generally variable degree weathered and fractured, and is generally considered to be permeable. Below the upper portion, the shale is less permeable. The model was designed to extend to this depth as a no-flow boundary, because this is thought to be the base of the active flow system that has significant impact to the groundwater flow to the river. The river channel bottom ranges from 740 to 710 ft msl. The model bottom is about 90 to 60 ft below the river bottom, thus the assumed model bottom as a no-flow boundary will likely have minimal impact on the vertical hydraulic gradient flow field.

The model layers above the bedrock layer (model layer 8) were used to represent the residuum in the southwest portion of the model domain where ash and alluvial deposits are absent. The layer thicknesses among the layers are variable, but they generally increase with depth.

The Rome Formation bedrock along the Pine Ridge is also represented by the 8 model layers, with model layer thickness generally increases with depth, except model layer 1 that is a slightly thicker layer was assigned due to expected greater water table depth. The model layers were used to represent the weathering effect of the bedrock as the bedrocks become less permeable with depth.

6.3 BOUNDARY CONDITIONS

Boundary condition in the numerical flow model defines the relationship between two medium. Boundary conditions can be related to levels of the water table, artesian pressures, and hydraulic head along the boundaries of the model (the head conditions), or to groundwater inflows and outflows along the boundaries of the model (the flow conditions).

6.3.1 Head and Flow Boundary Conditions

The model used the site topographic condition to establish the flow boundary condition. Figure 6-3.1 shows all the model boundary conditions in the 2010 model. The groundwater system in the site is bounded by Pine Ridge to the west. Pine ridge is a narrow and steep ridge, forming a surface water divide at the top. Since it is generally assumed that the shallow and active groundwater divide will mirror the surface water divide, the groundwater divide plane extending vertically downward from the crests of the ridges are specified to be no-flow boundaries for the groundwater flow system, and there is no groundwater import or export across the ridge crests.

The Swan Pond Diversion Channel, forming the northern model boundary, is a continuous flowing stream. The water levels were measured on July 28, 2010. The north boundary is assigned as constant head boundary condition in the model based on the water measurement (Table 3-6.2).

The Emory River and Plant Intake Channel form the east and southeast model flow boundary and are represented by the river boundary. The streambed bottom elevation varies according to bottom bathymetry as described in Section 3-2. The constant surface water elevation of the Emory River is 740.84 ft msl, the average elevation from July 28, 2010 surface water measurements. The surface water elevation of the Plant Intake Channel applied is 740.70 ft msl, which is an average elevation from July 28, 2010 surface water measurements.

To the southwest, there is not a clear topographic relief to mark a groundwater divide. However the groundwater flow is likely down the Pine Ridge slope toward the Plant Intake Channel. On this basis, the southwestern model boundary follows an assumed groundwater streamline representing a no-flow boundary condition.

To represent the surface water-groundwater interaction within the model, all the surface water features within the model domain are also represented in the model, including the surface water body and surface drainage features. The surface drainage features are represented in the model as drain cells. The drain cell elevations are set at 0.5 ft below the surface ditch elevation at its location. River cells are used to represent the Sluice Trench at elevation range of 762.8 ft msl and three small constructed wetlands near the Plant Intake Channel at elevations of 748.7, 747.5, and 744.3 ft msl, respectively.

Constant head cells are used to represent constant surface water bodies, including Ash Pond, Stilling Pond, and two water bodies (Redwater Channel in the south and a water pond at the north). The Ash Pond and Stilling Pond are set at 760.4 and 754.75 ft msl, respectively, based on July 28, 2010 surface water measurements. The surface water elevation of the Redwater Channel is at 760.30 ft msl which is an average elevation from July 28, 2010 surface water measurements. The northern water pond is set at 741 ft msl.

6.3.2 Recharge

Recharge to the groundwater system at the site includes precipitation and potential seepage from plant operation related surface water bodies (sluice channels and impoundments). Seepage from the surface water body to groundwater is computed internally during the model calculation based on the given boundary head condition.

Precipitation is the most important source of groundwater recharge in the site. The natural groundwater recharge is a function of precipitation, runoff, and evapotranspiration. The net recharge to groundwater thus is a function of the hydraulic properties of geologic media above the groundwater zone, surface slope, and vegetation.

Different recharge rates were used in the model domain, based on surface and subsurface media (Figure 6-3.2). No site-specific investigation of surface recharge has been conducted at the site, although extensive studies have been conducted at the nearby Oak Ridge Reservation which possesses a similar geological setting (Solomon et al. 1992). The natural setting of Pine Ridge likely receives the most recharge due to the presence of a weathered and fractured shallow bedrock zone. The final recharge rate was set at 9 in/yr. The residuum area may receive slightly less (8 in/yr) than the Pine ridge, because of the well developed finer soil above the Conasauga shale. The lower recharge rate applied to railyard (4 in/yr) reflects the impact from the extensive subsurface drainage network in this area.

The recharge rate to the ash area was initially calculated using HELP model. The model was used to estimate the infiltration rate through a uniform fly ash. The estimated percolation rates are between 14.26 to 14.98 in/yr for various slope factors and slope length. Considering the heterogeneous and layered nature of the ash disposal activities, the infiltration rate is lower. The final recharge rate (6 in/yr) in the ash area thus was determined through model calibration.

6.4 HYDRAULIC PROPERTIES

Previous hydraulic property investigations at the site and the recent K testing presented in Appendix B and Appendix D of the report were crucial for the successful calibration of the site groundwater flow model. These data established a range of hydraulic conductivity to constrain the hydraulic conductivity values assigned in the model during the model calibration process. In addition to bracketing the potential range in hydraulic conductivity for each aquifer matrix, the general relationship between hydraulic conductivity and depth was also important in assigning hydraulic conductivity values in the Rome Formation.

Hydraulic property tests have been conducted at the site (Milligan and Ruane 1980; Velasco and Bohac, 1991; Young 1993; Law 1995; MACTEC, 2004, AECOM 2009; Geosyntec 2010a/b). These tests have conducted in ash, alluvial clay and sand, residuum, and Conasauga Shale used methods of in-situ field test and lab test.

The 2010 site-specific investigation included in-situ hydraulic conductivity measurements and laboratory-based hydraulic properties of undisturbed samples (Appendices B and D). Historical K measurements were used to create a range of applicable values for each hydrostratigraphic layer before the investigation. For those layers lacking an adequate quantity of values, or adequate spatial coverage, additional wells/piezometers were selected or installed for testing. Pump testing was the preferred method of hydraulic conductivity testing, but for wells/piezometers that could not sustain pumping with time or whose diameter was too small to install the pumping equipment downhole, slug testing was utilized. Borehole flowmeter testing was also performed. The borehole flowmeter method provides direct information concerning the flow of water that enters a well under either ambient or pumping conditions. Laboratory-based hydraulic properties of undisturbed samples were also measured.

During this model study, all the hydraulic conductivity data available at the site were analyzed based on its media. The hydraulic conductivities for the fly ash range from 3.70E-06 to 1.39E-03 cm/s, with a geometric mean of 5.35E-05 cm/s. The ratio of horizontal conductivity and vertical conductivity is about 1.29. The hydraulic conductivities for the bottom ash range from 1.10E-05 to 1.39e-03 cm/s and a geometric mean of 1.00E-04 cm/s. The alluvial media have a hydraulic conductivity range of 6.60E-08 and 1.30E-04 cm/s, with a geometric mean of 2.83E-6 cm/s. The alluvial media are mostly from the alluvial clay layers. The hydraulic conductivity values at the Conasauga shale bedrock range from 3.1E-09 to 2.5E-03 cm/s, based on data from nearby Oak Ridge area (U.S. Department of Energy 1997).

Ash media at the site is composed of fly ash, bottom ash, and a mixture of the two. Based on the lithological analysis as discussed in Section 3-6.1, the fly ash and bottom ash three-dimensional distribution were identified. Based on the hydraulic conductivities of the fly ash and bottom ash, the representative hydraulic conductivities were calculated using depth-averaged values for the variable degree mixtures of fly ash and bottom ash. The ash mixtures are divided into four groups based on thickness of the bottom ash in the 10 ft ash interval; <1 ft, 1-3.3 ft, 3.3-6.7 ft, and >6.7 ft. The horizontal hydraulic conductivity values used in the final calibrated model are 5.40E-05, 3.36E-04, 6.18E-04, and 9.00E-04 cm/s for the ash mixtures, respectively.

These site-specific K values were used initially as the model input parameters for variable media. The K field assigned for the 8 model layers is illustrated in Figure 6-4.1 and 6-4.2. Table 6-4.1 lists the values for each individual media in the 2010 calibrated flow model. Based on the media properties, various anisotropy ratios [Kz vs Kx (Ky)] were used to represent the deposition nature and heterogeneous nature. Kx and Ky represent the conductivities at the horizontal directions and Kz represents the conductivities in the vertical direction, respectively.

6.5 CALIBRATION PROCESS

Calibration of a groundwater flow model refers to the process of adjusting model input parameters (e.g., K) and boundary conditions (e.g., precipitation recharge, stream and seep conductances, etc.) to obtain a reasonable match between measured and predicted groundwater potentiometric levels within the model domain. In practice, this usually involves an iterative process of adjusting hydraulic properties and/or boundary conditions assigned in the model. At all stages of the model calibration process, parameter values and boundary conditions were constrained by hydrogeological data collected in the field and engineering design values.

In calibrating the groundwater flow model for the site, 179 discrete water-level calibration targets measured in 34 monitoring wells in July 28 to 30, 2010 were used (Figure 6-5.1). The dataset represents the most extensive site-wide groundwater level snapshot available. The use of discrete water levels measured at monitoring wells eliminates the potential for interpretive bias that may result from attempting to match a contoured potentiometric surface (Anderson and Woessner 1992).

After model boundary condition and initial model parameters were established, more than 30 steady-state calibration runs were conducted during the calibration of the 2010 condition groundwater flow model. PEST, a parameter optimization method, was used during the model calibration. However, because of the large size of the model (> 4 million model cells), highly variable range in topography (>300 ft difference) within the model domain, and complex distribution of the variable media, the automated method runs were computationally long and did not provide desirable results as expected. Therefore, the model calibration process relied on mostly on the use of the trial and error parameter adjustment technique.

Hydraulic conductivity and recharge rate were the primary model parameters adjusted during model calibration. During the model calibration process, the complex fly ash and bottom ash distribution and their impact on modeling results were revealed and led to the detailed analysis on the three dimensional distribution as discussed in Section 3.6.

6.6 CALIBRATION RESULTS

After model calibration process, the calibrated model was used to develop head distribution, calibration statistics, and mass balance summary. The calibrated model was used as the base case to conduct sensitivity analyses on key model parameters. The calibrated model forms the basis for the development of future conditions model.

6.6.1 Predicted Heads

A contour map of the steady-state water table from the calibrated model is shown in Figure 6-6.1. The water table matches with the general understanding of the water table distribution at the area as shown in the Figure 3-6.9.

Contour maps of the steady-state hydraulic head distribution at bottom of the clay layer (model layer 5), alluvial clay (model layer 6), alluvial sand (model layer 7), and bedrock (model layer 8) as predicted by the model are shown in Figures 6-6.2 through 6-6.5. The potentiometric surface portrayed by these maps mirrors these maps drawn from actual water-level data as shown in the Figures 3-6.10 and 3-6.11. The groundwater levels shown by the model layer suggested that the groundwater has mostly downward groundwater flow in the ash area, similar to the field measurement as shown in Appendix B. These potentiometric maps are consistent with our present understanding of the groundwater flow system in the area. The maps illustrate that the model is predicting the flow of groundwater into Emory River and Plant Intake Channel.

6.6.2 Calibration Statistics

Table 6-6.1 lists the model predicted groundwater levels and residuals (i.e., differences between measured and predicted groundwater levels) at the target locations. The residual mean is 0.51 ft and the standard error of the estimate is 0.26 ft. Considering the large topographic relief across the site (>300 ft) and complexity of the site-specific hydrogeologic condition, the model calibration is considered to be acceptable.

In general, the water levels computed by the model reasonably match those observed in the field. This is illustrated in Figure 6-6.6 which shows the relationship between model predicted and observed water levels. Most of the plotted values are close to the 45 degree line shown on the figure indicating relative close agreement between model predicted and observed water levels. The values are randomly distributed along the 45 degree line, suggesting there is no obvious bias predicted by the model in response to biased model parameters (e.g., K value for a particular layer or a unit).

6.6.3 Mass Balance

Volumetric water balances are quantitative model estimates of the sources and sinks of water in an aquifer system. A water budget analysis is performed to better understand the movement of water in the aquifer system. The water balance error for the calibrated model was about 2.56%, within the typical accepted limit. The water balance shows that essentially all water has been mathematically accounted for and that MODFLOW simulation has correctly solved the governing flow equations.

A zone budget water balance analysis was conducted based on the area of interests for the calibrated model. The model domain was divided into natural and ash area as shown in Figure 6-6.7. Overall, recharge accounts for over 80% of the net inflow into the system, with rest of the inflow from constant head boundary condition (surface water bodies in the interior of the model domain). The groundwater sinks are discharges to river directly and to surface drainage features that also flow into the Emory River eventually. In the natural area, the groundwater discharges mostly to the surface drainage features (97%) whereas the groundwater in the ash area discharges to river directly (69%) and to surface drainage features (39%) that also flow into the river eventually. The groundwater interaction between the two areas is also shown in Figure 6-6.7.

6.7 SENSITIVITY ANALYSES AND UNCERTAINTY

A sensitivity analysis was performed to identify the key model input parameters that may have the most impact on the degree of calibration and on the conclusions of the modeling analysis. For this model, the most important and uncertain parameters are K and recharge rate. Therefore, the response of the calibrated model to changes in recharge rate and K were evaluated. Since there were concerns of the groundwater flow impact on the disposal area from the Pine Ridge, sensitivity analysis of the Pine Ridge on the model results was also conducted.

One parameter at a time was varied while all other parameters were held constant. Each parameter was, in turn, multiplied by factors of a higher and lower of the base values. A model run was conducted for each case and the model calibration result was statistically summarized. The deviation from the base calibration run is an indicator of the overall sensitivity of the water levels computed at the calibration target locations to the change in the parameter. A high deviation indicates that the model is sensitive to the change in a particular parameter.

6.7.1 Sensitivity to Hydraulic Conductivity

Model response to the K values in the ash, alluvial clay, alluvial sand, and Conasauga Shale were analyzed. The base value for the calibrated model was multiplied by a factor of 0.5 (lower K) or 2.0 (higher K) for alluvial clay, alluvial sand, and Conasauga Shale for each model run. Factors of 0.5 and

1.5 were used for ash and ash mixture matrix. Table 6-7.1 illustrates the results of the sensitivity analysis conducted for K.

Figure 6-7.1 shows the relationship of changes in K parameters and the model results. The model was most sensitive to changes in the K assigned the ash, followed by bedrock, and alluvial clay and sand. The impact from the K in ash is expected because the majority of the calibration targets are within the ash media. The lower sensitivity indicated for alluvial clay and sand might be partially due to the small number of calibration targets in these model layers.

6.7.2 Sensitivity to Recharge

The recharge values for the whole model domain was globally changed for each sensitivity runs. Factors of 0.5, 1.5, and 2.0 were used. Figure 6-7.2 shows the impact of changes in recharge rates on the model results. In general, the model is very sensitive to recharge and the rate of change on model result is in a constant rate. The sensitivity runs also indicate that the base case has the best model calibration in relation to available targets.

6.7.3 Sensitivity to Pine Ridge

The groundwater under Pine Ridge, hydraulically upgradient of the ash disposal area, flows toward the ash disposal area. Because of the 45 degree east-tilted Rome bedrock at the Pine Ridge as shown in Figure 3-5.3, it is possible that the groundwater recharge zone may lie slightly west of the ridge top (the model boundary). Therefore, the impact of the Pine Ridge on the groundwater impact on the ash disposal area was evaluated through a series of variable recharge rates. Factors of 0.5, 1.5, and 2.0 were used for the recharge rate of the Pine Ridge. The higher recharge rates represent the potential impact of Pine Ridge boundary condition. Figure 6-7.3 shows the impact of changes in recharge rates on the model results. In general, the model is not sensitive to recharge change in the Pine Ridge. This result suggests that the surface drainage ditches between the Pine Ridge and ash disposal area may act as a natural groundwater buffer zone.

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7. FUTURE CONDITIONS - FLOW MODEL CONSTRUCTION

7.1 DOMAIN AND DISCRETIZATION

The model domain of the future site is shown on Figure 3-2.4. Nominal dimensions of the domain are approximately 7,000 ft in the east/west direction and 6,000 ft in the north/south direction. The model domain generally follows natural hydrologic boundaries, including Pine Ridge and the reservoir. These boundaries represent hydrologic divides across which no shallow groundwater flow occurs. As shown on Figure 4-2.1, the model boundary is conceived as: the top of Pine Ridge along the northwest; Swan Pond Creek to the north; the Emory River thalweg along the east, the Plant Intake Channel thalweg along the southeast (from the Emory River to the Plant Intake Pumping Station); and a straight line from the top of Pine Ridge to the Plant Intake Pumping Station along the southeast.

Relative to the 2010 model, the model representing future conditions required a domain modification along Swan Pond Creek. Final design for the Swan Pond Embayment area immediately north of former Dredge Cell 2 has not been finalized. However, TVA indicated that planning considerations for the area involve restoration to pre-failure conditions. For the purposes of modeling (i.e., domain and boundary conditions), it was assumed that the Swan Pond Creek channel will be restored to its pre-failure location as shown on Figure 3-2.5.

To increase computational efficiency the areas outside of the domain were assigned as inactive flow zones in all model layers. The model domain is discretized (i.e., subdivided into discrete cells) on a grid of 10 ft by 10 ft as illustrated on Figure 7-1.1. As indicated in Table 7-1.1, this results in 680 rows and 750 columns (over 2,089,600 active flow cells).

7.2 GEOMETRY

Vertically, the model is subdivided into eight layers as shown on Figure 7-2.1 to represent distinct hydrogeologic units. Model layer enumeration is 1 to 8, top to bottom. With the exception of the model bottom, upper and lower layer surfaces are variable in elevation. The bottom of the model (no flow) is represented by unweathered bedrock (Conasauga and Rome) at 650 ft msl. As described in Section 3-2, high resolution LIDAR data were imported directly into the model to define the top of ground surface (i.e., top of layer 1). Spatial designation of the surfaces of model layers 2 to 6 are based on the interpolation of available site boring data as described in Section 3-6. Compared to the 2010 model, the upper model surface required modification to represent closure conditions (closed Ash Landfill, capped Stilling Pond, and capped Ball Field) as described in Section 4.

Model layers 1 to 5 encompass ash within the disposal areas. Layers 6 and 7 represent alluvial clay and alluvial sand, respectively, beneath the disposal areas (Figures 3-6.4 and 3-6.5). Bedrock (Conasauga beneath disposal areas) corresponds to model layer 8. Model layers 6 to 8 outcrop variably (beneath surface water levels) along the Emory River and Plant Intake Channel. Model layering beneath Pine Ridge includes an uppermost (layer 1) residuum layer with Rome bedrock in underlying layers. Residuum occurs in model layers 1 to 8 on the southeast margin of the model (Figure 3-6.6).

7.3 ENGINEERED DESIGN FEATURES

The groundwater flow model representing future (closed) site conditions includes the closed Ash Landfill, leveled and capped Ball Field area, and leveled and capped Stilling Pond. In addition to capping of the closed Ash Landfill, a foundation stabilization wall is to be installed (Figure 7-3.1). Engineered design features are described in Section 4.3 and application of these design features within the model are described in ensuing paragraphs.

7.4 BOUNDARY CONDITIONS

A numerical model requires an appropriate set of boundary conditions to represent relationships with the surrounding systems. For the groundwater flow model, boundary conditions describe the exchange of water between the model and coupled systems. In the case of the transport model, boundary conditions refer to source and sink terms that describe the exchange of constituent mass into and out of the system. Boundary conditions specified for the future conditions model are shown on Figure 7-4.1 and are described below.

7.4.1 Flow Boundary Conditions

Groundwater flow boundary conditions used in this model included several MODFLOW packages (boundary conditions) in addition to recharge. The assigned boundary conditions as they apply to different features of the site are summarized below.

Emory River was simulated using the River Package in MODFLOW. The streambed bottom elevation varies according to bottom bathymetry as described in Section 3-2. The boundary condition extends to the river thalweg to allow prediction of cell-by-cell inflow rates and COC concentrations for groundwater emerging through bottom sediments. The constant surface water elevation of the Emory River applied for modeling purposes is 740.84 ft msl. This is an average elevation from July 28, 2010 surface water measurements (Table 3-6.2) and is slightly higher than the average of mean daily summer pool elevations (740.55 ft msl; 1994 to 2010) exhibited in Figure 3-3.1.

The *Plant Intake Channel* was simulated using the River Package in MODFLOW. The streambed bottom elevation varies according to bottom bathymetry as described in Section 3-2. As indicated earlier, the boundary condition extends to the river thalweg to allow prediction of cell-by-cell inflow rates and COC concentrations for groundwater emerging through bottom sediments. The surface water elevation of the Plant Intake Channel applied for modeling purposes is 740.70 ft msl which is an average elevation from July 28, 2010 surface water measurements (Table 3-6.2).

Swan Pond Creek/Embayment was simulated using the River Package in MODFLOW. The streambed bottom elevation was prescribed an elevation of 740-ft msl to maintain a pooled condition. The boundary condition extends to the former stream centerline to allow prediction of cell-by-cell inflow rates and COC concentrations for groundwater emerging through bottom sediments. The surface water elevation of Swan Pond Creek applied for modeling purposes is 740.84 ft msl as prescribed for the Emory River.

The *Redwater Channel* was simulated using the Constant-Head Boundary Package in MODFLOW. The surface water elevation of the Redwater Channel applied for modeling purposes is 760.30 ft msl which is an average elevation from July 28, 2010 surface water measurements (Table 3-6.2).

The *PWS* was simulated using the Horizontal Flow Barrier Package in MODFLOW. The walls are designed to extend around the perimeter of the closed Ash Landfill as shown in Figure 7-3.1 and are parallel. According to design information provided by TVA and Stantec, the target wall thickness is 3 ft (per wall) and this was assigned in the model. Values of K for the wall vary depending on the hydrogeologic unit intersected. K values assigned for the wall boundary are 5.0E-06 cm/s for ash layers 1 to 5, 2.0E-08 cm/s for alluvial clay (layer 6), and 1.0E-07 cm/s for alluvial sand (layer 7). The walls do not penetrate bedrock (layer 8).

Shallow *drains* across the site are represented using the Drain Package in MODFLOW. Ground surface elevations for drains are highly variable. Water surface elevations along drain cells were assigned to be 0.5 ft below ground surface.

7.4.2 Recharge

The distribution of recharge for future model conditions is shown on Figure 7-4.2. With the exception of areas that include engineered design features, recharge conditions for future conditions are the same as those for the 2010 conditions model (Section 6-3). As shown in Figure 7-4.2 and described in Section 4.3, capping of the closed Ash Landfill, Ball Field, and Stilling Pond are anticipated to reduce recharge to 0.372 in/yr. This recharge value is based on HELP model simulations performed by Stantec (2011) that assumes capping of the closed Ash Landfill with a flexible membrane liner and 2 ft of moderately compacted clay soil.

7.5 HYDRAULIC PROPERTIES

Figures 7-5.1 and 7-5.2 show the K distribution for all model layers. The only significant difference in configuration of the K field between 2010 and future model conditions is associated with installation of a new dike for the closed Ash Landfill and K values associated with the PWS described above. An assumption for future model conditions is that the current surface areas beneath the closed and capped disposal areas will be raised to design elevations using fly ash. Table 7-4.1 tabulates K values for future model conditions and Section 6.4 describes derivation of those values.

7.6 FLOW RESULTS AND LIMITATIONS

7.6.1 Predicted Heads

The predicted potentiometric surface from steady-state flow simulations are shown on Figures 7-6.1 to 7-6.4 for ash, alluvial clay, alluvial sand, and bedrock horizons. As indicated in the figures, groundwater gradients beneath the closed Ash Landfill are easterly in all media, from Pine Ridge toward the Emory River. In the Ball Field area, gradients are southeasterly toward the Plant Intake Channel. Reduction in recharge from capping disposal areas produces a striking difference relative to predicted potentiometric surfaces under 2010 conditions (Figures 6-6.2 to 6-6.5). Predicted potentiometric surfaces under 2010 conditions indicate pseudo radial groundwater movement from the relic Dredge Cell. The influences of boundary conditions (i.e., drains and surface water features) are most prominent in shallow (ash and alluvial clay) predicted potentiometric surfaces under 2010 conditions.

Vertical hydraulic gradients are downward beneath the vast majority of the closed Ash Landfill in ash and alluvial clay layers, but are reduced to relatively gentle horizontal gradients in alluvial sand and bedrock layers. At the Pine Ridge boundary of the closed Ash Landfill, vertical gradients in shallow media horizons outside of the PWS trend toward shallow drains that parallel the landfill. At greater depths (in shallow bedrock), vertical gradients trend slightly upward beneath the PWS. Along the Emory River and outside of the PWS, the directions of vertical gradients are upward and magnitudes are higher than within the landfill.

7.6.2 Mass Balance

The total groundwater flow mass balance for future model conditions was a discrepancy of only -0.21%. As shown in Figure 7-6.5, the majority of water (10,797 cy ft/day [ft^3/d]) exiting the model domain is discharged to river boundaries (i.e., Emory River, Swan Pond Embayment, and Plant Intake Channel) with another 8,961 ft^3/d of groundwater being removed by drains in natural areas of the site. Compared to 2010 model conditions (Figure 6-6.7), recharge is reduced by >75% in ash disposal areas as a result of capping.

7.6.3 Limitations

The 2010 groundwater flow model was calibrated to July 28 to 30, 2010 water level measurements collected during a site-wide sampling event. Parameterization of the future conditions flow model was predicated on the 2010 conditions model. The groundwater flow modeling was performed for steady-state conditions. While the calibration period may be representative of higher river (summer pool) conditions, it is recognized that this steady-state assumption is an approximation of field conditions that may have a transient component.

Values of K for the PWS are based on laboratory analyses of design mixes. More recent in-situ K data (Appendix G) suggest that final design and installation of the walls may result in significantly different values. Model simulations indicate that long-term potentiometric heads are somewhat sensitive to K estimates and dimensions for the walls. Model values of K assumed for the walls vary depending on mixing with in-situ media (i.e., ash, alluvial clay, alluvial sand). The assumed K values for the walls are at least an order of magnitude lower than those of corresponding media across each model layer. Hence, the walls reduce lateral groundwater movement into and out of the closed Ash Landfill. If measured K values, configurations, or thickness for the installed walls differ substantially from modeled data, the model should be restructured accordingly.

The future conditions model assumes that fly ash will be used to infill the failed ash surface to achieve the increased design elevations of the closed Ash Landfill. Hence, hydraulic properties are accordingly those of fly ash. If mixed media or other material is used for infilling, there may be modest differences in model predictions.

8. TRANSPORT MODEL DEVELOPMENT

8.1 DEVELOPMENT PROCESS AND ASSUMPTIONS

The site transport model is coupled with the future conditions groundwater flow model described in Section 7. As previously indicated, the groundwater transport model focuses on arsenic, selenium, and radium-226. To model constituent transport, input parameters were developed to describe hydrodynamic dispersion, retardation, and degradation processes. These parameters include dispersivity, Kd, and constituent half-life. Constituent release mechanisms or processes (such as source location and release history) and the existing constituent distribution are also important. Bulk density and porosity are physical parameters of soils and bedrock that also influence constituent transport.

In addition to boundary conditions identified for the groundwater flow model (Section 7.4), boundary conditions for the transport model include recharge concentrations for each COC to represent leachate emanating from the vadose zone of the ash landfill. Initial conditions for the transport model include constituent (COC) concentration distributions that were developed for model input as described in Section 3.7.

As indicated in Section 5, the transport model was solved using the MT3DMS code (Zheng and Wang 1999). MT3DMS is a modular three-dimensional multi-species transport model for simulation of advection, dispersion, and chemical reactions of constituents in groundwater systems. MT3DMS is linked with MODFLOW to specifically handle advectively-dominated transport problems.

8.2 TRANSPORT PROPERTIES

Physical, chemical, and biological processes that potentially influence COC fate and transport of include: advection, hydrodynamic dispersion, retardation, biodegradation, and reactive transformation.

8.2.1 Advection

Advection involves physical transport of constituents entrained in flowing groundwater. Advective flow with groundwater is important since it is likely the primary transport mechanism. Model parameters that control advection include hydraulic gradients, vertical and horizontal K, and porosity. Since output from the future conditions groundwater flow model is coupled to the transport model code, primary parameters associated with advection can be located in Section 7 (e.g., Table 7-4.1). Total and effective porosity values applied in the transport model are provided in Table 8-2.1.

8.2.2 Hydrodynamic Dispersion Parameters

Definition of dispersivity values for use in field-scale transport simulations is inherently difficult and has been the subject of some controversy. Numerous studies have been conducted to characterize field-scale dispersivity values. Gelhar et al. (1985, 1992) provide a comprehensive review of field-scale physical transport processes and discuss many practical implications for transport modeling. Hydrodynamic dispersion refers to the spreading of a constituent by the combined action of mechanical dispersion and molecular diffusion. Dispersion causes some of the constituent to move faster and some to move slower than the average linear velocity of groundwater. Mechanical dispersion is caused by the variations in the magnitude and direction of velocity of groundwater. Molecular diffusion results from constituent concentration gradients, which cause the constituent to move from regions of higher concentration to regions of lower concentration.

Dispersivity is a scale dependent property and is not constituent-specific. The transport model requires longitudinal, transverse, and vertical dispersivity values as input. As a rule of thumb, and in the absence of site specific data, horizontal transverse dispersivity can be assumed to be approximately one order of magnitude smaller than longitudinal dispersivity, while vertical transverse dispersivity can be assumed to be approximately two orders of magnitude smaller than longitudinal dispersivity (Zheng and Bennett 1995). Estimates of longitudinal dispersivity for the transport model were obtained from Gelhar et al. (1985, 1992) for a silty matrix at the observational scale of COC distribution beneath the landfill. Transport model values included a longitudinal dispersivity of 30 ft, a transverse dispersivity of 3 ft, and a vertical dispersivity of 0.3 ft (Table 8-2.1).

8.2.3 Retardation Parameters

The retardation factor is the empirical parameter commonly used in transport models to describe the chemical interaction between a constituent and geological materials (i.e., soils, sediments, and rocks). The retardation factor includes processes such as surface adsorption, absorption into the soil structure, precipitation, and physical filtration of colloids. The retardation factor (R_f) is defined as:

$$R_f = 1 + K_d \frac{\rho_b}{n_e}$$

Where: ρ_b = bulk density of the soil (g/cm^3),
n_e = effective porosity of aquifer matrix (ratio), and
K_d = soil/water partition coefficient (g/mL).

For a given mass of constituent, the fraction available for advective transport is influenced by the adsorptive properties of the soil matrix. The soil/water partition coefficient is very important in estimating the potential for the adsorption of dissolved constituents in contact with subsurface media. The soil/water partition coefficient (K_d) describes the ratio of adsorbed to dissolved constituent:

$$K_d = \frac{C_s}{C_{aq}}$$

Where: C_s = concentration of constituent in soil (mg/g), and
C_{aq} = concentration of constituent in aqueous solution (g/mL).

Porosity affects the transport calculation in two important ways. It is a factor in calculating seepage velocity (which controls advective transport), and it defines the pore volume of a model cell available for storage of constituent mass. Total porosity, effective porosity, and bulk density of hydrogeologic media represented in the model are listed in Table 8-2.1. Total and effective porosity values for fly ash are the average values for three fly ash samples analyzed in the laboratory by DBS (2010a; Appendix D). Porosity values for alluvial clay (average of 6 samples) and alluvial sand (average of 4 samples) are based on similar analyses by DBS (2010b; Appendix D). Total and effective porosity values for the Conasauga bedrock (9.9%) were obtained from Dorsch et al. (1996). Due to an absence of available data, it was assumed that Rome bedrock porosity values are equivalent to those of the Conasauga. Model results are insensitive to porosity values of the Rome formation since it is not directly involved in transport (i.e., does not underlie ash disposal areas). The effective porosity of residuum (33.7%) was obtained from Dorsch et al. (1996). The total porosity value for dike fill media (40%) was based on the average of 20 porosity values calculated from void ratios (Stantec 2009a). Porosity values for the railroad area are representative of gravel media.

Bulk density values for fly ash are the average values for three fly ash samples analyzed in the laboratory by DBS (2010a; Appendix D). Bulk density values for alluvial clay (average of 6 samples) and alluvial sand (average of 4 samples) are based on similar analyses by DBS (2010b; Appendix D). Bulk density for the Conasauga bedrock was obtained from Dorsch et al. (1996). Due to an absence of available data, it was assumed that the Rome bedrock bulk density is equivalent to those of the Conasauga. Model results are insensitive to the bulk density value of the Rome formation since it is not directly involved in transport. The bulk density of residuum was obtained from an average of four samples analyzed by PMET (1990). The bulk density for dike fill media was based on the average of 20 sample values from Stantec (2009a). Bulk density assigned to the railroad area is representative of gravel media.

The linear, Freundlich, and Langmuir isotherms are the most commonly used relations for describing equilibrium controlled reversible sorption. These sorption isotherms describe the functional relationship between dissolved and sorbed constituent concentrations at equilibrium under a constant temperature. The linear sorption isotherm assumes that the sorbed concentration is directly proportional to the dissolved concentration. The nonlinear Freundlich and Langmuir isotherms require definition of empirical values that are obtained from experimental measurements. Empirical parameters necessary to implement Freundlich or Langmuir isotherms are lacking for this site; hence, the linear isotherm is employed in transport simulations. The linear isotherm uses a single distribution coefficient, Kd, to define the relationship between the constituent concentrations in the dissolved phase and the concentrations of sorbed material in the porous matrix.

The Kd values applied in transport modeling vary depending on the COC (arsenic, selenium, and radium-226) and properties of the media. Table 8-2.2 lists Kd values applied to ash and geologic media. Considering that transport results can be sensitive to Kd assignment, model simulations (scenarios) were performed to bracket Kd values when possible.

For arsenic, three unique ash Kd values are used to provide a range of the possible site conditions. Arsenic Kd values are based on primarily based on geochemical modeling described in Section 5.2 and listed in Table 5-2.3. Ash Kd values of 180 and 100 L/kg are applied to represent dissolved arsenic concentrations in the ranges of 0.001 to 100 ug/L, and 100 to 1,100 ug/L, respectively. The Kd value of 61.6 L/kg was calculated using the highest measure ash porewater concentration (915 ug/L) relative to the mean ash solids concentration in Table 3-7.1 (56.37 mg/kg; 67 detections). With the exception of bedrock, arsenic Kd values for underlying media are derived from geochemical modeling results. Geochemical modeling predictions for bedrock Kd were based on free iron oxide data from a study performed on Conasauga saprolite at Oak Ridge, Tennessee (Jardine et al. 1989). The resulting Kd values were considered too high for model application. The arsenic Kd value of 9.2 L/kg for bedrock was the lowest value obtained from geochemical modeling and relied on alluvial clay as a surrogate. However, this Kd value is considered to be conservative.

Kd values for selenium are bounded by two values for ash (Table 8-2.2). A value of 21 L/kg is calculated based on batch leaching testing test results (Appendix A) at a liquid:solid ratio of 0.5 and selenium concentration of 305 ug/L. The selenium ash Kd value of 250 L/kg is derived from the highest measured porewater (aqueous) concentration (19.6 ug/L) relative to the mean ash solids concentration in Table 3-7.1 (4.94 mg/kg; 48 detections). Dissolved selenium was not detected in the groundwater of underlying alluvial clay, alluvial sand or bedrock. Furthermore, geochemical modeling of selenium at the site predicted selenium to be precipitated as elemental selenium with site geochemical conditions favoring natural attenuation. The value of 4 L/kg for selenium in media underlying ash was obtained from the literature, but is considered conservatively low. It represents the lowest Kd value observed for selenium (+6) from six soil samples representative of fossil plants in the southeastern United States (EPRI 2004).

For radium-226, a single model simulation is performed using an ash Kd of 3,370 L/kg (Table 8-2.2). The ash Kd value for radium-226 is derived from the highest measured porewater concentration (2.35 pCi/L) relative to the mean ash solids concentration (7.93 pCi/g). An absence of data for radium-226 required development of Kd values for underlying media using regression equations developed by Sheppard (2011) that are a function of pH.

8.2.4 Degradation Parameters

In MT3DMS, the first-order irreversible rate constant is expressed in terms of half-life. The half-life of a constituent ($t_{½}$) represents the time required to reduce constituent concentrations by half. The decay rate (λ) is specified as:

$$\lambda = \ln(2) / t_{½}$$

The half-life of a constituent varies greatly in various environments. For arsenic and selenium, no half-life values are applied in the transport model. Since radium-226 undergoes radioactive decay, it is assigned a half-life value of 1,600 years (Smith and Amonette 2006).

8.2.5 Reactive Transformation Parameters

Reactive transformation generally refers to the conversion of an organic constituent to another chemical. Since the COCs are inorganic constituents, no transformations were applicable in transport modeling.

8.3 BOUNDARY CONDITIONS

In addition to boundary conditions identified for the groundwater flow model (Section 7.4), boundary conditions for the transport model include recharge concentrations (source terms) for each COC to represent leachate emanating from the vadose zone of the ash landfill. This is further described in Section 8.5.

8.4 INITIAL CONDITIONS

Initial conditions for the transport model include constituent (COC) concentration distributions that were developed from field sample measurements for model input as described in Section 3.7. The concentration distributions for arsenic, selenium, and radium-226 were mapped into the model grid in a layer by layer fashion using results from porewater and groundwater sampling (Appendix E). Figures 3-7.1 to 3-7.6 illustration COC concentration distributions based strictly on porewater/groundwater sampling results.

For conservatism, potential background concentrations of COCs outside of the porewater/groundwater sampling network were used to infill all active model cells where field data was absent. Therefore, the mass flux to the river for the three COCs predicted by the model is a combination of a leaching source from the closed Ash Landfill, existing COC concentration distributions, and COC background concentrations. Background concentrations for each COC are singular values based on the averages of three samples from upgradient wells GW01, GW02, and GW03. Background concentrations for arsenic, selenium, and radium-226 are 0.45 ug/L, 0.33 ug/L, and 9.52E-07 ug/L (0.941 pCi/L), respectively.

8.5 REPRESENTATION OF SOURCE TERM

The source terms in transport modeling are recharge concentrations of each COC to represent leachate emanating from the vadose zone of the ash landfill. The mass flux associated with this source term is a function of the recharge rate (0.372 in/yr) prescribed for the capped landfill. As shown in Figure 8-5.1, recharge concentrations encompass the entire footprint of the closed Ash Landfill. The source of COCs for the source term is unsaturated ash residing above the groundwater. Infiltrating water through the ash will dissolve the COC from the ash based on its Kd relationship and recharge vertically to underlying groundwater. Table 8-2.2 lists recharge concentrations for each transport model scenario.

8.6 TRANSPORT RESULTS AND LIMITATIONS

8.6.1 Groundwater Flux

In meetings and correspondence with risk analysts from Jacobs and Arcadis, it was determined that surface waters receiving groundwater flow should be subdivided into three segments due to differences in geography, hydrology (e.g., minimum surface water flows, groundwater fluxes, etc.), and potential receptors. Figure 4-3.2 illustrates aerial coverage of each segment: Swan Pond Embayment, Emory River, and the Plant Intake Channel (eastern portion). It is important to note that the Plant Intake Channel segment only includes the eastern portion to evaluate COC contributions from the Stilling Pond area and proposed Ash Landfill.

Table 8-6.1 summarizes steady-state groundwater contributions to each receiving water segment. As indicated, the Emory River segment is recipient to 1,963 ft^3/d (10.2 gpm) of groundwater influx. The Swan Pond Creek and Plant Intake Channel segments receive 1931 ft^3/d (10.0 gallons per minute [gpm]) and 1259 ft^3/d (6.5 gpm) of groundwater influx, respectively. The segment areas recipient to groundwater discharge are smaller for Swan Pond Creek and Plant Intake Channel segments in comparison to the Emory River (Table 8-6.1). However, groundwater discharge to these segments is also a function of hydraulic gradients (i.e., groundwater velocity) and layer thicknesses. For instance, the hydraulic gradients in the vicinity of the Swan Pond Creek segment are relatively steep (Figure 7-6.1) compared to the Emory River and Plant Intake Channel segments which produces higher cell by cell flux rates.

8.6.2 Zonal Distributions of COCs

Figures 8-6.1 to 8-6.13 illustrate representative COC distributions with time (0, 30, and 100 years) in plan and profile based on transport model scenario 1 for arsenic (ash Kd of 61.6 L/kg), scenario 2 for selenium (ash Kd of 50 L/kg), and scenario 1 for radium-226 (ash Kd of 3,370 L/kg). Transport model scenarios are provided in Table 8-2.2. Aerial plots of selenium in alluvial sand and bedrock are not included because the model predicts no transport into these horizons exceeding the detection level of 0.33 ug/L.

A general observation for all Figures 8-6.1 to 8-6.13 is very little movement of COCs with time. That is, COC plumes are nearly stationary. This is primarily a result of sorption, limited recharge (0.372 in/yr) due to capping, and reductions in lateral groundwater movement afforded by the foundation stabilization walls. However, COCs transport to receiving streams does occur at low concentrations. Subsequent to model simulations, cell-by-cell groundwater flux and COC concentration values were exported for the entire model matrix. The data were then processed such that groundwater and concentration values are prescribed for each cell contributing contaminant mass to the associated surface water segment. Detailed (cell-by-cell) transport modeling results of predicted COC mass fluxes to receiving waters have been furnished to risk analysts for evaluating long-term risks to human and ecological receptors exposed to either surface water or sediment porewater (Appendix K). Constituent mass fluxes to receiving streams are described in the following paragraphs.

8.6.3 Constituent Mass Flux to Receiving Streams

Table 8-6.2 summarizes arsenic mass fluxes to each receiving water segment in relation to transport model scenarios 1 to 3. As indicated, transport predictions based on scenario 1 input data (e.g., ash Kd of 61.6 L/kg) predict slightly more arsenic mass entering the Emory River segment after 100 years. However, the differences in mass flux between modeling scenarios are small. As shown in Table 8-6.2, predictions of arsenic mass fluxes to receiving streams are insensitive to the range of Kd values employed for model scenarios. The Plant Intake Channel segment is recipient to a larger mass flux of arsenic (0.105 g/d) compared to the Swan Pond Creek and Emory River segments. This is apparently due to the location of higher arsenic concentrations in the relic portion of the Former Dredge Cells (e.g., Figure 8-6.1), arsenic mass alignment with southerly hydraulic gradients, and relatively shorter travel distance toward the Plant Intake Channel.

Table 8-6.3 summarizes radium-226 mass fluxes to each receiving water segment for the single transport model scenario (ash Kd of 3370 L/kg). As indicated, transport predictions show slightly more radium-226 mass entering the Emory River segment over time. As with arsenic, higher radium-226 mass flux rates to the river are due to the location of higher radium-226 mass (e.g., Figure 8-6.6), mass alignment with westerly hydraulic gradients, and relatively shorter travel distance toward the Emory River.

Table 8-6.4 summarizes selenium mass fluxes to each receiving water segment for the two transport model scenarios. As indicated, transport predictions show slightly more selenium mass entering the Emory River segment over time compared to the Swan Pond Creek and Plant Intake Channel segments. Transport predictions based on scenario 1 (ash Kd of 21 L/g) are slightly more conservative than scenario 2. However, predictions of selenium mass fluxes to receiving streams in Table 8-6.4 indicate little sensitivity to the Kd values applied for model scenarios. Higher selenium mass flux rates to the river are likely due to the location of higher selenium mass (e.g., Figure 8-6.11), mass alignment with easterly hydraulic gradients, and relatively short migration distance to the Emory River.

8.6.4 Temporal Trends of COCs

Figures 8-6.14 to 8-6.16 are provided to illustrate the behavior of COCs with time along Swan Pond Creek and Emory River segments. As shown in Figure 8-6.14, arsenic concentrations begin to exceed the background concentration of 0.45 ug/L along Swan Pond Creek (Location 1) after approximately 75 years. Along the Emory River (Locations 2 and 3), arsenic concentration begin to increase after 125 years. The implications of these results are unknown considering the risk-based screening level for human health is 0.018 ug/L and model assumptions for the initial arsenic background concentration is 0.45 ug/L.

As shown in Figure 8-6.15, selenium remains at background concentration (0.33 ug/L) with time along Swan Pond Creek (Location 1) and at Location 3 on the Emory River. Slight increases in selenium concentrations are observed at Location 2 on the Emory River corresponding with alluvial sand and bedrock model layers. However, these concentrations are negligible relative to risk-based screening levels for selenium.

Figure 8-6.16 depicts radium-226 concentrations with time along Swan Pond Creek and the Emory River. As indicated, radium-226 concentrations continually decrease with time at all locations due to its high affinity for natural attenuation (e.g., sorption) and degradation by radioactive decay. The starting (background concentration) for radium-226 is 9.52E-07 ug/L (0.941 pCi/L).

Conservative transport predictions indicate that arsenic and selenium concentrations will increase slightly over time at some surface water locations. While the migration rates of these constituents are reduced by natural attenuation, the close proximity of closed ash disposal facilities to potential stream receptors dictates that the constituents will eventually discharge to these streams.

8.6.5 Limitations

As discussed in Section 7, the steady state assumption for groundwater flow model calibration is an approximation of field conditions that may have a transient component. Likewise, flow model parameterization (e.g., PWS and ash fill) and geometry are based on design plans that might be modified before or during construction. Considering that advective flow with groundwater is expected to be the primary transport mechanism for COCs, modifications to such parameters would limit the applicability of model predictions.

Kd values cannot be applied equally to both low and high dissolved concentrations of a constituent. For a typical adsorption isotherm, the value of Kd will vary nonlinearly with constituent concentration. Empirical parameters necessary to implement Freundlich or Langmuir isotherms are lacking for this site; hence, the linear isotherm is employed in transport simulations. Recognizing that transport results can be sensitive to Kd assignment, geochemical modeling was performed to assist in Kd development and model simulations were performed to bracket Kd values when possible; however, at some point in time, all potential sorption sites can become occupied. Model simulations using the Kd approach assume an infinite number of sorption sites. An evaluation of the sorption capacity of native media with time was not performed in this modeling analysis. However, the potential for diminished sorption capacity may not be an issue since ash is subject to secondary mineralization over time. Recent studies by EPRI (2003, 2006) illustrate that natural weathering of ash produces minerals (e.g., amorphous clays and Fe-oxyhydroxides) that provide both a physical and chemical barrier to leaching of metals to groundwater. The presence of the clay and secondary minerals during ash weathering reduces permeability, incorporates metals within the structure of the clay, and provides a higher sorption capacity than original ash minerals. However the rate of clay mineral formation at the site may be greatly reduced due to reduction of net infiltration (capping) since the weathering of ash is accelerated by repeated wetting/drying cycles (Zevenbergen et al. 1999).

Although the groundwater flow model was calibrated against a comprehensive water level data set, the transport model has not been calibrated to site-specific observations (e.g., water quality data). Given that site restoration activities during model development have involved significant amounts of ash and water disturbance, this would be very problematic to impossible. The use of historical observation data might provide an appropriate approach for transport model calibration. However, it would be a considerable undertaking since the three-dimensional model would require reconstruction to historical site conditions.

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9. SUMMARY

A groundwater flow and transport model has been developed to quantify ash-related constituent concentrations and mass loadings entering the Emory River, Swan Pond Embayment, and Plant Intake Channel via groundwater seepage from ash source areas.

Potential COCs identified in the SAP (Jacobs 2010a) included arsenic, mercury, chromium, selenium, radium-226, and thorium-228. Before detailed calculations were performed, COC screening level evaluations were conducted to assess their potential occurrence and mobility in the site groundwater. Geosyntec (2011; Appendix G) indicates that certain COCs (i.e., mercury, chromium, selenium, and thorium-228) are subject to natural attenuation at the site or occur at negligible concentrations such that transport modeling is unwarranted. These constituents are subject to natural attenuation by adsorption, ion-exchange, and chemical precipitation or exist at concentrations less than applicable risk-based screening levels. Geosyntec (2011) included an evaluation of historical and current laboratory analytical data for ash and ash leachate samples to assess the presence, frequency of detection, and concentration range of these constituents; an evaluation of porewater and groundwater concentrations of these constituents in recent samples collected within ash and underlying native media; an evaluation of historical analytical data for COCs from compliance groundwater monitoring; and geochemical modeling to assess the mobility and solubility of these constituents. Geochemical modeling used site-specific ash solids and porewater data, groundwater composition data, mineralogy, and hydraulic parameters. Based on this evaluation, mercury, chromium, selenium, and thorium-228 were screened out due to presence in ash at negligible concentrations, immobility in site groundwater, or both. Of these four constituents, selenium was carried forward in groundwater transport modeling considering its potential for bio-magnification by aquatic organisms.

A comprehensive three-dimensional groundwater flow model was initially developed for calibration to 2010 known field conditions using available data. Since 2010, site conditions do not represent potential long-term constituent flux to receiving waters following closure of ash disposal facilities (i.e., former Dredge Cells, Ash Pond, Stilling Pond, and Ball Field), revisions to the calibrated flow model were necessary to incorporate planned engineering design features. The groundwater flow model representing future (closed) site conditions includes the capped Ash Landfill, leveled and capped Ball Field area, and leveled and capped Stilling Pond. In addition to capping of the Ash Landfill, a foundation stabilization wall is to be installed around the perimeter of the landfill. Model simulations of future conditions incorporate changes in geometry of ash fill areas, recharge, and model boundary conditions. The groundwater flow model representing future site conditions was subsequently linked to a transport model that predicts concentrations of COCs (arsenic, selenium, and radium-226) over a time period of 100 years. Future COC source areas include the closed Ash Landfill, capped Ball Field, and capped Stilling Pond.

Groundwater flow modeling was performed under steady-state conditions using a model domain that represents hydrologic divides across which no shallow groundwater flow occurs. The model boundary is conceived as: the top of Pine Ridge along the northwest; Swan Pond Creek to the north; the Emory River thalweg along the east, the Plant Intake Channel thalweg along the southeast (from the Emory River to the Plant Intake Pumping Station); and a straight line from the top of Pine Ridge to the Plant Intake Pumping Station along the southeast. Vertically, the model is subdivided into eight layers to represent distinct hydrogeologic units (i.e., fly ash, bottom ash, alluvial clay, alluvial sand, bedrock, and residuum). The bottom of the model (no flow) is represented by unweathered bedrock (Conasauga and Rome) at 650 ft msl. The K field for the groundwater flow model is based on a comprehensive evaluation of historical data and the results of field (Appendix B) and lab (Appendix D) testing conducted for this study. Groundwater and surface water levels from 179 wells and piezometers were collected to support groundwater flow model calibration during a single, site-wide water level measurement event performed from July 28 to 30, 2010. These data were supplemented by surface water level measurements at the 34 locations. Model calibration results in a residual mean of 0.51 ft and the standard error of the estimate is 0.26 ft. Considering model elevation differences (>300 ft) and the complexity of site hydrogeologic conditions, the model calibration is considered acceptable. The 2010 conditions flow model is sensitive to recharge rate assignment to K values assigned to ash. While the July 2010 calibration period may be representative of higher river (summer pool) conditions, it is recognized that this steady-state assumption is an approximation of field conditions that may have a transient component.

The groundwater flow model for future conditions is predicated on calibration of the flow model representing 2010 conditions. Relative to the 2010 model, the steady-state flow model representing future conditions required a domain modification along Swan Pond Creek. Final design for Swan Pond Embayment area immediately north of former Dredge Cell 2 has not been finalized; however, TVA indicated that planning considerations for the area involve restoration to pre-failure conditions. For the purposes of modeling (i.e., domain and boundary conditions), it was assumed that the Swan Pond Creek channel will be restored to its pre-failure location. The groundwater flow model representing future (closed) site conditions includes the capped Ash Landfill, leveled and capped Ball Field area, and leveled and capped Stilling Pond. Recharge rate reductions over capped areas of the model (0.372 in/yr) are based on HELP model simulations by Stantec. The PWS has an assumed thickness of 3 ft (per wall) with K values that vary depending on the hydrogeologic unit intersected (based on laboratory analyses of design mixes). Predicted groundwater gradients beneath the closed Ash Landfill are easterly in all media, from Pine Ridge toward the Emory River. In the Ball Field area, gradients are southeasterly toward the Plant Intake Channel.

The future conditions groundwater flow model is representative of higher river (summer pool) conditions; however, this approximation of field conditions that may have a transient component. Model simulations indicate that long-term potentiometric heads are somewhat sensitive to K estimates and dimension for the PWS that reduce lateral groundwater movement into and out of the closed Ash Landfill. If measured K values, configurations, or thicknesses of the installed walls differ substantially from modeled data, the model should be restructured accordingly. The future conditions flow model assumes that fly ash will be used to infill the failed ash surface to achieve the increased design elevations of the closed Ash Landfill. Hence, hydraulic properties are accordingly those of fly ash. If mixed media or other material is used for infilling, there may be modest differences in model predictions.

Reduction in recharge from disposal areas capping produces a striking difference relative to predicted potentiometric surfaces under 2010 conditions. Predicted potentiometric surfaces under 2010 conditions indicate pseudo radial groundwater movement from the relic Dredge Cell. The influences of boundary conditions (i.e., drains and surface water features) are most prominent in shallow (ash and alluvial clay) predicted potentiometric surfaces under 2010 conditions. For the future conditions flow model, predicted potentiometric surfaces beneath the closed Ash Landfill are easterly in all media, from Pine Ridge toward the Emory River. In the Ball Field area, hydraulic gradients are southeasterly toward the Plant Intake Channel.

The site transport model is coupled to the future conditions groundwater flow model. As previously indicated, the groundwater transport model focuses on arsenic, selenium, and radium-228. In addition to boundary conditions identified for the groundwater flow model, boundary conditions for the transport model include recharge concentrations (source term) for each COC to represent leachate emanating from the vadose zone of the ash landfill. Initial conditions for the transport model include constituent (COC) concentration distributions that were developed from porewater and groundwater sampling. For conservatism, potential background concentrations of COCs outside of the porewater/groundwater sampling network were used to infill all active model cells where field data was absent. Therefore, the predicted mass flux to the river for the three COCs is a combination of a leaching source from the closed Ash Landfill, existing COC concentration distributions, and COC background concentrations.

Kd values were used to represent adsorption/retardation behavior of arsenic, radium-226, and selenium during groundwater transport. The Kd values applied in transport modeling vary depending on the COC (arsenic, selenium, and radium-226) and properties of the media. Recognizing that transport results can be sensitive to Kd assignment, model simulations were performed to bracket Kd values when possible. Geochemical modeling was performed to develop arsenic Kd values for ash and geologic media. Geochemical modeling predicted that dissolved selenium would precipitate (by reduction) and selenium minerals in contact with groundwater would not dissolve to increase aqueous selenium concentrations (Appendix G). Predicted selenium behavior is confirmed by only rare detections of selenium in historical groundwater monitoring data at the site. Hence, geochemical modeling could not be applied to produce a plausible Kd for selenium. Because radium-226 is an isotope and the geochemical software does not compute isotope-specific interactions, ash porewater and solid radium-226 concentration data were used to compute empirical Kd values. For conservatism, calculated Kd values for selenium and radium-228 relied on the highest measured porewater concentrations in ash and native media.

The predicted spatial distributions of arsenic with time (0, 30, and 100 years) exhibit little differences other than minor increases in arsenic concentrations laterally from ash toward downgradient surface water boundaries. Predictions of arsenic mass fluxes to receiving streams are insensitive to the range of Kd values employed for model scenarios. The highest arsenic concentrations predicted to enter Swan Pond Creek and the Emory River are 13.49 and 1.27 ug/L, respectively, at 100 years under the conditions of Scenario 1 (ash Kd of 61.1 L/kg). The highest arsenic concentration predicted to enter the Plant Intake Channel is 31.43 ug/L at 100 years under the same conditions. With increasing time, arsenic concentrations are reduced below detection concentrations (0.33 ug/L) in certain upgradient portions of the site. Recall that a background concentration of 0.45 ug/L was used for the initial arsenic concentration distributions which conservatively exaggerate the initial mass available for transport. Time-series results reveal that arsenic contributions to receiving streams are primarily associated with shallow groundwater (model layers 4 and 5) that coincide with the lower portion of the ash fill.

The spatial distributions of selenium with time exhibit little differences other than reductions below detection concentrations (0.33 ug/L) in certain portions of the site and minimal vertical transport from ash into alluvial clay. The highest selenium concentrations predicted to enter Swan Pond Creek and the Emory River are 0.39 and 0.96 ug/L, respectively, at 100 years (Table 8-6.4) under the conditions of Scenario 1 (ash Kd of 21 L/kg). The highest selenium concentration predicted to enter the Plant Intake Channel is 1.07 ug/L at 100 years assuming an ash Kd of 250 L/kg. A background concentration of 0.33 ug/L (analytic detection level) was used for the initial selenium concentration distributions which conservatively overstates the initial mass available for transport. Predictions of selenium mass fluxes to receiving streams indicate little sensitivity to the Kd values applied under two model scenarios. Time-series results suggest that selenium contributions to receiving streams might be associated with deeper geologic media (i.e., alluvial clay, alluvial sand, and bedrock).

The distributions of radium-226 with time exhibit little differences. The highest radium-226 concentrations predicted to enter Swan Pond Creek and the Emory River are 8.97E-07 and 9.31E-07 ug/L, respectively, at 30 years (Table 8-6.3). The highest radium-226 concentration predicted to enter the Plant Intake Channel is 9.25E-07 ug/L at 30 years under the same conditions. The maximum radium-226 concentrations entering receiving streams are lower. With increasing time, radium-226 concentrations are reduced below background concentrations in certain upgradient portions of the site. Recall that a background concentration of 9.52E-07 ug/L (0.941 pCi/L) was used for the initial radium-226 concentration distributions, which conservatively exaggerates the initial mass available for transport. Time-series results illustrate that radium-226 contributions to receiving streams are highest at the onset of transport predictions (0 years), with continuously decreasing concentrations thereafter.

Surface waters recipient to groundwater discharge were subdivided into three segments due to differences in geography, hydrology (e.g., minimum surface water flows, groundwater fluxes, etc.), and potential receptors. The segments include: Swan Pond Embayment, Emory River, and the Plant Intake Channel (eastern portion). Transport predictions indicate slightly more arsenic mass entering the Emory River segment after 100 years relative to Swan Pond Creek and Plant Intake Channel segments; however, the differences in mass flux between modeling scenarios are small. The Plant Intake Channel segment is recipient to a larger mass flux of arsenic (0.105 grams per day) compared to the Swan Pond Creek and Emory River segments. This is apparently due to the location of higher arsenic concentrations in the relic portion of the former Dredge Cell, initial arsenic mass alignment with southerly hydraulic gradients, and relatively shorter travel distance toward the Plant Intake Channel. Transport predictions show slightly more radium-226 mass entering the Emory River segment. As with arsenic, higher radium-226 mass flux rates to the river are due to the location of relatively higher radium-226 initial concentrations, alignment of this mass with westerly hydraulic gradients, and relatively shorter travel distance toward the Emory River. Slightly more selenium mass is predicted to enter the Emory River segment over time based on transport predictions. Relatively higher selenium mass flux rates to the river are likely due to the location of higher selenium initial concentrations, mass alignment with westerly hydraulic gradients, and travel distance toward the Emory River.

As previously indicated, the steady-state assumption for groundwater flow model calibration is an approximation of field conditions that may have a transient component. Likewise, flow model parameterization (e.g., PWS and ash fill) and geometry are based on design plans that might be modified before or during construction. Considering that advective flow with groundwater is expected to be the primary transport mechanism for COCs, modifications to such parameters would limit the applicability of model predictions.

Kds cannot be applied equally to both low and high dissolved concentrations of a constituent. For a typical adsorption isotherm, the value of Kd will vary nonlinearly with constituent concentration. Empirical parameters necessary to develop and implement nonlinear isotherms are lacking for this site; hence, the linear isotherm is employed in transport simulations. Recognizing that transport results can be sensitive to Kd assignment, geochemical modeling was performed to assist in Kd development and model simulations were performed to bracket Kd values when possible. Model simulations using the Kd approach assume an infinite number of sorption sites, however, there is a possibility that all potential sorption sites can become occupied. An evaluation of the sorption capacity of native media with time was not performed in this modeling analysis. However, the potential for diminished sorption capacity may not be an issue since ash is subject to secondary mineralization (e.g., amorphous clays and Fe-oxyhydroxides) over time. The presence of the clay and secondary minerals during ash weathering reduces permeability, incorporates metals within the structure of the clay, and provides a higher sorption capacity than original ash minerals. However the rate of clay mineral formation at the site may be greatly reduced due to reduction of net infiltration (capping) since the weathering of ash is accelerated by repeated wetting/drying cycles.

Although the groundwater flow model was calibrated against a comprehensive water level data set, the transport model has not been calibrated to site-specific observations (e.g., water quality data). Given that site restoration activities during model development have involved significant amounts of ash and water disturbance, this would be very problematic to impossible. The use of historical observation data might provide an appropriate approach for transport model calibration. However, it would be a considerable undertaking since the three-dimensional model would require reconstruction to historical site conditions.

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Tables

Table 1-2.1. Risk-Based Screening Levels

Analyte	Units	Human Health Screening Level[1]	Ecological Screening Level[2]
Arsenic	ug/L	0.018	150
Chromium	ug/L	100	NA[3]
Mercury	ug/L	0.05	0.012
Selenium	ug/L	18	5
Radium-226	pCi/L	0.000816	NA
Thorium-228	pCi/L	0.159	NA

Notes:
[1] *chronic values; mix of risk-based screening levels and regulatory standards/criteria.*
[2] *regulatory criteria or recommended ecological toxicity screening values.*
[3] *NA = not applicable*

Table 3-6.1. Groundwater Elevation Data (July 28 - 30, 2010)

ID	TN State Plane (NAD 27) x (ft)	TN State Plane (NAD 27) y (ft)	Top of Ground (ft-msl)	Top of Screen (ft-msl)	Middle of Screen (ft-msl)	Bottom of Screen (ft-msl)	Water Level (ft-msl)	Screened Media
101	2440333.8	557678.6	768.22	732.22	731.22	730.22	758.21	fly ash
101	2440333.8	557678.6	768.22	729.22	728.22	727.22	755.90	alluvium (clay)/(sand)
101	2440333.8	557678.6	768.22	721.22	720.22	719.22	753.90	alluvium (sand)
102	2440504.9	557776.2	761.42	748.42	747.42	746.42	757.34	fly ash
102	2440504.9	557776.2	761.42	736.42	735.42	734.42	755.49	fly ash
102	2440504.9	557776.2	761.42	731.42	730.42	729.42	754.41	alluvium (silt)
102	2440504.9	557776.2	761.42	713.42	712.42	711.42	753.48	weathered shale
103	2440714.7	557711.9	766.37	733.37	732.37	731.37	753.59	fly ash
103	2440714.7	557711.9	766.37	727.37	726.37	725.37	753.36	alluvium (silt)
103	2440714.7	557711.9	766.37	715.87	714.87	713.87	752.47	weathered shale
106	2441197.3	557301.2	754.69	725.69	724.69	723.69	746.60	alluvium (clay)
106	2441197.3	557301.2	754.69	716.69	715.69	714.69	749.83	alluvium (silt)
106	2441197.3	557301.2	754.69	706.69	705.69	704.69	749.52	alluvium (sand)
109	2441623.3	556965.5	763.41	744.41	743.41	742.41	754.25	fly ash
109	2441623.3	556965.5	763.41	733.41	732.41	731.41	754.56	alluvium (silt)
109	2441623.3	556965.5	763.41	723.41	722.41	721.41	754.09	alluvium (sand)
109	2441623.3	556965.5	763.41	703.41	702.41	701.41	754.08	alluvium (sand)
211	2441966.5	557054.3	765.55	698.05	697.05	696.05	746.88	shale
211(A)	2441975.5	557047.5	765.43	734.43	733.43	732.43	747.60	alluvium (silt)/(sand)
211(B)	2441970.4	557050.9	765.38	745.38	744.38	743.38	750.15	bottom ash
303	2439974.6	555756.1	817.42	747.42	746.42	745.42	764.87	fly ash
303	2439974.6	555756.1	817.42	733.42	732.42	731.42	764.72	fly ash
303	2439974.6	555756.1	817.42	726.92	725.92	724.92	763.75	alluvium (silt)
303	2439974.6	555756.1	817.42	722.42	721.42	720.42	763.40	alluvium (silt)
303	2439974.6	555756.1	817.42	713.42	712.42	711.42	762.94	alluvium (silt)
404	2439087.0	556359.7	763.62	733.62	732.62	731.62	761.86	fly ash
404	2439087.0	556359.7	763.62	723.62	722.62	721.62	759.93	alluvium (silt)
404	2439087.0	556359.7	763.62	717.62	716.62	715.62	759.08	alluvium (sand)
408	2439698.9	556900.9	764.76	731.76	730.26	728.76	757.75	fly ash
408	2439698.9	556900.9	764.76	725.76	724.76	723.76	757.75	alluvium (silt)
408	2439698.9	556900.9	764.76	702.76	701.76	700.76	758.97	alluvium (sand)
500	2440227.9	556623.5	757.63	736.63	735.63	734.63	756.39	fly ash
500	2440227.9	556623.5	757.63	728.63	727.63	726.63	756.93	silt fill
500	2440227.9	556623.5	757.63	724.63	723.63	722.63	758.69	alluvium (clay)
500	2440227.9	556623.5	757.63	707.63	706.63	705.63	756.69	alluvium (sand)
502	2440872.6	556618.3	752.82	733.82	732.82	731.82	748.97	fly ash
502	2440872.6	556618.3	752.82	729.32	728.32	727.32	750.23	alluvium (clay)
502	2440872.6	556618.3	752.82	722.82	721.82	720.82	749.96	alluvium (sand)
502	2440872.6	556618.3	752.82	710.82	710.07	709.32	750.88	alluvium (sand)
503	2439908.3	556834.3	768.11	748.61	747.61	746.61	760.49	fly ash
503	2439908.3	556834.3	768.11	736.11	735.11	734.11	759.10	alluvium (silt)
503	2439908.3	556834.3	768.11	730.11	729.11	728.11	759.56	alluvium (clay)
503	2439908.3	556834.3	768.11	715.11	714.11	713.11	759.32	alluvium (sand)
503	2439908.3	556834.3	768.11	711.11	710.11	709.11	759.24	alluvium (sand)
600	2441424.5	556462.8	776.66	721.66	720.66	719.66	758.51	alluvium (sand)

Table 3-6.1 Continued. Groundwater Elevation Data (July 28 - 30, 2010)

ID	TN State Plane (NAD 27) x (ft)	TN State Plane (NAD 27) y (ft)	Top of Ground (ft-msl)	Top of Screen (ft-msl)	Middle of Screen (ft-msl)	Bottom of Screen (ft-msl)	Water Level (ft-msl)	Screened Media
600(A)	2441420.8	556462.4	776.66	731.66	730.66	729.66	760.21	alluvium (silt)
603	2441187.5	555809.9	780.61	705.61	705.11	704.61	766.66	weathered shale
603(A)	2441185.1	555805.4	780.55	733.55	732.55	731.55	759.83	fly ash
603(B)	2441182.5	555801.2	780.55	725.55	725.05	724.55	764.06	alluvium (sand)
604	2440526.2	554800.4	782.50	692.00	691.00	690.00	760.18	shale
604(A)	2440515.4	554803.2	782.39	720.39	719.39	718.39	763.68	alluvium (clay)
604(B)	2440521.0	554802.0	782.36	727.36	726.36	725.36	758.89	fly ash
605	2441499.0	556273.1	781.64	754.64	753.64	752.64	763.33	fly ash
605	2441499.0	556273.1	781.64	740.64	739.64	738.64	762.71	fly ash
605	2441499.0	556273.1	781.64	733.64	732.64	731.64	761.71	alluvium (silt)
605	2441499.0	556273.1	781.64	706.64	705.64	704.64	758.70	weathered shale
PZ-1A	2440140.4	556601.8	757.28	744.30	742.30	740.30	762.40	fly ash
PZ-1B	2440140.4	556601.8	757.28	733.30	731.30	729.30	757.40	fly ash
PZ-1C	2440140.4	556601.8	757.28	721.30	719.30	717.30	757.00	alluvium (clay)
PZ-1D	2440140.4	556601.8	757.28	716.30	714.30	712.30	756.80	alluvium (gravel)
PZ-2A	2440294.5	556494.7	760.22	744.50	742.50	740.50	759.30	fly ash
PZ-2B	2440294.5	556494.7	760.22	733.50	731.50	729.50	759.90	fly ash
PZ-2C	2440294.5	556494.7	760.22	722.50	720.50	718.50	757.80	alluvium (clay)
PZ-2D	2440294.5	556494.7	760.22	715.50	713.50	711.50	758.20	alluvium (sand)
PZ-3A	2440383.2	556390.5	760.32	747.30	745.30	743.30	760.80	fly ash
PZ-3B	2440383.2	556390.5	760.32	736.30	734.30	732.30	760.50	fly ash
PZ-3C	2440383.2	556390.5	760.32	725.30	723.30	721.30	759.40	alluvium (clay)
PZ-3D	2440383.2	556390.5	760.32	719.30	717.30	715.30	759.40	alluvium (sand)
PZ-4A	2440237.9	556436.4	760.49	744.50	742.50	740.50	761.60	fly ash
PZ-4B	2440237.9	556436.4	760.49	733.50	731.50	729.50	763.50	fly ash
PZ-4C	2440237.9	556436.4	760.49	722.50	720.50	718.50	760.10	alluvium (clay)
PZ-4D	2440237.9	556436.4	760.49	715.50	713.50	711.50	759.80	alluvium (sand)
PZ-5A	2440334.9	556312.7	769.01	751.00	749.00	747.00	766.70	fly ash
PZ-5B	2440334.9	556312.7	769.01	741.00	739.00	737.00	762.60	fly ash
PZ-5C	2440334.9	556312.7	769.01	728.00	726.00	724.00	761.90	alluvium (clay)
PZ-5D	2440334.9	556312.7	769.01	723.00	721.00	719.00	761.90	alluvium (sand)
PZ-6A	2440547.3	556149.7	777.34	755.10	753.10	751.10	763.80	fly ash
PZ-6B	2440547.3	556149.7	777.34	738.40	736.40	734.40	763.50	fly ash
PZ-6C	2440547.3	556149.7	777.34	727.30	725.30	723.30	766.00	alluvium (clay)
PZ-6D	2440547.3	556149.7	777.34	719.40	717.40	715.40	762.20	alluvium (sand)
PZ-7A	2440168.3	556361.2	771.29	748.00	746.00	744.00	763.10	fly ash
PZ-7B	2440168.3	556361.2	771.29	737.90	735.90	733.90	764.00	fly ash
PZ-7C	2440168.3	556361.2	771.29	725.80	723.80	721.80	761.80	alluvium (clay)
PZ-7D	2440168.3	556361.2	771.29	720.30	718.30	716.30	761.60	alluvium (sand)
PZ-8A	2440301.8	556240.9	773.13	752.10	750.10	748.10	763.80	fly ash
PZ-8B	2440301.8	556240.9	773.13	741.10	739.10	737.10	764.60	fly ash
PZ-8C	2440301.8	556240.9	773.13	727.10	725.10	723.10	761.20	alluvium (clay)
PZ-8D	2440301.8	556240.9	773.13	722.10	720.10	718.10	763.10	alluvium (sand)
PZ-9A	2441018.0	556371.6	757.70	748.50	746.50	744.50	756.50	fly ash
PZ-9B	2441018.0	556371.6	757.70	737.50	735.50	733.50	755.70	fly ash

Table 3-6.1 Continued. Groundwater Elevation Data (July 28 - 30, 2010)

ID	TN State Plane (NAD 27)		Top of Ground (ft-msl)	Top of Screen (ft-msl)	Middle of Screen (ft-msl)	Bottom of Screen (ft-msl)	Water Level (ft-msl)	Screened Media
	x (ft)	y (ft)						
PZ-9C	2441018.0	556371.6	757.70	728.50	726.50	724.50	756.70	alluvium (clay)
PZ-9D	2441018.0	556371.6	757.70	720.50	718.50	716.50	760.00	alluvium (clay)/(sand)
PZ-11A	2441170.3	556250.7	764.80	746.80	744.80	742.80	757.90	fly ash
PZ-11B	2441170.3	556250.7	764.80	736.80	734.80	732.80	758.10	fly ash
PZ-11C	2441170.3	556250.7	764.80	727.80	725.80	723.80	759.50	alluvium (clay)
PZ-11D	2441170.3	556250.7	764.80	721.80	719.80	717.80	758.70	alluvium (sand)
PZ-12A	2441002.6	555917.9	772.20	742.20	740.20	738.20	763.40	fly ash
PZ-12B	2441002.6	555917.9	772.20	732.70	730.70	728.70	763.70	fly ash
PZ-12C	2441002.6	555917.9	772.20	726.70	724.70	722.70	763.40	alluvium (clay)
PZ-12D	2441002.6	555917.9	772.20	721.20	719.20	717.20	762.80	alluvium (sand)
PZ-13A	2440943.0	555965.2	761.60	745.60	743.60	741.60	763.40	fly ash
PZ-13B	2440943.0	555965.2	761.60	735.60	733.60	731.60	763.20	fly ash
PZ-13C	2440943.0	555965.2	761.60	725.60	723.60	721.60	767.30	alluvium (clay)
PZ-13D	2440943.0	555965.2	761.60	717.60	715.60	713.60	763.00	alluvium (sand)
PZ-R1A	2439483.9	555966.8	789.48	770.88	769.93	768.98	767.00	fly ash
PZ-R2A	2439705.6	556102.2	805.45	785.45	768.80	752.15	775.20	fly ash
PZ-R2B	2439705.6	556102.2	805.45	747.55	742.50	737.45	765.80	bottom ash
PZ-R2C	2439705.6	556102.2	805.45	734.55	732.10	729.65	765.40	bottom ash
PZ-R3A	2439760.2	556420.4	783.30	760.40	759.60	758.80	766.40	bottom ash
PZ-R4B	2440073.7	555986.5	807.83	742.83	741.33	739.83	766.20	bottom ash
PZ-R4C	2440073.7	555986.5	807.83	736.33	733.08	729.83	765.60	bottom ash
PZ-R5B	2440386.5	555579.3	818.11	748.11	746.11	744.11	764.90	fly ash
PZ-R5C	2440386.5	555579.3	818.11	733.11	732.01	730.91	764.70	fly ash
PZ-R6A	2439817.2	555388.6	812.26	748.26	746.61	744.96	764.80	fly ash
PZ-R6B	2439817.2	555388.6	812.26	735.56	733.56	731.56	763.90	fly ash
PZ-R6C	2439817.2	555388.6	812.26	729.06	727.31	725.56	763.90	fly ash
PZ-R6D	2439817.2	555388.6	812.26	724.86	722.21	719.56	764.10	fly ash
PZ-R6E	2439817.2	555388.6	812.26	715.56	713.41	711.26	763.20	alluvium (silt)
D-PZ-1D	2441468.2	556650.8	765.30	745.80	742.30	738.80	756.92	fly ash
D-PZ-2D	2441500.1	556636.4	766.90	756.90	753.65	750.40	756.94	bottom ash
D-PZ-3D	2441588.5	556823.0	766.30	746.60	743.20	739.80	756.24	fly ash
D-PZ-4D	2441602.2	556814.3	766.00	756.00	752.75	749.50	756.11	fly ash
D-PZ-5D	2441690.9	556958.6	763.70	744.20	741.20	738.20	754.70	fly ash
D-PZ-6D	2441708.6	556942.4	763.70	753.70	750.45	747.20	754.91	fly ash
D-PZ-7D	2441791.0	557106.7	760.00	744.50	741.45	738.40	753.23	fly ash
D-PZ-8D	2441819.1	557091.6	760.10	750.10	746.85	743.60	753.66	fly ash
AD-1	2438377.7	555441.9	777.25	755.80	750.53	745.25	772.79	weathered shale
AD-2	2439781.5	553295.1	753.34	739.44	734.44	729.44	748.45	residuum
AD-3	2440722.4	553770.4	748.66	739.36	736.86	734.36	744.12	weathered shale
6AR	2442760.4	553949.6	749.04	723.09	718.46	713.82	740.89	alluvium (sand)
KIF-22	2442742.7	555663.9	753.20	736.20	718.70	701.20	742.17	fly ash/alluvium
A-1	2439676.7	553306.7	757.02	753.02	745.52	738.02	753.37	bottom ash
A-2	2439700.0	553255.3	754.82	750.32	747.82	745.32	752.12	silty clay fill
A-3	2439727.6	553231.3	747.09	742.09	734.59	727.09	745.38	silty clay fill
B-1	2439911.3	553531.6	759.45	752.35	747.35	742.35	752.03	bottom ash

Table 3-6.1 Continued. Groundwater Elevation Data (July 28 - 30, 2010)

ID	TN State Plane (NAD 27) x (ft)	y (ft)	Top of Ground (ft-msl)	Top of Screen (ft-msl)	Middle of Screen (ft-msl)	Bottom of Screen (ft-msl)	Water Level (ft-msl)	Screened Media
B-2	2439946.5	553469.7	753.17	748.17	740.67	733.17	749.13	silty clay fill
B-3	2439942.3	553416.9	748.49	743.49	735.99	728.49	746.81	silty clay fill
TWP-04	2439792.8	556466.8	782.91	718.91	713.91	708.91	759.71	alluvium (sand)
TWP-05	2441056.6	555670.8	789.01	714.11	709.11	704.11	761.51	alluvium (sand)
P-A1	2439179.0	554804.0	768.90	745.50	743.00	740.50	759.60	fly ash
P-A2	2439107.0	554061.0	769.30	744.30	743.20	742.10	758.95	fly ash
P-C3A	2439530.0	554120.0	768.10	730.10	729.10	728.10	759.40	alluvium
P-A4	2439673.0	554611.0	768.50	741.20	740.20	739.20	758.73	fly ash
P-C4	2439669.0	554606.0	768.70	716.90	715.90	714.90	758.08	alluvium
P-A5	2439415.0	554580.0	769.50	751.10	748.60	746.10	759.28	fly ash
P-C5	2439441.0	554579.0	768.10	711.60	710.55	709.50	758.68	alluvium
PZ-1	2442329.3	556806.6	751.20	731.70	727.70	723.70	742.07	alluvium (clay)
PZ-2(U)	2442259.8	556762.0	763.90	757.90	754.40	750.90	754.73	clay fill
PZ-2(L)	2442259.8	556762.0	763.90	743.90	740.40	736.90	757.38	bottom ash
PZ-4	2442256.4	556765.1	763.80	724.80	721.30	717.80	747.11	alluvium (sand)
PZ-5	2442734.2	555687.6	753.10	743.60	740.10	736.60	740.06	clay fill
PZ-6(U)	2442691.4	555669.7	765.60	759.60	756.10	752.60	754.60	fly ash/clay fill
PZ-7(L)	2442691.4	555669.7	765.60	744.60	741.10	737.60	748.09	bottom ash
PZ-8	2442690.3	555672.2	765.60	716.60	713.10	709.60	743.46	alluvium (sand)
PZ-9	2442904.2	554604.7	750.00	739.00	735.50	732.00	741.21	clay fill
PZ-10(U)	2442840.2	554600.6	765.30	758.50	755.00	751.50	754.67	clay fill
PZ-11(L)	2442840.2	554600.6	765.30	741.50	737.90	734.30	750.68	bottom ash
PZ-12	2442840.5	554606.2	765.30	714.50	710.50	706.50	745.41	alluvium (silt)
PZ-13	2442200.0	553766.1	751.90	744.40	741.15	737.90	741.00	clay fill
PZ-14(U)	2442182.4	553799.4	764.10	759.40	755.90	752.40	752.87	clay fill
PZ-15(L)	2442182.4	553799.4	764.10	744.60	741.10	737.60	740.87	clay fill
PZ-16	2442186.2	553800.5	764.12	721.42	717.77	714.12	747.16	alluvium (sand)/shale
PZ-17	2441141.2	553733.6	753.10	750.90	748.65	746.40	747.71	bottom ash
PZ-18(U)	2441159.0	553771.8	765.30	763.10	759.60	756.10	756.71	clay fill
PZ-19(L)	2441159.0	553771.8	765.30	752.50	748.85	745.20	750.28	clay fill
PZ-20	2441163.3	553769.4	765.30	726.10	722.60	719.10	746.08	alluvium (sand)
PZ-121(A)	2442496.6	556248.2	765.69	756.69	753.19	749.69	755.05	clay fill
PZ-121(B)	2442496.6	556248.2	765.69	741.69	738.19	734.69	749.59	bottom ash/alluvium (silt)
PZ-122	2442498.4	556243.6	765.68	716.78	713.28	709.78	745.10	alluvium (sand)
PZ-123(A)	2442544.3	556264.6	754.75	746.25	742.75	739.25	744.36	alluvium (clay)
PZ-123(B)	2442544.3	556264.6	754.75	731.25	727.75	724.25	743.89	alluvium (sand)
PZ-124(A)	2442848.6	555189.2	766.24	756.74	753.24	749.74	751.85	clay fill
PZ-124(B)	2442848.6	555189.2	766.24	742.24	738.74	735.24	743.93	bottom ash/alluvium (sand)
PZ-125	2442849.4	555184.6	766.22	721.52	718.02	714.52	745.22	alluvium (sand)
PZ-126(A)	2442895.8	555195.0	753.43	745.43	741.93	738.43	741.48	bottom ash
PZ-126(B)	2442895.8	555195.0	753.43	731.43	727.93	724.43	741.39	alluvium (clay)/(sand)
PZ-127(A)	2442388.3	553927.1	761.75	755.75	752.25	748.75	754.26	clay fill
PZ-127(B)	2442388.3	553927.1	761.75	741.75	738.25	734.75	750.95	fly ash
PZ-128	2442380.2	553923.6	761.99	720.99	717.49	713.99	745.17	alluvium (clay)
PZ-129	2442405.2	553846.5	754.85	741.95	738.20	734.45	740.77	fill mix

Table 3-6.2. Surface Water Elevation Data (July 28, 2010)

ID	TN State Plane (NAD 27)		Water Level	Feature
	x (ft)	y (ft)	(ft-msl)	
AP-1	2442714.0	555436.4	760.40	Ash Pond
AP-2	2442071.1	554721.4	760.44	Ash Pond
AP-3	2441588.0	554109.6	760.45	Ash Pond
ASP-1	2442818.2	554385.0	754.74	Settling Basin
ASP-2	2441650.1	554087.7	754.76	Settling Basin
ER-1	2443005.4	557893.7	740.74	Emory River
ER-2	2442481.9	558225.4	740.86	Emory River
ER-3	2442042.1	557177.7	740.86	Emory River
ER-4	2442495.4	556635.5	740.87	Emory River
ER-5	2442669.3	556143.9	740.87	Emory River
ER-6	2442879.6	555500.5	740.86	Emory River
ER-7	2442944.4	554392.9	740.81	Emory River
ER-8	2443231.1	553928.0	740.78	Emory River
IC-1	2443151.1	553955.6	740.76	Intake Channel
IC-2	2442568.9	553853.6	740.89	Intake Channel
IC-3	2442446.1	553815.6	740.84	Intake Channel
IC-4	2440551.1	553646.9	740.60	Intake Channel
IC-5	2439740.1	553212.0	740.56	Intake Channel
IC-6	2439593.5	552844.9	740.59	Intake Channel
RW-1	2438767.3	553702.3	760.35	Red Water Channel
RW-2	2438868.3	553124.3	760.27	Red Water Channel
SC-1	2439179.6	553277.1	762.82	Sluice Channel
SC-2	2439336.0	553428.4	762.94	Sluice Channel
SC-3	2439781.3	553868.3	762.83	Sluice Channel
SC-5	2440503.3	554593.8	762.62	Sluice Channel
SC-7	2440366.5	554604.1	766.30	Sluice Channel
SC-9	2439798.2	554010.2	765.80	Sluice Channel
SC-10	2439312.7	553538.6	765.84	Sluice Channel
SP-1	2439269.8	558311.9	737.99	Swan Pond Creek Diversion Channel
SP-4	2440739.7	558371.7	740.86	Swan Pond Creek Diversion Channel
SP-5	2441439.5	558415.3	741.08	Swan Pond Creek Diversion Channel
SP-6	2442077.6	558198.4	740.90	Swan Pond Creek Diversion Channel
SP-7	2442219.6	558201.8	740.96	Swan Pond Creek Diversion Channel
SP-8	2442091.2	557912.1	741.51	Swan Pond Creek Diversion Channel

Table 3-6.3. Soil Mineralogy from Bulk X-Ray Diffraction (from PMET, 1990)

Well	ID	Depth Range (ft)	Media	Mineral							
				quartz	muscovite	calcite	kaolinite	k-feldspar	illite	zeolites	chlorite
J1	300-1	5-8	residuum or fill	major[1]	trace	---	minor[2]	trace	---	trace[3]	---
J1	300-3	20-23	residuum	major	trace	---	trace	---	---	---	---
J2	300-6	20-23	fill	major	minor	minor	minor	trace	---	trace	trace
J3	300-8	5-8	residuum or fill	major	trace	---	trace	---	trace	---	---
J3	300-10	15-18	residuum	major	trace	---	minor	trace	---	---	trace
J4	300-11	60-63	alluvial sand	major	minor	---	trace	trace	---	---	trace
J5	300-14	15-18	alluvial clay	major	minor	moderate	trace	---	---	trace	trace
J6	300-19	55-58	alluvial sand	major	---	---	---	---	minor[4]	---	trace

Notes:
[1]*major > 25%*
[2]*minor = 5 to 25%*
[3]*trace < 5%*
[4]*potential of randomly interstratified smectite-illite*

Table 3-6.4. Soil Geochemistry (from PMET, 1990)

Well	ID	Depth Range (ft)	Media	Bulk Density (lb/ft3)	Specific Gravity (g/cm3)	Weight (g)	Moisture (%)	Soil pH	Free Fe Oxide (%)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	CO_3^{2-} (mg/L)	HCO_3^- (mg/L)	SO_4^{2-} (mg/L)	Cl^- (mg/L)	$NO3^-$ (mg/L)	$CaCO_3$ (%)
J-1	300-1	5-8	residuum or fill	81.2	2.52	1427	14.9	3.33	0.230	125	62	6	28	<30	<30	0.018	30	0.4	305
J-1	300-2	13-16	residuum	80.8	2.50	1413	16.4	5.80	0.140	12	4	5	10	<30	<30	<0.001	45	0.6	31
J-1	300-3	20-23	residuum	78.0	2.55	1826	19.8	4.52	0.050	46	13	4	12	<30	<30	<0.001	65	0.2	115
J-1	300-4	25-28	residuum	80.1	2.62	1778	20.4	4.50	0.061	29	9	4	9	<30	<30	<0.001	<5	0.2	72
J-2	300-5	15-18	fill	79.6	2.57	1425	18.1	6.92	0.046	30	8	9	17	<30	<30	<0.001	<5	<0.1	74
J-2	300-6	20-23	fill	85.7	2.60	1261	14.9	7.73	0.062	125	26	21	19	<30	1430	<0.001	14	<0.1	310
J-2	300-7	25-27	fill	93.3	2.65	633	6.1	8.33	0.088	96	13	17	20	<30	365	0.002	18	<0.1	240
J-3	300-8	5-8	residuum or fill	75.6	2.53	823	18.8	6.89	0.054	150	29	5	27	<30	660	<0.001	24	<0.1	375
J-3	300-9	10-13	residuum or fill	82.6	2.60	1660	16.9	5.37	0.087	30	5	4	12	<30	135	<0.001	<5	0.2	76
J-3	300-10	15-18	residuum	87.4	2.64	1625	8.5	7.37	0.033	44	28	7	87	<30	100	0.002	<5	<0.1	110
J-4	300-11	60-63	alluvial sand	91.3	2.64	1800	12.7	4.33	0.076	57	9	8	34	<30	<30	<0.001	5	<0.1	140
J-5	300-12	5-8	dike fill	87.8	2.59	802	12.5	8.01	0.070	135	13	18	58	<30	220	0.002	80	<0.1	345
J-5	300-13	10-13	dike fill	84.3	2.63	1300	17.4	8.12	0.080	94	9	16	20	<30	230	<0.001	45	0.2	235
J-5	300-14	15-18	alluvial clay	86.3	2.60	1089	14.6	8.15	0.089	100	11	16	16	<30	185	<0.001	50	<0.1	250
J-5	300-15	20-23	alluvial clay	86.4	2.65	1890	74.3	8.12	0.065	105	10	17	18	<30	150	<0.001	11	<0.1	255
J-5	300-16	25-18	alluvial clay	77.9	2.60	1262	21.3	7.35	0.160	185	19	7	33	<30	400	<0.001	29	0.3	470
J-5	300-17	30-33	alluvial sand	85.6	2.66	957	21.9	5.73	0.170	25	6	20	15	<30	<30	<0.001	<5	5.3	62
J-6	300-18	50-53	alluvial clay	72.3	2.52	2051	19.9	4.52	0.160	21	11	12	6	<30	<30	<0.001	<5	0.1	51
J-6	300-19	55-58	alluvial sand	78.4	2.58	2359	20.9	5.17	0.600	30	16	15	30	<30	<30	<0.001	7	0.2	75
J-6	300-20	60-63	alluvial sand	95.6	2.65	1756	18.0	5.77	0.260	120	11	10	30	<30	150	<0.001	10	0.1	300

Table 3-6.5. Exchangeable Cations (meq/100g; from PMET, 1990)

Well	ID	Depth Range (ft)	Media	CEC[a]	Na	Ca	K	Mg
J-1	300-1	5-8	residuum or fill	22.0	0.087	0.71	0.11	0.37
J-1	300-2	13-16	residuum	21.0	0.087	0.74	0.12	0.30
J-1	300-3	20-23	residuum	20.0	0.087	1.00	0.12	0.43
J-1	300-4	25-28	residuum	25.0	0.087	0.95	0.10	0.34
J-2	300-5	15-18	fill	34.0	0.130	7.90	0.46	2.80
J-2	300-6	20-23	fill	19.0	0.130	12.00	0.31	2.50
J-2	300-7	25-27	fill	29.0	0.130	17.00	0.29	1.90
J-3	300-8	5-8	residuum or fill	31.0	0.087	9.90	0.47	2.20
J-3	300-9	10-13	residuum or fill	31.0	0.087	2.80	0.16	0.57
J-3	300-10	15-18	residuum	34.0	0.130	14.00	0.59	2.30
J-4	300-11	60-63	alluvial sand	9.3	0.087	2.10	0.16	0.38
J-5	300-12	5-8	dike fill	21.0	0.130	63.00	0.34	1.80
J-5	300-13	10-13	dike fill	28.0	0.130	32.00	0.37	1.50
J-5	300-14	15-18	alluvial clay	28.0	0.130	42.00	0.27	1.70
J-5	300-15	20-23	alluvial clay	29.0	0.170	22.00	0.45	1.60
J-5	300-16	25-18	alluvial clay	24.0	0.087	11.00	0.19	0.90
J-5	300-17	30-33	alluvial sand	14.0	0.086	0.84	0.06	0.13
J-6	300-18	50-53	alluvial clay	30.0	0.130	5.10	0.19	2.10
J-6	300-19	55-58	alluvial sand	24.0	0.043	0.79	0.05	0.08
J-6	300-20	60-63	alluvial sand	6.6	0.130	2.50	0.12	0.90

Notes:
[a]*CEC = Cation Exchange Capacity*

Table 3-6.6. Soil Mineralogy from X-Ray Diffraction (from PMET, 2010)

Well	ID	Depth Range (ft)	Media	Mineral (% by weight)											
				quartz	muscovite	plagioclase	kaolinite	k-feldspar	anatase	hematite	amorphous[2]	magnetite	mullite	pyrite	marcasite
GP-23	5575-1	16-38	residuum[1]	5.5	0.0	0.0	0.0	0.0	0.0	3.4	66.1	4.4	17.3	2.0	1.3
GP-16	5575-2	28-32	alluvial clay	63.3	5.9	0.2	3.5	1.3	0.2	0.4	25.2	---	---	---	---
GP-16	5575-3	42-52	alluvial sand	77.5	2.4	0.0	0.7	0.4	0.0	0.2	18.8	---	---	---	---
TWP-04	5575-4	58-68	alluvial clay	59.7	6.1	1.6	3.1	5.3	0.2	0.3	23.7	---	---	---	---
TWP-04	5575-5	72-78	alluvial sand	81.4	1.4	0.6	1.1	1.4	0.1	0.0	14.0	---	---	---	---
TWP-05	5575-6	78-85	alluvial sand	76.7	1.8	0.7	2.1	1.2	0.3	0.0	17.2	---	---	---	---
TWP-05	5575-7	61-66	alluvial clay	67.5	4.9	0.7	2.6	2.1	0.3	0.3	21.6	---	---	---	---
TWP-06	5575-8	35-51	residuum[1]	55.8	6.7	1.2	4.0	1.4	0.4	0.3	28.7	0.2	1.1	0.2	0.0
TWP-06	5575-9	51-60	alluvial sand	72.3	3.9	1.2	2.2	1.4	0.2	0.2	18.6	---	---	---	---

Notes:

[1]contained ash

[2]glass/clay

Table 3-6.7. Soil Geochemistry (from PMET, 2010)

Well	ID	Depth Range (ft)	Media	Soil pH	Free Fe Oxide (%)	CEC[2] (meq/100g)	Exchangeable Cations (meg/100g)					Saturation Extract - Soluble Salts												
							Na	Mg	Al	K	Ca	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Al (%)	Mn (ppm)	BO_3^{-3} (ug/L)	Cl^{-1} (ug/g)	NO_3^{-1} (ug/g)	SO_4^{-2} (ug/g)	$CaCO_3$ (mg/L)	CO_3^{-2} (mg/L)	HCO_3^{-1} (mg/L)
GP-23	5575-1	16-38	residuum[1]	6.02	0.074	0.4	<0.1	<0.1	<0.1	<0.1	0.7	0.0	3.4	66.1	4.4	17.3	2.0	<500	3.56	0.23	1900	7	<1	7
GP-16	5575-2	28-32	alluvial clay	5.12	0.023	0.4	<0.1	0.2	0.1	<0.1	0.5	0.2	0.4	25.2	---	---	---	<500	3.22	0.17	185	<2	<1	2
GP-16	5575-3	42-52	alluvial sand	4.69	0.019	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.0	0.2	18.8	---	---	---	<500	2.72	0.07	153	<2	<1	1
TWP-04	5575-4	58-68	alluvial clay	7.15	0.063	0.2	<0.1	0.5	<0.1	<0.1	1.0	0.2	0.3	23.7	---	---	---	<500	1.81	<0.05	96.1	15	<1	15
TWP-04	5575-5	72-78	alluvial sand	6.4	0.050	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.1	0.0	14.0	---	---	---	<500	2.18	0.05	65.5	5	<1	5
TWP-05	5575-6	78-85	alluvial sand	5.75	0.050	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.0	17.2	---	---	---	<500	3.93	0.18	26.5	6	<1	6
TWP-05	5575-7	61-66	alluvial clay	5.39	0.041	<0.1	<0.1	0.1	0.2	<0.1	0.2	0.3	0.3	21.6	---	---	---	600	2.35	0.12	9.54	5	<1	5
TWP-06	5575-8	35-51	residuum[1]	6.09	0.139	0.3	<0.1	0.4	<0.1	<0.1	0.5	0.4	0.3	28.7	0.2	1.1	0.2	8100	2.88	0.07	315	8	<1	8
TWP-06	5575-9	51-60	alluvial sand	4.9	0.114	<0.1	<0.1	0.1	<0.1	<0.1	0.2	0.2	0.2	18.6	---	---	---	<500	1.42	0.09	38.2	5	<1	5

Notes:

[1]contained ash

[2]CEC = Cation Exchange Capacity

Table 3-6.8. Oxides (weight %) of KIF Fly Ash and Bottom Ash

Ash Type	Sample Location	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	CaO	MgO	K_2O	NaO_2	SO_3	P_2O_5	SrO	BaO	MgO
Bottom Ash	Ash Pond	51.0	22.2	1.0	20.3	1.2	0.8	2.3	0.3	0.2	0.4	0.1	0.2	0.1
Fly Ash	Hopper	56.8	27.0	1.2	8.5	1.5	1.0	2.8	0.3	0.3	0.4	0.1	0.2	0.1
Fly Ash	Dredge Cell	54.9	28.9	1.3	8.6	1.3	1.0	2.7	0.3	0.1	0.5	0.1	0.2	0.1

Table 3-6.9. Fly Ash TCLP Concentrations (1995 and 2002)

Analyte	Units	Results	Location	Date (yr)
Arsenic	ug/L	561	Hopper	2002
Arsenic	ug/L	460	Dredge Cell	2002
Arsenic	ug/L	920	Dredge Cell 1	1995
Arsenic	ug/L	320	Dredge Cell 3	1995
Selenium	ug/L	< 1.0	Hopper	2002
Selenium	ug/L	21.9	Dredge Cell	2002
Selenium	ug/L	67	Dredge Cell 1	1995
Selenium	ug/L	18	Dredge Cell 3	1995

Table 3-6.10. Summary Statistics for TVA, TDEC, and EPA Ash Data (from Jacobs, 2010c)

Analyte	Units	Summary Statistics for TVA Ash Data				Summary Statistics for TDEC Ash Data				Summary Statistics for EPA Ash Data			
		Min. Detected Result	Max. Detected Result	Average Detected Result	Frequency of Detect	Min. Detected Result	Max. Detected Result	Average Detected Result	Frequency of Detect	Min. Detected Result	Max. Detected Result	Average Detected Result	Frequency of Detect
Arsenic	mg/kg	2.78	166	65	52/52	26	100	73	12/12	44.8	81.3	61.1	7/7
Selenium	mg/kg	2.64	17.8	6.7	45/52	2.2	2.2	2.2	1/12	3.13	7.15	5.88	7/7
Radium-226	pCi/g	4.6	8.79	5.85	11/11	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
NA = Not Analyzed

Table 3-6.11. Summary of Analytical Results for Ash from Rail Car Loading

Analyte	Units	Detection Limit	Minimum	Maximum	Number of Detections / Samples	Mean of Detections
TCLP Metals						
Arsenic	ug/L	100	156	270	4 / 109	218.8
Selenium	ug/L	100	101	141	7 / 109	110.0
Total Metals						
Arsenic	mg/kg	1.2 - 9.7	43.7	63.0	2 / 2	35.1
Selenium	mg/kg	2.4 - 2.5	3.6	6.6	2 / 2	5.6
Radionuclides						
Radium-226 (Alpha)	pCi/g	---	2.29	5.72	90 / 90	3.90
Radium-226 (Gamma)	pCi/g	0.181 - 5.316	2.17	6.91	107 / 107	4.03

Table 3-6.12. Summary of Ash Solids Concentrations from Leaching Tests (Jacobs, 2010b)

Analyte	Units	MDL[1]	Results
Arsenic	mg/kg dry	6.69	58.5
Selenium	mg/kg dry	6.69	ND[2]
Radium-226	Not Analyzed		

[1] *Method Detection Limit*
[2] *Not Detected*

Table 3-6.13. Summary of Analytical Results (Dissolved Concentrations) from Groundwater/Porewater Sampling

ID	Media	Analyte (COC)					
		As (ug/L)	Cr (ug/L)	Hg (ug/L)	Ra-226 (pCi/L)	Se (ug/L)	Th-228 (pCi/L)
GP07	Ash	55.2	0.38	ND(0.15)	0.617	ND(0.33)	ND(0.062)
GP08	Ash	66.6	ND[1](0.33)	ND(0.15)	ND(0.373)	0.35	ND(0.102)
GP09	Ash	48.1	0.41	ND(0.15)	ND(0.478)	ND(0.33)	ND(0.108)
GP10	Ash	43.5	0.45	ND(0.15)	ND(0.523)	ND(0.33)	ND(0.123)
GP11	Ash	382	0.37	ND(0.15)	ND(0.501)	0.53	ND(0.066)
GP12	Ash	915	ND(0.33)	ND(0.15)	ND(0.707)	0.97	ND(0.043)
GP13	Ash	463	0.51	NAn[2]	ND(0.636)	16.5	NAn
GP14	Ash	905	0.34	ND(0.15)	0.861	ND(0.33)	ND(0.092)
GP15	Ash	339	0.38	ND(0.15)	ND(0.646)	0.40	ND(0.110)
GP16	Ash	8.9	ND(0.33)	ND(0.15)	ND(0.548)	0.92	ND (0.095)
GP18	Ash	3.9	ND(0.33)	ND(0.15)	2.350	19.6	ND(0.128)
	MDL[3]	0.33	0.33	0.15	0.352 to 0.707	0.33	0.043 to 0.128
	Minimum	3.9	ND(0.33)	NA[4]	0.617	ND(0.33)	NA
	Maximum	915	0.51	NA	2.350	19.6	NA
	Mean	293.7	0.38	NA	1.276	3.69	NA
22	Alluvium	0.72	ND(0.33)	ND(0.15)	ND(0.584)	ND(0.33)	ND(0.049)
6AR	Alluvium	DD(0.33)	ND(0.33)	ND(0.15)	ND(0.468)	ND(0.33)	ND(0.081)
TWP04	Alluvium	594	ND(0.33)	ND(0.20)	1.020	ND(0.33)	ND(0.094)
TWP05	Alluvium	17.3	ND(0.33)	ND(0.20)	ND(0.357)	ND(0.33)	ND(0.088)
TWP06	Alluvium	119	ND(0.33)	ND(0.15)	ND(0.594)	ND(0.33)	ND(0.087)
	MDL	0.33	0.33	0.15 to 0.2	0.357 to 0.594	0.33	0.049 to 0.094
	Minimum	ND(0.33)	NA	NA	ND (0.357)	NA	NA
	Maximum	594	NA	NA	1.020	NA	NA
	Mean	146.3	NA	NA	1.020	NA	NA
AD1	Residuum	0.37	ND(0.33)	ND(0.15)	ND(0.788)	ND(0.33)	ND(0.063)
AD2	Residuum	1.64	ND(0.33)	ND(0.15)	ND(0.491)	ND(0.33)	ND(0.114)
AD3	Residuum	0.50	ND(0.33)	ND(0.15)	0.941	ND(0.33)	ND(0.108)
GW02	Residuum	ND(0.33)	0.51	ND(0.15)	1.580	ND(0.33)	ND(0.032)
	MDL	0.33	0.33	0.15	0.491 to 0.788	0.33	0.032 to 0.114
	Minimum	ND(0.33)	ND(0.33)	NA	ND (0.491)	NA	NA
	Maximum	1.64	0.51	NA	1.580	NA	NA
	Mean	0.71	0.38	NA	1.261	NA	NA

Notes:
[1] *ND = Not Detected*
[2] *NAn = Not Analyzed*
[3] *MDL = Method Detection Limit*
[4] *NA = Not Applicable*

Table 3-6.13 Continued. Summary of Analytical Results (Dissolved Concentrations) from Groundwater/Porewater Sampling

ID	Media	Analyte (COC)					
		As (ug/L)	**Cr (ug/L)**	**Hg (ug/L)**	**Ra-226 (pCi/L)**	**Se (ug/L)**	**Th-228 (pCi/L)**
TWP24	Bedrock	2.72	0.64	ND(0.20)	ND(0.645)	ND(0.33)	ND(0.084)
TWP25	Bedrock	0.33	ND(0.33)	ND(0.20)	ND(0.815)	ND(0.33)	ND(0.081)
TWP26	Bedrock	0.76	ND(0.33)	ND(0.15)	0.283	ND(0.33)	ND(0.085)
	MDL	0.33	0.33	0.15 to 0.2	0.216 to 0.815	0.33	0.034 to 0.138
	Minimum	ND(0.33)	ND(0.33)	NA	0.283	NA	NA
	Maximum	2.72	1.54	NA	0.283	NA	NA
	Mean	1.27	0.65	NA	0.283	NA	NA

Notes:
[1] *ND = Not Detected*
[2] *NAn = Not Analyzed*
[3] *MDL = Method Detection Limit*
[4] *NA = Not Applicable*

Table 3-6.14. Groundwater Compositions Used for Geochemical Modeling

Media	pH (s.u.)	Eh (mV)	Ca^{++} (mg/L)	Mg^{++} (mg/L)	Na^{++} (mg/L)	K^{+} (mg/L)	SO_4^{--} (mg/L)	HCO_3^{-} (mg/L)	Cl^{-} (mg/L)	Fe^{++} (mg/L)	Mn^{++} (mg/L)
Alluvial Sand	5.4	3	52.4	13.3	112	4.55	118.5	235	4.4	9.67	6.75
Alluvial Clay	5.8	42	52.4	13.3	112	4.55	118.5	235	4.4	9.67	6.75
Residuum	6.75	41.5	64.1	10.8	28.9	3.65	144	0.37	4.97	0.37	1.68
Bedrock	6.8	97	39.1	2.6	69	47.4	10.3	36.9	3.1	0.4	0.3
Ash	7.3	-11	28.4	35.5	9.42	17.6	651	235	10.6	32.9	1.62

Table 3-7.1. Summary of Ash Solid Concentrations from EQuIS Database

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Arsenic	mg/kg	1.2 / 9.71	ND	1.84	110	67 / 97	56.37
Chromium	mg/kg	0.5 / 9.71	ND	3.19	49	134 / 136	21.61
Mercury	mg/kg	0.0031 / 0.217	ND	0.028	4.4	67 / 138	0.483
Selenium	mg/kg	2.1 / 19.4	ND	2.45	7.5	48 / 97	4.936
Radium-226 (Gamma)	pCi/g		2.17	2.17	6.914	107 / 107	4.032
Thorium-228 (Alpha)	pCi/g		0.884	0.884	0.884	1 / 1	0.884

Table 5-2.1. Media Input Parameters for Geochemical Modeling

Media	Effective Porosity	Density (g/cm3)	Free Iron Oxide (%)	Free Fe Oxide (g/L groundwater)	Solids Mass (kg/L groundwater)
Ash	0.345	2.6	0.107	4.74	4.738
Alluvial Clay	0.345	2.6	0.178	1.77	4.428
Alluvial Sand	0.332	2.6	0.061	2.76	4.516
Bedrock	0.099	2.1	0.032	1.27	3.973
Residuum	0.345	2.6	0.064	2.83	4.428

Table 5-2.2. User-Specified Input for Geochemists Workbench React Model

Description	Model ID	Value	Units
Heat Capacity of Water	cpw	1	cal/g C
Heat Capacity of Rock	cpr	0.2	cal/g C
Fractional Reaction Increment	delxi	0.01	linear
Density of Water	density	1	g/cm^3
Initial Reaction Increment	dx_init	0.01	0.01
Convergence Criterion	epsilon	5.00E-11	--
Inert Matter	Inert	0	cm^3
Maximum Stoichiometric Ionic Strength	simax	3	molal
Initial Total Dissolved Solids	TDS	0	mg/kg
Kinetic Time-Weighting	theta	0.6	--
Maximum Ionic Strength	timax	3	molal

Table 5-2.3. Predicted Kd (L/kg) Ranges for Arsenic in Different Media

Media	As Kd (L/kg)	As Concentration (ug/L)
Ash	< 180	0.001 - 100
	< 180 - 90	100 - 1100
Alluvial Clay	< 14	0.015 - 100
	< 14 - 12	100 - 1000
Alluvial Sand	< 17	0.0015 - 100
	< 17 - 11	100 - 3000
Bedrock	> 200	0.0034 - 15
Residuum	< 450	0.006 - 1
	250 - 24	10 - 1600

Table 6-3.1. Current Conditions - Model Parameter Summary

GRID INFORMATION	
Number of Rows	680
Number of Columns	750
Number of Layers	8
Total Cells	4,080,000
Total Active Cells	2,261,144
Percent Inactive	55.4%
GRID DIMENSIONS	
Row Spacing	
Minimum Delta-Y (ft)	10
Maximum Delta-Y (ft)	10
Column Spacing	
Minimum Delta-X (ft)	10
Maximum Delta-X (ft)	10
MODEL BOUNDARY CONDITIONS (cells)	
Constant Heads	25,791
Rivers	34,665
Drains	4,213
No Flow	1,818,856
RECHARGE (inches/year)	
Ash/Dike	6
Residuum	8
Railroad Unloaded Yard	4
Pine Ridge	9

Table 6-4.1. Current Conditions - Hydraulic Conductivity Summary

Media	Model Layer 1			Model Layers 2-5			Model Layer 6			Model Layer 7			Model Layer 8		
	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio
Fly Ash	5.40E-05	4.20E-05	1.29	5.40E-05	4.20E-05	1.29									
FA/BA[1]				3.36E-04	1.68E-04	2.00									
FA/BA[2]				6.18E-04	3.09E-04	2.00									
FA/BA[3]				9.00E-04	4.50E-04	2.00									
Dike	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00									
Outer Dike	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00									
Railroad Backfill	1.00E-03	1.00E-03	1.00	1.00E-03	1.00E-03	1.00									
Railroad Loaded Yard	9.00E-04	9.00E-04	1.00												
Alluvial Clay							5.00E-06	2.50E-06	2.00						
Alluvial Sand										5.00E-04	2.50E-04	2.00			
Conasauga Bedrock													5.00E-04	5.00E-04	1.00
Residuum	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00			
Rome Bedrock	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00	7.85E-05	7.85E-05	1.00	4.00E-05	4.00E-05	1.00	2.00E-05	2.00E-05	1.00

Notes:

shaded cells indicate not applicable

FA = fly ash

BA = bottom ash

FA/BA[1] = bottom ash 1 to 3.3 ft thick

FA/BA[2] = bottom ash 3.3 to 6.7 ft thick

FA/BA[3] = bottom ash 6.7 to 10 ft thick

Table 6-6.1. Comparison of Predicted and Measured Groundwater Elevations

Well	Observed (ft-msl)	Predicted (ft-msl)	Predicted - Observed (ft)
101/C	753.90	756.89	2.99
101/B	755.90	757.39	1.49
101/A	758.21	757.39	-0.82
102/D	753.48	755.70	2.22
102/C	754.41	756.31	1.90
102/B	755.49	756.87	1.38
102/A	757.34	756.98	-0.36
103/D	752.47	754.79	2.32
103/B	753.36	755.48	2.12
103/A	753.59	756.21	2.62
106/A	746.60	753.65	7.05
106/C	749.52	753.02	3.50
106/B	749.83	753.02	3.19
109/D	754.08	751.77	-2.31
109/C	754.09	751.77	-2.32
109/A	754.25	752.96	-1.29
109/B	754.56	752.37	-2.19
211/A	746.88	747.94	1.06
211(A)/A	747.60	748.43	0.83
211(B)/A	750.15	749.03	-1.12
303/E	762.94	766.79	3.85
303/D	763.40	766.79	3.39
303/C	763.75	766.79	3.04
303/B	764.72	767.96	3.24
303/A	764.87	768.01	3.14
404/C	759.08	764.81	5.73
404/B	759.93	764.81	4.88
404/A	761.86	765.00	3.14
408/A	757.75	761.13	3.38
408/B	757.75	761.13	3.38
408/C	758.97	761.00	2.03
500/A	756.39	757.33	0.94
500/D	756.69	759.00	2.31
500/B	756.93	757.33	0.40
500/C	758.69	758.20	-0.49
502/A	748.97	752.56	3.59
502/C	749.96	755.49	5.53
502/B	750.23	754.06	3.83
502/D	750.88	755.49	4.61
503/B	759.10	760.25	1.15
503/E	759.24	760.22	0.98
503/D	759.32	760.22	0.90
503/C	759.56	760.23	0.67
503/A	760.49	760.25	-0.24
600/A	758.51	755.57	-2.94

Well	Observed (ft-msl)	Predicted (ft-msl)	Predicted - Observed (ft)
600(A)/A	760.21	756.22	-3.99
603/A	766.66	760.07	-6.59
603(A)/A	759.83	761.59	1.76
603(B)/A	764.06	760.85	-3.21
604/A	760.18	762.80	2.62
604(A)/A	763.68	763.55	-0.13
604(B)/A	758.89	764.23	5.34
605/D	758.70	756.31	-2.39
605/C	761.71	757.12	-4.59
605/B	762.71	757.92	-4.79
605/A	763.33	757.97	-5.36
6AR/A	740.89	744.46	3.58
A-1/A	753.37	750.47	-2.90
A-2/A	752.12	747.12	-5.00
A-3/A	745.38	745.05	-0.33
AD-2/A	748.45	746.09	-2.36
AD-3/A	744.12	745.79	1.67
B-1/A	752.03	751.58	-0.45
B-2/A	749.13	747.14	-1.98
B-3/A	746.81	745.07	-1.74
D-PZ-1D/A	756.92	755.76	-1.16
D-PZ-2D/A	756.94	755.72	-1.22
D-PZ-3D/A	756.24	754.40	-1.84
D-PZ-4D/A	756.11	754.36	-1.75
D-PZ-5D/A	754.70	752.53	-2.17
D-PZ-6D/A	754.91	749.93	-4.99
D-PZ-7D/A	753.23	750.79	-2.44
D-PZ-8D/A	753.66	750.64	-3.02
KIF-22/A	742.17	747.32	5.14
P-A1/A	759.60	768.85	9.25
P-A2/A	758.95	765.63	6.68
P-A4/A	758.73	767.34	8.61
P-A5/A	759.28	767.86	8.58
P-C3A/A	759.40	765.79	6.39
P-C4/A	758.08	766.46	8.39
P-C5/A	758.68	766.89	8.21
PZ-1/A	742.07	745.08	3.01
PZ-10(U)/A	754.67	749.39	-5.28
PZ-11(L)/B	750.68	748.03	-2.65
PZ-11A/A	757.90	757.70	-0.20
PZ-11B/B	758.10	757.69	-0.41
PZ-11C/C	759.50	757.63	-1.87
PZ-11D/D	758.70	757.57	-1.13
PZ-12/A	745.41	747.06	1.65
PZ-121(A)/A	755.05	749.93	-5.13

Table 6-6.1 Continued. Comparison of Predicted and Measured Groundwater Elevations

Well	Observed (ft-msl)	Predicted (ft-msl)	Predicted - Observed (ft)
PZ-121(B)/B	749.59	746.09	-3.50
PZ-122/A	745.10	746.73	1.63
PZ-123(A)/A	744.36	744.81	0.45
PZ-123(B)/B	743.89	745.97	2.08
PZ-124(A)/A	751.85	749.55	-2.30
PZ-124(B)/B	743.93	746.62	2.69
PZ-125/A	745.22	747.00	1.78
PZ-126(A)/A	741.48	741.05	-0.43
PZ-126(B)/B	741.39	744.29	2.90
PZ-127(A)/A	754.26	750.97	-3.29
PZ-127(B)/B	750.95	750.78	-0.16
PZ-128/A	745.17	750.11	4.94
PZ-129/A	740.77	744.41	3.64
PZ-12A/A	763.40	761.68	-1.72
PZ-12B/B	763.70	761.60	-2.10
PZ-12C/C	763.40	760.95	-2.45
PZ-12D/D	762.80	760.34	-2.46
PZ-13/A	741.00	749.61	8.61
PZ-13A/A	763.40	761.57	-1.83
PZ-13B/B	763.20	761.51	-1.69
PZ-13C/C	767.30	760.90	-6.40
PZ-13D/D	763.00	760.32	-2.68
PZ-14(U)/A	752.87	751.98	-0.89
PZ-15(L)/B	740.87	750.54	9.67
PZ-16/A	747.16	749.27	2.11
PZ-17/A	747.71	745.72	-1.99
PZ-18(U)/A	756.71	758.52	1.81
PZ-19(L)/B	750.28	748.04	-2.24
PZ-1A/A	762.40	759.29	-3.11
PZ-1B/B	757.40	759.31	1.91
PZ-1C/C	757.00	759.60	2.60
PZ-1D/D	756.80	759.87	3.07
PZ-2(L)/B	757.38	746.68	-10.70
PZ-2(U)/A	754.73	749.93	-4.81
PZ-20/A	746.08	749.04	2.96
PZ-2A/A	759.30	759.32	0.02
PZ-2B/B	759.90	759.31	-0.59
PZ-2C/C	757.80	759.43	1.63
PZ-2D/D	758.20	759.55	1.35
PZ-3A/A	760.80	760.15	-0.65
PZ-3B/B	760.50	760.12	-0.38
PZ-3C/C	759.40	759.99	0.59
PZ-3D/D	759.40	759.86	0.46
PZ-4/A	747.11	746.92	-0.19
PZ-4A/A	761.60	760.80	-0.80

Well	Observed (ft-msl)	Predicted (ft-msl)	Predicted - Observed (ft)
PZ-4B/B	763.50	760.77	-2.73
PZ-4C/C	760.10	760.61	0.51
PZ-4D/D	759.80	760.48	0.68
PZ-5/A	740.06	746.89	6.83
PZ-5A/A	766.70	761.48	-5.22
PZ-5B/B	762.60	761.45	-1.15
PZ-5C/C	761.90	761.14	-0.76
PZ-5D/D	761.90	761.14	-0.76
PZ-6(U)/A	754.60	750.92	-3.68
PZ-6A/A	763.80	762.13	-1.67
PZ-6B/B	763.50	761.97	-1.53
PZ-6C/C	766.00	761.42	-4.58
PZ-6D/D	762.20	760.90	-1.30
PZ-7(L)/B	748.09	751.22	3.13
PZ-7A/A	763.10	762.31	-0.79
PZ-7B/B	764.00	762.25	-1.75
PZ-7C/C	761.80	761.89	0.09
PZ-7D/D	761.60	761.56	-0.04
PZ-8/A	743.46	748.36	4.90
PZ-8A/A	763.80	762.78	-1.02
PZ-8B/B	764.60	762.64	-1.96
PZ-8C/C	761.20	762.11	0.91
PZ-8D/D	763.10	761.62	-1.48
PZ-9/A	741.21	744.92	3.71
PZ-9A/A	756.50	754.89	-1.61
PZ-9B/B	755.70	754.98	-0.72
PZ-9C/C	756.70	755.99	-0.71
PZ-9D/D	760.00	756.96	-3.04
PZ-R1A/A	767.00	767.85	0.85
PZ-R2A/A	775.20	767.04	-8.16
PZ-R2B/B	765.80	766.88	1.08
PZ-R2C/C	765.40	766.79	1.39
PZ-R3A/A	766.40	765.00	-1.40
PZ-R4B/B	766.20	766.89	0.69
PZ-R4C/C	765.60	766.75	1.15
PZ-R5B/B	764.90	766.66	1.76
PZ-R5C/C	764.70	766.56	1.86
PZ-R6A/A	764.80	768.80	4.00
PZ-R6B/B	763.90	768.73	4.83
PZ-R6C/C	763.90	768.73	4.83
PZ-R6D/D	764.10	767.75	3.65
PZ-R6E/E	763.20	767.75	4.55
TWP-04/A	759.71	763.11	3.41
TWP-05/A	761.51	761.09	-0.42

Table 6-7.1. Summary of Sensitivity Analysis

Parameters	Scenario	Number of Data Points	Maximum Residual (ft)	Minimum Residual (ft)	Residual Mean (ft)	Absolute Residual Mean (ft)	Standard Error of Estimate (ft)	RMS (ft)	Normalized RMS (%)	Correlation Coefficient
	Base	179	-10.704 at PZ-2(L)/B	0.016 at PZ-2A/A	0.51	2.73	0.26	3.48	9.89	0.88
Hydraulic Conductivity	K-ash - 0.5 X	179	10.095 at P-A1/A	0.024 at PZ-4B/B	1.80	3.15	0.26	3.87	11.02	0.89
	K-ash - 1.5 X	179	-10.93 at PZ-2(L)/B	0.011 at PZ-R1A/A	0.23	2.68	0.26	3.45	9.81	0.88
	K-alluvial clay - 0.5 X	179	-10.313 at PZ-2(L)/B	-0.029 at PZ-7C/C	0.55	2.63	0.25	3.41	9.71	0.88
	K-alluvial clay - 2.0 X	179	-11.143 at PZ-2(L)/B	0.005 at PZ-R4C/C	0.18	2.74	0.26	3.48	9.89	0.88
	K-alluvial sand - 0.5 X	179	-10.613 at PZ-2(L)/B	0.022 at 604(A)/A	0.61	2.72	0.26	3.47	9.89	0.88
	K-alluvial sand - 2.0 X	179	-10.598 at PZ-2(L)/B	-0.024 at PZ-7C/C	0.36	2.67	0.25	3.40	9.66	0.88
	K-bedrock - 0.5 X	179	-10.144 at PZ-2(L)/B	0.012 at 101/A	1.34	2.75	0.25	3.62	10.30	0.89
	K-bedrock - 2.0 X	179	-11.012 at PZ-2(L)/B	-0.015 at 503/E	-0.47	2.77	0.26	3.50	9.96	0.87
Recharge	R- 0.5 X	179	-12.377 at PZ-R2A/A	-0.022 at 303/E	-1.71	3.35	0.28	4.07	11.58	0.85
	R- 1.5 X	179	11.082 at P-A1/A	0.002 at B-1/A	2.80	3.63	0.26	4.41	12.55	0.90
	R- 2.0 X	179	12.737 at P-A1/A	0.118 at PZ-127(B)/B	4.31	4.92	0.28	5.67	16.15	0.90
Pine Ridge	Recharge - 0.5 X	179	-10.913 at PZ-2(L)/B	0.156 at PZ-2D/D	-0.28	2.73	0.26	3.43	9.77	0.88
	Recharge - 1.5 X	179	-10.512 at PZ-2(L)/B	0.006 at 102/A	0.82	2.69	0.25	3.46	9.85	0.89
	Recharge - 2.0 X	179	-10.523 at PZ-2(L)/B	0.008 at 102/A	0.82	2.71	0.25	3.48	9.89	0.88

Notes:
RMS = Root Mean Squared

Table 7-1.1. Future Conditions - Model Parameter Summary

GRID INFORMATION	
Number of Rows	680
Number of Columns	750
Number of Layers	8
Total Cells	4,080,000
Total Active Cells	2,089,600
Percent Inactive	51.2%
GRID DIMENSIONS	
Row Spacing	
Minimum Delta-Y (ft)	10
Maximum Delta-Y (ft)	10
Column Spacing	
Minimum Delta-X (ft)	10
Maximum Delta-X (ft)	10
MODEL BOUNDARY CONDITIONS (cells)	
Constant Head	273
River	26,681
Drain	4,931
Wall	21,574
No Flow	1,990,400
RECHARGE (inches/year)	
Ash/Dike	6
Residuum	8
Railroad Unloaded Yard	4
Pine Ridge	9
Capped Areas	0.372

Table 7-4.1. Future Conditions - Hydraulic Conductivity Summary

Properties	Model Layer 1			Model Layers 2-5			Model Layer 6			Model Layer 7			Model Layer 8		
	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio	Kh (cm/s)	Kv (cm/s)	Kh/Kv Ratio
Fly Ash	5.40E-05	4.20E-05	1.29	5.40E-05	4.20E-05	1.29									
FA/BA[1]				3.36E-04	1.68E-04	2.00									
FA/BA[2]				6.18E-04	3.09E-04	2.00									
FA/BA[3]				9.00E-04	4.50E-04	2.00									
Dike	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00									
Outer Dike	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00									
Railroad Backfill	1.00E-03	1.00E-03	1.00	1.00E-03	1.00E-03	1.00									
Railroad Loaded Yard	9.00E-04	9.00E-04	1.00												
Alluvial Clay							5.00E-06	2.50E-06	2.00						
Alluvial Sand										5.00E-04	2.50E-04	2.00			
Conasauga Bedrock													5.00E-04	5.00E-04	1.00
Residuum	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00	5.00E-04	2.50E-04	2.00			
Rome Bedrock	8.00E-04	8.00E-04	1.00	8.00E-04	8.00E-04	1.00	7.85E-05	7.85E-05	1.00	4.00E-05	4.00E-05	1.00	2.00E-05	2.00E-05	1.00
Stabilization Wall - Ash	5.00E-06	5.00E-06	1.00	5.00E-06	5.00E-06	1.00									
Stabilization Wall - Clay							2.00E-08	2.00E-08	1.00						
Stabilization Wall - Silt/Sand										1.00E-07	1.00E-07	1.00			

Notes:

shaded cells indicate not applicable

FA = fly ash

BA = bottom ash

FA/BA[1] = bottom ash 1 to 3.3 ft thick

FA/BA[2] = bottom ash 3.3 to 6.7 ft thick

FA/BA[3] = bottom ash 6.7 to 10 ft thick

Table 8-2.1. Summary of Transport Model Parameters

Material Type	Porosity (%)	Effective Porosity (%)	Dry Bulk Density (lb/ft^3)	Longitudinal Dispersivity (ft)	Lateral Dispersivity (ft)	Transverse Dispersivity (ft)
Ash	48.74	40.24	84.28	30.0	3.0	0.3
Alluvial Clay	36.06	26.47	106.34	30.0	3.0	0.3
Alluvial Sand	40.28	36.65	97.44	30.0	3.0	0.3
Conasauga Bedrock	9.90	9.90	125.00	30.0	3.0	0.3
Residuum	42.13	33.70	84.22	3.3	3.0	0.3
Rome Bedrock	9.90	9.90	125.00	30.0	3.0	0.3
Dike Media	40.00	32.00	100.90	30.0	3.0	0.3
Railroad Backfill	31.25	25.00	100.00	30.0	3.0	0.3
Railroad Unloaded Yard	31.25	25.00	100.00	30.0	3.0	0.3

Table 8-2.2. Summary of COC Partition Coefficients (Kds) and Recharge Concentrations

Constituent of Concern (COC)	Scenario	Media	Kd (L/kg)	Recharge Concentration (ug/L)
Arsenic	**1**	ash	61.6	915
		alluvial clay	14.0	
		alluvial sand	17.0	
		residuum	379.3	
		bedrock	9.2	
	2	ash	100.0	564
		alluvial clay	14.0	
		alluvial sand	17.0	
		residuum	379.3	
		bedrock	9.2	
	3	ash	180.0	313
		alluvial clay	14.0	
		alluvial sand	17.0	
		residuum	379.3	
		bedrock	9.2	
Selenium	**1**	ash	21.0	235
		alluvial clay	4.0	
		alluvial sand	4.0	
		residuum	4.0	
		bedrock	4.0	
	2	ash	250.0	19.6
		alluvial clay	4.0	
		alluvial sand	4.0	
		residuum	4.0	
		bedrock	4.0	
Radium-226	**1**	ash	3370.0	2.38E-06 (2.35 = pCi/L)
		alluvial clay	19.1	
		alluvial sand	19.1	
		residuum	282.0	
		bedrock	90.5	

Table 8-6.1. Summary of Groundwater Water Fluxes to Surface Water

Parameter	Swan Pond Creek	Emory River	Intake Channel
Number of Model Cells[1]	5,100	10,722	4,480
Segment Area (ft^2)	510,000	1,072,200	448,000
Minimum Cell Flux (ft^3/d)	0.00	0.00	0.01
Maximum Cell Flux (ft^3/d)	11.69	5.70	7.89
Average Cell Flux (ft^3/d)	0.38	0.18	0.28
Segment Water Flux (ft^3/d)	1930.6	1963.0	1258.5
Segment Water Flux (gal/min)	10.03	10.20	6.54

Notes:
[1] *Model cells are 10 ft x 10 ft in horizontal*

Table 8-6.2. Arsenic Mass Flux Summary

Parameter	Swan Pond Creek		Emory River		Intake Channel		Ash Kd (L/kg)
	30-Year	100-Year	30-Year	100-Year	30-Year	100-Year	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.30	**61.6**
Maximum Concentration (ug/L)	2.10	13.49	0.81	1.27	31.01	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (g/d)	0.028	0.072	0.026	0.026	0.099	0.105	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.30	**100**
Maximum Concentration (ug/L)	2.06	13.47	0.81	0.92	31.00	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (g/d)	0.028	0.072	0.026	0.025	0.099	0.105	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.29	**180**
Maximum Concentration (ug/L)	2.04	13.41	0.81	0.82	30.99	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (g/d)	0.028	0.071	0.026	0.025	0.099	0.105	

Table 8-6.3. Radium-226 Mass Flux Summary

Parameter	Swan Pond Creek		Emory River		Intake Channel		Ash Kd (L/kg)
	30-Year	100-Year	30-Year	100-Year	30-Year	100-Year	
Min Concentration (ug/L)	7.11E-07	6.27E-07	6.42E-07	4.52E-07	8.14E-07	6.05E-07	**3370**
Max Concentration (ug/L)	8.97E-07	8.61E-07	9.31E-07	8.85E-07	9.25E-07	8.75E-07	
Ave Concentration (ug/L)	8.94E-07	8.52E-07	8.95E-07	8.53E-07	8.95E-07	8.50E-07	
Segment Mass Flux (g/d)	4.78E-08	4.42E-08	4.87E-08	4.45E-08	3.16E-08	2.90E-08	

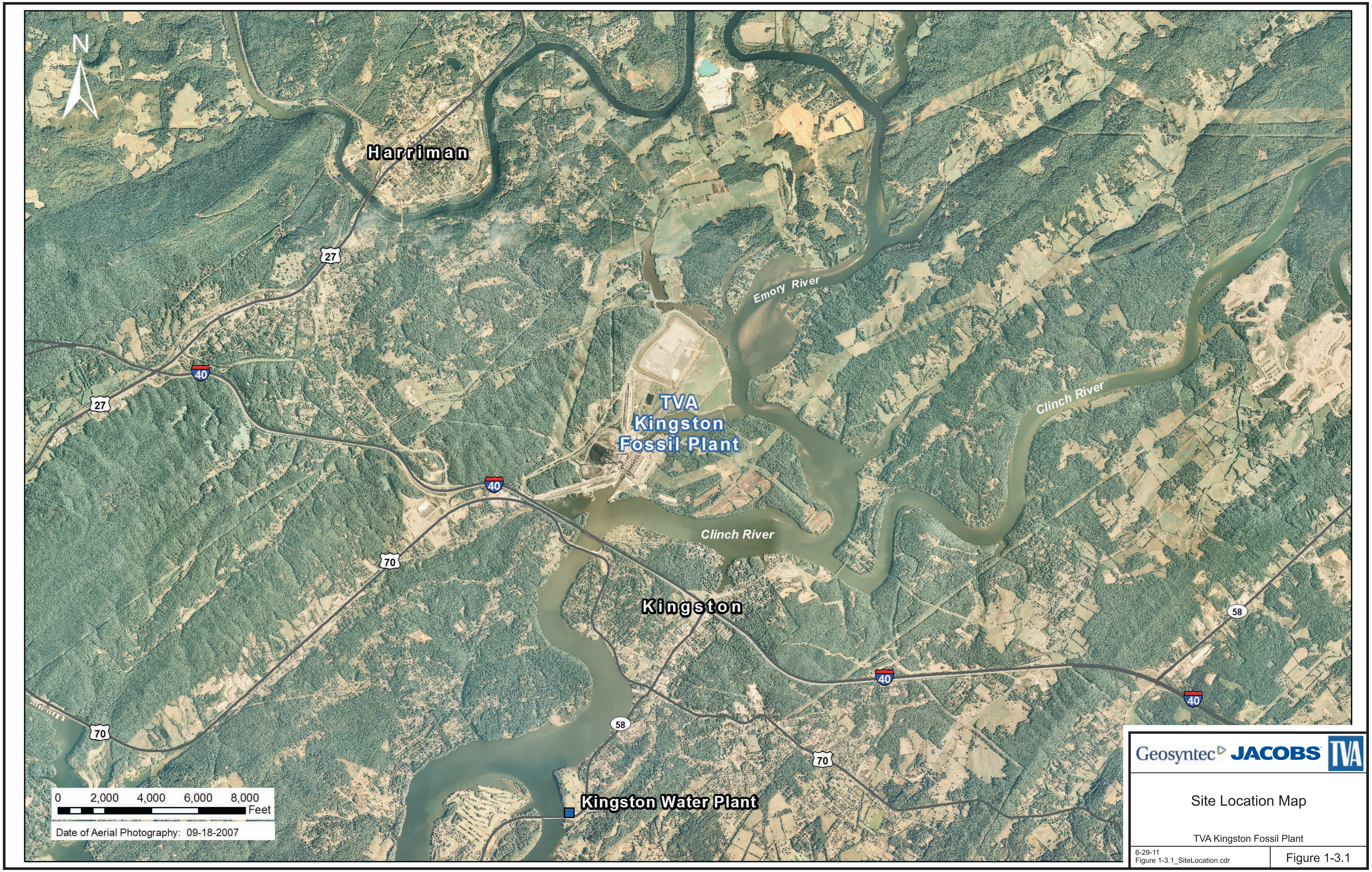
Notes:
Kd = soil/water partition coefficient

Table 8-6.4. Selenium Mass Flux Summary

Parameter	Swan Pond Creek		Emory River		Intake Channel		Ash Kd (L/kg)
	30-Year	100-Year	30-Year	100-Year	30-Year	100-Year	
Minimum Cell Concentration (ug/L)	0.26	0.26	0.15	0.08	0.21	0.11	**21**
Maximum Cell Concentration (ug/L)	0.33	0.39	0.70	0.96	1.07	1.02	
Average Cell Concentration (ug/L)	0.33	0.33	0.33	0.34	0.35	0.35	
Segment Mass Flux (g/d)	0.018	0.017	0.019	0.020	0.015	0.015	
Minimum Cell Concentration (ug/L)	0.29	0.27	0.15	0.08	0.20	0.11	**250**
Maximum Cell Concentration (ug/L)	0.33	0.33	0.65	0.67	1.05	1.07	
Average Cell Concentration (ug/L)	0.33	0.33	0.33	0.33	0.35	0.35	
Segment Mass Flux (g/d)	0.018	0.018	0.019	0.019	0.015	0.015	

Notes:
Kd = soil/water partition coefficient

Figures


N
Harriman
27
40
27
Emory River
TVA
Kingston
Fossil Plant
Clinch River
40
70
Clinch River
Kingston
58
40
40
70
58
70
0 2,000 4,000 6,000 8,000
Feet
Date of Aerial Photography: 09-18-2007
Kingston Water Plant
Geosyntec JACOBS TVA
Site Location Map
TVA Kingston Fossil Plant
6-29-11
Figure 1-3.1_SiteLocation.cdr
Figure 1-3.1

Geosyntec JACOBS TVA

Pre-Failure Site Features

TVA Kingston Fossil Plant

7-9-11
Figure 1-3.2_PreFailureFeatures.cdr

Figure 1-3.2

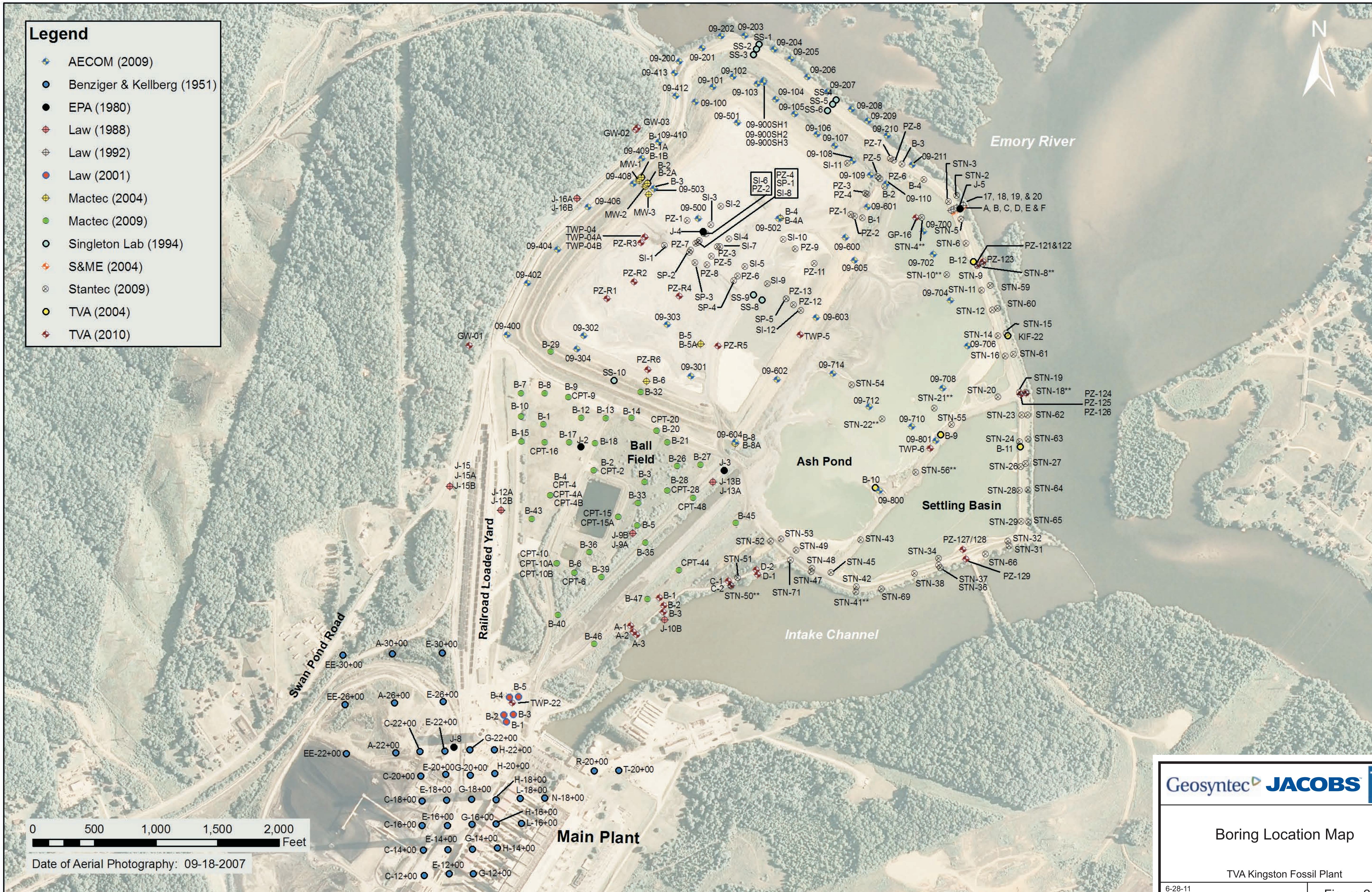
Geosyntec JACOBS TVA

Post-Failure Site Features

TVA Kingston Fossil Plant

7-9-11
Figure 1-3.3_PostFailureFeatures.cdr

Figure 1-3.3



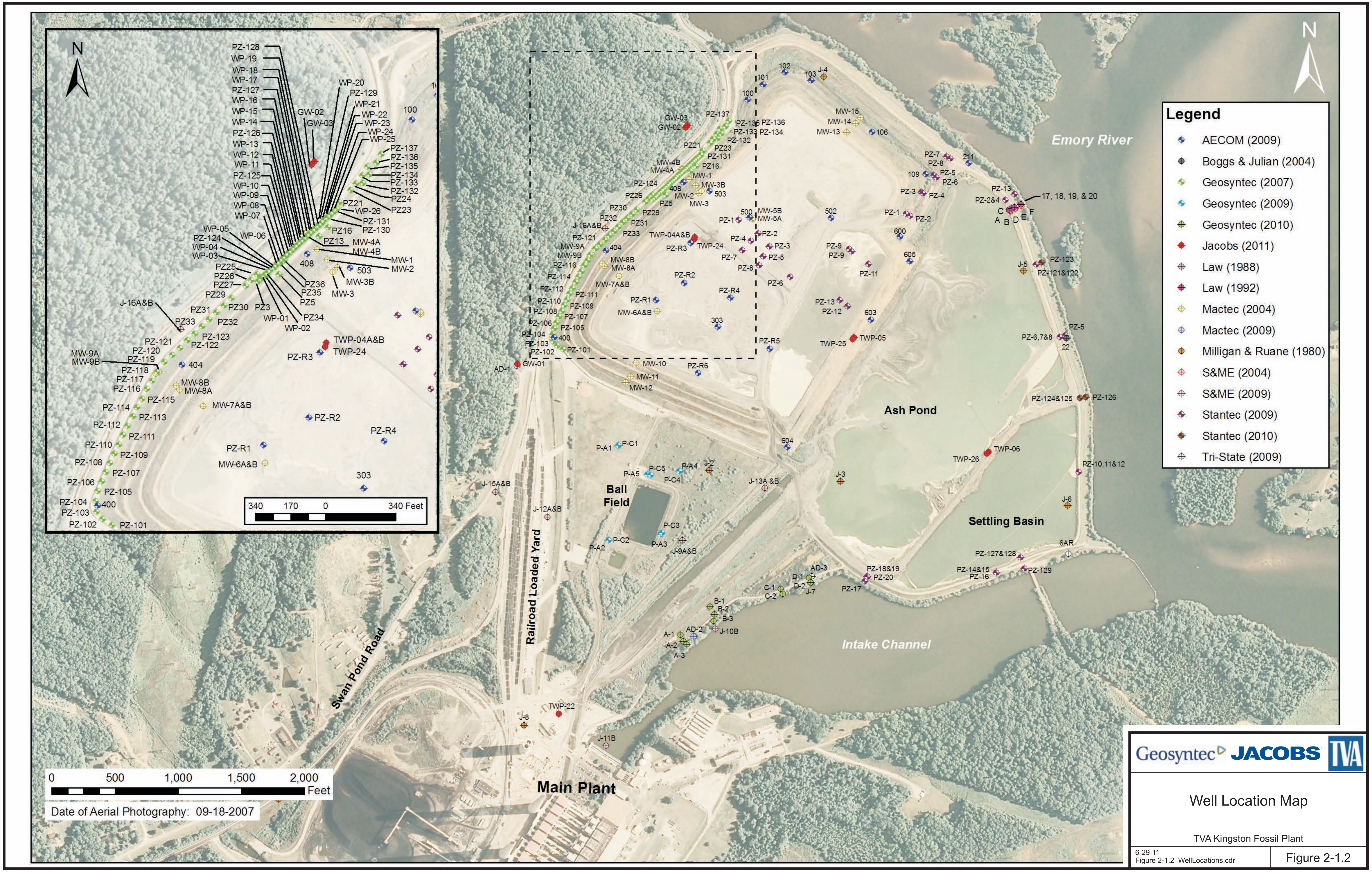
Geosyntec JACOBS TVA

Boring Location Map

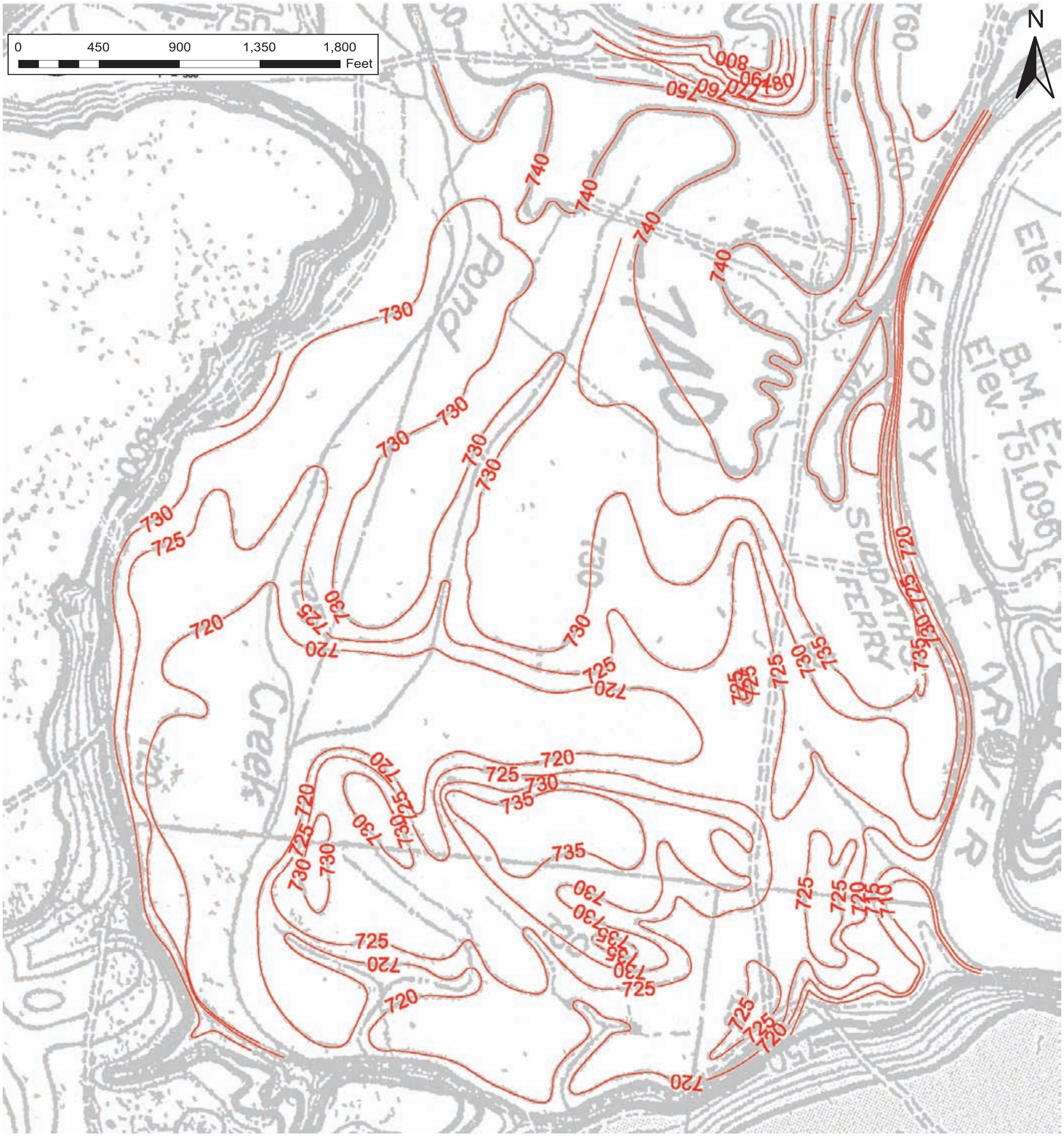
TVA Kingston Fossil Plant

6-28-11
Figure 2-1.1_BoringLocations.cdr

Figure 2-1.1



Legend
AECOM (2009)
Boggs & Julian (2004)
Geosyntec (2007)
Geosyntec (2009)
Geosyntec (2010)
Jacobs (2011)
Law (1988)
Law (1992)
Mactec (2004)
Mactec (2009)
Milligan & Ruane (1980)
S&ME (2004)
S&ME (2009)
Stantec (2009)
Stantec (2010)
Tri-State (2009)
N
Emory River
Ash Pond
Settling Basin
Intake Channel
Ball Field
Railroad Loaded Yard
Swan Pond Road
Main Plant
0 500 1,000 1,500 2,000 Feet
340 170 0 340 Feet
Date of Aerial Photography: 09-18-2007
17, 18, 19, & 20
Geosyntec JACOBS TVA
Well Location Map
TVA Kingston Fossil Plant
6-29-11
Figure 2-1.2_WellLocations.cdr
Figure 2-1.2



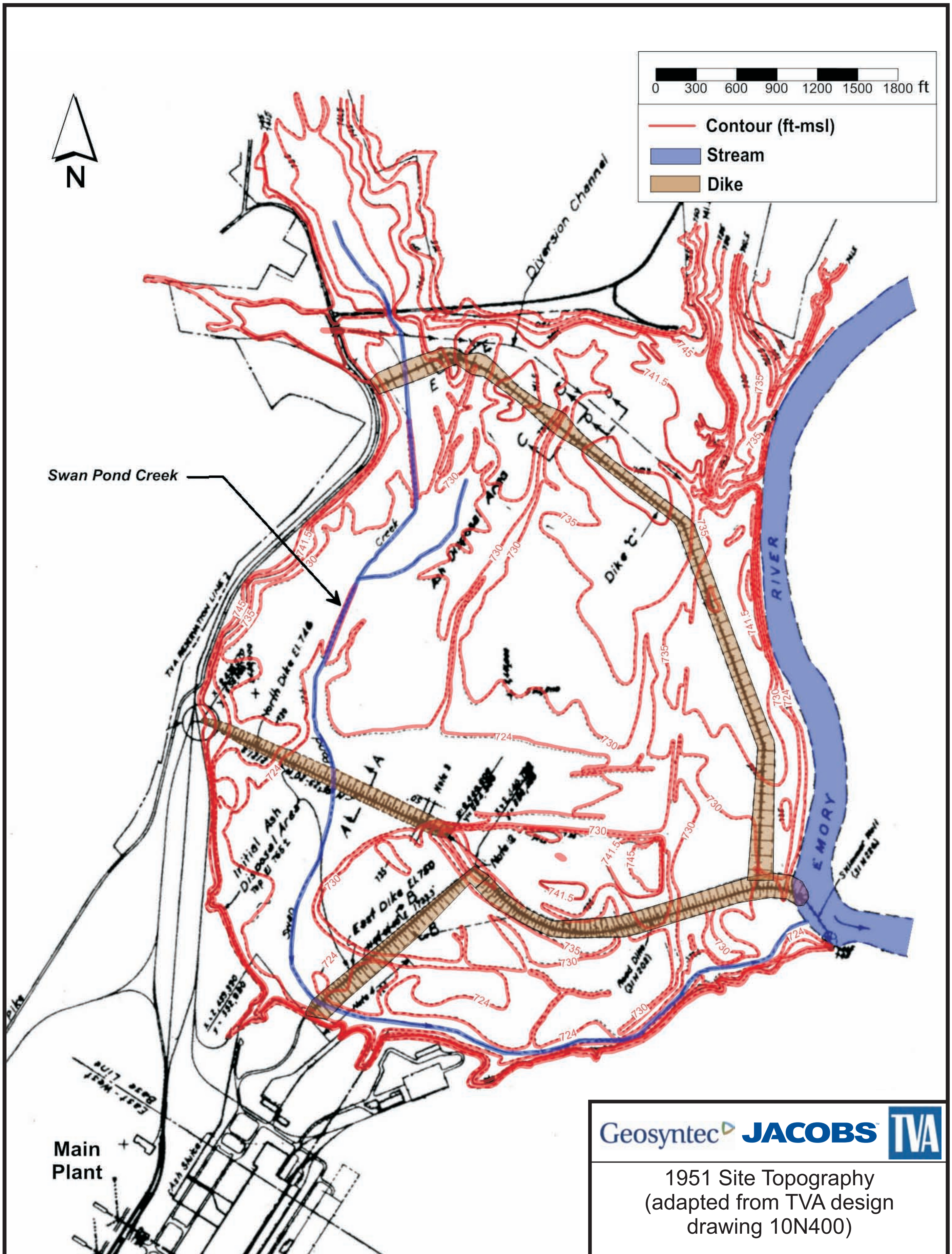
Geosyntec JACOBS TVA

1924 Site Topography
(adapted from Aerial and Plane Table Survey by War Department)

TVA Kingston Fossil Plant

6-21-11
Figure 3-2.1 1924Topo.cdr

Figure 3-2.1



Geosyntec JACOBS TVA

1951 Site Topography
(adapted from TVA design drawing 10N400)

TVA Kingston Fossil Plant

6-28-11
Figure 3-2.2_1951Topo.cdr

Figure 3-2.2

0 250 500 750 1000 ft

Contour (ft-msl)

Model Domain

Survey Datum: NAD 27 (TN State Plane)

Date of Aerial Photography: 04-09-2010

Geosyntec JACOBS TVA

2010 Site Topography and Bathymetry

TVA Kingston Fossil Plant

7-8-11
Figure 3-2.3_ExistingTopo.cdr

Figure 3-2.3

0 250 500 750 1000 ft

Contour (ft-msl)

Model Domain

Survey Datum: NAD 27 (TN State Plane)

Date of Aerial Photography: 04-09-2010

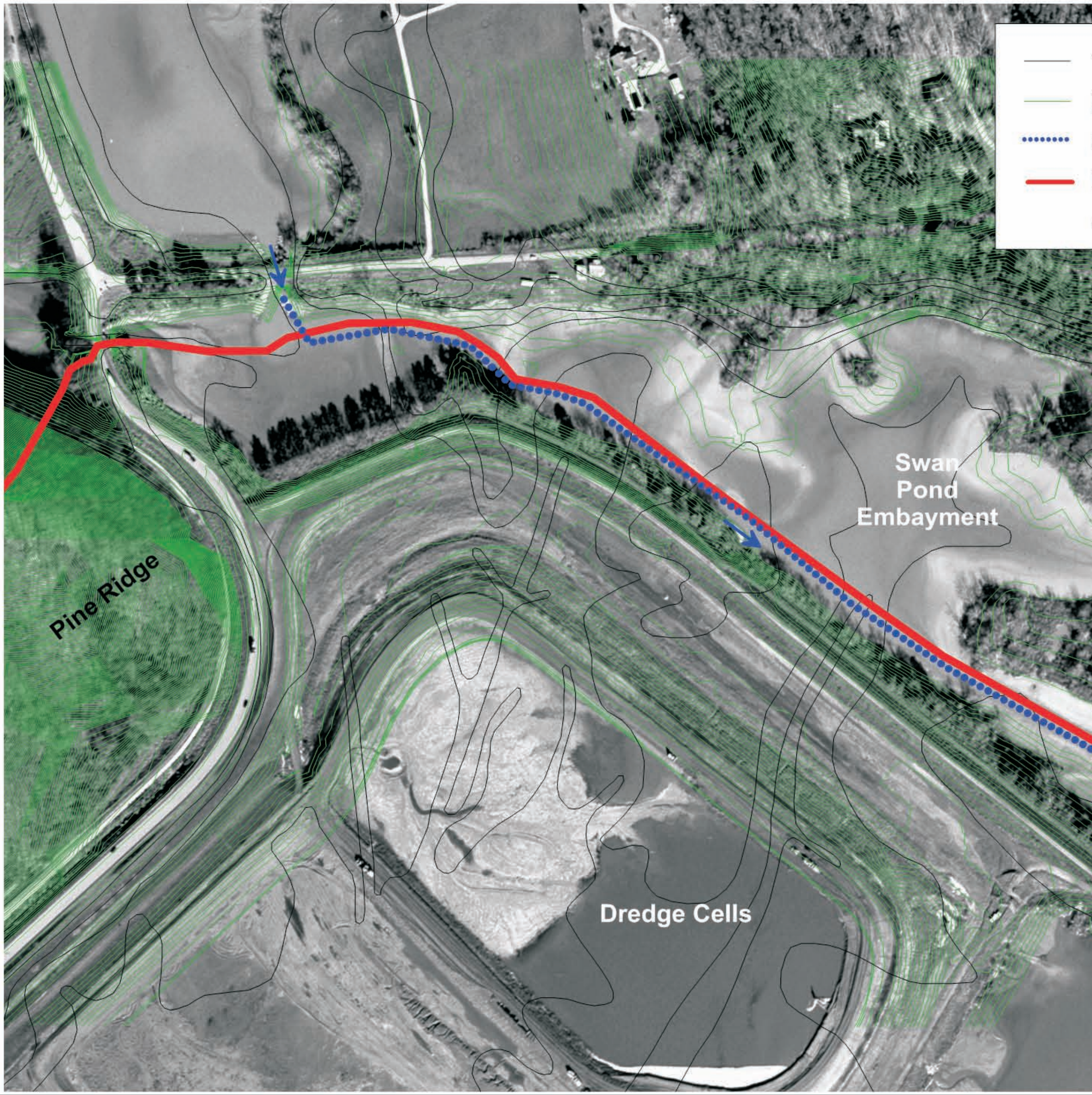
Geosyntec JACOBS TVA

Future Site Topography
and Bathymetry

TVA Kingston Fossil Plant

7-9-11
Figure 3-2.4_TopoAfterClosure.cdr

Figure 3-2.4



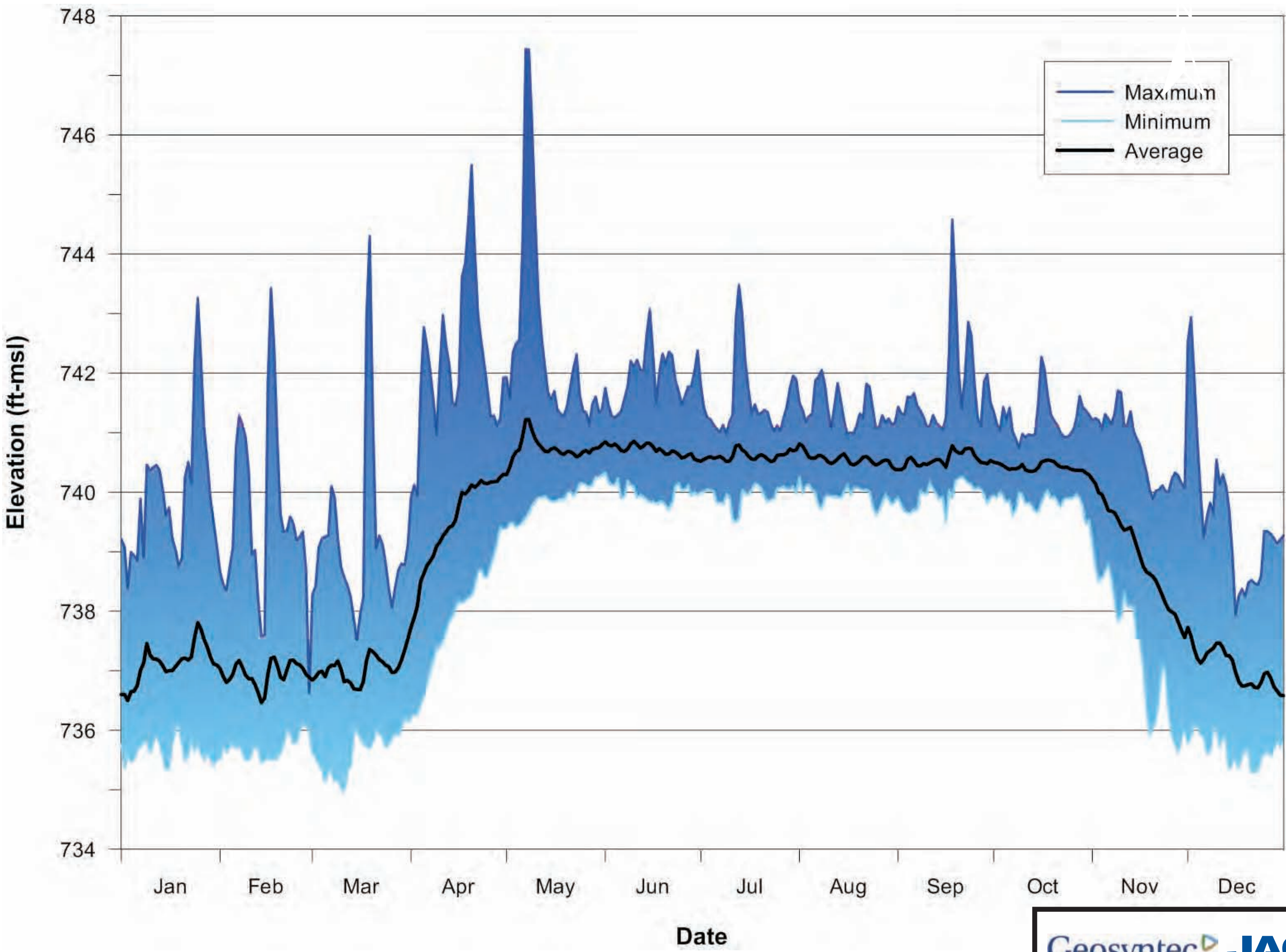
Geosyntec JACOBS TVA

Pre-Failure Swan Pond Creek/Embayment

TVA Kingston Fossil Plant

6-29-11
Figure 3-2.5_PreFailSwanPond.cdr

Figure 3-2.5



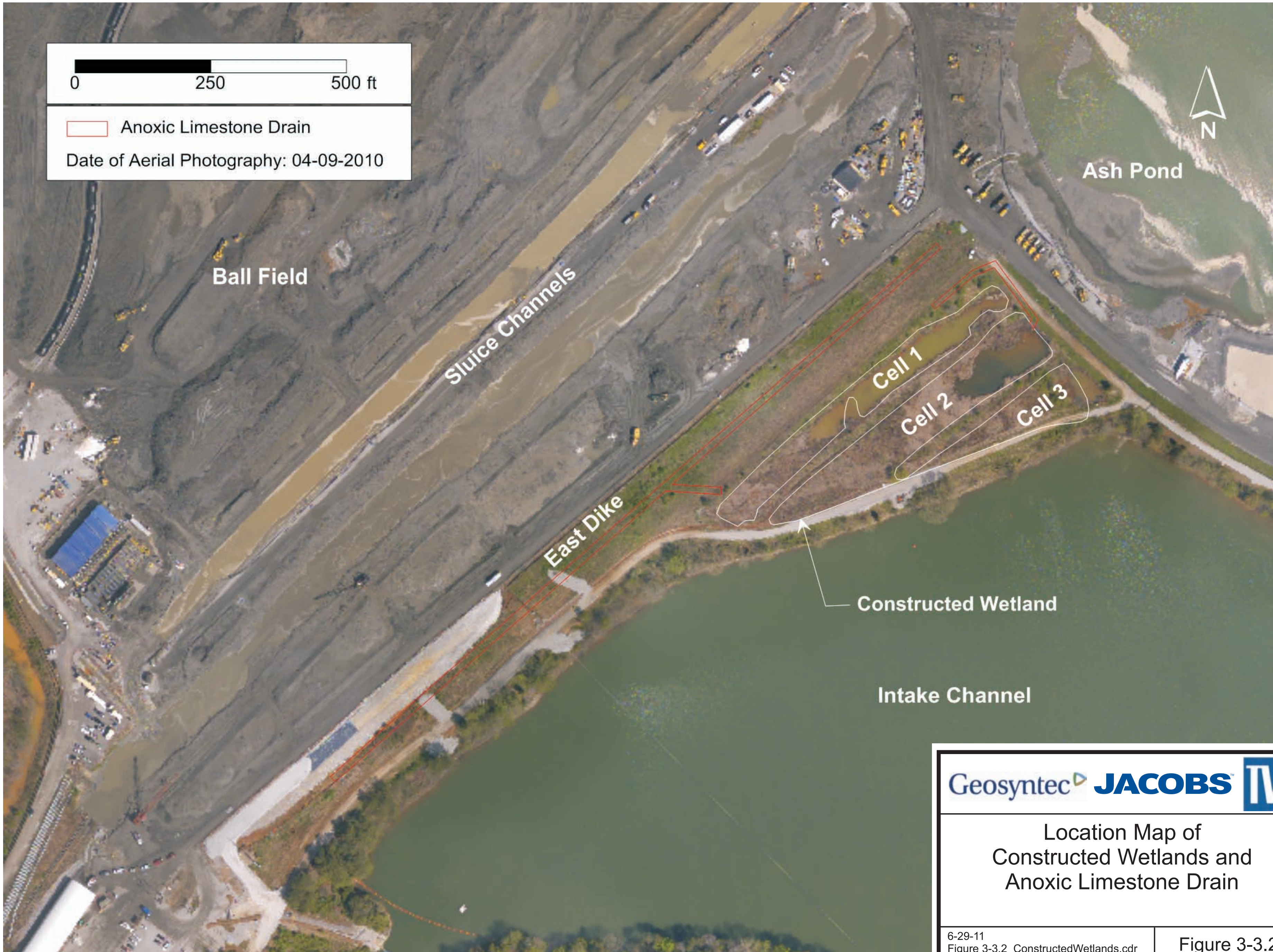
Geosyntec JACOBS TVA

Range of Average Clinch River Elevations at Kingston Water Treatment Plant (March 5, 1994 to September 8, 2010

TVA Kingston Fossil Plant

6-23-11
Figure 3-3.1_ClinchRiverWL.cdr

Figure 3-3.1

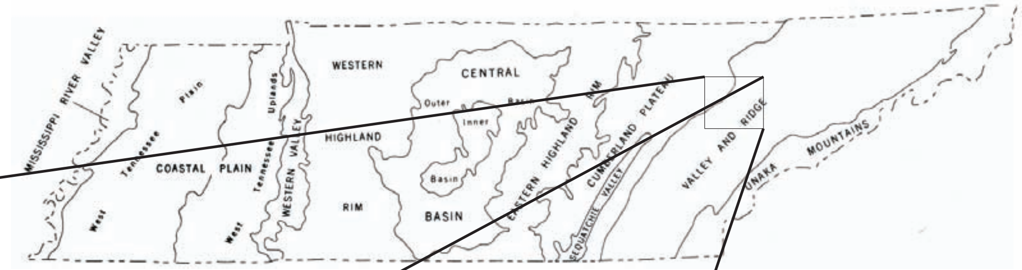


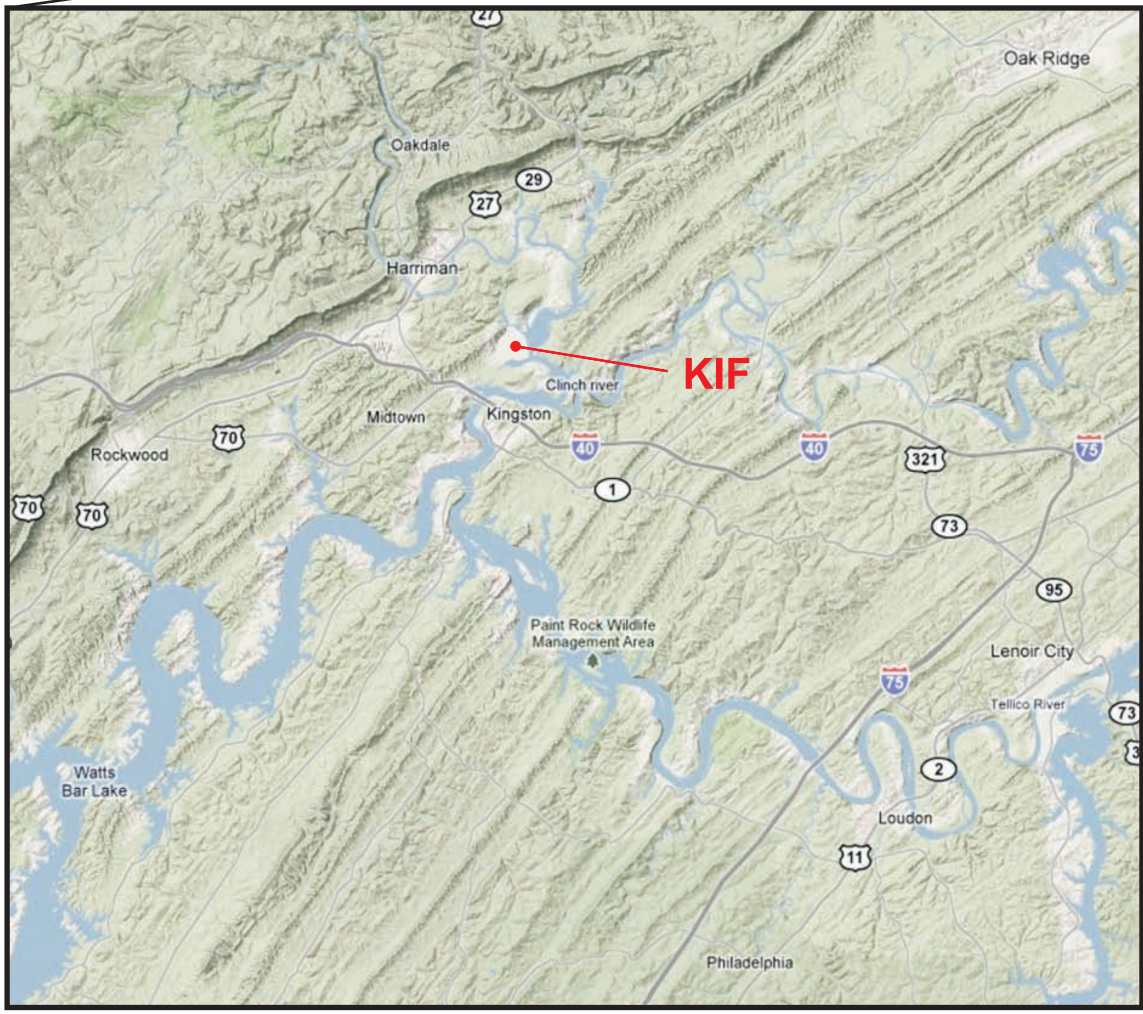
Geosyntec JACOBS TVA

Location Map of Constructed Wetlands and Anoxic Limestone Drain

6-29-11
Figure 3-3.2_ConstructedWetlands.cdr

Figure 3-3.2





N

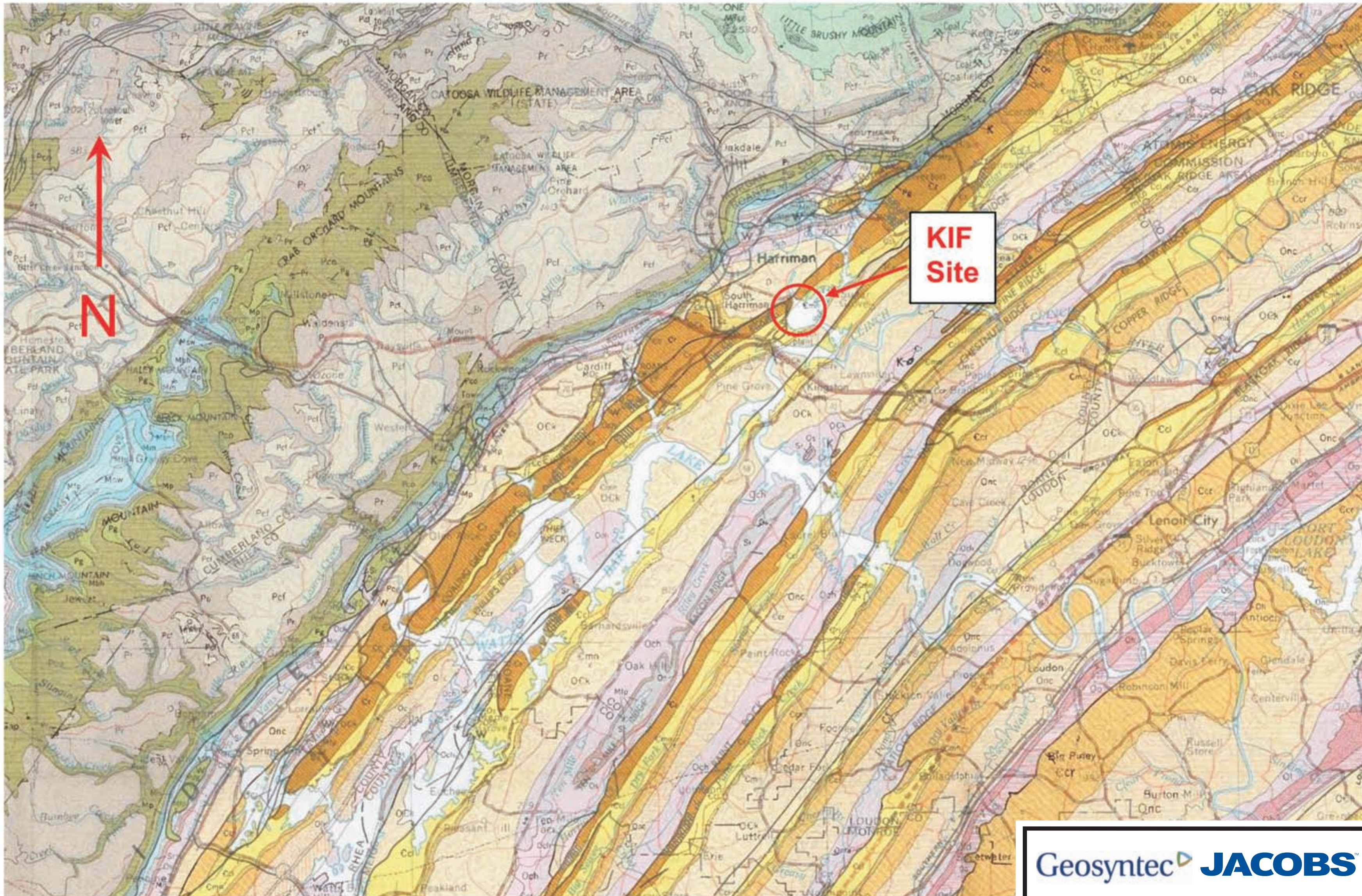
Geosyntec JACOBS TVA

Physiography

TVA Kingston Fossil Plant

6-24-11
Figure 3-5.1_Physiography.cdr

Figure 3-5.1



Note:
Figure is adapted from AECOM (2009).

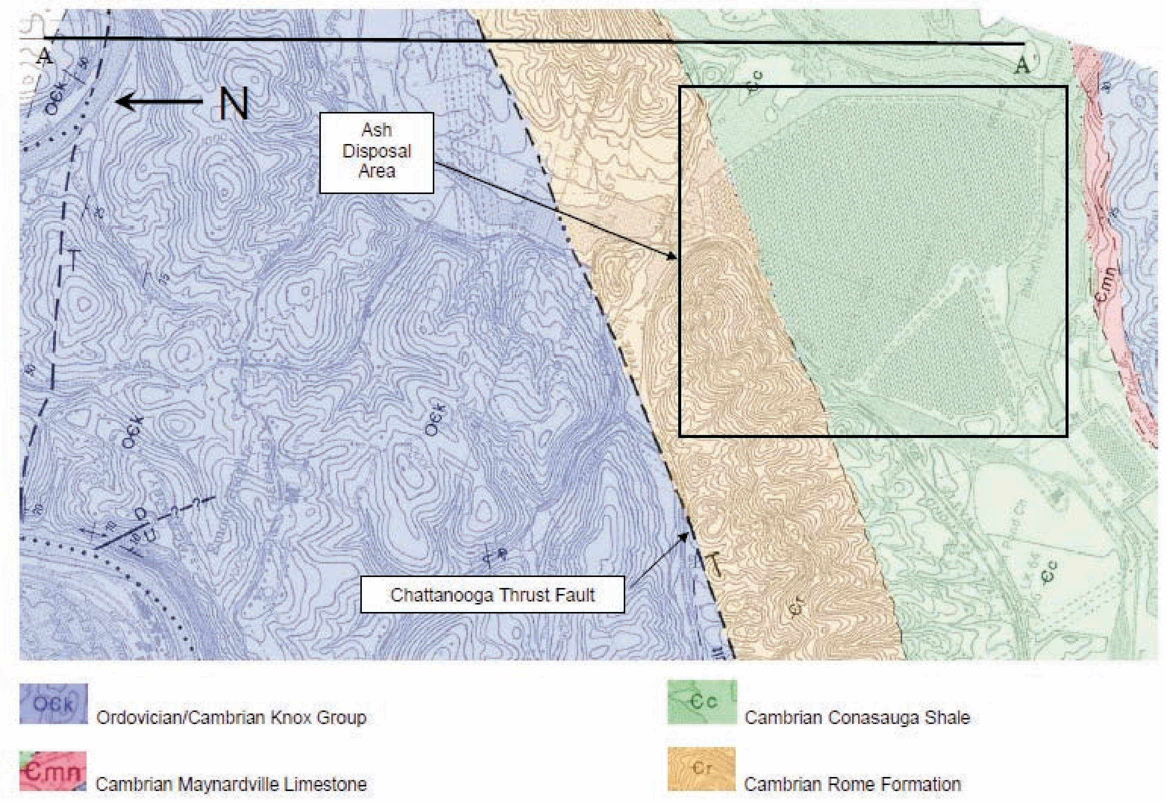
Geosyntec JACOBS TVA

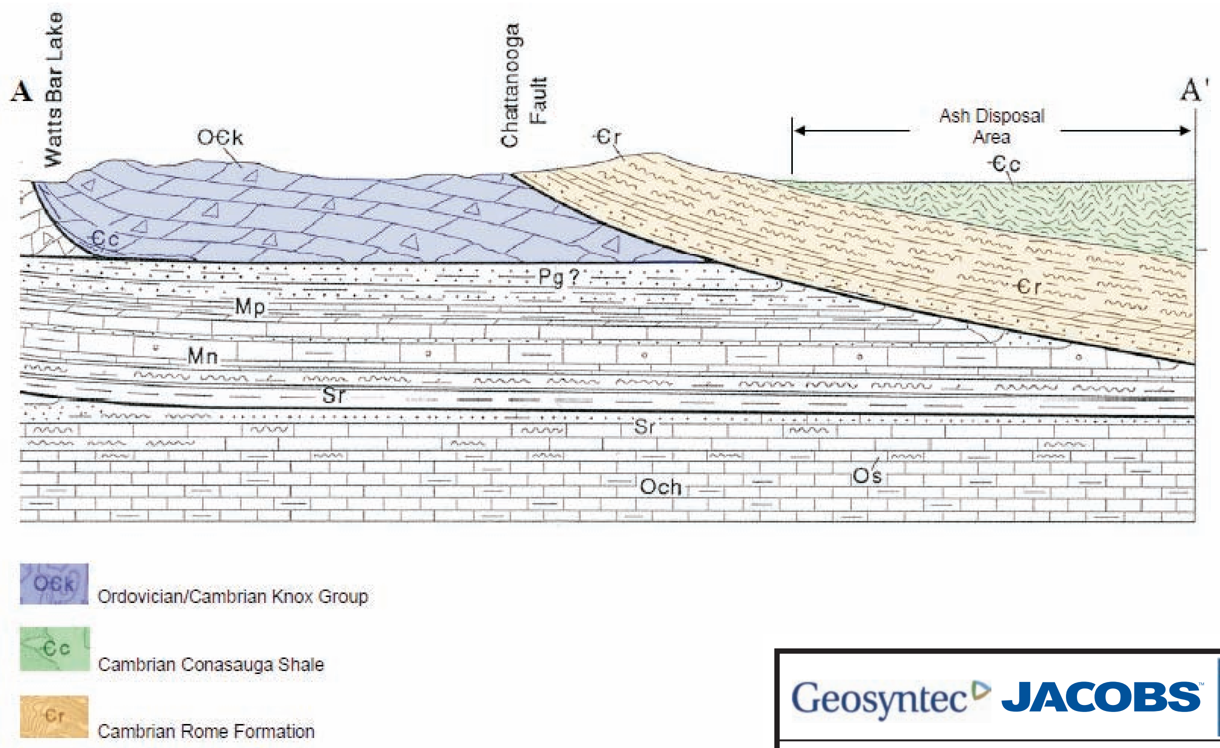
Regional Geology

TVA Kingston Fossil Plant

6-24-11
Figure 3-5.2_RegionalGeology.cdr

Figure 3-5.2





Geosyntec JACOBS TVA

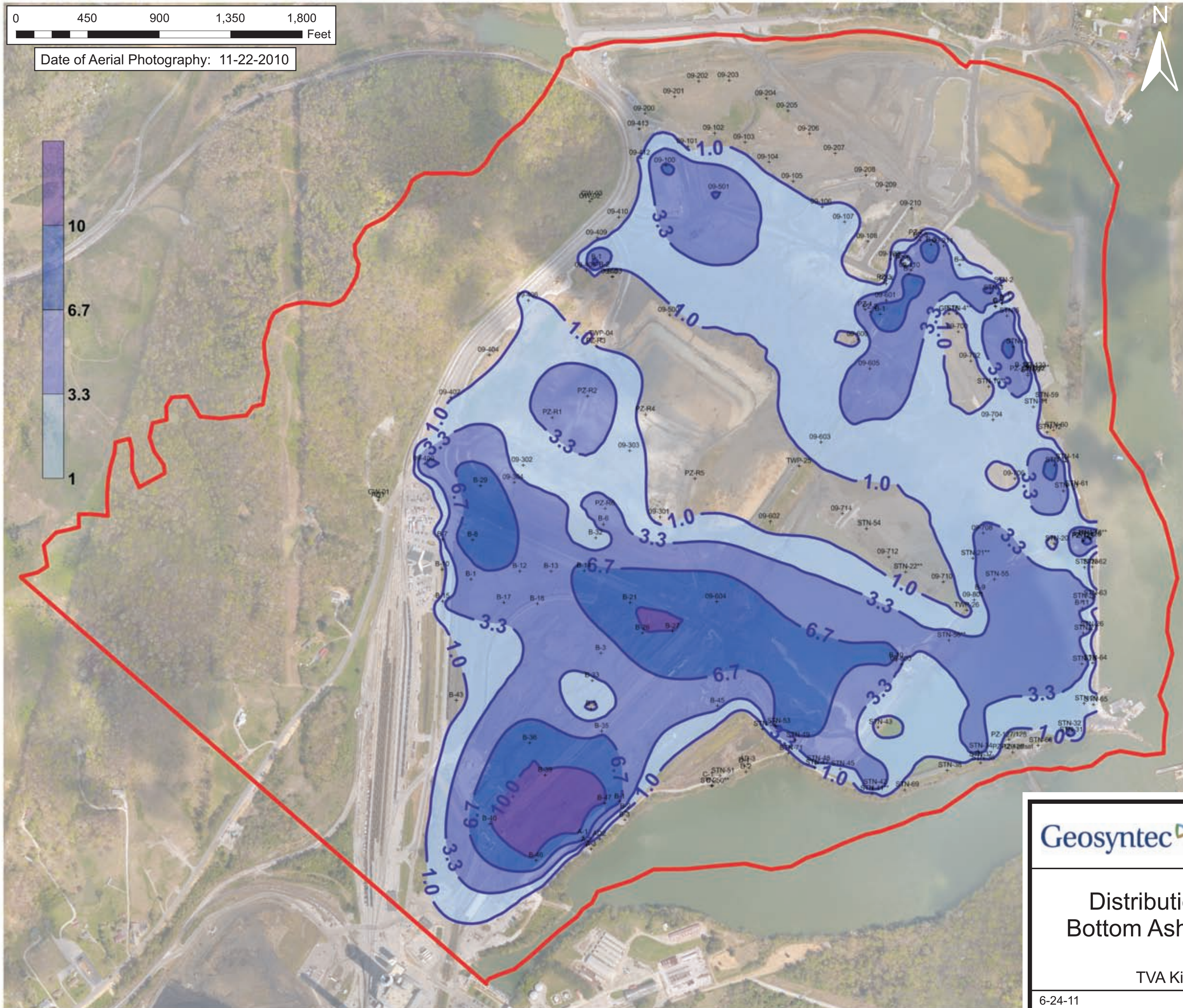
Local Geology

TVA Kingston Fossil Plant

6-24-11
Figure 3-5.3 LocalGeology.cdr

Figure 3-5.3

Note:
Figure is adapted from AECOM (2009).



Note:
Contours are thickness of bottom ash.

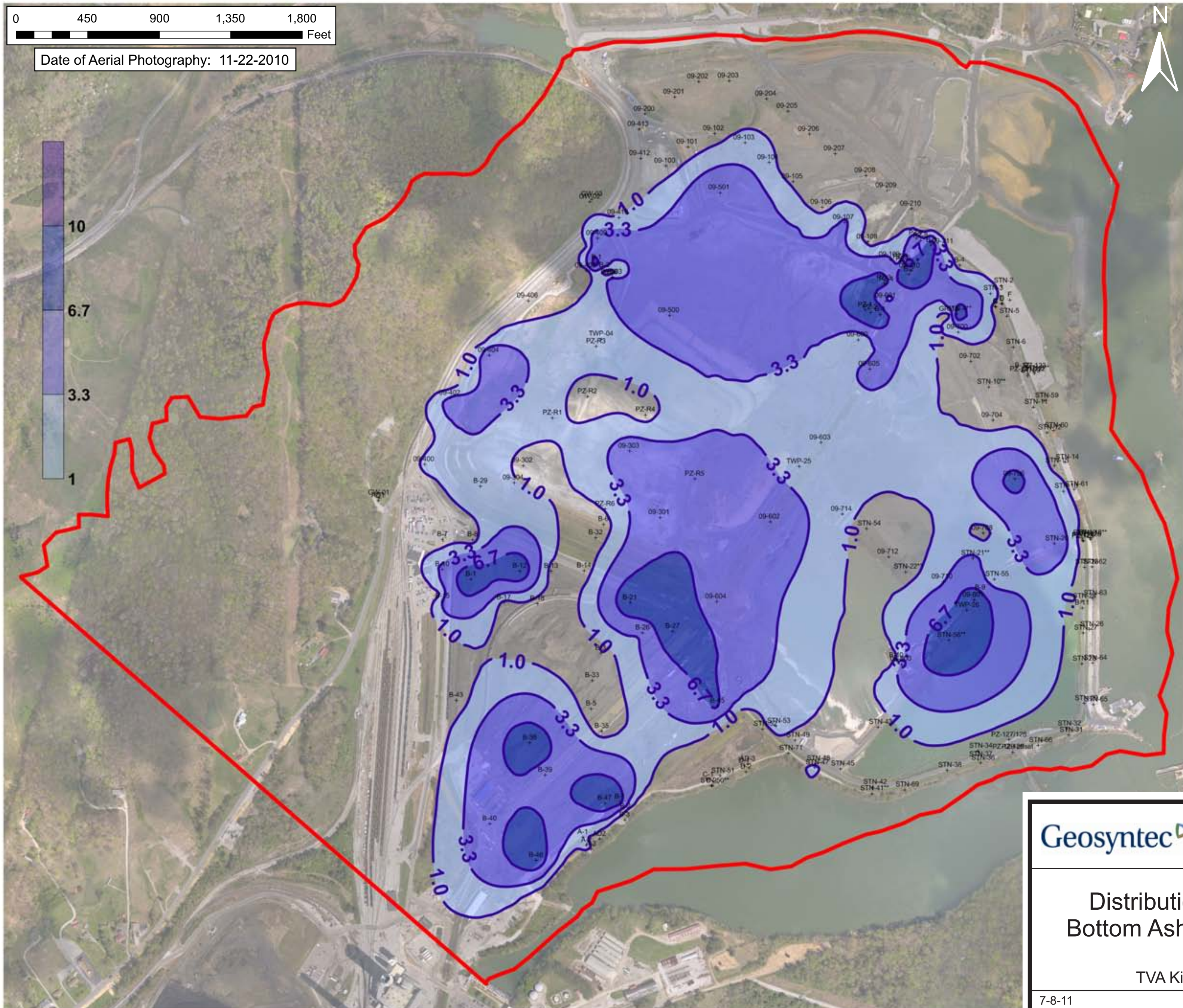
Geosyntec JACOBS TVA

Distribution of Fly Ash and Bottom Ash (740 to 750 ft-msl)

TVA Kingston Fossil Plant

6-24-11
Figure 3-6.1_FlyAsh_740-750ft.cdr

Figure 3-6.1



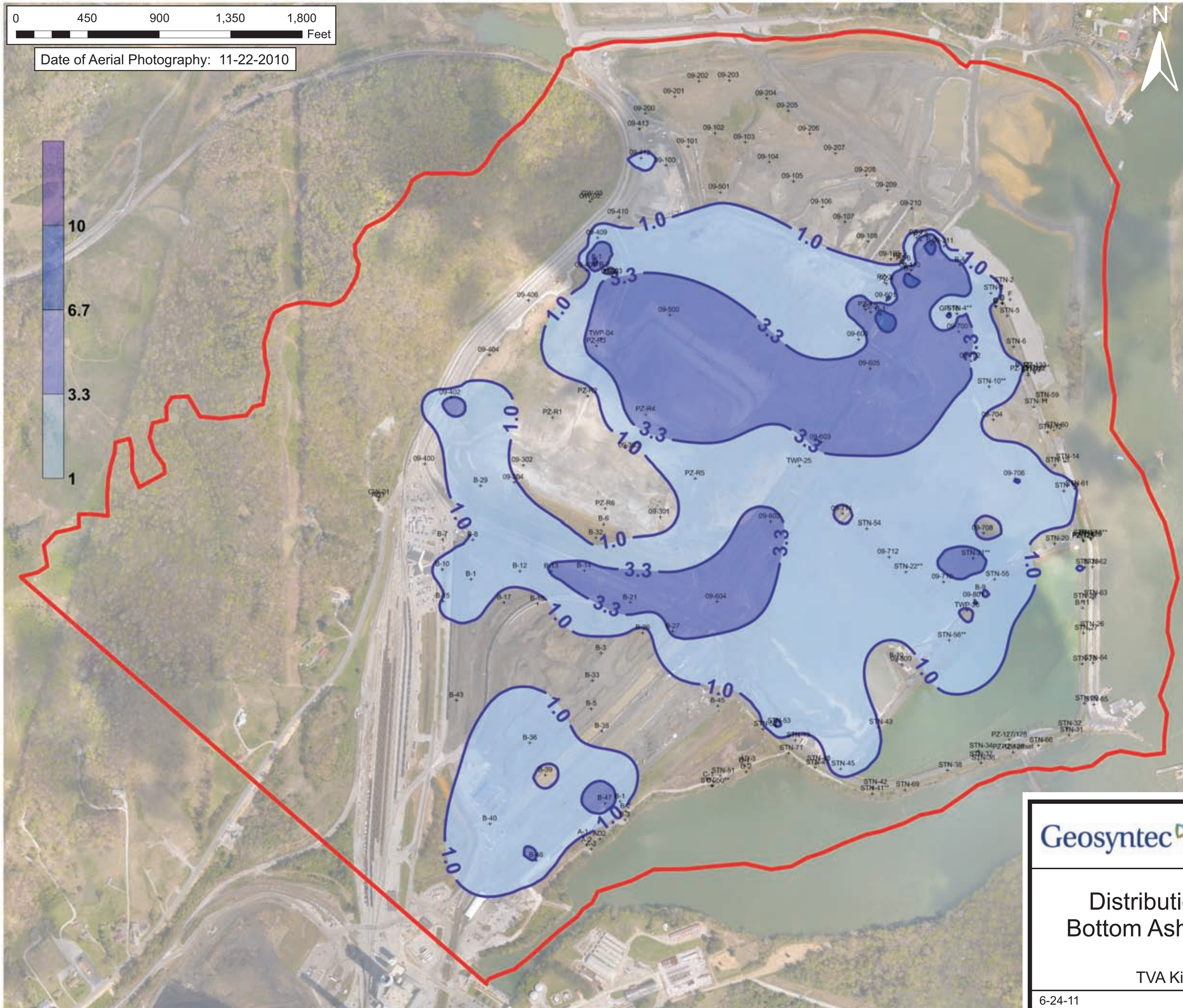
Note:
Contours are thickness of bottom ash.

Distribution of Fly Ash and Bottom Ash (750 to 760 ft-msl)

TVA Kingston Fossil Plant

7-8-11
Figure 3-6.2_FlyAsh_750-760ft.cdr

Figure 3-6.2



Note:
Contours are thickness of bottom ash.

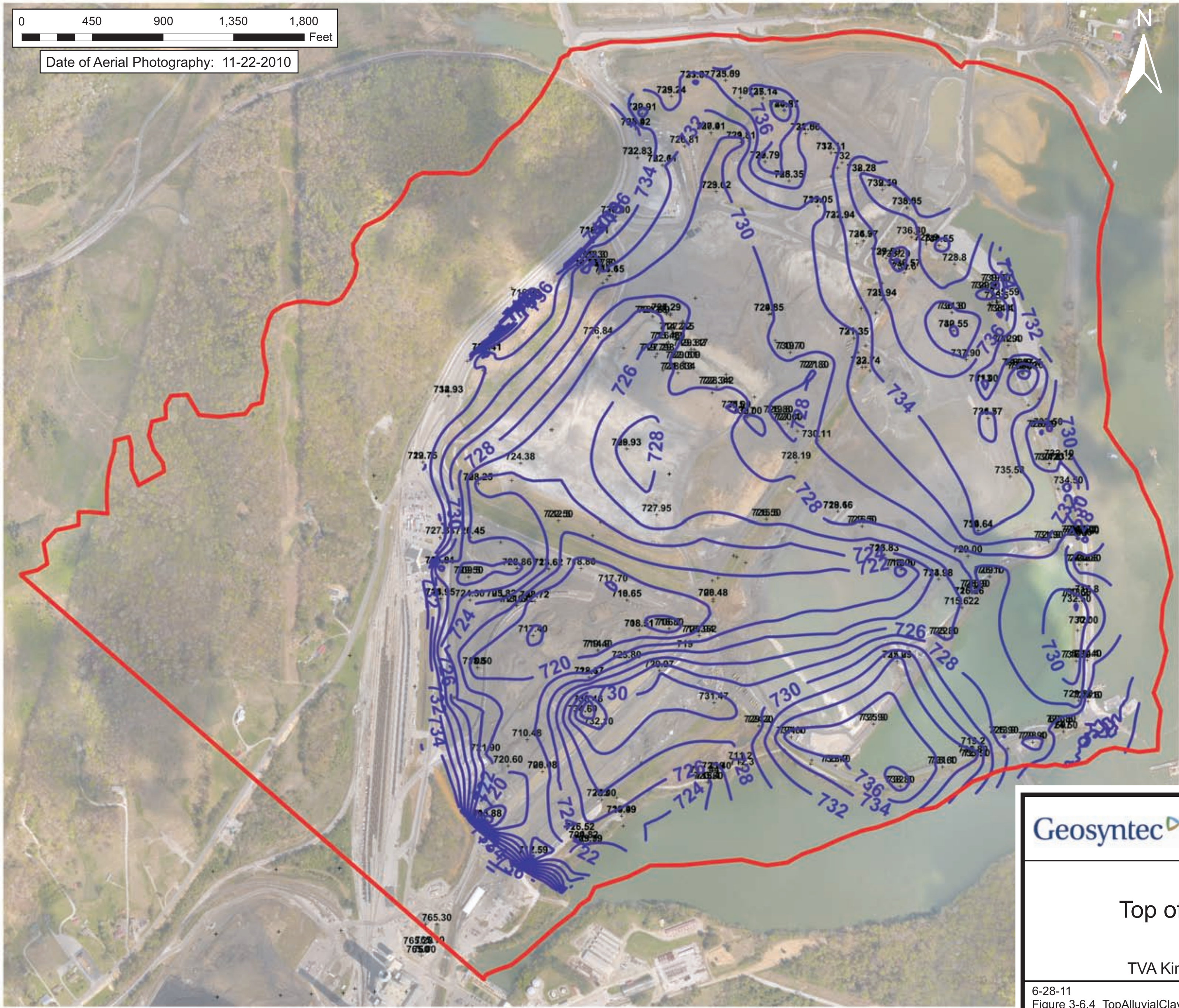
Geosyntec JACOBS TVA

Distribution of Fly Ash and Bottom Ash (760 to 770 ft-msl)

TVA Kingston Fossil Plant

6-24-11
Figure 3-6.3_FlyAsh_760-770ft.cdr

Figure 3-6.3



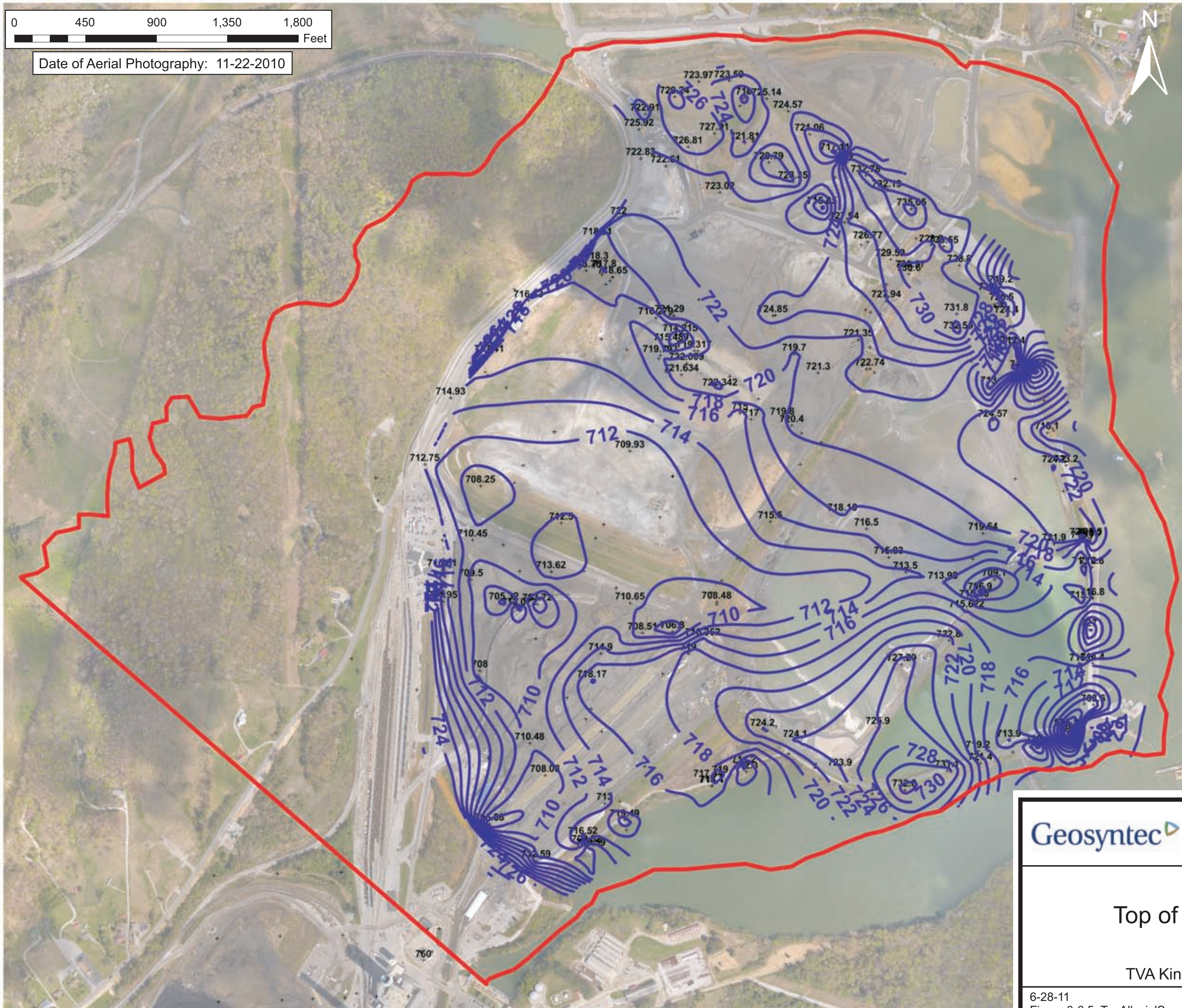
Note:
Contours are in ft-msl.

Geosyntec JACOBS TVA

Top of Alluvial Clay

TVA Kingston Fossil Plant

6-28-11 Figure 3-6.4_TopAlluvialClay.cdr	Figure 3-6.4



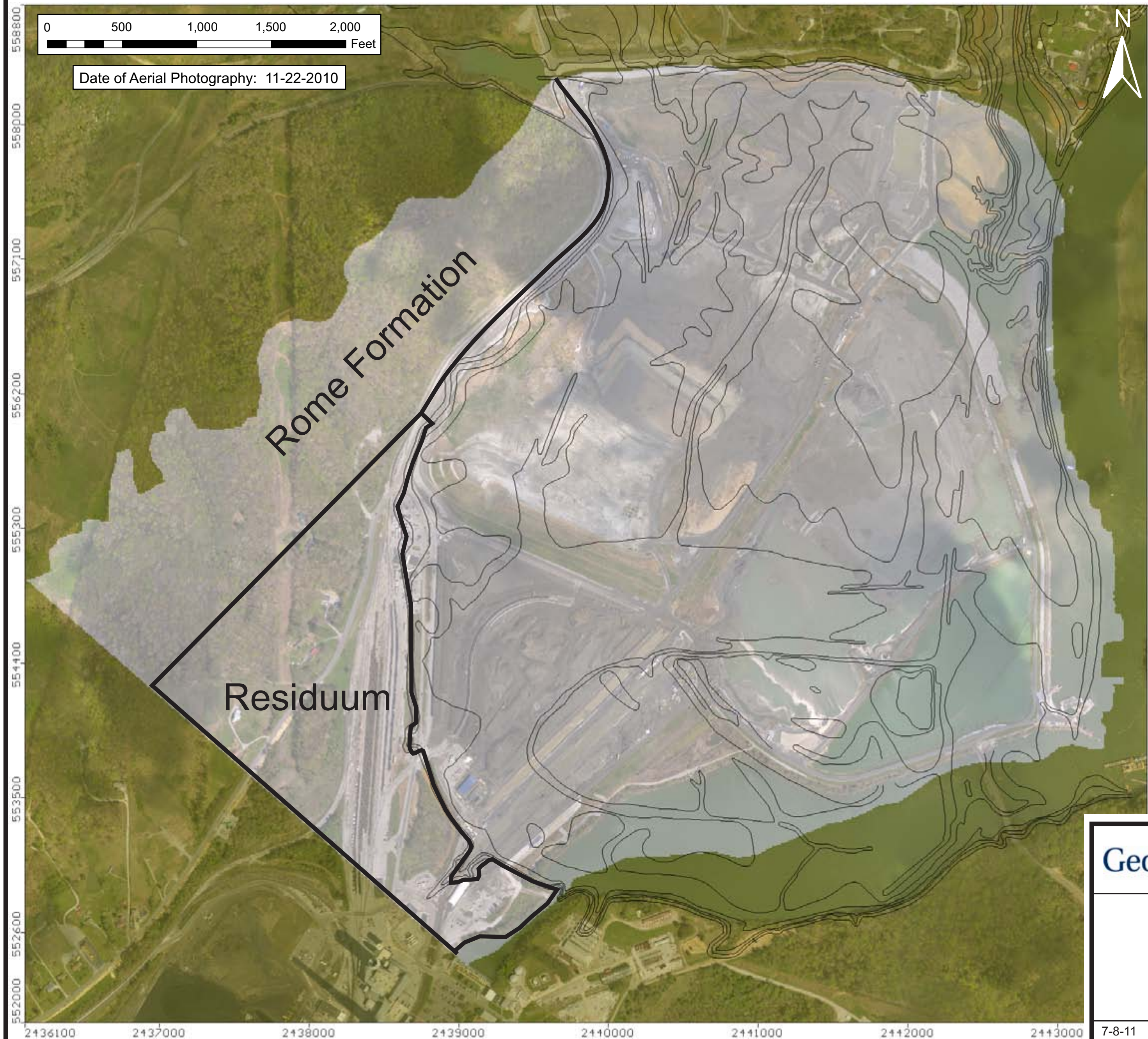
Note:
Contours are in ft-msl.

Geosyntec JACOBS TVA

Top of Alluvial Sand

TVA Kingston Fossil Plant

6-28-11 Figure 3-6.5_TopAlluvialSand.cdr	Figure 3-6.5



Note:
Contours are 1951 topography.

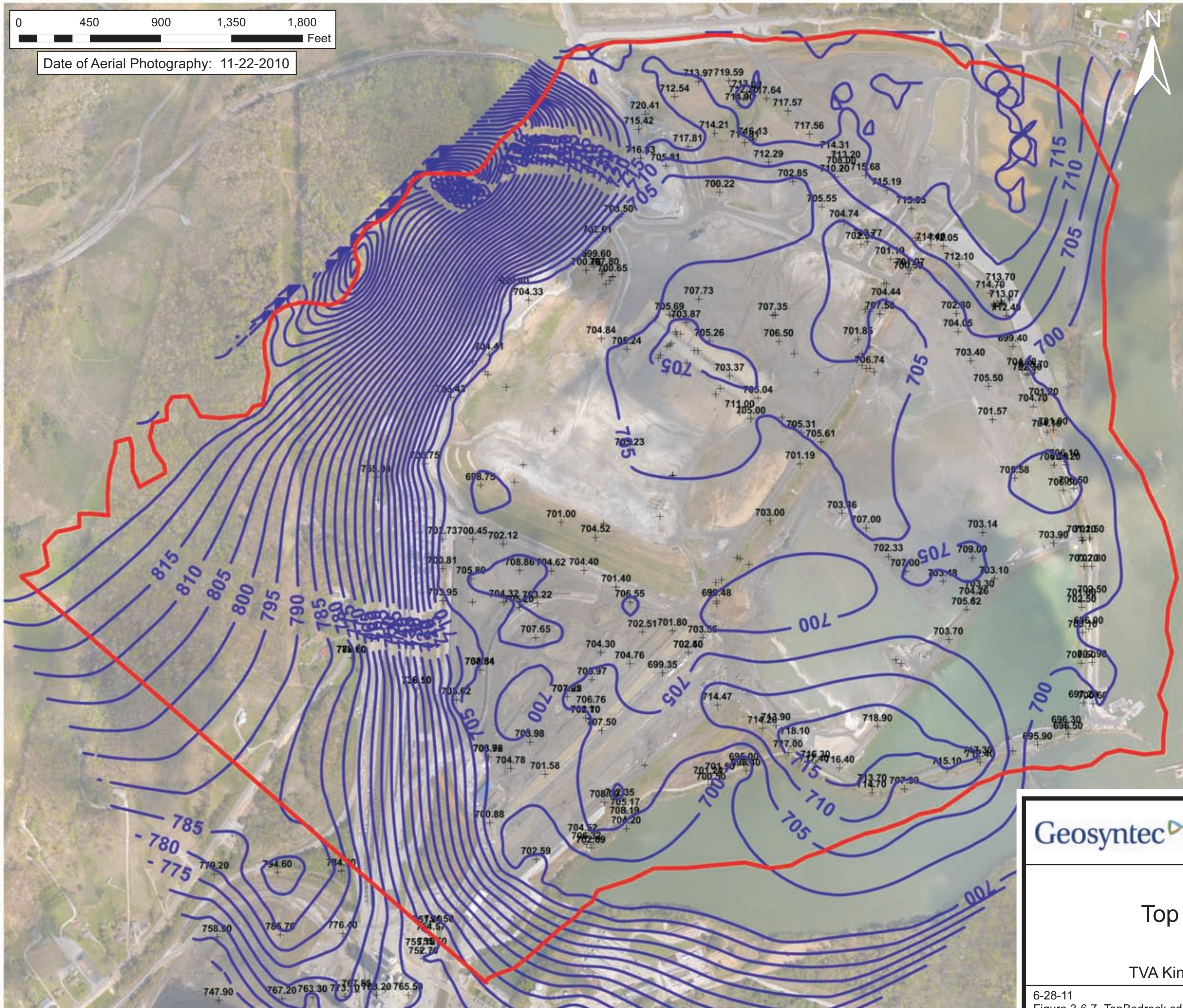
Geosyntec JACOBS TVA

Residuum Distribution and Rome Formation

TVA Kingston Fossil Plant

7-8-11
Figure 3-6.6_ResiduumDistrib.cdr

Figure 3-6.6



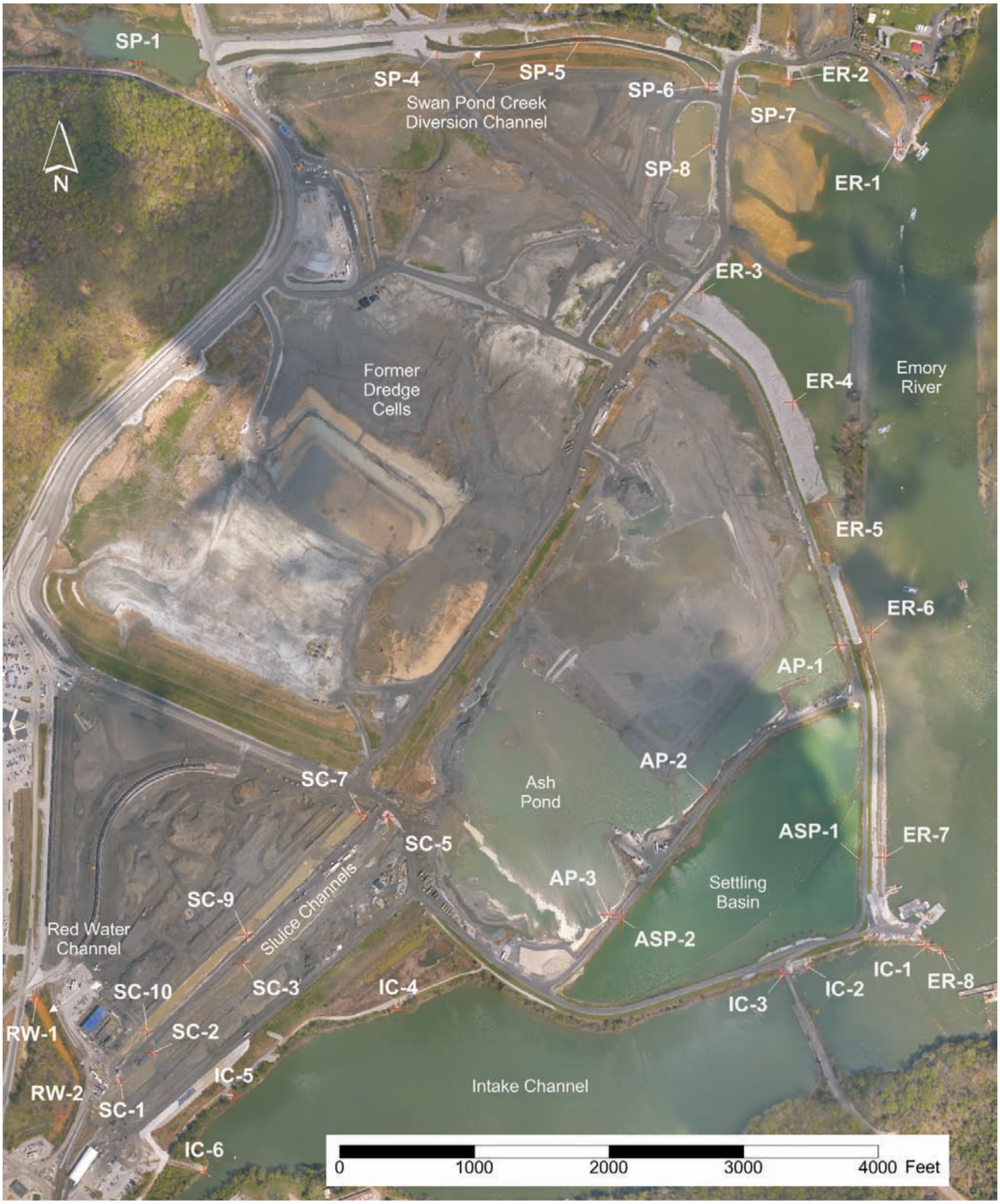
Note:
Contours are in ft-msl.

Top of Bedrock

TVA Kingston Fossil Plant

6-28-11
Figure 3-6.7_TopBedrock.cdr

Figure 3-6.7



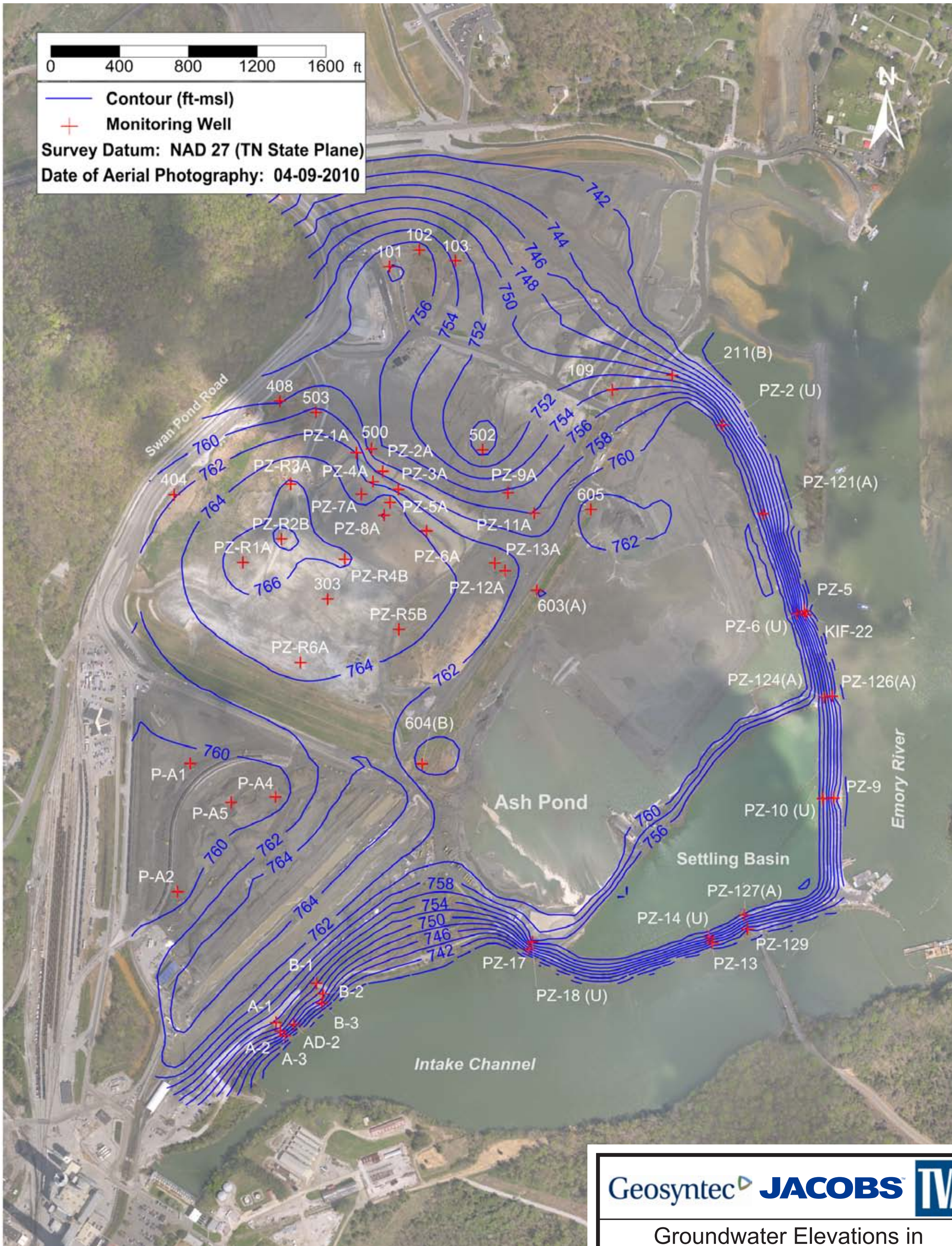
Geosyntec JACOBS TVA

Surface Water Measurement Locations (July 2010)

TVA Kingston Fossil Plant

6-28-11
Figure 3-6.8_SW-MeasJuly2010.cdr

Figure 3-6.8



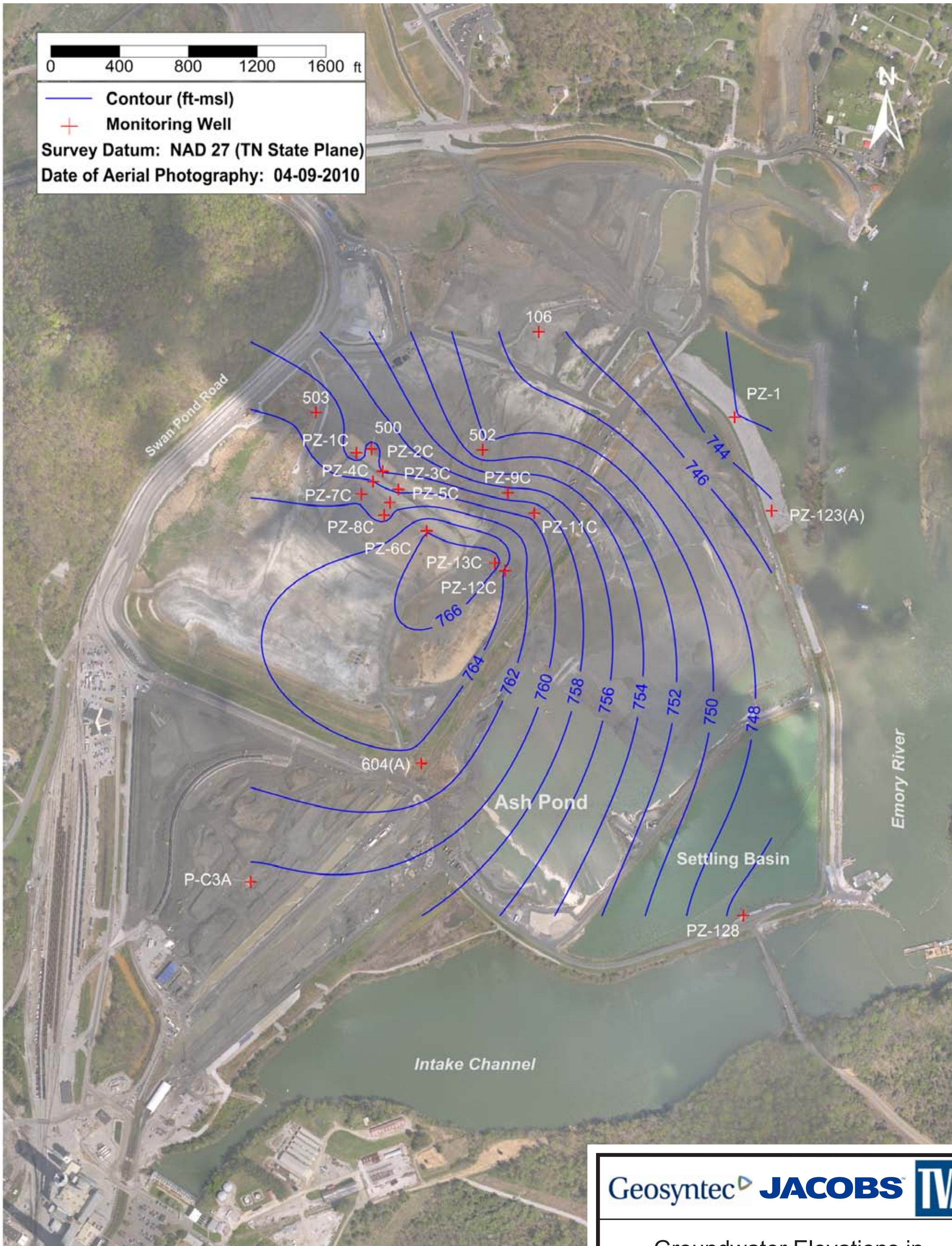
Geosyntec JACOBS TVA

Groundwater Elevations in Ash and Shallow Soils (July 2010)

TVA Kingston Fossil Plant

7-9-11
Figure 3-6.9_GW_ElevAsh.cdr

Figure 3-6.9



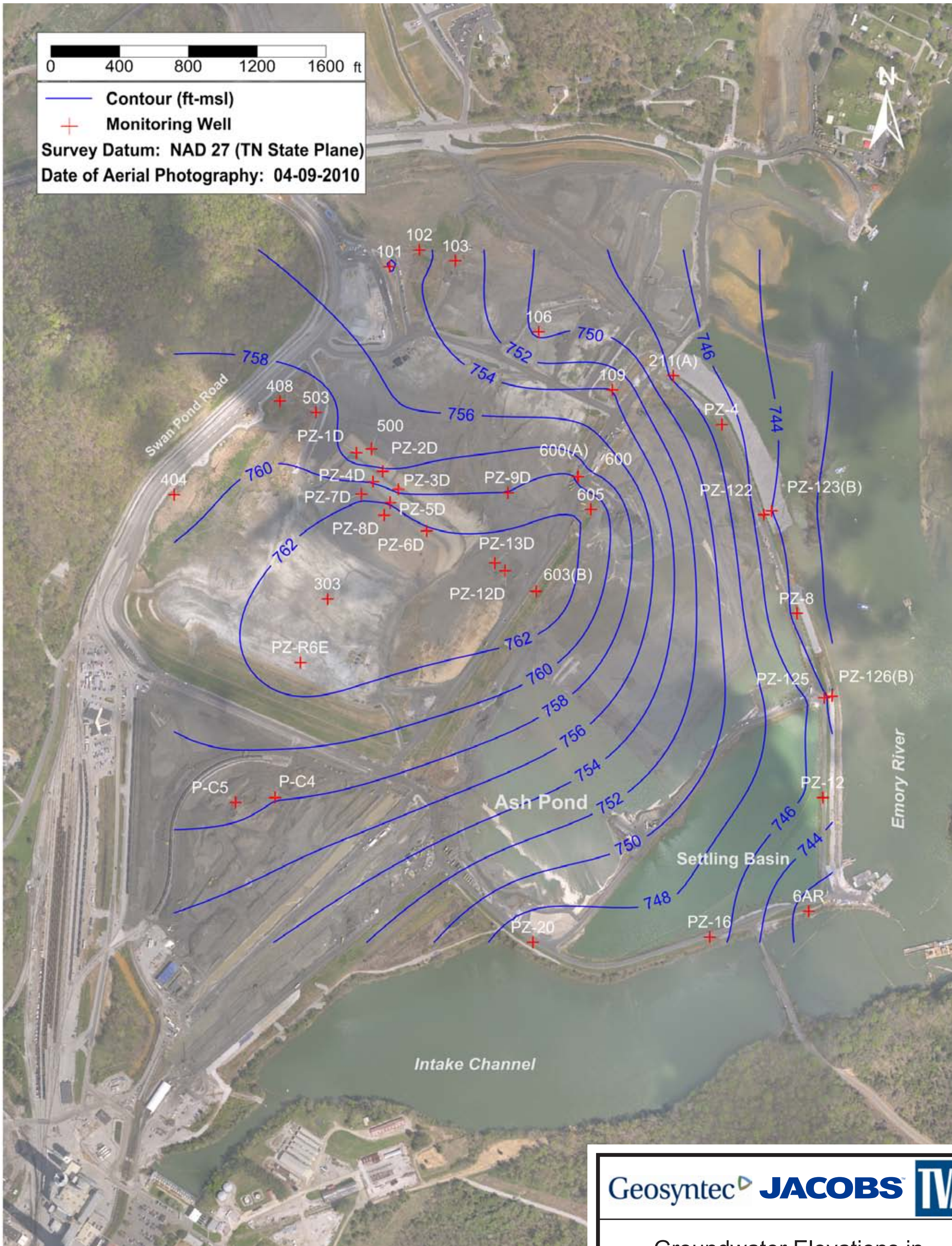
Geosyntec JACOBS TVA

Groundwater Elevations in Alluvial Clay (July 2010)

TVA Kingston Fossil Plant

7-9-11
Figure 3-6.10_GW_ElevClay.cdr

Figure 3-6.10



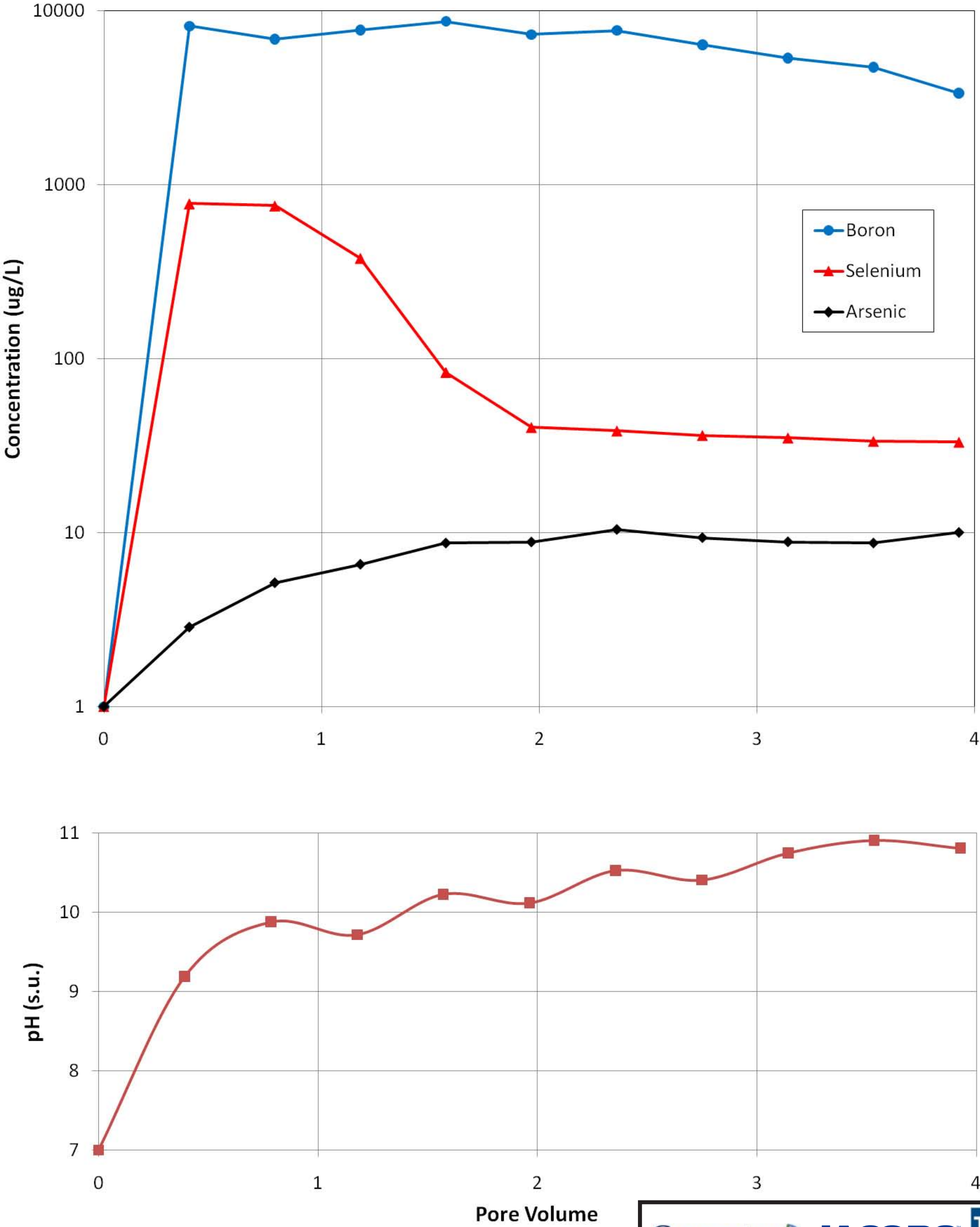
Geosyntec JACOBS TVA

Groundwater Elevations in Alluvial Sand (July 2010)

TVA Kingston Fossil Plant

7-9-11
Figure 3-6.11_GW_ElevSand.cdr

Figure 3-6.11



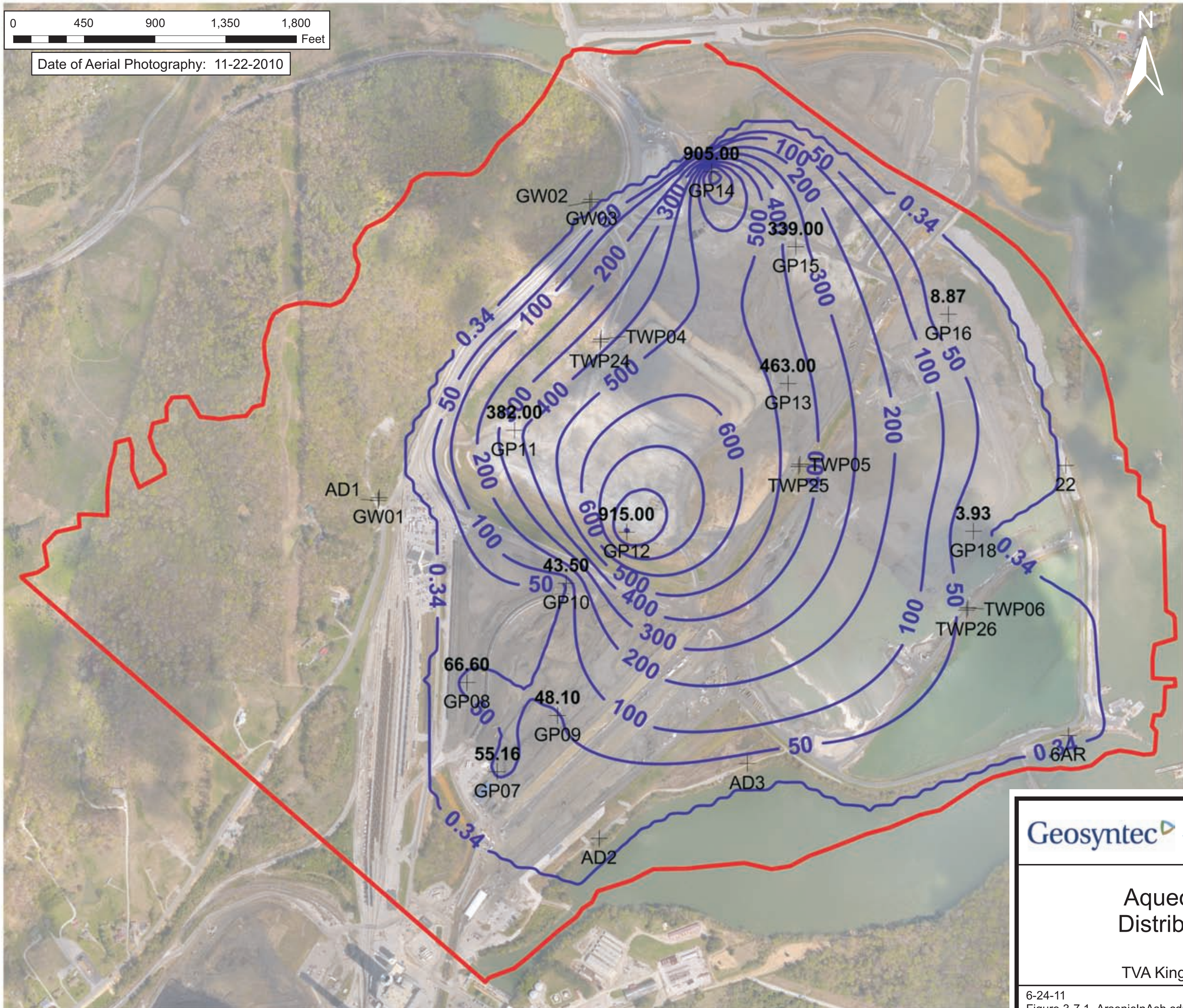
Geosyntec JACOBS TVA

Column Leaching Results for Untreated Ash as a Function of Pore Volume

TVA Kingston Fossil Plant

6-28-11
Figure 3-6.12_LeachingResults.cdr

Figure 3-6.12



Note:
Aqueous concentrations are in μg/L.

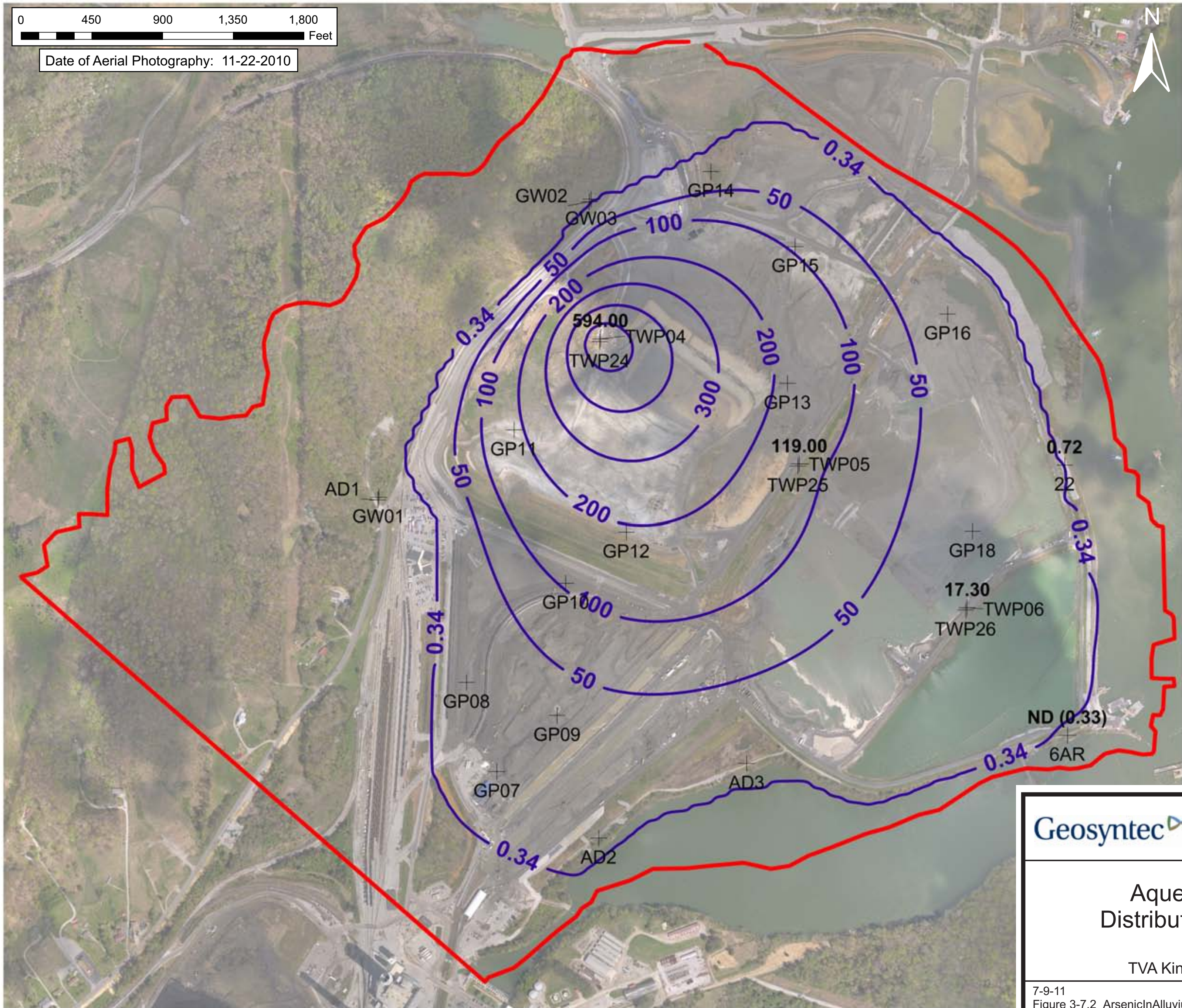
Geosyntec JACOBS TVA

Aqueous Arsenic Distribution in Ash

TVA Kingston Fossil Plant

6-24-11
Figure 3-7.1_ArsenicInAsh.cdr

Figure 3-7.1



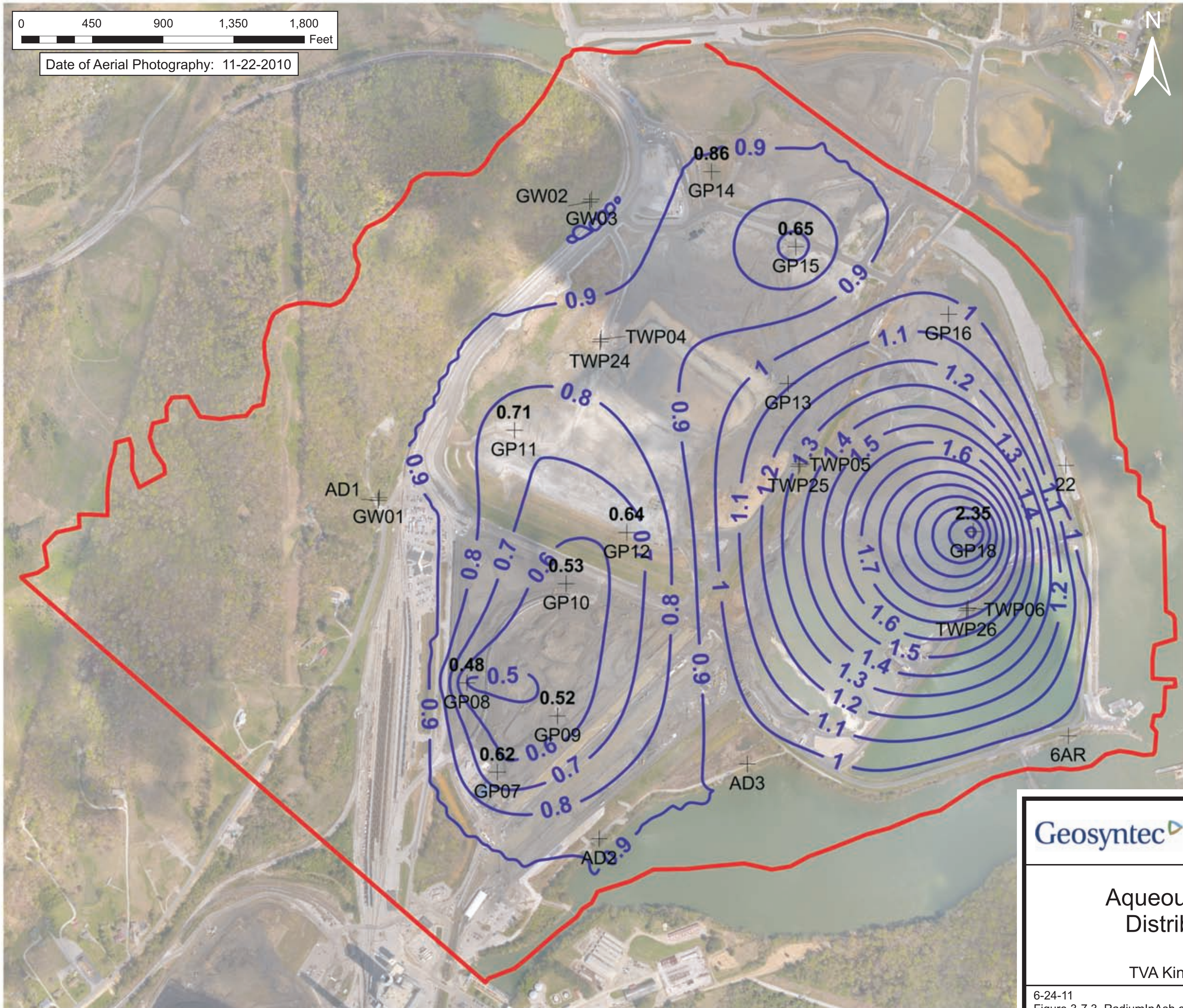
Note:
Aqueous concentrations are in μg/L.

Aqueous Arsenic
Distribution in Alluvium

TVA Kingston Fossil Plant

7-9-11
Figure 3-7.2_ArsenicInAlluvium.cdr

Figure 3-7.2



Note:
Aqueous concentrations are in pCi/L.

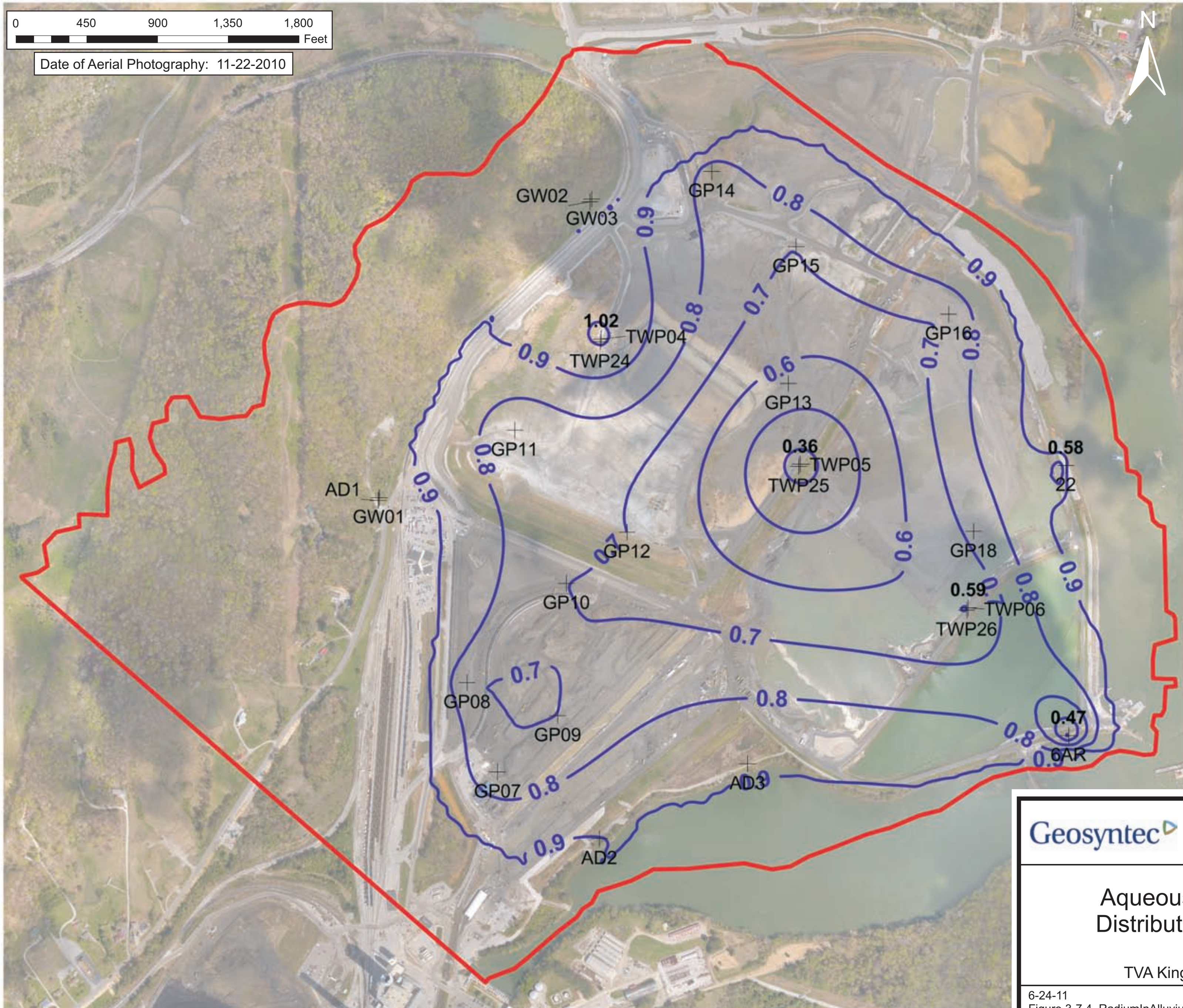
Geosyntec JACOBS TVA

Aqueous Radium-226 Distribution in Ash

TVA Kingston Fossil Plant

6-24-11
Figure 3-7.3_RadiumInAsh.cdr

Figure 3-7.3



Note:
Aqueous concentrations are in pCi/L.

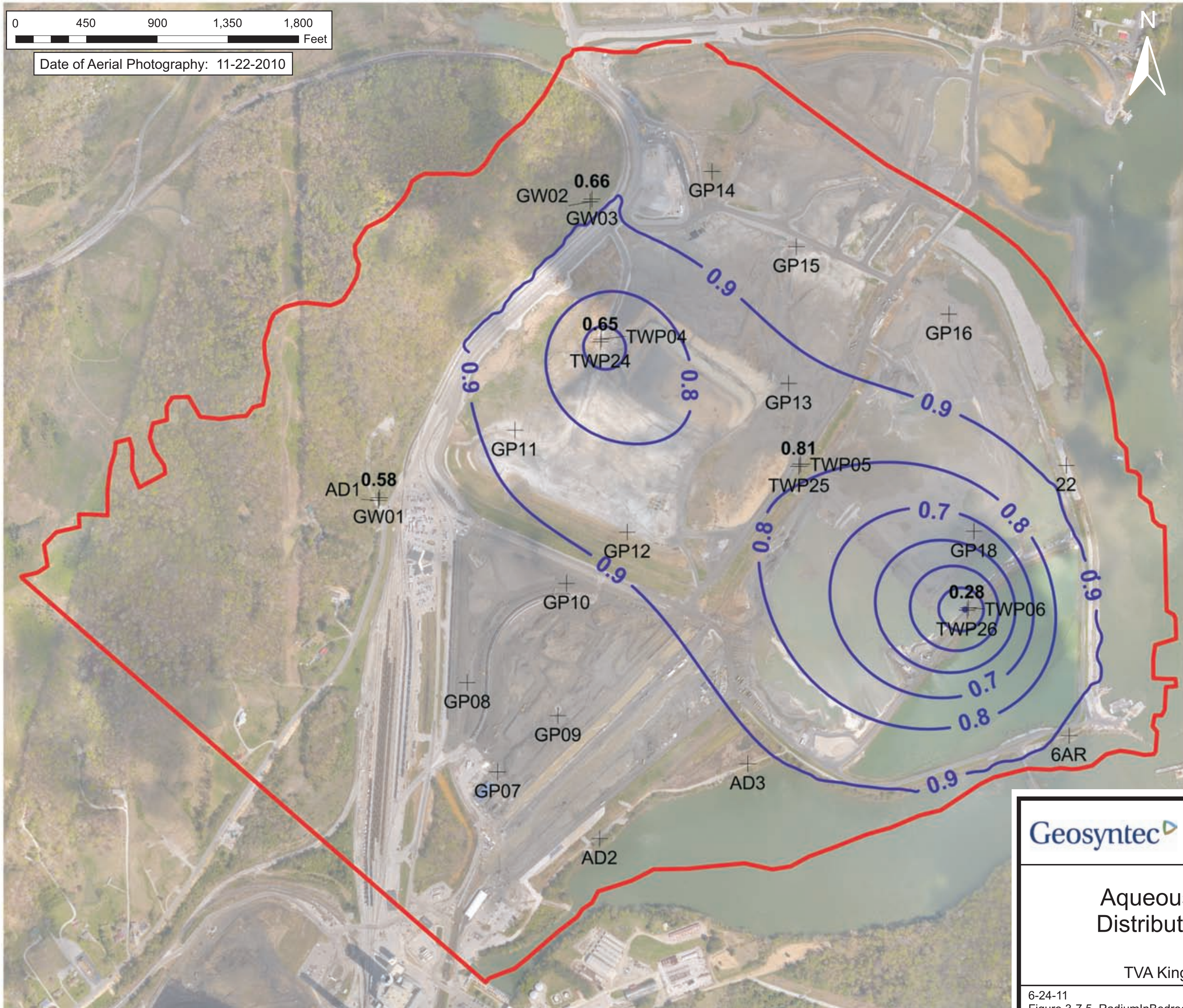
Geosyntec JACOBS TVA

Aqueous Radium-226 Distribution in Alluvium

TVA Kingston Fossil Plant

6-24-11
Figure 3-7.4_RadiumInAlluvium.cdr

Figure 3-7.4



Note:
Aqueous concentrations are in pCi/L.

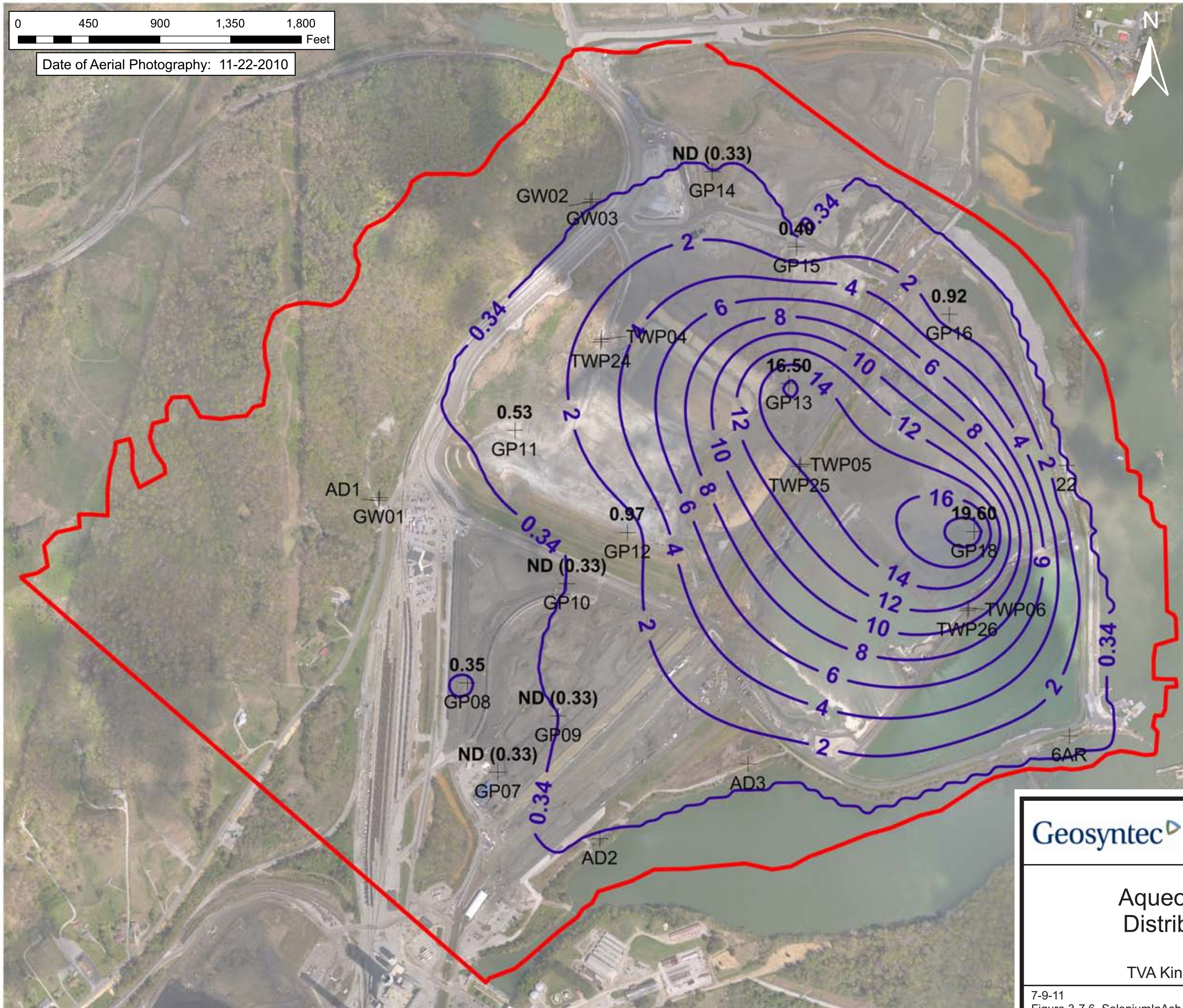
Geosyntec JACOBS TVA

Aqueous Radium-226 Distribution in Bedrock

TVA Kingston Fossil Plant

6-24-11
Figure 3-7.5_RadiumInBedrock.cdr

Figure 3-7.5



Note:
Aqueous concentrations are in μg/L.

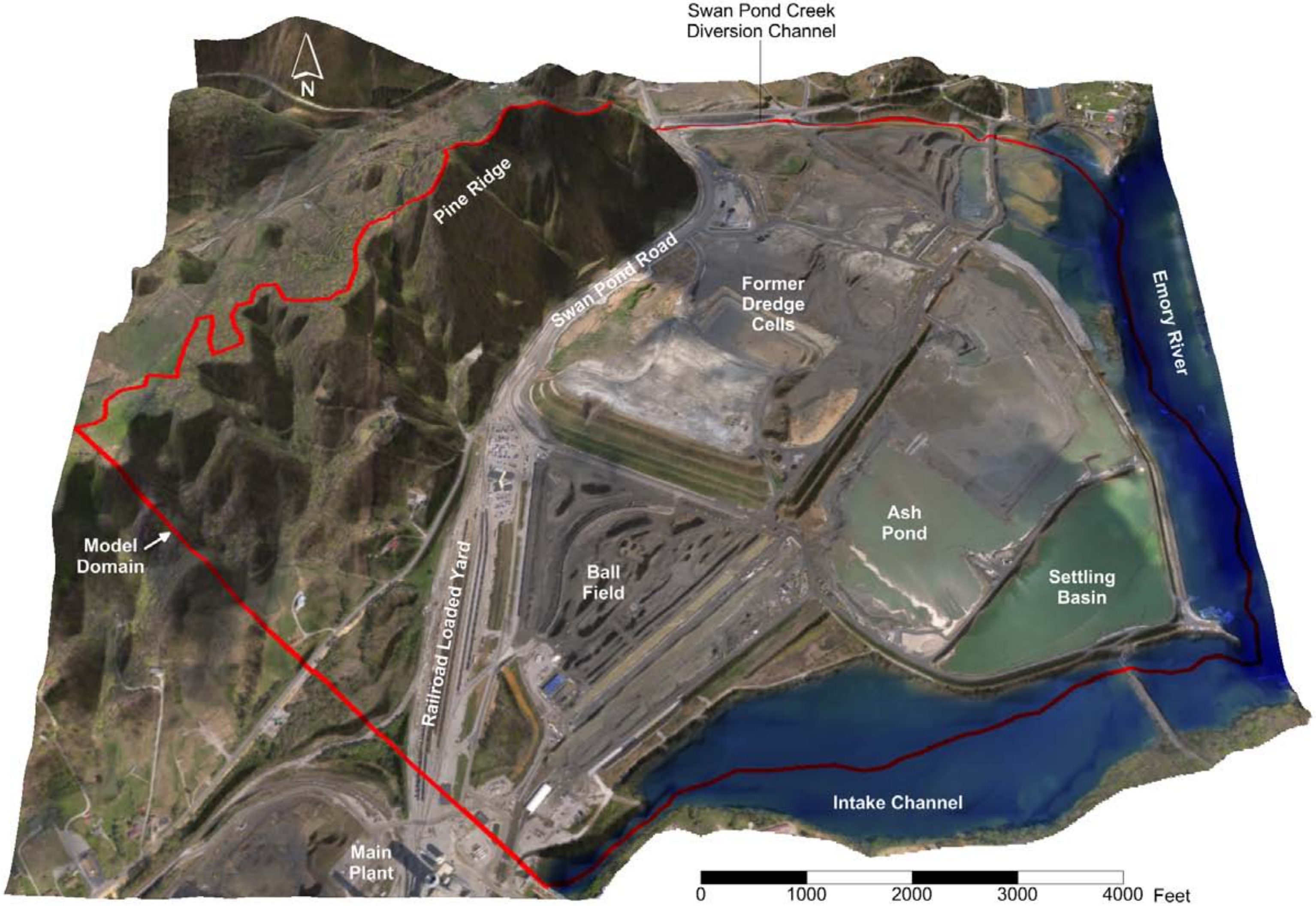
Geosyntec JACOBS TVA

Aqueous Selenium Distribution in Ash

TVA Kingston Fossil Plant

7-9-11
Figure 3-7.6_SeleniumInAsh.cdr

Figure 3-7.6



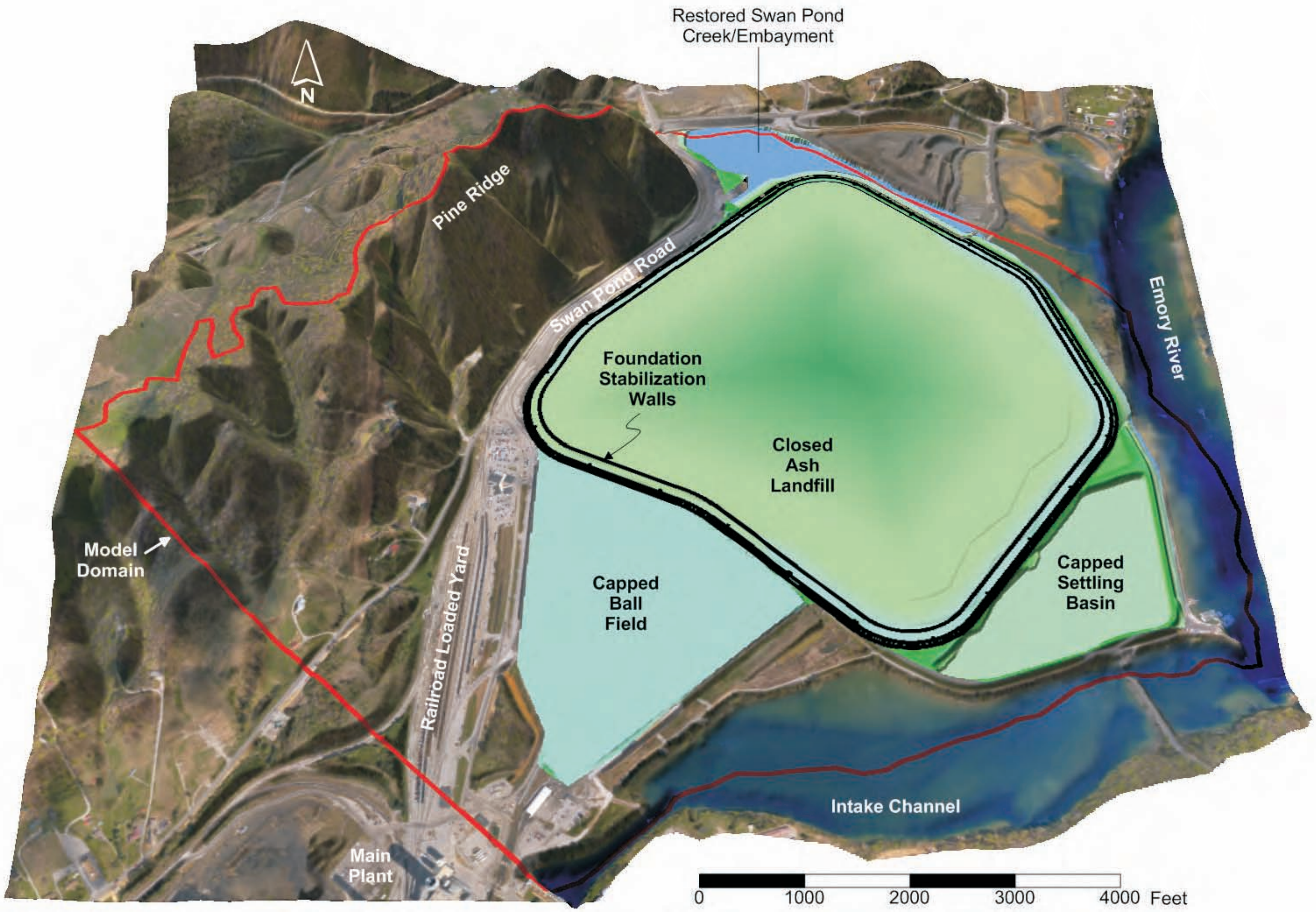
Geosyntec JACOBS TVA

Three-Dimensional Geometry of 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 4-2.1_3D-ExistingCond.cdr

Figure 4-2.1



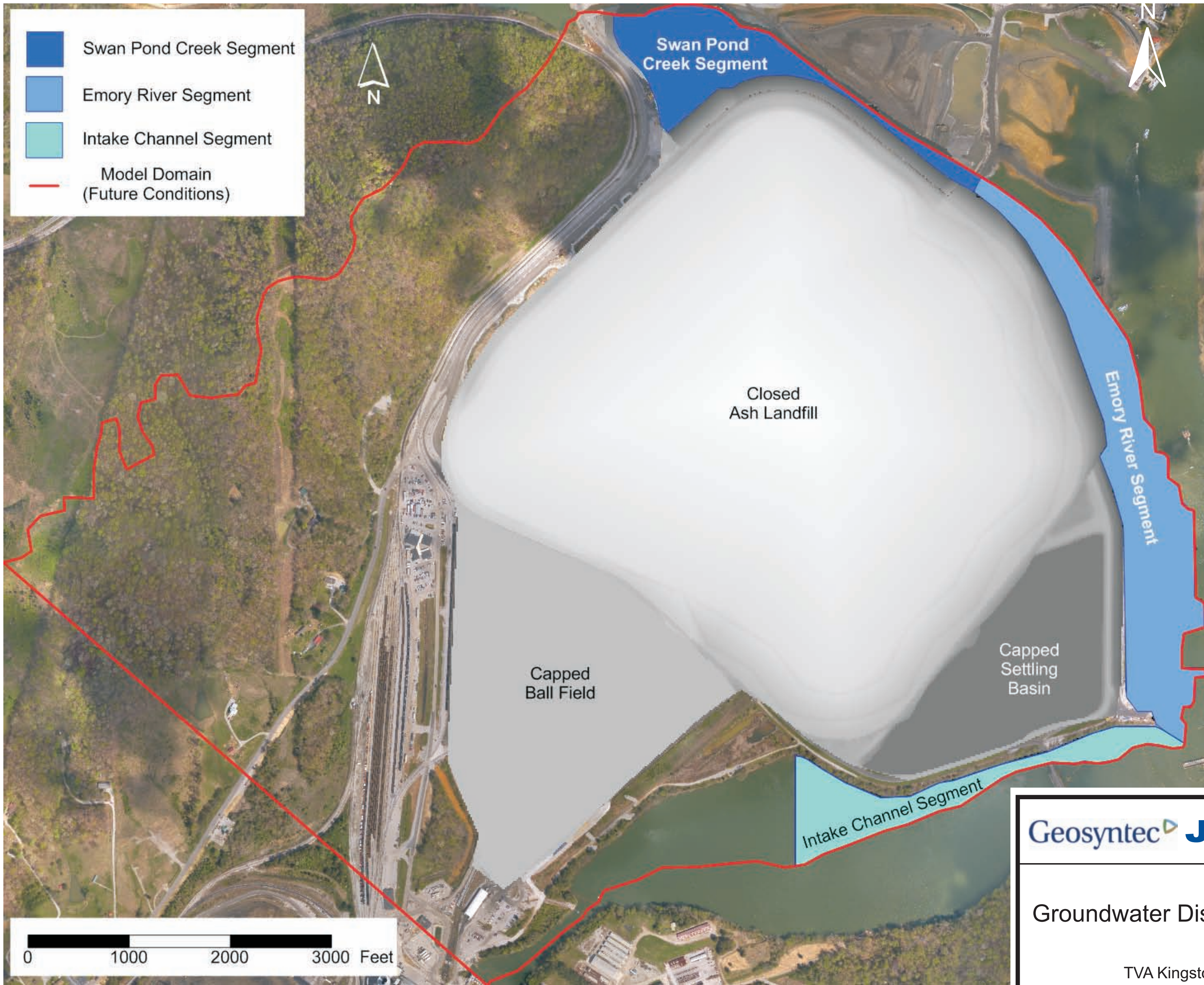
Geosyntec JACOBS TVA

Three-Dimensional Geometry of Future Conditions

TVA Kingston Fossil Plant

6-23-11
Figure 4-3.1_3D-FutureCond.cdr

Figure 4-3.1



Geosyntec JACOBS TVA

Groundwater Discharge Segments

TVA Kingston Fossil Plant

6-28-11
Figure 4-3.2_GW-DischargeSegs.cdr

Figure 4-3.2

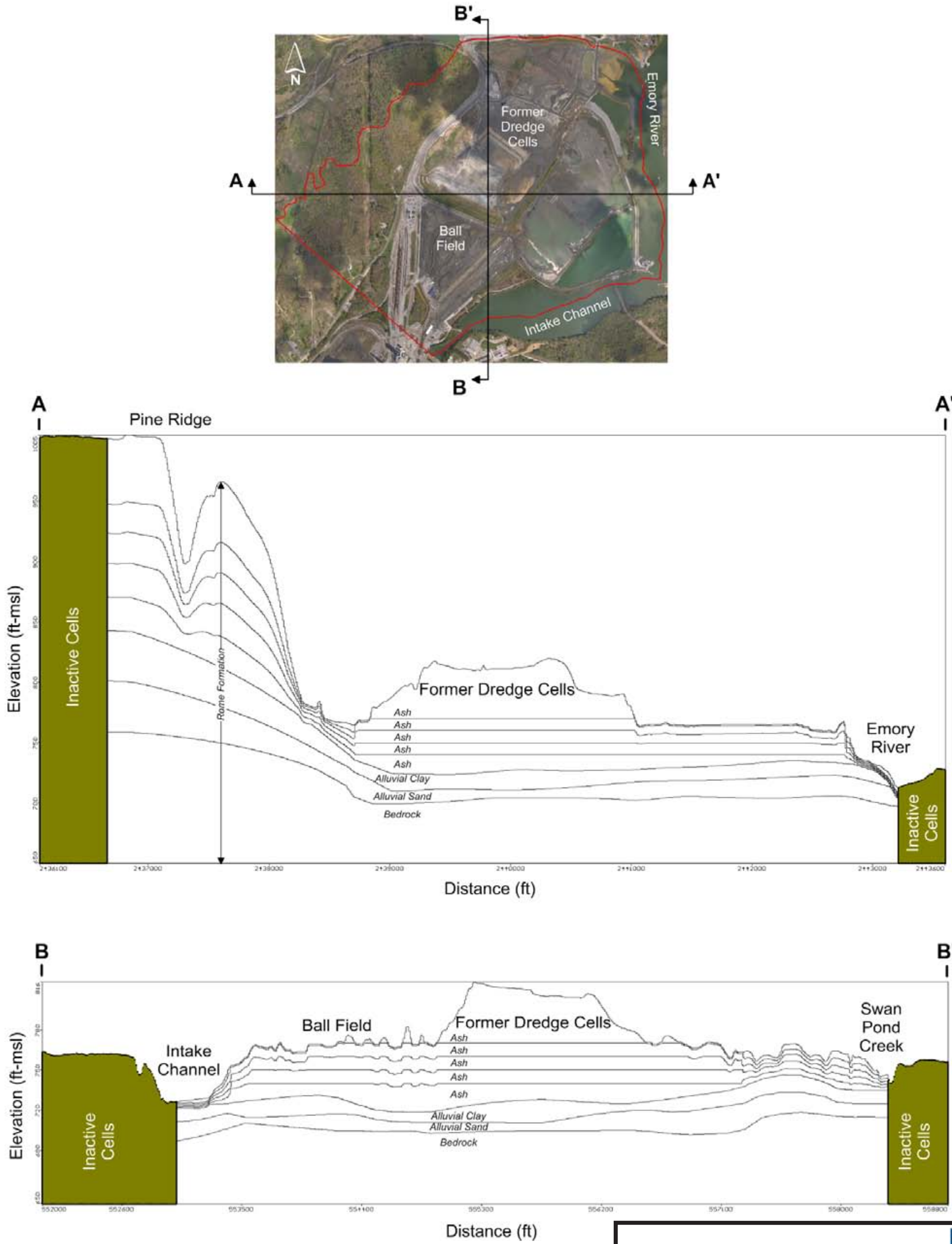
Geosyntec JACOBS TVA

Model Domain and Discretization
2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-1.1_CurrentModelDomain.cdr

Figure 6-1.1



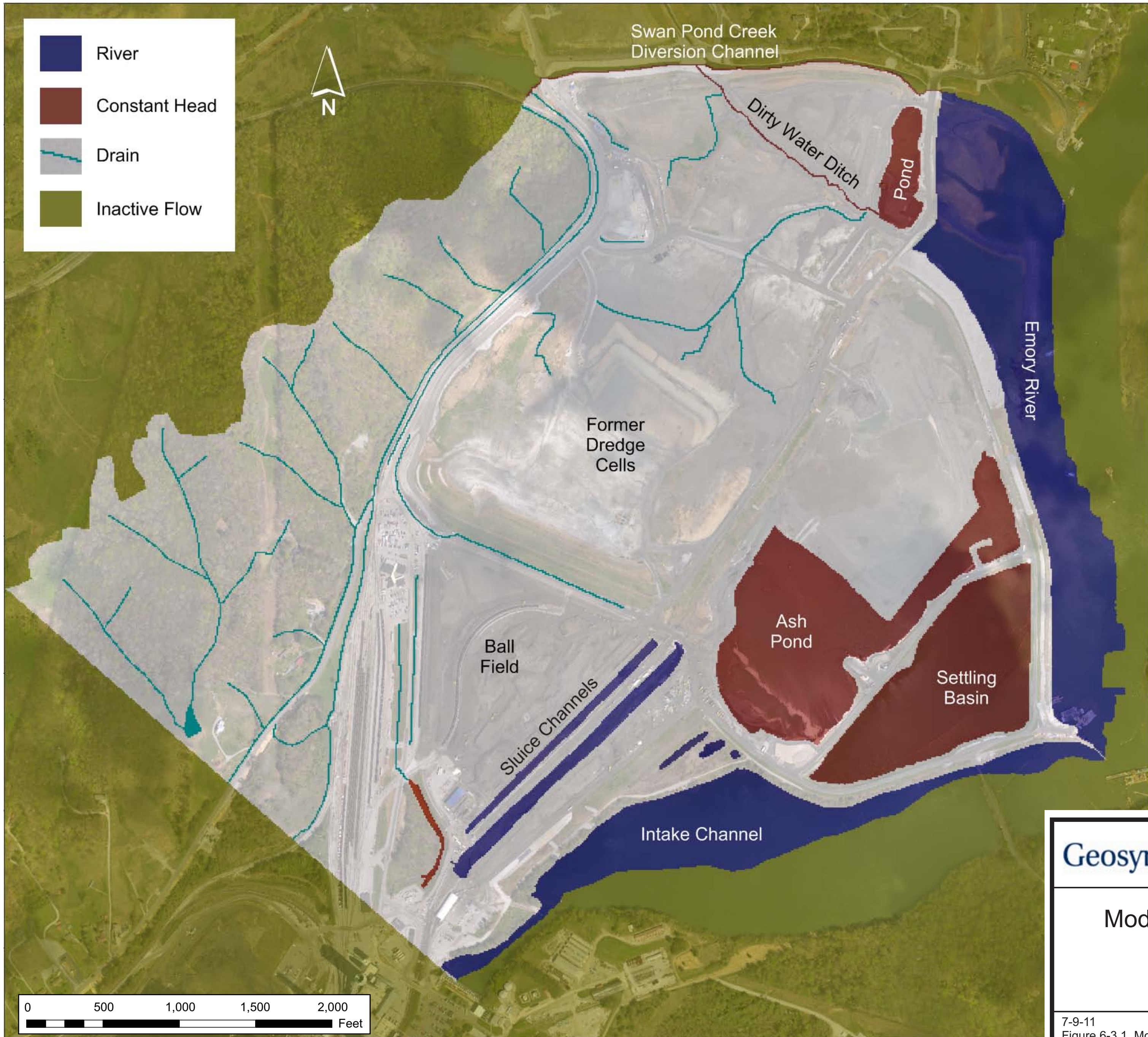
Geosyntec JACOBS TVA

Cross-Sections Showing Model Layering - 2010 Conditions

TVA Kingston Fossil Plant

7-9-11
Figure 6-2.1_ModelLayer2010.cdr

Figure 6-2.1



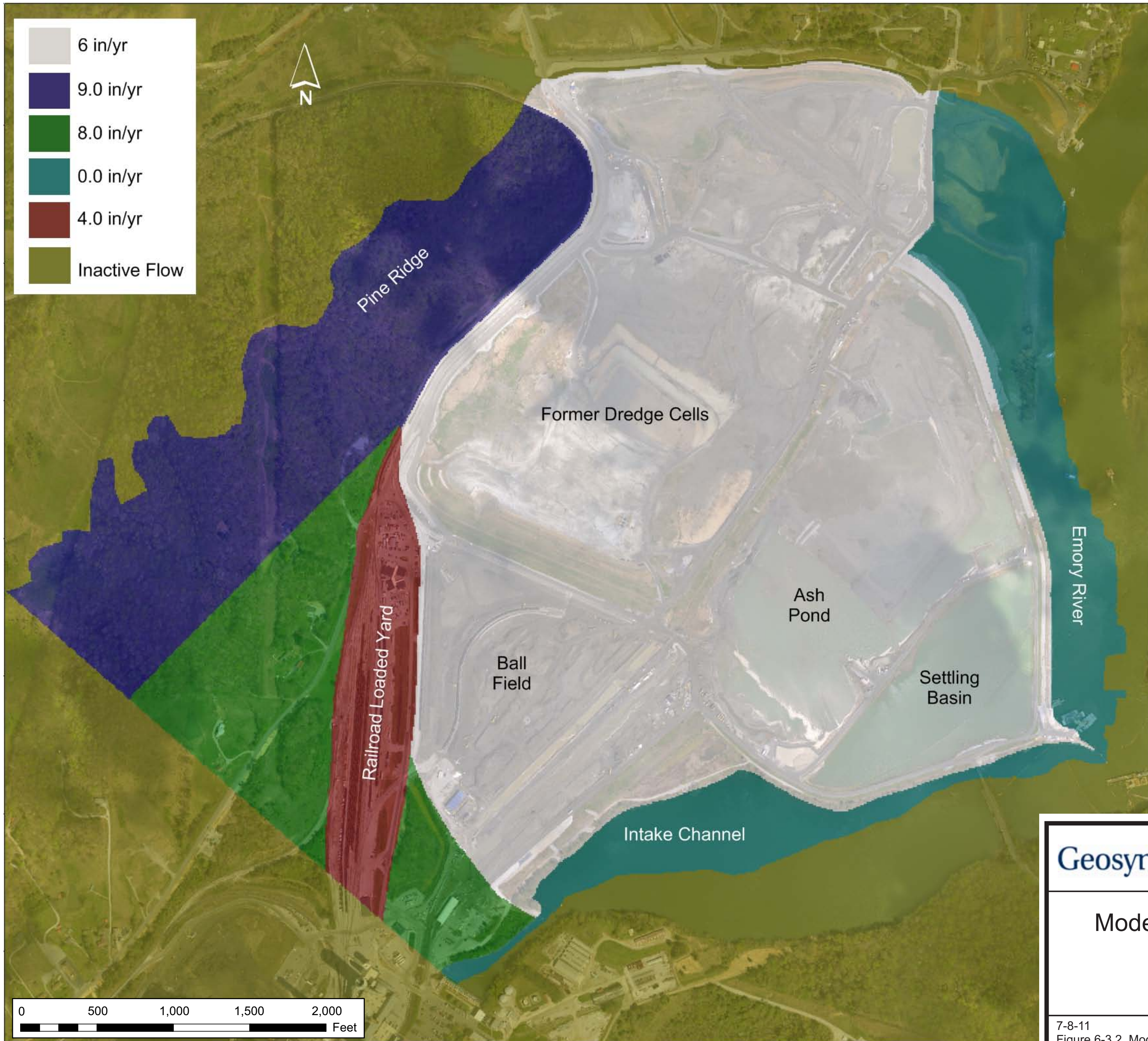
Geosyntec JACOBS TVA

Model Boundary Conditions
2010 Conditions

TVA Kingston Fossil Plant

7-9-11
Figure 6-3.1_ModelBoundExist.cdr

Figure 6-3.1



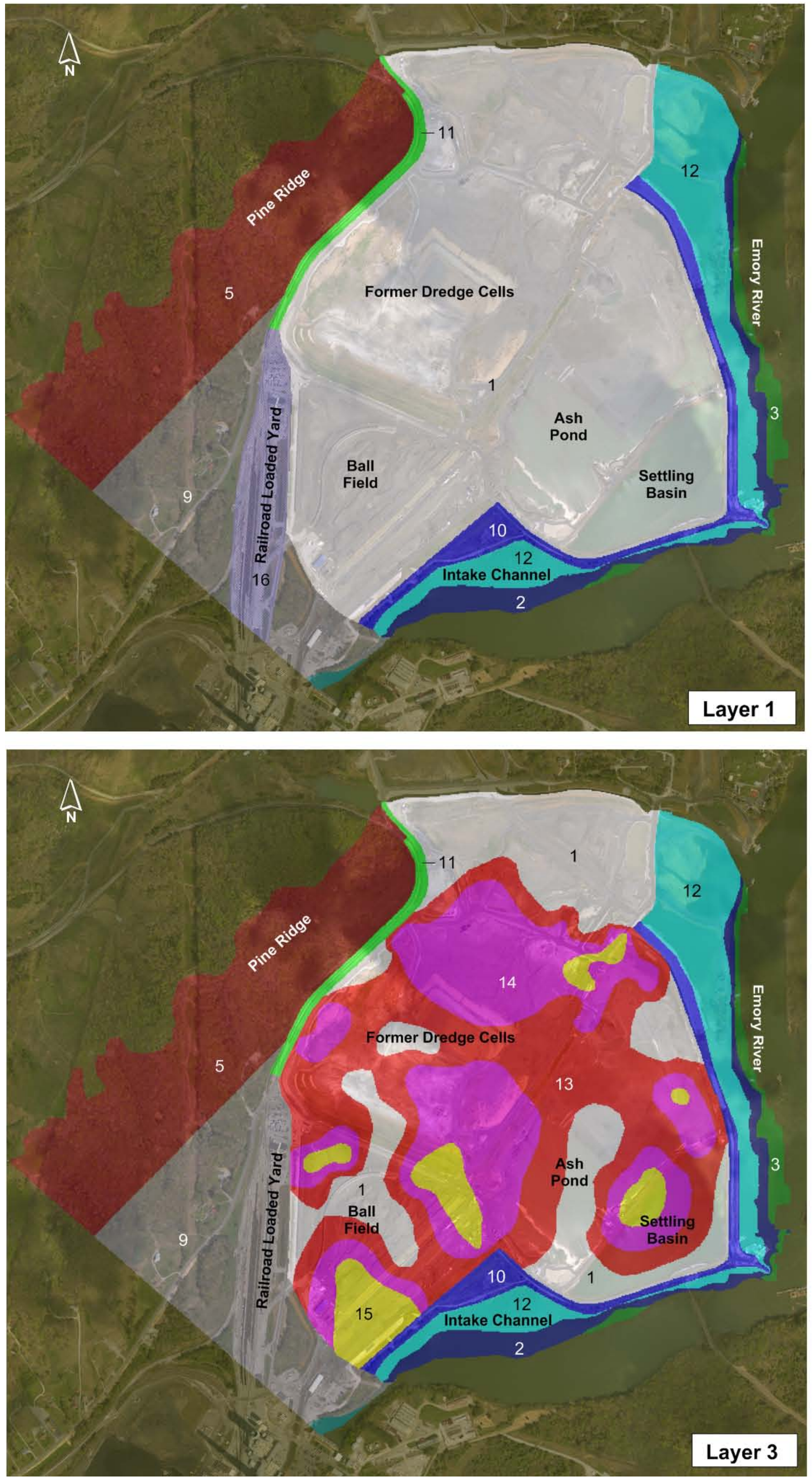
Geosyntec JACOBS TVA

Model Recharge Distribution 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-3.2_ModelRechargeExist.cdr

Figure 6-3.2



Zone	Kx & Ky (cm/sec)	Kz (cm/sec)
1	5.4E-5	4.2E-5
2	5.0E-6	2.5E-6
3	5.0E-4	2.5E-4
4	5.0E-4	5.0E-4
5	8.0E-4	8.0E-4
6	2.0E-5	2.0E-5
7	4.0E-5	4.0E-5
8	7.9E-5	7.9E-5
9	5.0E-4	2.5E-4
10	8.0E-4	8.0E-4
11	1.0E-3	1.0E-3
12	8.0E-4	8.0E-4
13	3.4E-4	1.7E-4
14	6.2E-4	3.1E-4
15	9.0E-4	4.5E-4
16	9.0E-4	9.0E-4
Inactive Flow		

0 600 1,200 1,800 2,400 Feet

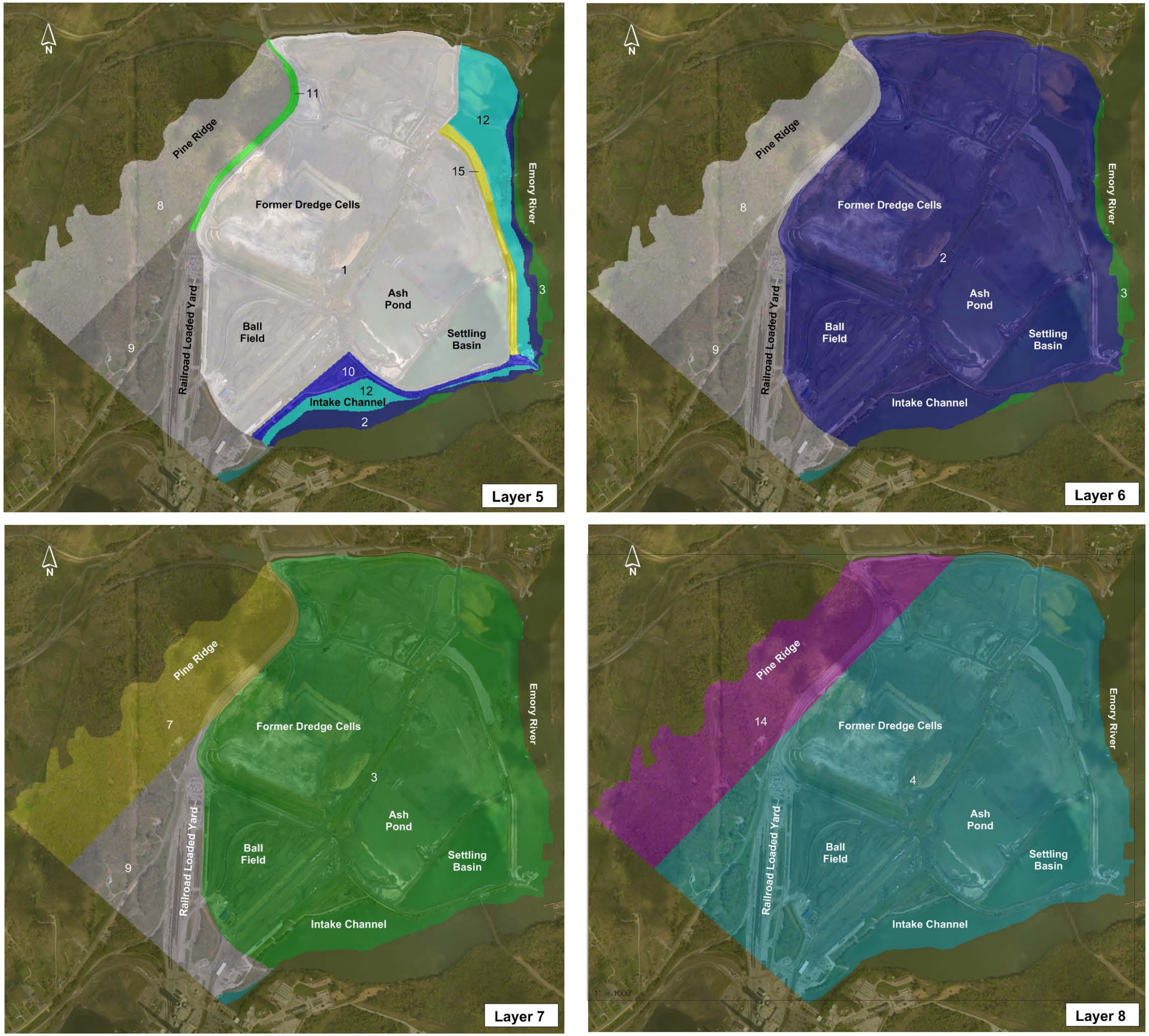
Geosyntec JACOBS TVA

Model Hydraulic Conductivity Distribution (Layers 1 to 4) 2010 Condtions

TVA Kingston Fossil Plant

7-8-11
Figure 6-4.1_HydCondLay1-4Existing.cdr

Figure 6-4.1



Zone	Kx & Ky (cm/sec)	Kz (cm/sec)
1	5.4E-5	4.2E-5
2	5.0E-6	2.5E-6
3	5.0E-4	2.5E-4
4	5.0E-4	5.0E-4
5	8.0E-4	8.0E-4
6	2.0E-5	2.0E-5
7	4.0E-5	4.0E-5
8	7.9E-5	7.9E-5
9	5.0E-4	2.5E-4
10	8.0E-4	8.0E-4
11	1.0E-3	1.0E-3
12	8.0E-4	8.0E-4
13	3.4E-4	1.7E-4
14	6.2E-4	3.1E-4
15	9.0E-4	4.5E-4
16	9.0E-4	9.0E-4
	Inactive Flow	

0 600 1,200 1,800 2,400 Feet

Geosyntec JACOBS TVA

Model Hydraulic Conductivity Distribution (Layers 5 to 8) 2010 Condtions

TVA Kingston Fossil Plant

7-8-11
Figure 6-4.2_HydCondLay5-8Existing.cdr

Figure 6-4.2

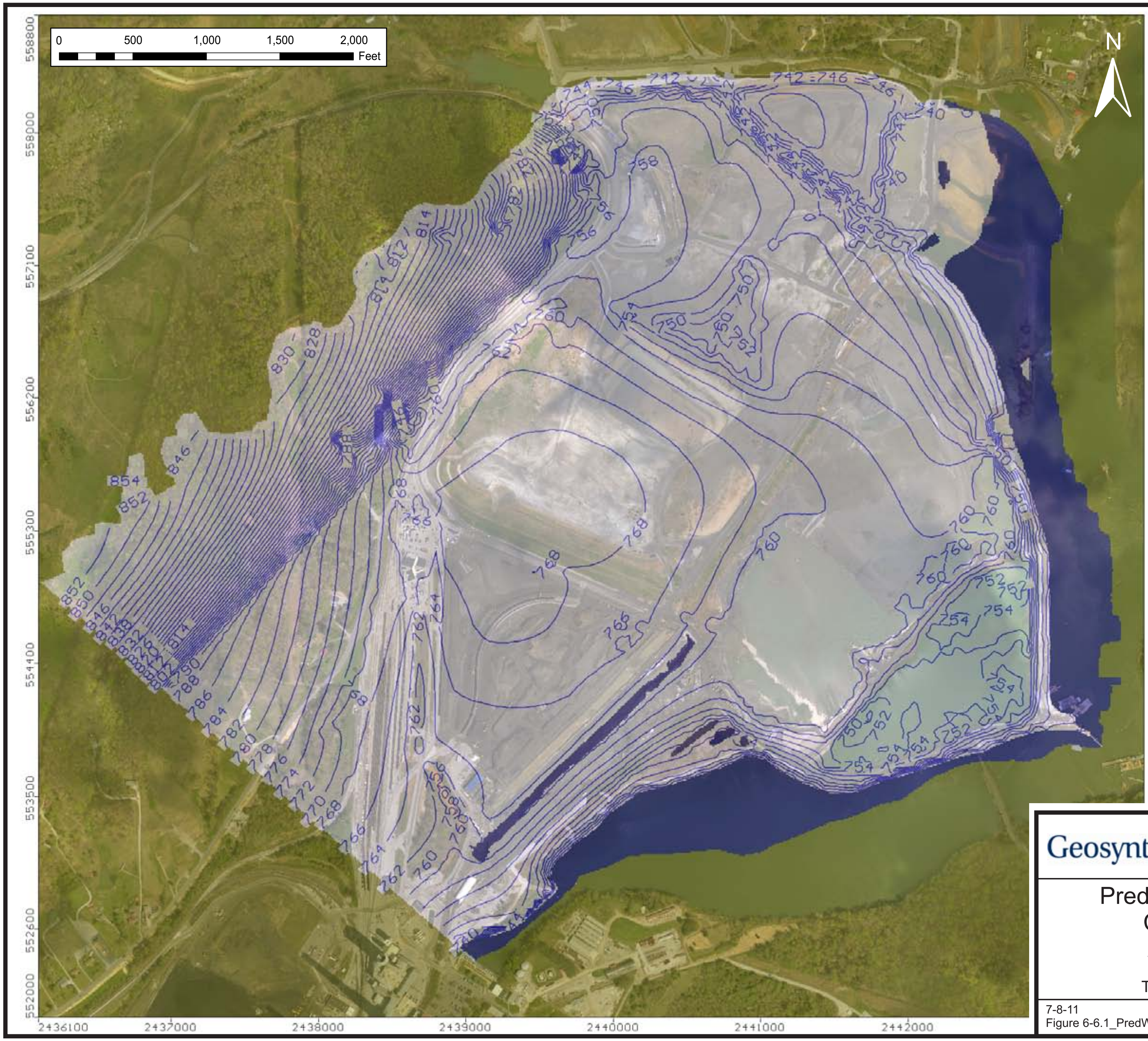
Geosyntec JACOBS TVA

Wells Used in Flow Model Calibration

TVA Kingston Fossil Plant

6-28-11
Figure 6-5.1_WellsCalibration.cdr

Figure 6-5.1



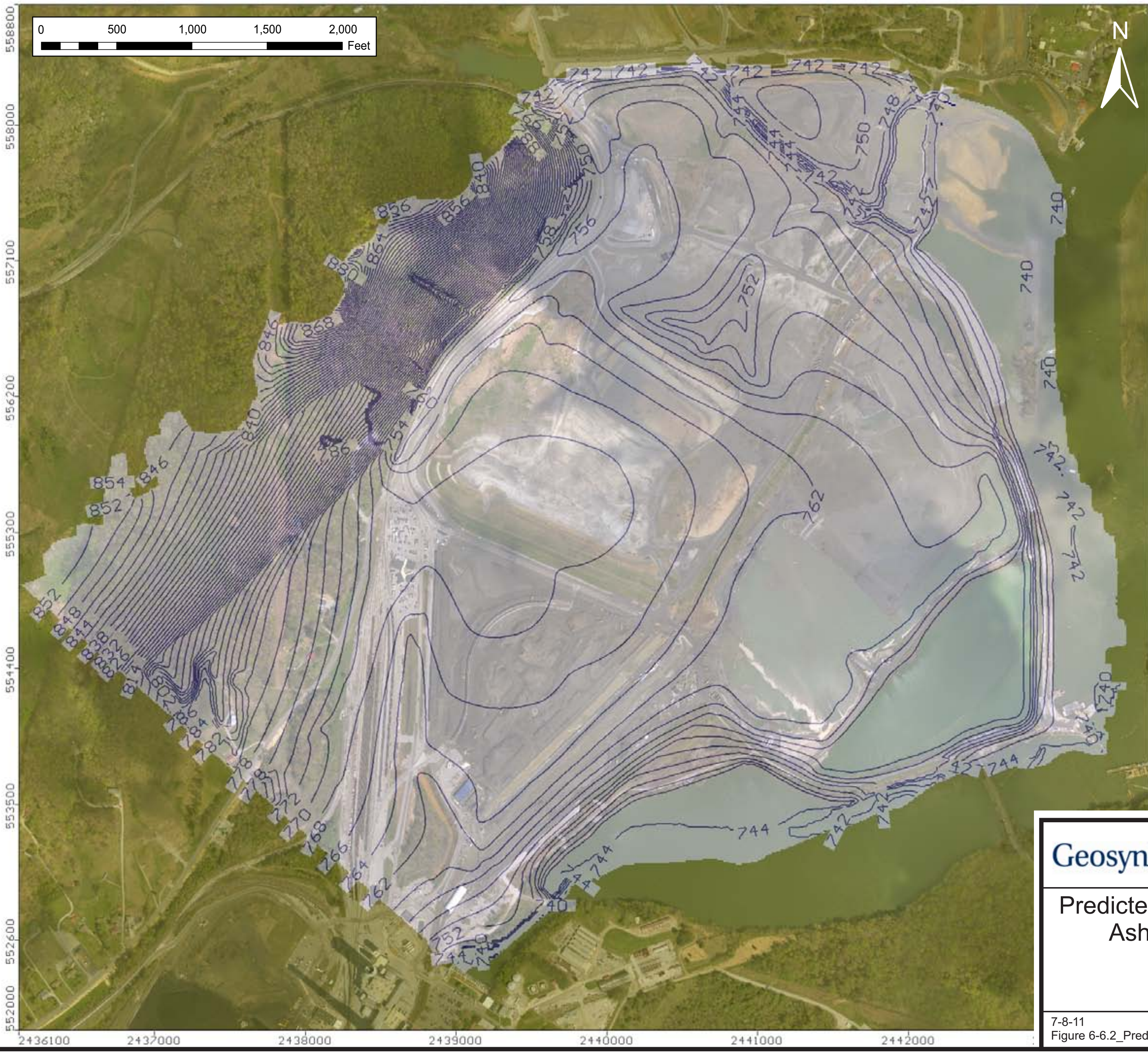
Geosyntec JACOBS TVA

Predicted Water Table for Calibrated Model 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-6.1_PredWTExisting.cdr

Figure 6-6.1



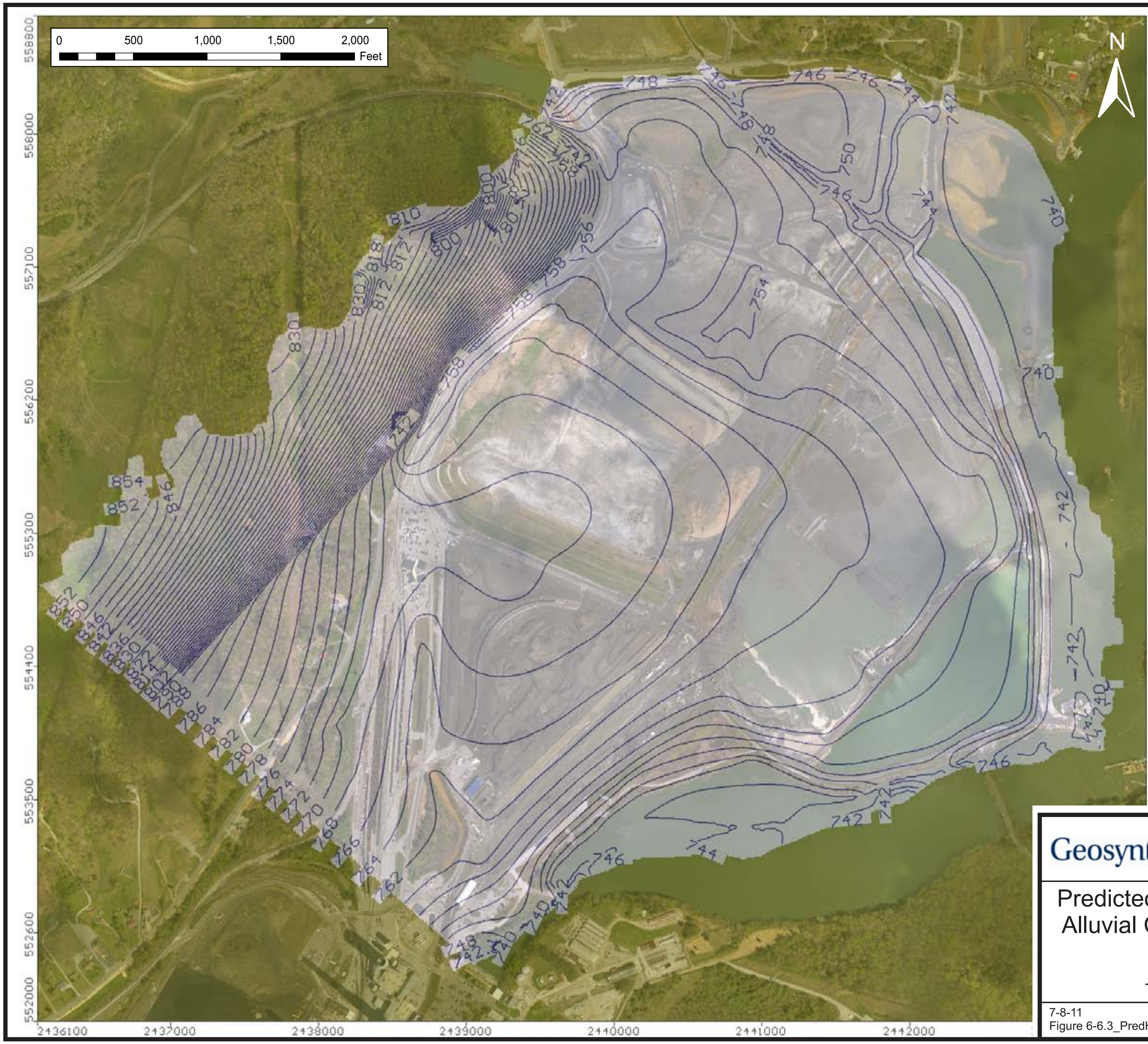
Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Ash for Calibrated Model 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-6.2_PredHeadAshExisting.cdr

Figure 6-6.2



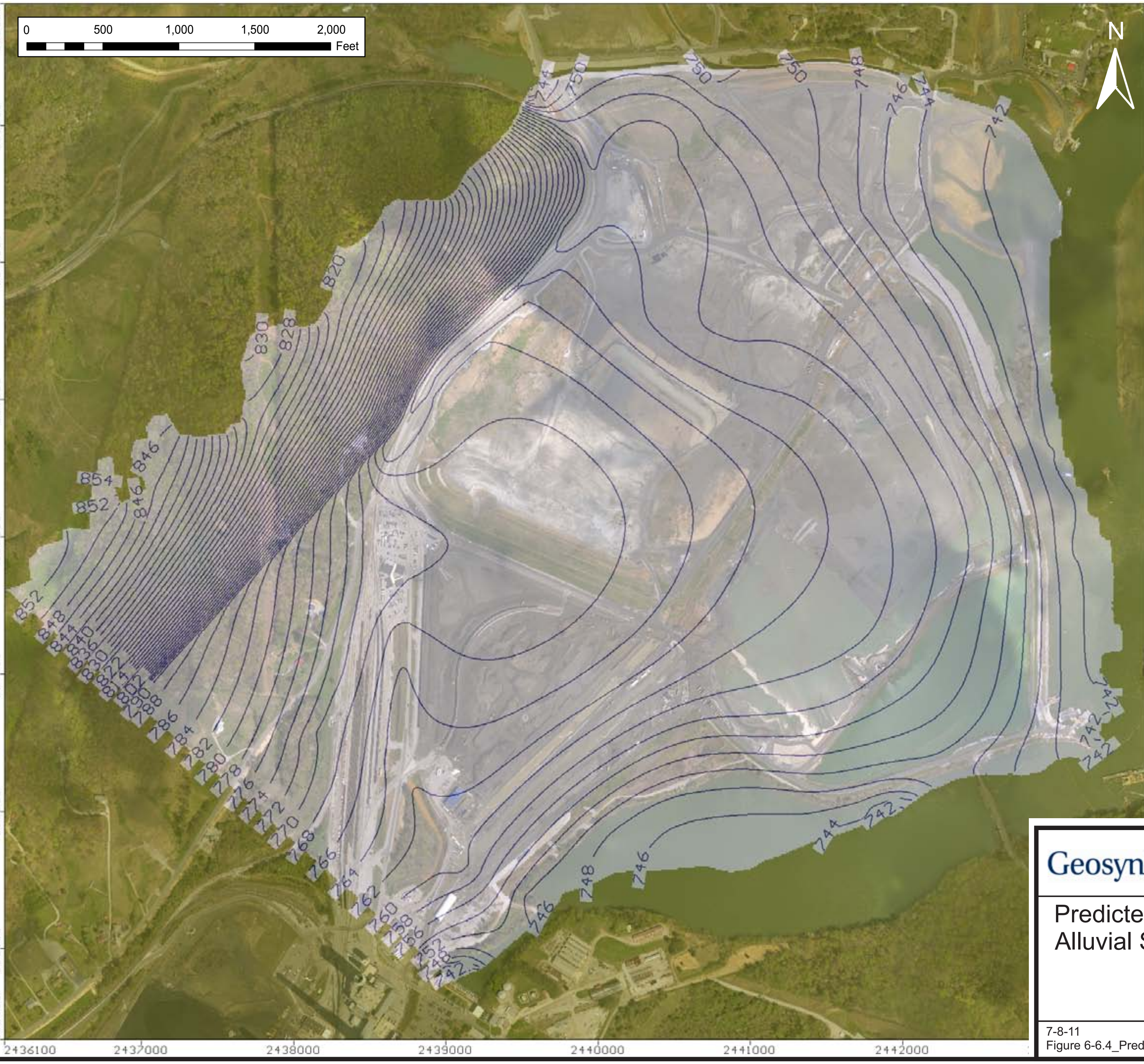
Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Alluvial Clay for Calibrated Model 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-6.3_PredHeadClayExisting.cdr

Figure 6-6.3



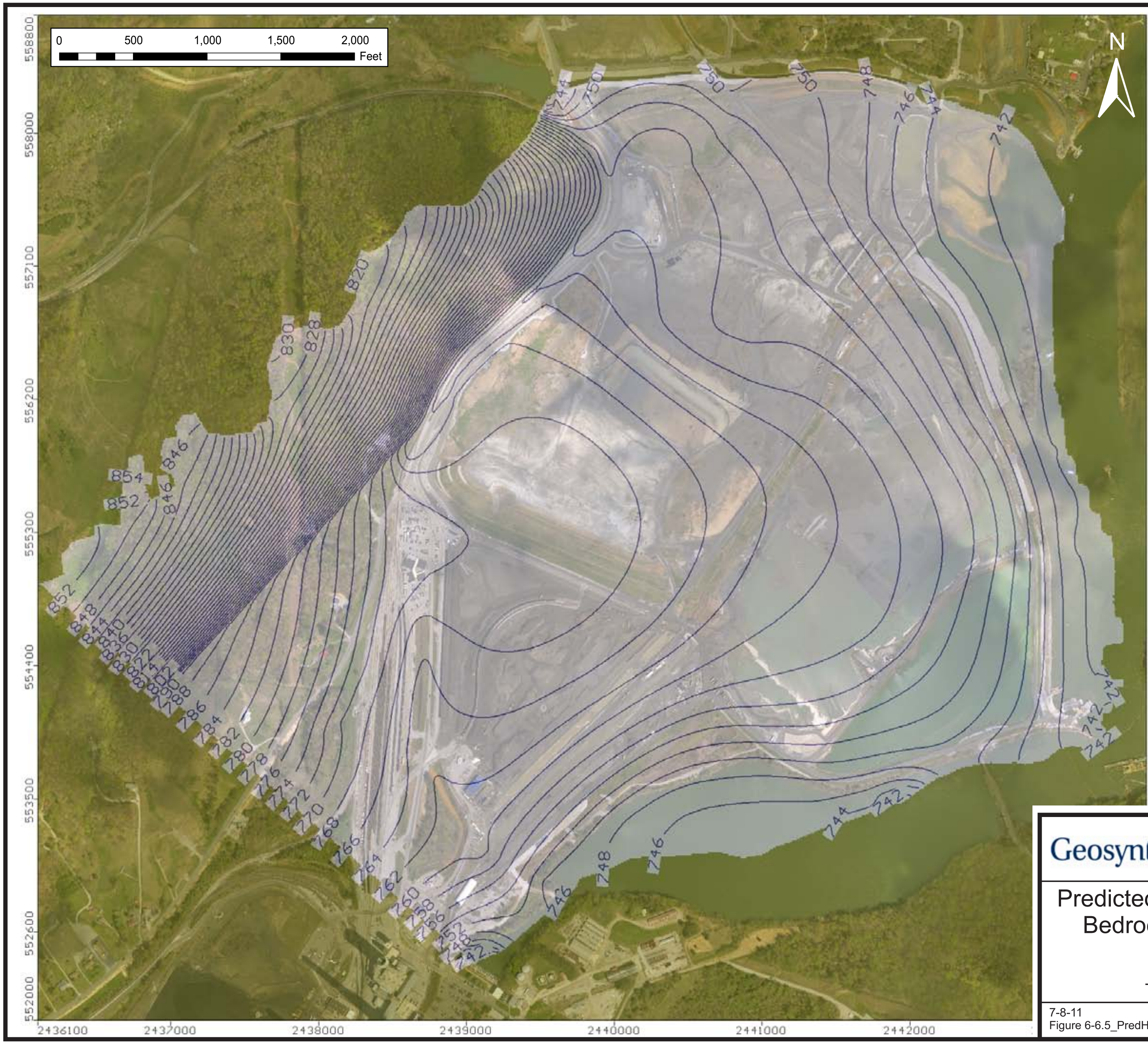
Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Alluvial Sand for Calibrated Model 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-6.4_PredHeadSandExisting.cdr

Figure 6-6.4



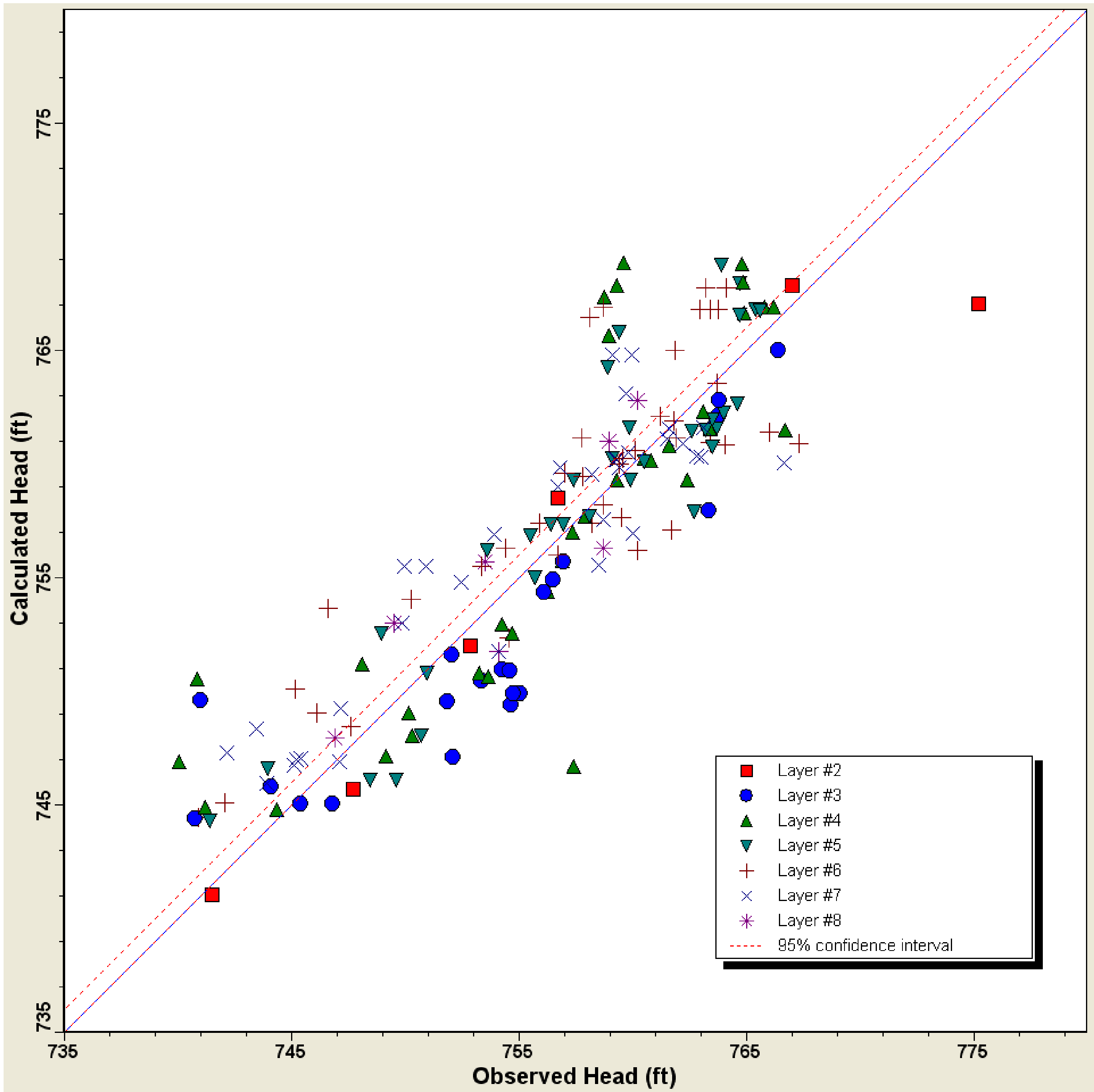
Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Bedrock for Calibrated Model 2010 Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 6-6.5_PredHeadBedrockExisting.cdr

Figure 6-6.5



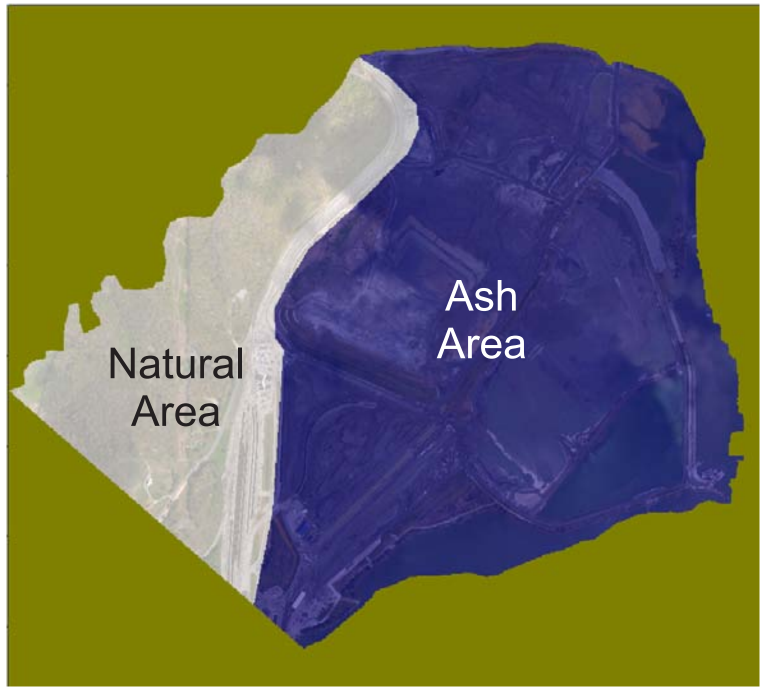
Geosyntec JACOBS TVA

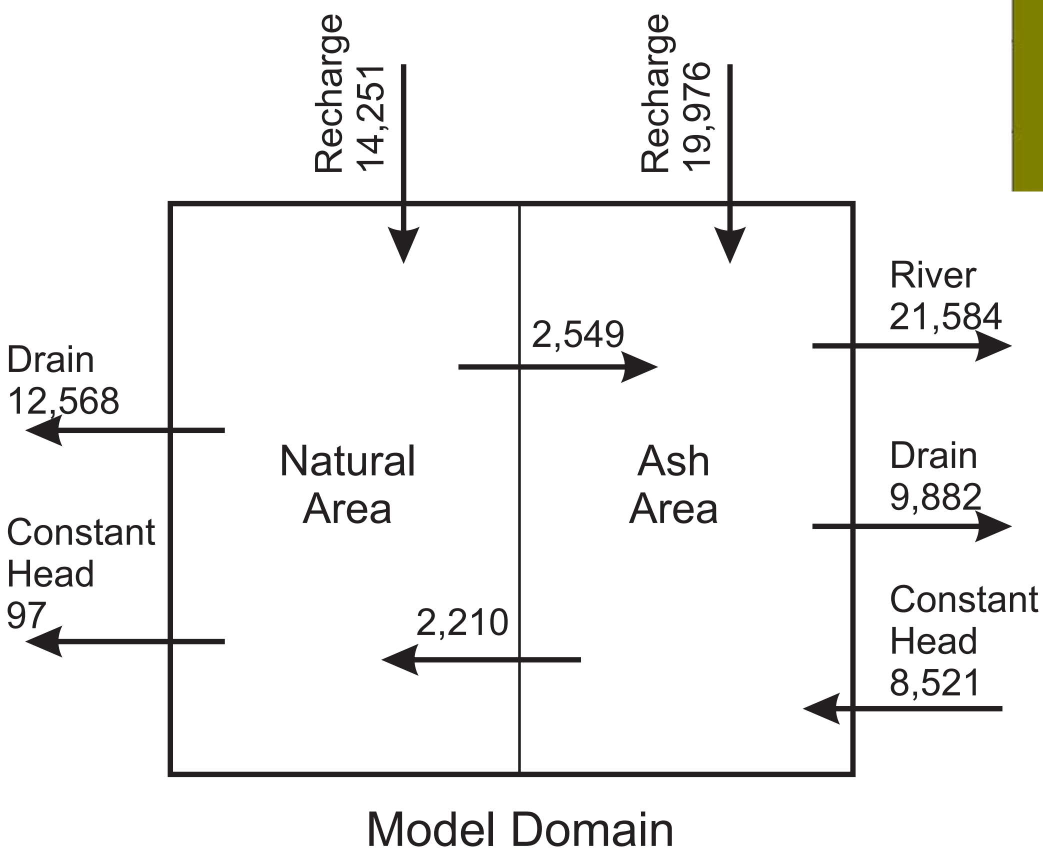
Calibration Statistics

TVA Kingston Fossil Plant

7-11-11
Figure 6-6.6_ModelCalibration.cdr

Figure 6-6.6





Note:
Units are in ft^3/day.

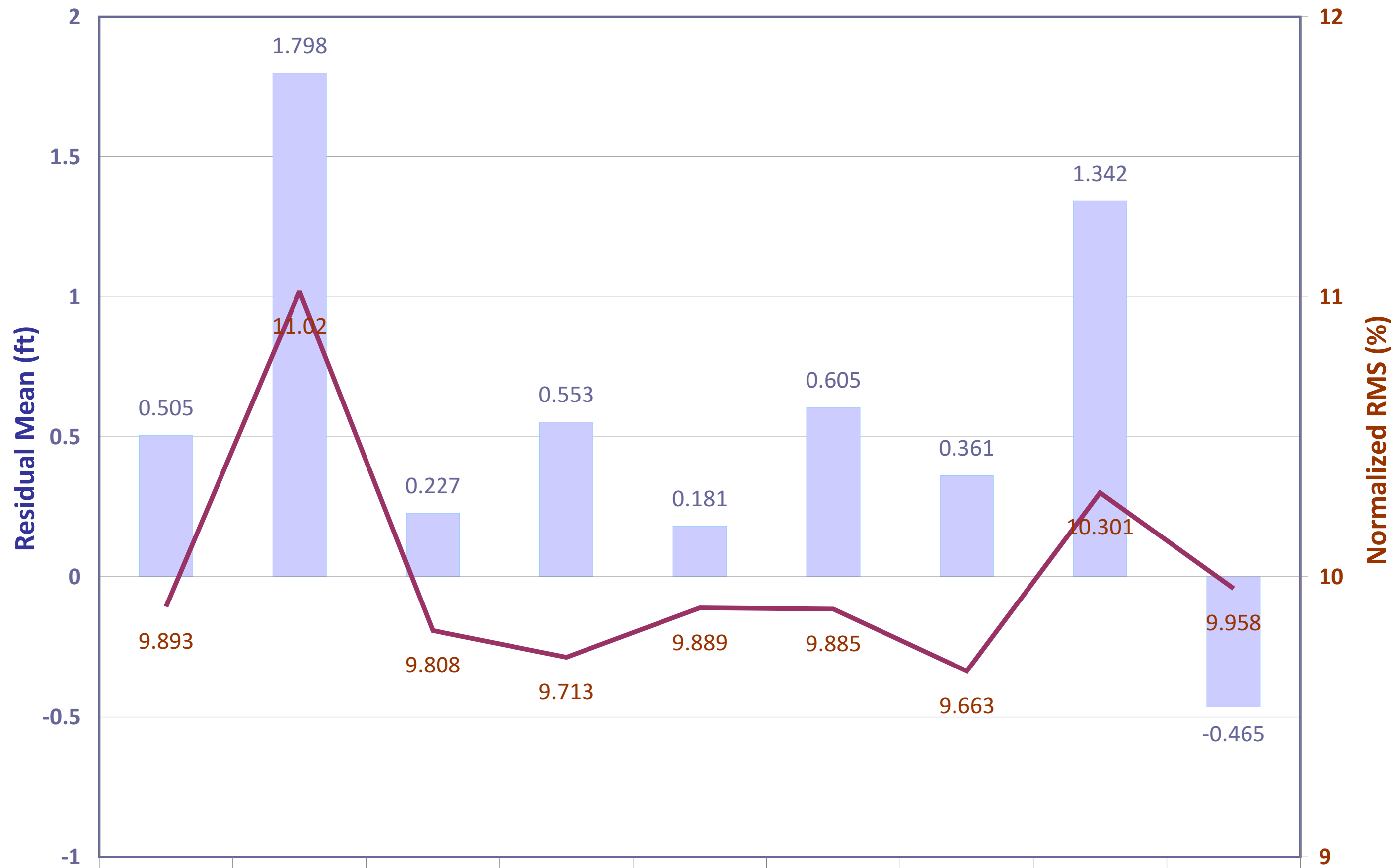
Geosyntec JACOBS TVA

Flow Mass Balance
2010 Conditions

TVA Kingston Fossil Plant

7-11-11
Figure 6-6.7_FlowMassBalExisting.cdr

Figure 6-6.7



	K (Base)	K-ash - 0.5X	K-ash - 1.5X	K-alluvial clay - 0.5X	K-alluvial clay - 2X	K-alluvial sand - 0.5X	K-alluvial sand - 2X	K-bedrock - 0.5X	K-bedrock - 2X
Residual Mean (ft)	0.505	1.798	0.227	0.553	0.181	0.605	0.361	1.342	-0.465
Normalized RMS (%)	9.893	11.02	9.808	9.713	9.889	9.885	9.663	10.301	9.958

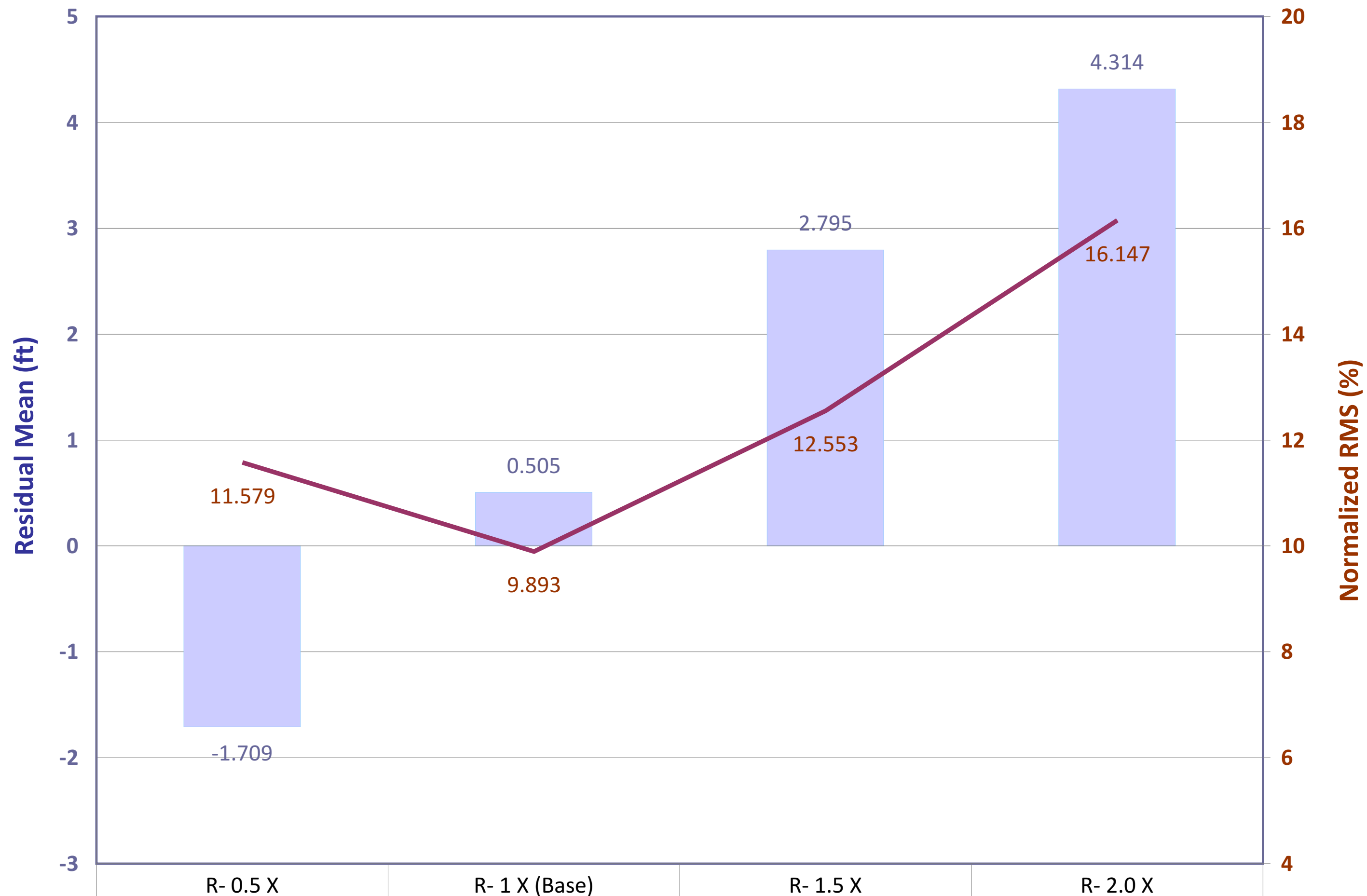
Geosyntec JACOBS TVA

Hydraulic Conductivity Sensitivity

TVA Kingston Fossil Plant

7-8-11
Figure 6-7.1_HydraulicConductivity.cdr

Figure 6-7.1



	R- 0.5 X	R- 1 X (Base)	R- 1.5 X	R- 2.0 X
Residual Mean (ft)	-1.709	0.505	2.795	4.314
Normalized RMS (%)	11.579	9.893	12.553	16.147

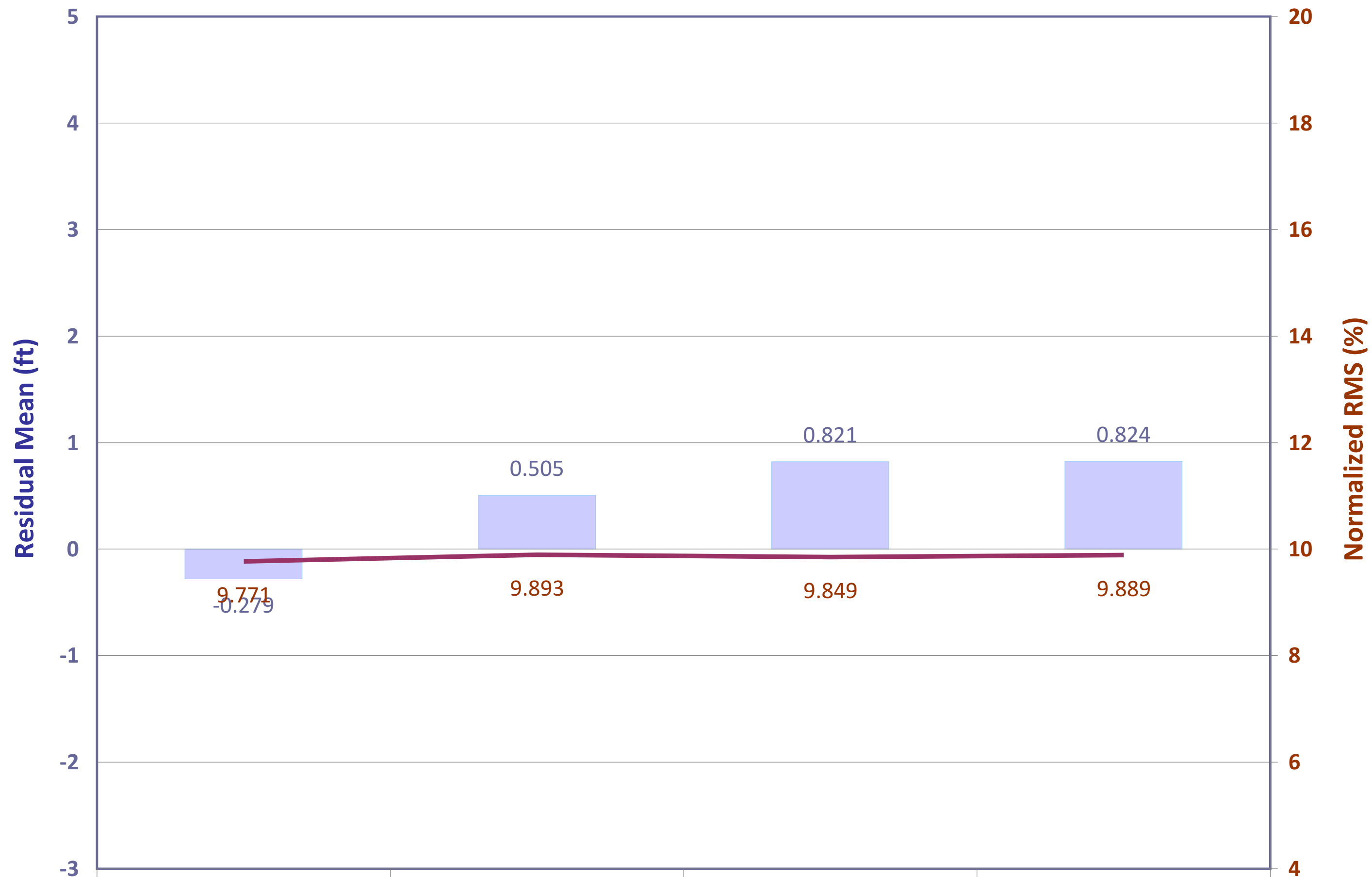
Geosyntec JACOBS TVA

Recharge Sensitivity

TVA Kingston Fossil Plant

7-8-11
Figure 6-7.2_RechargeSensitivity.cdr

Figure 6-7.2



	R- 0.5 X	R- 1 X (Base)	R- 1.5 X	R- 2.0 X
Residual Mean (ft)	-0.279	0.505	0.821	0.824
Normalized RMS (%)	9.771	9.893	9.849	9.889

Geosyntec JACOBS TVA

Pine Ridge Sensitivity

TVA Kingston Fossil Plant

7-8-11
Figure 6-7.3_PineRidgeSensitivity.cdr

Figure 6-7.3

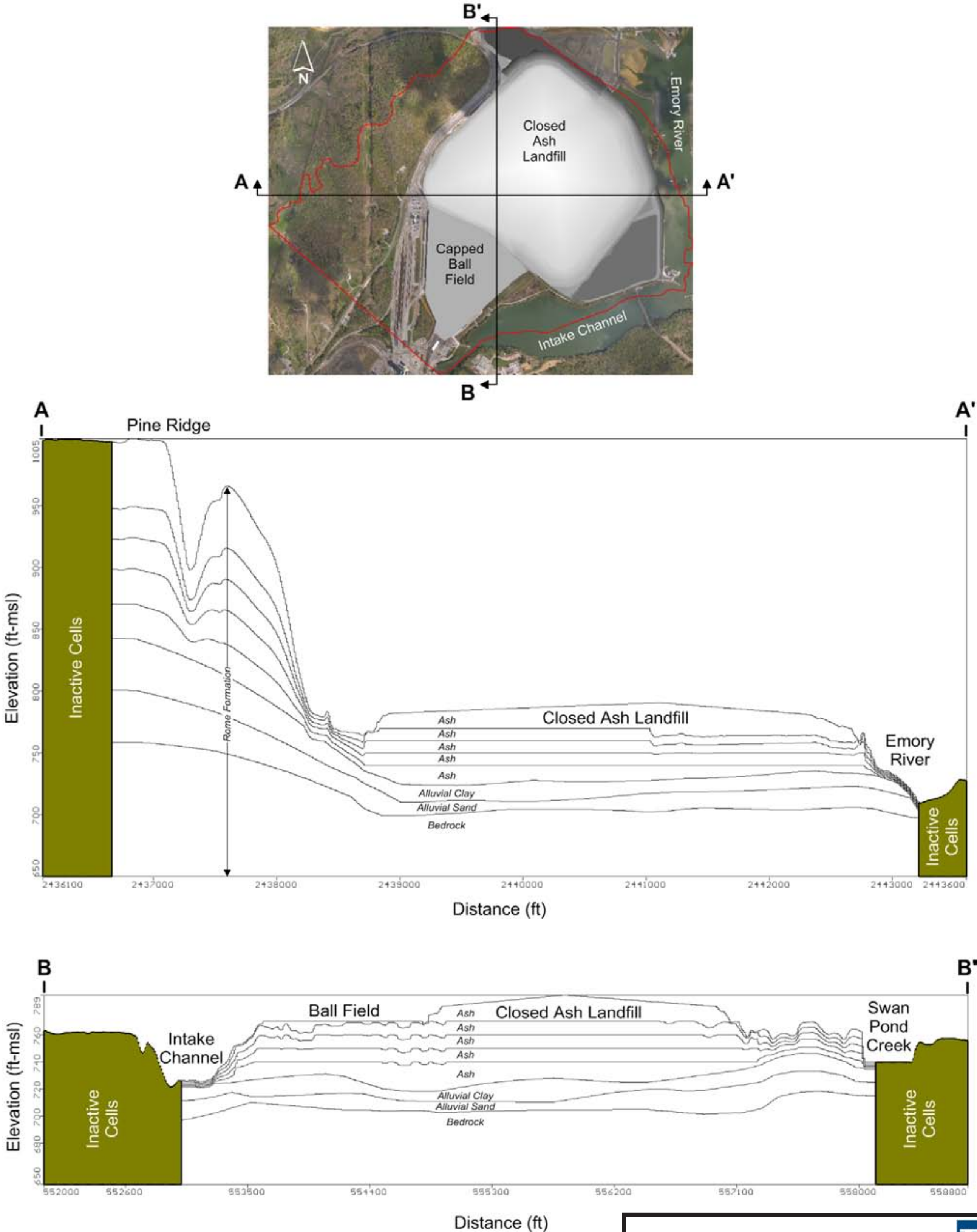
Geosyntec JACOBS TVA

Model Domain and Discretization
Future Conditions

TVA Kingston Fossil Plant

7-8-11
Figure 7-1.1_FutureModelDomain.cdr

Figure 7-1.1



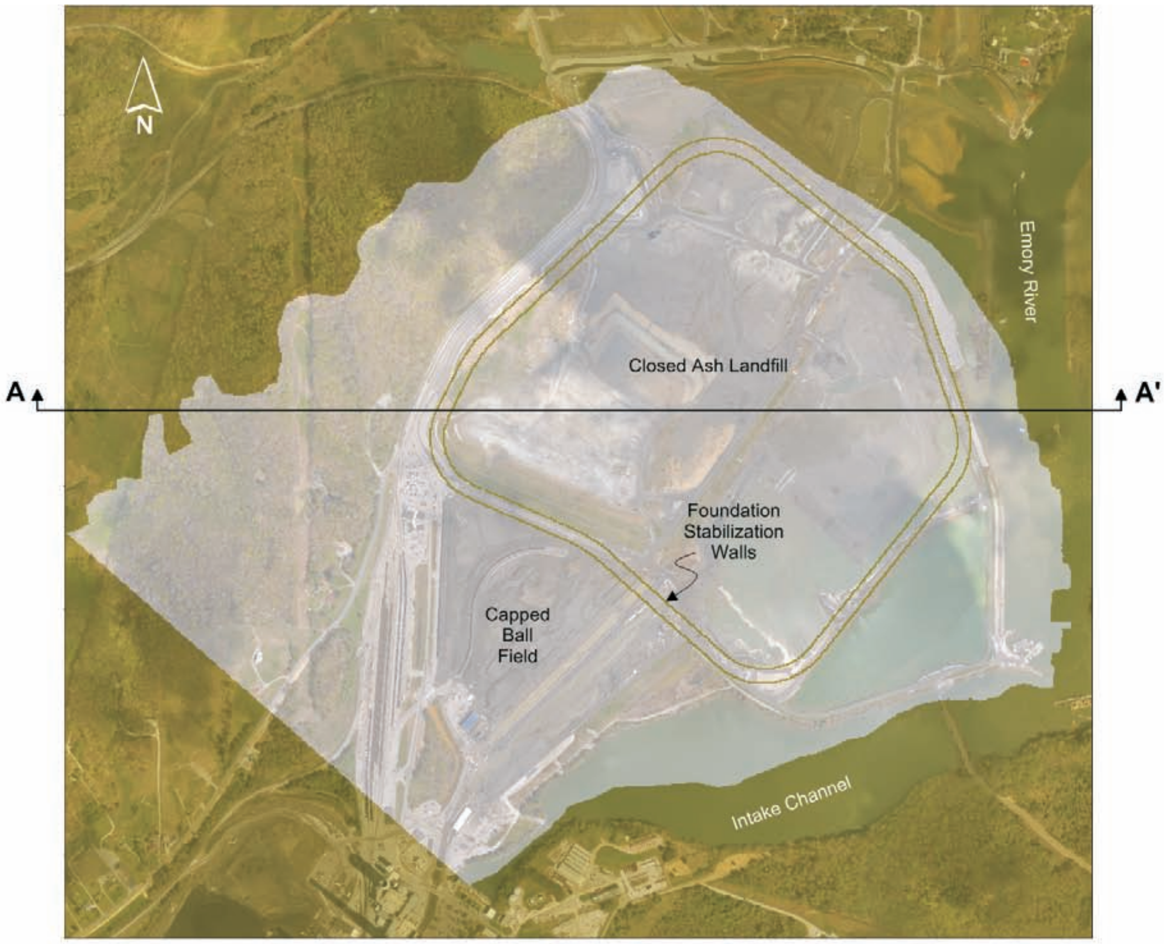
Geosyntec JACOBS TVA

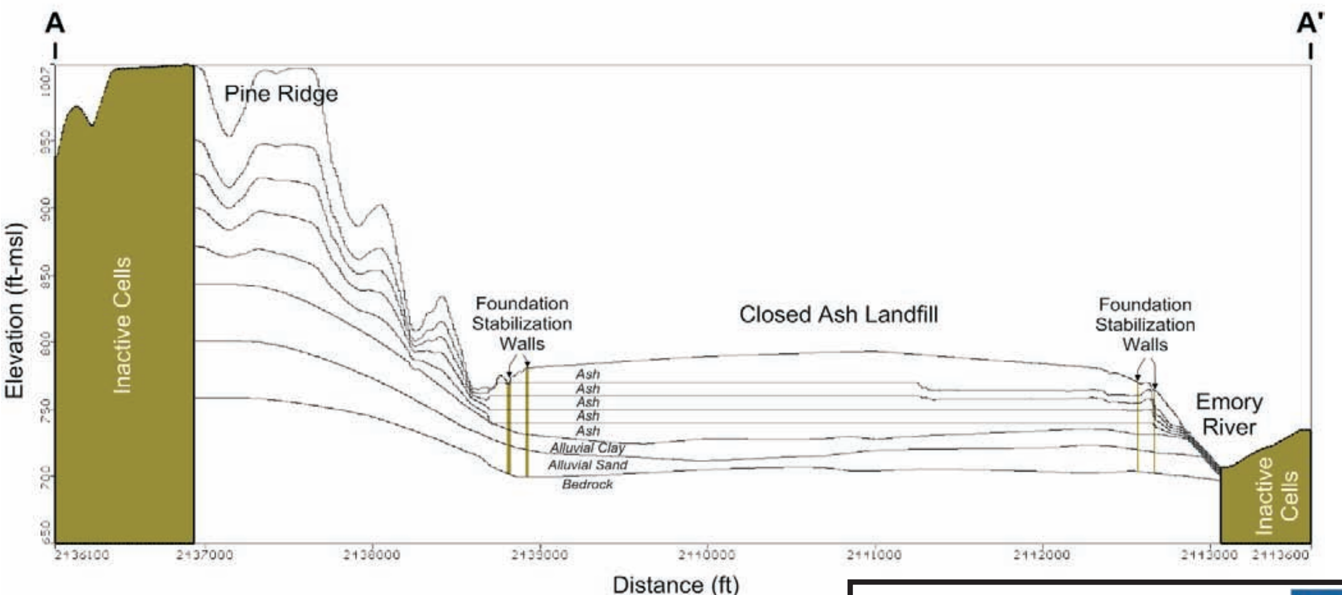
Cross-Sections Showing Model Layering - Future Conditions

TVA Kingston Fossil Plant

7-9-11
Figure 7-2.1_ModelLayerFuture.cdr

Figure 7-2.1





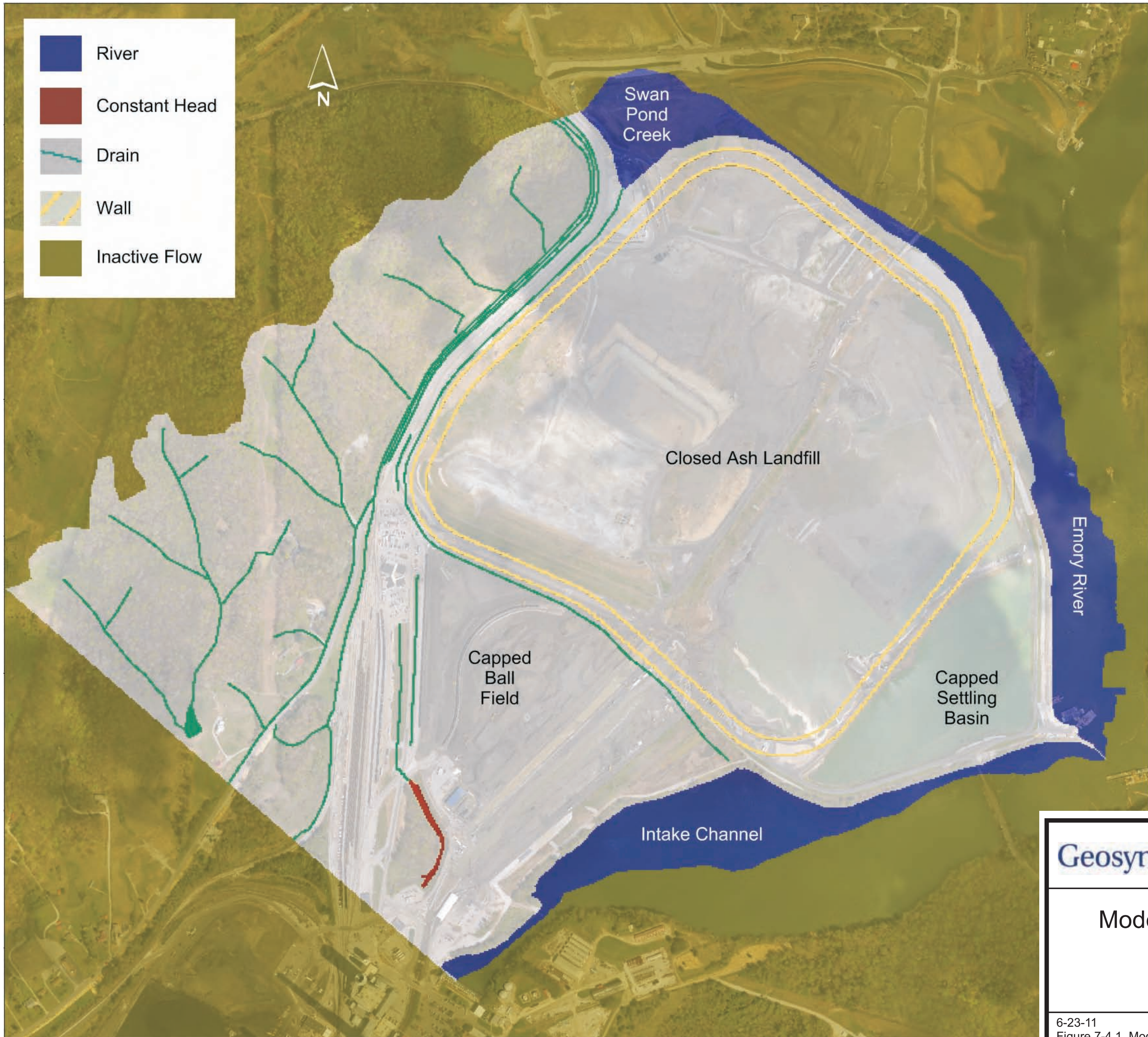
Geosyntec JACOBS TVA

Stabilization Wall
Location and Profile

TVA Kingston Fossil Plant

6-28-11
Figure 7-3.1_StabilizationWall.cdr

Figure 7-3.1



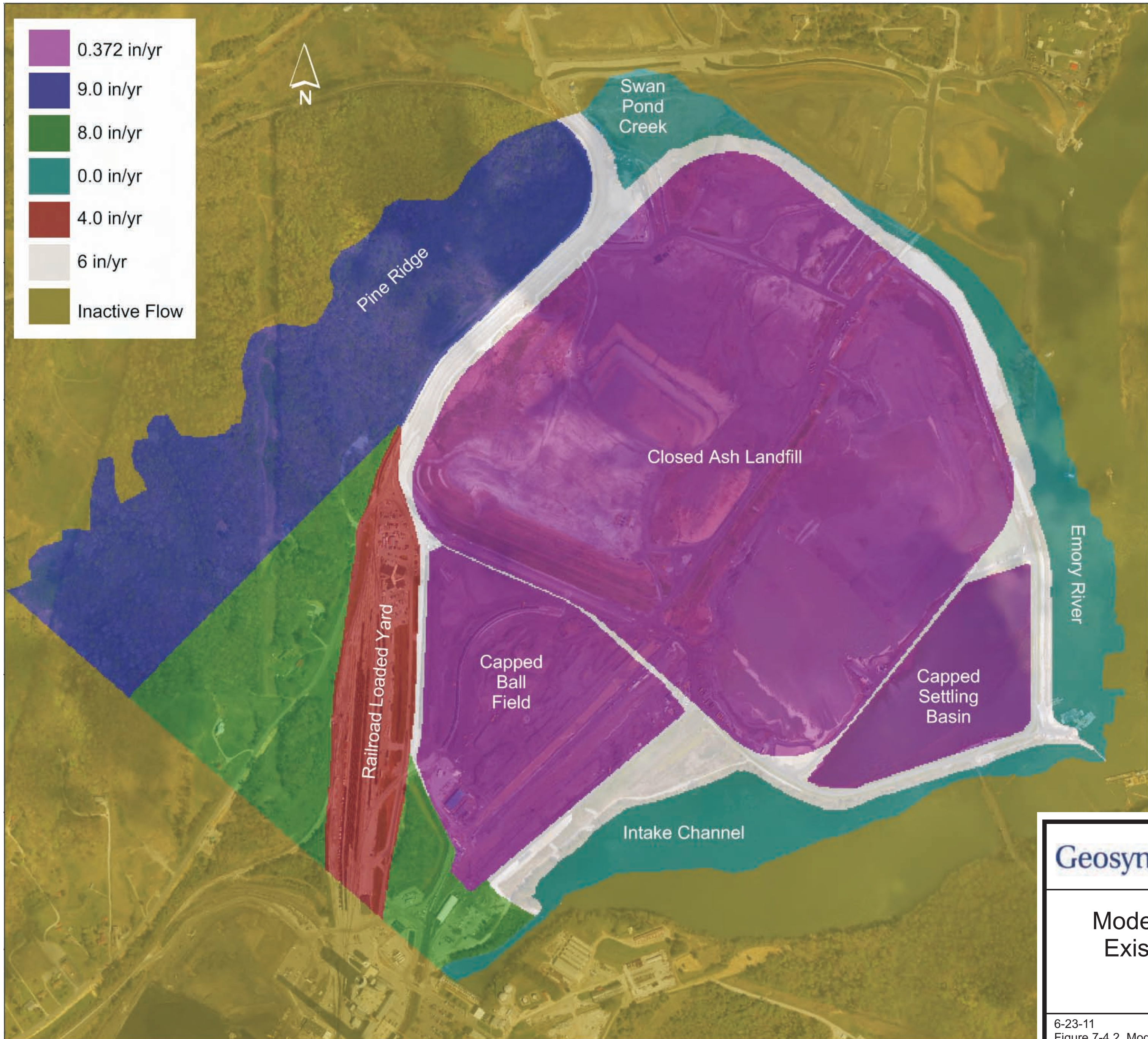
Geosyntec JACOBS TVA

Model Boundary Conditions
Future Conditions

TVA Kingston Fossil Plant

6-23-11
Figure 7-4.1_ModelBoundFuture.cdr

Figure 7-4.1



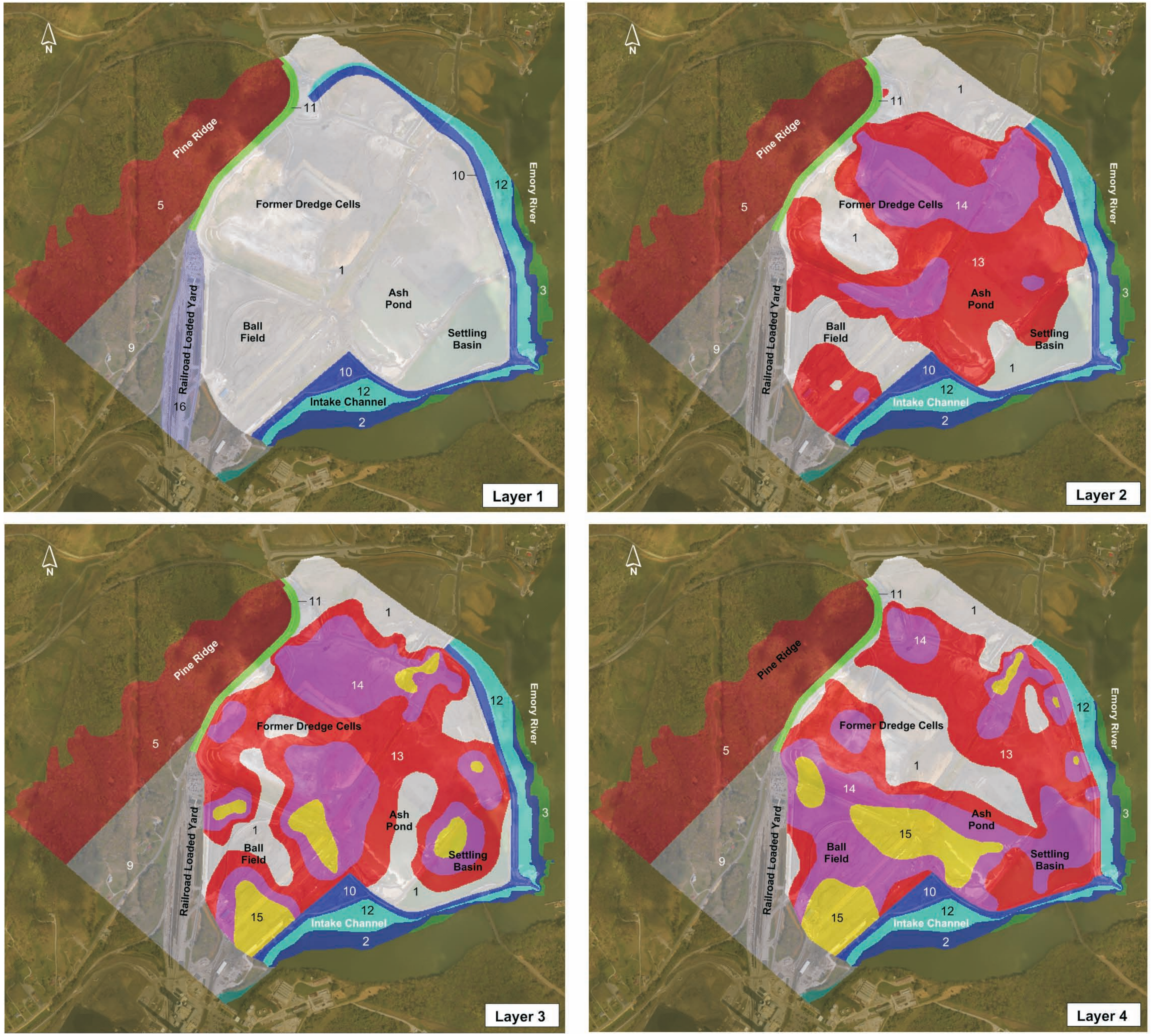
Geosyntec JACOBS TVA

Model Recharge Distribution
Existing (2010) Conditions

TVA Kingston Fossil Plant

6-23-11
Figure 7-4.2_ModelRechargeFuture.cdr

Figure 7-4.2



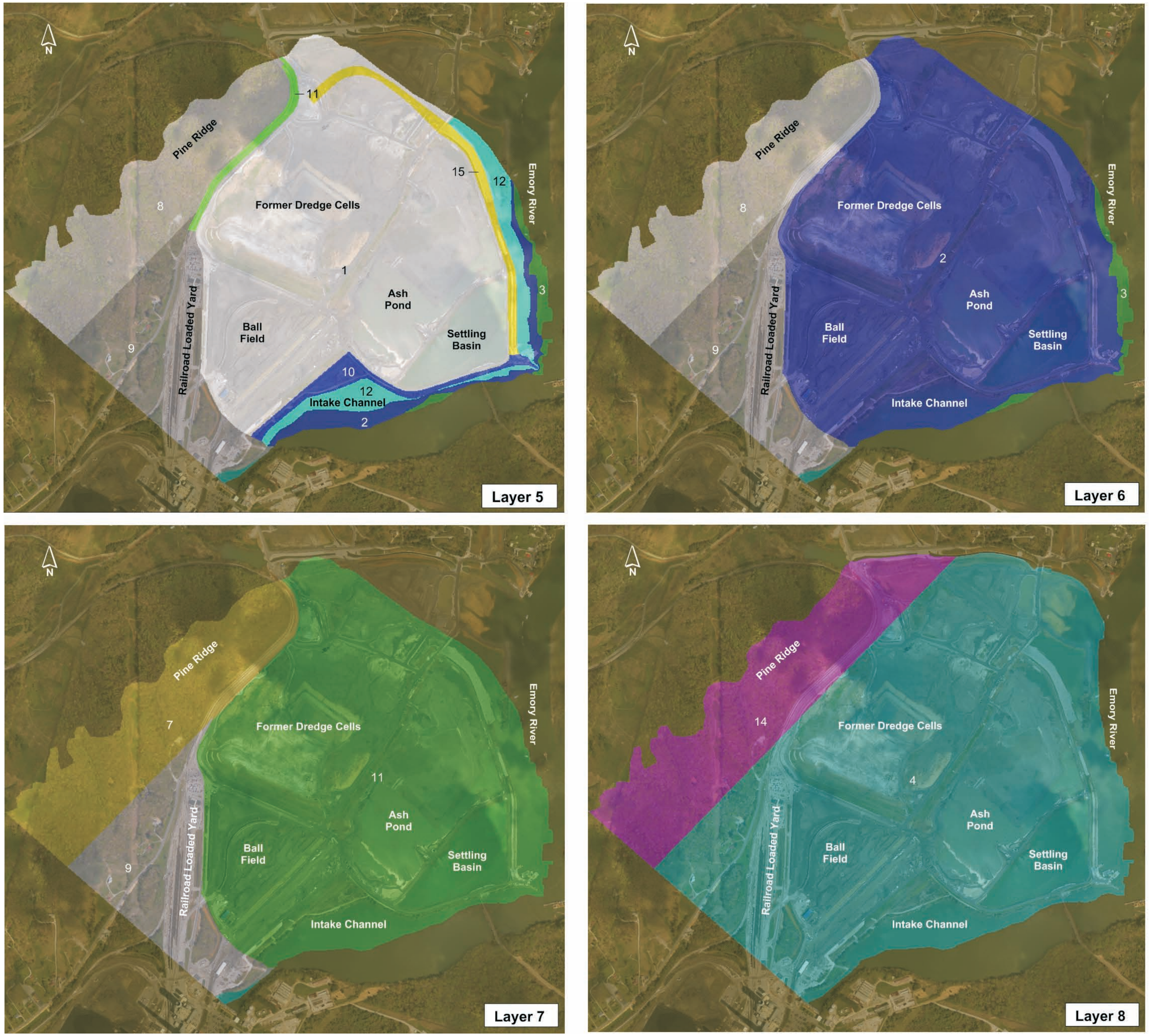
Zone	Kx & Ky (cm/sec)	Kz (cm/sec)
1	5.4E-5	4.2E-5
2	5.0E-6	2.5E-6
3	5.0E-4	2.5E-4
4	5.0E-4	5.0E-4
5	8.0E-4	8.0E-4
6	2.0E-5	2.0E-5
7	4.0E-5	4.0E-5
8	7.9E-5	7.9E-5
9	5.0E-4	2.5E-4
10	8.0E-4	8.0E-4
11	1.0E-3	1.0E-3
12	8.0E-4	8.0E-4
13	3.4E-4	1.7E-4
14	6.2E-4	3.1E-4
15	9.0E-4	4.5E-4
16	9.0E-4	9.0E-4
	Inactive Flow	

Model Hydraulic Conductivity Distribution (Layers 1 to 4) Future Condtions

TVA Kingston Fossil Plant

6-29-11
Figure 7-5.1_HydCondLay1-4Future.cdr

Figure 7-5.1



Zone	Kx & Ky (cm/sec)	Kz (cm/sec)
1	5.4E-5	4.2E-5
2	5.0E-6	2.5E-6
3	5.0E-4	2.5E-4
4	5.0E-4	5.0E-4
5	8.0E-4	8.0E-4
6	2.0E-5	2.0E-5
7	4.0E-5	4.0E-5
8	7.9E-5	7.9E-5
9	5.0E-4	2.5E-4
10	8.0E-4	8.0E-4
11	1.0E-3	1.0E-3
12	8.0E-4	8.0E-4
13	3.4E-4	1.7E-4
14	6.2E-4	3.1E-4
15	9.0E-4	4.5E-4
16	9.0E-4	9.0E-4
	Inactive Flow	

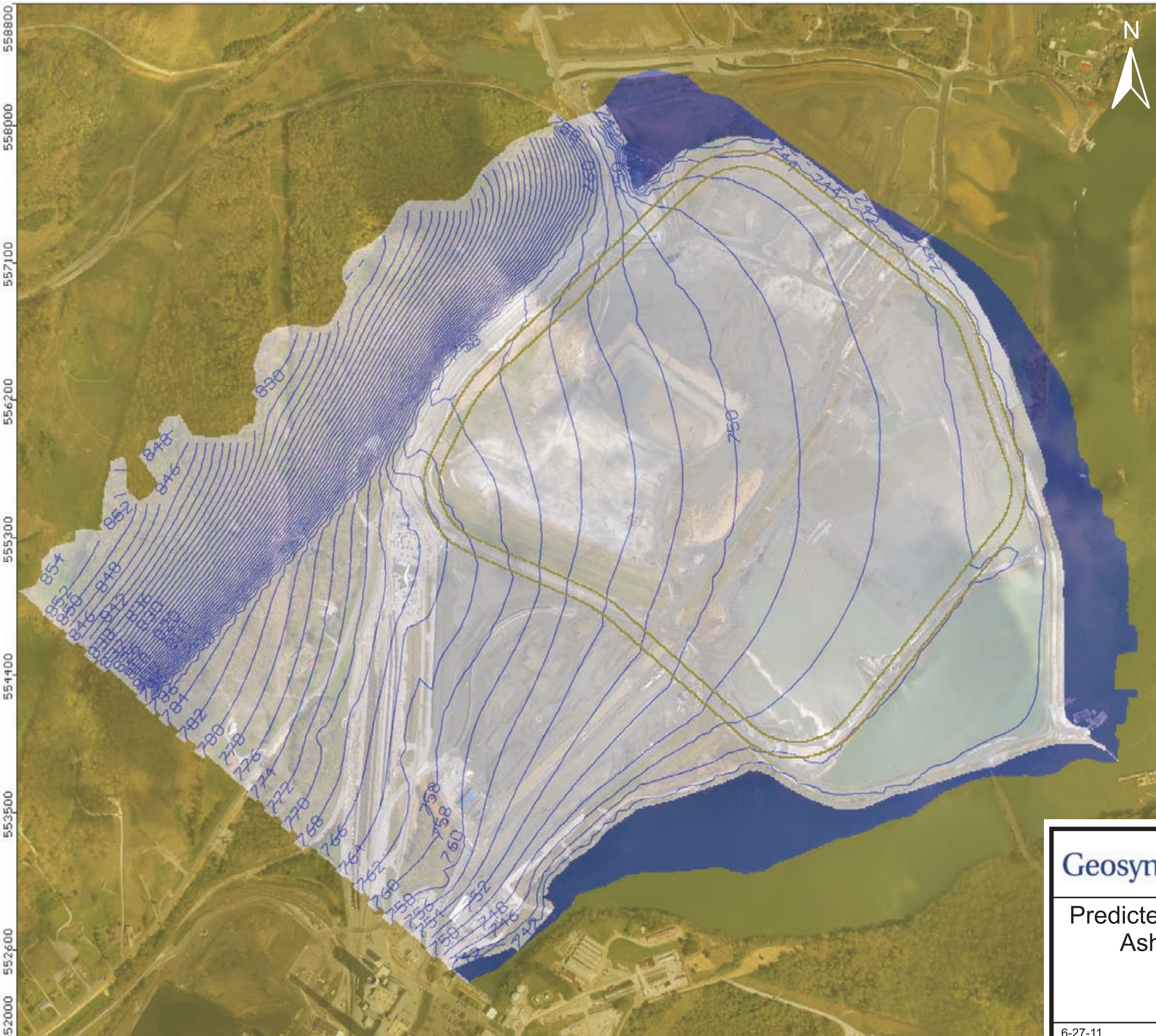
Geosyntec JACOBS TVA

Model Hydraulic Conductivity Distribution (Layers 5 to 8) Future Condtions

TVA Kingston Fossil Plant

6-29-11
Figure 7-5.2_HydCondLay5-8Future.cdr

Figure 7-5.2



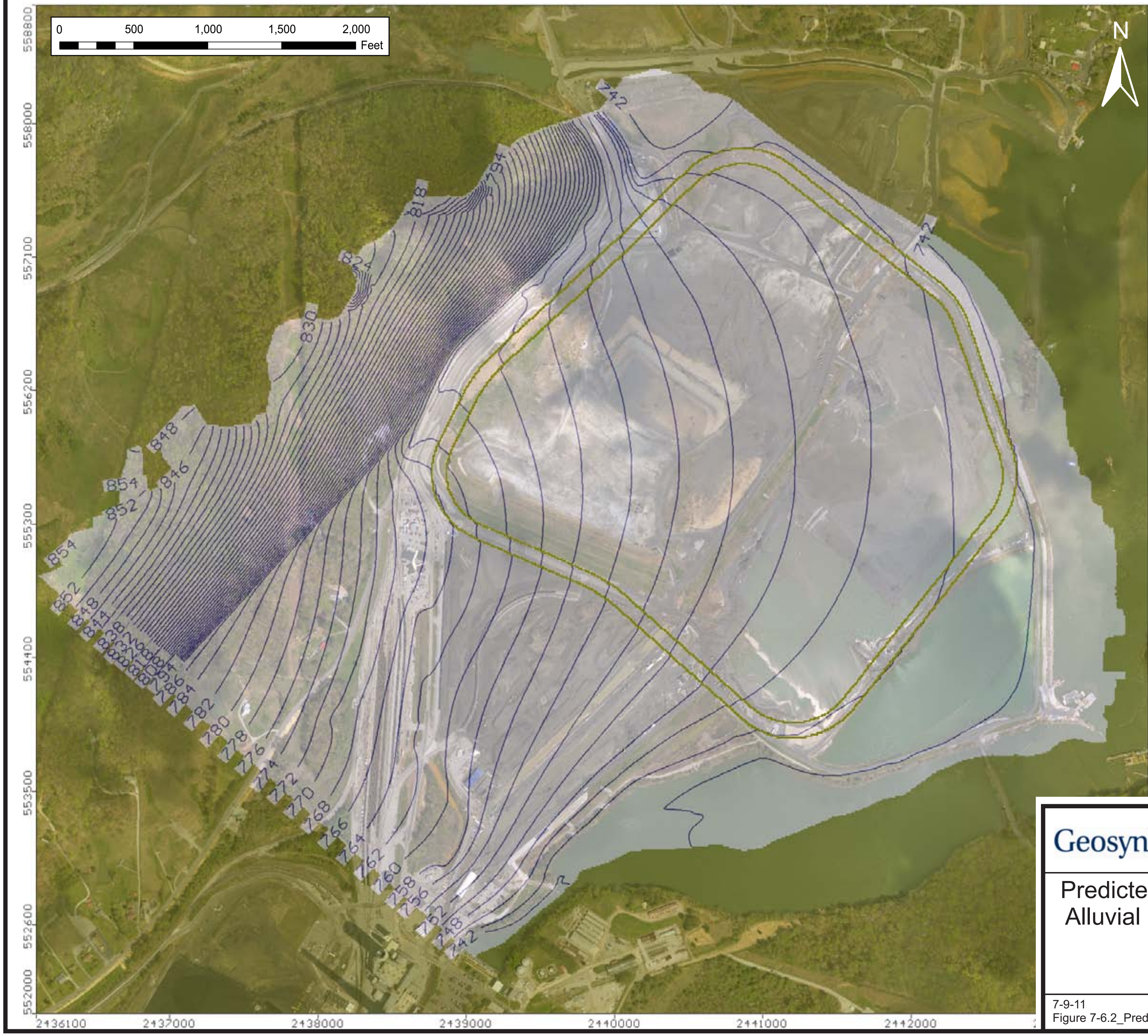
Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Ash for Calibrated Model Future Conditions

TVA Kingston Fossil Plant

6-27-11
Figure 7-6.1_PredHeadAshFuture.cdr

Figure 7-6.1

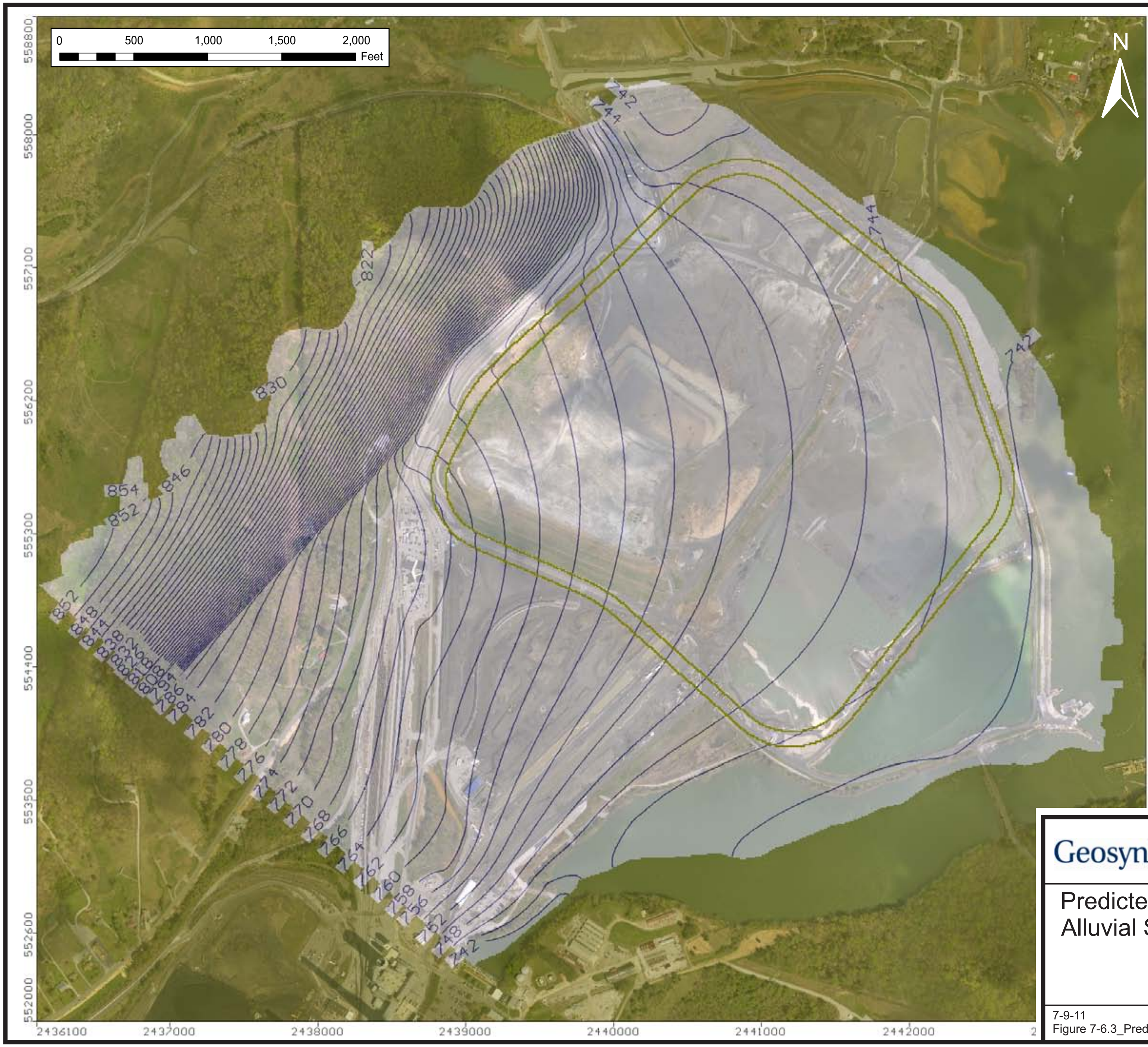


Geosyntec JACOBS TVA

Predicted Potentiometric Heads in Alluvial Clay for Calibrated Model Future Conditions

TVA Kingston Fossil Plant

7-9-11 Figure 7-6.2_PredHeadClayFuture.cdr	Figure 7-6.2

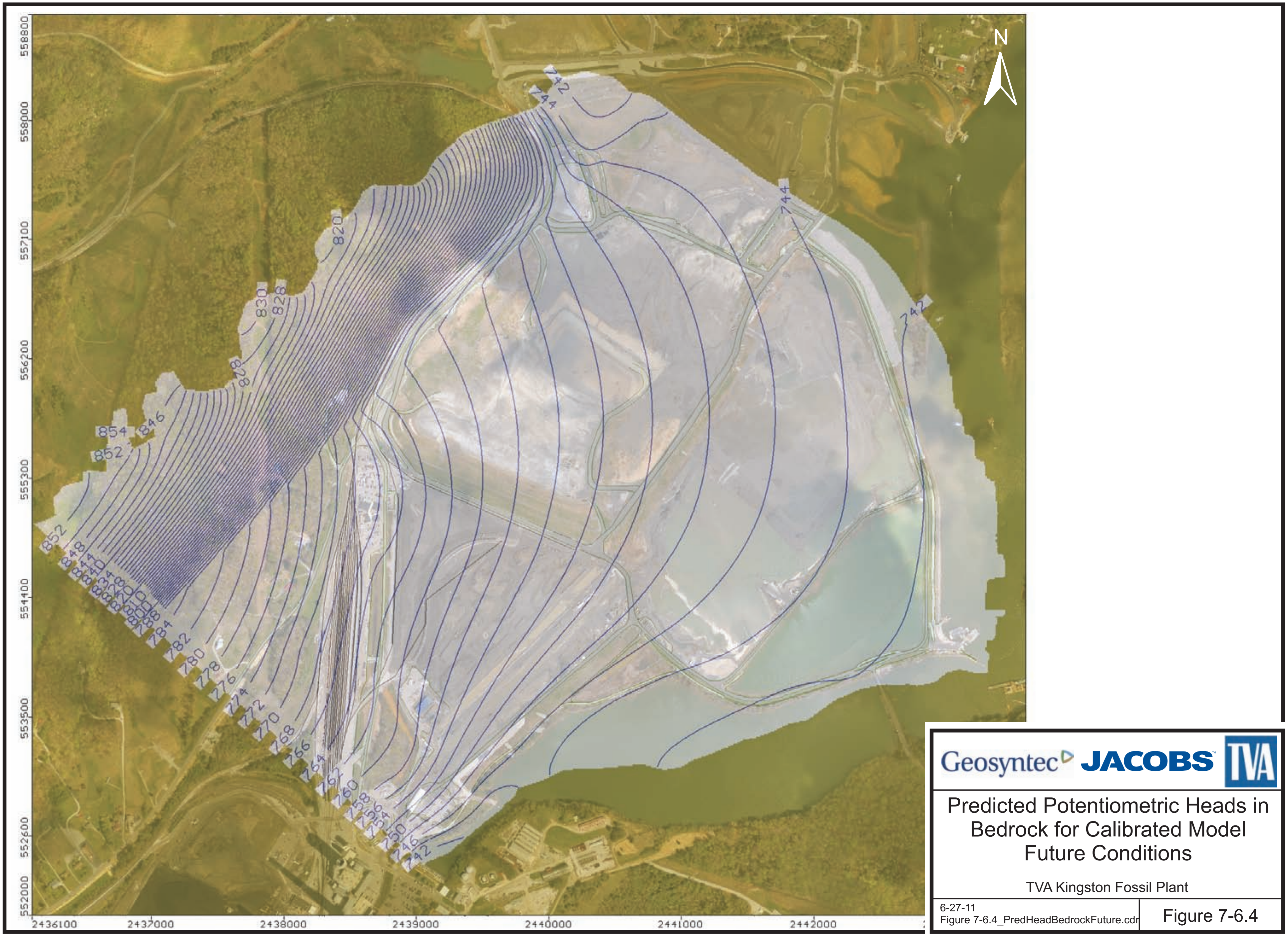


Predicted Potentiometric Heads in Alluvial Sand for Calibrated Model Future Conditions

TVA Kingston Fossil Plant

7-9-11
Figure 7-6.3_PredHeadSandFuture.cdr

Figure 7-6.3



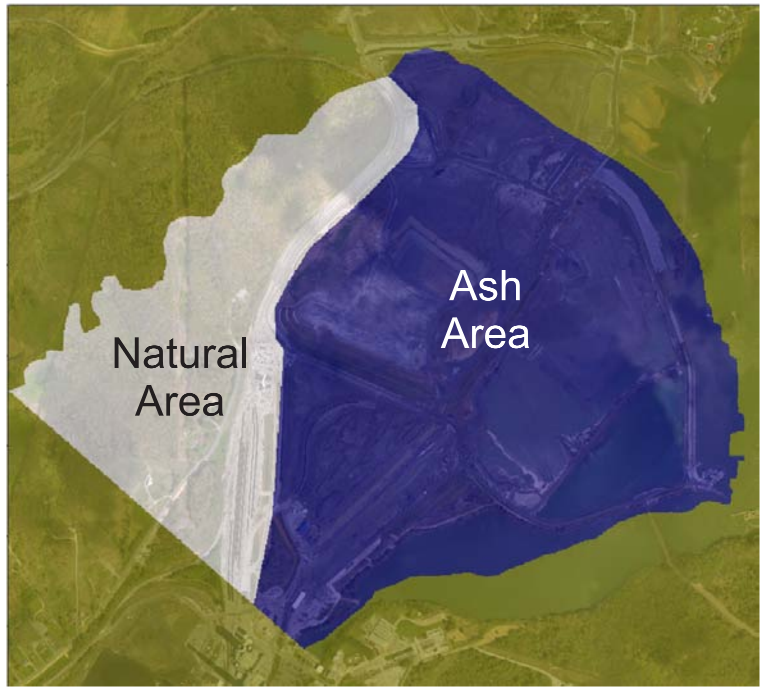
Geosyntec JACOBS TVA

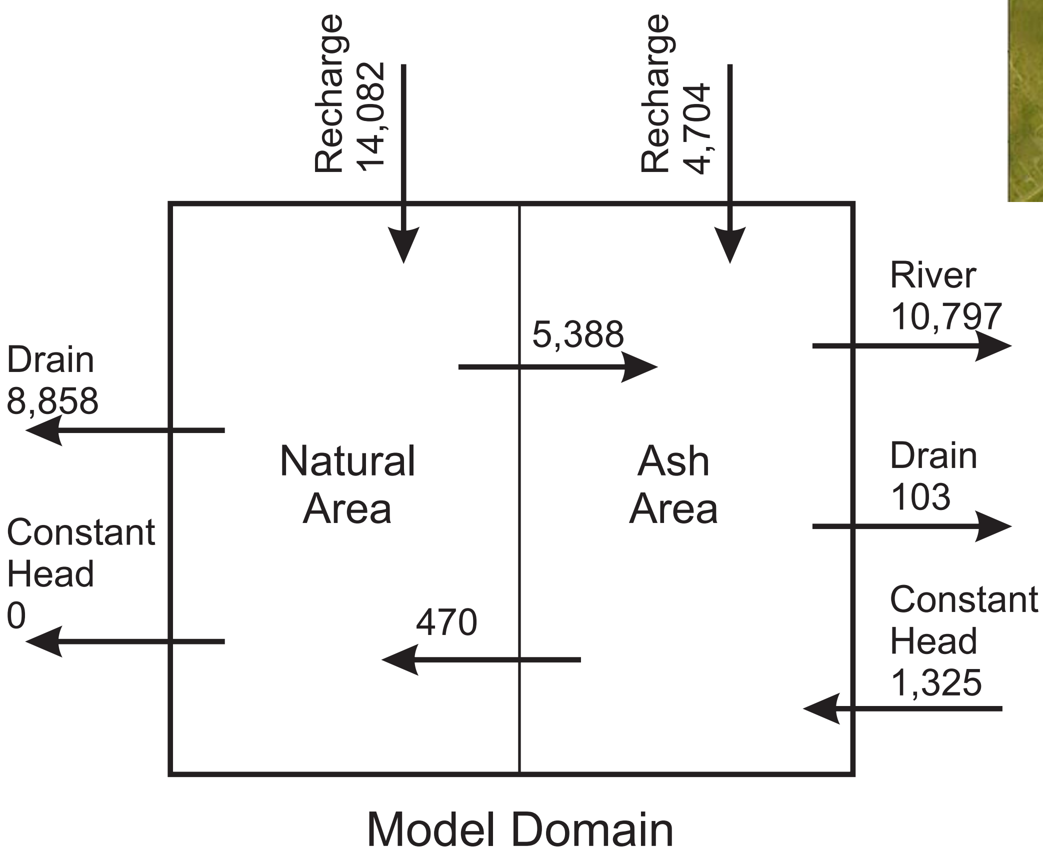
Predicted Potentiometric Heads in Bedrock for Calibrated Model Future Conditions

TVA Kingston Fossil Plant

6-27-11
Figure 7-6.4_PredHeadBedrockFuture.cdr

Figure 7-6.4





Note:
Units are in ft^3/day.

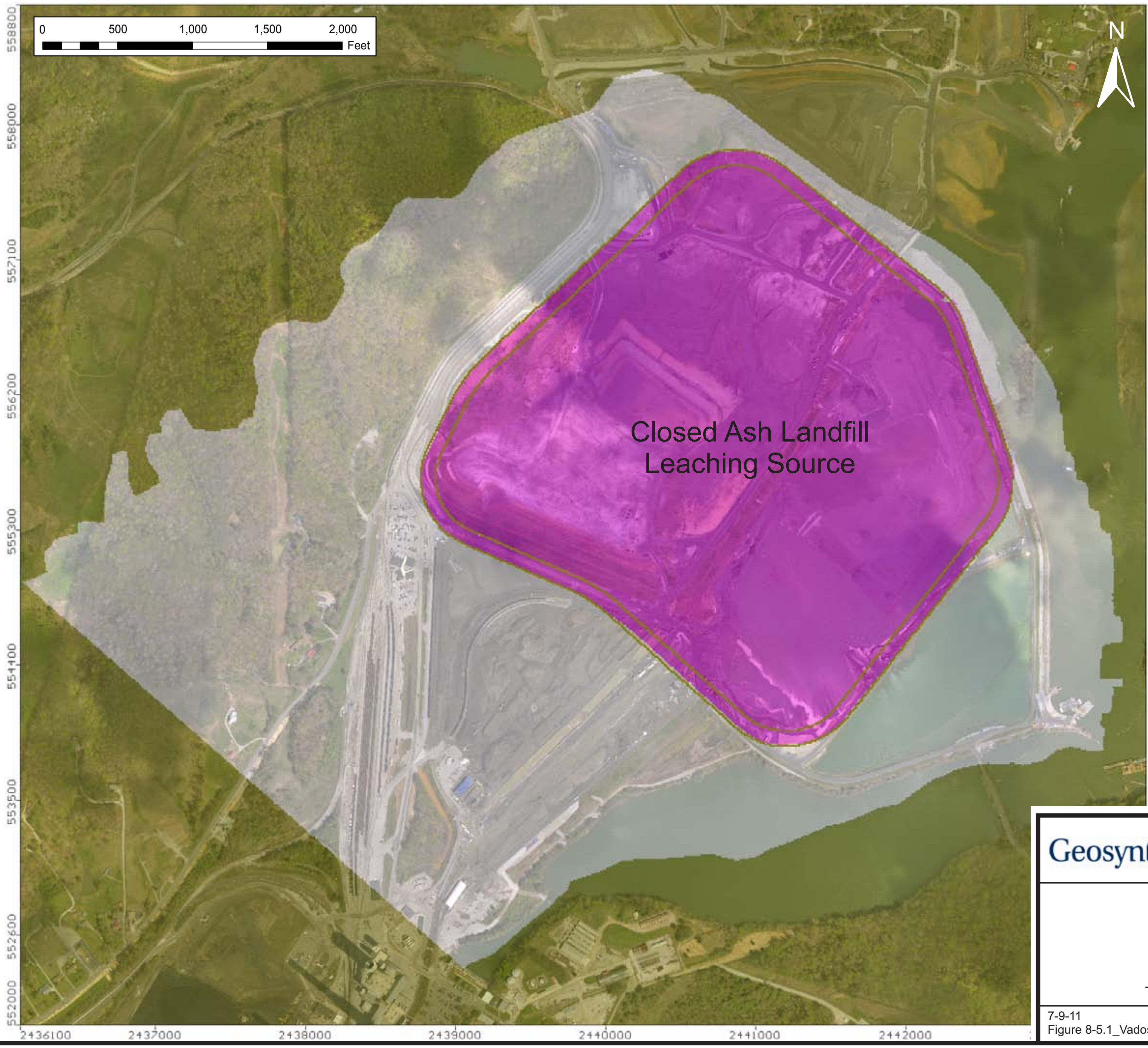
Geosyntec JACOBS TVA

Flow Mass Balance
Future Conditions

TVA Kingston Fossil Plant

7-11-11
Figure 7-6.5_FlowMassBalFuture.cdr

Figure 7-6.5



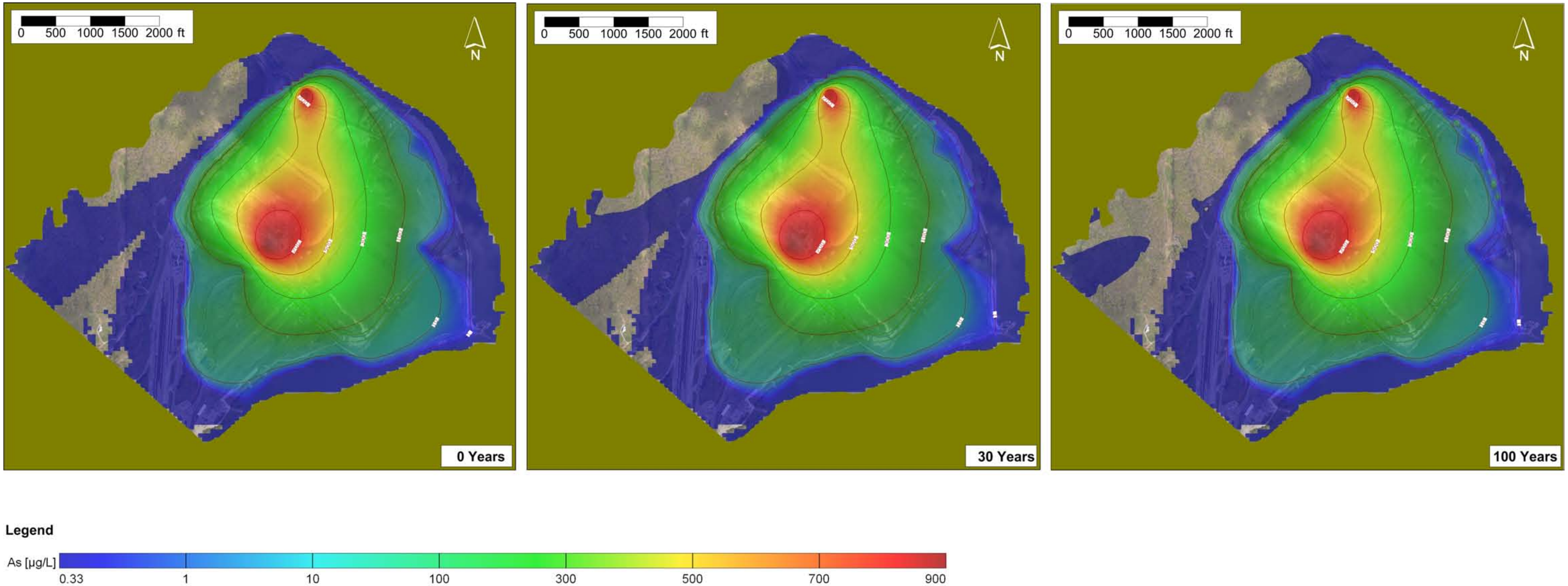
Geosyntec JACOBS TVA

Vadose Zone
Leaching Source

TVA Kingston Fossil Plant

7-9-11
Figure 8-5.1_VadoseZone.cdr

Figure 8-5.1



Note:
Kd = 61.1 L/kg

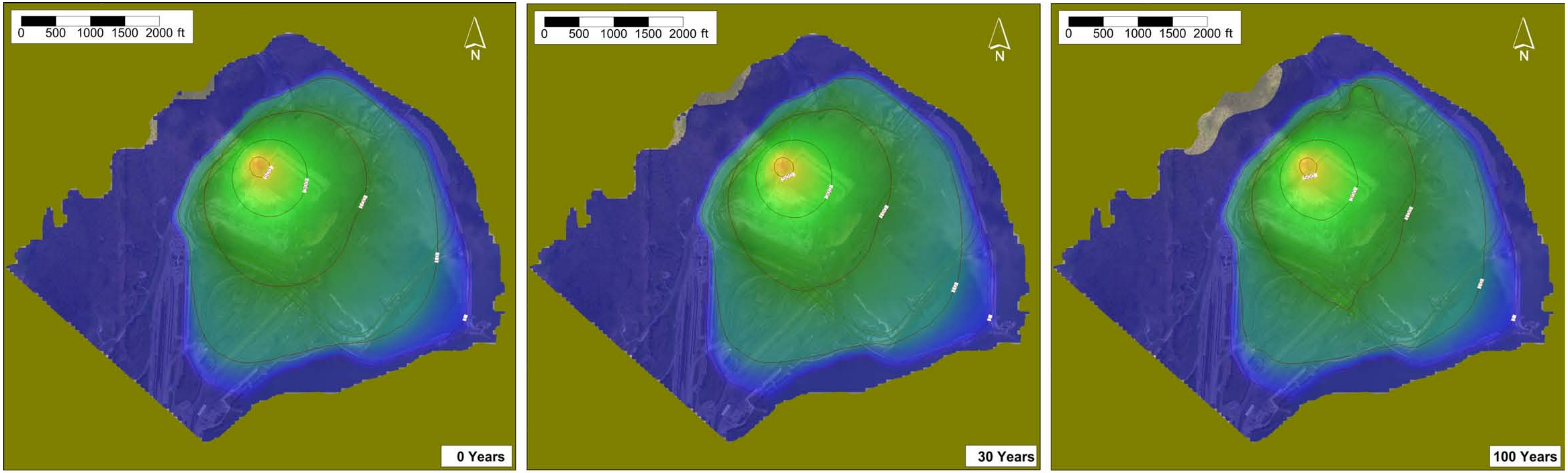
Geosyntec JACOBS TVA

Predicted Arsenic Distribution in Ash at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.1_PredArsenicAsh.cdr

Figure 8-6.1



Legend

As [µg/L]

0.33 | 1 | 10 | 100 | 300 | 500 | 700 | 900

Note:
Kd = 61.1 L/kg

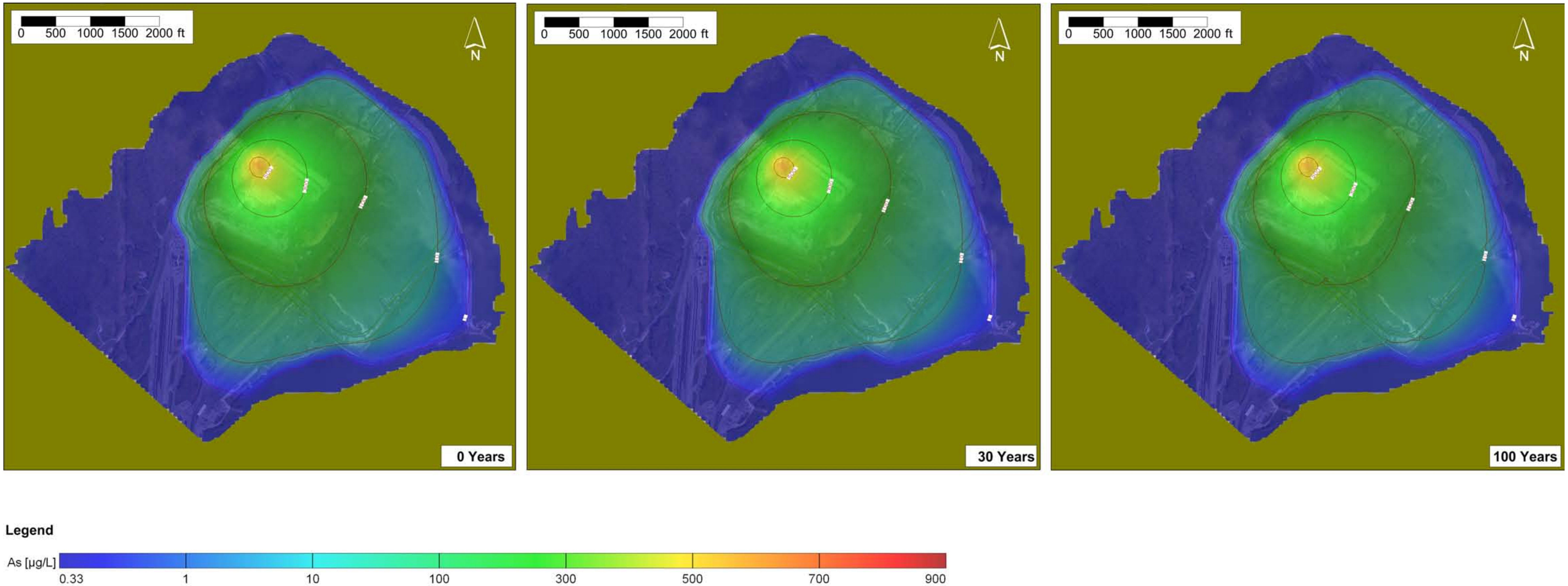
Geosyntec JACOBS TVA

Predicted Arsenic Distribution in Alluvial Clay at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.2_PredArsenicClay.cdr

Figure 8-6.2



Note:
Kd = 61.1 L/kg

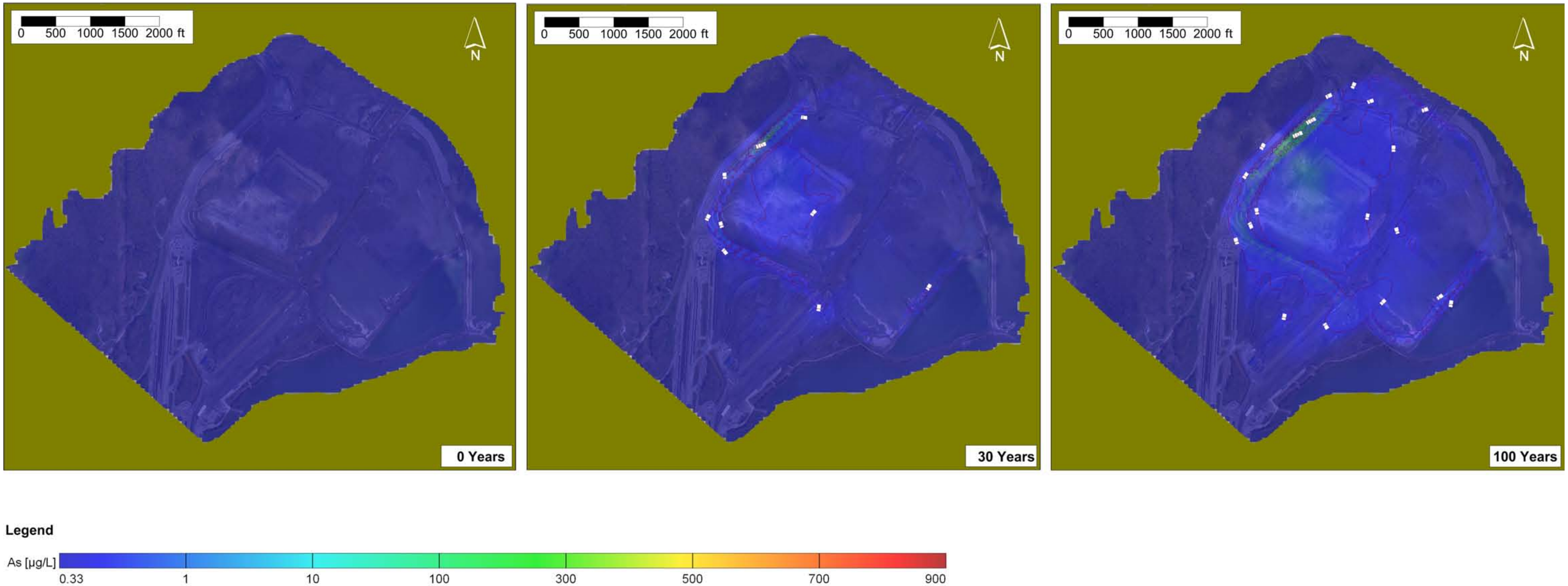
Geosyntec JACOBS TVA

Predicted Arsenic Distribution in Alluvial Sand at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.3_PredArsenicSand.cdr

Figure 8-6.3



Note:
Kd = 61.1 L/kg

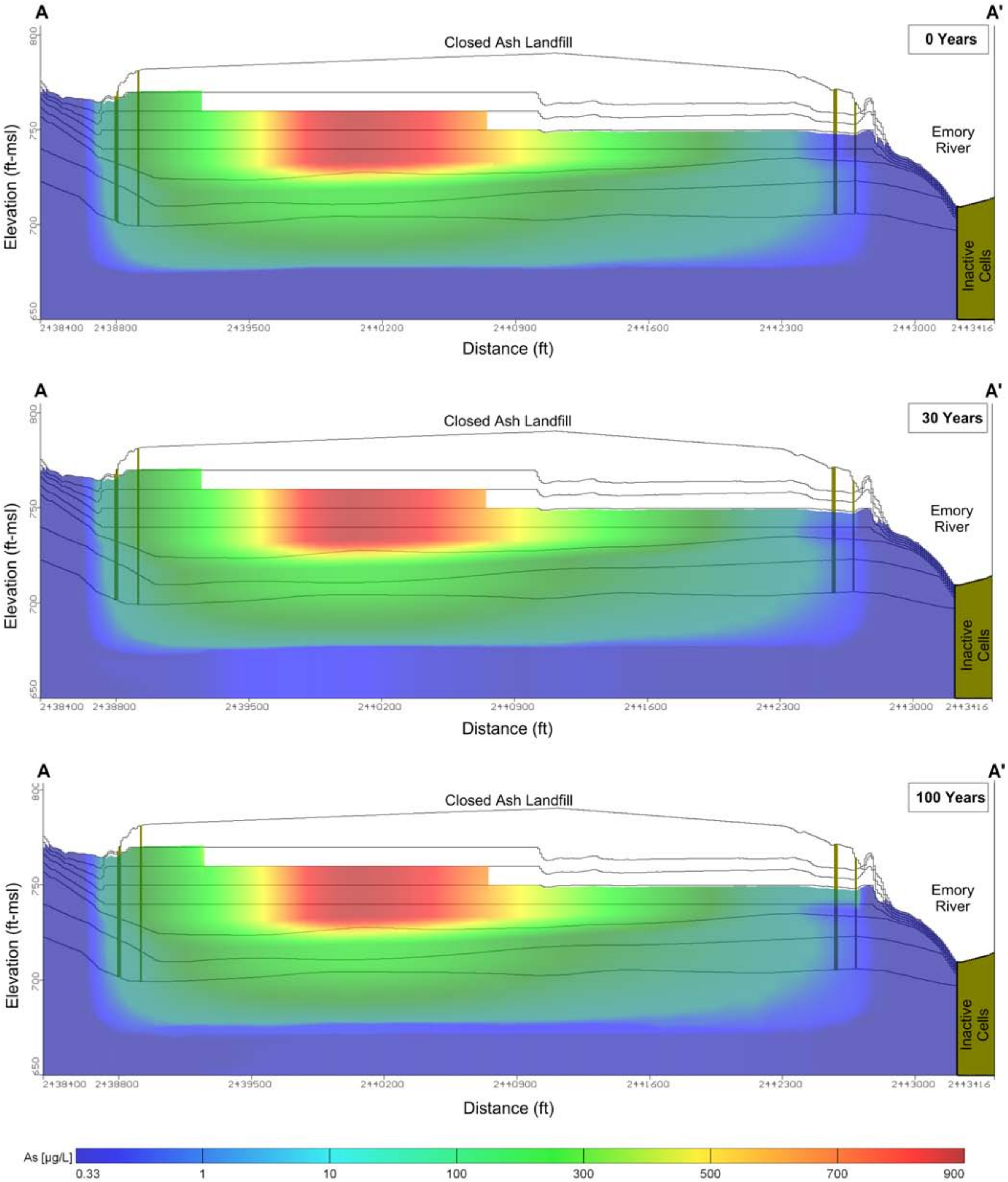
Geosyntec JACOBS TVA

Predicted Arsenic Distribution in Bedrock at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.4_PredArsenicBedrock.cdr

Figure 8-6.4



Note: Above cross-section A-A' profiles per Figure 6-2.1

Note:
Kd = 61.1 L/kg

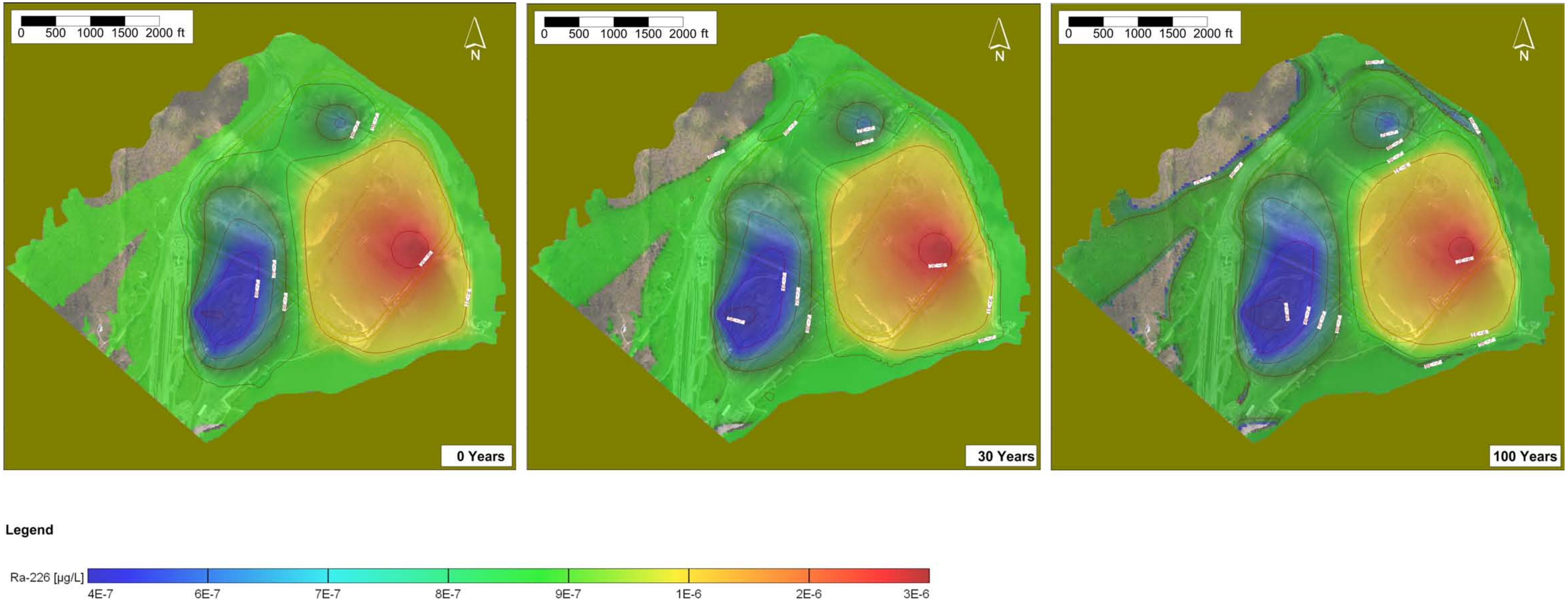
Geosyntec JACOBS TVA

Profile of Predicted Arsenic Distribution at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.5_PredArsenicProfile.cdr

Figure 8-6.5



Note:
Kd = 3370 L/kg

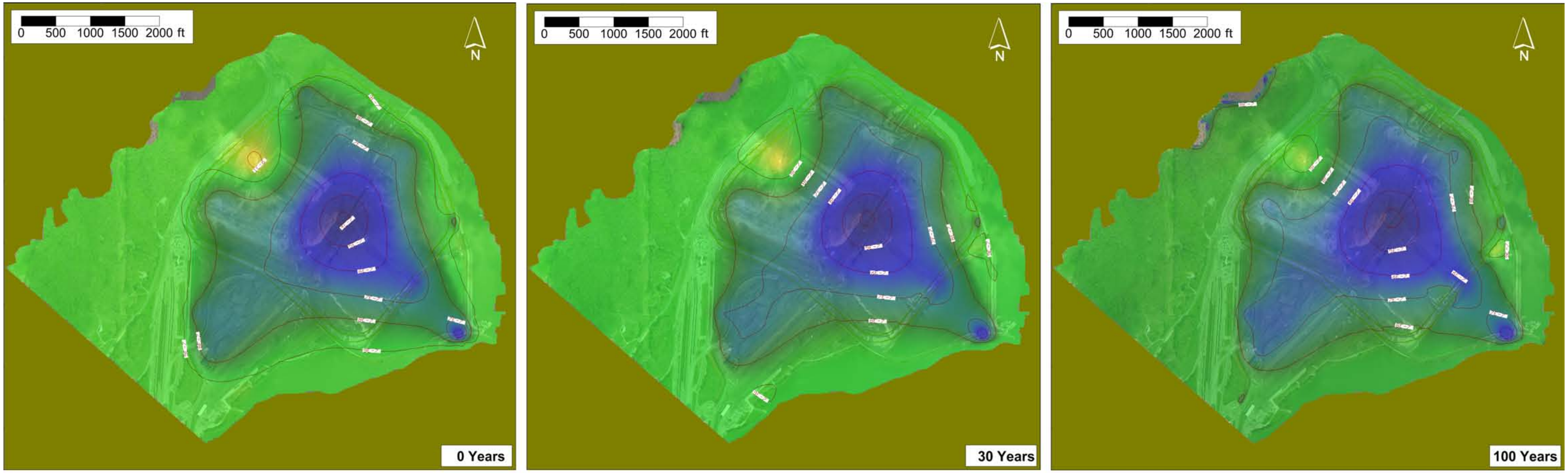
Geosyntec JACOBS TVA

Predicted Radium-226 Distribution in Ash at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.6_PredRadiumAsh.cdr

Figure 8-6.6



Legend

Ra-226 [µg/L]

4E-7 6E-7 7E-7 8E-7 9E-7 1E-6 2E-6 3E-6

Note:
Kd = 3370 L/kg

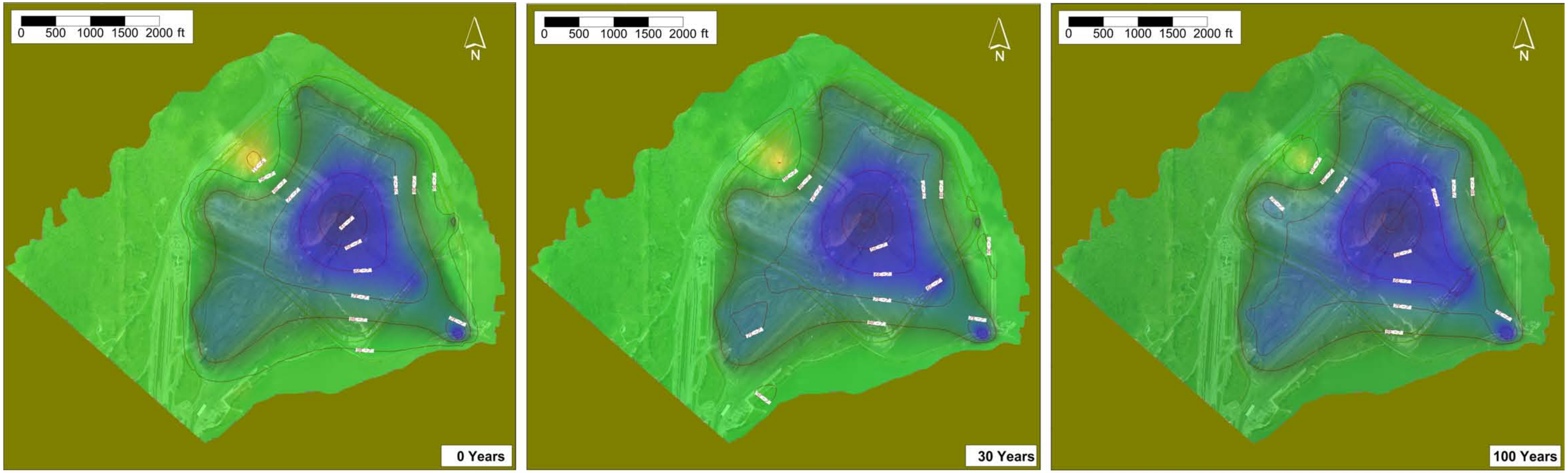
Geosyntec JACOBS TVA

Predicted Radium-226 Distribution in Alluvial Clay at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.7_PredRadiumClay.cdr

Figure 8-6.7



Legend

Ra-226 [µg/L]

4E-7 6E-7 7E-7 8E-7 9E-7 1E-6 2E-6 3E-6

Note:
Kd = 3370 L/kg

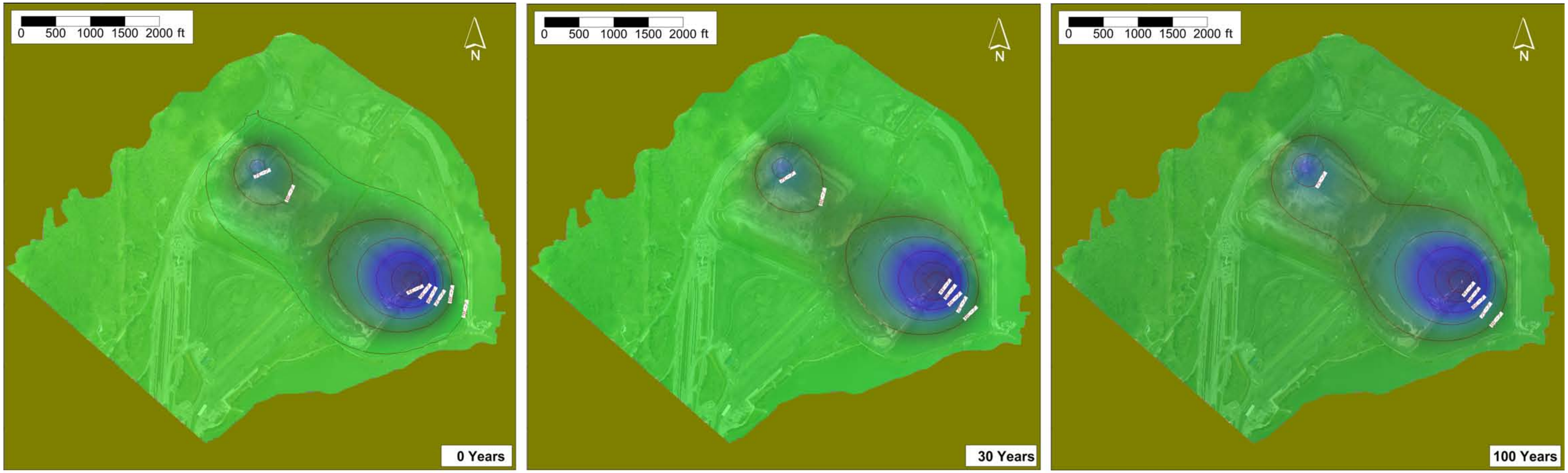
Geosyntec JACOBS TVA

Predicted Radium-226 Distribution in Alluvial Sand at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.8_PredRadiumSand.cdr

Figure 8-6.8



Legend

Ra-226 [µg/L]

4E-7 | 6E-7 | 7E-7 | 8E-7 | 9E-7 | 1E-6 | 2E-6 | 3E-6

Note:
Kd = 3370 L/kg

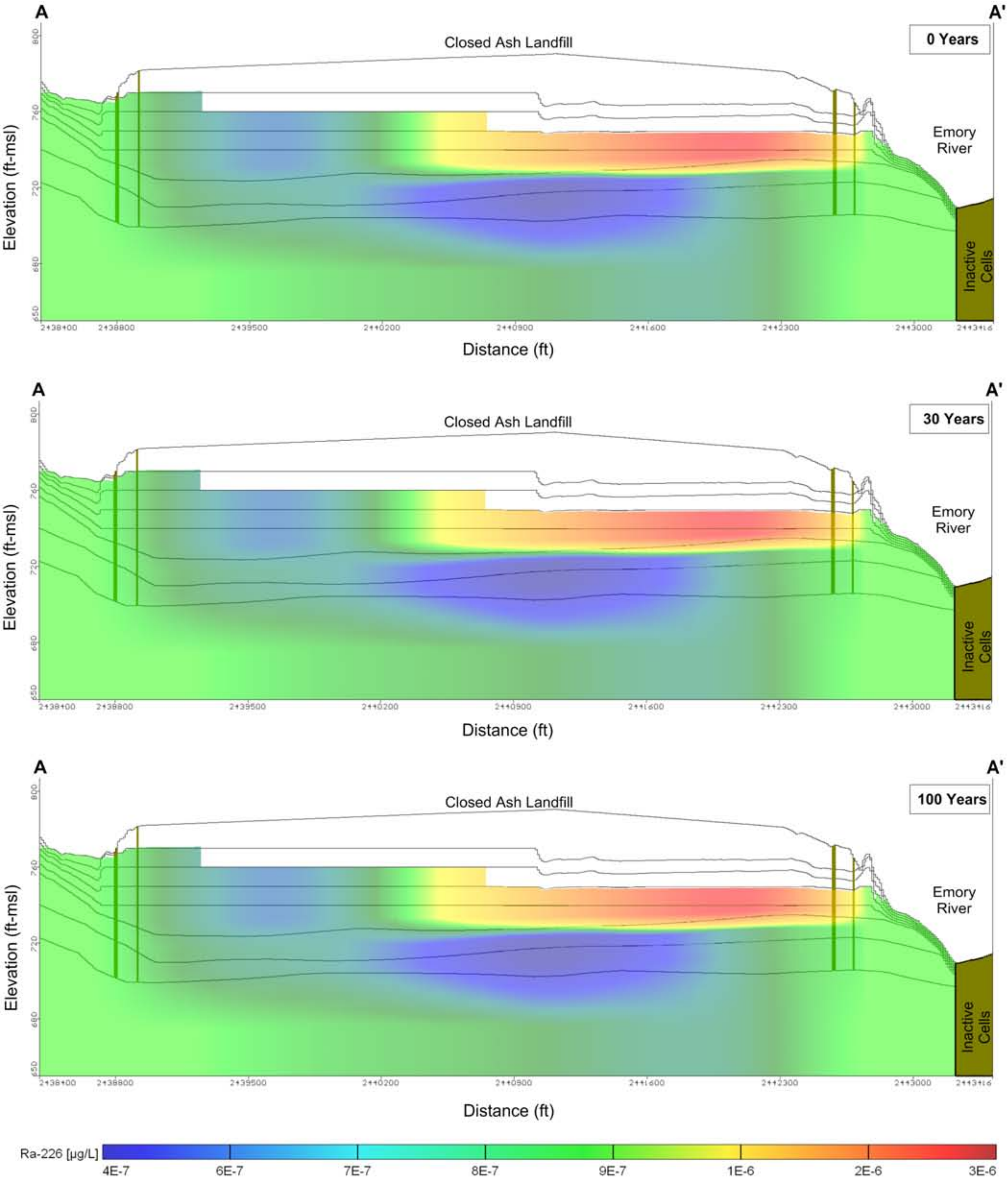
Geosyntec JACOBS TVA

Predicted Radium-226 Distribution in Bedrock at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.9_PredRadiumBedrock.cdr

Figure 8-6.9



Note: Above cross-section A-A' profiles per Figure 6-2.1

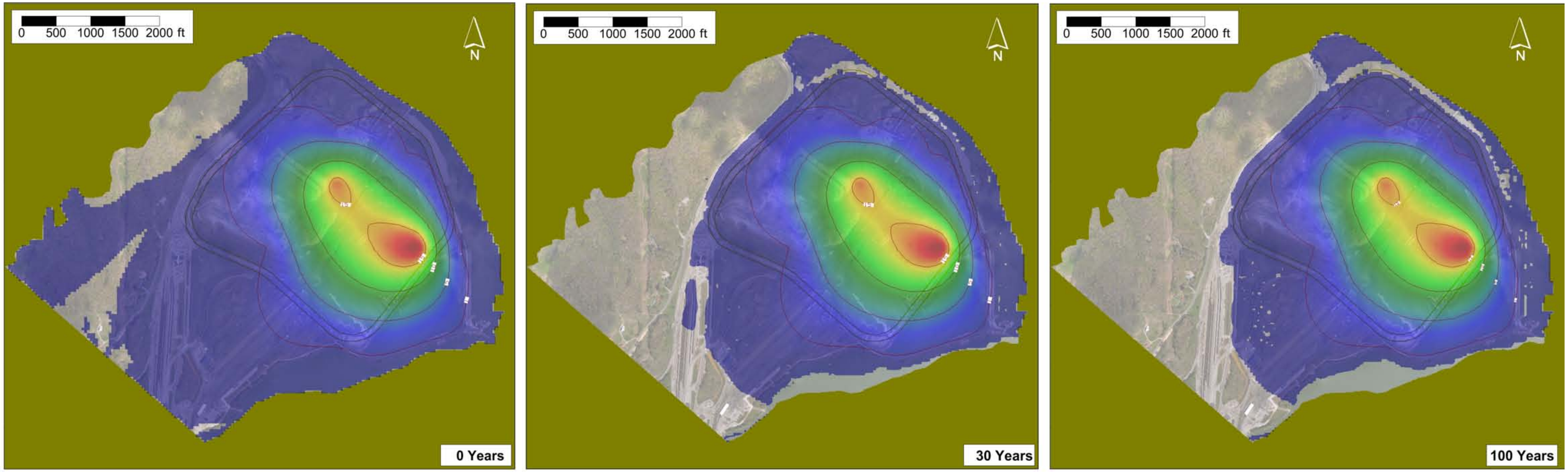
Note:
Kd = 3370 L/kg

Geosyntec JACOBS TVA

Profile of Predicted Radium-226 Distribution at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11 Figure 8-6.10_PredRadiumProfile.cdr	Figure 8-6.10



Legend

Se [µg/L]: 0.33 | 3 | 6 | 9 | 12 | 14 | 17 | 20

Note:
Kd = 250 L/kg

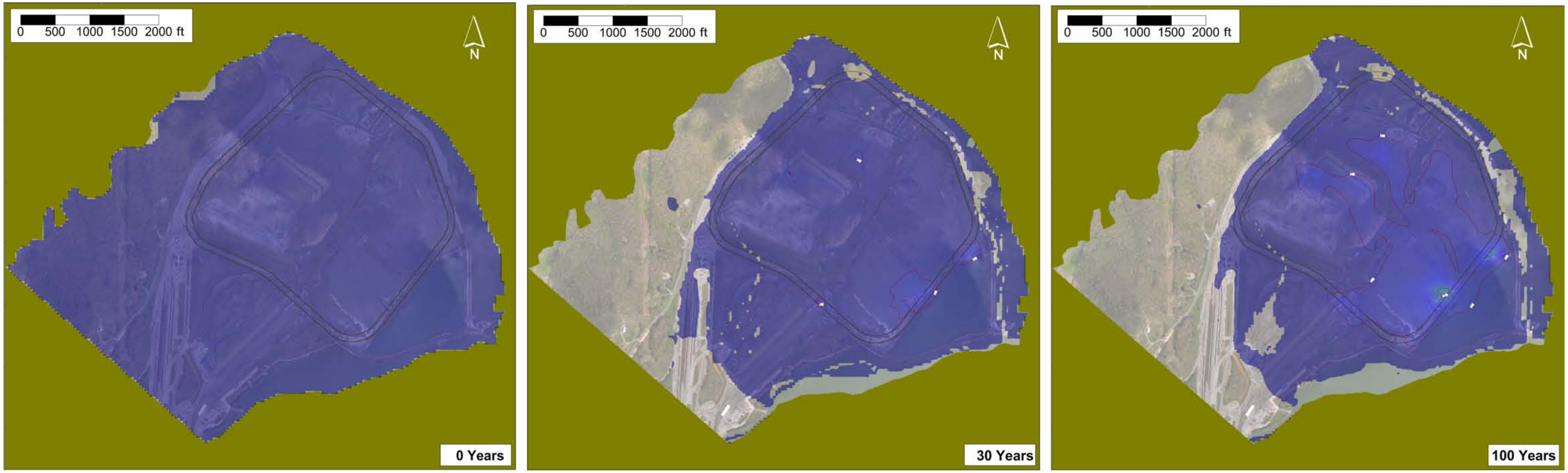
Geosyntec JACOBS TVA

Predicted Selenium Distribution in Ash at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.11_PredSeleniumAsh.cdr

Figure 8-6.11



Legend

Se [µg/L] 0.33 3 6 9 12 14 17 20

Note:
Kd = 250 L/kg

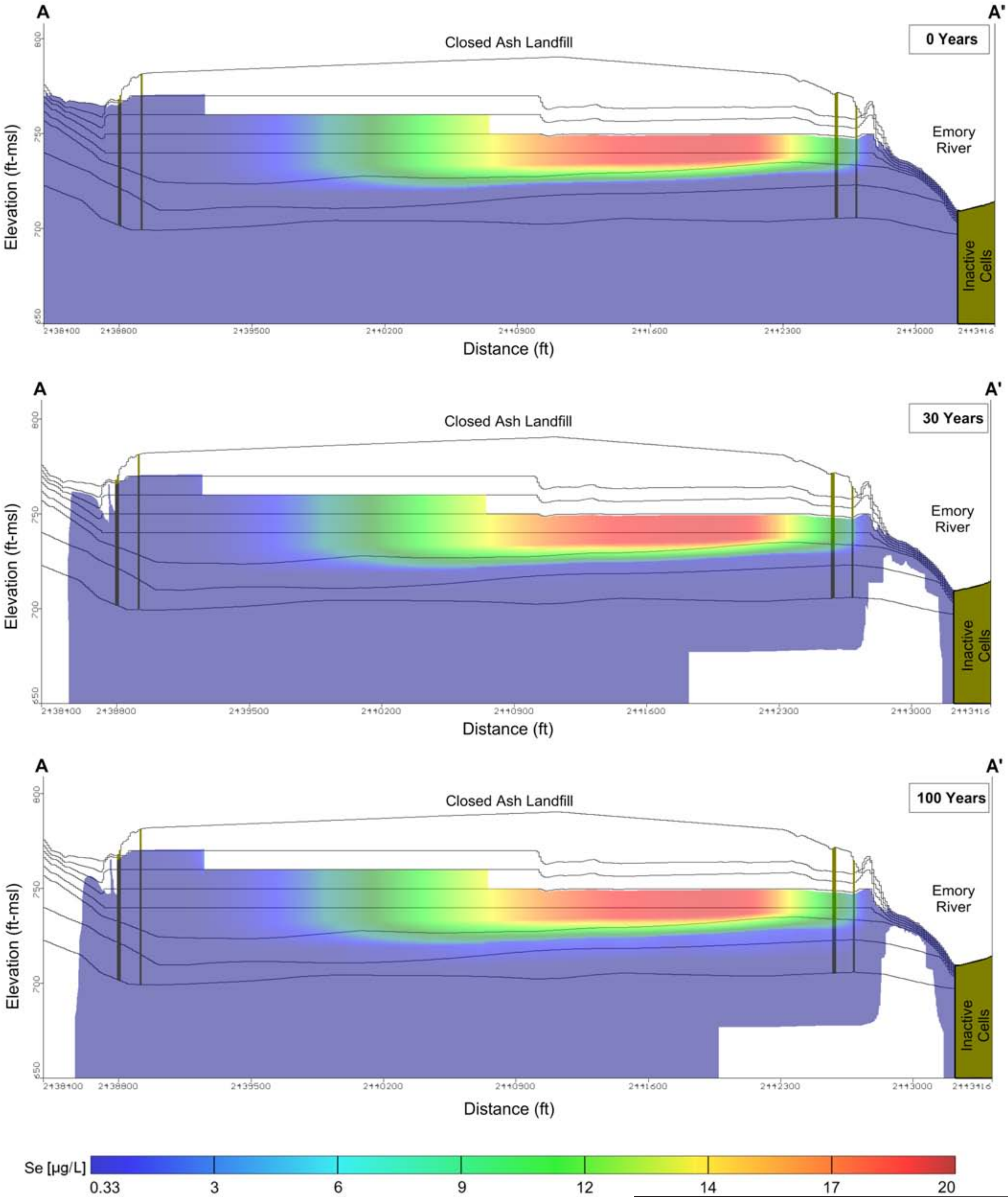
Geosyntec JACOBS TVA

Predicted Selenium Distribution in Alluvial Clay at 0, 30, and 100 Years

TVA Kingston Fossil Plant

7-8-11
Figure 8-6.12_PredSeleniumClay.cdr

Figure 8-6.12



Note: Above cross-section A-A' profiles per Figure 6-2.1

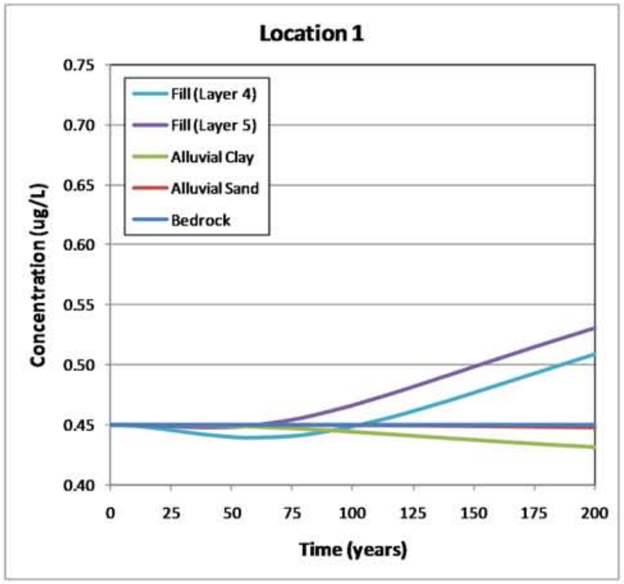
Note:
Kd = 250 L/kg

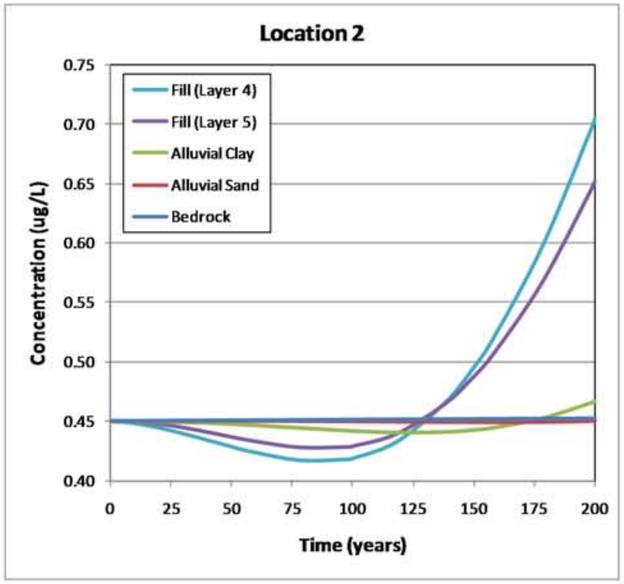
Profile of Predicted Selenium Distribution at 0, 30, and 100 Years

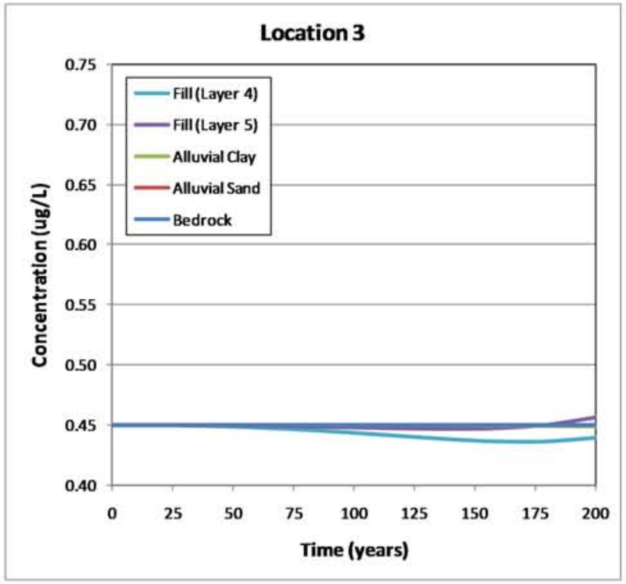
TVA Kingston Fossil Plant

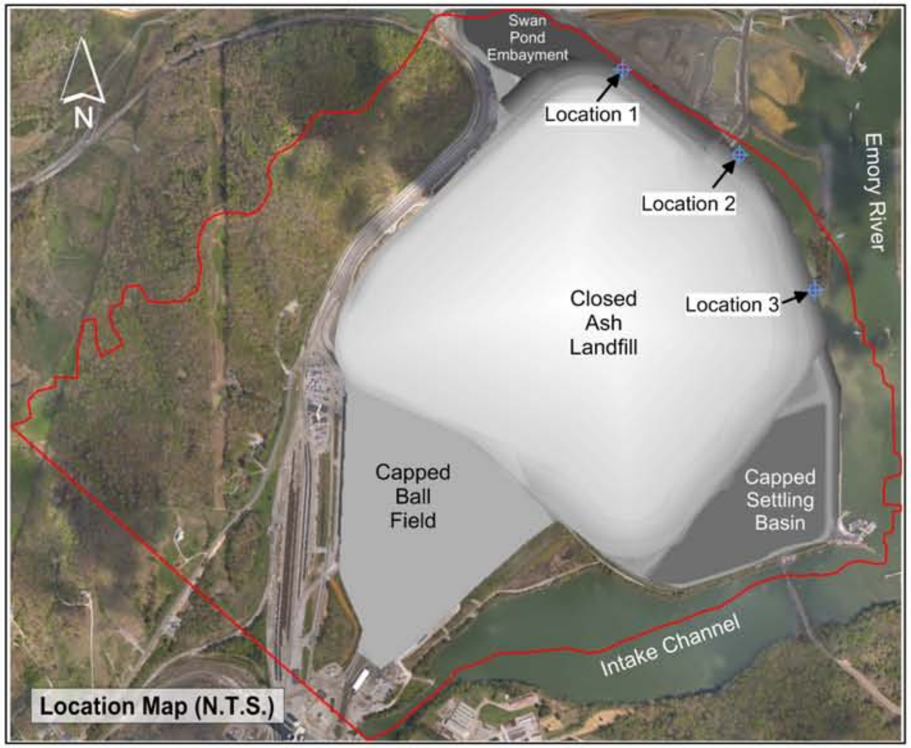
7-8-11
Figure 8-6.13_PredSeleniumProfile.cdr

Figure 8-6.13









Note:
Kd = 61.1 L/kg

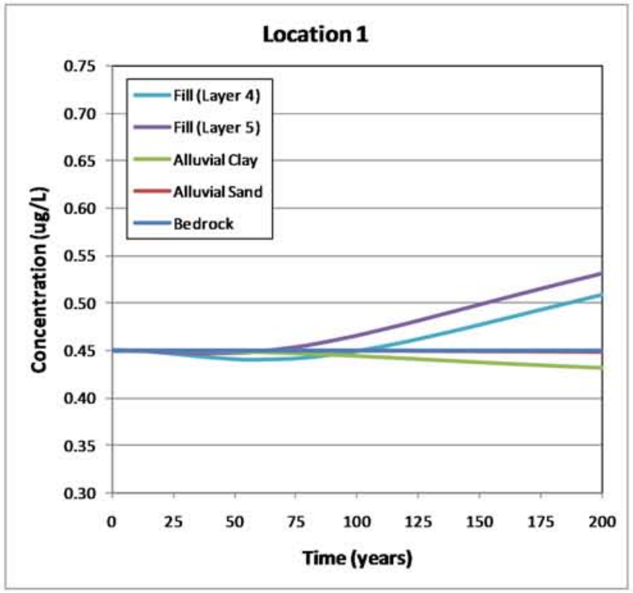
Geosyntec JACOBS TVA

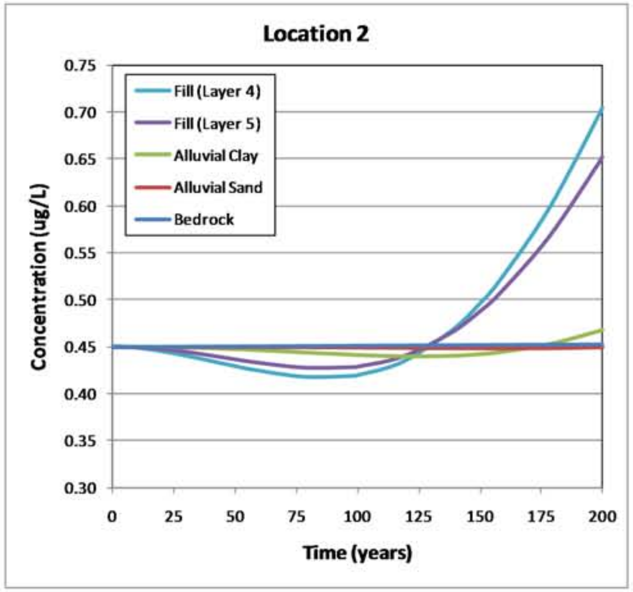
Predicted Arsenic Concentration with Time at Selected Locations

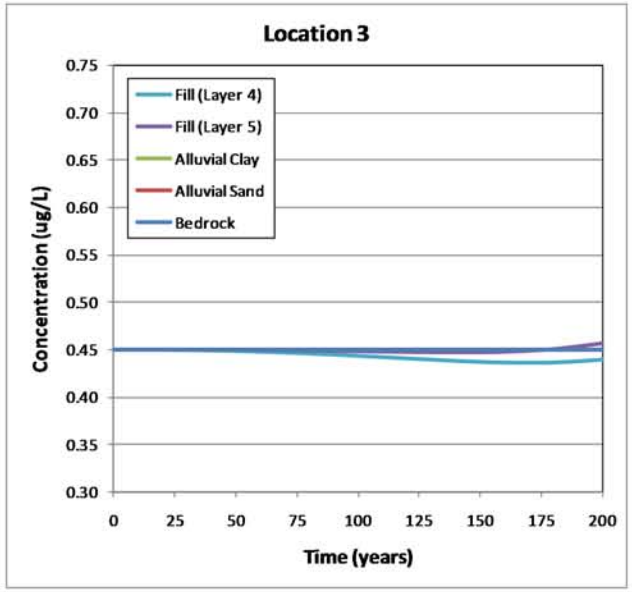
TVA Kingston Fossil Plant

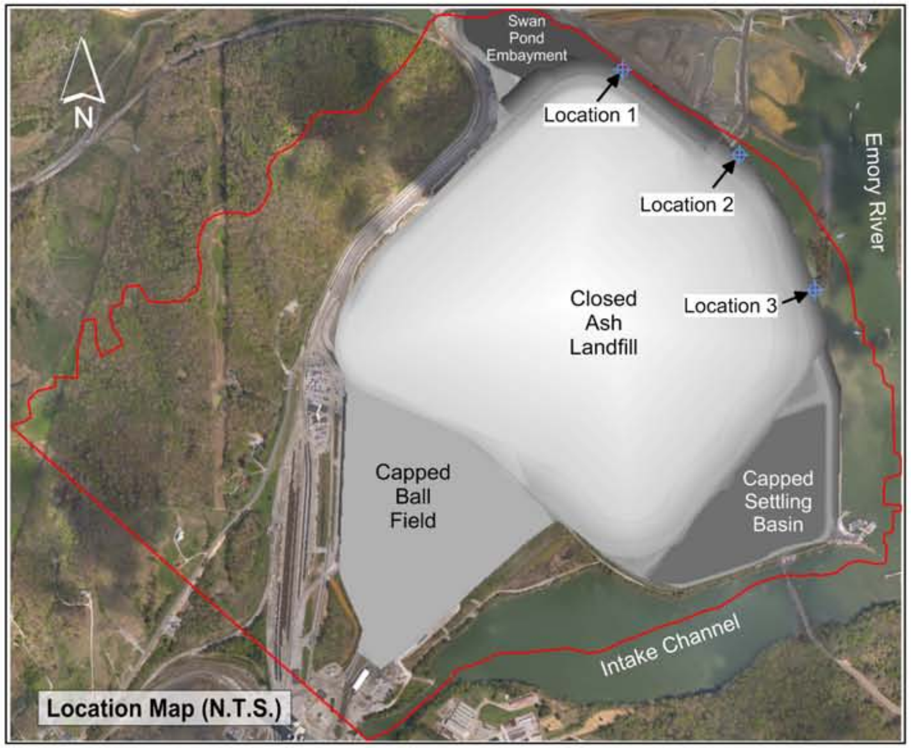
7-9-11
Figure 8-6.14_PredArsenicTime.cdr

Figure 8-6.14









Note:
Kd = 250 L/kg

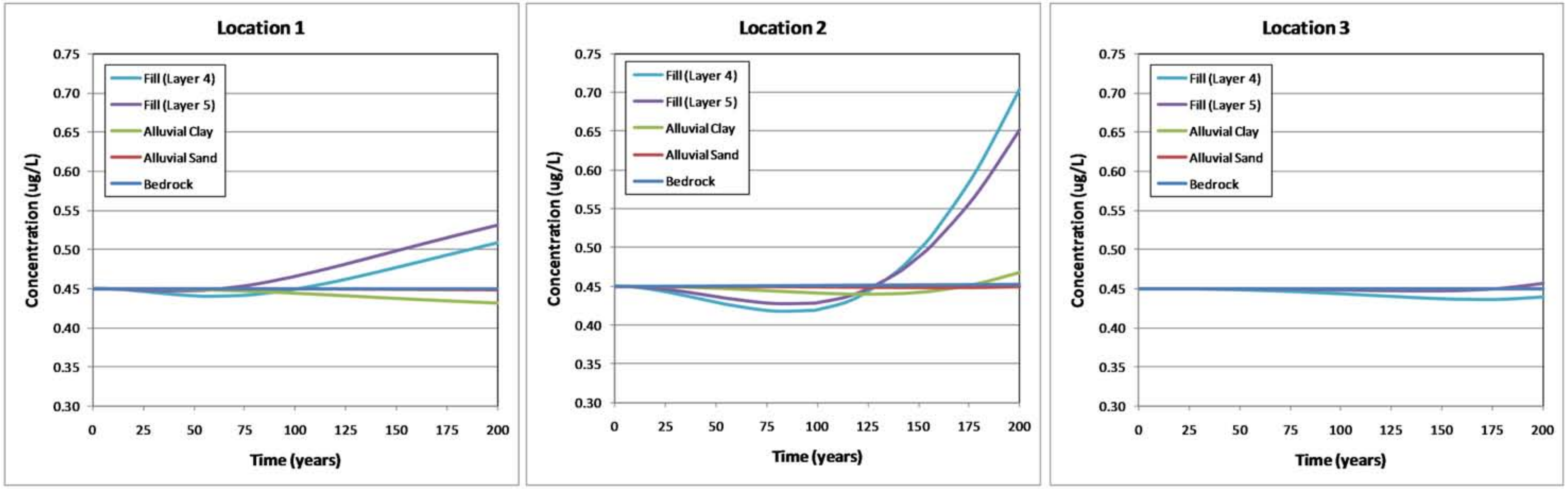
Geosyntec JACOBS TVA

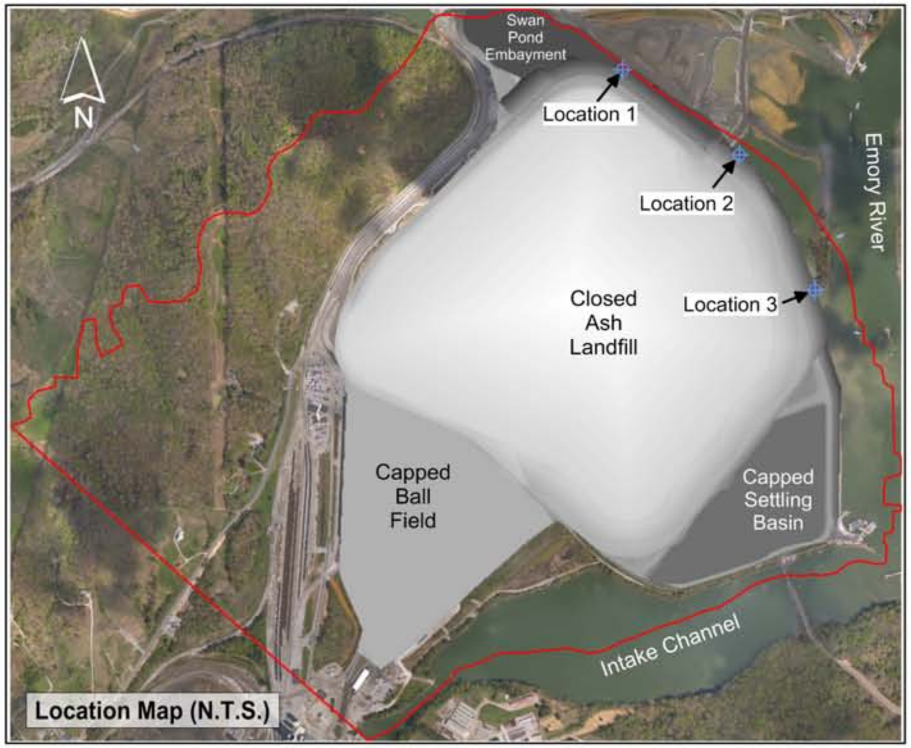
Predicted Selenium Concentration with Time at Selected Locations

TVA Kingston Fossil Plant

7-9-11
Figure 8-6.15_PredSeleniumTime.cdr

Figure 8-6.15





Note:
Kd = 3370 L/kg

Geosyntec JACOBS TVA

Predicted Radium-266 Concentration with Time at Selected Locations

TVA Kingston Fossil Plant

7-9-11
Figure 8-6.16_PredRadiumTime.cdr

Figure 8-6.16

APPENDIX A

Jacobs (2010) and TVA (2010) – Column and Batch Leaching with Solids Results

TVA

Document No. RAWP-072A

Kingston Ash Recovery Project
Non-Time-Critical Removal Action
for the River System

Ash Leaching Test Results

Prepared by:
Jacobs

for the Tennessee Valley Authority

Revision	Description	Date
00	Draft for TVA review	October 26, 2010
01	Draft for Regulator review	December 2, 2010

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List of Acronyms

cm	centimeter
cm^3	square centimeter
EPA	U.S. Environmental Protection Agency
mg/L	milligram per liter
mL	milliliter
mV	millivolt
ORP	oxidation-reduction potential
TCLP	Toxicity Characteristic Leaching Procedure
TVA	Tennessee Valley Authority
µg/L	microgram per liter

1. SITE BACKGROUND

This report presents the results of the sampling, bench-scale testing, and analysis for testing the leaching behavior of ash, lime-treated ash, and cement-treated ash at the Kingston Ash Recovery Project site. The testing was conducted in accordance with the Ash Leaching Test Plan, RAWP-072 (TVA 2010).

1.1 PURPOSE OF TEST

Groundwater modeling will be conducted as part of the River System Sampling and Analysis Plan to analyze the groundwater transport of ash-related constituents to the Watts Bar reservoir. Results of the leaching tests presented in this report will be used to quantify constituent concentration variations as a function of leaching from the ash.

Control of moisture content in the ash is critical to the successful dry ash stacking operations during closure of the Dredge Cell and Ash Pond. The addition of approximately 6% lime to the ash has been considered as one method to assist in controlling the moisture content and drying out the ash. Results of the leaching tests will be used to quantify constituent concentration variations as a function of leaching from the lime-treated ash.

Closure of the Dredge Cell and Ash Pond will also involve construction of a soil-cement foundation stabilization zone around the landfill perimeter. Results of the leaching tests will be used to quantify constituent concentration variations as a function of leaching from the cement-treated ash monolith.

1.2 TEST OBJECTIVES (DATA QUALITY OBJECTIVES)

Ash-related constituents, such as arsenic, may be mobilized as a result of infiltration of precipitation and may be transported downgradient in the groundwater to the Emory River, where exposure by humans or ecological receptors may occur. Addition of lime or cement may alter the mobilization potential. The principal study question is: Does the flux of ash-related constituents from groundwater to the Emory River result in unacceptable risk to these human or ecological receptors? The correlating study question is: Does this predicted flux change as a result of adding lime or cement to the ash?

Results of leaching tests will be used as inputs to the groundwater modeling, which will support the decision on acceptable risk. The spatial boundaries of the study are those areas where ash may be disposed onsite, namely within the Dredge Cell or Ash Pond. The temporal boundaries for the fate and transport modeling include the time following closure until peak concentrations are predicted by the model to occur in groundwater.

The U.S. Environmental Protection Agency (EPA) has proposed four new methods (Methods 1313 through 1316) for determining the leaching characteristics from coal ash and other landfilled materials. The proposed new EPA leach tests are alternate leaching procedures that are under development in EPA research studies and have not yet been formally adopted. The tests provide a useful standardized method for testing the leaching response of a material, such as ash or lime-treated ash; however, the leaching characteristics should be evaluated relative to the specific environmental (pH and redox) conditions expected for the Kingston Ash Recovery Project site.

Toxicity Characteristic Leaching Procedure (TCLP) limits do not apply to these new methods. However, the TCLP limits may be useful in putting the results in perspective, and are therefore referenced in this report. The TCLP limits for arsenic and selenium are 5 milligrams per liter (mg/L) and 1 mg/L, respectively.

2. TEST RESULTS

Ash leaching behavior was characterized by collecting two ash composite samples for laboratory bench-scale testing. Results are presented in Appendix A. Four different types of leaching tests were done: (1) batch (shake) tests with varying pH, (2) batch (shake) tests with varying liquid:solid ratio, (3) column tests, and (4) monolith tests.

2.1 BATCH (SHAKE) TESTS WITH VARYING PH (METHOD 1313)

Site-specific pH conditions at the Kingston site do not vary over a large range, with a mean of 6.7 and a range of 4.5 to 8.7. Therefore, leaching characteristics were tested at a pH of 5.0, 7.0, and 10.0. Each sample was prepared at a single liquid:solid ratio of 10:1. A composite sample of both untreated ash and ash mixed with lime (at 6% by weight) were tested. Method blank samples (not containing any solids) were tested, at a pH of 5.0, 7.0, and 10.0. In addition, because results of initial testing showed significant change in arsenic leaching behavior at pH of 10.0, an additional test was conducted on untreated ash at a pH of 7.0, 8.0, 9.0, 10.0, and 11.0 for arsenic and selenium.

Placement of materials in the Dredge Cell will likely result in layering of untreated dry ash and lime-treated dry ash. Therefore, a third set of tests was planned to be conducted on untreated ash using the leachate from a lime-treated ash batch test as reagent water at varying dilutions. This dilution series test was not performed due to a misunderstanding by the laboratory and because a similar test at varying liquid:solid ratios was conducted instead.

Samples were prepared in accordance with Method 1313. Batch test samples were placed on a tumbler (shaker) and gently tumbled for 48 hours. The eluate was then extracted and analyzed for metals, in particular the target elements of arsenic and selenium. In addition, one random sample was submitted for anion analysis (SO_4^{2-}, Cl^-, PO_4^{3-}, and CO_3^{2-}) and one for arsenic speciation. Results are presented in Appendix A.

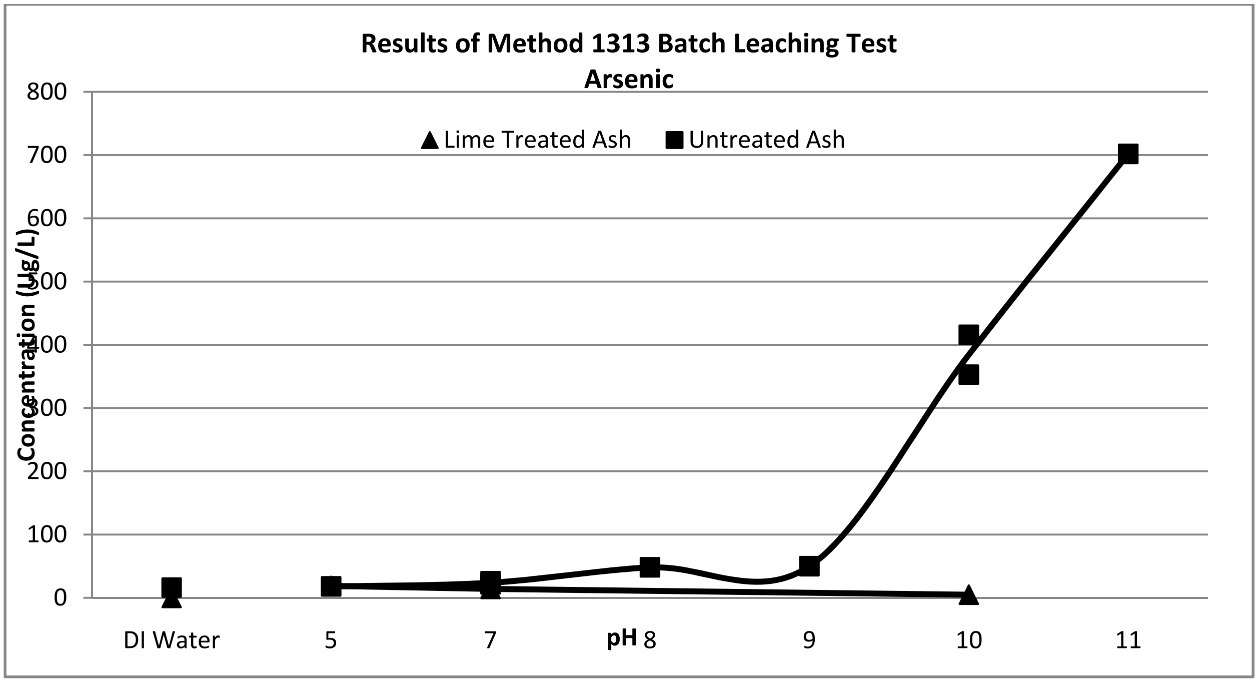
Results of the Method 1313 batch tests are presented in Table 2-1 for arsenic and selenium. Results of these tests are presented graphically on Figure 2-1. The results indicate that arsenic concentrations increase significantly at pH levels greater than pH 9.0 for untreated ash. However, for lime-treated ash, a similar rise in arsenic concentrations was not observed at higher pH; results for arsenic for lime-treated ash at lower pH levels were similar to those of untreated ash, indicating no apparent adverse leaching behavior due to lime treatment for arsenic. The maximum arsenic concentration was measured for the test conducted on untreated ash at pH 11.0; that concentration (702 microgram per liter [µg/L]) is less than the TCLP limit for arsenic (5,000 µg/L).

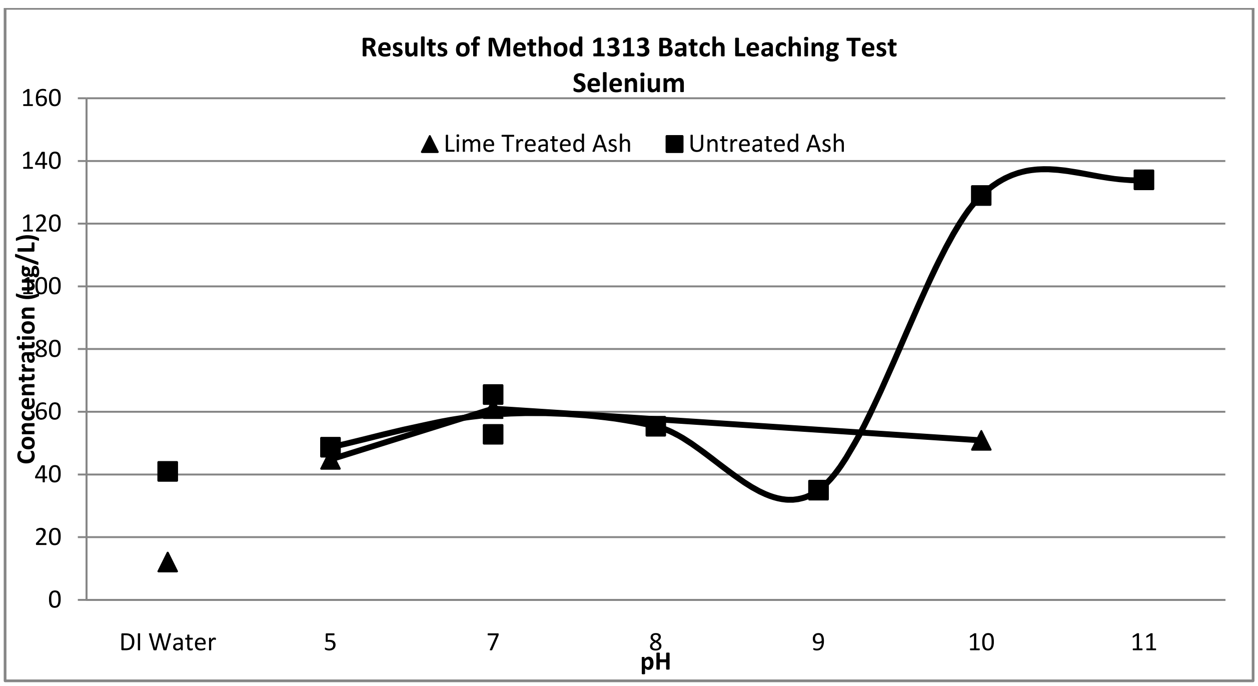
Table 2-1. Results of the Method 1313 Batch Tests for Arsenic and Selenium

	Arsenic Concentration (µg/L)		Selenium Concentration (µg/L)	
	Untreated	**Lime-Treated**	**Untreated**	**Lime-Treated**
DI Water	16.3	<2	41	12.1
pH 5	18.2	18.9	48.7	44.8
pH 7	26.5, 21.4	14.2	65.5, 52.8	61
pH 8	48.2	*	55.4	*
pH 9	50	*	35	*
pH 10	416, 353	4.9	<200, 129	50.9
pH 11	702	*	134	*

* Test was not conducted at this pH.

Figure 2-1. Results of Method 1313 Leaching Test





Results for selenium similarly show an increase at pH levels greater than pH 10.0 for untreated ash, although results for pH 10 .0 were contradictory between the two batch tests. Results for selenium for lime-treated ash were similar to those of untreated ash, indicating no apparent adverse leaching behavior due to lime treatment for selenium. The maximum selenium concentration was measured for the test conducted on untreated ash at pH 11.0; that concentration (134 µg/L) is less than the TCLP limit for arsenic (1,000 µg/L).

2.2 BATCH (SHAKE) TESTS WITH VARYING LIQUID-SOLID RATIO (METHOD 1316)

Leaching characteristics were tested over a range of liquid:solid ratios. A total of five liquid:solid ratios were tested: 0.5, 1, 2, 5, and 10. Unbuffered deionized water was used as reagent water for each test. A composite sample of both ash and ash mixed with lime (at 6% by weight) was tested. The test at a liquid:solid ratio of 0.5 was not completed of lime-treated ash due to the mixture not producing any leachate for analysis. One method blank sample was also tested.

Placement of materials in the Dredge Cell will likely result in layering of untreated dry ash and lime-treated dry ash. Therefore, a third set of tests was conducted on untreated ash using the leachate from a lime-treated ash batch test. The leachate was produced using lime-treated ash, unbuffered deionized water as reagent water, a liquid:solid ratio of 10:1, and a 48-hour hold time.

Samples were prepared in accordance with Method 1316. Batch test samples were gently tumbled for 48 hours. The eluate was extracted and analyzed for metals, in particular the target elements arsenic and selenium. No eluate could be extracted from the test samples conducted using lime-treated ash at a liquid:solid ratio of 0.5:1, as the liquid became fully sorbed to the solid fraction; therefore there are no results available for those tests.

Results of the Method 1316 batch tests are presented in Table 2-2 for arsenic and selenium. Results of these tests are presented graphically on Figure 2-2. The results for arsenic for untreated ash indicate that arsenic concentrations increase by a factor of two as the liquid:solid ratio increases from 0.5:1 to 10:1. Results for arsenic for lime-treated ash and for untreated ash using lime-treated leachate both indicate a slight decrease in arsenic concentrations with increasing liquid:solid ratio. Arsenic concentrations for those tests are lower than for untreated ash, indicating no adverse leaching behavior due to lime treatment for arsenic. The maximum arsenic concentration was measured for the test conducted on untreated ash at a liquid:solid ratio of 10:1; that concentration (58.2 µg/L) is less than the TCLP limit for arsenic (5,000 µg/L).

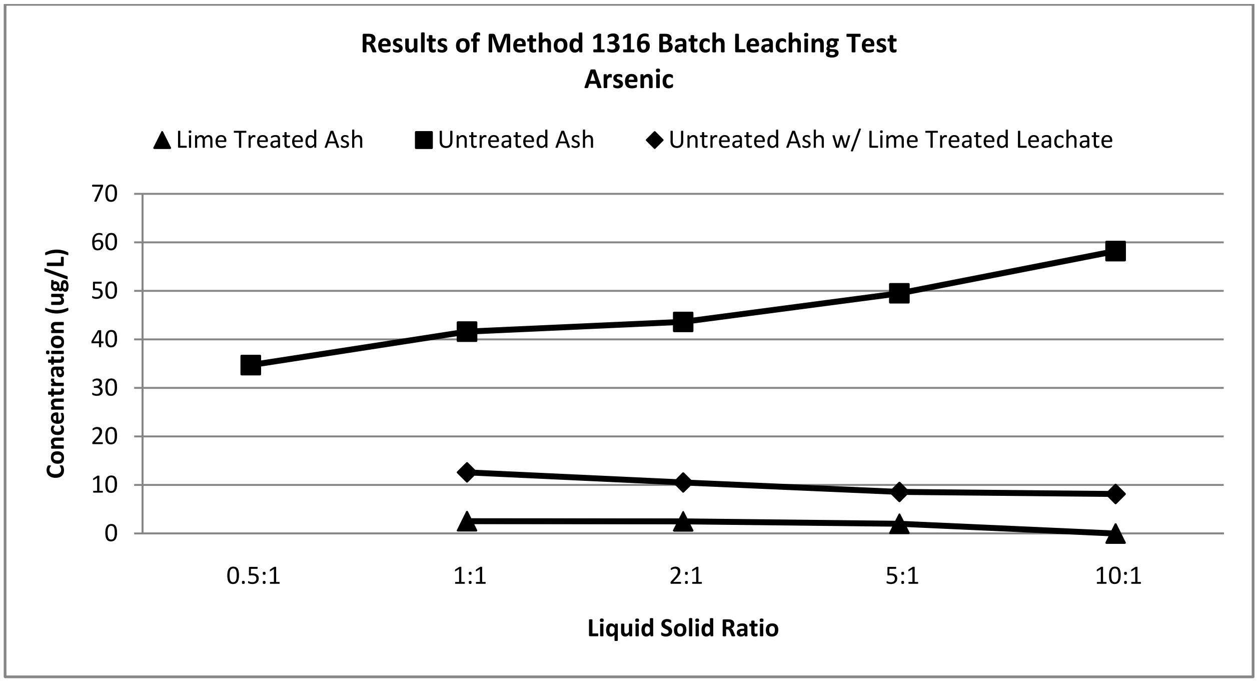
Table 2-2. Results of the Method 1316 Batch Tests for Arsenic and Selenium

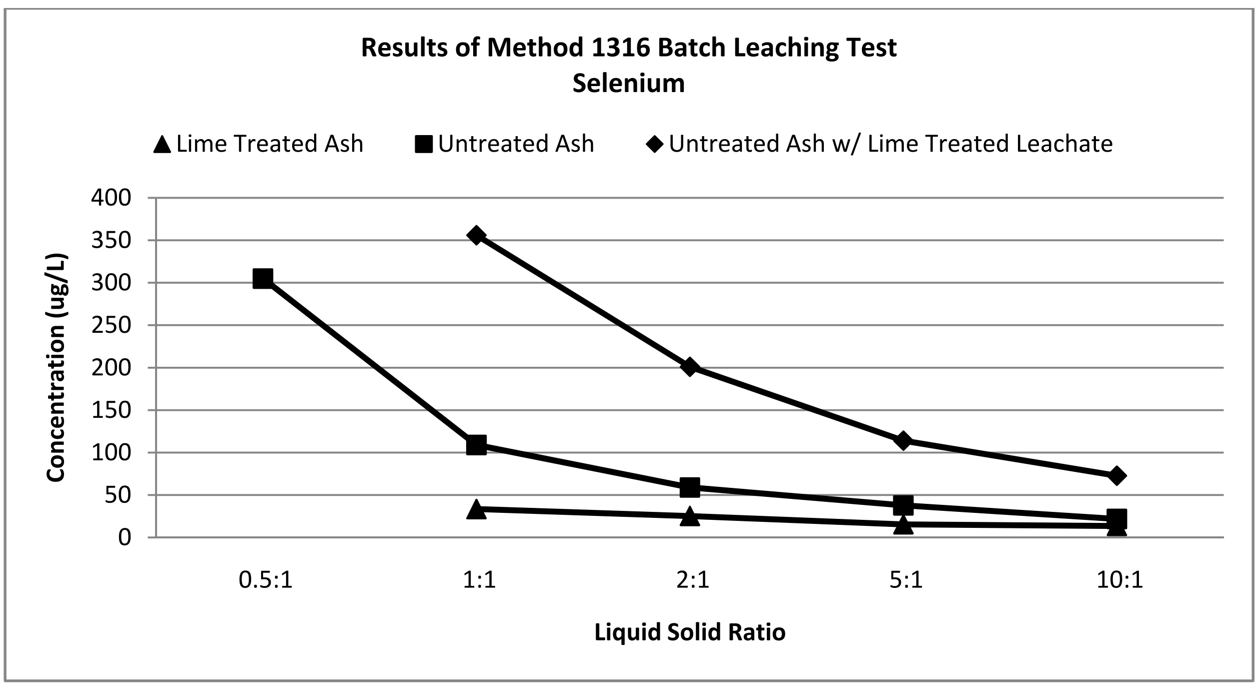
	Arsenic Concentration (µg/L)			**Selenium Concentration (µg/L)**		
	Untreated	**Lime-Treated**	**Untreated, Lime-Treated Leachate**	**Untreated**	**Lime-Treated**	**Untreated, Lime-Treated Leachate**
L:S 0.5:1	34.7	*	*	305	*	*
L:S 1:1	41.6	2.54	12.6	109	33.5	356
L:S 2:1	43.6	2.5	10.5	58.9	25.3	201
L:S 5:1	49.5	2.02	8.55	37.8	15.5	114
L:S 10:1	58.2	<2	8.13	21.8	13.6	72.7

* Test was conducted, but no leachate was produced for analysis.

Results for selenium show a decrease in selenium concentrations with increasing liquid:solid ratio. For untreated ash, selenium concentrations dropped 10-fold as the liquid:solid ratio increased. For lime-treated ash, there was only a slight decrease in selenium concentrations. For untreated ash using leachate from a lime-treated sample, selenium concentrations were significantly higher at the same liquid:solid ratio than either untreated or lime-treated samples alone. These results suggest that as leachate infiltrates slowly through lime-treated ash, there may be an increase in leaching behavior in underlying ash leachate, at least initially. The maximum selenium concentration was measured for the test conducted on untreated ash using leachate from a lime-treated sample at a liquid:solid ratio of 1:1; that concentration (356 µg/L) is less than the TCLP limit for selenium (1,000 µg/L).

Figure 2-2. Results of Method 1316 Leaching Test





The higher concentrations for selenium in the untreated/lime-treated leachate should not be detrimental, since the large amount of untreated ash relative to lime-treated ash expected in the Dredge cell and Ash Pond will attenuate selenium in leachate moving through the untreated ash. In addition, selenium in leachate reaching the Emory River will be diluted to non-detectable concentrations by the large volume of the river (average flow 27M gal/hr).

2.3 COLUMN TESTS (METHOD 1314)

Leaching characteristics of ash from the Kingston Ash Recovery Project site were tested by passing reagent water (unbuffered deionized water) through prepared columns of ash in an upflow configuration. Both ash and ash mixed with lime (at 6% by weight) were tested. A third column half-filled with ash and half-filled with lime-treated ash (6%) was also tested, with water passing first through the lime-treated ash. The column tests were conducted in accordance with Method 1314.

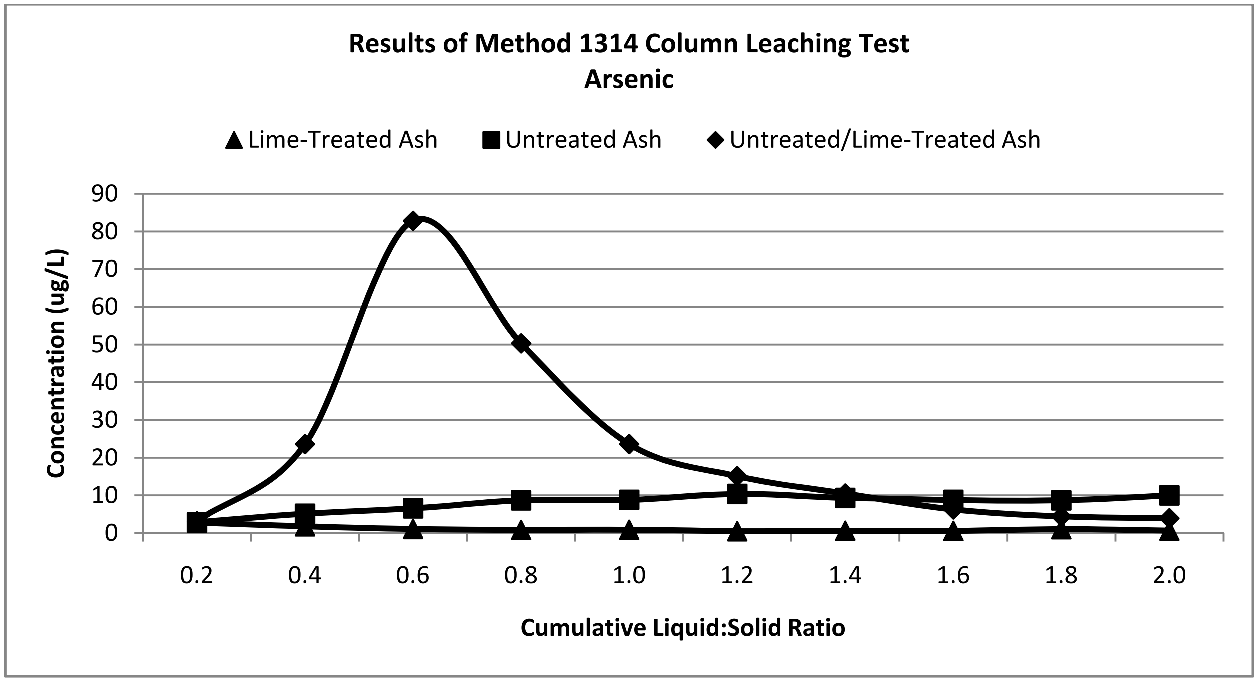
The ash was filtered through a 2 millimeter sieve before being packed into the columns. Each column (5 centimeter [cm] inner diameter) was packed with approximately 600 grams of ash on a dry weight basis (column 1 packed with untreated ash 620 grams; column two with lime-treated ash 598 grams; column 3 with layered untreated/lime-treated ash 629 grams). Density of ash in each column was calculated based on the column volume and dry ash weight (column 1 calculated at 1.08 grams/cubic centimeter [cm3]; column 2 at 1.06 grams/cm3; column 3 at 1.09 grams/cm3). The packed columns were filled with water for a 24-hour equilibration period, as specified in the procedure. However, due to leaks from the threaded column caps in columns 2 and 3 and use of a slow-curing glue to remedy this, the equilibrium period extended to four days. Flow rate through the columns was set at 1.3 milliliters (mL)/hour using syringe pumps, for a flow of 31.2 mL/day; this rate was used in order to simulate the flow through the ash in the closed Dredge Cell and Ash Pond. Water was bubbled with nitrogen before use to remove dissolved oxygen. Samples were collected every four days, which provided a volume of 125 mL for each sample, and this volume gave a liquid:solid ratio of approximately 0.2 (125 mL/600 grams ash). The columns were run for 40 days, which provided a cumulative liquid:solid ratio of 2.0 and a total of 10 samples taken from each column. A 10 mL aliquot from each sample was used to measure pH, conductivity, and oxidation-reduction potential (ORP). The samples were filtered and put into sample bottles containing nitric acid as a preservative. Samples were analyzed for metals, in particular the target elements of arsenic and selenium. A reagent water blank and a process water blank were included.

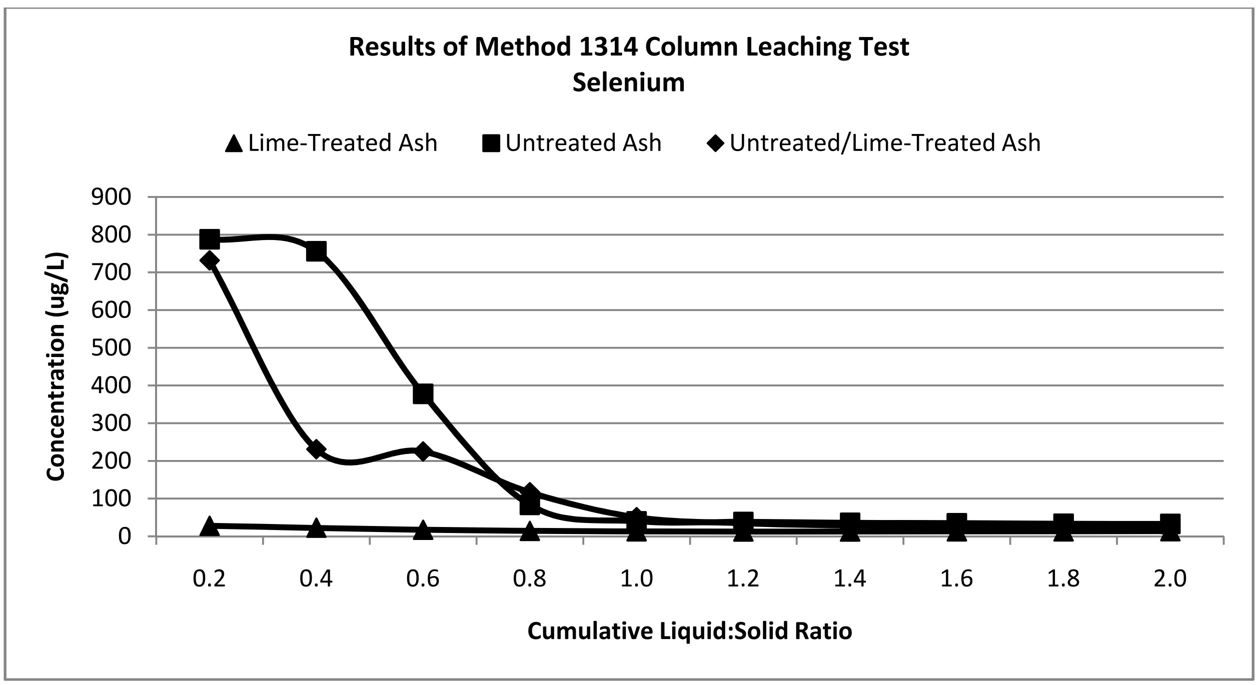
The results of the column leaching tests are listed in Table 2-3. Results of these tests are presented graphically on Figure 2-3.

Table 2-3. Results of the Method 1314 Column Tests for Arsenic and Selenium

Cumulative Liquid:Solid Ratio	Arsenic Concentration (µg/L)			Selenium Concentration (µg/L)		
	Untreated	Lime-Treated	Untreated / Lime-Treated	Untreated	Lime-Treated	Untreated / Lime-Treated
0.2	2.86	2.80	3.13	788	27.9	732
0.4	5.14	1.82	23.6	756	22.9	231
0.6	6.56	1.11	82.8	378	17.4	225
0.8	8.69	0.87	50.3	83.4	14.4	117
1.0	8.81	0.91	23.6	40.2	13.4	50.7
1.2	10.40	0.51	15.1	38.4	12.8	35.0
1.4	9.33	0.64	10.5	36.2	13.0	28.8
1.6	8.83	0.6	6.27	35	13.2	28.6
1.8	8.69	1.06	4.43	33.5	13.4	26.2
2.0	10.00	0.67	3.95	33.1	13.8	23.4

Figure 2-3. Results of Method 1314 Leaching Test





The arsenic concentrations in leachate from untreated ash increased from 2.9 µg/L in the first sample to concentrations close to 10 µg/L for a cumulative liquid:solid ratio of 1.0. Concentrations remained at this level through the final sample period, indicating that an equilibrium leaching rate had been reached around the cumulative liquid:solid ratio of 1.0. Leaching from the lime-treated ash was much lower, with most rates below 1 µg/L arsenic, indicating that addition of lime to the ash decreased arsenic leaching. However, for the untreated/lime-treated ash column, leachate concentrations increased to a maximum of 83 µg/L at a cumulative 0.6 liquid:solid ratio, and then decreased to 4 µg/L by the end of the test (cumulative 2.0 liquid:solid ratio). The maximum concentration (83 µg/L) is less than the TCLP limit for arsenic (5,000 µg/L). The high arsenic concentrations initially observed for the untreated/lime-treated ash should not be environmentally detrimental, since these concentrations were transitory and subsequent arsenic levels decreased below that of untreated ash.

Leaching of selenium from untreated ash showed initial high concentration of 800 µg/L that decreased to 40 µg/L by a cumulative liquid:solid ratio of 1.0. Concentrations continued to decrease slightly to a concentration of 33 µg/L. Leachate from lime-treated ash had much lower selenium concentrations, ranging from an initial concentration of 28 µg/L to a final of 13 µg/L, indicating that lime treatment inhibits selenium leaching, similar to its effect on arsenic leaching. Leaching from the untreated/lime-treated ash followed the same pattern as from the untreated ash, but the initial concentrations for the untreated/lime-treated ash were lower than for the untreated ash. The maximum selenium concentration for all tests (800 µg/L) is less than the TCLP limit for selenium (1,000 µg/L). These results indicate that addition of lime to the ash could decrease selenium leaching.

Both the pH and conductivity of the leachate were affected by addition of lime (Table 2-4). The pH increased with lime addition by 1 to 3 pH units, with the pH of the untreated/lime-treated leachate intermediate between the untreated and the lime-treated leachate. Conductivity increased by a factor of 10 to 15 with the addition of lime. The conductivity of the untreated/lime-treated leachate initially showed only a small increase over that of the untreated ash, but conductivity of the untreated/lime-treated leachate increased in the later samples. Lime addition also decreased ORP values slightly. The ORP values in the leachate samples were similar to values measured in ash piles, so bubbling nitrogen through the reagent water to remove oxygen provided conditions similar to that expected in the closed ash cell.

Table 2-4. Results of the Method 1314 Column Tests for pH, Conductivity, and Oxidation-Reduction Potential

Cumulative Liquid:Solid Ratio	pH			Conductivity (μSiemens/cm)		
	Untreated	Lime-Treated	Untreated / Lime-Treated	Untreated	Lime-Treated	Untreated / Lime-Treated
0.2	9.19	12.36	9.67	500	6,842	520
0.4	9.88	12.21	10.03	370	6,388	532
0.6	9.72	12.29	10.71	451	4,748	833
0.8	10.23	12.16	10.89	462	5,109	609
1.0	10.12	12.21	11.20	364	4,742	486
1.2	10.53	12.15	11.13	315	4,864	474
1.4	10.41	12.11	11.33	151	4,340	*
1.6	10.75	12.03	11.55	271	4,218	1075
1.8	10.91	12.29	11.92	306	4,939	1782
2.0	10.81	12.13	11.95	330	4,327	1748

*Test was not conducted at this pH.

Cumulative Liquid:Solid Ratio	Oxidation-Reduction Potential (mV)		
	Untreated	Lime-Treated	Untreated / Lime-Treated
0.2	161.2	78.6	130.6
0.4	146.0	83.0	128.0
0.6	138.1	80.6	112.2
0.8	135.0	75.0	102.9
1.0	142.2	60.2	80.5
1.2	134.5	100.1	118.4
1.4	131.7	99.3	121.3
1.6	133.7	86.5	109.6
1.8	140.1	113.3	120.3
2.0	130.7	111.4	94.3

2.4 MONOLITH TESTS (METHOD 1315)

Results of the monolith tests are not yet available and will be reported in a revision to this report.

Construction of the foundation stabilization zone around the perimeter of the Dredge Cell and Ash Pond will involve deep soil mixing of cement with the subsurface ash and native soil materials. Therefore, a monolith test will be conducted on core samples taken from the soil-cement columns constructed during the upcoming Deep Soil Mixing Pilot Test. Core samples are expected to be collected for testing in late July 2010, after a 28-day cure time.

Samples will be prepared and tests conducted in accordance with Method 1315 using intact cores. Tests will be conducted on two cores (taken at different depths within the subsurface ash interval). Unbuffered deionized water will be used as reagent water for each test.

3. CONCLUSIONS

Results of the ash leaching test indicate that leaching of arsenic and selenium at higher pH (10 to 11) may increase the concentration of those constituents in the leachate from untreated ash. Leaching from ash treated with lime at 6% by weight does not increase the concentrations of those constituents in the leachate.

Leaching from lime-treated into untreated ash may increase concentrations of arsenic or selenium in the leachate, although results are not consistent between two different types of tests. The higher concentrations for selenium in the untreated/lime-treated leachate for the Method 1316 test should not be detrimental, since the large amount of untreated ash relative to lime-treated ash expected in the Dredge cell and Ash Pond will attenuate selenium in leachate moving through the untreated ash. The high arsenic concentrations initially observed for the untreated/lime-treated ash in the Method 1314 test should not be environmentally detrimental, since these concentrations were transitory and subsequent arsenic levels decreased below that of untreated ash.

Therefore, lime applied at 6% by weight is acceptable for use in treating the ash.

4. REFERENCE

Tennessee Valley Authority (TVA), June 4, 2010. *Kingston Ash Recovery Project, Non-Time-Critical Removal Action for the River System, Ash Leaching Test Plan*, RAWP-072.

APPENDIX A

Laboratory Analytical Results

ANALYTICAL REPORT

PROJECT NO. NTG0744

NTG0744/TVA

Lot #: A0I100526

Mark Hollingsworth

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204

TESTAMERICA LABORATORIES, INC.

Amy McCormick

Approved for release.
Amy McCormick
Project Manager
9/30/2010 1:49 PM

Amy L. McCormick
Project Manager
amy.mccormick@testamericainc.com

September 28, 2010

TestAmerica Laboratories, Inc.
TestAmerica North Canton 4101 Shuffel Street NW, North Canton, OH 44720
Tel (330)497-9396 Fax (330)497-0772 www.testamericainc.com

Table of Contents

CASE NARRATIVE

CASE NARRATIVE

A0I100526

The following report contains the analytical results for two water samples submitted to TestAmerica North Canton by TestAmerica Nashville from the NTG0744/TVA Site, project number NTG0744. The samples were received September 10, 2010, according to documented sample acceptance procedures.

TestAmerica utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameter(s) listed on the analytical methods summary page in accordance with the method(s) indicated. Preliminary results were provided to Johnny Mitchell and Mark Hollingsworth on September 19, 2010. A summary of QC data for these analyses is included at the back of the report.

TestAmerica North Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the applicable methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

All parameters were evaluated to the reporting limit.

Please refer to the Quality Control Elements Narrative following this case narrative for additional quality control information.

If you have any questions, please call the Project Manager, Amy L. McCormick, at 330-497-9396.

This report is sequentially paginated. The final page of the report is labeled as "END OF REPORT."

SUPPLEMENTAL QC INFORMATION

SAMPLE RECEIVING

The temperature of the cooler upon sample receipt was 2.1°C.

CASE NARRATIVE (continued)

GC VOLATILES

The analytical results met the requirements of the laboratory's QA/QC program.

QUALITY CONTROL ELEMENTS NARRATIVE

TestAmerica conducts a quality assurance/quality control (QA/QC) program designed to provide scientifically valid and legally defensible data. Toward this end, several types of quality control indicators are incorporated into the QA/QC program, which is described in detail in QA Policy, QA-003. These indicators are introduced into the sample testing process to provide a mechanism for the assessment of the analytical data. Program or agency specific requirements take precedence over the requirements listed in this narrative.

QC BATCH

Environmental samples are taken through the testing process in groups called QUALITY CONTROL BATCHES (QC batches). A QC batch contains up to twenty environmental samples of a similar matrix (water, soil) that are processed using the same reagents and standards. TestAmerica North Canton requires that each environmental sample be associated with a QC batch.

Several quality control samples are included in each QC batch and are processed identically to the twenty environmental samples.

For SW846/RCRA methods, QC samples include a METHOD BLANK (MB), a LABORATORY CONTROL SAMPLE (LCS) and, where appropriate, a MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) pair or a MATRIX SPIKE/SAMPLE DUPLICATE (MS/DU) pair. If there is insufficient sample to perform an MS/MSD or an MS/DU, then a LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) is included in the QC batch.

For 600 series/CWA methods, QC samples include a METHOD BLANK (MB), a LABORATORY CONTROL SAMPLE (LCS) and, where appropriate, a MATRIX SPIKE (MS). An MS is prepared and analyzed at a 10% frequency for GC Methods and at a 5% frequency for GC/MS methods.

LABORATORY CONTROL SAMPLE

The Laboratory Control Sample is a QC sample that is created by adding known concentrations of a full or partial set of target analytes to a matrix similar to that of the environmental samples in the QC batch. Multi peak responders may not be included in the target spike list due to co-elution. The LCS analyte recovery results are used to monitor the analytical process and provide evidence that the laboratory is performing the method within acceptable guidelines. All control analytes indicated by a bold type in the LCS must meet acceptance criteria. Failure to meet the established recovery guidelines requires the repreparation and reanalysis of all samples in the QC batch. Comparison of only the failed parameters from the first batch are evaluated. The only exception to the rework requirement is that if the LCS recoveries are biased high and the associated sample is ND (non-detected) for the parameter(s) of interest, the batch is acceptable.

At times, a Laboratory Control Sample Duplicate (LCSD) is also included in the QC batch. An LCSD is a QC sample that is created and handled identically to the LCS. Analyte recovery data from the LCSD is assessed in the same way as that of the LCS. The LCSD recoveries, together with the LCS recoveries, are used to determine the reproducibility (precision) of the analytical system. Precision data are expressed as relative percent differences (RPDs). If the RPD fails for an LCS/LCSD and yet the recoveries are within acceptance criteria, the batch is still acceptable.

METHOD BLANK

The Method Blank is a QC sample consisting of all the reagents used in analyzing the environmental samples contained in the QC batch. Method Blank results are used to determine if interference or contamination in the analytical system could lead to the reporting of false positive data or elevated analyte concentrations. All target analytes must be below the reporting limits (RL) or the associated sample(s) must be ND except under the following circumstances:

- Common organic contaminants may be present at concentrations up to 5 times the reporting limits. Common metals contaminants may be present at concentrations up to 2 times the reporting limit, or the reported blank concentration must be twenty fold less than the concentration reported in the associated environmental samples. (See common laboratory contaminants listed in the table.)

Volatile (GC or GC/MS)	Semivolatile (GC/MS)	Metals ICP-MS	Metals ICP Trace
Methylene Chloride, Acetone, 2-Butanone	Phthalate Esters	Copper, Iron, Zinc, Lead, Calcium, Magnesium, Potassium, Sodium, Barium, Chromium, Manganese	Copper, Iron, Zinc, Lead

QUALITY CONTROL ELEMENTS NARRATIVE (continued)

- Organic blanks will be accepted if compounds detected in the blank are present in the associated samples at levels 10 times the blank level. Inorganic blanks will be accepted if elements detected in the blank are present in the associated samples at 20 times the blank level.

- Blanks will be accepted if the compounds/elements detected are not present in any of the associated environmental samples.

Failure to meet these Method Blank criteria requires the repreparation and reanalysis of all samples in the QC batch.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

A Matrix Spike and a Matrix Spike Duplicate are a pair of environmental samples to which known concentrations of a full or partial set of target analytes are added. The MS/MSD results are determined in the same manner as the results of the environmental sample used to prepare the MS/MSD. The analyte recoveries and the relative percent differences (RPDs) of the recoveries are calculated and used to evaluate the effect of the sample matrix on the analytical results. Due to the potential variability of the matrix of each sample, the MS/MSD results may not have an immediate bearing on any samples except the one spiked; therefore, the associated batch MS/MSD may not reflect the same compounds as the samples contained in the analytical report. When these MS/MSD results fail to meet acceptance criteria, the data is evaluated. If the LCS is within acceptance criteria, the batch is considered acceptable.

For certain methods, a Matrix Spike/Sample Duplicate (MS/DU) may be included in the QC batch in place of the MS/MSD. For the parameters (i.e. pH, ignitability) where it is not possible to prepare a spiked sample, a Sample Duplicate may be included in the QC batch. However, a Sample Duplicate is less likely to provide usable precision statistics depending on the likelihood of finding concentrations below the standard reporting limit. When the Sample Duplicate result fails to meet acceptance criteria, the data is evaluated.

For certain methods (600 series methods/CWA), a Matrix Spike is required in place of a Matrix Spike/Matrix Spike Duplicate (MS/MSD) or Matrix Spike/Sample Duplicate (MS/DU).

The acceptance criteria do not apply to samples that are diluted.

SURROGATE COMPOUNDS

In addition to these batch-related QC indicators, each organic environmental and QC sample is spiked with surrogate compounds. Surrogates are organic chemicals that behave similarly to the analytes of interest and that are rarely present in the environment. Surrogate recoveries are used to monitor the individual performance of a sample in the analytical system.

If surrogate recoveries are biased high in the LCS, LCSD, or the Method Blank, and the associated sample(s) are ND, the batch is acceptable. Otherwise, if the LCS, LCSD, or Method Blank surrogate(s) fail to meet recovery criteria, the entire sample batch is reprepared and reanalyzed. If the surrogate recoveries are outside criteria for environmental samples, the samples will be reprepared and reanalyzed unless there is objective evidence of matrix interference or if the sample dilution is greater than the threshold outlined in the associated method SOP.

The acceptance criteria do not apply to samples that are diluted. All other surrogate recoveries will be reported.

For the GC/MS BNA methods, the surrogate criterion is that two of the three surrogates for each fraction must meet acceptance criteria. The third surrogate must have a recovery of ten percent or greater.

For the Pesticide and PCB methods, the surrogate criterion is that one of two surrogate compounds must meet acceptance criteria. The second surrogate must have a recovery of 10% or greater.

TestAmerica Certifications and Approvals:

The laboratory is certified for the analytes listed on the documents below. These are available upon request.
California (#01144CA), Connecticut (#PH-0590), Florida (#E87225),
Illinois (#200004), Kansas (#E10336), Minnesota (#39-999-348), New Jersey (#OH001), New York (#10975), Nevada (#OH-000482008A), OhioVAP (#CL0024), Pennsylvania (#008), West Virginia (#210), Wisconsin (#999518190),NAVY, ARMY, USDA Soil Permit

N:\QAQC\Customer Service\Narrative - Combined RCRA _CWA 032609.doc

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY - Detection Highlights

A0I100526

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
NO DETECTABLE PARAMETERS				

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

METHOD SUMMARY

ANALYTICAL METHODS SUMMARY

A0I100526

PARAMETER	ANALYTICAL METHOD
Arsenic (III) Speciation by ASV	SW846 7063
Arsenic (V) Speciation by ASV	SW846 7063

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

SAMPLE SUMMARY

A0I100526

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
L6TJ8	001	NTG0744-25	09/09/10	00:01
L6TKA	002	NTG0744-26	09/09/10	00:01

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SHIPPING
AND
RECEIVING DOCUMENTS

TestAmerica Cooler Receipt Form/Narrative **Lot Number:** A0I100526
North Canton Facility

Client TA Nashville Project NTG0744 By: [signature] (Signature)

Cooler Received on 9-10-10 Opened on 9-10-10

FedEx ☑ UPS ☐ DHL ☐ FAS ☐ Stetson ☐ Client Drop Off ☐ TestAmerica Courier ☐ Other ______

TestAmerica Cooler # ______ Multiple Coolers ☐ Foam Box ☐ Client Cooler ☑ Other ______

1. Were custody seals on the outside of the cooler(s)? Yes ☐ No ☑ Intact? Yes ☐ No ☐ NA ☑
   If YES, Quantity ______ Quantity Unsalvageable ______
   Were custody seals on the outside of cooler(s) signed and dated? Yes ☐ No ☐ NA ☑
   Were custody seals on the bottle(s)? Yes ☐ No ☑
   If YES, are there any exceptions? ______
2. Shippers' packing slip attached to the cooler(s)? Yes ☑ No ☐
3. Did custody papers accompany the sample(s)? Yes ☑ No ☐ Relinquished by client? Yes ☑ No ☐
4. Were the custody papers signed in the appropriate place? Yes ☑ No ☐
5. Packing material used: Bubble Wrap ☑ Foam ☐ None ☐ Other ______
6. Cooler temperature upon receipt 2.1 °C See back of form for multiple coolers/temps ☐
   METHOD: IR ☑ Other ☐ ______
   COOLANT: Wet Ice ☑ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐
7. Did all bottles arrive in good condition (Unbroken)? Yes ☑ No ☐
8. Could all bottle labels be reconciled with the COC? Yes ☑ No ☐
9. Were sample(s) at the correct pH upon receipt? Yes ☐ No ☐ NA ☑
10. Were correct bottle(s) used for the test(s) indicated? Yes ☑ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☐ NA ☑
12. Sufficient quantity received to perform indicated analyses? Yes ☑ No ☐
13. Was a trip blank present in the cooler(s)? Yes ☐ No ☑ Were VOAs on the COC? Yes ☐ No ☑

Contacted PM ______ Date ______ by ______ via Verbal ☐ Voice Mail ☐ Other ☐

Concerning ______

14. CHAIN OF CUSTODY

The following discrepancies occurred:

15. SAMPLE CONDITION

Sample(s) ______ were received after the recommended holding time had expired.
Sample(s) ______ were received in a broken container.
Sample(s) ______ were received with bubble >6 mm in diameter. (Notify PM)

16. SAMPLE PRESERVATION

Sample(s) ______ were further preserved in Sample Receiving to meet recommended pH level(s). *Nitric Acid Lot#* 051010-*HNO_3; Sulfuric Acid Lot#* 051010-*H_2SO_4; Sodium Hydroxide Lot#* 100108 *-NaOH; Hydrochloric Acid Lot#* 092006-*HCl; Sodium Hydroxide and Zinc Acetate Lot#* 100108-*$(CH_3COO)_2ZN/NaOH$*. What time was preservative added to sample(s)? ______

Client ID	pH	Date	Initials

TestAmerica Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials

Cooler #	Temp. °C	Method	Coolant

Discrepancies Cont'd:

GC VOLATILE DATA

QC SUMMARY DATA

SW846 7063 CHECK SAMPLE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L631H1AC
BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (V)	20	8.8	44	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc. Client: TestAmerica Nashville

Lab Code: TALCAN SDG No:

Lot #: A0I160000 WO #: L631H1AD

BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (V)	20	8.4	42	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L63111AC
BATCH: 0259373

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (III)	20	16	81	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L63111AD
BATCH: 0259373

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (III)	20	18	90	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Matrix Spike ID: LAB MS/MSD

Lot #: A0I030441   WO #: L6HQJ1AD

BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	MS CONCENT. (ug/L)	MS % REC	LIMITS REC	QUAL
Arsenic (V)	20	ND	7.7	39	25- 130	

NOTES(S):

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 0 out of 0 outside limits
Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Matrix Spike ID: LAB MS/MSD

Lot #: A0I030441   WO #: L6HQJ1AE
BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENT. (ug/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC	QUAL
Arsenic (V)	20	6.1	30	23	50	25- 130	

NOTES(S):

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 0 out of 1 outside limits
Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

BLANK WORKORDER NO.

L631H1AA

SW846 7063 METHOD BLANK SUMMARY

Lab Name: TestAmerica Laboratories, Inc.

Lab Code: TALCAN SDG Number:

Lab File ID: Lot Number: A0I100526

Date Analyzed: 09/16/10 Time Analyzed: 00:00

Matrix: WATER Date Extracted:09/16/10

GC Column: ID: .00 Extraction Method:

Instrument ID: AS35 Level:(low/med) LOW

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, LCS, LCSD, MS , MSD:

	CLIENT ID.	SAMPLE WORK ORDER #	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	INTRA-LAB QC	L6HQJ1AC		09/16/10	00:00
02	LAB MS/MSD	L6HQJ1AD S		09/16/10	00:00
03	LAB MS/MSD	L6HQJ1AE D		09/16/10	00:00
04	NTG0744-25	L6TJ81AC		09/16/10	00:00
05	NTG0744-26	L6TKA1AC		09/16/10	00:00
06	CHECK SAMPLE	L631H1AC C		09/16/10	00:00
07	DUPLICATE CHECK	L631H1AD L		09/16/10	00:00
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

COMMENTS:

FORM IV

BLANK WORKORDER NO.

L63111AA

SW846 7063 METHOD BLANK SUMMARY

Lab Name: TestAmerica Laboratories, Inc.

Lab Code: TALCAN

SDG Number:

Lab File ID:

Lot Number: A0I100526

Date Analyzed: 09/16/10

Time Analyzed: 00:00

Matrix: WATER

Date Extracted:09/16/10

GC Column: ID: .00

Extraction Method:

Instrument ID: AS35

Level:(low/med) LOW

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, LCS, LCSD, MS , MSD:

	CLIENT ID.	SAMPLE WORK ORDER #	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	NTG0744-25	L6TJ81AA		09/16/10	00:00
02	NTG0744-26	L6TKA1AA		09/16/10	00:00
03	CHECK SAMPLE	L63111AC C		09/16/10	00:00
04	DUPLICATE CHECK	L63111AD L		09/16/10	00:00
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

COMMENTS:

FORM IV

SAMPLE DATA

TestAmerica Nashville

Client Sample ID: NTG0744-25

GC Volatiles

Lot-Sample #...: A0I100526-001 **Work Order #...:** L6TJ81AA **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (III)	ND	10	ug/L	5.5

TestAmerica Nashville

Client Sample ID: NTG0744-25

GC Volatiles

Lot-Sample #...: A0I100526-001 **Work Order #...:** L6TJ81AC **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (V)	ND	10	ug/L	4.2

TestAmerica Nashville

Client Sample ID: NTG0744-26

GC Volatiles

Lot-Sample #...: A0I100526-002	**Work Order #...:** L6TKA1AA	**Matrix.........:** WG
Date Sampled...: 09/09/10 00:01	**Date Received..:** 09/10/10	
Prep Date......: 09/16/10	**Analysis Date..:** 09/16/10	
Prep Batch #...: 0259373		
Dilution Factor: 5	**Initial Wgt/Vol:** 42 mL	**Final Wgt/Vol..:** 42 mL
	Method.........: SW846 7063	

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (III)	ND	10	ug/L	5.5

TestAmerica Nashville

Client Sample ID: NTG0744-26

GC Volatiles

Lot-Sample #...:	A0I100526-002	**Work Order #...:**	L6TKA1AC	**Matrix.........:**	WG
Date Sampled...:	09/09/10 00:01	**Date Received..:**	09/10/10		
Prep Date......:	09/16/10	**Analysis Date..:**	09/16/10		
Prep Batch #...:	0259371				
Dilution Factor:	5	**Initial Wgt/Vol:**	42 mL	**Final Wgt/Vol..:**	42 mL
		Method.........:	SW846 7063		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (V)	ND	10	ug/L	4.2

METHOD BLANK REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AA **Matrix.........:** WATER
MB Lot-Sample #: A0I160000-371
Prep Date......: 09/16/10 **Final Wgt/Vol..:** 42 mL
Analysis Date..: 09/16/10 **Prep Batch #...:** 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Arsenic (V)	ND	2.0	ug/L	SW846 7063

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AA **Matrix.........:** WATER
MB Lot-Sample #: A0I160000-373
Prep Date......: 09/16/10 **Final Wgt/Vol..:** 42 mL
Analysis Date..: 09/16/10 **Prep Batch #...:** 0259373
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Arsenic (III)	ND	2.0	ug/L	SW846 7063

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-371 L631H1AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (V)	**44**	**(25 - 130)**			**SW846 7063**
	42	**(25 - 130)**	**4.1**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-371 L631H1AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Arsenic (V)	**20**	**8.8**	**ug/L**	**44**		**SW846 7063**
	20	**8.4**	**ug/L**	**42**	**4.1**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-373 L63111AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (III)	**81**	**(25 - 130)**			**SW846 7063**
	90	**(25 - 130)**	**11**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-373 L63111AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Arsenic (III)	**20**	**16**	**ug/L**	**81**		**SW846 7063**
	20	**18**	**ug/L**	**90**	**11**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L6HQJ1AD-MS **Matrix.........:** WATER
MS Lot-Sample #: A0I030441-001 L6HQJ1AE-MSD
Date Sampled...: 08/31/10 13:30 **Date Received..:** 09/02/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (V)	**39**	**(25 - 130)**			**SW846 7063**
	30	**(25 - 130)**	**23**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L6HQJ1AD-MS **Matrix.........:** WATER
MS Lot-Sample #: A0I030441-001 L6HQJ1AE-MSD
Date Sampled...: 08/31/10 13:30 **Date Received..:** 09/02/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Arsenic (V)	**ND**	**20**	**7.7**	**ug/L**	**39**		**SW846 7063**
	ND	**20**	**6.1**	**ug/L**	**30**	**23**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

SUPPORTIVE RAW DATA

TestAmerica North Canton Arsenic (III)/Arsenic (V) Data Review Checklist

Run/Project Information

Run Date: 9/15/10 - 9/16/2010 **Analyst:** Ray Shock **Instrument:** Trace Detect Nano Band Explorer
Prep Batches Run: 0259371, 0259373, 0259374 **Lot #:** A0I030441, A0I030572, A0I100526
Methods used: 7063 mod : NC-WC-0090 Rev 1

Review Items:

A. Instrument Setup	Yes	No	N/A	2ndLevel
1. Electrode sensitivity check?	X			
2. MSA working standard and verification standard within control limits?	X			
3. Cleanliness check (ICB) within +/- RL?	X			
B. Sample Results				
1. Were non-detect samples verified with single point MSA?	X			
2. All samples with As(III) quantified with 3-4 point MSA?	X			
3. Sample analyses done within holding time?	X			
C. Preparation/Matrix QC				
1. Samples preserved in the field?	X			
2. LCS done per prep batch and within QC limits?	X			
3. Method blank done per prep batch and < RL?	X			
4. MS run at required frequency (1 per 20 samples) and within limits?	X			
5. MSD or DU run at required frequency (1 per 20 samples) and RPD within limits?	X			
D. Other				
1. Are all nonconformances documented appropriately?	X			
2. Current MDL data on file?	X			
3. Calculations and Transcriptions checked for error?	X			
4. All client/ project specific requirements met?	X			
5. Date of analysis verified as correct?	X			

Analyst: Ray Shock [signature] **Date:** 9/16/2010
Comments:

2nd Level Reviewer : [signature] **Date:** 9/19/10

Standard, Reagent and Supply Numbers

MSA Working Std: 3904 MSA Verification Std: 3905 MS As(V) Std: 3906

Au Plate Soln: 3916 conc HCl: Lot H33A01 Cu Remover: Lot I12267

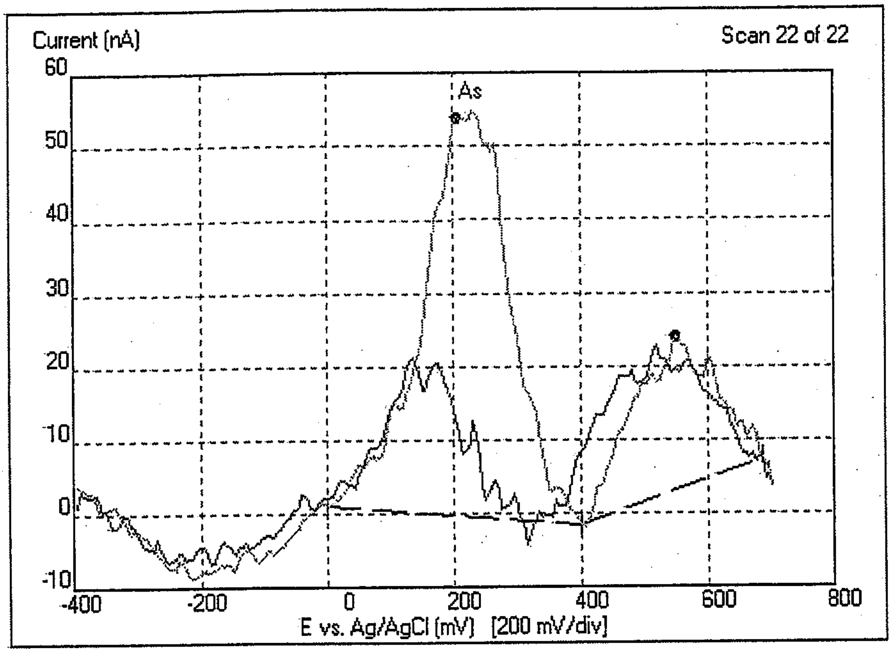
Acidic ext: ____________ Basic ext: ____________

Sodium Thiosulfate: 3888 Starch Indicator: 3887 Working Iodine Soln: 3915

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	09:56 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_21.tds	Analysis Time/Date:	09:54 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_21.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	SENSITIVITY CK + 2 PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	205	250	54.3 nA	894 pC	145 mV	Auto	**14.8 ppb**	**17.6 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	01	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

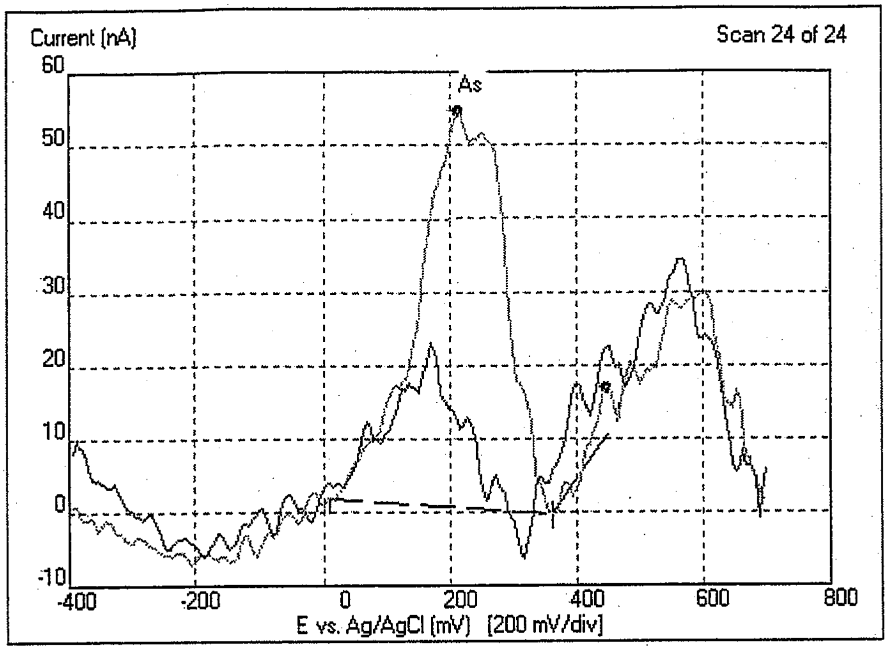
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE 2	Report Time/Date:	11:01 AM on 16/Sep/2010
Data File Name:	GOLD PLATE 2_23.tds	Analysis Time/Date:	11:00 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00915CURX\GOLD PLATE 2\GOLD PLATE 2_23.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	SENSITIVITY CK + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	210	250	54.3 nA	867 pC	145 mV	Auto	**14.8 ppb**	**17.6 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

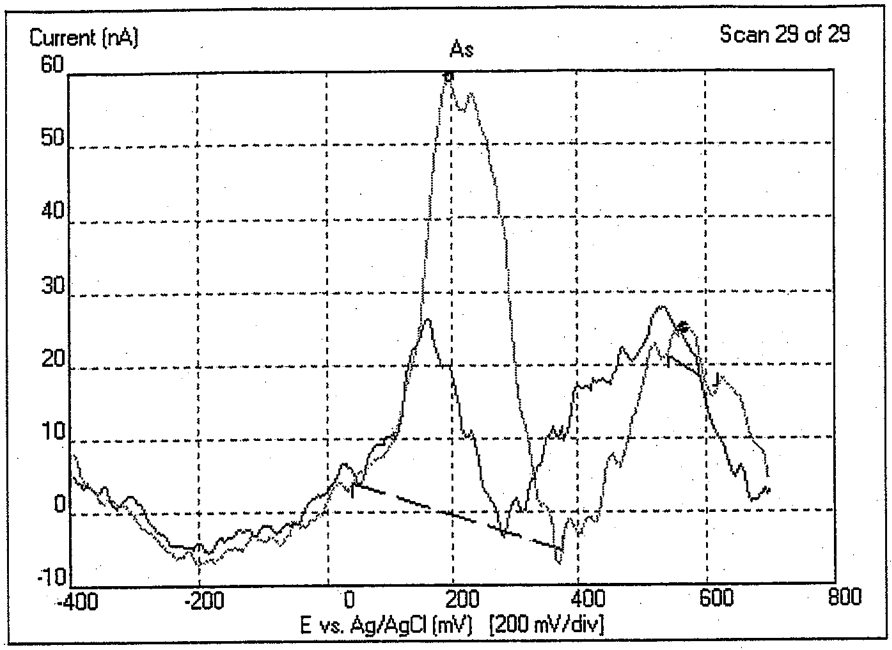
☑ Use Background subtraction — Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE 3	Report Time/Date:	03:06 PM on 16/Sep/2010
Data File Name:	GOLD PLATE 3_28.tds	Analysis Time/Date:	03:05 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE 3\GOLD PLATE 3_28.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	SENSITIVITY CK +2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	195	250	60.0 nA	883 pC	145 mV	Auto	**16.3 ppb**	**19.4 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

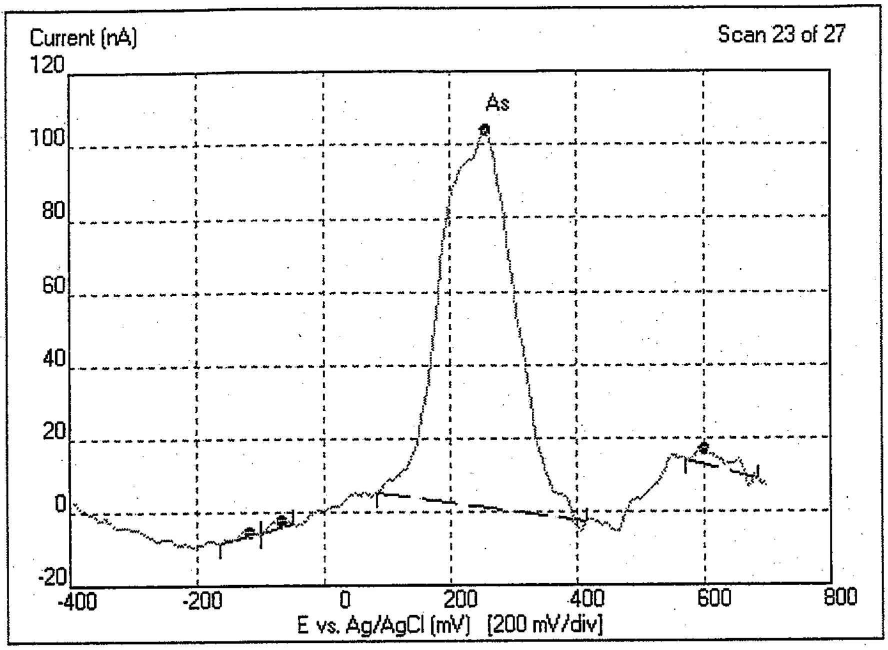
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	10:03 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_22.tds	Analysis Time/Date:	09:57 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_22.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS III PRIMARY STD	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ● No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	255	250	103 nA	1.39 nC	135 mV	Auto	**28.1 ppb**	**33.5 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

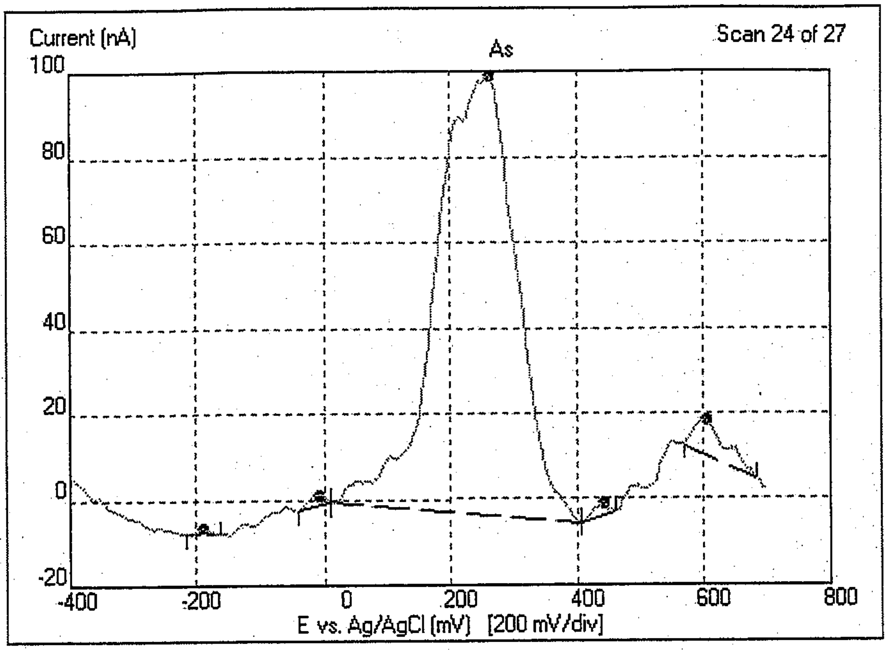
Session Name: GOLD PLATE
Data File Name: GOLD PLATE_23.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_23.tds

Session Description:

Scan ID: AS III SECONDARY STD

Report Time/Date: 10:03 AM on 16/Sep/2010
Analysis Time/Date: 09:57 AM on 16/Sep/2010
CalibrationTime/Date: n.a.
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

◯ This Scan is part of a MSA Measurement
◯ MSA Measurement used as Cal. Curve
◯ Calibration Curve Used
◉ No Calibration Available
☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:
Input 1 (mV):
Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	260	250	103 nA	1.51 nC	145 mV	Auto	**27.9 ppb**	**33.3 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

$\frac{28.1}{27.9} = 100.7\%$

Background Subtraction:

☑ Use Background subtraction

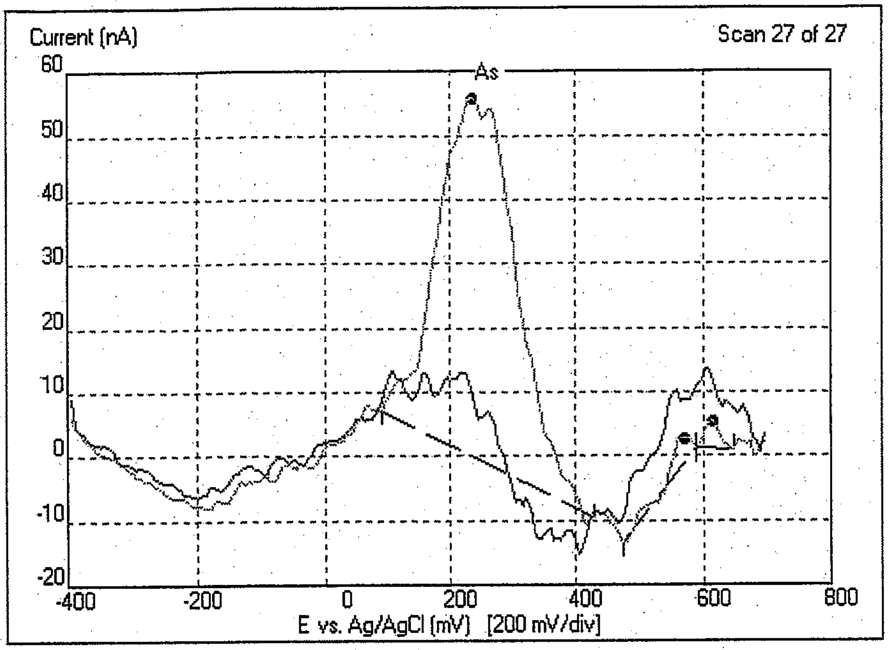
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	10:03 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_26.tds	Analysis Time/Date:	10:00 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_26.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	INSTRUMENT BLANK + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- ☑ Background Subtracted
- ☑ Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- ☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	235	250	56.0 nA	819 pC	140 mV	Auto	**15.2 ppb**	**18.1 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

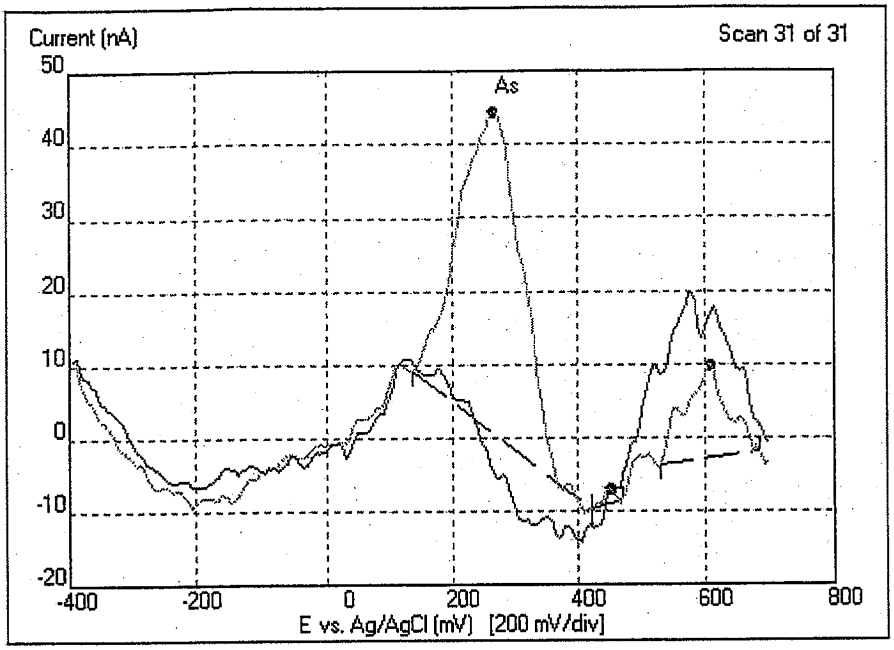
☑ Use Background subtraction — Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE 3	Report Time/Date:	03:09 PM on 16/Sep/2010
Data File Name:	GOLD PLATE 3_30.tds	Analysis Time/Date:	03:08 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE 3\GOLD PLATE 3_30.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS III BLK +2PPB AS III CURX	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	44.0 nA	516 pC	125 mV	Auto	**12.0 ppb**	**14.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction

Background Scan Plate Time: 1 seconds

- [ ] Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

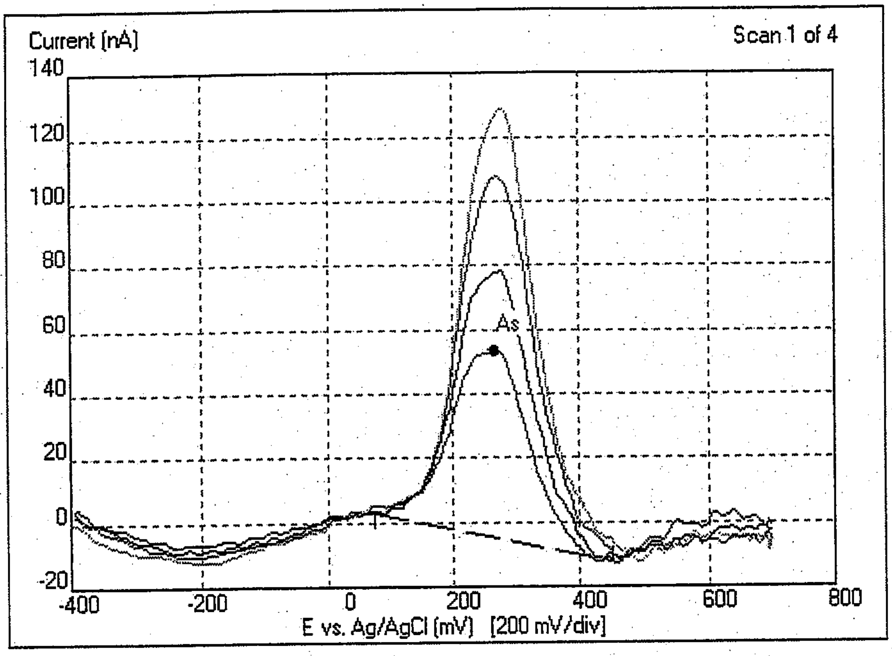
Session Name: AS III LCS
Data File Name: AS III LCS_15.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III LCS\AS III LCS_15.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 03:15 PM on 16/Sep/2010
Analysis Time/Date: 03:14 PM on 16/Sep/2010
CalibrationTime/Date: 12:02 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

◉ This Scan is part of a MSA Measurement
○ MSA Measurement used as Cal. Curve
○ Calibration Curve Used
○ No Calibration Available
☑ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190
Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:
Input 1 (mV):
Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	58.3 nA	853 pC	135 mV	Auto	**13.6 ppb (Cal.)**	**16.2 ppb (Cal.)**

Measurement Scan Settings:

Clean Time: 0.1 seconds
Plate Time: 10 seconds
Clean Voltage: 500 mV
Plate Voltage: -400 mV

Start Voltage: -400 mV
Stop Voltage: 700 mV
Step Voltage: 5 mV
Signal Avg. 8 A/D conv
Frequency: 2000 Hz
Range: 12.5 µA

Electrode: Carbon
Thin Film: Gold
Cell Type: Three Electrode
Waveform: Staircase

Background Subtraction:

☑ Use Background subtraction
Background Scan Plate Time: 1 seconds

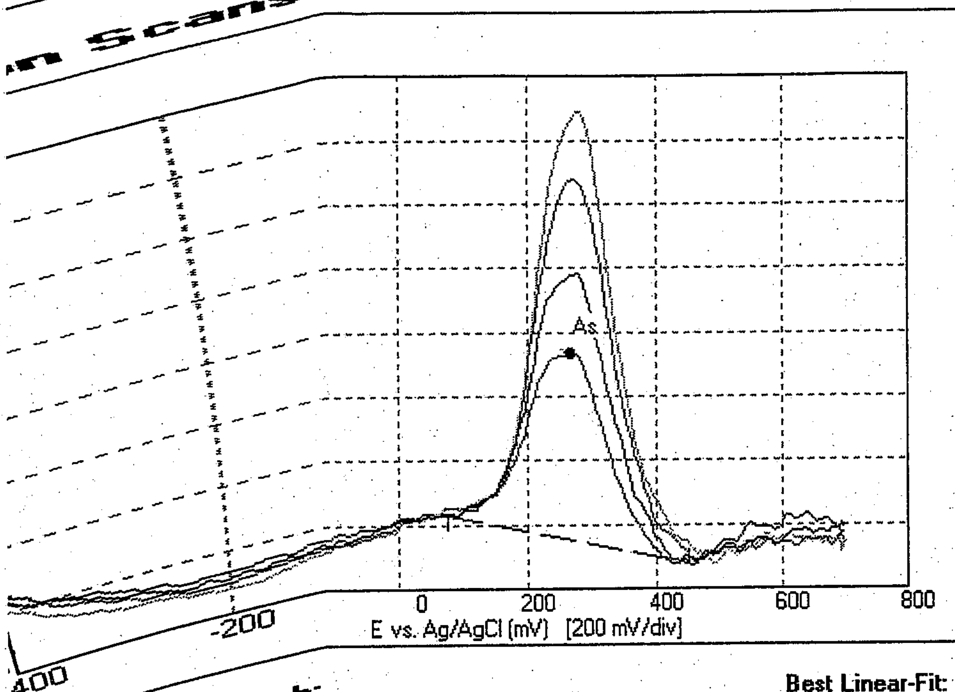
☐ Display measurement and background

...an Files\TraceDetect\Nano-Band Explorer
...ions\00916CURX\AS III LCS\AS III LCS.tcl

CalibrationTime/Date: 03:15 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

...n Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.900 mL

Options:

(•) Individual Standards Used

( ) Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

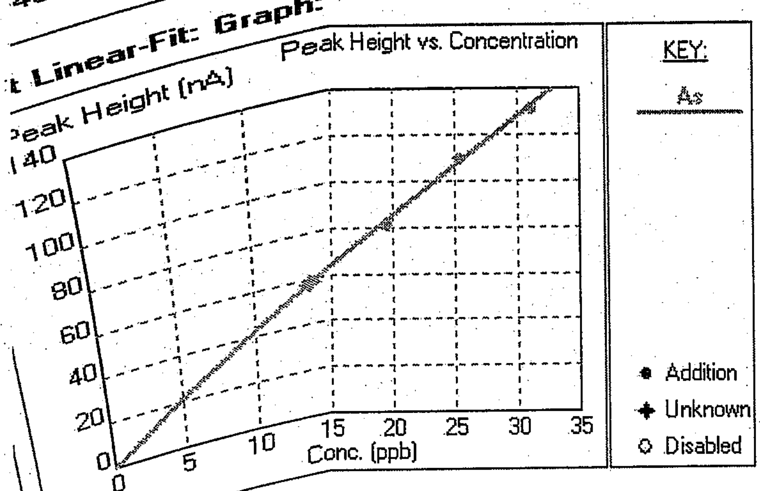
[■] Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

...t Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9980	0.235 ppb/nA	13.6 ppb
	Area	0.9985	17.6 ppb/nC	15.0 ppb

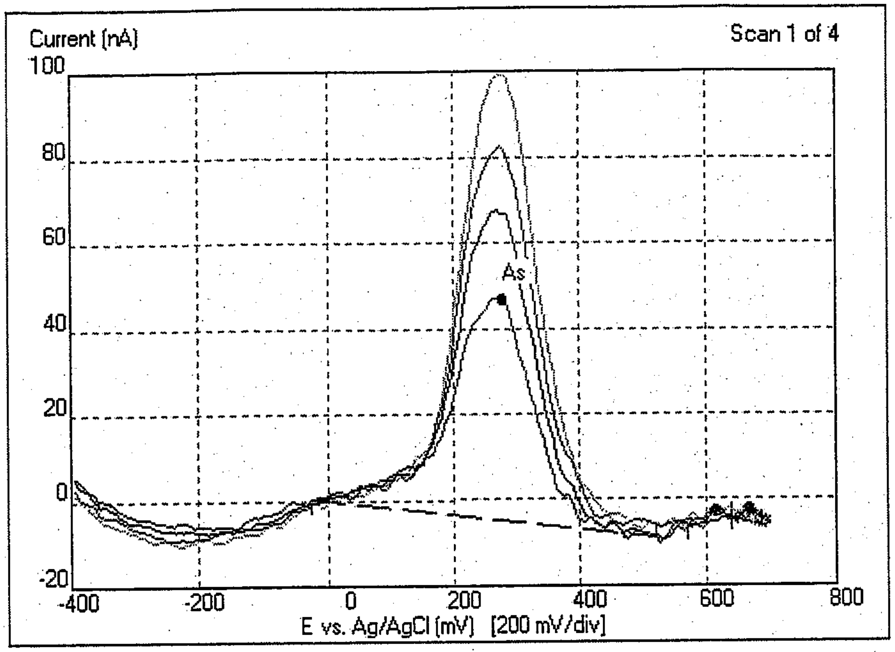
Addition and Peak Data:

	As			
Addition	Std (ppm)	Vol (uL)	Peak (nA)	Scan Status
Unknown			58.3 nA	
1st	1.00 ppm	300 uL	81.9 nA	Enabled
2nd	1.00 ppm	300 uL	110 nA	Enabled
3rd	1.00 ppm	300 uL	132 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS III LCSD	Report Time/Date:	03:20 PM on 16/Sep/2010
Data File Name:	AS III LCSD_15.tds	Analysis Time/Date:	03:20 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III LCSD\AS III LCSD_15.tds	CalibrationTime/Date:	03:20 PM on 16/Sep/2010
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	Scan of unknown sample	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (●) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	275	250	52.0 nA	834 pC	140 mV	Auto	15.1 ppb (Cal.)	18.0 ppb (Cal.)

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

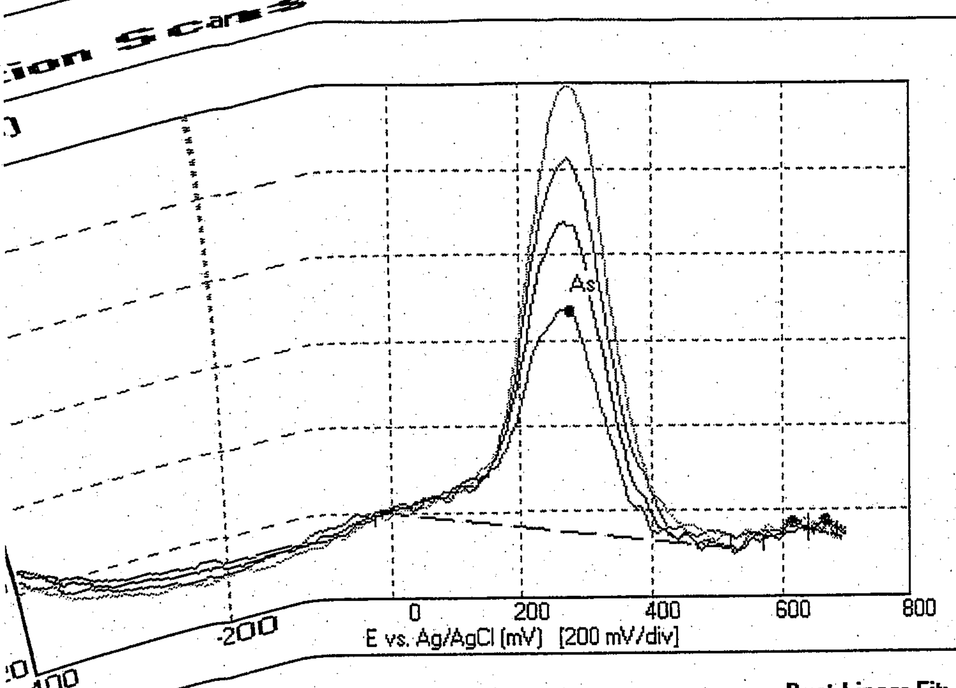
Background Scan Plate Time: 1 seconds

...eDetect
AS III LCSD
C:\Program Files\TraceDetect\Nano-Band Explorer
3.0\Sessions\00916CURX\AS III LCSD\AS III LCSD.tcl

CalibrationTime/Date: 03:20 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

...ion Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.750 mL

Options:

(•) Individual Standards Used

( ) Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

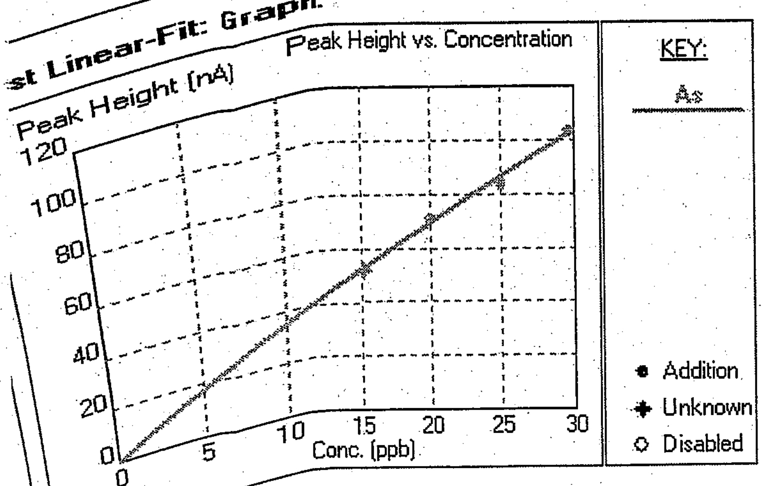
[■] Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

...st Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	**Height**	0.9936	0.288 ppb/nA	15.1 ppb
	Area	0.9591	19.9 ppb/nC	16.2 ppb

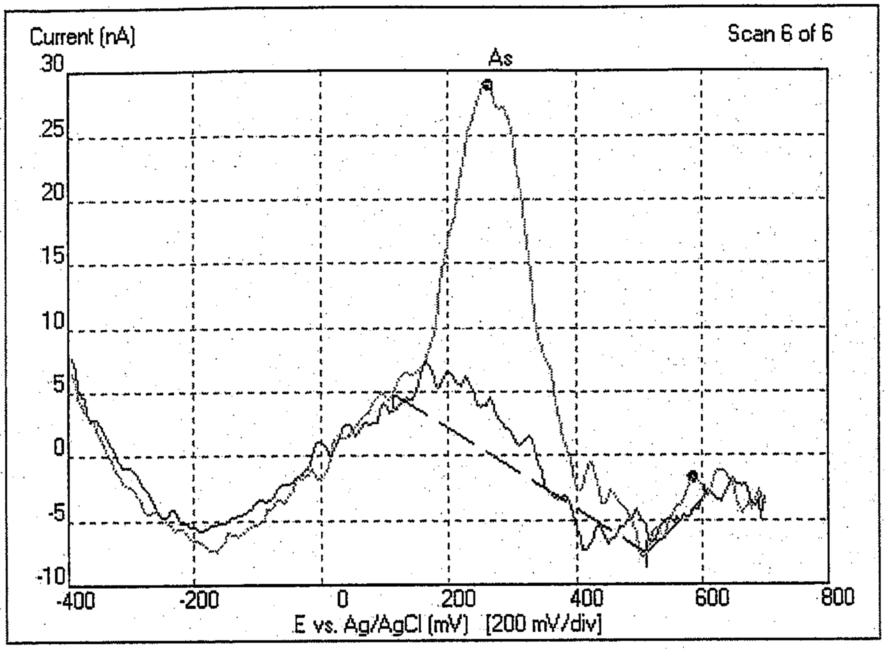
Addition and Peak Data:

Addition	As Std (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			52.0 nA	
1st	1.00 ppm	250 uL	71.4 nA	Enabled
2nd	1.00 ppm	250 uL	84.2 nA	Enabled
3rd	1.00 ppm	250 uL	104 nA	Enabled

TraceDetect Measurement Report

Session Name:	AS III L6TKA1AA 5X	Report Time/Date:	03:25 PM on 16/Sep/2010
Data File Name:	AS III L6TKA1AA 5X_5.tds	Analysis Time/Date:	03:24 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III L6TKA1AA 5X\AS III L6TKA1AA 5 X 5.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
	ND	Electrode Thin Film:	Gold
Scan ID:	L6TKA + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- ☑ Background Subtracted
- ☑ Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- ☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	260	250	28.8 nA	433 pC	140 mV	Auto	**6.76 ppb**	**40.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1 seconds	Clean Voltage:	500 mV
Plate Time:	40 seconds	Plate Voltage:	-400 mV
Start Voltage:	-400 mV	Signal Avg.	8 A/D conv
Stop Voltage:	700 mV	Frequency:	2000 Hz
Step Voltage:	5 mV	Range:	12.5 µA
Electrode:	Carbon	Waveform:	Staircase
Thin Film:	Gold		
Cell Type:	Three Electrode		

Background Subtraction:

☑ Use Background subtraction — Background Scan Plate Time: 1 seconds

☐ Display measurement and background

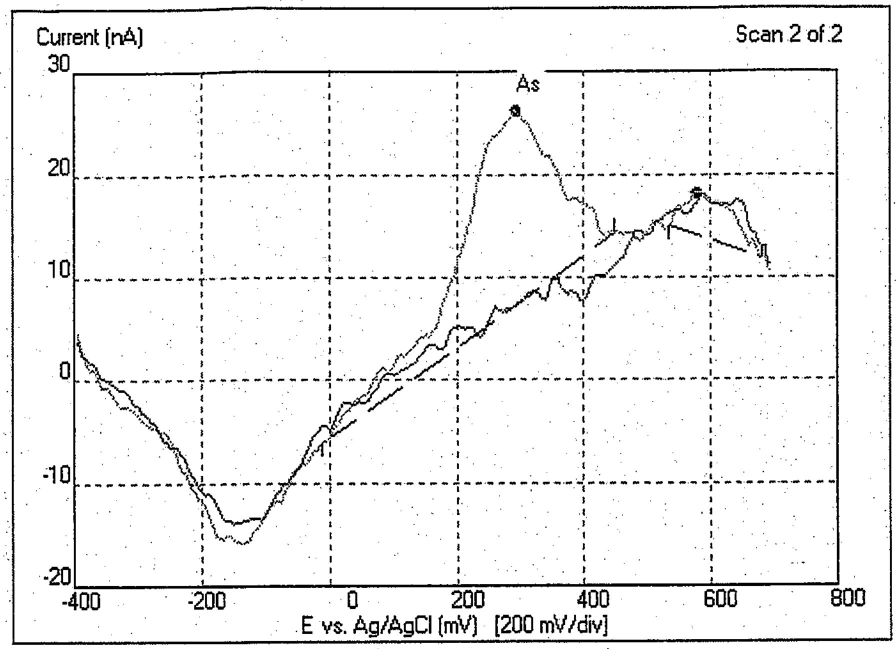
TraceDetect Measurement Report

Session Name:	AS V L6TKA1AC 5X
Data File Name:	AS V L6TKA1AC 5X_1.tds
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6TKA1AC 5X\AS V L6TKA1AC 5X_1.tds
Session Description:	
Scan ID:	L6TKA1AC + 2PPB AS III

ND

Report Time/Date:	03:31 PM on 16/Sep/2010
Analysis Time/Date:	03:30 PM on 16/Sep/2010
CalibrationTime/Date:	n.a.
Software Version:	3.0.5
Operator:	402582
Electrode Type:	Carbon
Electrode Thin Film:	Gold
Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	290	250	19.0 nA	336 pC	155 mV	Auto	**4.45 ppb**	**26.5 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

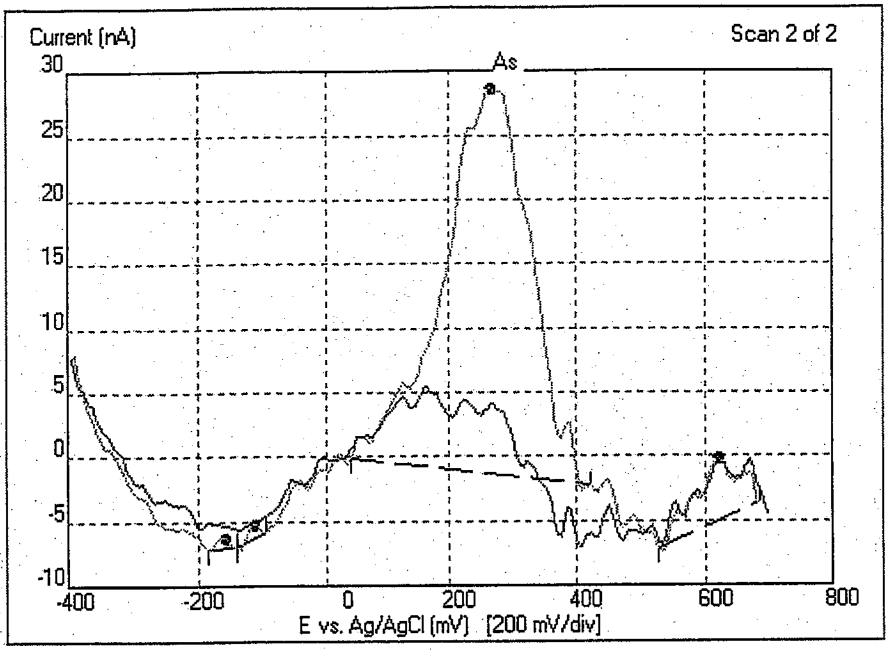
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	AS III L6JT81AA 5X	Report Time/Date:	03:28 PM on 16/Sep/2010
Data File Name:	AS III L6JT81AA 5X_1.tds	Analysis Time/Date:	03:27 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III L6JT81AA 5X\AS III L6JT81AA 5X_1.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
	ND	Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	L6JT81AA + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	30.0 nA	480 pC	150 mV	Auto	**7.05 ppb**	**42.0 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	μA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

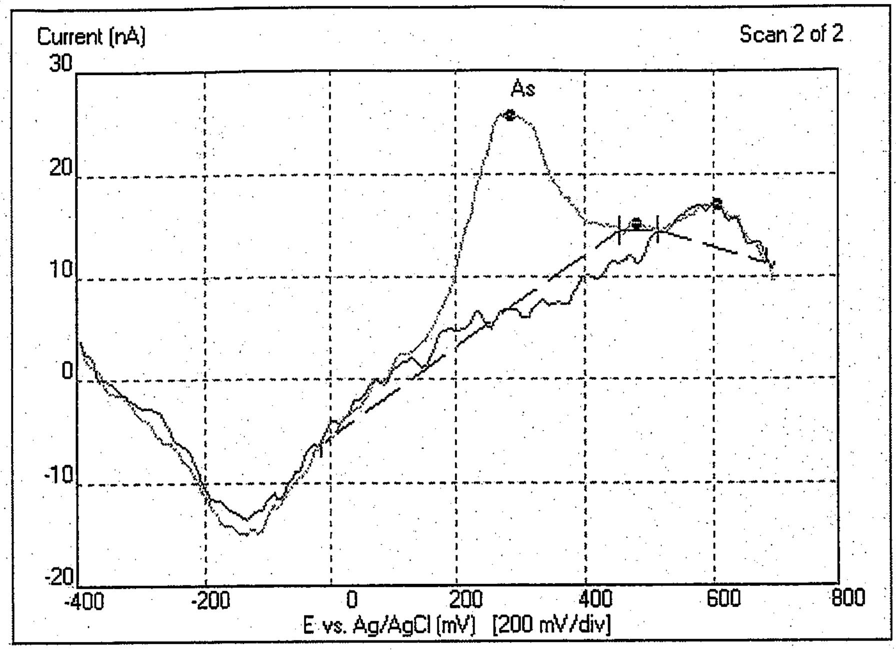
- [x] Use Background subtraction — Background Scan Plate Time: 1 seconds
- [ ] Display measurement and background

TraceDetect Measurement Report

Session Name:	AS V L6JT81AC 5X	Report Time/Date:	03:34 PM on 16/Sep/2010
Data File Name:	AS V L6JT81AC 5X_1.tds	Analysis Time/Date:	03:32 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6JT81AC 5X\AS V L6JT81AC 5X_1.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	L6JT81AC + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

P.D

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ( ) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- (•) No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	285	250	18.8 nA	316 pC	150 mV	Auto	**4.41 ppb**	**26.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

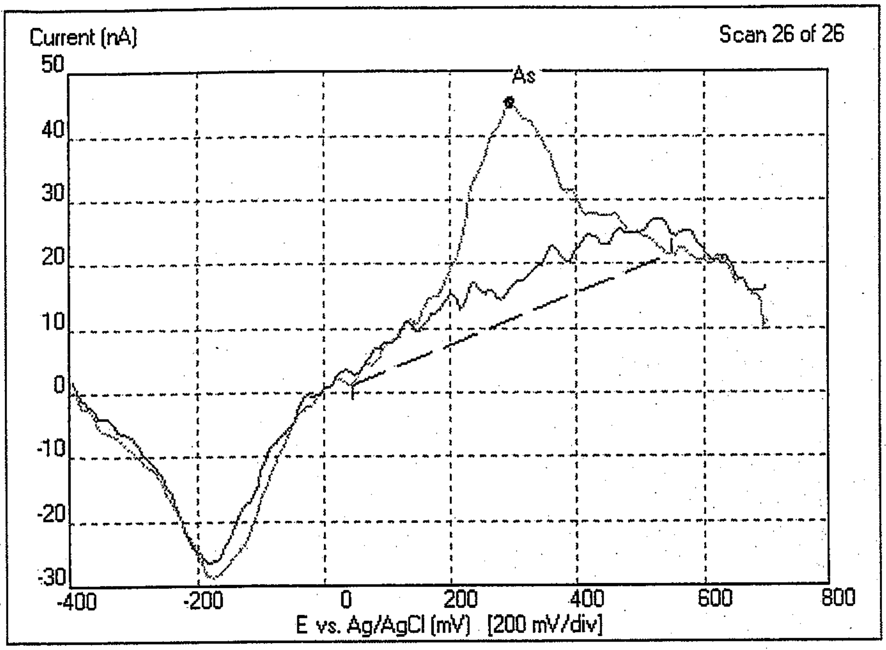
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE 2	Report Time/Date:	11:04 AM on 16/Sep/2010
Data File Name:	GOLD PLATE 2_25.tds	Analysis Time/Date:	11:03 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00915CURX\GOLD PLATE 2\GOLD PLATE 2_25.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
	ND	Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS V BLANK CURX + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	250	34.1 nA	683 pC	185 mV	Auto	**9.27 ppb**	**11.0 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1 seconds	Clean Voltage:	500 mV
Plate Time:	40 seconds	Plate Voltage:	-400 mV
Start Voltage:	-400 mV	Signal Avg.	8 A/D conv
Stop Voltage:	700 mV	Frequency:	2000 Hz
Step Voltage:	5 mV	Range:	12.5 µA
Electrode:	Carbon	Waveform:	Staircase
Thin Film:	Gold		
Cell Type:	Three Electrode		

Background Subtraction:

☑ Use Background subtraction

Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

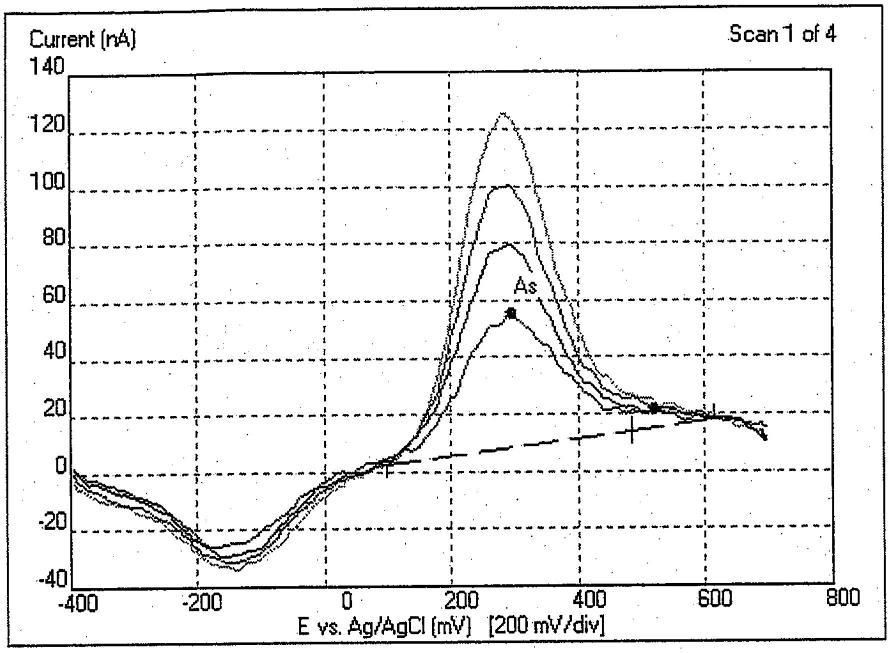
Session Name: AS V LCS CURX
Data File Name: AS V LCS CURX_16.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCS CURX\AS V LCS CURX_16.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 11:19 AM on 16/Sep/2010
Analysis Time/Date: 11:18 AM on 16/Sep/2010
CalibrationTime/Date: 10:20 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (•) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	300	47.0 nA	861 pC	180 mV	Auto	**7.36 ppb (Cal.)**	**8.77 ppb (Cal.)**

Measurement Scan Settings:

Clean Time: 0.1 seconds
Plate Time: 20 seconds
Clean Voltage: 500 mV
Plate Voltage: -400 mV

Start Voltage: -400 mV
Stop Voltage: 700 mV
Step Voltage: 5 mV
Signal Avg. 8 A/D conv
Frequency: 2000 Hz
Range: 12.5 μA

Electrode: Carbon
Thin Film: Gold
Cell Type: Three Electrode
Waveform: Staircase

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

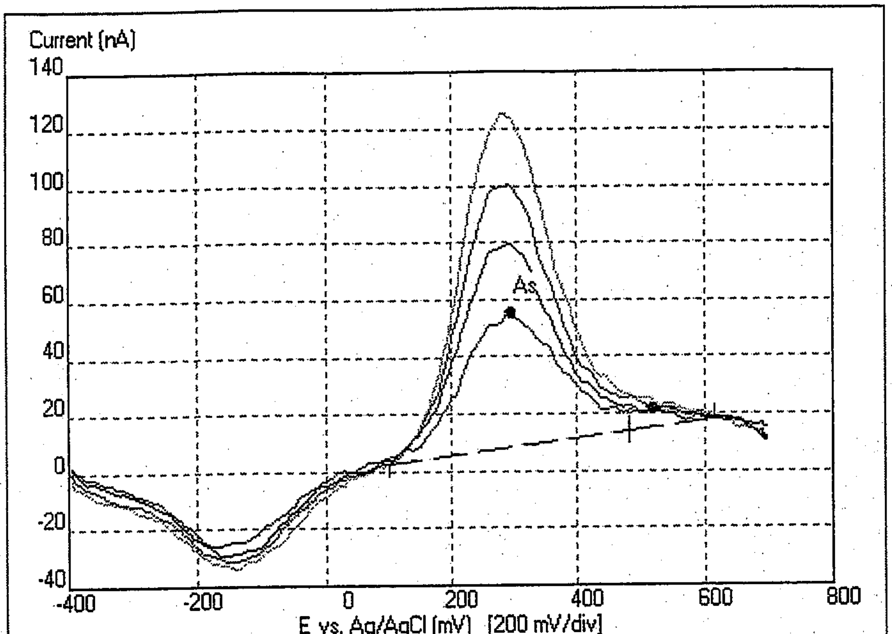
Background Scan Plate Time: 1 seconds

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V LCS CURX	CalibrationTime/Date:	11:19 AM on 16/Sep/2010
Calibration File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCS CURX\AS V LCS CURX.tcl	Software Version:	3.0.5
		Operator:	402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

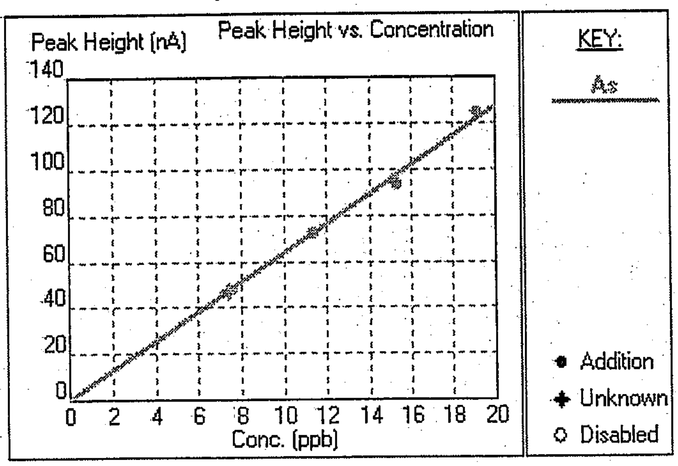
☐ Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9943	0.157 ppb/nA	7.36 ppb
	Area	0.9850	7.17 ppb/nC	6.00 ppb

Addition and Peak Data:

Addition	As			Scan Status
	Std. (ppm)	Vol. (uL)	Peak (nA)	
Unknown			47.0 nA	
1st	1.00 ppm	200 uL	73.0 nA	Enabled
2nd	1.00 ppm	200 uL	93.9 nA	Enabled
3rd	1.00 ppm	200 uL	125 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

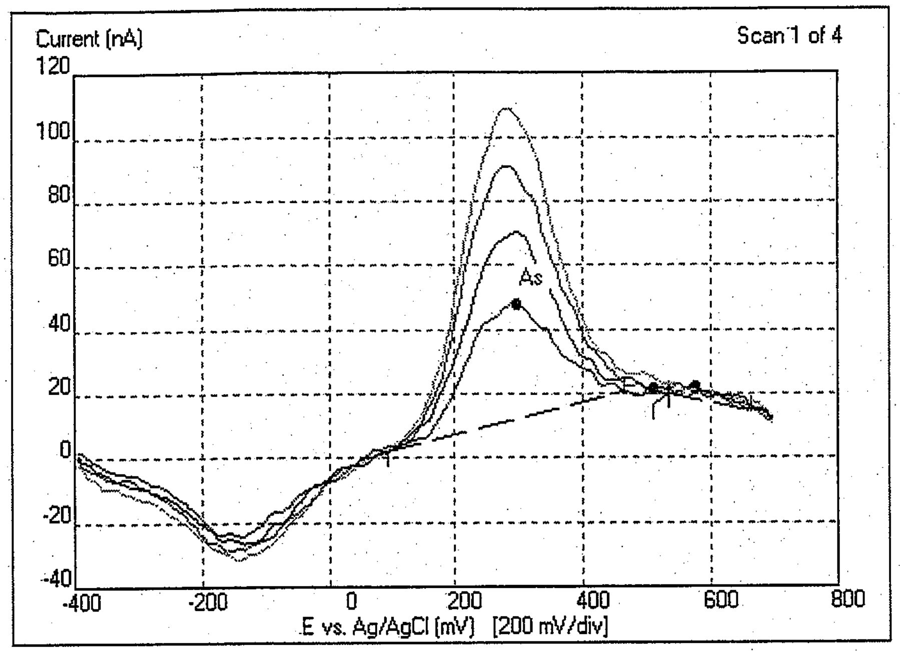
Session Name: AS V LCSD
Data File Name: AS V LCSD_15.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCSD\AS V LCSD_15.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 11:28 AM on 16/Sep/2010
Analysis Time/Date: 11:26 AM on 16/Sep/2010
CalibrationTime/Date: 11:27 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (●) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	295	300	36.4 nA	592 pC	155 mV	Manual	**7.07 ppb (Cal.)**	**8.42 ppb (Cal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	20	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

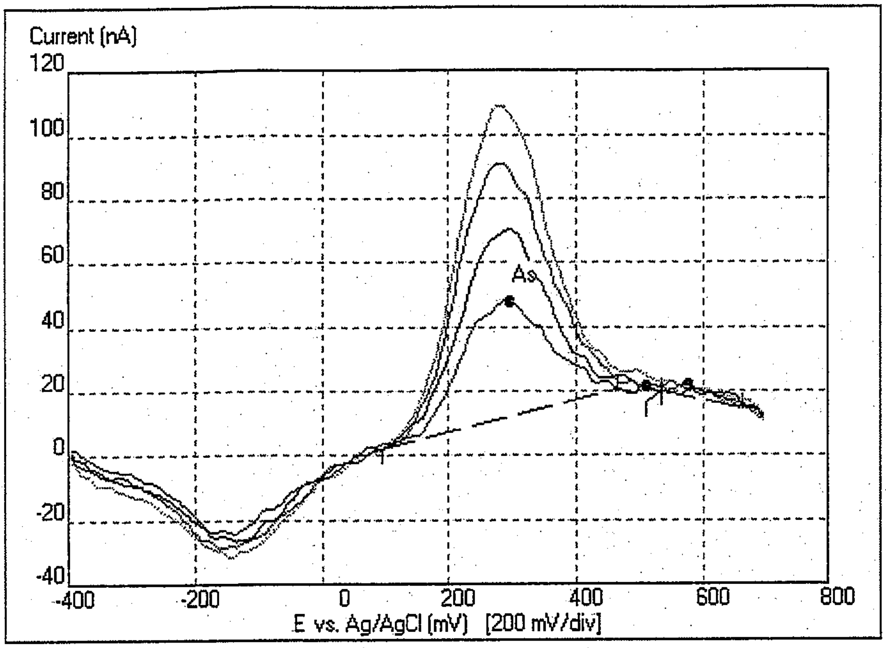
TraceDetect Method of Standard Additions Measurement Report

Session Name: AS V LCSD
Calibration File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCSD\AS V LCSD.tcl

CalibrationTime/Date: 11:28 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: **3**

Scans Averaged per Addition: **1**

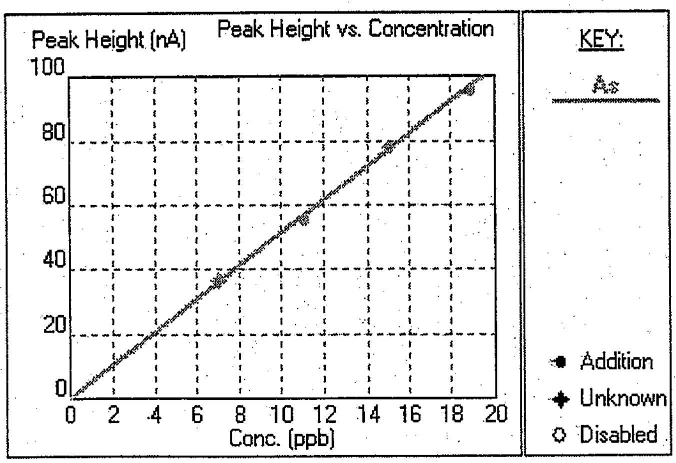
Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	**Height**	0.9986	0.195 ppb/nA	7.07 ppb
	Area	0.9961	11.8 ppb/nC	6.84 ppb

Addition and Peak Data:

Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			36.4 nA	
1st	1.00 ppm	200 uL	56.1 nA	Enabled
2nd	1.00 ppm	200 uL	78.2 nA	Enabled
3rd	1.00 ppm	200 uL	96.1 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

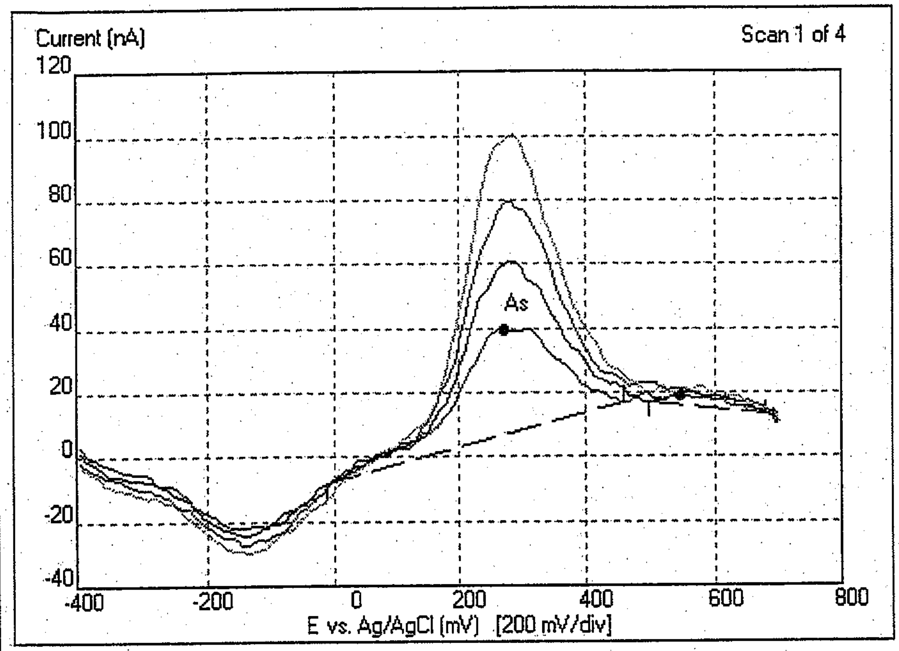
Session Name: AS V L6HQJMS
Data File Name: AS V L6HQJMS_16.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJMS\AS V L6HQJMS_16.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 11:54 AM on 16/Sep/2010
Analysis Time/Date: 11:53 AM on 16/Sep/2010
CalibrationTime/Date: 11:54 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

◉ This Scan is part of a MSA Measurement
○ MSA Measurement used as Cal. Curve
○ Calibration Curve Used
○ No Calibration Available
☑ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	270	300	33.1 nA	621 pC	180 mV	Manual	6.49 ppb (Cal.)	7.72 ppb (Cal.)

Measurement Scan Settings:

Clean Time: 0.1 seconds
Plate Time: 20 seconds
Clean Voltage: 500 mV
Plate Voltage: -400 mV

Start Voltage: -400 mV
Stop Voltage: 700 mV
Step Voltage: 5 mV
Signal Avg.: 8 A/D conv
Frequency: 2000 Hz
Range: 12.5 µA

Electrode: Carbon
Thin Film: Gold
Cell Type: Three Electrode
Waveform: Staircase

Background Subtraction:

☑ Use Background subtraction
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

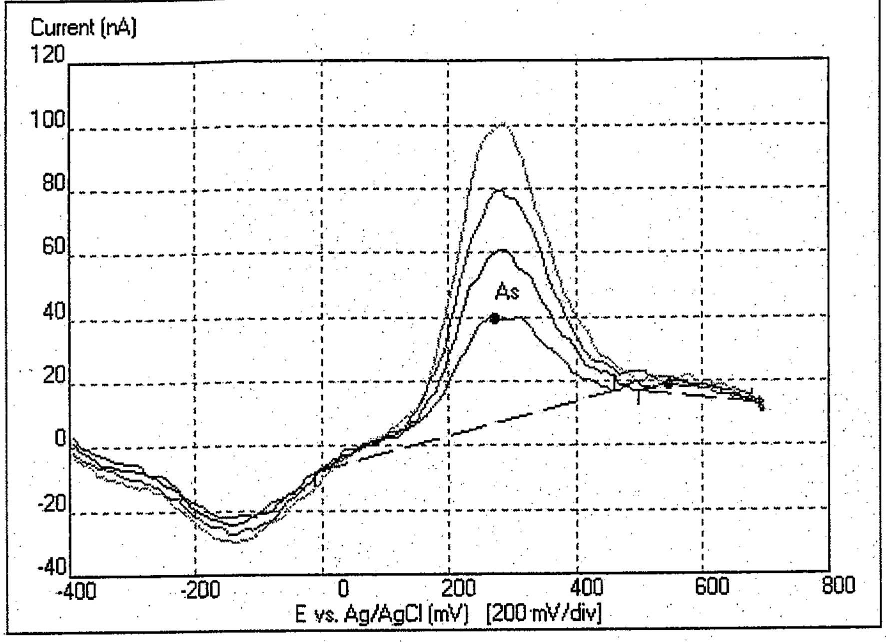
TraceDetect Method of Standard Additions Measurement Report

Session Name: AS V L6HQJMS
Calibration File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJMS\AS V L6HQJMS.tcl

CalibrationTime/Date: 11:54 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

(•) Individual Standards Used

( ) Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

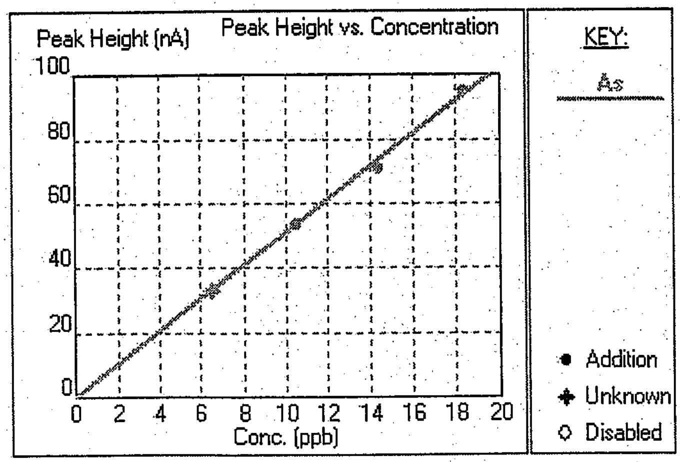
Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9963	0.196 ppb/nA	6.49 ppb
	Area	0.9833	10.6 ppb/nC	6.51 ppb

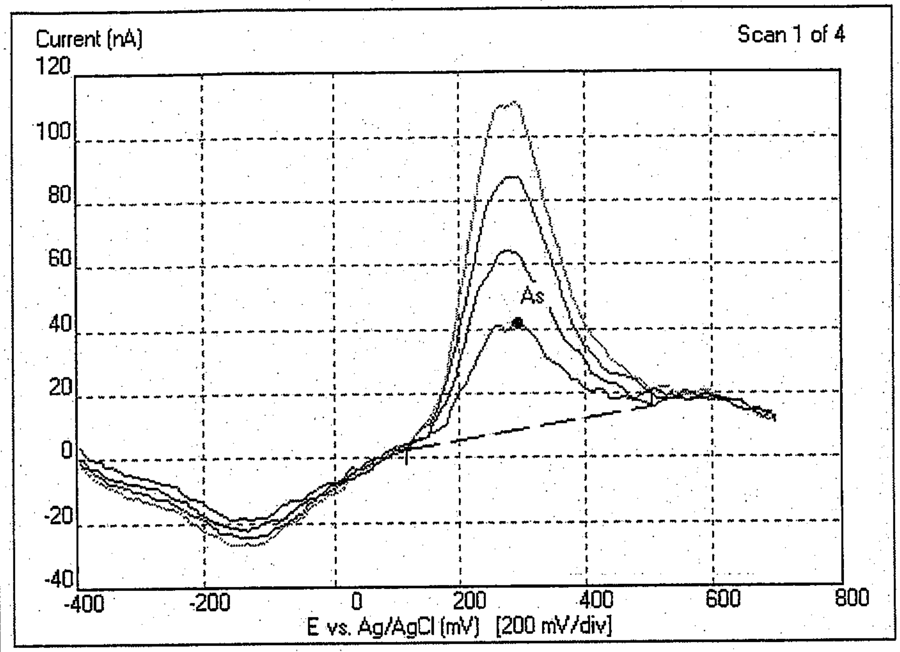
Addition and Peak Data:

Addition	As			
	Std (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			33.1 nA	
1st	1.00 ppm	200 uL	53.9 nA	Enabled
2nd	1.00 ppm	200 uL	71.3 nA	Enabled
3rd	1.00 ppm	200 uL	95.1 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V L6HQJ MSD	Report Time/Date:	12:02 PM on 16/Sep/2010
Data File Name:	AS V L6HQJ MSD_15.tds	Analysis Time/Date:	12:01 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJ MSD\AS V L6HQJ MSD_15.tds	CalibrationTime/Date:	12:02 PM on 16/Sep/2010
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	Scan of unknown sample	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

◉ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

○ No Calibration Available

☑ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	300	33.5 nA	572 pC	160 mV	Auto	5.12 ppb (Cal.)	6.10 ppb (Cal.)

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	20	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

Background Scan Plate Time: 1 seconds

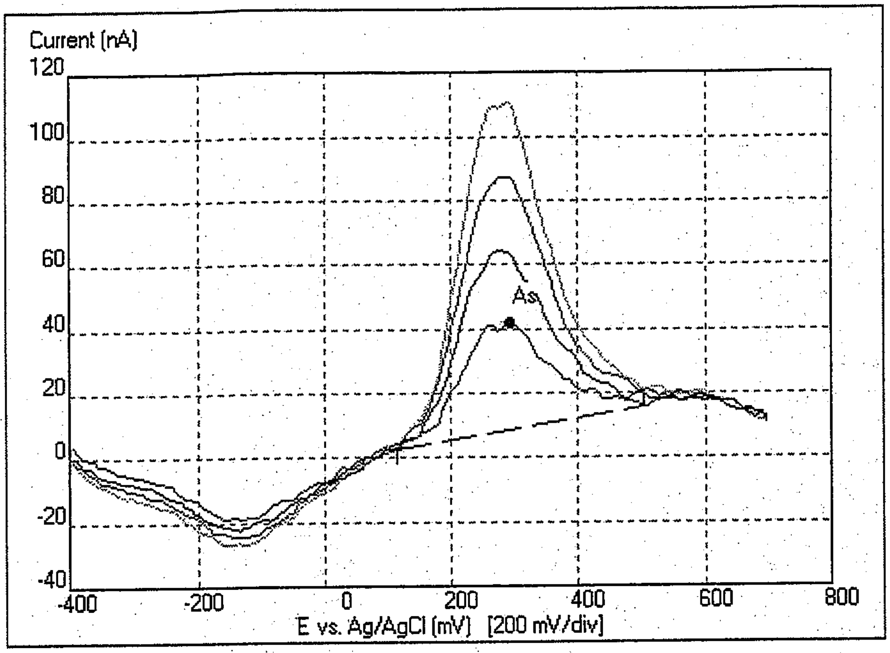
☐ Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V L6HQJ MSD	CalibrationTime/Date:	12:02 PM on 16/Sep/2010
Calibration File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJ MSD\AS V L6HQJ MSD.tcl	Software Version:	3.0.5
		Operator:	402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

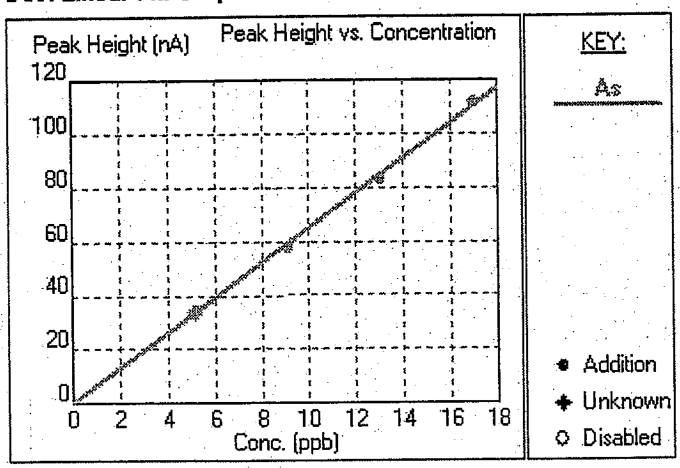
☐ Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9987	0.154 ppb/nA	5.12 ppb
	Area	0.9937	6.84 ppb/nC	3.61 ppb

Addition and Peak Data:

Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			33.5 nA	
1st	1.00 ppm	200 uL	58.4 nA	Enabled
2nd	1.00 ppm	200 uL	83.7 nA	Enabled
3rd	1.00 ppm	200 uL	112 nA	Enabled

0259373 Arsenic (III) Speciation by ASV

Analyst: **Ray Shock**

Work Order	Result	Units	RL	PrepAnalysis	Analysis Time	dil	Inst	BlankRL	MDLChk	Expired	Expiration Prep -- Anl	MS Run#	Client
L6TJ8-1-AA	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07		
L6TKA-1-AA	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07		
L6311-1-AA B	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		10/07		

Work Order	Exc. Cod	True Spike	Measured Spike	Units	% Recovery	Control Limits	RPD	RPD Limit	Prep - Analysis
L6311 C		20	16.2	ug/L	81	(25 - 130)	10.52	(0-50)	09/16/10
L6311 C			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6311 L		20	18	ug/L	90	(25 - 130)	10.52	(0-50)	09/16/10
L6311 L			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10

0259371 Arsenic (V) Speciation by ASV

Analyst: **Ray Shock**

Work Order	Result	Units	RL	PrepAnalysis	Analysis Time	dil	Inst	BlankRL	MDLChk	Expired	Expiration Prep – Anl	MS Run#	Client
L6HQJ-1-AC	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		09/28	0259216	
L6HQJ-1-AC	NA	ug/L		09/16/10	00:00	1	AS35				09/28	0259216	
L6TJ8-1-AC	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07	0259216	
L6TKA-1-AC	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07	0259216	
L631H-1-AA B	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		09/28		

Work Order	Exc. Cod	True Spike	Measured Spike	Units	% Recovery	Control Limits	RPD	RPD Limit	Prep - Analysis
L631H C		20	8.77	ug/L	43.85	(25 - 130)	4.07	(0-50)	09/16/10
L631H C			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L631H L		20	8.42	ug/L	42.1	(25 - 130)	4.07	(0-50)	09/16/10
L631H L			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6HQJ S		20	7.72	ug/L	38.6	(25 - 130)	23.44	(0-50)	09/16/10
L6HQJ S			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6HQJ D		20	6.1	ug/L	30.5	(25 - 130)	23.44	(0-50)	09/16/10
L6HQJ D			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10

North Canton

END OF REPORT

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Road
Nashville, TN 37204
Tel: 800-765-0980

TestAmerica Job ID: NTG0744
TestAmerica Sample Delivery Group: NTG0744
Client Project/Site: [none]
Client Project Description: Kingston Fossil Plant (Prior 091109)

For:
TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748

Attn: William Rogers

JAMitchell

Authorized for release by:
10/18/2010 12:29 PM

Johnny A. Mitchell
Laboratory Director
johnny.mitchell@testamericainc.com

Designee for

Mark Hollingsworth
Laboratory Director
mark.hollingsworth@testamericainc.com

LINKS

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Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Table of Contents

Sample Summary

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
NTG0744-02	ASH-BT-001 (untreated)	Ash	07/07/10 10:15	07/09/10 09:50
NTG0744-03	ASH-BT-001 (treated)	Ash	07/07/10 10:15	07/09/10 09:50
NTG0744-04	BLK1	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-05	BLK2	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-06	BLK3	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-07	untreated DI Water leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-08	Untreated pH 5 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-09	untreated pH 7 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-10	untreated pH10 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-11	lime treated DI Water leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-12	Lime Treated pH 5 Leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-13	Lime Treated pH 7 Leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-14	Lime Treated pH 10 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-15	Untreated- 10:1ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-16	untreated - 5:1 ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-17	untreated- 2:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-18	untreated- 1:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-19	Untreated - 1:2 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-20	Treated - 10:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-21	Treated - 5:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-22	Treated - 2:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-23	Treated - 1:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-24	Blank	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-25	Blank	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-26	T01 10:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-27	T02 5:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-28	T03 2:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-29	T04 1:1	Leachate	09/09/10 00:01	07/09/10 09:50

Notes

None.

Qualifier Definition/Glossary

Qualifiers

WetChem

Qualifier	Qualifier Description
HT3	Sample received with insufficient holding time remaining for analysis to be performed within the method's holding time requirements.
M4	The MS/MSD required a dilution due to matrix interference. Because of this dilution, the matrix spike concentrations in the sample were reduced to a level where the recovery calculation does not provide useful information. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
RL1	Reporting limit raised due to sample matrix effects.

Glossary

Glossary	Glossary Description
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis.

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: ASH-BT-001 (untreated)

Lab Sample ID: NTG0744-02

Date Collected: 07/07/10 10:15
Matrix: Ash
Date Received: 07/09/10 09:50

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Phosphate	2850		30.6		mg/kg		07/14/10 12:20	07/16/10 11:55	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: ASH-BT-001 (treated)
Lab Sample ID: NTG0744-03
Date Collected: 07/07/10 10:15
Matrix: Ash
Date Received: 07/09/10 09:50

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Phosphate	2950		30.6		mg/kg		07/14/10 12:20	07/16/10 11:58	1

Client Sample ID: BLK1
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-04
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:53	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:53	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**428**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.38**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: BLK2
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-05
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:56	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:56	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**762**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**44.9**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**1.20**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: BLK3
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-06
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:59	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:59	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	751	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	18.6		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	1.39		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: untreated DI Water leachate

Lab Sample ID: NTG0744-07

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	16.3		2.00		ug/L		08/12/10 09:35	08/13/10 12:03	1
Selenium	0.0410		0.00200		mg/L		08/12/10 09:35	08/13/10 12:03	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	489	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	200		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.3		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Untreated pH 5 leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-08
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	18.2		2.00		ug/L		08/12/10 09:35	08/13/10 12:06	1
Selenium	0.0487		0.00200		mg/L		08/12/10 09:35	08/13/10 12:06	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	477	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	224		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.55		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: untreated pH 7 leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-09
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	26.5		2.00		ug/L		08/12/10 09:35	08/13/10 12:09	1
Selenium	0.0655		0.00200		mg/L		08/12/10 09:35	08/13/10 12:09	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	509	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	2740		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.13		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: untreated pH10 leachate

Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-10
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	85.7		0.100		mg/L		08/12/10 09:00	08/12/10 15:22	1
Barium	15.4		0.100		mg/L		08/12/10 09:00	08/13/10 10:53	10
Beryllium	0.0423		0.00400		mg/L		08/12/10 09:00	08/12/10 15:22	1
Boron	4.32		0.500		mg/L		08/12/10 09:00	08/13/10 10:53	10
Cobalt	0.126		0.0200		mg/L		08/12/10 09:00	08/12/10 15:22	1
Iron	9.10		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Magnesium	62.2		1.00		mg/L		08/12/10 09:00	08/12/10 15:22	1
Manganese	0.727		0.0150		mg/L		08/12/10 09:00	08/12/10 15:22	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Strontium	14.3		0.500		mg/L		08/12/10 09:00	08/13/10 10:53	10
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Titanium	1.34		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.0148		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Chromium	0.138		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Copper	0.208		0.00500		mg/L		08/12/10 09:00	08/13/10 11:12	1
Lead	0.0322		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Nickel	0.209		0.00500		mg/L		08/12/10 09:00	08/13/10 11:12	1
Thallium	0.0112		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1

Method: EPA 200.8 - Total Metals by EPA 200.8 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Zinc	0.881		0.250		mg/L		08/12/10 09:00	08/13/10 11:30	5

Method: EPA 200.8 - Total Metals by EPA 200.8 - RE2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.416		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100
Cadmium	ND		0.100		mg/L		08/12/10 09:00	08/13/10 11:33	100
Selenium	ND		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100
Silver	ND		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	0.214		0.100		mg/L		08/06/10 13:00	08/09/10 11:24	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	568	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5490		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND	RL1	5.00		mg/L		08/01/10 19:19	08/01/10 19:19	5
Sulfate	23.3		5.00		mg/L		08/01/10 19:19	08/01/10 19:19	5

Client Sample ID: untreated pH10 leachate

Lab Sample ID: NTG0744-10

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	0.655		0.306		mg/L		08/06/10 13:00	08/09/10 11:24	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.4		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

1 2 3 4 5 6 7 8 9 10 11 12

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: lime treated DI Water leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-11
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 12:12	1
Selenium	**0.0121**		0.00200		mg/L		08/12/10 09:35	08/13/10 12:12	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**299**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**3980**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**12.0**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: Lime Treated pH 5 Leachate

Lab Sample ID: NTG0744-12

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	18.9		2.00		ug/L		08/12/10 09:35	08/13/10 12:23	1
Selenium	0.0448		0.00200		mg/L		08/12/10 09:35	08/13/10 12:23	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	391	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	13800		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.75		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Lime Treated pH 7 Leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-13
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		08/12/10 09:00	08/12/10 15:26	1
Barium	**1.51**		0.0100		mg/L		08/12/10 09:00	08/12/10 15:26	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:26	1
Boron	**4.30**		0.500		mg/L		08/12/10 09:00	08/13/10 10:56	10
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:26	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Magnesium	**85.1**		1.00		mg/L		08/12/10 09:00	08/12/10 15:26	1
Manganese	**0.107**		0.0150		mg/L		08/12/10 09:00	08/12/10 15:26	1
Molybdenum	**0.104**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Strontium	**11.7**		0.500		mg/L		08/12/10 09:00	08/13/10 10:56	10
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.0298**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Arsenic	**0.0142**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:15	1
Chromium	**0.0632**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Copper	**0.00900**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:15	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Nickel	**0.0215**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:15	1
Selenium	**0.0610**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Thallium	**0.00295**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:15	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/06/10 13:00	08/09/10 11:25	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**389**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**9440**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**14.0**		5.00		mg/L		08/01/10 20:20	08/01/10 20:20	5
Sulfate	**134**		5.00		mg/L		08/01/10 20:20	08/01/10 20:20	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	ND		0.306		mg/L		08/06/10 13:00	08/09/10 11:25	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Analytical Data

Client Sample ID: Lime Treated pH 7 Leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-13
Matrix: Leachate

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.15		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Lime Treated pH 10 leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-14
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.99		2.00		ug/L		08/12/10 09:35	08/13/10 12:26	1
Selenium	0.0509		0.00200		mg/L		08/12/10 09:35	08/13/10 12:26	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	369	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	6060		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.4		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: Untreated- 10:1ratio

Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-15

Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4.49**		0.100		mg/L		08/12/10 09:00	08/12/10 15:29	1
Barium	**0.196**		0.0100		mg/L		08/12/10 09:00	08/12/10 15:29	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:29	1
Boron	**1.48**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:29	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Magnesium	**2.14**		1.00		mg/L		08/12/10 09:00	08/12/10 15:29	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:29	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Strontium	**0.568**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.0103**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Arsenic	**0.0582**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:18	1
Chromium	**0.0197**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Copper	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:18	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:18	1
Selenium	**0.0218**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:18	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	**0.124**		0.100		mg/L		08/13/10 12:23	08/16/10 09:45	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**109**		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND	RL1	5.00		mg/L		08/12/10 23:58	08/12/10 23:58	5
Sulfate	**13.1**		5.00		mg/L		08/12/10 23:58	08/12/10 23:58	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	**0.379**		0.306		mg/L		08/13/10 12:23	08/16/10 09:45	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**8.75**		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

1 2 3 4 5 6 7 8 9 10 11 12

Client Sample ID: untreated - 5:1 ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-16
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	49.5		2.00		ug/L		08/12/10 09:35	08/13/10 12:29	1
Selenium	0.0378		0.00200		mg/L		08/12/10 09:35	08/13/10 12:29	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	154		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.93		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: untreated- 2:1 Ratio

Lab Sample ID: NTG0744-17

Date Collected: 08/09/10 13:20

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	43.6		2.00		ug/L		08/12/10 09:35	08/13/10 12:33	1
Selenium	0.0589		0.00200		mg/L		08/12/10 09:35	08/13/10 12:33	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	222		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.86		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: untreated- 1:1 Ratio

Lab Sample ID: NTG0744-18

Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	41.6		2.00		ug/L		08/12/10 09:35	08/13/10 12:36	1
Selenium	0.109		0.00200		mg/L		08/12/10 09:35	08/13/10 12:36	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	291		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.87		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Untreated - 1:2 Ratio

Lab Sample ID: NTG0744-19

Date Collected: 08/09/10 13:20

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	34.7		2.00		ug/L		08/12/10 09:35	08/13/10 12:39	1
Selenium	0.305		0.00200		mg/L		08/12/10 09:35	08/13/10 12:39	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	203		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.57		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Treated - 10:1 Ratio

Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-20
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4.57**		0.100		mg/L		08/12/10 09:00	08/12/10 15:32	1
Barium	**5.53**		0.0100		mg/L		08/12/10 09:00	08/12/10 15:32	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:32	1
Boron	**0.0843**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:32	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Magnesium	ND		1.00		mg/L		08/12/10 09:00	08/12/10 15:32	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:32	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Strontium	**5.76**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Arsenic	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:21	1
Chromium	**0.00621**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Copper	**0.0123**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:21	1
Lead	**0.00226**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:21	1
Selenium	**0.0136**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:21	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	**1.63**		0.100		mg/L		08/13/10 12:23	08/16/10 09:46	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**4460**		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**7.62**		5.00		mg/L		08/13/10 00:52	08/13/10 00:52	5
Sulfate	ND	RL1	5.00		mg/L		08/13/10 00:52	08/13/10 00:52	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	**4.99**		0.306		mg/L		08/13/10 12:23	08/16/10 09:46	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**12.2**		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

1 2 3 4 5 6 7 8 9 10 11 12

Client Sample ID: Treated - 5:1 Ratio

Lab Sample ID: NTG0744-21

Date Collected: 08/09/10 13:20

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.02		2.00		ug/L		08/12/10 09:35	08/13/10 12:42	1
Selenium	0.0155		0.00200		mg/L		08/12/10 09:35	08/13/10 12:42	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5060		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Treated - 2:1 Ratio

Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-22

Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.50		2.00		ug/L		08/12/10 09:35	08/13/10 12:46	1
Selenium	0.0253		0.00200		mg/L		08/12/10 09:35	08/13/10 12:46	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5430		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Treated - 1:1 Ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-23
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.54		2.00		ug/L		08/12/10 09:35	08/13/10 12:49	1
Selenium	0.0335		0.00200		mg/L		08/12/10 09:35	08/13/10 12:49	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5560		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Blank

Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-24

Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 12:52	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 12:52	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.14**		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Blank
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-25
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**7.86**		0.100		mg/L		09/14/10 08:35	09/15/10 15:33	1
Barium	**2.83**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:33	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:33	1
Boron	**0.358**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:33	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:33	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:33	1
Molybdenum	**0.0537**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	**3.86**		0.250		mg/L		09/14/10 08:35	09/16/10 09:44	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00218**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Arsenic	**0.00357**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:07	1
Chromium	**0.0404**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Copper	**0.0268**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:07	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:07	1
Selenium	**0.0285**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:07	1

Analytical Data

Client Sample ID: T01 10:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-26
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**19.4**		0.100		mg/L		09/14/10 08:35	09/15/10 15:37	1
Barium	**1.57**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:37	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:37	1
Boron	**1.44**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:37	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:37	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:37	1
Molybdenum	**0.0816**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	**4.39**		0.250		mg/L		09/14/10 08:35	09/16/10 09:47	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00342**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Arsenic	**0.00813**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:10	1
Chromium	**0.0600**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Copper	**0.0164**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:10	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:10	1
Selenium	**0.0727**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:10	1

1 2 3 4 5 6 7 8 9 10 11 12

Client Sample ID: T02 5:1

Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-27

Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**22.6**		0.100		mg/L		09/14/10 08:35	09/15/10 15:40	1
Barium	**1.24**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:40	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:40	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:40	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:40	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:40	1
Molybdenum	**0.112**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**1.99**		0.250		mg/L		09/14/10 08:35	09/16/10 09:50	5
Strontium	**4.34**		0.250		mg/L		09/14/10 08:35	09/16/10 09:50	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00326**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Arsenic	**0.00855**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:13	1
Chromium	**0.0793**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Copper	**0.0137**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:13	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:13	1
Selenium	**0.114**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:13	1

Client Sample ID: T03 2:1

Lab Sample ID: NTG0744-28

Date Collected: 09/09/10 00:01

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24.6**		0.100		mg/L		09/14/10 08:35	09/15/10 15:43	1
Barium	**0.640**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:43	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:43	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:43	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:43	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:43	1
Molybdenum	**0.178**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**3.83**		0.250		mg/L		09/14/10 08:35	09/16/10 09:53	5
Strontium	**3.03**		0.250		mg/L		09/14/10 08:35	09/16/10 09:53	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00540**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Arsenic	**0.0105**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:17	1
Chromium	**0.125**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Copper	**0.00911**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:17	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:17	1
Selenium	**0.201**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:17	1

Client Sample ID: T04 1:1

Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-29

Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24.9**		0.100		mg/L		09/14/10 08:35	09/15/10 15:46	1
Barium	**0.531**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:46	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:46	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:46	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:46	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:46	1
Molybdenum	**0.306**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**5.58**		0.250		mg/L		09/14/10 08:35	09/16/10 09:57	5
Strontium	**2.69**		0.250		mg/L		09/14/10 08:35	09/16/10 09:57	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00688**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Arsenic	**0.0126**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:20	1
Chromium	**0.199**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Copper	**0.00768**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:20	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:20	1
Selenium	**0.356**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:20	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Lab Sample ID: 10G4886-BLK1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BLK1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		08/12/10 09:00	08/12/10 15:13	1
Barium	ND		0.0100		mg/L		08/12/10 09:00	08/12/10 15:13	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:13	1
Boron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:13	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Magnesium	ND		1.00		mg/L		08/12/10 09:00	08/12/10 15:13	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:13	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Strontium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1

Lab Sample ID: 10G4886-BS1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BS1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Aluminum	2.00	2.09		mg/L		104	85 - 115
Barium	2.00	2.18		mg/L		109	85 - 115
Beryllium	0.0500	0.0516		mg/L		103	85 - 115
Boron	1.00	1.06		mg/L		106	85 - 115
Cobalt	0.500	0.508		mg/L		102	85 - 115
Iron	1.00	0.998		mg/L		100	85 - 115
Magnesium	5.00	5.32		mg/L		106	85 - 115
Manganese	0.500	0.514		mg/L		103	85 - 115
Molybdenum	0.500	0.487		mg/L		97	85 - 115
Strontium	1.00	1.03		mg/L		103	85 - 115
Tin	1.00	1.11		mg/L		111	85 - 115
Titanium	1.00	1.07		mg/L		107	85 - 115

Lab Sample ID: 10G4886-BSD1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BSD1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Aluminum	2.00	2.09		mg/L		104	85 - 115	0.1	20
Barium	2.00	2.17		mg/L		108	85 - 115	0.7	20
Beryllium	0.0500	0.0514		mg/L		103	85 - 115	0.4	20
Boron	1.00	1.06		mg/L		106	85 - 115	0.7	20
Cobalt	0.500	0.504		mg/L		101	85 - 115	0.9	20
Iron	1.00	1.01		mg/L		101	85 - 115	1	20
Magnesium	5.00	5.30		mg/L		106	85 - 115	0.4	20
Manganese	0.500	0.517		mg/L		103	85 - 115	0.6	20
Molybdenum	0.500	0.494		mg/L		99	85 - 115	1	20
Strontium	1.00	1.03		mg/L		103	85 - 115	0.7	20
Tin	1.00	1.10		mg/L		110	85 - 115	1	20
Titanium	1.00	1.06		mg/L		106	85 - 115	0.7	20

1 2 3 4 5 6 7 8 9 10 11 12

Method: EPA 200.7 - Total Metals by EPA Method 200.7 (Continued)

Lab Sample ID: 10I1524-BLK1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BLK1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		09/14/10 08:35	09/15/10 15:24	1
Barium	ND		0.0100		mg/L		09/14/10 08:35	09/15/10 15:24	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:24	1
Boron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:24	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:24	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:24	1
Molybdenum	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Strontium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1

Lab Sample ID: 10I1524-BS1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BS1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Aluminum	2.00	2.14		mg/L		107	85 - 115
Barium	2.00	2.08		mg/L		104	85 - 115
Beryllium	0.0500	0.0505		mg/L		101	85 - 115
Boron	1.00	1.05		mg/L		105	85 - 115
Cobalt	0.500	0.488		mg/L		98	85 - 115
Iron	1.00	1.05		mg/L		105	85 - 115
Magnesium	5.00	5.08		mg/L		102	85 - 115
Manganese	0.500	0.525		mg/L		105	85 - 115
Molybdenum	0.500	0.492		mg/L		98	85 - 115
Strontium	1.00	1.06		mg/L		106	85 - 115
Tin	1.00	1.03		mg/L		103	85 - 115
Titanium	1.00	0.996		mg/L		100	85 - 115

Lab Sample ID: 10I1524-BSD1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BSD1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Aluminum	2.00	2.14		mg/L		107	85 - 115	0.2	20
Barium	2.00	2.07		mg/L		103	85 - 115	0.8	20
Beryllium	0.0500	0.0503		mg/L		101	85 - 115	0.4	20
Boron	1.00	1.05		mg/L		105	85 - 115	0.1	20
Cobalt	0.500	0.485		mg/L		97	85 - 115	0.6	20
Iron	1.00	1.05		mg/L		105	85 - 115	0.1	20
Magnesium	5.00	5.07		mg/L		101	85 - 115	0.4	20
Manganese	0.500	0.524		mg/L		105	85 - 115	0.3	20
Molybdenum	0.500	0.496		mg/L		99	85 - 115	0.8	20
Strontium	1.00	1.06		mg/L		106	85 - 115	0.09	20
Tin	1.00	1.02		mg/L		102	85 - 115	1	20
Titanium	1.00	0.990		mg/L		99	85 - 115	0.6	20

Method: EPA 200.8 - Total Metals by EPA 200.8

Lab Sample ID: 10G4885-BLK1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BLK1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Arsenic	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:09	1
Chromium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Copper	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:09	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:09	1
Selenium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:09	1

Lab Sample ID: 10G4885-BS1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BS1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	0.100	0.104		mg/L		104	85 - 115
Arsenic	0.100	0.0992		mg/L		99	85 - 115
Cadmium	0.100	0.102		mg/L		102	85 - 115
Chromium	0.100	0.100		mg/L		100	85 - 115
Copper	0.100	0.102		mg/L		102	85 - 115
Lead	0.100	0.105		mg/L		105	85 - 115
Nickel	0.100	0.102		mg/L		102	85 - 115
Selenium	0.100	0.0996		mg/L		100	85 - 115
Silver	0.100	0.111		mg/L		111	85 - 115
Thallium	0.100	0.0993		mg/L		99	85 - 115
Zinc	0.100	0.102		mg/L		102	85 - 115

Lab Sample ID: 10G4885-BSD1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BSD1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Antimony	0.100	0.104		mg/L		104	85 - 115	0.5	20
Arsenic	0.100	0.0972		mg/L		97	85 - 115	2	20
Cadmium	0.100	0.0999		mg/L		100	85 - 115	2	20
Chromium	0.100	0.102		mg/L		102	85 - 115	1	20
Copper	0.100	0.104		mg/L		104	85 - 115	2	20
Lead	0.100	0.104		mg/L		104	85 - 115	1	20
Nickel	0.100	0.102		mg/L		102	85 - 115	0.9	20
Selenium	0.100	0.0976		mg/L		98	85 - 115	2	20
Silver	0.100	0.108		mg/L		108	85 - 115	2	20
Thallium	0.100	0.0992		mg/L		99	85 - 115	0.1	20
Zinc	0.100	0.103		mg/L		103	85 - 115	1	20

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: EPA 200.8 - Total Metals by EPA 200.8 (Continued)

Lab Sample ID: 10I1528-BLK1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BLK1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Arsenic	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:03	1
Chromium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Copper	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:03	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:03	1
Selenium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:03	1

Lab Sample ID: 10I1528-BS1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BS1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	0.100	0.101		mg/L		101	85 - 115
Arsenic	0.100	0.0906		mg/L		91	85 - 115
Cadmium	0.100	0.102		mg/L		102	85 - 115
Chromium	0.100	0.0976		mg/L		98	85 - 115
Copper	0.100	0.0989		mg/L		99	85 - 115
Lead	0.100	0.0983		mg/L		98	85 - 115
Nickel	0.100	0.0951		mg/L		95	85 - 115
Selenium	0.100	0.0965		mg/L		96	85 - 115
Silver	0.100	0.0991		mg/L		99	85 - 115
Thallium	0.100	0.0942		mg/L		94	85 - 115
Zinc	0.100	0.102		mg/L		102	85 - 115

Lab Sample ID: 10I1528-BSD1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BSD1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Antimony	0.100	0.102		mg/L		102	85 - 115	0.6	20
Arsenic	0.100	0.0926		mg/L		93	85 - 115	2	20
Cadmium	0.100	0.104		mg/L		104	85 - 115	3	20
Chromium	0.100	0.0984		mg/L		98	85 - 115	0.8	20
Copper	0.100	0.0991		mg/L		99	85 - 115	0.2	20
Lead	0.100	0.0976		mg/L		98	85 - 115	0.7	20
Nickel	0.100	0.0971		mg/L		97	85 - 115	2	20
Selenium	0.100	0.0982		mg/L		98	85 - 115	2	20
Silver	0.100	0.101		mg/L		101	85 - 115	2	20
Thallium	0.100	0.0944		mg/L		94	85 - 115	0.3	20
Zinc	0.100	0.102		mg/L		102	85 - 115	0.5	20

Method: SW846 6020 - Total Metals by Method 6020

Lab Sample ID: 10G4884-BLK1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BLK1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:50	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:50	1

Lab Sample ID: 10G4884-BS1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BS1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Arsenic	100	98.1		ug/L		98	80 - 120
Selenium	0.100	0.100		mg/L		100	80 - 120

Lab Sample ID: 10G4884-BSD1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BSD1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Arsenic	100	99.2		ug/L		99	80 - 120	1	20
Selenium	0.100	0.0985		mg/L		99	80 - 120	2	20

Method: EPA 365.4 - General Chemistry Parameters

Lab Sample ID: 10H0891-BLK2
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BLK2
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/06/10 13:00	08/09/10 15:59	1

Lab Sample ID: 10H0891-BS1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BS1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	2.00	1.96		mg/L		98	90 - 110

Lab Sample ID: 10H0891-BSD1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BSD1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	2.00	1.94		mg/L		97	90 - 110	1	20

Lab Sample ID: 10H0891-MS1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: NTG2350-02
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	0.188		2.00	1.41	M8	mg/L		61	66 - 121

Method: EPA 365.4 - General Chemistry Parameters (Continued)

Lab Sample ID: 10H0891-MSD1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: NTG2350-02
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	0.188		2.00	1.38	M8	mg/L		60	66 - 121	2	20

Lab Sample ID: 10H0891-DUP2
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: NTH0048-01RE1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
Phosphorus	5980			5460		mg/L				9	20

Lab Sample ID: 10H1839-BLK1
Matrix: Water
Analysis Batch: 10H1839

Client Sample ID: 10H1839-BLK1
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/11/10 12:23	08/16/10 09:20	1

Lab Sample ID: 10H1839-BS1
Matrix: Water
Analysis Batch: 10H1839

Client Sample ID: 10H1839-BS1
Prep Type: total
Prep Batch: 10H1839_P

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits		
Phosphorus			2.00	1.85		mg/L		92	90 - 110		

Lab Sample ID: 10H1839-MS1
Matrix: Water
Analysis Batch: 10H1839

Client Sample ID: NTH0821-06
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits		
Phosphorus	ND		2.00	1.91		mg/L		96	66 - 121		

Lab Sample ID: 10H1839-MSD1
Matrix: Water
Analysis Batch: 10H1839

Client Sample ID: NTH0821-06
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	ND		2.00	1.94		mg/L		97	66 - 121	2	20

Lab Sample ID: 10H1839-DUP1
Matrix: Water
Analysis Batch: 10H1839

Client Sample ID: NTH0821-16
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
Phosphorus	ND			0.164		mg/L					20

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: SM 2580 - General Chemistry Parameters

Lab Sample ID: 10G5315-DUP1
Matrix: Water
Analysis Batch: 10G5315

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G5315_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
Oxidation/Reduction Potential	369	HT3		368		mV vs. NHE				0.3	20

Method: SW846 9050A - General Chemistry Parameters

Lab Sample ID: 10G5312-BLK1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: 10G5312-BLK1
Prep Type: total
Prep Batch: 10G5312_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Lab Sample ID: 10G5312-BS1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: 10G5312-BS1
Prep Type: total
Prep Batch: 10G5312_P

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits		
Specific conductance			1410	1390		umho/cm		99	90 - 110		

Lab Sample ID: 10G5312-DUP1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G5312_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
Specific conductance	6060			6060		umho/cm				0	10

Lab Sample ID: 10H4167-BLK1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: 10H4167-BLK1
Prep Type: total
Prep Batch: 10H4167_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Lab Sample ID: 10H4167-BS1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: 10H4167-BS1
Prep Type: total
Prep Batch: 10H4167_P

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits		
Specific conductance			1410	1400		umho/cm		99	90 - 110		

Lab Sample ID: 10H4167-DUP1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H4167_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
Specific conductance	109			108		umho/cm				0.9	10

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: SW846 9056A - General Chemistry Parameters

Lab Sample ID: 10G4880-BLK1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: 10G4880-BLK1
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L		08/01/10 18:18	08/01/10 18:18	1
Sulfate	ND		1.00		mg/L		08/01/10 18:18	08/01/10 18:18	1

Lab Sample ID: 10G4880-BS1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: 10G4880-BS1
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Chloride	3.00	2.92	M4	mg/L		97	90 - 110
Sulfate	15.0	15.8		mg/L		105	90 - 110

Lab Sample ID: 10G4880-DUP1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: Lime Treated pH 7 Leachate
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Chloride	14.0		13.5		mg/L		4	20
Sulfate	134		127		mg/L		5	20

Lab Sample ID: 10H2079-BLK1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: 10H2079-BLK1
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L		08/12/10 23:05	08/12/10 23:05	1
Sulfate	ND		1.00		mg/L		08/12/10 23:05	08/12/10 23:05	1

Lab Sample ID: 10H2079-BS1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: 10H2079-BS1
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Chloride	3.00	3.09	M4	mg/L		103	90 - 110
Sulfate	15.0	16.5		mg/L		110	90 - 110

Lab Sample ID: 10H2079-DUP1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: Treated - 10:1 Ratio
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Chloride	7.62		7.56		mg/L		0.8	20
Sulfate	ND	RL1	3.52	RL1	mg/L		0.1	20

Method: EPA 170.1 - General Chemistry Parameters

Lab Sample ID: 10G4666-DUP1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: BLK1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Lab Sample ID: 10G4666-DUP2
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Lab Sample ID: 10H2208-DUP1
Matrix: Water
Analysis Batch: 10H2208

Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Method: SW846 9040C - General Chemistry Parameters

Lab Sample ID: 10G4666-BS1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: 10G4666-BS1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
pH	7.00	6.99		pH Units		100	95 - 105

Lab Sample ID: 10G4666-BSD1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: 10G4666-BSD1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
pH	7.00	6.98		pH Units		100	95 - 105	0.1	10

Lab Sample ID: 10G4666-DUP1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: BLK1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
pH	7.38		7.37		pH Units		0.1	10

Lab Sample ID: 10G4666-DUP2
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
pH	10.4		10.5		pH Units		0.1	10

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: SW846 9040C - General Chemistry Parameters (Continued)

Lab Sample ID: 10H2208-BS1
Matrix: Water
Analysis Batch: 10H2208

Client Sample ID: 10H2208-BS1
Prep Type: total
Prep Batch: 10H2208_P

Analyte				Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits		
pH					6.98		pH Units			95 - 105		

Lab Sample ID: 10H2208-BSD1
Matrix: Water
Analysis Batch: 10H2208

Client Sample ID: 10H2208-BSD1
Prep Type: total
Prep Batch: 10H2208_P

Analyte				Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
pH					7.01		pH Units			95 - 105	0.4	10

Lab Sample ID: 10H2208-DUP1
Matrix: Water
Analysis Batch: 10H2208

Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Sample Result	Sample Qualifier		Duplicate Result	Duplicate Qualifier	Unit	D			RPD	RPD Limit
pH	8.75			8.75		pH Units				0	10

Metals

Prep Batch: 10G4884_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4884-BS1	10G4884-BS1	total	Water	EPA 3010A / 6020	
10G4884-BSD1	10G4884-BSD1	total	Water	EPA 3010A / 6020	
10G4884-BLK1	10G4884-BLK1	total	Water	EPA 3010A / 6020	
NTG0744-04	BLK1	total	Leachate	EPA 3010A / 6020	
NTG0744-05	BLK2	total	Leachate	EPA 3010A / 6020	
NTG0744-06	BLK3	total	Leachate	EPA 3010A / 6020	
NTG0744-07	untreated DI Water leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-09	untreated pH 7 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-11	lime treated DI Water leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-24	Blank	total	Leachate	EPA 3010A / 6020	

Prep Batch: 10G4885_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4885-BS1	10G4885-BS1	total	Water	EPA 200.8	
10G4885-BSD1	10G4885-BSD1	total	Water	EPA 200.8	
10G4885-BLK1	10G4885-BLK1	total	Water	EPA 200.8	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.8	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.8	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.8	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.8	
NTG0744-10 - RE1	untreated pH10 leachate	total	Leachate	EPA 200.8	
NTG0744-10 - RE2	untreated pH10 leachate	total	Leachate	EPA 200.8	

Prep Batch: 10G4886_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4886-BLK1	10G4886-BLK1	total	Water	EPA 200.7	
10G4886-BS1	10G4886-BS1	total	Water	EPA 200.7	
10G4886-BSD1	10G4886-BSD1	total	Water	EPA 200.7	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.7	

1 2 3 4 5 6 7 8 9 10 11 12

Metals (Continued)

Prep Batch: 10G4886_P (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.7	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	

Prep Batch: 10I1524_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1524-BLK1	10I1524-BLK1	total	Water	EPA 200.7	
10I1524-BS1	10I1524-BS1	total	Water	EPA 200.7	
10I1524-BSD1	10I1524-BSD1	total	Water	EPA 200.7	
NTG0744-25	Blank	total	Leachate	EPA 200.7	
NTG0744-26	T01 10:1	total	Leachate	EPA 200.7	
NTG0744-27	T02 5:1	total	Leachate	EPA 200.7	
NTG0744-28	T03 2:1	total	Leachate	EPA 200.7	
NTG0744-29	T04 1:1	total	Leachate	EPA 200.7	
NTG0744-25 - RE1	Blank	total	Leachate	EPA 200.7	
NTG0744-26 - RE1	T01 10:1	total	Leachate	EPA 200.7	
NTG0744-27 - RE1	T02 5:1	total	Leachate	EPA 200.7	
NTG0744-28 - RE1	T03 2:1	total	Leachate	EPA 200.7	
NTG0744-29 - RE1	T04 1:1	total	Leachate	EPA 200.7	

Prep Batch: 10I1528_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1528-BS1	10I1528-BS1	total	Water	EPA 200.8	
10I1528-BSD1	10I1528-BSD1	total	Water	EPA 200.8	
10I1528-BLK1	10I1528-BLK1	total	Water	EPA 200.8	
NTG0744-25	Blank	total	Leachate	EPA 200.8	
NTG0744-26	T01 10:1	total	Leachate	EPA 200.8	
NTG0744-27	T02 5:1	total	Leachate	EPA 200.8	
NTG0744-28	T03 2:1	total	Leachate	EPA 200.8	
NTG0744-29	T04 1:1	total	Leachate	EPA 200.8	

Analysis Batch: T012257

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4886-BLK1	10G4886-BLK1	total	Water	EPA 200.7	10G4886_P
10G4886-BS1	10G4886-BS1	total	Water	EPA 200.7	10G4886_P
10G4886-BSD1	10G4886-BSD1	total	Water	EPA 200.7	10G4886_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.7	10G4886_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.7	10G4886_P

Analysis Batch: T012279

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4885-BS1	10G4885-BS1	total	Water	EPA 200.8	10G4885_P
10G4885-BSD1	10G4885-BSD1	total	Water	EPA 200.8	10G4885_P
10G4885-BLK1	10G4885-BLK1	total	Water	EPA 200.8	10G4885_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.8	10G4885_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.8	10G4885_P
NTG0744-10 - RE1	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-10 - RE2	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P

Metals (Continued)

Analysis Batch: T012280

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4884-BS1	10G4884-BS1	total	Water	SW846 6020	10G4884_P
10G4884-BSD1	10G4884-BSD1	total	Water	SW846 6020	10G4884_P
10G4884-BLK1	10G4884-BLK1	total	Water	SW846 6020	10G4884_P
NTG0744-04	BLK1	total	Leachate	SW846 6020	10G4884_P
NTG0744-05	BLK2	total	Leachate	SW846 6020	10G4884_P
NTG0744-06	BLK3	total	Leachate	SW846 6020	10G4884_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-24	Blank	total	Leachate	SW846 6020	10G4884_P
T012280-SRD1	Blank	total	Water	SW846 6020	

Analysis Batch: T012345

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	10G4886_P

Analysis Batch: T014236

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1528-BS1	10I1528-BS1	total	Water	EPA 200.8	10I1528_P
10I1528-BSD1	10I1528-BSD1	total	Water	EPA 200.8	10I1528_P
10I1528-BLK1	10I1528-BLK1	total	Water	EPA 200.8	10I1528_P
NTG0744-25	Blank	total	Leachate	EPA 200.8	10I1528_P
NTG0744-26	T01 10:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-27	T02 5:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-28	T03 2:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-29	T04 1:1	total	Leachate	EPA 200.8	10I1528_P

Analysis Batch: T014343

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1524-BLK1	10I1524-BLK1	total	Water	EPA 200.7	10I1524_P
10I1524-BS1	10I1524-BS1	total	Water	EPA 200.7	10I1524_P
10I1524-BSD1	10I1524-BSD1	total	Water	EPA 200.7	10I1524_P
NTG0744-25	Blank	total	Leachate	EPA 200.7	10I1524_P
NTG0744-26	T01 10:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-27	T02 5:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-28	T03 2:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-29	T04 1:1	total	Leachate	EPA 200.7	10I1524_P

Analysis Batch: T014345

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-25 - RE1	Blank	total	Leachate	EPA 200.7	10I1524_P

Metals (Continued)

Analysis Batch: T014345 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-26 - RE1	T01 10:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-27 - RE1	T02 5:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-28 - RE1	T03 2:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-29 - RE1	T04 1:1	total	Leachate	EPA 200.7	10I1524_P

WetChem

Analysis Batch: [CALC]

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-02	ASH-BT-001 (untreated)	total	Ash	Total Phosphorus	[CALC]_P
NTG0744-03	ASH-BT-001 (treated)	total	Ash	Total Phosphorus	[CALC]_P
NTG0744-10	untreated pH10 leachate	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	Total Phosphorus	[CALC]_P

Prep Batch: [CALC]_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-02	ASH-BT-001 (untreated)	total	Ash	[CALC]	
NTG0744-03	ASH-BT-001 (treated)	total	Ash	[CALC]	
NTG0744-10	untreated pH10 leachate	total	Leachate	[CALC]	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	[CALC]	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	[CALC]	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	[CALC]	

Analysis Batch: 10G4880

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4880-BLK1	10G4880-BLK1	total	Water	SW846 9056A	10G4880_P
10G4880-BS1	10G4880-BS1	total	Water	SW846 9056A	10G4880_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9056A	10G4880_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9056A	10G4880_P
10G4880-DUP1	Lime Treated pH 7 Leachate	total	Water	SW846 9056A	10G4880_P

Prep Batch: 10G4880_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4880-BLK1	10G4880-BLK1	total	Water	NO PREP	
10G4880-BS1	10G4880-BS1	total	Water	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
10G4880-DUP1	Lime Treated pH 7 Leachate	total	Water	NO PREP	

Analysis Batch: 10G5312

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5312-BLK1	10G5312-BLK1	total	Water	SW846 9050A	10G5312_P
10G5312-BS1	10G5312-BS1	total	Water	SW846 9050A	10G5312_P
10G5312-DUP1	Lime Treated pH 10 leachate	total	Water	SW846 9050A	10G5312_P
NTG0744-04	BLK1	total	Leachate	SW846 9050A	10G5312_P
NTG0744-05	BLK2	total	Leachate	SW846 9050A	10G5312_P
NTG0744-06	BLK3	total	Leachate	SW846 9050A	10G5312_P

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

WetChem (Continued)

Analysis Batch: 10G5312 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 9050A	10G5312_P

Prep Batch: 10G5312_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5312-BLK1	10G5312-BLK1	total	Water	NO PREP	
10G5312-BS1	10G5312-BS1	total	Water	NO PREP	
10G5312-DUP1	Lime Treated pH 10 leachate	total	Water	NO PREP	
NTG0744-04	BLK1	total	Leachate	NO PREP	
NTG0744-05	BLK2	total	Leachate	NO PREP	
NTG0744-06	BLK3	total	Leachate	NO PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	NO PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	NO PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	NO PREP	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	NO PREP	

Analysis Batch: 10G5315

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5315-DUP1	Lime Treated pH 10 leachate	total	Water	SM 2580	10G5315_P
NTG0744-04	BLK1	total	Leachate	SM 2580	10G5315_P
NTG0744-05	BLK2	total	Leachate	SM 2580	10G5315_P
NTG0744-06	BLK3	total	Leachate	SM 2580	10G5315_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SM 2580	10G5315_P

Prep Batch: 10G5315_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5315-DUP1	Lime Treated pH 10 leachate	total	Water	NO PREP	
NTG0744-04	BLK1	total	Leachate	NO PREP	
NTG0744-05	BLK2	total	Leachate	NO PREP	
NTG0744-06	BLK3	total	Leachate	NO PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	NO PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	NO PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	NO PREP	

WetChem (Continued)

Prep Batch: 10G5315_P (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	NO PREP	

Analysis Batch: 10H0891

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H0891-BS1	10H0891-BS1	total	Water	EPA 365.4	10H0891_P
10H0891-BSD1	10H0891-BSD1	total	Water	EPA 365.4	10H0891_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 365.4	10H0891_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 365.4	10H0891_P
10H0891-MS1	NTG2350-02	total	Water	EPA 365.4	10H0891_P
10H0891-MSD1	NTG2350-02	total	Water	EPA 365.4	10H0891_P
10H0891-BLK2	10H0891-BLK2	total	Water	EPA 365.4	10H0891_P
10H0891-DUP2	NTH0048-01RE1	total	Water	EPA 365.4	10H0891_P

Prep Batch: 10H0891_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H0891-BS1	10H0891-BS1	total	Water	NO PREP	
10H0891-BSD1	10H0891-BSD1	total	Water	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
10H0891-MS1	NTG2350-02	total	Water	NO PREP	
10H0891-MSD1	NTG2350-02	total	Water	NO PREP	
10H0891-BLK2	10H0891-BLK2	total	Water	NO PREP	
10H0891-DUP2	NTH0048-01RE1	total	Water	NO PREP	

Analysis Batch: 10H1839

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H1839-BLK1	10H1839-BLK1	total	Water	EPA 365.4	10H1839_P
10H1839-BS1	10H1839-BS1	total	Water	EPA 365.4	10H1839_P
10H1839-MS1	NTH0821-06	total	Water	EPA 365.4	10H1839_P
10H1839-MSD1	NTH0821-06	total	Water	EPA 365.4	10H1839_P
10H1839-DUP1	NTH0821-16	total	Water	EPA 365.4	10H1839_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 365.4	10H1839_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 365.4	10H1839_P

Prep Batch: 10H1839_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H1839-BLK1	10H1839-BLK1	total	Water	NO PREP	
10H1839-BS1	10H1839-BS1	total	Water	NO PREP	
10H1839-MS1	NTH0821-06	total	Water	NO PREP	
10H1839-MSD1	NTH0821-06	total	Water	NO PREP	
10H1839-DUP1	NTH0821-16	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	

Analysis Batch: 10H2079

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-BLK1	10H2079-BLK1	total	Water	SW846 9056A	10H2079_P
10H2079-BS1	10H2079-BS1	total	Water	SW846 9056A	10H2079_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9056A	10H2079_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9056A	10H2079_P

WetChem (Continued)

Analysis Batch: 10H2079 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-DUP1	Treated - 10:1 Ratio	total	Water	SW846 9056A	10H2079_P

Prep Batch: 10H2079_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-BLK1	10H2079-BLK1	total	Water	NO PREP	
10H2079-BS1	10H2079-BS1	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	
10H2079-DUP1	Treated - 10:1 Ratio	total	Water	NO PREP	

Analysis Batch: 10H4167

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H4167-BLK1	10H4167-BLK1	total	Water	SW846 9050A	10H4167_P
10H4167-BS1	10H4167-BS1	total	Water	SW846 9050A	10H4167_P
10H4167-DUP1	Untreated- 10:1ratio	total	Water	SW846 9050A	10H4167_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-24	Blank	total	Leachate	SW846 9050A	10H4167_P

Prep Batch: 10H4167_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H4167-BLK1	10H4167-BLK1	total	Water	NO PREP	
10H4167-BS1	10H4167-BS1	total	Water	NO PREP	
10H4167-DUP1	Untreated- 10:1ratio	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	NO PREP	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	NO PREP	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	NO PREP	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	NO PREP	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	NO PREP	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	NO PREP	
NTG0744-24	Blank	total	Leachate	NO PREP	

TCLP

Analysis Batch: 10G4666

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4666-BS1	10G4666-BS1	total	Water	SW846 9040C	10G4666_P
10G4666-BSD1	10G4666-BSD1	total	Water	SW846 9040C	10G4666_P
10G4666-DUP1	BLK1	total	Water	SW846 9040C	10G4666_P
10G4666-DUP1	BLK1	total	Water	EPA 170.1	10G4666_P
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	SW846 9040C	10G4666_P
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	EPA 170.1	10G4666_P

TCLP (Continued)

Analysis Batch: 10G4666 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-04	BLK1	total	Leachate	SW846 9040C	10G4666_P
NTG0744-04	BLK1	total	Leachate	EPA 170.1	10G4666_P
NTG0744-05	BLK2	total	Leachate	SW846 9040C	10G4666_P
NTG0744-05	BLK2	total	Leachate	EPA 170.1	10G4666_P
NTG0744-06	BLK3	total	Leachate	SW846 9040C	10G4666_P
NTG0744-06	BLK3	total	Leachate	EPA 170.1	10G4666_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-07	untreated DI Water leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	EPA 170.1	10G4666_P

Prep Batch: 10G4666_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4666-BS1	10G4666-BS1	total	Water	METHOD PREP	
10G4666-BSD1	10G4666-BSD1	total	Water	METHOD PREP	
10G4666-DUP1	BLK1	total	Water	METHOD PREP	
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	METHOD PREP	
NTG0744-04	BLK1	total	Leachate	METHOD PREP	
NTG0744-05	BLK2	total	Leachate	METHOD PREP	
NTG0744-06	BLK3	total	Leachate	METHOD PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	METHOD PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	METHOD PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	METHOD PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	METHOD PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	METHOD PREP	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	METHOD PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	METHOD PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	METHOD PREP	

Analysis Batch: 10H2208

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2208-BS1	10H2208-BS1	total	Water	SW846 9040C	10H2208_P
10H2208-BSD1	10H2208-BSD1	total	Water	SW846 9040C	10H2208_P
10H2208-DUP1	Untreated- 10:1ratio	total	Water	SW846 9040C	10H2208_P
10H2208-DUP1	Untreated- 10:1ratio	total	Water	EPA 170.1	10H2208_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 9040C	10H2208_P

TCLP (Continued)

Analysis Batch: 10H2208 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-24	Blank	total	Leachate	SW846 9040C	10H2208_P
NTG0744-24	Blank	total	Leachate	EPA 170.1	10H2208_P

Prep Batch: 10H2208_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2208-BS1	10H2208-BS1	total	Water	METHOD PREP	
10H2208-BSD1	10H2208-BSD1	total	Water	METHOD PREP	
10H2208-DUP1	Untreated- 10:1ratio	total	Water	METHOD PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	METHOD PREP	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	METHOD PREP	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	METHOD PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-24	Blank	total	Leachate	METHOD PREP	

Client Sample ID: ASH-BT-001 (untreated)

Lab Sample ID: NTG0744-02

Date Collected: 07/07/10 10:15

Matrix: Ash

Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	[CALC]		0	[CALC]_P	07/14/10 12:20		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	07/16/10 11:55	SAB	TestAmerica Nashville

Client Sample ID: ASH-BT-001 (treated)

Lab Sample ID: NTG0744-03

Date Collected: 07/07/10 10:15

Matrix: Ash

Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	Total Phosphorus		1	[CALC]	07/16/10 11:58	SAB	TestAmerica Nashville

Client Sample ID: BLK1

Lab Sample ID: NTG0744-04

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10G4884_P	08/12/10 09:35	MET	TestAmerica Nashville
total	Analysis	SW846 6020		1	T012280	08/13/10 11:53	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10G5315_P	07/30/10 14:15	TEM	TestAmerica Nashville
total	Analysis	SM 2580		1	10G5315	08/01/10 18:30	TEM	TestAmerica Nashville
total	Prep	NO PREP		1	10G5312_P	07/30/10 14:08	TEM	TestAmerica Nashville
total	Analysis	SW846 9050A		1	10G5312	07/30/10 14:30	TEM	TestAmerica Nashville
total	Analysis	EPA 170.1		1	10G4666	08/13/10 09:11	MSR	TestAmerica Nashville
total	Prep	METHOD PREP		1	10G4666_P	07/28/10 08:16	SJM	TestAmerica Nashville
total	Analysis	SW846 9040C		1	10G4666	08/13/10 09:11	MSR	TestAmerica Nashville

Client Sample ID: BLK2

Lab Sample ID: NTG0744-05

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 11:56	MET	TestAmerica Nashville

Client Sample ID: BLK3

Lab Sample ID: NTG0744-06

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 11:59	MET	TestAmerica Nashville

Client Sample ID: untreated DI Water leachate

Lab Sample ID: NTG0744-07
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:03	MET	TestAmerica Nashville

Client Sample ID: Untreated pH 5 leachate

Lab Sample ID: NTG0744-08
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:06	MET	TestAmerica Nashville

Client Sample ID: untreated pH 7 leachate

Lab Sample ID: NTG0744-09
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:09	MET	TestAmerica Nashville

Client Sample ID: untreated pH10 leachate

Lab Sample ID: NTG0744-10
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10G4886_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:22	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7		10	T012345	08/13/10 10:53	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Prep	EPA 200.8	RE1	1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Prep	EPA 200.8	RE2	1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:12	MET	TestAmerica Nashville
total	Analysis	EPA 200.8	RE1	5	T012279	08/13/10 11:30	MET	TestAmerica Nashville
total	Analysis	EPA 200.8	RE2	100	T012279	08/13/10 11:33	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10H0891_P	08/06/10 13:00	JDJ	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H0891	08/09/10 11:24	MLM	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10G4880	08/01/10 19:19	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10G4880_P	08/01/10 19:19	SKO	TestAmerica Nashville
total	Prep	[CALC]		0	[CALC]_P	08/06/10 13:00		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/09/10 11:24	MLM	TestAmerica Nashville

Client Sample ID: lime treated DI Water leachate

Lab Sample ID: NTG0744-11
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:12	MET	TestAmerica Nashville

Client Sample ID: Lime Treated pH 5 Leachate

Lab Sample ID: NTG0744-12

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:23	MET	TestAmerica Nashville

Client Sample ID: Lime Treated pH 7 Leachate

Lab Sample ID: NTG0744-13

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:26	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7		10	T012345	08/13/10 10:56	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:15	MET	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H0891	08/09/10 11:25	MLM	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10G4880	08/01/10 20:20	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10G4880_P	08/01/10 20:20	SKO	TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/09/10 11:25	MLM	TestAmerica Nashville

Client Sample ID: Lime Treated pH 10 leachate

Lab Sample ID: NTG0744-14

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:26	MET	TestAmerica Nashville

Client Sample ID: Untreated- 10:1ratio

Lab Sample ID: NTG0744-15

Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10G4886_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:29	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:18	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10H1839_P	08/13/10 12:23	PRC	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H1839	08/16/10 09:45	SAB	TestAmerica Nashville
total	Prep	NO PREP		1	10H4167_P	08/24/10 12:02	JDJ	TestAmerica Nashville
total	Analysis	SW846 9050A		1	10H4167	08/24/10 12:50	JDJ	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10H2079	08/12/10 23:58	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10H2079_P	08/12/10 23:58	JHS	TestAmerica Nashville
total	Prep	[CALC]		0	[CALC]_P	08/13/10 12:23		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/16/10 09:45	SAB	TestAmerica Nashville
total	Analysis	EPA 170.1		1	10H2208	08/13/10 09:21	MSR	TestAmerica Nashville
total	Prep	METHOD PREP		1	10H2208_P	07/23/10 23:59	MSR	TestAmerica Nashville
total	Analysis	SW846 9040C		1	10H2208	08/13/10 09:21	MSR	TestAmerica Nashville

Client Sample ID: untreated - 5:1 ratio
Lab Sample ID: NTG0744-16
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10G4884_P	08/12/10 09:35	jwd	TestAmerica Nashville
total	Analysis	SW846 6020		1	T012280	08/13/10 12:29	MET	TestAmerica Nashville

Client Sample ID: untreated- 2:1 Ratio
Lab Sample ID: NTG0744-17
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:33	MET	TestAmerica Nashville

Client Sample ID: untreated- 1:1 Ratio
Lab Sample ID: NTG0744-18
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:36	MET	TestAmerica Nashville

Client Sample ID: Untreated - 1:2 Ratio
Lab Sample ID: NTG0744-19
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:39	MET	TestAmerica Nashville

Client Sample ID: Treated - 10:1 Ratio
Lab Sample ID: NTG0744-20
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:32	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:21	MET	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H1839	08/16/10 09:46	SAB	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10H2079	08/13/10 00:52	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10H2079_P	08/13/10 00:52	JHS	TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/16/10 09:46	SAB	TestAmerica Nashville

Client Sample ID: Treated - 5:1 Ratio
Lab Sample ID: NTG0744-21
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:42	MET	TestAmerica Nashville

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Treated - 2:1 Ratio
Lab Sample ID: NTG0744-22
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:46	MET	TestAmerica Nashville

Client Sample ID: Treated - 1:1 Ratio
Lab Sample ID: NTG0744-23
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:49	MET	TestAmerica Nashville

Client Sample ID: Blank
Lab Sample ID: NTG0744-24
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:52	MET	TestAmerica Nashville

Client Sample ID: Blank
Lab Sample ID: NTG0744-25
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10I1524_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Prep	EPA 200.7	RE1	1	10I1524_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:33	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:44	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10I1528_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:07	MET	TestAmerica Nashville

Client Sample ID: T01 10:1
Lab Sample ID: NTG0744-26
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:37	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:47	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:10	MET	TestAmerica Nashville

Client Sample ID: T02 5:1
Lab Sample ID: NTG0744-27
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:40	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:50	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:13	MET	TestAmerica Nashville

Client Sample ID: T03 2:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-28
Matrix: Leachate

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:43	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:53	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:17	MET	TestAmerica Nashville

Client Sample ID: T04 1:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-29
Matrix: Leachate

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:46	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:57	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:20	MET	TestAmerica Nashville

Method Summary

Method	Method Description	Protocol	Laboratory
EPA 200.7	Total Metals by EPA Method 200.7		TAL NSH
EPA 200.8	Total Metals by EPA 200.8		TAL NSH
SW846 6020	Total Metals by Method 6020		TAL NSH
EPA 365.4	General Chemistry Parameters		TAL NSH
SM 2580	General Chemistry Parameters		TAL NSH
SW846 9050A	General Chemistry Parameters		TAL NSH
SW846 9056A	General Chemistry Parameters		TAL NSH
Total Phosphorus	General Chemistry Parameters		TAL NSH
EPA 170.1	General Chemistry Parameters		TAL NSH
SW846 9040C	General Chemistry Parameters		TAL NSH

Protocol References:

=

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Road, Nashville, TN 37204, TEL 800-765-0980

Certification Summary

Laboratory	Authority	Program	EPA Region	Certification ID	Expiration Date
TestAmerica Nashville		AIHA		100790	09/01/11
TestAmerica Nashville		USDA		S-48469	01/22/11
TestAmerica Nashville	A2LA	A2LA	0	0453.07	12/31/11
TestAmerica Nashville	A2LA	WY UST	0	453.07	12/31/11
TestAmerica Nashville	Alabama	State Program	4	41150	10/31/10
TestAmerica Nashville	Alaska	Alaska UST	10	UST-087	07/24/11
TestAmerica Nashville	Arizona	State Program	9	AZ0473	05/05/11
TestAmerica Nashville	Arkansas	State Program	6	88-0737	04/25/11
TestAmerica Nashville	California	NELAC	9	1168CA	10/31/10
TestAmerica Nashville	Colorado	State Program	8	N/A	02/28/11
TestAmerica Nashville	Connecticut	State Program	1	PH-0220	12/31/11
TestAmerica Nashville	Florida	NELAC	4	E87358	06/30/11
TestAmerica Nashville	Illinois	NELAC	5	200010	12/09/10
TestAmerica Nashville	Iowa	State Program	7	131	05/01/12
TestAmerica Nashville	Kansas	NELAC	7	E-10229	10/31/10
TestAmerica Nashville	Kentucky	State Program	4	2	07/13/12
TestAmerica Nashville	Kentucky	State Program	4	90038	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	LA100011	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	30613	06/30/11
TestAmerica Nashville	Maryland	State Program	3	316	03/31/11
TestAmerica Nashville	Massachusetts	State Program	1	M-TN032	06/30/11
TestAmerica Nashville	Minnesota	State Program	5	047-999-345	12/31/10
TestAmerica Nashville	Mississippi	State Program	4	N/A	06/30/11
TestAmerica Nashville	Montana	State Program	8	NA	01/01/15
TestAmerica Nashville	Nevada	State Program	9	TN00032	07/31/11
TestAmerica Nashville	New Jersey	NELAC	2	TN965	06/30/11
TestAmerica Nashville	New York	NELAC	2	11342	04/01/11
TestAmerica Nashville	North Carolina	State Program	4	387	12/31/10
TestAmerica Nashville	North Dakota	State Program	8	R-146	06/30/11
TestAmerica Nashville	Ohio	VAP	5	CL0033	04/01/12
TestAmerica Nashville	Oklahoma	State Program	6	9412	08/31/11
TestAmerica Nashville	Oregon	NELAC	10	TN200001	04/30/11
TestAmerica Nashville	Pennsylvania	NELAC	3	68-00585	06/30/11
TestAmerica Nashville	Rhode Island	State Program	1	LAO00268	12/30/10
TestAmerica Nashville	South Carolina	State Program	4	84009	02/28/11
TestAmerica Nashville	South Carolina	State Program	4	84009	03/19/11
TestAmerica Nashville	Tennessee	State Program	4	2008	03/19/11
TestAmerica Nashville	Texas	NELAC	6	T104704077-09-TX	08/31/11
TestAmerica Nashville	Utah	NELAC	8	TAN	06/30/11
TestAmerica Nashville	Virginia	State Program	3	00323	06/30/11
TestAmerica Nashville	Washington	State Program	10	C789	07/19/11
TestAmerica Nashville	West Virginia	State Program	3	219	02/28/11
TestAmerica Nashville	Wisconsin	State Program	5	998020430	08/31/11

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

NTG0744

07/20/10 23:59

Cooler Received/Opened On 7/23/2010 @ 0940

1. Tracking # 1Z939Ex20191517747

Courier: UPS IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 3.7 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front/back

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) PM

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

   b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) PM

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

   b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) M

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) P

I certify that I attached a label with the unique LIMS number to each container (intial) P

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

Additional sample for NTG0744-01-03

BIS = Broken in shipment
Cooler Receipt Form.doc

LF-1
End of Form

Revised 6/24/09

1 2 3 4 5 6 7 8 9 10 11 12

TENNESSEE VALLEY AUTHORITY

NTG0744
07/20/10 23:59

HAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 1
Cooler # 1 of 1

COC # RSI-072210-001

10/18/2010

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800 765 0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	1134 Swan Pond Road
City	Harriman
State, Zip	TN 37748
Site PM Name	Bruce Haas
Phone/Fax:	865-717-1602
Site PM Email:	bjhaas@tva.gov

Required Sampler Information:

Sampler	Chad Fairless
Sampling Company	TVA - Kingston Fossil Ash Recovery Operations
Address:	1134 Swan Pond Road
City/State	Harriman, TN
Phone #:	865 717 6542
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	bjhaas@tva.gov
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard X Rush Mark One

Filtered: NA
Preserve: NONE
Analysis: BATCH (SHAKE) TESTS, METHOD 1313, 1316

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: in)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	BATCH (SHAKE) TESTS, METHOD 1313, 1316
1	ASH - BT - 001	TVA-KIF	6	6	CA	G	~~N~~	07/22/2010	1140	2	32 oz CWM glass jar	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

4MC 072210

CF 072210

Additional Comments/Special Instructions:

Ash and lime samples collected in support of Kingston Ash Recover Project, Non-Time-Critical Removal Action for the River System Investigation, Ash Leaching Test Plan Document No. RAWP-072.

THIS IS A NON-EQUIS CHAIN OF CUSTODY

SAMPLE REASON (check only one)

X	Investigatory
	Split Comparison
	Split Legal
	Special Study
	Plant Ops
	Oth:

RELINQUISHED BY AFFILIATION	DATE	TIME	ACCEPTED BY AFFILIATION	DATE	TIME	Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
[signature] / RSI	072210	1500	[signature] / RSI	072210	1500		Y / N	Y / N	Y / N
[signature] / RSI	072210	1539	Jesse Morris / RSI	072210	1539		Y / N	Y / N	Y / N
Jesse Morris / RSI	072210	1550	[signature]	7/23/10	0940	3.7	Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS COURIER \ FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Chad Fairless

SIGNATURE of SAMPLER: [signature] DATE Signed 072210 Time: 1151

UPS tracking#: 12939 EX2 0148187747

Environmental Standards, Inc-LastUpdated-031609

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

September 14, 2010 4:35:04PM

Client: TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748
Attn: William Rogers

Work Order: NTI0347
Project Name: Kingston Fossil Plant 050710
Project Nbr: RSICA0902Y10A
P/O Nbr: Contract #75140 PO#8559
Date Received: 09/03/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-RELIC_C1-T1-LH-081310	NTI0347-01	08/13/10 14:00
KIF-RELIC_C1-T2-LH-081710	NTI0347-02	08/17/10 11:00
KIF-RELIC_C1-T3-LH-082110	NTI0347-03	08/21/10 11:00
KIF-RELIC_C1-T4-LH-082510	NTI0347-04	08/25/10 11:00
KIF-RELIC_C1-T5-LH-082910	NTI0347-05	08/29/10 14:00
KIF-RELIC_C2-T1-LH-081310	NTI0347-06	08/13/10 14:00
KIF-RELIC_C2-T2-LH-081710	NTI0347-07	08/17/10 11:00
KIF-RELIC_C2-T3-LH-082110	NTI0347-08	08/21/10 11:00
KIF-RELIC_C2-T4-LH-082510	NTI0347-09	08/25/10 11:00
KIF-RELIC_C2-T5-LH-082910	NTI0347-10	08/29/10 14:00
KIF-RELIC_C3-T1-LH-081310	NTI0347-11	08/13/10 14:00
KIF-RELIC_C3-T2-LH-081710	NTI0347-12	08/17/10 11:00
KIF-RELIC_C3-T3-LH-082110	NTI0347-13	08/21/10 11:00
KIF-RELIC_C3-T4-LH-082510	NTI0347-14	08/25/10 11:00
KIF-RELIC_C3-T5-LH-082910	NTI0347-15	08/29/10 14:00
KIF-RELIC_MaterialBlank-A-090210	NTI0347-16	09/02/10 00:01

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this material is strictly prohibited. If you have received this material in error, please notify us immediately at 615-726-0177.

Additional Laboratory Comments:
The client supplied a revised COC. It has been attached to the end of this report.

Tennessee Certification Number: 02008
The Chain(s) of Custody, 5 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

Mark Hollingsworth

Program Manager - National Accounts

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-01 (KIF-RELIC C1-T1-LH-081310 - Water) Sampled: 08/13/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.00957**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Arsenic	**0.00286**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Cadmium	**0.000420**	J	mg/L	0.000330	0.00100	1	09/13/10 22:12	EPA 200.8	10I0985
Chromium	**0.198**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Copper	**0.00993**		mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Lead	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Manganese	**0.000380**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Molybdenum	**0.711**		mg/L	0.00165	0.0250	5	09/13/10 23:41	EPA 200.8	10I0985
Nickel	**0.00300**	J	mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Selenium	**0.778**		mg/L	0.00165	0.0100	5	09/13/10 23:41	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Vanadium	**0.0911**		mg/L	0.00100	0.00400	1	09/13/10 22:12	EPA 200.8	10I0985
Zinc	**0.00849**	J	mg/L	0.00830	0.0500	1	09/13/10 22:12	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**9.41**		mg/L	0.0500	0.100	1	09/09/10 21:29	EPA 200.7	10I0983
Barium	**0.0578**		mg/L	0.0100	0.0100	1	09/09/10 21:29	EPA 200.7	10I0983
Boron	**8.14**	MHA	mg/L	0.125	0.500	10	09/10/10 10:45	EPA 200.7	10I0983
Calcium	**78.6**	MHA	mg/L	0.500	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:29	EPA 200.7	10I0983
Magnesium	**0.375**	J	mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Potassium	**8.33**		mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Sodium	**13.8**		mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Strontium	**2.96**	M8	mg/L	0.125	0.500	10	09/10/10 10:45	EPA 200.7	10I0983
Sample ID: NTI0347-02 (KIF-RELIC C1-T2-LH-081710 - Water) Sampled: 08/17/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.0105**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Arsenic	**0.00514**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Cadmium	**0.000380**	J	mg/L	0.000330	0.00100	1	09/13/10 22:22	EPA 200.8	10I0985
Chromium	**0.273**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Cobalt	**0.000390**	J	mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Copper	**0.00711**		mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Manganese	**0.000340**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Molybdenum	**0.694**		mg/L	0.00165	0.0250	5	09/13/10 23:45	EPA 200.8	10I0985
Nickel	**0.00297**	J	mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Selenium	**0.756**		mg/L	0.00165	0.0100	5	09/13/10 23:45	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Vanadium	**0.362**		mg/L	0.00100	0.00400	1	09/13/10 22:22	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:22	EPA 200.8	10I0985

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-02 (KIF-RELIC C1-T2-LH-081710 - Water) - cont. Sampled: 08/17/10 11:00

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**20.5**	MHA	mg/L	0.0500	0.100	1	09/09/10 21:39	EPA 200.7	10I0983
Barium	**0.336**		mg/L	0.0100	0.0100	1	09/09/10 21:39	EPA 200.7	10I0983
Boron	**6.85**	MHA	mg/L	0.125	0.500	10	09/10/10 10:48	EPA 200.7	10I0983
Calcium	**84.6**	MHA	mg/L	0.500	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:39	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Potassium	**8.52**		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Sodium	**10.8**		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Strontium	**2.72**		mg/L	0.125	0.500	10	09/10/10 10:48	EPA 200.7	10I0983

Sample ID: NTI0347-03 (KIF-RELIC C1-T3-LH-082110 - Water) Sampled: 08/21/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00980**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Arsenic	**0.00656**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:32	EPA 200.8	10I0985
Chromium	**0.175**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Cobalt	**0.000390**	J	mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Copper	**0.0137**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Lead	**0.000750**	J	mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Manganese	**0.000370**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Molybdenum	**0.300**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Nickel	**0.0248**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Selenium	**0.378**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Vanadium	**0.472**		mg/L	0.00100	0.00400	1	09/13/10 22:32	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:32	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**22.1**		mg/L	0.0500	0.100	1	09/09/10 21:48	EPA 200.7	10I0983
Barium	**0.416**		mg/L	0.0100	0.0100	1	09/09/10 21:48	EPA 200.7	10I0983
Boron	**7.75**		mg/L	0.125	0.500	10	09/10/10 10:52	EPA 200.7	10I0983
Calcium	**72.6**		mg/L	0.500	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:48	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Potassium	**6.84**		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Sodium	**7.80**		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Strontium	**2.66**		mg/L	0.125	0.500	10	09/10/10 10:52	EPA 200.7	10I0983

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-04 (KIF-RELIC C1-T4-LH-082510 - Water) Sampled: 08/25/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00908**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Arsenic	**0.00869**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:35	EPA 200.8	10I0985
Chromium	**0.0765**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Copper	**0.00681**		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Molybdenum	**0.0967**		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Nickel	**0.00201**	J	mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Selenium	**0.0834**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Vanadium	**0.498**		mg/L	0.00100	0.00400	1	09/13/10 22:35	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:35	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**23.9**		mg/L	0.0500	0.100	1	09/09/10 21:52	EPA 200.7	10I0983
Barium	**0.377**		mg/L	0.0100	0.0100	1	09/09/10 21:52	EPA 200.7	10I0983
Boron	**8.67**		mg/L	0.125	0.500	10	09/10/10 10:55	EPA 200.7	10I0983
Calcium	**61.9**		mg/L	0.500	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:52	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Potassium	**5.01**		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Sodium	**5.16**		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Strontium	**2.35**		mg/L	0.125	0.500	10	09/10/10 10:55	EPA 200.7	10I0983

Sample ID: NTI0347-05 (KIF-RELIC C1-T5-LH-082910 - Water) Sampled: 08/29/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00762**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Arsenic	**0.00881**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:45	EPA 200.8	10I0985
Chromium	**0.0423**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Copper	**0.00795**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Lead	**0.00149**	J	mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Molybdenum	**0.0642**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Nickel	**0.0313**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Selenium	**0.0402**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Vanadium	**0.465**		mg/L	0.00100	0.00400	1	09/13/10 22:45	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:45	EPA 200.8	10I0985

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Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-05 (KIF-RELIC C1-T5-LH-082910 - Water) - cont. Sampled: 08/29/10 14:00									
Total Metals by EPA Method 200.7									
Aluminum	**23.3**		mg/L	0.0500	0.100	1	09/09/10 21:55	EPA 200.7	10I0983
Barium	**0.326**		mg/L	0.0100	0.0100	1	09/09/10 21:55	EPA 200.7	10I0983
Boron	**7.28**		mg/L	0.125	0.500	10	09/10/10 10:58	EPA 200.7	10I0983
Calcium	**52.4**		mg/L	0.500	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:55	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Potassium	**3.60**		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Sodium	**3.42**		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Strontium	**1.94**		mg/L	0.0125	0.0500	1	09/09/10 21:55	EPA 200.7	10I0983
Sample ID: NTI0347-06 (KIF-RELIC C2-T1-LH-081310 - Water) Sampled: 08/13/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.000740**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Arsenic	**0.00280**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:48	EPA 200.8	10I0985
Chromium	**0.00936**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Cobalt	**0.000520**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Copper	**0.0269**		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Lead	**0.000960**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Molybdenum	**0.0349**		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Nickel	**0.00221**	J	mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Selenium	**0.0279**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Vanadium	**0.00263**	J	mg/L	0.00100	0.00400	1	09/13/10 22:48	EPA 200.8	10I0985
Zinc	**0.0270**	J	mg/L	0.00830	0.0500	1	09/13/10 22:48	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**3.59**		mg/L	0.0500	0.100	1	09/09/10 21:58	EPA 200.7	10I0983
Barium	**34.2**		mg/L	0.100	0.100	10	09/10/10 11:01	EPA 200.7	10I0983
Boron	**0.123**		mg/L	0.0125	0.0500	1	09/09/10 21:58	EPA 200.7	10I0983
Calcium	**338**		mg/L	0.500	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:58	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Potassium	**456**		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Sodium	**77.6**		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Strontium	**44.0**		mg/L	1.25	5.00	100	09/10/10 11:04	EPA 200.7	10I0983

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-07 (KIF-RELIC C2-T2-LH-081710 - Water) Sampled: 08/17/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.000930**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Arsenic	**0.00182**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:52	EPA 200.8	10I0985
Chromium	**0.00879**		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Cobalt	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Copper	**0.0240**		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Lead	**0.000680**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Molybdenum	**0.0304**		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Nickel	**0.00167**	J	mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Selenium	**0.0229**		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Vanadium	**0.00154**	J	mg/L	0.00100	0.00400	1	09/13/10 22:52	EPA 200.8	10I0985
Zinc	**0.0254**	J	mg/L	0.00830	0.0500	1	09/13/10 22:52	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**3.62**		mg/L	0.0500	0.100	1	09/09/10 22:14	EPA 200.7	10I0983
Barium	**33.9**		mg/L	0.100	0.100	10	09/10/10 11:07	EPA 200.7	10I0983
Boron	**0.208**		mg/L	0.0125	0.0500	1	09/09/10 22:14	EPA 200.7	10I0983
Calcium	**341**		mg/L	0.500	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:14	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Potassium	**323**		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Sodium	**56.2**		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Strontium	**44.6**		mg/L	1.25	5.00	100	09/10/10 11:11	EPA 200.7	10I0983
Sample ID: NTI0347-08 (KIF-RELIC C2-T3-LH-082110 - Water) Sampled: 08/21/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.000970**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Arsenic	**0.00111**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:55	EPA 200.8	10I0985
Chromium	**0.00808**		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Copper	**0.0269**		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Lead	**0.000510**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Molybdenum	**0.0272**		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Nickel	**0.00178**	J	mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Selenium	**0.0174**		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Vanadium	**0.00140**	J	mg/L	0.00100	0.00400	1	09/13/10 22:55	EPA 200.8	10I0985
Zinc	**0.0289**	J	mg/L	0.00830	0.0500	1	09/13/10 22:55	EPA 200.8	10I0985

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-08 (KIF-RELIC C2-T3-LH-082110 - Water) - cont. Sampled: 08/21/10 11:00									
Total Metals by EPA Method 200.7									
Aluminum	**4.08**		mg/L	0.0500	0.100	1	09/09/10 22:17	EPA 200.7	10I0983
Barium	**38.5**		mg/L	0.100	0.100	10	09/10/10 11:14	EPA 200.7	10I0983
Boron	**0.318**		mg/L	0.0125	0.0500	1	09/09/10 22:17	EPA 200.7	10I0983
Calcium	**386**		mg/L	0.500	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:17	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Potassium	**170**		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Sodium	**31.9**		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Strontium	**51.1**		mg/L	1.25	5.00	100	09/10/10 11:30	EPA 200.7	10I0983
Sample ID: NTI0347-09 (KIF-RELIC C2-T4-LH-082510 - Water) Sampled: 08/25/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.00115**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Arsenic	**0.000870**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:58	EPA 200.8	10I0985
Chromium	**0.00744**		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Copper	**0.0277**		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Lead	**0.000460**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Molybdenum	**0.0273**		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Nickel	**0.00201**	J	mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Selenium	**0.0144**		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Vanadium	**0.00106**	J	mg/L	0.00100	0.00400	1	09/13/10 22:58	EPA 200.8	10I0985
Zinc	**0.0269**	J	mg/L	0.00830	0.0500	1	09/13/10 22:58	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**4.54**		mg/L	0.0500	0.100	1	09/09/10 22:21	EPA 200.7	10I0983
Barium	**37.5**		mg/L	0.100	0.100	10	09/10/10 11:33	EPA 200.7	10I0983
Boron	**0.352**		mg/L	0.0125	0.0500	1	09/09/10 22:21	EPA 200.7	10I0983
Calcium	**395**		mg/L	0.500	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:21	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Potassium	**102**		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Sodium	**18.9**		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Strontium	**53.3**		mg/L	1.25	5.00	100	09/10/10 11:36	EPA 200.7	10I0983

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-10 (KIF-RELIC C2-T5-LH-082910 - Water) Sampled: 08/29/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.00104**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Arsenic	**0.000910**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:02	EPA 200.8	10I0985
Chromium	**0.00709**		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Copper	**0.0284**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Lead	**0.000760**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Molybdenum	**0.0257**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Nickel	**0.00667**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Selenium	**0.0134**		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Vanadium	**0.00112**	J	mg/L	0.00100	0.00400	1	09/13/10 23:02	EPA 200.8	10I0985
Zinc	**0.0253**	J	mg/L	0.00830	0.0500	1	09/13/10 23:02	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**4.92**		mg/L	0.0500	0.100	1	09/09/10 22:24	EPA 200.7	10I0983
Barium	**36.4**		mg/L	0.100	0.100	10	09/10/10 11:39	EPA 200.7	10I0983
Boron	**0.352**		mg/L	0.0125	0.0500	1	09/09/10 22:24	EPA 200.7	10I0983
Calcium	**389**		mg/L	0.500	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:24	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Potassium	**71.2**		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Sodium	**16.8**		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Strontium	**49.4**		mg/L	1.25	5.00	100	09/10/10 11:43	EPA 200.7	10I0983
Sample ID: NTI0347-11 (KIF-RELIC C3-T1-LH-081310 - Water) Sampled: 08/13/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.00987**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Arsenic	**0.00313**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:05	EPA 200.8	10I0985
Chromium	**0.238**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Cobalt	**0.000330**	J	mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Copper	**0.0138**		mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Molybdenum	**0.664**		mg/L	0.00165	0.0250	5	09/13/10 23:48	EPA 200.8	10I0985
Nickel	**0.00393**	J	mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Selenium	**0.732**		mg/L	0.00165	0.0100	5	09/13/10 23:48	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Vanadium	**0.119**		mg/L	0.00100	0.00400	1	09/13/10 23:05	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:05	EPA 200.8	10I0985

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-11 (KIF-RELIC C3-T1-LH-081310 - Water) - cont. Sampled: 08/13/10 14:00									
Total Metals by EPA Method 200.7									
Aluminum	**8.49**		mg/L	0.0500	0.100	1	09/09/10 22:28	EPA 200.7	10I0983
Barium	**0.104**		mg/L	0.0100	0.0100	1	09/09/10 22:28	EPA 200.7	10I0983
Boron	**7.21**		mg/L	0.125	0.500	10	09/10/10 11:46	EPA 200.7	10I0983
Calcium	**73.4**		mg/L	0.500	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:28	EPA 200.7	10I0983
Magnesium	**0.519**	J	mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Potassium	**10.8**		mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Sodium	**17.9**		mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Strontium	**2.47**		mg/L	0.125	0.500	10	09/10/10 11:46	EPA 200.7	10I0983
Sample ID: NTI0347-12 (KIF-RELIC C3-T2-LH-081710 - Water) Sampled: 08/17/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.0176**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Arsenic	**0.0236**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:08	EPA 200.8	10I0985
Chromium	**0.159**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Cobalt	**0.000480**	J	mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Copper	**0.0110**		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Molybdenum	**0.164**		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Nickel	**0.00421**	J	mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Selenium	**0.231**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Vanadium	**1.04**		mg/L	0.00500	0.0200	5	09/13/10 23:51	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:08	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**42.5**		mg/L	0.0500	0.100	1	09/09/10 22:31	EPA 200.7	10I0983
Barium	**0.177**		mg/L	0.0100	0.0100	1	09/09/10 22:31	EPA 200.7	10I0983
Boron	**14.8**		mg/L	0.125	0.500	10	09/10/10 11:49	EPA 200.7	10I0983
Calcium	**26.8**		mg/L	0.500	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:31	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Potassium	**94.8**		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Sodium	**37.9**		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Strontium	**1.20**		mg/L	0.0125	0.0500	1	09/09/10 22:31	EPA 200.7	10I0983

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-13 (KIF-RELIC C3-T3-LH-082110 - Water) Sampled: 08/21/10 11:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.0206**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Arsenic	**0.0828**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:12	EPA 200.8	10I0985
Chromium	**0.0387**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Cobalt	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Copper	**0.0157**		mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Manganese	**0.000880**	J, B	mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Molybdenum	**0.0453**		mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Nickel	**0.00431**	J	mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Selenium	**0.225**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Vanadium	**2.59**		mg/L	0.0100	0.0400	10	09/13/10 23:54	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:12	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**87.7**		mg/L	0.0500	0.100	1	09/09/10 22:34	EPA 200.7	10I0983
Barium	**0.0767**		mg/L	0.0100	0.0100	1	09/09/10 22:34	EPA 200.7	10I0983
Boron	**7.32**		mg/L	0.125	0.500	10	09/10/10 11:52	EPA 200.7	10I0983
Calcium	**4.81**		mg/L	0.500	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:34	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Potassium	**183**		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Sodium	**28.1**		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Strontium	**0.268**		mg/L	0.0125	0.0500	1	09/09/10 22:34	EPA 200.7	10I0983

Sample ID: NTI0347-14 (KIF-RELIC C3-T4-LH-082510 - Water) Sampled: 08/25/10 11:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.0149**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Arsenic	**0.0503**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:15	EPA 200.8	10I0985
Chromium	**0.0204**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Copper	**0.0102**		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Molybdenum	**0.0313**		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Nickel	**0.00186**	J	mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Selenium	**0.117**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Vanadium	**1.76**		mg/L	0.0100	0.0400	10	09/14/10 00:05	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:15	EPA 200.8	10I0985

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-14 (KIF-RELIC C3-T4-LH-082510 - Water) - cont. Sampled: 08/25/10 11:00									
Total Metals by EPA Method 200.7									
Aluminum	**60.2**		mg/L	0.0500	0.100	1	09/09/10 22:37	EPA 200.7	10I0983
Barium	**0.0820**		mg/L	0.0100	0.0100	1	09/09/10 22:37	EPA 200.7	10I0983
Boron	**2.98**		mg/L	0.125	0.500	10	09/10/10 11:55	EPA 200.7	10I0983
Calcium	**7.92**		mg/L	0.500	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:37	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Potassium	**139**		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Sodium	**14.2**		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Strontium	**0.430**		mg/L	0.0125	0.0500	1	09/09/10 22:37	EPA 200.7	10I0983
Sample ID: NTI0347-15 (KIF-RELIC C3-T5-LH-082910 - Water) Sampled: 08/29/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.00924**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Arsenic	**0.0236**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:25	EPA 200.8	10I0985
Chromium	**0.00815**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Copper	**0.00723**		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Molybdenum	**0.0228**		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Nickel	**0.00192**	J	mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Selenium	**0.0507**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Vanadium	**0.866**		mg/L	0.00500	0.0200	5	09/14/10 00:08	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:25	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**36.5**		mg/L	0.0500	0.100	1	09/09/10 22:40	EPA 200.7	10I0983
Barium	**0.112**		mg/L	0.0100	0.0100	1	09/09/10 22:40	EPA 200.7	10I0983
Boron	**1.81**		mg/L	0.0125	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983
Calcium	**14.0**		mg/L	0.500	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Potassium	**77.4**		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Sodium	**11.8**		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Strontium	**0.783**		mg/L	0.0125	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-16 (KIF-RELIC MaterialBlank-A-090210 - Water) Sampled: 09/02/10 00:01

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Arsenic	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:28	EPA 200.8	10I0985
Chromium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Copper	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Nickel	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Selenium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Vanadium	**0.00193**	J	mg/L	0.00100	0.00400	1	09/13/10 23:28	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:28	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	09/09/10 22:43	EPA 200.7	10I0983
Barium	ND		mg/L	0.0100	0.0100	1	09/09/10 22:43	EPA 200.7	10I0983
Boron	ND		mg/L	0.0125	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983
Calcium	ND		mg/L	0.500	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Potassium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Sodium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Strontium	ND		mg/L	0.0125	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

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THE LEADER IN ENVIRONMENTAL TESTING
2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748
Attn William Rogers

Work Order: NTI0347
Project Name: Kingston Fossil Plant 050710
Project Number: RSICA0902Y10A
Received: 09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10I0985-BLK1						
Antimony	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Arsenic	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Beryllium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Cadmium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Chromium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Cobalt	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Copper	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Lead	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Manganese	0.000330	J	mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Molybdenum	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Nickel	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Selenium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Silver	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Thallium	<0.000500		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Vanadium	<0.00100		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Zinc	<0.00830		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Total Metals by EPA Method 200.7						
10I0983-BLK1						
Aluminum	<0.0500		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Barium	<0.0100		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Boron	<0.0125		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Calcium	<0.500		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Iron	<0.0250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Magnesium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Potassium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Sodium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Strontium	<0.0125		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10I0985-BS1								
Antimony	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Arsenic	0.100	0.0928		mg/L	93%	85 - 115	10I0985	09/13/10 22:06
Beryllium	0.100	0.103		mg/L	103%	85 - 115	10I0985	09/13/10 22:06
Cadmium	0.100	0.0981		mg/L	98%	85 - 115	10I0985	09/13/10 22:06
Chromium	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Cobalt	0.100	0.0989		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Copper	0.100	0.0992		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Lead	0.100	0.101		mg/L	101%	85 - 115	10I0985	09/13/10 22:06
Manganese	0.100	0.0942	B	mg/L	94%	85 - 115	10I0985	09/13/10 22:06
Molybdenum	0.100	0.104		mg/L	104%	85 - 115	10I0985	09/13/10 22:06
Nickel	0.100	0.0987		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Selenium	0.100	0.0976		mg/L	98%	85 - 115	10I0985	09/13/10 22:06
Silver	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Thallium	0.100	0.0963		mg/L	96%	85 - 115	10I0985	09/13/10 22:06
Vanadium	0.100	0.0995		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Zinc	0.100	0.0994		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Total Metals by EPA Method 200.7								
10I0983-BS1								
Aluminum	2.00	2.12		mg/L	106%	85 - 115	10I0983	09/09/10 21:14
Barium	2.00	2.14		mg/L	107%	85 - 115	10I0983	09/09/10 21:14
Boron	1.00	1.05		mg/L	105%	85 - 115	10I0983	09/09/10 21:14
Calcium	5.00	5.16		mg/L	103%	85 - 115	10I0983	09/09/10 21:14
Iron	1.00	1.04		mg/L	104%	85 - 115	10I0983	09/09/10 21:14
Magnesium	5.00	5.19		mg/L	104%	85 - 115	10I0983	09/09/10 21:14
Potassium	5.00	5.16		mg/L	103%	85 - 115	10I0983	09/09/10 21:14
Sodium	5.00	5.25		mg/L	105%	85 - 115	10I0983	09/09/10 21:14
Strontium	1.00	1.04		mg/L	104%	85 - 115	10I0983	09/09/10 21:14

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA 200.8										
10I0985-MS1										
Antimony	0.00957	0.115		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Arsenic	0.00286	0.101		mg/L	0.100	98%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Cadmium	0.000420	0.0992		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Chromium	0.198	0.300		mg/L	0.100	102%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Cobalt	ND	0.101		mg/L	0.100	101%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Copper	0.00993	0.106		mg/L	0.100	96%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Lead	0.000340	0.105		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Manganese	0.000380	0.0983	B	mg/L	0.100	98%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Molybdenum	0.756	0.855		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Nickel	0.00300	0.100		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Selenium	0.787	0.852	MHA	mg/L	0.100	65%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Silver	ND	0.0952		mg/L	0.100	95%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Thallium	ND	0.101		mg/L	0.100	101%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Vanadium	0.0911	0.194		mg/L	0.100	103%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Zinc	0.00849	0.108		mg/L	0.100	100%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
10I0985-MS2										
Antimony	0.0105	0.117		mg/L	0.100	107%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Arsenic	0.00514	0.104		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Cadmium	0.000380	0.0991		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Chromium	0.273	0.362		mg/L	0.100	89%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Cobalt	0.000390	0.0992		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Copper	0.00711	0.102		mg/L	0.100	95%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Lead	ND	0.105		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Manganese	0.000340	0.0972	B	mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Molybdenum	0.764	0.824	MHA	mg/L	0.100	60%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Nickel	0.00297	0.0996		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Selenium	0.762	0.838		mg/L	0.100	76%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Silver	ND	0.0967		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Thallium	ND	0.100		mg/L	0.100	100%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Vanadium	0.362	0.452		mg/L	0.100	90%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Zinc	ND	0.0980		mg/L	0.100	98%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Total Metals by EPA Method 200.7										
10I0983-MS1										
Aluminum	9.41	11.4		mg/L	2.00	99%	70 - 130	10I0983	NTI0347-01	09/09/10 21:32

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike - Cont.

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA Method 200.7										
10I0983-MS1										
Barium	0.0578	2.19		mg/L	2.00	106%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Boron	8.14	8.18	MHA	mg/L	1.00	4%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Calcium	78.6	82.6	MHA	mg/L	5.00	81%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Iron	ND	1.07		mg/L	1.00	107%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Magnesium	0.375	5.54		mg/L	5.00	103%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Potassium	8.33	13.4		mg/L	5.00	100%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Sodium	13.8	18.9		mg/L	5.00	101%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Strontium	2.96	3.62	M8	mg/L	1.00	66%	70 - 130	10I0983	NTI0347-01	09/09/10 21:32
10I0983-MS2										
Aluminum	20.5	21.2	MHA	mg/L	2.00	37%	70 - 130	10I0983	NTI0347-02	09/09/10 21:42
Barium	0.336	2.39		mg/L	2.00	103%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Boron	6.85	8.20	MHA	mg/L	1.00	134%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Calcium	84.6	84.0	MHA	mg/L	5.00	-12%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Iron	ND	1.05		mg/L	1.00	105%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Magnesium	ND	5.08		mg/L	5.00	102%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Potassium	8.52	13.0		mg/L	5.00	91%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Sodium	10.8	15.4		mg/L	5.00	91%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Strontium	2.72	3.82		mg/L	1.00	110%	70 - 130	10I0983	NTI0347-02	09/09/10 21:42

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10I0985-MSD1												
Antimony	0.00957	0.117		mg/L	0.100	108%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Arsenic	0.00286	0.105		mg/L	0.100	102%	75 - 125	4	20	10I0985	NTI0347-01	09/13/10 22:19
Beryllium	ND	0.109		mg/L	0.100	109%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Cadmium	0.000420	0.101		mg/L	0.100	101%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Chromium	0.198	0.308		mg/L	0.100	110%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Cobalt	ND	0.103		mg/L	0.100	103%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Copper	0.00993	0.109		mg/L	0.100	99%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Lead	0.000340	0.106		mg/L	0.100	105%	75 - 125	0.5	20	10I0985	NTI0347-01	09/13/10 22:19
Manganese	0.000380	0.101	B	mg/L	0.100	101%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Molybdenum	0.756	0.883	MHA	mg/L	0.100	127%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Nickel	0.00300	0.105		mg/L	0.100	102%	75 - 125	5	20	10I0985	NTI0347-01	09/13/10 22:19
Selenium	0.787	0.866		mg/L	0.100	79%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Silver	ND	0.0984		mg/L	0.100	98%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Thallium	ND	0.102		mg/L	0.100	102%	75 - 125	0.4	20	10I0985	NTI0347-01	09/13/10 22:19
Vanadium	0.0911	0.200		mg/L	0.100	109%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Zinc	0.00849	0.107		mg/L	0.100	99%	75 - 125	1	20	10I0985	NTI0347-01	09/13/10 22:19
10I0985-MSD2												
Antimony	0.0105	0.117		mg/L	0.100	107%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Arsenic	0.00514	0.104		mg/L	0.100	99%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Cadmium	0.000380	0.102		mg/L	0.100	102%	75 - 125	3	20	10I0985	NTI0347-02	09/13/10 22:28
Chromium	0.273	0.367		mg/L	0.100	95%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Cobalt	0.000390	0.102		mg/L	0.100	101%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Copper	0.00711	0.102		mg/L	0.100	95%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Lead	ND	0.105		mg/L	0.100	105%	75 - 125	0	20	10I0985	NTI0347-02	09/13/10 22:28
Manganese	0.000340	0.0984	B	mg/L	0.100	98%	75 - 125	1	20	10I0985	NTI0347-02	09/13/10 22:28
Molybdenum	0.764	0.840		mg/L	0.100	76%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Nickel	0.00297	0.101		mg/L	0.100	98%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Selenium	0.762	0.844		mg/L	0.100	81%	75 - 125	0.6	20	10I0985	NTI0347-02	09/13/10 22:28
Silver	ND	0.0996		mg/L	0.100	100%	75 - 125	3	20	10I0985	NTI0347-02	09/13/10 22:28
Thallium	ND	0.101		mg/L	0.100	101%	75 - 125	0.8	20	10I0985	NTI0347-02	09/13/10 22:28
Vanadium	0.362	0.452		mg/L	0.100	90%	75 - 125	0.02	20	10I0985	NTI0347-02	09/13/10 22:28
Zinc	ND	0.0987		mg/L	0.100	99%	75 - 125	0.8	20	10I0985	NTI0347-02	09/13/10 22:28
Total Metals by EPA Method 200.7												
10I0983-MSD1												
Aluminum	9.41	11.6		mg/L	2.00	109%	70 - 130	2	20	10I0983	NTI0347-01	09/09/10 21:36
Barium	0.0578	2.18		mg/L	2.00	106%	75 - 125	0.4	20	10I0983	NTI0347-01	09/09/10 21:36
Boron	8.14	8.34	MHA	mg/L	1.00	21%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36
Calcium	78.6	84.2	MHA	mg/L	5.00	112%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA

Matrix Spike Dup - Cont.

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA Method 200.7												
10I0983-MSD1												
Iron	ND	1.08		mg/L	1.00	108%	75 - 125	0.6	20	10I0983	NTI0347-01	09/09/10 21:36
Magnesium	0.375	5.55		mg/L	5.00	103%	75 - 125	0.1	20	10I0983	NTI0347-01	09/09/10 21:36
Potassium	8.33	13.5		mg/L	5.00	103%	75 - 125	1	20	10I0983	NTI0347-01	09/09/10 21:36
Sodium	13.8	19.2		mg/L	5.00	108%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36
Strontium	2.96	3.67		mg/L	1.00	71%	70 - 130	1	20	10I0983	NTI0347-01	09/09/10 21:36
10I0983-MSD2												
Aluminum	20.5	22.2		mg/L	2.00	84%	70 - 130	4	20	10I0983	NTI0347-02	09/09/10 21:45
Barium	0.336	2.44		mg/L	2.00	105%	75 - 125	2	20	10I0983	NTI0347-02	09/09/10 21:45
Boron	6.85	8.58	MHA	mg/L	1.00	173%	75 - 125	5	20	10I0983	NTI0347-02	09/09/10 21:45
Calcium	84.6	88.8	MHA	mg/L	5.00	83%	75 - 125	5	20	10I0983	NTI0347-02	09/09/10 21:45
Iron	ND	1.06		mg/L	1.00	106%	75 - 125	0.9	20	10I0983	NTI0347-02	09/09/10 21:45
Magnesium	ND	5.11		mg/L	5.00	102%	75 - 125	0.6	20	10I0983	NTI0347-02	09/09/10 21:45
Potassium	8.52	13.6		mg/L	5.00	101%	75 - 125	4	20	10I0983	NTI0347-02	09/09/10 21:45
Sodium	10.8	15.9		mg/L	5.00	101%	75 - 125	3	20	10I0983	NTI0347-02	09/09/10 21:45
Strontium	2.72	3.95		mg/L	1.00	123%	70 - 130	3	20	10I0983	NTI0347-02	09/09/10 21:45

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

DATA QUALIFIERS AND DEFINITIONS

B	Analyte was detected in the associated Method Blank.
J	Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
ND	Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

[redacted]

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Cooler # 1 of 1

COC # RSICA0902Y10A

RSICA0902Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name:	Test America Nashville	Site ID #:	KIF	Sampler	
Address:	2960 Foster Creighton Drive□□ Nashville, TN 37204	Project #:	Kingston Fossil Plant	Sampling Company	
		Site Address	714 Swan Pond Rd	Address:	
Lab PM:	Mark Hollingsworth	City	Harriman; State, Zip	City/State	Phone #:
Phone/Fax:	800.765.0980	Site PM Name	Bill Rogers	Reimbursement project?	Non-reimbursement project? Mark one
Lab PM email		Phone/Fax:	865-717-1627	Send EDD to	TVAEDD@envstd.com
Applicable Lab Quote #:		Site PM Email:	wjrogers@tva.gov	CC Hardcopy report to	
				CC Hardcopy report to	

TAT: Standard 5 day X | Rush | Mark One

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. PAP 9/2/2010 Time	N	HNO3	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 1, Test 1			X
2	KIF-RELIC_C1-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 1, Test 2			X
3	KIF-RELIC_C1-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 1, Test 3			X
4	KIF-RELIC_C1-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 1, Test 4			X
5	KIF-RELIC_C1-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 1, Test 5			X
6	KIF-RELIC_C2-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 2, Test 1			X
7	KIF-RELIC_C2-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 2, Test 2			X
8	KIF-RELIC_C2-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 2, Test 3			X
9	KIF-RELIC_C2-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 2, Test 4			X
10	KIF-RELIC_C2-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 2, Test 5			X
11	KIF-RELIC_C3-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 3, Test 1			X
12	KIF-RELIC_C3-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 3, Test 2			X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
X Investigatory	Paul H. Pier - TVA	9/2/2010	PAP ~~[illegible]~~ 11:42pm	9/2/2010		
Split Comparison						
Split Legal						
Special Study						
Plant Ops						
Oth:						

Sample Receipt Conditions

Temp in OC	Samples on Ice?	Sample Intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier | DATE Signed: | Time:

[redacted]

PAP 9/2/2010

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 2 of 2
Cooler # ~~#1~~ of 1

COC # RSICA0902Y10A

RSICA0902Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler #	
Sampling Company	
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard 5 day X Rush Mark One

Preservative: N HNO3 — METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. PAP 9/2/2010 Time	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 3, Test 3	X
2	KIF-RELIC_C3-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 3, Test 4	X
3	KIF-RELIC_C3-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 3, Test 5	X
4	KIF-RELIC_MaterialBlank-A-090210	RELIC	NA	NA	A	G	N	09/02/2010		1	Material Blank	X
5												
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier - TVA	9/2/2010	PAP 9/2/2010 ~~12:42 pm~~ 11:42 pm			

SHIPPING METHOD (mark as appropriate): UPS COURIER \ FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: Time:

Sample Receipt Conditions

Temp in 0C	Samples on ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECE

NTI0347

Cooler Received/Opened On 9/3/2010 @ 0955

1. Tracking # 1233(170 01 9238 7733

Courier: UPS IR Gun ID 97460373

2. Temperature of rep. sample or temp blank when opened: 4.4 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) B

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) M

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) M

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) M

I certify that I attached a label with the unique LIMS number to each container (intial) M

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

BIS = Broken in shipment

Cooler Receipt Form.doc

TENNESSEE VALLEY AUTHORITY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 2
Cooler # 1 of

NTI0347
09/13/10 23:59

COC # RSICA0902Y10A
RSICA0902Y10A

Required Ship to Lab:

Lab Name	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler	
Sampling Company	
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard 5 day X | Rush | Mark One

Filtered: N
Preserve: HNO3
Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. (PAP 9/2/2010 Time)	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	1 Column 1, Test 1	X
2	KIF-RELIC_C1-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	2 Column 1, Test 2	X
3	KIF-RELIC_C1-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	3 Column 1, Test 3	X
4	KIF-RELIC_C1-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	4 Column 1, Test 4	X
5	KIF-RELIC_C1-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	5 Column 1, Test 5	X
6	KIF-RELIC_C2-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	6 Column 2, Test 1	X
7	KIF-RELIC_C2-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	7 Column 2, Test 2	X
8	KIF-RELIC_C2-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	8 Column 2, Test 3	X
9	KIF-RELIC_C2-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	9 Column 2, Test 4	X
10	KIF-RELIC_C2-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	10 Column 2, Test 5	X
11	KIF-RELIC_C3-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	11 Column 3, Test 1	X
12	KIF-RELIC_C3-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	12 Column 3, Test 2	X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Paul H. Pier - TVA	9/2/2010	12:42 pm	TA	9/3/10	0955	4.4	(Y)/N	(Y)/N	Y/(N)
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
						Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul H. Pier
DATE Signed:
Time:

PHP 9/2/2010

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUME ... ate

~~NTI0347~~

09/13/10 23:59

TENNESSEE VALLEY AUTHORITY

Page: 2 of 2
Cooler # ~~2~~ 1 of 1

COC # RSICA0902Y10A

RSICA0902Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	
Address	2960 Foster Creighton Drive, Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	
		Site Address	714 Swan Pond Rd	Address	
Lab PM	Mark Hollingsworth	City	Hamman	City/State	Phone #:
		State, Zip		Reimbursement project?	Non-reimbursement project? Mark one
Phone/Fax	800.765.0980	Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax	865-717-1627	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email	wjrogers@tva.gov	CC Hardcopy report to	

TAT: Standard 5 day X | Rush | Mark One

Filtered: N | Preserve: HNO3 | Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. (PHP 9/2/2010 Time)	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	13 Column 3, Test 3	X
2	KIF-RELIC_C3-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	14 Column 3, Test 4	X
3	KIF-RELIC_C3-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	15 Column 3, Test 5	X
4	KIF-RELIC_MaterialBlank-A-090210	RELIC	NA	NA	A	G	N	09/02/2010		1	16 Material Blank	X
5												
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
X Investigatory	Paul A. Pier - TVA	9/2/2010	12:42pm	[signature] TA	9/3/10	0955	4.4	Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study								Y/N	Y/N	Y/N
Plant Ops							Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?
Oth:										

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier | DATE Signed | Time:

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Road
Nashville, TN 37204
Tel: 800-765-0980

TestAmerica Job ID: NTI0751
TestAmerica Sample Delivery Group: NTI0751
Client Project/Site: [none]
Client Project Description: Kingston Fossil Plant 050710

For:
TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748

Attn: Bruce Haas

Authorized for release by:
10/19/2010 5:53 PM
Johnny A. Mitchell
Laboratory Director
johnny.mitchell@testamericainc.com

Designee for

Mark Hollingsworth
Laboratory Director
mark.hollingsworth@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

LINKS
Review your project results through TotalAccess
Have a Question? Ask The Expert
Visit us at: www.testamericainc.com

Table of Contents

Sample Summary

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
NTI0751-03	pH 7	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-04	pH 8	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-05	pH 9	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-06	pH 10	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-07	pH 11	Ash	09/09/10 12:51	09/09/10 16:30

Client: TVA - Kingston Fossil
TestAmerica Job ID: NTI0751
Project/Site: [none]
SDG: NTI0751

Glossary

Glossary	Glossary Description
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis.

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Client Sample ID: pH 7
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-03
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0214		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:44	1
Selenium	0.0528		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:44	1

Client Sample ID: pH 8
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-04
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0482		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:47	1
Selenium	0.0554		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:47	1

Client Sample ID: pH 9

Lab Sample ID: NTI0751-05

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0500		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:51	1
Selenium	0.0350		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:51	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Client Sample ID: pH 10
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-06
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.353**		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:54	1
Selenium	**0.129**		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:54	1

Client Sample ID: pH 11
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-07
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	0.134		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 12:05	1

Method: SW846 6020 - Total Metals by Method 6020 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.702		0.0100	0.000300	mg/L		10/13/10 11:45	10/14/10 12:22	5

1 2 3 4 5 6 7 8 9 10 11

1 2 3 4 5 6 7 8 9 10 11

Method: SW846 6020 - Total Metals by Method 6020

Lab Sample ID: 10J1832-BLK1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BLK1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.00200	0.000330	mg/L		10/13/10 11:45	10/14/10 11:33	1
Selenium	ND		0.00200	0.000330	mg/L		10/13/10 11:45	10/14/10 11:33	1

Lab Sample ID: 10J1832-BS1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BS1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Arsenic	0.100	0.0868		mg/L		87	80 - 120
Selenium	0.100	0.0864		mg/L		86	80 - 120

Lab Sample ID: 10J1832-BSD1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BSD1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Arsenic	0.100	0.0839		mg/L		84	80 - 120	3	20
Selenium	0.100	0.0850		mg/L		85	80 - 120	2	20

Metals

Prep Batch: 10J1832_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10J1832-BLK1	10J1832-BLK1	total	Water	EPA 3010A / 6020	
10J1832-BS1	10J1832-BS1	total	Water	EPA 3010A / 6020	
10J1832-BSD1	10J1832-BSD1	total	Water	EPA 3010A / 6020	
NTI0751-03	pH 7	total	Ash	EPA 3010A / 6020	
NTI0751-04	pH 8	total	Ash	EPA 3010A / 6020	
NTI0751-05	pH 9	total	Ash	EPA 3010A / 6020	
NTI0751-06	pH 10	total	Ash	EPA 3010A / 6020	
NTI0751-07	pH 11	total	Ash	EPA 3010A / 6020	
NTI0751-07 - RE1	pH 11	total	Ash	EPA 3010A / 6020	

Analysis Batch: T015999

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10J1832-BLK1	10J1832-BLK1	total	Water	SW846 6020	10J1832_P
10J1832-BS1	10J1832-BS1	total	Water	SW846 6020	10J1832_P
10J1832-BSD1	10J1832-BSD1	total	Water	SW846 6020	10J1832_P
NTI0751-03	pH 7	total	Ash	SW846 6020	10J1832_P
NTI0751-04	pH 8	total	Ash	SW846 6020	10J1832_P
NTI0751-05	pH 9	total	Ash	SW846 6020	10J1832_P
NTI0751-06	pH 10	total	Ash	SW846 6020	10J1832_P
NTI0751-07	pH 11	total	Ash	SW846 6020	10J1832_P
T015999-SRD1	pH 11	total	Water	SW846 6020	
NTI0751-07 - RE1	pH 11	total	Ash	SW846 6020	10J1832_P

Analysis Batch: N/A

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTI0751-07	pH 11	total	Ash	SW846 6020	

Lab Chronicle

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Client Sample ID: pH 7
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-03
Matrix: Ash

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10J1832_P	10/13/10 11:45	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		1	T015999	10/14/10 11:44	JWD	TestAmerica Nashville

Client Sample ID: pH 8
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-04
Matrix: Ash

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:47	JWD	TestAmerica Nashville

Client Sample ID: pH 9
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-05
Matrix: Ash

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:51	JWD	TestAmerica Nashville

Client Sample ID: pH 10
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-06
Matrix: Ash

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:54	JWD	TestAmerica Nashville

Client Sample ID: pH 11
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-07
Matrix: Ash

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020	RE1	1	10J1832_P	10/13/10 11:45	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		1	T015999	10/14/10 12:05	JWD	TestAmerica Nashville
total	Analysis	SW846 6020	RE1	5	T015999	10/14/10 12:22	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		5	N/A	10/14/10 12:08		TestAmerica Nashville

Method Summary

Method	Method Description	Protocol	Laboratory
SW846 6020	Total Metals by Method 6020		TAL NSH

Protocol References:

=

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Road, Nashville, TN 37204, TEL 800-765-0980

Certification Summary

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Laboratory	Authority	Program	EPA Region	Certification ID	Expiration Date
TestAmerica Nashville		AIHA		100790	09/01/11
TestAmerica Nashville		USDA		S-48469	01/22/11
TestAmerica Nashville	A2LA	A2LA	0	0453.07	12/31/11
TestAmerica Nashville	A2LA	WY UST	0	453.07	12/31/11
TestAmerica Nashville	Alabama	State Program	4	41150	10/31/10
TestAmerica Nashville	Alaska	Alaska UST	10	UST-087	07/24/11
TestAmerica Nashville	Arizona	State Program	9	AZ0473	05/05/11
TestAmerica Nashville	Arkansas	State Program	6	88-0737	04/25/11
TestAmerica Nashville	California	NELAC	9	1168CA	10/31/10
TestAmerica Nashville	Colorado	State Program	8	N/A	02/28/11
TestAmerica Nashville	Connecticut	State Program	1	PH-0220	12/31/11
TestAmerica Nashville	Florida	NELAC	4	E87358	06/30/11
TestAmerica Nashville	Illinois	NELAC	5	200010	12/09/10
TestAmerica Nashville	Iowa	State Program	7	131	05/01/12
TestAmerica Nashville	Kansas	NELAC	7	E-10229	10/31/10
TestAmerica Nashville	Kentucky	State Program	4	2	07/13/12
TestAmerica Nashville	Kentucky	State Program	4	90038	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	LA100011	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	30613	06/30/11
TestAmerica Nashville	Maryland	State Program	3	316	03/31/11
TestAmerica Nashville	Massachusetts	State Program	1	M-TN032	06/30/11
TestAmerica Nashville	Minnesota	State Program	5	047-999-345	12/31/10
TestAmerica Nashville	Mississippi	State Program	4	N/A	06/30/11
TestAmerica Nashville	Montana	State Program	8	NA	01/01/15
TestAmerica Nashville	Nevada	State Program	9	TN00032	07/31/11
TestAmerica Nashville	New Hampshire	NELAC	1	2963	10/09/10
TestAmerica Nashville	New Jersey	NELAC	2	TN965	06/30/11
TestAmerica Nashville	New York	NELAC	2	11342	04/01/11
TestAmerica Nashville	North Carolina	State Program	4	387	12/31/10
TestAmerica Nashville	North Dakota	State Program	8	R-146	06/30/11
TestAmerica Nashville	Ohio	VAP	5	CL0033	04/01/12
TestAmerica Nashville	Oklahoma	State Program	6	9412	08/31/11
TestAmerica Nashville	Oregon	NELAC	10	TN200001	04/30/11
TestAmerica Nashville	Pennsylvania	NELAC	3	68-00585	06/30/11
TestAmerica Nashville	Rhode Island	State Program	1	LAO00268	12/30/10
TestAmerica Nashville	South Carolina	State Program	4	84009	03/19/11
TestAmerica Nashville	South Carolina	State Program	4	84009	02/28/11
TestAmerica Nashville	Tennessee	State Program	4	2008	03/19/11
TestAmerica Nashville	Texas	NELAC	6	T104704077-09-TX	08/31/11
TestAmerica Nashville	Utah	NELAC	8	TAN	06/30/11
TestAmerica Nashville	Virginia	State Program	3	00323	06/30/11
TestAmerica Nashville	Washington	State Program	10	C789	07/19/11
TestAmerica Nashville	West Virginia	State Program	3	219	02/28/11
TestAmerica Nashville	Wisconsin	State Program	5	998020430	08/31/11

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECE

NTI0751

Cooler Received/Opened On 9/9/2010 @ 1630

1. Tracking # N/A

Courier: Off-Street IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 2.7 Degrees Celsius
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front/back
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) M

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES..NO..NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO..NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) A

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO..NA

16. Was residual chlorine present? YES...NO..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) A

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) A

I certify that I attached a label with the unique LIMS number to each container (intial) A

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

Cooler 1 of 1

BIS = Broken in shipment
Cooler Receipt Form.doc

Revised 6/24/09

RECORD COPY

CHAIN OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

TENNESSEE VALLEY AUTHORITY

NTI0751
09/20/10 23:59

Page: 1 of 1
Cooler # 1 of 1

COC # RSI-090910-003

10/19/2010

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	Mark W. Greer
Address	2960 Foster Creighton Drive, Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	TVA - Kingston Fossil Ash Recovery Operations
		Site Address	1134 Swan Pond Road	Address	1134 Swan Pond Road
Lab PM	Mark Hollingsworth	City	Harriman	City/State	Harriman, TN; Phone #: 865.717.6542
		State, Zip	TN. 37748	Reimbursement project?	Non-reimbursement project? Mark one
Phone/Fax	800.765.0980	Site PM Name	Bruce Haas	Send EDD to	bjhaas@tva.gov
Lab PM email		Phone/Fax	865-717-1602	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email	bjhaas@tva.gov	CC Hardcopy report to	

TAT: Standard X | Rush | Mark One

Filtered: NA
Preserve: NONE
Analysis: BATCH TEST, METHOD 1313

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: in)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	BATCH TEST, METHOD 1313
1	ASH - BT- 002	TVA-KIF	0	6	CA	G	N	09/09/2010	1251	2	32 oz CWM glass jar 1/2	x
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

DM 090910

Additional Comments/Special Instructions:

Ash sample collected in support of Kingston Ash Recover Project, Non-Time-Critical Removal Action for the River System Investigation, Ash Leaching Test Plan Document No. RAWP-072.

THIS IS A NON-EQUIS CHAIN OF CUSTODY

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY AFFILIATION	DATE	TIME	ACCEPTED BY AFFILIATION	DATE	TIME
Mark W. Greer / RSI	090910	1337	/ RSI	090910	1337
/ RSI	090910	1443	/ TA	9/11/10	1630

Sample Receipt Conditions

Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
2.7	Y / N (Y circled)	Y / N (Y circled)	Y / N (N circled)
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX; US MAIL Sonic

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Mark W. Greer
SIGNATURE of SAMPLER: [signature] DATE Signed: 090910 Time: 1255

Page 16 of 17

NTI0751
09/20/10 23:59

COURIER TRANSPORT DOCUMENTATION

DATE: 09/09/10

COURIER COMPANY:

Sonic Subcontractor

From:	To:
TVA c/o David Mathis 189 Lakeshore Drive Harriman. TN 37748 865-202-8313	Test America-Nashville c/o Mark Hollingsworth 2960 Foster Creighton Drive Nashville, TN 37204 800-765-0980

No. of Items:	Description:
24	Cooler(s) taped and custody sealed. Batches 23 of 23 containing surface water sample and 1 of 1 containing recovered ash and used oil samples.

Shippers Name/Company: David Mathis / RSI

Date / Time: 090910 / ~~1507~~ 1507 DM090910

Courier Signature/Company: Mike [illegible] / Direct Connections

Date / Time: 09-09-10 15:07

Receipt Signature/Company: [illegible] / TA

Date / Time: 9/9/10 1630 CST

Corresponding Chains of Custody:

- NTCSW0907Y10A p. 1 - 2
- RSISW0908Y10A p. 1 - 4
- NTCSW0908Y10B p. 1 of 1
- DISLO0909Y10A Page 1 of 1
- RSI-090910-003 Page 1 of 1

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

November 29, 2010 8:09:19AM

Client:	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Nbr:	RSICA0920Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#8559
		Date Received:	09/21/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-RELIC_C1-T10-LH-091810	NTI1887-01	09/18/10 14:00
KIF-RELIC_C1-T6-LH-090210	NTI1887-02	09/02/10 11:00
KIF-RELIC_C1-T7-LH-090610	NTI1887-03	09/06/10 12:30
KIF-RELIC_C1-T8-LH-091010	NTI1887-04	09/10/10 14:30
KIF-RELIC_C1-T9-LH-091410	NTI1887-05	09/14/10 12:00
KIF-RELIC_C2-T10-LH-091810	NTI1887-06	09/18/10 14:00
KIF-RELIC_C2-T6-LH-090210	NTI1887-07	09/02/10 11:00
KIF-RELIC_C2-T7-LH-090610	NTI1887-08	09/06/10 12:30
KIF-RELIC_C2-T8-LH-091010	NTI1887-09	09/10/10 14:30
KIF-RELIC_C2-T9-LH-091410	NTI1887-10	09/14/10 12:00
KIF-RELIC_C3-T10-LH-091810	NTI1887-11	09/18/10 14:00
KIF-RELIC_C3-T6-LH-090210	NTI1887-12	09/02/10 11:00
KIF-RELIC_C3-T7-LH-090610	NTI1887-13	09/06/10 12:30
KIF-RELIC_C3-T8-LH-091010	NTI1887-14	09/10/10 14:30
KIF-RELIC_C3-T9-LH-091410	NTI1887-15	09/14/10 12:00
KIF-MaterialBlank-A-092010	NTI1887-16	09/20/10 09:00
KIF-ProcessBlank-A-091810	NTI1887-17	09/18/10 15:00

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this material is strictly prohibited. If you have received this material in error, please notify us immediately at 615-726-0177.

Additional Laboratory Comments: ***Revised Report***
The following report has been revised for the following reason(s):
The last sample ID was corrected. No further changes were made. This report replaces all previously generated reports.

Tennessee Certification Number: 02008
The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

Mark Hollingsworth

Program Manager - National Accounts

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-01 (KIF-RELIC C1-T10-LH-091810 - Water) Sampled: 09/18/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00620**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Arsenic	**0.0100**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:25	EPA 200.8	10I3334
Chromium	**0.00806**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Copper	**0.00524**		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Molybdenum	**0.0322**		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Nickel	**0.00171**	J	mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Selenium	**0.0331**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Vanadium	**0.502**		mg/L	0.00500	0.0200	5	09/23/10 13:41	EPA 200.8	10I3334
Zinc	**0.0129**	J	mg/L	0.00830	0.0500	1	09/23/10 12:25	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**27.6**		mg/L	0.0500	0.100	1	09/22/10 18:34	EPA 200.7	10I3333
Barium	**0.332**		mg/L	0.0100	0.0100	1	09/22/10 18:34	EPA 200.7	10I3333
Boron	**3.35**		mg/L	0.0625	0.250	5	09/23/10 09:46	EPA 200.7	10I3333
Calcium	**51.4**		mg/L	0.500	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:34	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Potassium	**1.96**		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Sodium	**1.80**		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Strontium	**1.89**		mg/L	0.0125	0.0500	1	09/22/10 18:34	EPA 200.7	10I3333

Sample ID: NTI1887-02 (KIF-RELIC C1-T6-LH-090210 - Water) Sampled: 09/02/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00752**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Arsenic	**0.0104**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:28	EPA 200.8	10I3334
Chromium	**0.0313**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Copper	**0.0198**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Lead	**0.00176**	J	mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Manganese	**0.000920**	J	mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Molybdenum	**0.0548**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Nickel	**0.00943**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Selenium	**0.0384**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Vanadium	**0.504**		mg/L	0.00500	0.0200	5	09/23/10 13:45	EPA 200.8	10I3334
Zinc	**8.22**		mg/L	0.415	2.50	50	09/23/10 13:48	EPA 200.8	10I3334

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-02 (KIF-RELIC C1-T6-LH-090210 - Water) - cont. Sampled: 09/02/10 11:00									
Total Metals by EPA Method 200.7									
Aluminum	**26.4**		mg/L	0.0500	0.100	1	09/22/10 18:37	EPA 200.7	10I3333
Barium	**0.364**		mg/L	0.0100	0.0100	1	09/22/10 18:37	EPA 200.7	10I3333
Boron	**7.69**		mg/L	0.125	0.500	10	09/23/10 09:49	EPA 200.7	10I3333
Calcium	**54.2**		mg/L	0.500	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:37	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Potassium	**3.49**		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Sodium	**3.10**		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Strontium	**2.02**		mg/L	0.125	0.500	10	09/23/10 09:49	EPA 200.7	10I3333
Sample ID: NTI1887-03 (KIF-RELIC C1-T7-LH-090610 - Water) Sampled: 09/06/10 12:30									
Total Metals by EPA 200.8									
Antimony	**0.00717**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Arsenic	**0.00933**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:32	EPA 200.8	10I3334
Chromium	**0.0218**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Copper	**0.00471**	J	mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Molybdenum	**0.0459**		mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Nickel	**0.00116**	J	mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Selenium	**0.0362**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Vanadium	**0.479**		mg/L	0.00100	0.00400	1	09/23/10 12:32	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 12:32	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**26.7**		mg/L	0.0500	0.100	1	09/22/10 18:40	EPA 200.7	10I3333
Barium	**0.352**		mg/L	0.0100	0.0100	1	09/22/10 18:40	EPA 200.7	10I3333
Boron	**6.37**		mg/L	0.125	0.500	10	09/23/10 09:52	EPA 200.7	10I3333
Calcium	**52.1**		mg/L	0.500	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:40	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Potassium	**2.61**		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Sodium	**2.49**		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Strontium	**2.00**		mg/L	0.125	0.500	10	09/23/10 09:52	EPA 200.7	10I3333

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order: Project Name: Project Number:	NTI1887 Kingston Fossil Plant 050710 RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-04 (KIF-RELIC C1-T8-LH-091010 - Water) Sampled: 09/10/10 14:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00694**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Arsenic	**0.00883**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:35	EPA 200.8	10I3334
Chromium	**0.0166**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Copper	**0.00478**	J	mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Molybdenum	**0.0397**		mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Nickel	**0.00115**	J	mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Selenium	**0.0350**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Vanadium	**0.505**		mg/L	0.00500	0.0200	5	09/23/10 13:52	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 12:35	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**27.4**		mg/L	0.0500	0.100	1	09/22/10 18:43	EPA 200.7	10I3333
Barium	**0.334**		mg/L	0.0100	0.0100	1	09/22/10 18:43	EPA 200.7	10I3333
Boron	**5.34**		mg/L	0.125	0.500	10	09/23/10 09:55	EPA 200.7	10I3333
Calcium	**51.3**		mg/L	0.500	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:43	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Potassium	**2.36**		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Sodium	**2.22**		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Strontium	**2.01**		mg/L	0.125	0.500	10	09/23/10 09:55	EPA 200.7	10I3333

Sample ID: NTI1887-05 (KIF-RELIC C1-T9-LH-091410 - Water) Sampled: 09/14/10 12:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00649**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Arsenic	**0.00869**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:38	EPA 200.8	10I3334
Chromium	**0.0114**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Copper	**0.0343**		mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Lead	**0.00356**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Manganese	**0.000950**	J	mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Molybdenum	**0.0354**		mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Nickel	**0.00449**	J	mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Selenium	**0.0335**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Vanadium	**0.487**		mg/L	0.00100	0.00400	1	09/23/10 12:38	EPA 200.8	10I3334
Zinc	**3.18**		mg/L	0.0830	0.500	10	09/23/10 13:55	EPA 200.8	10I3334

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-05 (KIF-RELIC C1-T9-LH-091410 - Water) - cont. Sampled: 09/14/10 12:00									
Total Metals by EPA Method 200.7									
Aluminum	**27.5**		mg/L	0.0500	0.100	1	09/22/10 18:46	EPA 200.7	10I3333
Barium	**0.362**		mg/L	0.0100	0.0100	1	09/22/10 18:46	EPA 200.7	10I3333
Boron	**4.72**		mg/L	0.125	0.500	10	09/23/10 09:58	EPA 200.7	10I3333
Calcium	**50.9**		mg/L	0.500	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:46	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Potassium	**2.17**		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Sodium	**3.08**		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Strontium	**1.97**		mg/L	0.125	0.500	10	09/23/10 09:58	EPA 200.7	10I3333
Sample ID: NTI1887-06 (KIF-RELIC C2-T10-LH-091810 - Water) Sampled: 09/18/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.000650**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Arsenic	**0.000670**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:42	EPA 200.8	10I3334
Chromium	**0.00705**		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Copper	**0.0224**		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Lead	**0.000340**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Molybdenum	**0.0272**		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Nickel	**0.00270**	J	mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Selenium	**0.0138**		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Vanadium	**0.00295**	J	mg/L	0.00100	0.00400	1	09/23/10 12:42	EPA 200.8	10I3334
Zinc	**0.0243**	J	mg/L	0.00830	0.0500	1	09/23/10 12:42	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**6.81**		mg/L	0.0500	0.100	1	09/22/10 18:49	EPA 200.7	10I3333
Barium	**21.4**		mg/L	0.0100	0.0100	1	09/22/10 18:49	EPA 200.7	10I3333
Boron	**0.319**		mg/L	0.0125	0.0500	1	09/22/10 18:49	EPA 200.7	10I3333
Calcium	**371**		mg/L	0.500	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:49	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Potassium	**32.0**		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Sodium	**9.48**		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Strontium	**19.8**		mg/L	0.250	1.00	20	09/23/10 10:01	EPA 200.7	10I3333

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Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-07 (KIF-RELIC C2-T6-LH-090210 - Water) Sampled: 09/02/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.000740**	J	mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Arsenic	**0.000510**	J	mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:45	EPA 200.8	10I3334
Chromium	**0.00658**		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Copper	**0.0246**		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Molybdenum	**0.0244**		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Nickel	**0.00223**	J	mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Selenium	**0.0128**		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Vanadium	**0.00137**	J	mg/L	0.00100	0.00400	1	09/23/10 12:45	EPA 200.8	10I3334
Zinc	**0.377**		mg/L	0.00830	0.0500	1	09/23/10 12:45	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**5.19**		mg/L	0.0500	0.100	1	09/22/10 18:53	EPA 200.7	10I3333
Barium	**28.5**		mg/L	0.0100	0.0100	1	09/22/10 18:53	EPA 200.7	10I3333
Boron	**0.379**		mg/L	0.0125	0.0500	1	09/22/10 18:53	EPA 200.7	10I3333
Calcium	**373**		mg/L	0.500	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:53	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Potassium	**52.2**		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Sodium	**13.5**		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Strontium	**44.3**		mg/L	1.25	5.00	100	09/23/10 10:04	EPA 200.7	10I3333
Sample ID: NTI1887-08 (KIF-RELIC C2-T7-LH-090610 - Water) Sampled: 09/06/10 12:30									
Total Metals by EPA 200.8									
Antimony	**0.000690**	J	mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Arsenic	**0.000640**	J	mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:55	EPA 200.8	10I3334
Chromium	**0.00666**		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Copper	**0.0224**		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Molybdenum	**0.0236**		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Nickel	**0.00210**	J	mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Selenium	**0.0130**		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Vanadium	**0.00241**	J	mg/L	0.00100	0.00400	1	09/23/10 12:55	EPA 200.8	10I3334
Zinc	**0.0145**	J	mg/L	0.00830	0.0500	1	09/23/10 12:55	EPA 200.8	10I3334

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-08 (KIF-RELIC C2-T7-LH-090610 - Water) - cont. Sampled: 09/06/10 12:30									
Total Metals by EPA Method 200.7									
Aluminum	**5.78**		mg/L	0.0500	0.100	1	09/22/10 18:56	EPA 200.7	10I3333
Barium	**26.9**		mg/L	0.0100	0.0100	1	09/22/10 18:56	EPA 200.7	10I3333
Boron	**0.356**		mg/L	0.0125	0.0500	1	09/22/10 18:56	EPA 200.7	10I3333
Calcium	**360**		mg/L	0.500	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:56	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Potassium	**43.6**		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Sodium	**11.9**		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Strontium	**37.6**		mg/L	1.25	5.00	100	09/23/10 10:07	EPA 200.7	10I3333
Sample ID: NTI1887-09 (KIF-RELIC C2-T8-LH-091010 - Water) Sampled: 09/10/10 14:30									
Total Metals by EPA 200.8									
Antimony	**0.000700**	J	mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Arsenic	**0.000600**	J	mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:59	EPA 200.8	10I3334
Chromium	**0.00672**		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Copper	**0.0221**		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Molybdenum	**0.0248**		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Nickel	**0.00271**	J	mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Selenium	**0.0132**		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Vanadium	**0.00145**	J	mg/L	0.00100	0.00400	1	09/23/10 12:59	EPA 200.8	10I3334
Zinc	**0.0132**	J	mg/L	0.00830	0.0500	1	09/23/10 12:59	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**6.23**		mg/L	0.0500	0.100	1	09/22/10 19:12	EPA 200.7	10I3333
Barium	**25.3**		mg/L	0.0100	0.0100	1	09/22/10 19:12	EPA 200.7	10I3333
Boron	**0.329**		mg/L	0.0125	0.0500	1	09/22/10 19:12	EPA 200.7	10I3333
Calcium	**367**		mg/L	0.500	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:12	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Potassium	**38.1**		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Sodium	**10.7**		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Strontium	**29.8**		mg/L	1.25	5.00	100	09/23/10 10:10	EPA 200.7	10I3333

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-10 (KIF-RELIC C2-T9-LH-091410 - Water) Sampled: 09/14/10 12:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000700**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Arsenic	**0.00106**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:02	EPA 200.8	10I3334
Chromium	**0.00677**		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Copper	**0.0249**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Lead	**0.000960**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Molybdenum	**0.0249**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Nickel	**0.00500**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Selenium	**0.0134**		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Vanadium	**0.00429**		mg/L	0.00100	0.00400	1	09/23/10 13:02	EPA 200.8	10I3334
Zinc	**0.272**		mg/L	0.00830	0.0500	1	09/23/10 13:02	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**6.48**		mg/L	0.0500	0.100	1	09/22/10 19:15	EPA 200.7	10I3333
Barium	**23.1**		mg/L	0.0100	0.0100	1	09/22/10 19:15	EPA 200.7	10I3333
Boron	**0.340**		mg/L	0.0125	0.0500	1	09/22/10 19:15	EPA 200.7	10I3333
Calcium	**363**		mg/L	0.500	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:15	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Potassium	**33.6**		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Sodium	**9.78**		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Strontium	**21.2**		mg/L	1.25	5.00	100	09/23/10 10:14	EPA 200.7	10I3333

Sample ID: NTI1887-11 (KIF-RELIC C3-T10-LH-091810 - Water) Sampled: 09/18/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00155**	J	mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Arsenic	**0.00395**		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:06	EPA 200.8	10I3334
Chromium	**0.000420**	J	mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Copper	**0.0155**		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Molybdenum	**0.0363**		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Nickel	**0.00126**	J	mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Selenium	**0.0234**		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Vanadium	**0.0782**		mg/L	0.00100	0.00400	1	09/23/10 13:06	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:06	EPA 200.8	10I3334

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-11 (KIF-RELIC C3-T10-LH-091810 - Water) - cont. Sampled: 09/18/10 14:00

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**33.6**		mg/L	0.0500	0.100	1	09/22/10 19:19	EPA 200.7	10I3333
Barium	**3.41**		mg/L	0.0100	0.0100	1	09/22/10 19:19	EPA 200.7	10I3333
Boron	**1.55**		mg/L	0.0125	0.0500	1	09/22/10 19:19	EPA 200.7	10I3333
Calcium	**164**		mg/L	0.500	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:19	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Potassium	**24.3**		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Sodium	**5.86**		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Strontium	**48.5**		mg/L	1.25	5.00	100	09/23/10 10:29	EPA 200.7	10I3333

Sample ID: NTI1887-12 (KIF-RELIC C3-T6-LH-090210 - Water) Sampled: 09/02/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00646**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Arsenic	**0.0151**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:09	EPA 200.8	10I3334
Chromium	**0.00343**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Copper	**0.00780**		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Molybdenum	**0.0201**		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Nickel	**0.00185**	J	mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Selenium	**0.0350**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Vanadium	**0.626**		mg/L	0.00500	0.0200	5	09/23/10 13:58	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:09	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**30.4**		mg/L	0.0500	0.100	1	09/22/10 19:22	EPA 200.7	10I3333
Barium	**0.284**		mg/L	0.0100	0.0100	1	09/22/10 19:22	EPA 200.7	10I3333
Boron	**1.61**		mg/L	0.0125	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333
Calcium	**29.8**		mg/L	0.500	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Potassium	**50.9**		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Sodium	**8.88**		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Strontium	**1.52**		mg/L	0.0125	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333

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Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-13 (KIF-RELIC C3-T7-LH-090610 - Water) Sampled: 09/06/10 12:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00418**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Arsenic	**0.0105**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:13	EPA 200.8	10I3334
Chromium	**0.000880**	J	mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Copper	**0.00829**		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Molybdenum	**0.0214**		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Nickel	**0.00112**	J	mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Selenium	**0.0288**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Vanadium	**0.358**		mg/L	0.00100	0.00400	1	09/23/10 13:13	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:13	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**30.4**		mg/L	0.0500	0.100	1	09/22/10 19:25	EPA 200.7	10I3333
Barium	**0.468**		mg/L	0.0100	0.0100	1	09/22/10 19:25	EPA 200.7	10I3333
Boron	**1.57**		mg/L	0.0125	0.0500	1	09/22/10 19:25	EPA 200.7	10I3333
Calcium	**59.6**		mg/L	0.500	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:25	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Potassium	**38.4**		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Sodium	**7.32**		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Strontium	**3.15**		mg/L	0.125	0.500	10	09/23/10 10:32	EPA 200.7	10I3333

Sample ID: NTI1887-14 (KIF-RELIC C3-T8-LH-091010 - Water) Sampled: 09/10/10 14:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00259**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Arsenic	**0.00627**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:16	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Copper	**0.0121**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Lead	**0.00104**	J	mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Molybdenum	**0.0250**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Nickel	**0.0192**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Selenium	**0.0286**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Vanadium	**0.192**		mg/L	0.00100	0.00400	1	09/23/10 13:16	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:16	EPA 200.8	10I3334

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Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-14 (KIF-RELIC C3-T8-LH-091010 - Water) - cont. Sampled: 09/10/10 14:30									
Total Metals by EPA Method 200.7									
Aluminum	**32.6**		mg/L	0.0500	0.100	1	09/22/10 19:28	EPA 200.7	10I3333
Barium	**1.33**		mg/L	0.0100	0.0100	1	09/22/10 19:28	EPA 200.7	10I3333
Boron	**1.56**		mg/L	0.0125	0.0500	1	09/22/10 19:28	EPA 200.7	10I3333
Calcium	**104**		mg/L	0.500	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:28	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Potassium	**31.0**		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Sodium	**6.55**		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Strontium	**17.5**		mg/L	0.125	0.500	10	09/23/10 10:35	EPA 200.7	10I3333
Sample ID: NTI1887-15 (KIF-RELIC C3-T9-LH-091410 - Water) Sampled: 09/14/10 12:00									
Total Metals by EPA 200.8									
Antimony	**0.00199**	J	mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Arsenic	**0.00443**		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:19	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Copper	**0.0121**		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Molybdenum	**0.0306**		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Nickel	**0.00172**	J	mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Selenium	**0.0262**		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Vanadium	**0.108**		mg/L	0.00100	0.00400	1	09/23/10 13:19	EPA 200.8	10I3334
Zinc	**0.0449**	J	mg/L	0.00830	0.0500	1	09/23/10 13:19	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**33.5**		mg/L	0.0500	0.100	1	09/22/10 19:32	EPA 200.7	10I3333
Barium	**2.47**		mg/L	0.0100	0.0100	1	09/22/10 19:32	EPA 200.7	10I3333
Boron	**1.54**		mg/L	0.0125	0.0500	1	09/22/10 19:32	EPA 200.7	10I3333
Calcium	**136**		mg/L	0.500	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:32	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Potassium	**26.3**		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Sodium	**6.06**		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Strontium	**40.4**		mg/L	1.25	5.00	100	09/23/10 10:38	EPA 200.7	10I3333

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-16 (KIF-MaterialBlank-A-092010 - Water) Sampled: 09/20/10 09:00									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Arsenic	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:23	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Copper	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Nickel	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Selenium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Vanadium	ND		mg/L	0.00100	0.00400	1	09/23/10 13:23	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:23	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	09/22/10 19:35	EPA 200.7	10I3333
Barium	ND		mg/L	0.0100	0.0100	1	09/22/10 19:35	EPA 200.7	10I3333
Boron	ND		mg/L	0.0125	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Calcium	ND		mg/L	0.500	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Potassium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Sodium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Strontium	ND		mg/L	0.0125	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Sample ID: NTI1887-17 (KIF-ProcessBlank-A-091810 - Water) Sampled: 09/18/10 15:00									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Arsenic	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:26	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Copper	**0.000510**	J	mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Nickel	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Selenium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Vanadium	ND		mg/L	0.00100	0.00400	1	09/23/10 13:26	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:26	EPA 200.8	10I3334

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-17 (KIF-ProcessBlank-A-091810 - Water) - cont. Sampled: 09/18/10 15:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA Method 200.7									
Aluminum	**0.160**		mg/L	0.0500	0.100	1	09/22/10 19:38	EPA 200.7	10I3333
Barium	**0.0264**		mg/L	0.0100	0.0100	1	09/22/10 19:38	EPA 200.7	10I3333
Boron	ND		mg/L	0.0125	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333
Calcium	**0.958**	J	mg/L	0.500	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Potassium	**0.295**	J	mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Sodium	ND		mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Strontium	**0.219**		mg/L	0.0125	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02RE2	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order: Project Name: Project Number:	NTI1887 Kingston Fossil Plant 050710 RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10I3334-BLK1						
Antimony	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Arsenic	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Beryllium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Cadmium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Chromium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Cobalt	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Copper	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Lead	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Manganese	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Molybdenum	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Nickel	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Selenium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Silver	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Thallium	<0.000500		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Vanadium	<0.00100		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Zinc	<0.00830		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Total Metals by EPA Method 200.7						
10I3333-BLK1						
Aluminum	<0.0500		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Barium	<0.0100		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Boron	<0.0125		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Calcium	<0.500		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Iron	<0.0250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Magnesium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Potassium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Sodium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Strontium	<0.0125		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10I3334-BS1								
Antimony	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Arsenic	0.100	0.0958		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Beryllium	0.100	0.0968		mg/L	97%	85 - 115	10I3334	09/23/10 12:15
Cadmium	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Chromium	0.100	0.0926		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Cobalt	0.100	0.0931		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Copper	0.100	0.0963		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Lead	0.100	0.0935		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Manganese	0.100	0.0917		mg/L	92%	85 - 115	10I3334	09/23/10 12:15
Molybdenum	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Nickel	0.100	0.0956		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Selenium	0.100	0.0959		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Silver	0.100	0.0933		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Thallium	0.100	0.0932		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Vanadium	0.100	0.0947		mg/L	95%	85 - 115	10I3334	09/23/10 12:15
Zinc	0.100	0.0954		mg/L	95%	85 - 115	10I3334	09/23/10 12:15
Total Metals by EPA Method 200.7								
10I3333-BS1								
Aluminum	2.00	2.13		mg/L	106%	85 - 115	10I3333	09/22/10 18:28
Barium	2.00	2.11		mg/L	106%	85 - 115	10I3333	09/22/10 18:28
Boron	1.00	1.04		mg/L	104%	85 - 115	10I3333	09/22/10 18:28
Calcium	5.00	5.01		mg/L	100%	85 - 115	10I3333	09/22/10 18:28
Iron	1.00	1.02		mg/L	102%	85 - 115	10I3333	09/22/10 18:28
Magnesium	5.00	5.07		mg/L	101%	85 - 115	10I3333	09/22/10 18:28
Potassium	5.00	4.99		mg/L	100%	85 - 115	10I3333	09/22/10 18:28
Sodium	5.00	5.26		mg/L	105%	85 - 115	10I3333	09/22/10 18:28
Strontium	1.00	1.04		mg/L	104%	85 - 115	10I3333	09/22/10 18:28

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA

LCS Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10I3334-BSD1												
Antimony		0.100	MNR1	mg/L	0.100	100%	85 - 115	2	20	10I3334		09/23/10 12:18
Arsenic		0.0994	MNR1	mg/L	0.100	99%	85 - 115	4	20	10I3334		09/23/10 12:18
Beryllium		0.0980	MNR1	mg/L	0.100	98%	85 - 115	1	20	10I3334		09/23/10 12:18
Cadmium		0.101	MNR1	mg/L	0.100	101%	85 - 115	3	20	10I3334		09/23/10 12:18
Chromium		0.0932	MNR1	mg/L	0.100	93%	85 - 115	0.7	20	10I3334		09/23/10 12:18
Cobalt		0.0927	MNR1	mg/L	0.100	93%	85 - 115	0.5	20	10I3334		09/23/10 12:18
Copper		0.0953	MNR1	mg/L	0.100	95%	85 - 115	1	20	10I3334		09/23/10 12:18
Lead		0.0961	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Manganese		0.0928	MNR1	mg/L	0.100	93%	85 - 115	1	20	10I3334		09/23/10 12:18
Molybdenum		0.102	MNR1	mg/L	0.100	102%	85 - 115	4	20	10I3334		09/23/10 12:18
Nickel		0.0950	MNR1	mg/L	0.100	95%	85 - 115	0.6	20	10I3334		09/23/10 12:18
Selenium		0.0983	MNR1	mg/L	0.100	98%	85 - 115	2	20	10I3334		09/23/10 12:18
Silver		0.0959	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Thallium		0.0958	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Vanadium		0.0939	MNR1	mg/L	0.100	94%	85 - 115	0.8	20	10I3334		09/23/10 12:18
Zinc		0.0948	MNR1	mg/L	0.100	95%	85 - 115	0.6	20	10I3334		09/23/10 12:18
Total Metals by EPA Method 200.7												
10I3333-BSD1												
Aluminum		2.12		mg/L	2.00	106%	85 - 115	0.5	20	10I3333		09/22/10 18:31
Barium		2.12		mg/L	2.00	106%	85 - 115	0.3	20	10I3333		09/22/10 18:31
Boron		1.04		mg/L	1.00	104%	85 - 115	0.2	20	10I3333		09/22/10 18:31
Calcium		5.00		mg/L	5.00	100%	85 - 115	0.08	20	10I3333		09/22/10 18:31
Iron		1.03		mg/L	1.00	103%	85 - 115	1	20	10I3333		09/22/10 18:31
Magnesium		5.06		mg/L	5.00	101%	85 - 115	0.3	20	10I3333		09/22/10 18:31
Potassium		5.00		mg/L	5.00	100%	85 - 115	0.4	20	10I3333		09/22/10 18:31
Sodium		5.32		mg/L	5.00	106%	85 - 115	1	20	10I3333		09/22/10 18:31
Strontium		1.05		mg/L	1.00	105%	85 - 115	0.8	20	10I3333		09/22/10 18:31

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

DATA QUALIFIERS AND DEFINITIONS

J Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

MNR1 There was no MS/MSD analyzed with this batch due to insufficient sample volume. See Blank Spike.

ND Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TestAmerica
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Nashville, TN

COOLER RECEI

NTI1887

Cooler Received/Opened On 9/21/2010 @ 0800

1. Tracking # 4288 (last 4 digits, FedEx)

Courier: FedEx IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 2.2 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) MJ

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? MJ 9/21/10 YES...NO...NA MJ 9/21/10

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) MJ

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) MJ

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) MJ

I certify that I attached a label with the unique LIMS number to each container (intial) MJ

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

TENNESSEE VALLEY AUTHORITY

NTI1887

09/28/10 23:59

HAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Cooler # ____ of ____

COC # RSICA0920Y10A

RSICA0920Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name:	Test America Nashville	Site ID #:	KIF	Sampler	
Address:	2960 Foster Creighton Drive, Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	
		Site Address	714 Swan Pond Rd	Address:	
Lab PM:	Mark Hollingsworth	City	Hamman State, Zip	City/State	Phone #:
Phone/Fax:	800.765.0980	Site PM Name	Bill Rogers	Reimbursement project?	Non-reimbursement project? Mark one
Lab PM email		Phone/Fax:	865-717-1627	Send EDD to	TVAEDD@envstd.com
Applicable Lab Quote #:		Site PM Email:	wjrogers@tva.gov	CC Hardcopy report to	
				CC Hardcopy report to	

TAT: NORMAL | X Rush | Mark One

Filtered: Y N — P ~~LH~~ 9/21/2010

Preserve: HNO3

Analysis: METALS_TVA_SW_TOTAL

Sample Depth — Depth Unit: NA

ITEM #	SAMPLE ID	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME		#OF CONTAINERS	Comments/Lab Sample I.D.		METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14	00	1	1	Column 1, Time 10	X
2	KIF-RELIC_C1-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11	00	1	2	Column 1, Time 6	X
3	KIF-RELIC_C1-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12	30	1	3	Column 1, Time 7	X
4	KIF-RELIC_C1-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14	30	1	4	Column 1, Time 8	X
5	KIF-RELIC_C1-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12	00	1	5	Column 1, Time 9	X
6	KIF-RELIC_C2-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14	00	1	6	Column 2, Time 10	X
7	KIF-RELIC_C2-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11	00	1	7	Column 2, Time 6	X
8	KIF-RELIC_C2-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12	30	1	8	Column 2, Time 7	X
9	KIF-RELIC_C2-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14	30	1	9	Column 2, Time 8	X
10	KIF-RELIC_C2-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12	00	1	10	Column 2, Time 9	X
11	KIF-RELIC_C3-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14	00	1	11	Column 3, Time 10	X
12	KIF-RELIC_C3-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11	00	1	12	Column 3, Time 6	X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Paul A. Pier	9/20/2010	9:53am	[illegible] / TA	9/21/10	0800	2.2	(Y)/N	(Y)/N	Y/(N)
X Investigatory								Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study										
Plant Ops										
Oth:										

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier | DATE Signed: 9-20-2010 | Time: 9:53am

TENNESSEE VALLEY AUTHORITY

NTI1887
09/28/10 23:59

AIN-OF-CUSTODY / Analytical Request Document

ain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 2 of 2
Cooler # ____ of ____

COC # RSICA0920Y10A
RSICA0920Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Hamman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler	
Sampling Company	
Address:	
City/State	
Phone #	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: NORMAL | X Rush | Mark One

Filtered: Y N (Lee 09/20/10)
Preserve: HNO3
Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12 30	1	13 Column 3, Time 7	X
2	KIF-RELIC_C3-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14 30	1	14 Column 3, Time 8	X
3	KIF-RELIC_C3-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12 00	1	15 Column 3, Time 9	X
4	KIF-MATERIALBLANK-A-092010	RELIC	NA	NA	A	G	N	09/20/2010	[illegible]	1	Material Blank	X — P Lee 09/20/10
5	KIF-PROCESSBLANK-A-091810	RELIC	NA	NA	A	G	N	09/18/2010	15 00	1	Process Blank ← 16	X — P Lee 09/20/10
6											← 17	
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Paul A. Pier	9/20/2010	9:53am	[illegible] / TA	9/21/10	0800	2.2	(Y)/N	(Y)/N	Y/(N)
X Investigatory								Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study										
Plant Ops										
Oth:										

SHIPPING METHOD: (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier
DATE Signed: 9-20-2010
Time: 9:53am

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

October 11, 2010 9:21:06AM

Client:	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Nbr:	RSICA0928Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#8559
		Date Received:	09/29/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-AFA_122208-6-3-I-CA-122208	NTI2912-01	09/28/10 00:01
KIF-RELIC_CT-CA-070710	NTI2912-02	09/28/10 00:01
KIF-RELIC_CTLIME-CA-070710	NTI2912-03	09/28/10 00:01

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

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Tennessee Certification Number: 02008

The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Mark Hollingsworth

Program Manager - National Accounts

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-01 (KIF-AFA 122208-6-3-I-CA-122208 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**81.9**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-01 (KIF-AFA 122208-6-3-I-CA-122208 - Sediment) - cont. Sampled: 09/28/10 00:01									
Total Metals by EPA Method 6010B									
Aluminum	**37300**	MHA	mg/kg dry	58.1	116	5	10/05/10 12:18	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Arsenic	**30.8**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Barium	**1290**	M8	mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Beryllium	**7.09**		mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Boron	**177**		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.581	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Calcium	**28100**	MHA	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Chromium	**54.2**		mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Cobalt	**27.5**		mg/kg dry	5.81	23.2	5	10/05/10 12:18	SW846 6010B	10I5294
Copper	**68.3**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Iron	**21400**	M8	mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Lead	**25.6**	M7	mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Magnesium	**6130**	M8	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Manganese	**86.2**		mg/kg dry	5.81	17.4	5	10/05/10 12:18	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Nickel	**49.2**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Potassium	**3340**		mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Silver	ND		mg/kg dry	2.91	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Sodium	**1060**	J	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Strontium	**615**	M8	mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Vanadium	**132**		mg/kg dry	11.6	23.2	5	10/05/10 12:18	SW846 6010B	10I5294
Zinc	**62.4**		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-02 (KIF-RELIC CT-CA-070710 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**74.4**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Sample ID: NTI2912-02 (KIF-RELIC CT-CA-070710 - Sediment) - cont. Sampled: 09/28/10 00:01

Total Metals by EPA Method 6010B

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**43700**		mg/kg dry	66.9	134	5	10/05/10 12:40	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Arsenic	**58.5**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Barium	**1170**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Beryllium	**8.03**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Boron	**177**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.669	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Calcium	**24500**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Chromium	**66.4**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Cobalt	**30.4**		mg/kg dry	6.69	26.8	5	10/05/10 12:40	SW846 6010B	10I5294
Copper	**95.0**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Iron	**18200**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Lead	**39.1**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Magnesium	**5940**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Manganese	**93.4**		mg/kg dry	6.69	20.1	5	10/05/10 12:40	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Nickel	**56.9**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Potassium	**4910**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Silver	ND		mg/kg dry	3.35	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Sodium	**1370**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Strontium	**626**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Vanadium	**154**		mg/kg dry	13.4	26.8	5	10/05/10 12:40	SW846 6010B	10I5294
Zinc	**93.4**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-03 (KIF-RELIC CTLIME-CA-070710 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**76.5**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Sample ID: NTI2912-03 (KIF-RELIC CTLIME-CA-070710 - Sediment) - cont. Sampled: 09/28/10 00:01

Total Metals by EPA Method 6010B

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**44000**		mg/kg dry	64.4	129	5	10/05/10 12:43	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Arsenic	**56.6**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Barium	**1110**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Beryllium	**7.86**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Boron	**166**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.644	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Calcium	**50000**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Chromium	**67.1**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Cobalt	**30.0**		mg/kg dry	6.44	25.8	5	10/05/10 12:43	SW846 6010B	10I5294
Copper	**91.5**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Iron	**18100**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Lead	**39.4**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Magnesium	**6600**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Manganese	**93.3**		mg/kg dry	6.44	19.3	5	10/05/10 12:43	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Nickel	**55.9**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Potassium	**5290**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Silver	ND		mg/kg dry	3.22	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Sodium	**1380**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Strontium	**616**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Vanadium	**150**		mg/kg dry	12.9	25.8	5	10/05/10 12:43	SW846 6010B	10I5294
Zinc	**93.8**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA Method 6010B							
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA Method 6010B						
10I5294-BLK1						
Aluminum	<9.58		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Antimony	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Arsenic	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Barium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Beryllium	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Boron	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Cadmium	<0.0958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Calcium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Chromium	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Cobalt	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Copper	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Iron	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Lead	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Magnesium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Manganese	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Molybdenum	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Nickel	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Potassium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Selenium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Silver	<0.479		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Sodium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Strontium	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Thallium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Vanadium	<1.92		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Zinc	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Duplicate

Analyte	Orig. Val.	Duplicate	Q	Units	RPD	Limit	Batch	Sample Duplicated	% Rec.	Analyzed Date/Time
General Chemistry Parameters										
10I5271-DUP1										
% Dry Solids	95.1	95.0		%	0.07	20	10I5271	NTI2889-01		10/01/10 08:19

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA Method 6010B								
10I5294-BS1								
Aluminum	778	777		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Antimony	38.9	40.0		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Arsenic	19.5	19.0		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Barium	778	805		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Beryllium	19.5	19.0		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Boron	389	393		mg/kg wet	101%	80 - 120	10I5294	10/05/10 12:15
Cadmium	19.5	19.2		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Calcium	1950	1930		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Chromium	77.8	74.9		mg/kg wet	96%	80 - 120	10I5294	10/05/10 12:15
Cobalt	195	190		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Copper	97.3	95.2		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Iron	389	397		mg/kg wet	102%	80 - 120	10I5294	10/05/10 12:15
Lead	19.5	19.6		mg/kg wet	101%	80 - 120	10I5294	10/05/10 12:15
Magnesium	1950	1950		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Manganese	195	195		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Molybdenum	195	198		mg/kg wet	102%	80 - 120	10I5294	10/05/10 12:15
Nickel	195	201		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Potassium	1950	1860		mg/kg wet	95%	80 - 120	10I5294	10/05/10 12:15
Selenium	19.5	19.2		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Silver	19.5	19.3		mg/kg wet	99%	75 - 125	10I5294	10/05/10 12:15
Sodium	1950	1950		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Strontium	389	389		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Thallium	19.5	19.2		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Vanadium	195	191		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Zinc	195	191		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA Method 6010B										
10I5294-MS1										
Aluminum	37300	39600	MHA	mg/kg dry	948	238%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Antimony	ND	42.4		mg/kg dry	47.4	89%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Arsenic	30.8	49.2		mg/kg dry	23.7	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Barium	1290	1920	M8	mg/kg dry	948	67%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Beryllium	7.09	26.7		mg/kg dry	23.7	83%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Boron	177	563		mg/kg dry	474	81%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Cadmium	ND	18.5		mg/kg dry	23.7	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Calcium	28100	27800	MHA	mg/kg dry	2370	-12%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Chromium	54.2	126		mg/kg dry	94.8	76%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Cobalt	27.5	272		mg/kg dry	237	103%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Copper	68.3	166		mg/kg dry	118	82%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Iron	21400	21900		mg/kg dry	474	117%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Lead	25.6	57.3	M7	mg/kg dry	23.7	134%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Magnesium	6130	7600	M8	mg/kg dry	2370	62%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Manganese	86.2	279		mg/kg dry	237	81%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Molybdenum	ND	202		mg/kg dry	237	85%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Nickel	49.2	309		mg/kg dry	237	110%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Potassium	3340	5860		mg/kg dry	2370	106%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Selenium	ND	23.0		mg/kg dry	23.7	97%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Silver	ND	20.7		mg/kg dry	23.7	88%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Sodium	1060	3100		mg/kg dry	2370	86%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Strontium	615	976		mg/kg dry	474	76%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Thallium	ND	23.4		mg/kg dry	23.7	99%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Vanadium	132	317		mg/kg dry	237	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Zinc	62.4	266		mg/kg dry	237	86%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup

Total Metals by EPA Method 6010B

10I5294-MSD1

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Aluminum	37300	39800	MHA	mg/kg dry	971	257%	75 - 125	0.6	20	10I5294	NTI2912-01	10/05/10 12:36
Antimony	ND	42.8		mg/kg dry	48.5	88%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Arsenic	30.8	49.6		mg/kg dry	24.3	77%	75 - 125	0.8	20	10I5294	NTI2912-01	10/05/10 12:36
Barium	1290	1910	M8	mg/kg dry	971	64%	75 - 125	0.8	20	10I5294	NTI2912-01	10/05/10 12:36
Beryllium	7.09	27.1		mg/kg dry	24.3	82%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Boron	177	570		mg/kg dry	485	81%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Cadmium	ND	18.9		mg/kg dry	24.3	78%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Calcium	28100	27500	MHA	mg/kg dry	2430	-26%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Chromium	54.2	131		mg/kg dry	97.1	79%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Cobalt	27.5	273		mg/kg dry	243	101%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Copper	68.3	167		mg/kg dry	121	81%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Iron	21400	21600	M8	mg/kg dry	485	55%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Lead	25.6	56.1	M7	mg/kg dry	24.3	126%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Magnesium	6130	7550	M8	mg/kg dry	2430	59%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Manganese	86.2	284		mg/kg dry	243	82%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Molybdenum	ND	206		mg/kg dry	243	85%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Nickel	49.2	311		mg/kg dry	243	108%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Potassium	3340	5720		mg/kg dry	2430	98%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Selenium	ND	23.7		mg/kg dry	24.3	98%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Silver	ND	21.3		mg/kg dry	24.3	88%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Sodium	1060	3150		mg/kg dry	2430	86%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Strontium	615	964	M8	mg/kg dry	485	72%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Thallium	ND	24.0		mg/kg dry	24.3	99%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Vanadium	132	322		mg/kg dry	243	78%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Zinc	62.4	268		mg/kg dry	243	85%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
none	Soil			
SW846 6010B	Soil	N/A	X	N/A
SW-846	Soil			

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

DATA QUALIFIERS AND DEFINITIONS

J	Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
M7	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
ND	Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECE

NTI2912

Cooler Received/Opened On 9/29/2010 @ 0955

1. Tracking # N/A

Courier: Off-Street IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 1.9 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front / back
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) VS

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) M

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) VS

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) VS

I certify that I attached a label with the unique LIMS number to each container (intial) VS

21. Were there Non-Conformance issues at login? YES..NO Was a PIPE generated? YES..NO...#

Cooler 17 of 17

BIS = Broken in shipment

NTI2912
10/06/10 23:59

TENNESSEE VALLEY AUTHORITY

CHAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 1 of 1
Cooler # 1 of 17

COC # RSICA0928Y10A

RSICA0928Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive, Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Hamman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler	Patrick Lee
Sampling Company	TVA
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: STANDARD X | Rush | Mark One

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_P1D_SEDIMENT (Filtered: N; Preserve: none)	SR_S (Filtered: N; Preserve: none)
1	KIF-AFA_122208-6-3-I-CA-122208	AFA	NA	NA	CA	G	N	09/28/2010	NA	1	1	X	X
2	KIF-RELIC_CT-CA-070710	RELIC	NA	NA	CA	G	N	09/28/2010	NA	1	2	X	X
3	KIF-RELIC_CTLIME-CA-070710	RELIC	NA	NA	CA	G	N	09/28/2010	NA	1	3	X	X
4													
5													
6													
7													
8													
9													
10													
11													
12													

DM 092810

Additional Comments/Special Instructions:

Item 1: ash sample

Item 2: ash from Relic used for column test

Item 3: ash from Relic mixed with lime (collected 07/08/10) used for column test

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Patrick Lee / TVA	09/28/10	1453	RSI	9-28-10	1453
RSI	9-28-10	1725	TA	9/29/10	0915

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
1.9	Y	Y	N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS, COURIER, FEDEX, US MAIL — Sonic

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Lee

SIGNATURE of SAMPLER: Patrick Lee DATE Signed: 9/28/10 Time: 1444

COURIER TRANSPORT DOCUMENTATION

NTI2912
10/06/10 23:59

DATE: 09/29/10

COURIER COMPANY:

Sonic Subcontractor

From:	To:
TVA c/o David Mathis 189 Lakeshore Drive Harriman, TN 37748 865-202-8313	Test America-Nashville c/o Mark Hollingsworth 2960 Foster Creighton Drive Nashville, TN 37204 800-765-0980

No. of Items:	Description:
17	Cooler(s) taped and custody sealed.

Shippers Name/Company: David Mathis / RSI

Date / Time: 092910 / 0759

Courier Signature/Company: Denise Braswell Whirlwind

Date / Time: 092910 / 0759

Receipt Signature/Company: [signature] / TA

Date / Time: 9/29/10 0955 CST

Corresponding Chains of Custody:

- DISBP0927Y10A p. 1 of 1
- RSIGEO0927Y10A p. 1 of 1
- RSIGW0927Y10A p. 1 of 1
- NTCSW0928Y10A p. 1 of 1
- RSICA0928Y10A p. 1 of 1
- RSIGEO0928Y10A p. 1 of 1
- RSIGW0928Y10A p. 1 of 1
- RSISW0928Y10A p. 1 - 6

ANALYTICAL REPORT

PROJECT NO. NTG0744

NTG0744/TVA

Lot #: A0I100526

Mark Hollingsworth

TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204

TESTAMERICA LABORATORIES, INC.

Amy McCormick

Approved for release.
Amy McCormick
Project Manager
9/30/2010 1:49 PM

Amy L. McCormick
Project Manager
amy.mccormick@testamericainc.com

September 28, 2010

TestAmerica Laboratories, Inc.
TestAmerica North Canton 4101 Shuffel Street NW, North Canton, OH 44720
Tel (330)497-9396 Fax (330)497-0772 www.testamericainc.com

Table of Contents

CASE NARRATIVE

CASE NARRATIVE

A0I100526

The following report contains the analytical results for two water samples submitted to TestAmerica North Canton by TestAmerica Nashville from the NTG0744/TVA Site, project number NTG0744. The samples were received September 10, 2010, according to documented sample acceptance procedures.

TestAmerica utilizes USEPA approved methods in all analytical work. The samples presented in this report were analyzed for the parameter(s) listed on the analytical methods summary page in accordance with the method(s) indicated. Preliminary results were provided to Johnny Mitchell and Mark Hollingsworth on September 19, 2010. A summary of QC data for these analyses is included at the back of the report.

TestAmerica North Canton attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the applicable methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

All parameters were evaluated to the reporting limit.

Please refer to the Quality Control Elements Narrative following this case narrative for additional quality control information.

If you have any questions, please call the Project Manager, Amy L. McCormick, at 330-497-9396.

This report is sequentially paginated. The final page of the report is labeled as "END OF REPORT."

SUPPLEMENTAL QC INFORMATION

SAMPLE RECEIVING

The temperature of the cooler upon sample receipt was 2.1°C.

CASE NARRATIVE (continued)

GC VOLATILES

The analytical results met the requirements of the laboratory's QA/QC program.

QUALITY CONTROL ELEMENTS NARRATIVE

TestAmerica conducts a quality assurance/quality control (QA/QC) program designed to provide scientifically valid and legally defensible data. Toward this end, several types of quality control indicators are incorporated into the QA/QC program, which is described in detail in QA Policy, QA-003. These indicators are introduced into the sample testing process to provide a mechanism for the assessment of the analytical data. Program or agency specific requirements take precedence over the requirements listed in this narrative.

QC BATCH

Environmental samples are taken through the testing process in groups called QUALITY CONTROL BATCHES (QC batches). A QC batch contains up to twenty environmental samples of a similar matrix (water, soil) that are processed using the same reagents and standards. TestAmerica North Canton requires that each environmental sample be associated with a QC batch.

Several quality control samples are included in each QC batch and are processed identically to the twenty environmental samples.

For SW846/RCRA methods, QC samples include a METHOD BLANK (MB), a LABORATORY CONTROL SAMPLE (LCS) and, where appropriate, a MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) pair or a MATRIX SPIKE/SAMPLE DUPLICATE (MS/DU) pair. If there is insufficient sample to perform an MS/MSD or an MS/DU, then a LABORATORY CONTROL SAMPLE DUPLICATE (LCSD) is included in the QC batch.

For 600 series/CWA methods, QC samples include a METHOD BLANK (MB), a LABORATORY CONTROL SAMPLE (LCS) and, where appropriate, a MATRIX SPIKE (MS). An MS is prepared and analyzed at a 10% frequency for GC Methods and at a 5% frequency for GC/MS methods.

LABORATORY CONTROL SAMPLE

The Laboratory Control Sample is a QC sample that is created by adding known concentrations of a full or partial set of target analytes to a matrix similar to that of the environmental samples in the QC batch. Multi peak responders may not be included in the target spike list due to co-elution. The LCS analyte recovery results are used to monitor the analytical process and provide evidence that the laboratory is performing the method within acceptable guidelines. All control analytes indicated by a bold type in the LCS must meet acceptance criteria. Failure to meet the established recovery guidelines requires the repreparation and reanalysis of all samples in the QC batch. Comparison of only the failed parameters from the first batch are evaluated. The only exception to the rework requirement is that if the LCS recoveries are biased high and the associated sample is ND (non-detected) for the parameter(s) of interest, the batch is acceptable.

At times, a Laboratory Control Sample Duplicate (LCSD) is also included in the QC batch. An LCSD is a QC sample that is created and handled identically to the LCS. Analyte recovery data from the LCSD is assessed in the same way as that of the LCS. The LCSD recoveries, together with the LCS recoveries, are used to determine the reproducibility (precision) of the analytical system. Precision data are expressed as relative percent differences (RPDs). If the RPD fails for an LCS/LCSD and yet the recoveries are within acceptance criteria, the batch is still acceptable.

METHOD BLANK

The Method Blank is a QC sample consisting of all the reagents used in analyzing the environmental samples contained in the QC batch. Method Blank results are used to determine if interference or contamination in the analytical system could lead to the reporting of false positive data or elevated analyte concentrations. All target analytes must be below the reporting limits (RL) or the associated sample(s) must be ND except under the following circumstances:

- Common organic contaminants may be present at concentrations up to 5 times the reporting limits. Common metals contaminants may be present at concentrations up to 2 times the reporting limit, or the reported blank concentration must be twenty fold less than the concentration reported in the associated environmental samples. (See common laboratory contaminants listed in the table.)

Volatile (GC or GC/MS)	Semivolatile (GC/MS)	Metals ICP-MS	Metals ICP Trace
Methylene Chloride, Acetone, 2-Butanone	Phthalate Esters	Copper, Iron, Zinc, Lead, Calcium, Magnesium, Potassium, Sodium, Barium, Chromium, Manganese	Copper, Iron, Zinc, Lead

QUALITY CONTROL ELEMENTS NARRATIVE (continued)

- Organic blanks will be accepted if compounds detected in the blank are present in the associated samples at levels 10 times the blank level. Inorganic blanks will be accepted if elements detected in the blank are present in the associated samples at 20 times the blank level.

- Blanks will be accepted if the compounds/elements detected are not present in any of the associated environmental samples.

Failure to meet these Method Blank criteria requires the repreparation and reanalysis of all samples in the QC batch.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE

A Matrix Spike and a Matrix Spike Duplicate are a pair of environmental samples to which known concentrations of a full or partial set of target analytes are added. The MS/MSD results are determined in the same manner as the results of the environmental sample used to prepare the MS/MSD. The analyte recoveries and the relative percent differences (RPDs) of the recoveries are calculated and used to evaluate the effect of the sample matrix on the analytical results. Due to the potential variability of the matrix of each sample, the MS/MSD results may not have an immediate bearing on any samples except the one spiked; therefore, the associated batch MS/MSD may not reflect the same compounds as the samples contained in the analytical report. When these MS/MSD results fail to meet acceptance criteria, the data is evaluated. If the LCS is within acceptance criteria, the batch is considered acceptable.

For certain methods, a Matrix Spike/Sample Duplicate (MS/DU) may be included in the QC batch in place of the MS/MSD. For the parameters (i.e. pH, ignitability) where it is not possible to prepare a spiked sample, a Sample Duplicate may be included in the QC batch. However, a Sample Duplicate is less likely to provide usable precision statistics depending on the likelihood of finding concentrations below the standard reporting limit. When the Sample Duplicate result fails to meet acceptance criteria, the data is evaluated.

For certain methods (600 series methods/CWA), a Matrix Spike is required in place of a Matrix Spike/Matrix Spike Duplicate (MS/MSD) or Matrix Spike/Sample Duplicate (MS/DU).

The acceptance criteria do not apply to samples that are diluted.

SURROGATE COMPOUNDS

In addition to these batch-related QC indicators, each organic environmental and QC sample is spiked with surrogate compounds. Surrogates are organic chemicals that behave similarly to the analytes of interest and that are rarely present in the environment. Surrogate recoveries are used to monitor the individual performance of a sample in the analytical system.

If surrogate recoveries are biased high in the LCS, LCSD, or the Method Blank, and the associated sample(s) are ND, the batch is acceptable. Otherwise, if the LCS, LCSD, or Method Blank surrogate(s) fail to meet recovery criteria, the entire sample batch is reprepared and reanalyzed. If the surrogate recoveries are outside criteria for environmental samples, the samples will be reprepared and reanalyzed unless there is objective evidence of matrix interference or if the sample dilution is greater than the threshold outlined in the associated method SOP.

The acceptance criteria do not apply to samples that are diluted. All other surrogate recoveries will be reported.

For the GC/MS BNA methods, the surrogate criterion is that two of the three surrogates for each fraction must meet acceptance criteria. The third surrogate must have a recovery of ten percent or greater.

For the Pesticide and PCB methods, the surrogate criterion is that one of two surrogate compounds must meet acceptance criteria. The second surrogate must have a recovery of 10% or greater.

TestAmerica Certifications and Approvals:

The laboratory is certified for the analytes listed on the documents below. These are available upon request.
California (#01144CA), Connecticut (#PH-0590), Florida (#E87225),
Illinois (#200004), Kansas (#E10336), Minnesota (#39-999-348), New Jersey (#OH001), New York (#10975), Nevada (#OH-000482008A), OhioVAP (#CL0024), Pennsylvania (#008), West Virginia (#210), Wisconsin (#999518190),NAVY, ARMY, USDA Soil Permit

N:\QAQC\Customer Service\Narrative - Combined RCRA _CWA 032609.doc

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY - Detection Highlights

A0I100526

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
NO DETECTABLE PARAMETERS				

METHOD SUMMARY

ANALYTICAL METHODS SUMMARY

A0I100526

PARAMETER	ANALYTICAL METHOD
Arsenic (III) Speciation by ASV	SW846 7063
Arsenic (V) Speciation by ASV	SW846 7063

References:

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

SAMPLE SUMMARY

A0I100526

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
L6TJ8	001	NTG0744-25	09/09/10	00:01
L6TKA	002	NTG0744-26	09/09/10	00:01

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SHIPPING AND RECEIVING DOCUMENTS

TestAmerica Cooler Receipt Form/Narrative **Lot Number:** A0I100526
North Canton Facility

Client TA Nashville Project NTG0744 By: [signature] (Signature)
Cooler Received on 9-10-10 Opened on 9-10-10
FedEx ☑ UPS ☐ DHL ☐ FAS ☐ Stetson ☐ Client Drop Off ☐ TestAmerica Courier ☐ Other ____
TestAmerica Cooler # ____ Multiple Coolers ☐ Foam Box ☐ Client Cooler ☑ Other ____

1. Were custody seals on the outside of the cooler(s)? Yes ☐ No ☑ Intact? Yes ☐ No ☐ NA ☑
   If YES, Quantity ____ Quantity Unsalvageable ____
   Were custody seals on the outside of cooler(s) signed and dated? Yes ☐ No ☐ NA ☑
   Were custody seals on the bottle(s)? Yes ☐ No ☑
   If YES, are there any exceptions? ____
2. Shippers' packing slip attached to the cooler(s)? Yes ☑ No ☐
3. Did custody papers accompany the sample(s)? Yes ☑ No ☐ Relinquished by client? Yes ☑ No ☐
4. Were the custody papers signed in the appropriate place? Yes ☑ No ☐
5. Packing material used: Bubble Wrap ☑ Foam ☐ None ☐ Other ____
6. Cooler temperature upon receipt 2.1 °C See back of form for multiple coolers/temps ☐
   METHOD: IR ☑ Other ☐ ____
   COOLANT: Wet Ice ☑ Blue Ice ☐ Dry Ice ☐ Water ☐ None ☐
7. Did all bottles arrive in good condition (Unbroken)? Yes ☑ No ☐
8. Could all bottle labels be reconciled with the COC? Yes ☑ No ☐
9. Were sample(s) at the correct pH upon receipt? Yes ☐ No ☐ NA ☑
10. Were correct bottle(s) used for the test(s) indicated? Yes ☑ No ☐
11. Were air bubbles >6 mm in any VOA vials? Yes ☐ No ☐ NA ☑
12. Sufficient quantity received to perform indicated analyses? Yes ☑ No ☐
13. Was a trip blank present in the cooler(s)? Yes ☐ No ☑ Were VOAs on the COC? Yes ☐ No ☑

Contacted PM ____ Date ____ by ____ via Verbal ☐ Voice Mail ☐ Other ☐
Concerning ____

14. CHAIN OF CUSTODY

The following discrepancies occurred:

15. SAMPLE CONDITION

Sample(s) ____ were received after the recommended holding time had expired.
Sample(s) ____ were received in a broken container.
Sample(s) ____ were received with bubble >6 mm in diameter. (Notify PM)

16. SAMPLE PRESERVATION

Sample(s) ____ were further preserved in Sample Receiving to meet recommended pH level(s). *Nitric Acid Lot#* 051010-*HNO_3; Sulfuric Acid Lot#* 051010-*H_2SO_4; Sodium Hydroxide Lot#* 100108 *-NaOH; Hydrochloric Acid Lot#* 092006-*HCl; Sodium Hydroxide and Zinc Acetate Lot#* 100108-*$(CH_3COO)_2ZN/NaOH$*. What time was preservative added to sample(s)? ____

Client ID	pH	Date	Initials

TestAmerica Cooler Receipt Form/Narrative
North Canton Facility

Client ID	pH	Date	Initials
Cooler #	**Temp. °C**	**Method**	**Coolant**

Discrepancies Cont'd:

GC VOLATILE DATA

QC SUMMARY DATA

SW846 7063 CHECK SAMPLE RECOVERY

Lab Name: TestAmerica Laboratories, Inc. Client: TestAmerica Nashville

Lab Code: TALCAN SDG No:

Lot #: A0I160000 WO #: L631H1AC

BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (V)	20	8.8	44	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L631H1AD
BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (V)	20	8.4	42	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L63111AC
BATCH: 0259373

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (III)	20	16	81	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 CHECK SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Lot #: A0I160000   WO #: L63111AD
BATCH: 0259373

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	% REC	QC LIMITS REC	QUAL
Arsenic (III)	20	18	90	25- 130	

NOTES(S):

* Values outside of QC limits

Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Matrix Spike ID: LAB MS/MSD

Lot #: A0I030441   WO #: L6HQJ1AD
BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENT. (ug/L)	MS CONCENT. (ug/L)	MS % REC	LIMITS REC	QUAL
Arsenic (V)	20	ND	7.7	39	25- 130	

NOTES(S):

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 0 out of 0 outside limits
Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: TestAmerica Laboratories, Inc.   Client: TestAmerica Nashville

Lab Code: TALCAN   SDG No:

Matrix Spike ID: LAB MS/MSD

Lot #: A0I030441   WO #: L6HQJ1AE
BATCH: 0259371

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENT. (ug/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC	QUAL
Arsenic (V)	20	6.1	30	23	50	25- 130	

NOTES(S):

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 0 out of 1 outside limits
Spike Recovery: 0 out of 1 outside limits

COMMENTS:

FORM III

SW846 7063 METHOD BLANK SUMMARY

BLANK WORKORDER NO.

L631H1AA

Lab Name: TestAmerica Laboratories, Inc.

Lab Code: TALCAN

SDG Number:

Lab File ID:

Lot Number: A0I100526

Date Analyzed: 09/16/10

Time Analyzed: 00:00

Matrix: WATER

Date Extracted:09/16/10

GC Column: ID: .00

Extraction Method:

Instrument ID: AS35

Level:(low/med) LOW

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, LCS, LCSD, MS , MSD:

	CLIENT ID.	SAMPLE WORK ORDER #	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	INTRA-LAB QC	L6HQJ1AC		09/16/10	00:00
02	LAB MS/MSD	L6HQJ1AD S		09/16/10	00:00
03	LAB MS/MSD	L6HQJ1AE D		09/16/10	00:00
04	NTG0744-25	L6TJ81AC		09/16/10	00:00
05	NTG0744-26	L6TKA1AC		09/16/10	00:00
06	CHECK SAMPLE	L631H1AC C		09/16/10	00:00
07	DUPLICATE CHECK	L631H1AD L		09/16/10	00:00
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

COMMENTS:

FORM IV

SW846 7063 METHOD BLANK SUMMARY

BLANK WORKORDER NO.

L63111AA

Lab Name: TestAmerica Laboratories, Inc.

Lab Code: TALCAN SDG Number:

Lab File ID: Lot Number: A0I100526

Date Analyzed: 09/16/10 Time Analyzed: 00:00

Matrix: WATER Date Extracted:09/16/10

GC Column: ID: .00 Extraction Method:

Instrument ID: AS35 Level:(low/med) LOW

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, LCS, LCSD, MS , MSD:

	CLIENT ID.	SAMPLE WORK ORDER #	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	NTG0744-25	L6TJ81AA		09/16/10	00:00
02	NTG0744-26	L6TKA1AA		09/16/10	00:00
03	CHECK SAMPLE	L63111AC C		09/16/10	00:00
04	DUPLICATE CHECK	L63111AD L		09/16/10	00:00
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

COMMENTS:

FORM IV

TestAmerica
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SAMPLE DATA

TestAmerica Nashville

Client Sample ID: NTG0744-25

GC Volatiles

Lot-Sample #...: A0I100526-001 **Work Order #...:** L6TJ81AA **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (III)	ND	10	ug/L	5.5

TestAmerica Nashville

Client Sample ID: NTG0744-25

GC Volatiles

Lot-Sample #...: A0I100526-001 **Work Order #...:** L6TJ81AC **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (V)	ND	10	ug/L	4.2

TestAmerica Nashville

Client Sample ID: NTG0744-26

GC Volatiles

Lot-Sample #...: A0I100526-002 **Work Order #...:** L6TKA1AA **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (III)	ND	10	ug/L	5.5

TestAmerica Nashville

Client Sample ID: NTG0744-26

GC Volatiles

Lot-Sample #...: A0I100526-002 **Work Order #...:** L6TKA1AC **Matrix.........:** WG
Date Sampled...: 09/09/10 00:01 **Date Received..:** 09/10/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 5 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL
Method.........: SW846 7063

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Arsenic (V)	ND	10	ug/L	4.2

METHOD BLANK REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AA **Matrix.........:** WATER
MB Lot-Sample #: A0I160000-371
Prep Date......: 09/16/10 **Final Wgt/Vol..:** 42 mL
Analysis Date..: 09/16/10 **Prep Batch #...:** 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Arsenic (V)	ND	2.0	ug/L	SW846 7063

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AA **Matrix.........:** WATER
MB Lot-Sample #: A0I160000-373
Prep Date......: 09/16/10 **Final Wgt/Vol..:** 42 mL
Analysis Date..: 09/16/10 **Prep Batch #...:** 0259373
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD
Arsenic (III)	ND	2.0	ug/L	SW846 7063

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-371 L631H1AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (V)	**44**	**(25 - 130)**			**SW846 7063**
	42	**(25 - 130)**	**4.1**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L631H1AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-371 L631H1AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Arsenic (V)	**20**	**8.8**	**ug/L**	**44**		**SW846 7063**
	20	**8.4**	**ug/L**	**42**	**4.1**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-373 L63111AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (III)	**81**	**(25 - 130)**			**SW846 7063**
	90	**(25 - 130)**	**11**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

LABORATORY CONTROL SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L63111AC-LCS **Matrix.........:** WATER
LCS Lot-Sample#: A0I160000-373 L63111AD-LCSD
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259373
Dilution Factor: 1 **Final Wgt/Vol..:** 42 mL
Initial Wgt/Vol: 42 mL

PARAMETER	SPIKE AMOUNT	MEASURED AMOUNT	UNITS	PERCENT RECOVERY	RPD	METHOD
Arsenic (III)	**20**	**16**	**ug/L**	**81**		**SW846 7063**
	20	**18**	**ug/L**	**90**	**11**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE EVALUATION REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L6HQJ1AD-MS **Matrix.........:** WATER
MS Lot-Sample #: A0I030441-001 L6HQJ1AE-MSD
Date Sampled...: 08/31/10 13:30 **Date Received..:** 09/02/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL

PARAMETER	PERCENT RECOVERY	RECOVERY LIMITS	RPD	RPD LIMITS	METHOD
Arsenic (V)	**39**	**(25 - 130)**			**SW846 7063**
	30	**(25 - 130)**	**23**	**(0-50)**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

MATRIX SPIKE SAMPLE DATA REPORT

GC Volatiles

Client Lot #...: A0I100526 **Work Order #...:** L6HQJ1AD-MS **Matrix.........:** WATER
MS Lot-Sample #: A0I030441-001 L6HQJ1AE-MSD
Date Sampled...: 08/31/10 13:30 **Date Received..:** 09/02/10
Prep Date......: 09/16/10 **Analysis Date..:** 09/16/10
Prep Batch #...: 0259371
Dilution Factor: 1 **Initial Wgt/Vol:** 42 mL **Final Wgt/Vol..:** 42 mL

PARAMETER	SAMPLE AMOUNT	SPIKE AMT	MEASRD AMOUNT	UNITS	PERCNT RECVRY	RPD	METHOD
Arsenic (V)	**ND**	**20**	**7.7**	**ug/L**	**39**		**SW846 7063**
	ND	**20**	**6.1**	**ug/L**	**30**	**23**	**SW846 7063**

NOTE(S):

Calculations are performed before rounding to avoid round-off errors in calculated results.

Bold print denotes control parameters

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SUPPORTIVE RAW DATA

TestAmerica North Canton Arsenic (III)/Arsenic (V) Data Review Checklist

Run/Project Information

Run Date: 9/15/10 - 9/16/2010 **Analyst:** Ray Shock **Instrument:** Trace Detect Nano Band Explorer
Prep Batches Run: 0259371, 0259373, 0259374 **Lot #:** A0I030441, A0I030572, A0I100526
Methods used: 7063 mod : NC-WC-0090 Rev 1

Review Items:

A. Instrument Setup	Yes	No	N/A	2ndLevel
1. Electrode sensitivity check?	X			
2. MSA working standard and verification standard within control limits?	X			
3. Cleanliness check (ICB) within +/- RL?	X			
B. Sample Results				
1. Were non-detect samples verified with single point MSA?	X			
2. All samples with As(III) quantified with 3-4 point MSA?	X			
3. Sample analyses done within holding time?	X			
C. Preparation/Matrix QC				
1. Samples preserved in the field?	X			
2. LCS done per prep batch and within QC limits?	X			
3. Method blank done per prep batch and < RL?	X			
4. MS run at required frequency (1 per 20 samples) and within limits?	X			
5. MSD or DU run at required frequency (1 per 20 samples) and RPD within limits?	X			
D. Other				
1. Are all nonconformances documented appropriately?	X			
2. Current MDL data on file?	X			
3. Calculations and Transcriptions checked for error?	X			
4. All client/ project specific requirements met?	X			
5. Date of analysis verified as correct?	X			

Analyst: Ray Shock [signature] Date: 9/16/2010

Comments:

2nd Level Reviewer : [signature] Date: 9/19/10

Standard, Reagent and Supply Numbers

MSA Working Std: 3904 MSA Verification Std: 3905 MS As(V) Std: 3906

Au Plate Soln: 3916 conc HCl: Lot H33A01 Cu Remover: Lot I12267

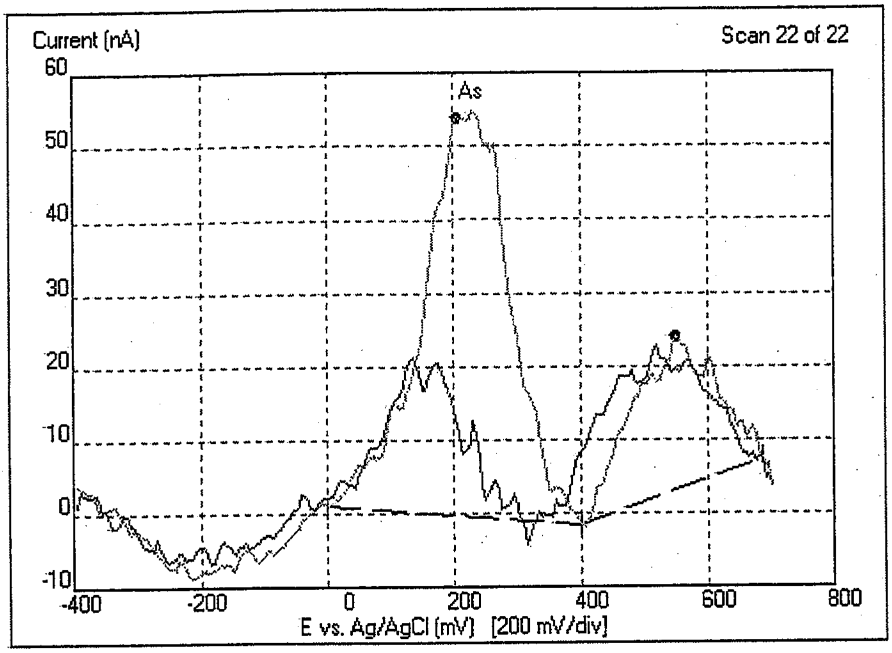
Acidic ext: ______ Basic ext: ______

Sodium Thiosulfate: 3888 Starch Indicator: 3887 Working Iodine Soln: 3915

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	09:56 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_21.tds	Analysis Time/Date:	09:54 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_21.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	SENSITIVITY CK + 2 PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ( ) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- (•) No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	205	250	54.3 nA	894 pC	145 mV	Auto	**14.8 ppb**	**17.6 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	01	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

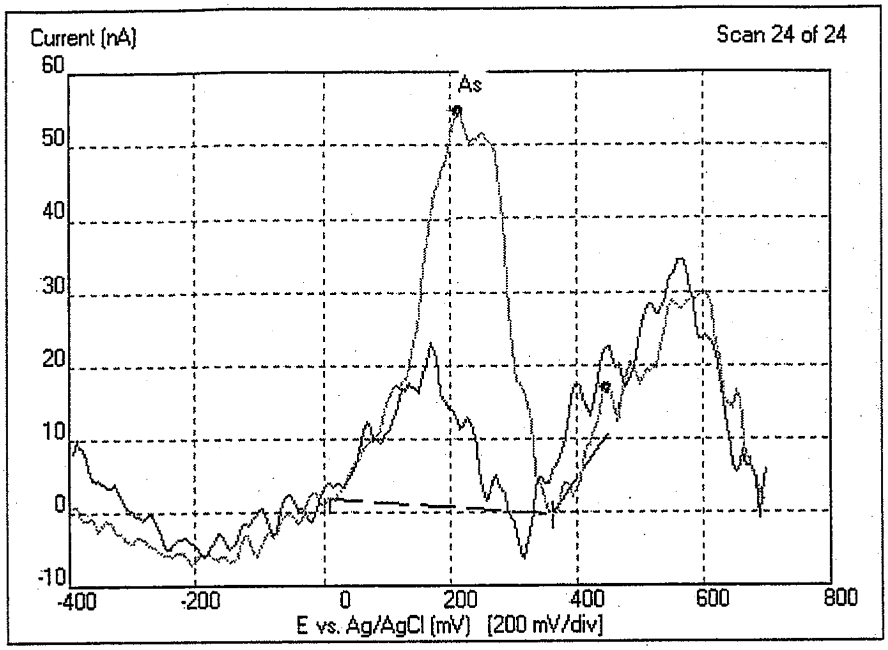
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE 2	Report Time/Date:	11:01 AM on 16/Sep/2010
Data File Name:	GOLD PLATE 2_23.tds	Analysis Time/Date:	11:00 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00915CURX\GOLD PLATE 2\GOLD PLATE 2_23.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	SENSITIVITY CK + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	210	250	54.3 nA	867 pC	145 mV	Auto	**14.8 ppb**	**17.6 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction   Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

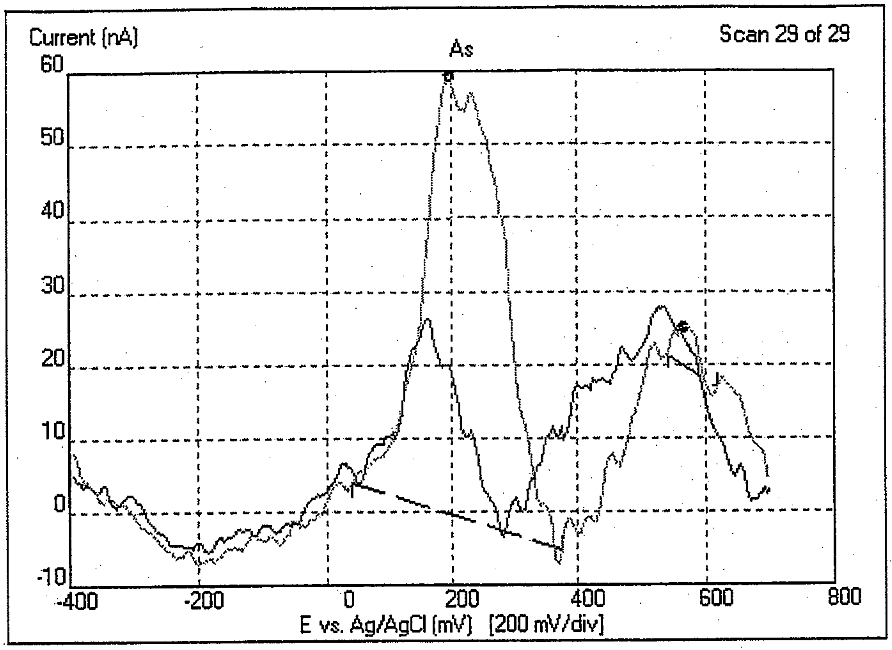
Session Name: GOLD PLATE 3
Data File Name: GOLD PLATE 3_28.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE 3\GOLD PLATE 3_28.tds

Session Description:

Scan ID: SENSITIVITY CK +2PPB AS III

Report Time/Date: 03:06 PM on 16/Sep/2010
Analysis Time/Date: 03:05 PM on 16/Sep/2010
CalibrationTime/Date: n.a.
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	195	250	60.0 nA	883 pC	145 mV	Auto	**16.3 ppb**	**19.4 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

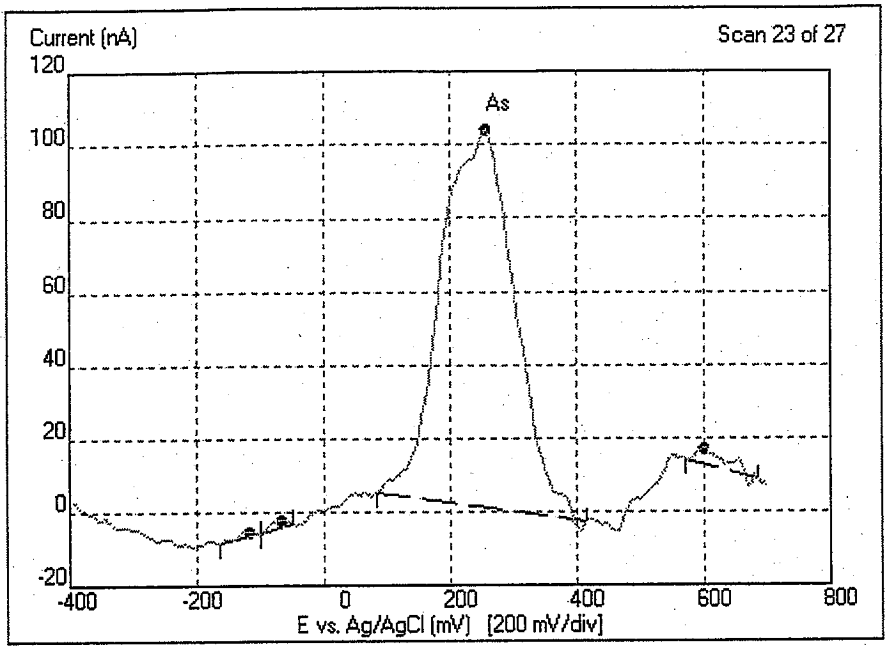
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	10:03 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_22.tds	Analysis Time/Date:	09:57 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_22.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS III PRIMARY STD	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ( ) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- (•) No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	255	250	103 nA	1.39 nC	135 mV	Auto	**28.1 ppb**	**33.5 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

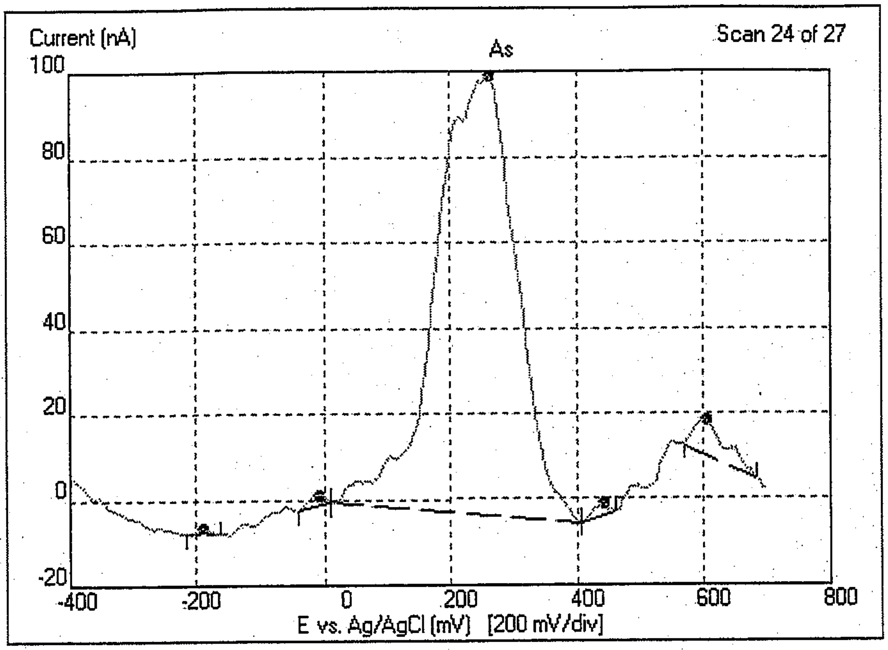
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	10:03 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_23.tds	Analysis Time/Date:	09:57 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_23.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS III SECONDARY STD	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	260	250	103 nA	1.51 nC	145 mV	Auto	**27.9 ppb**	**33.3 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

$\frac{28.1}{27.9} = 100.7\%$

Background Subtraction:

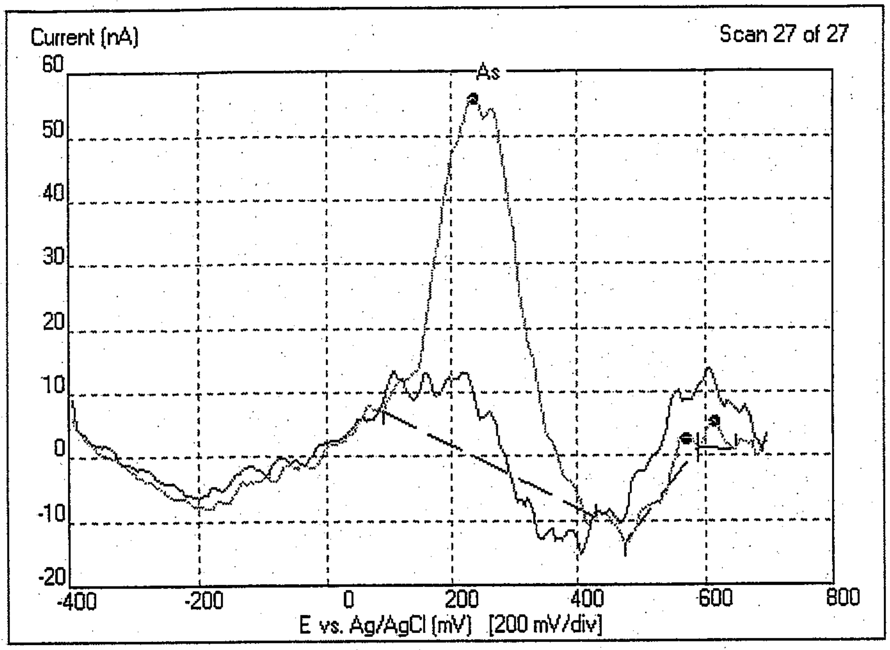
- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE	Report Time/Date:	10:03 AM on 16/Sep/2010
Data File Name:	GOLD PLATE_26.tds	Analysis Time/Date:	10:00 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE\GOLD PLATE_26.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	INSTRUMENT BLANK + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	235	250	56.0 nA	819 pC	140 mV	Auto	**15.2 ppb**	**18.1 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction — Background Scan Plate Time: 1 seconds

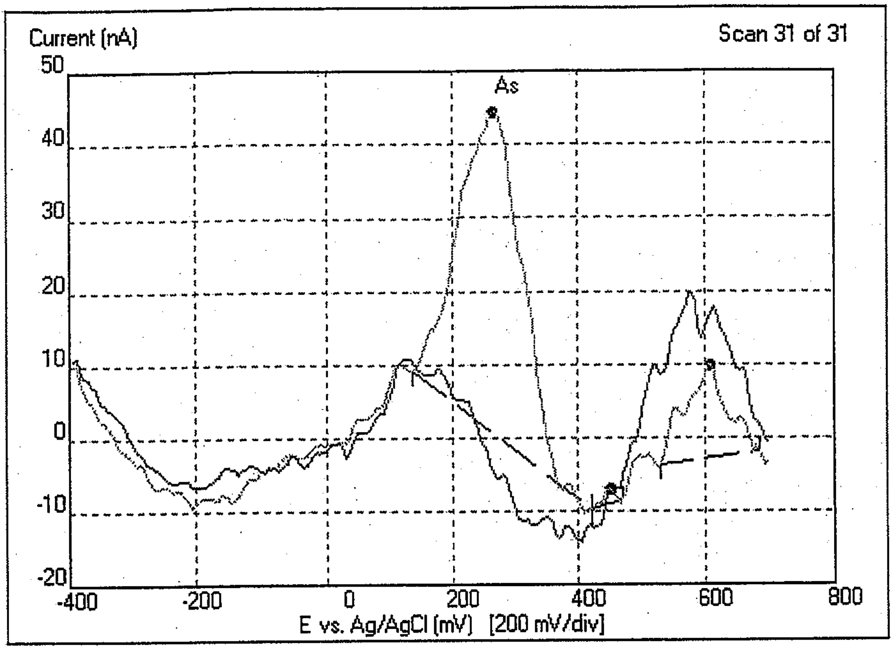
☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	GOLD PLATE 3
Data File Name:	GOLD PLATE 3_30.tds
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\GOLD PLATE 3\GOLD PLATE 3_30.tds
Session Description:	
Scan ID:	AS III BLK +2PPB AS III CURX

Report Time/Date:	03:09 PM on 16/Sep/2010
Analysis Time/Date:	03:08 PM on 16/Sep/2010
CalibrationTime/Date:	n.a.
Software Version:	3.0.5
Operator:	402582
Electrode Type:	Carbon
Electrode Thin Film:	Gold
Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	44.0 nA	516 pC	125 mV	Auto	**12.0 ppb**	**14.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction

Background Scan Plate Time: 1 seconds

- [ ] Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

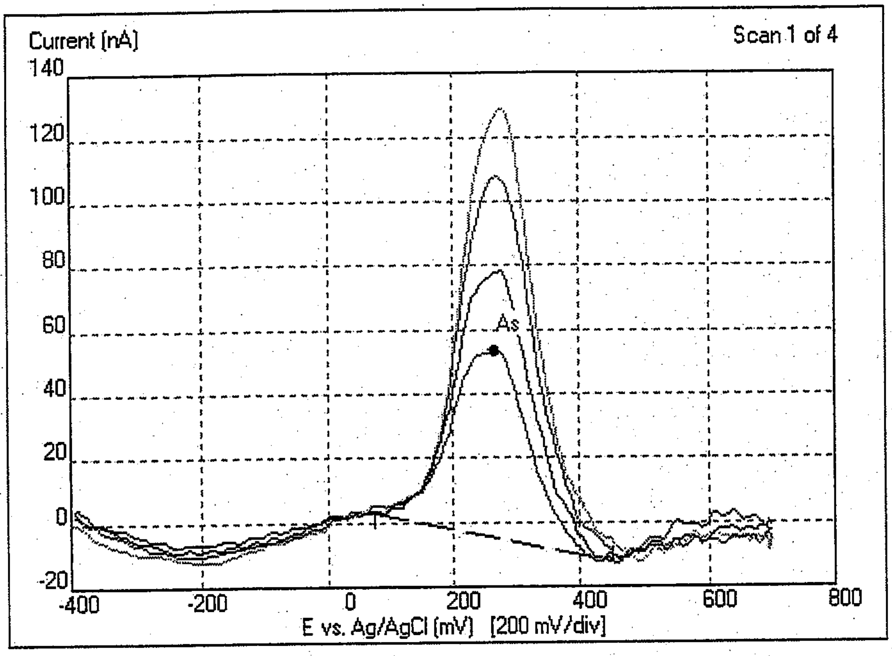
Session Name: AS III LCS
Data File Name: AS III LCS_15.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III LCS\AS III LCS_15.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 03:15 PM on 16/Sep/2010
Analysis Time/Date: 03:14 PM on 16/Sep/2010
CalibrationTime/Date: 12:02 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (•) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	58.3 nA	853 pC	135 mV	Auto	13.6 ppb (Cal.)	16.2 ppb (Cal.)

Measurement Scan Settings:

Clean Time: 0.1 seconds
Plate Time: 10 seconds

Clean Voltage: 500 mV
Plate Voltage: -400 mV

Start Voltage: -400 mV
Stop Voltage: 700 mV
Step Voltage: 5 mV

Signal Avg. 8 A/D conv
Frequency: 2000 Hz
Range: 12.5 µA

Electrode: Carbon
Thin Film: Gold
Cell Type: Three Electrode

Waveform: Staircase

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

Background Scan Plate Time: 1 seconds

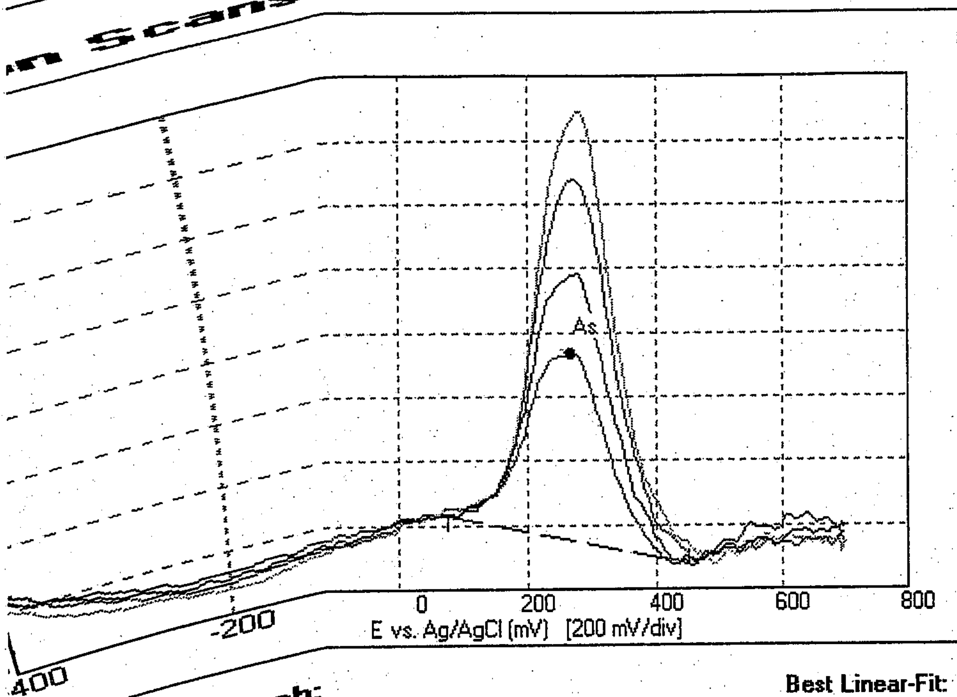
...t Method of Standard Additions Measurement Report

...Program Files\TraceDetect\Nano-Band Explorer
...3.0\Sessions\00916CURX\AS III LCS\AS III LCS.tcl

CalibrationTime/Date: 03:15 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

...n Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.900 mL

Options:

- (selected) Individual Standards Used
- Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

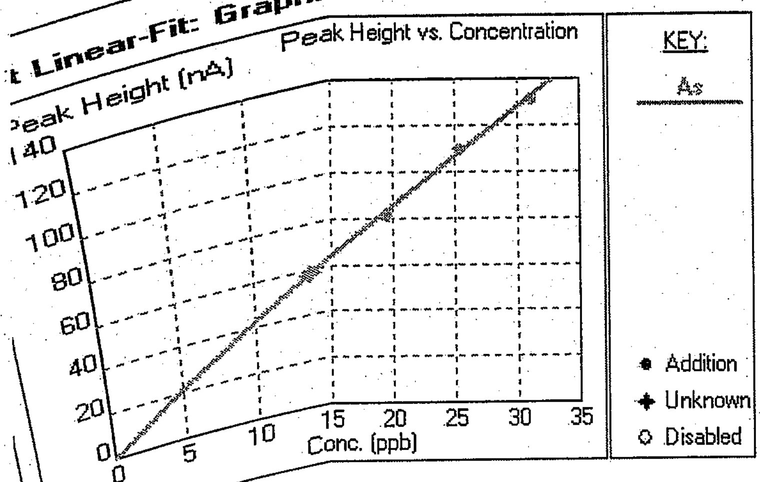
Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

...t Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	**Height**	0.9980	0.235 ppb/nA	13.6 ppb
	Area	0.9985	17.6 ppb/nC	15.0 ppb

Addition and Peak Data:

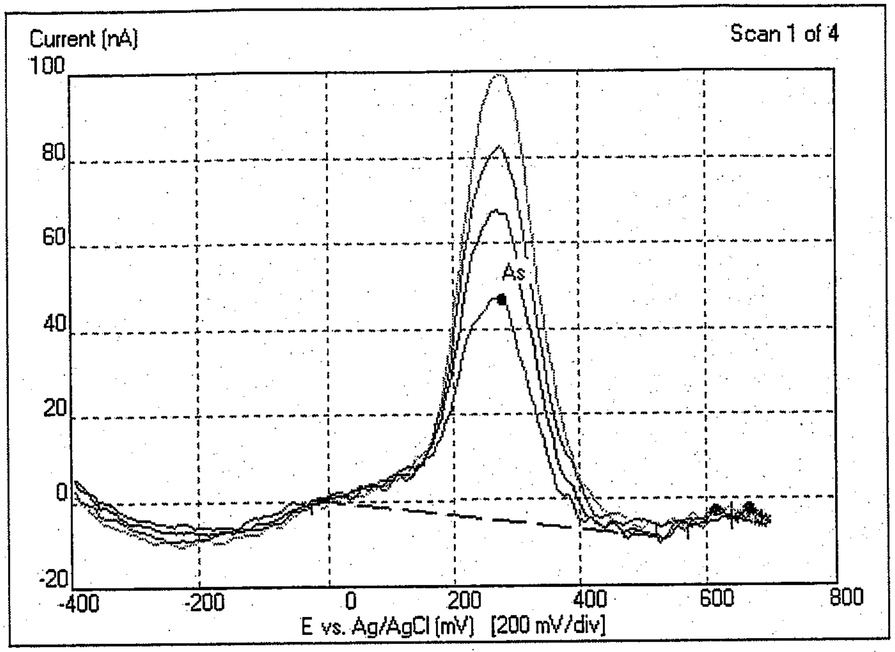
Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			58.3 nA	
1st	1.00 ppm	300 uL	81.9 nA	Enabled
2nd	1.00 ppm	300 uL	110 nA	Enabled
3rd	1.00 ppm	300 uL	132 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS III LCSD
Data File Name:	AS III LCSD_15.tds
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III LCSD\AS III LCSD_15.tds
Session Description:	
Scan ID:	Scan of unknown sample

Report Time/Date:	03:20 PM on 16/Sep/2010
Analysis Time/Date:	03:20 PM on 16/Sep/2010
CalibrationTime/Date:	03:20 PM on 16/Sep/2010
Software Version:	3.0.5
Operator:	402582
Electrode Type:	Carbon
Electrode Thin Film:	Gold
Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (•) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	275	250	52.0 nA	834 pC	140 mV	Auto	15.1 ppb (Cal.)	18.0 ppb (Cal.)

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	10	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

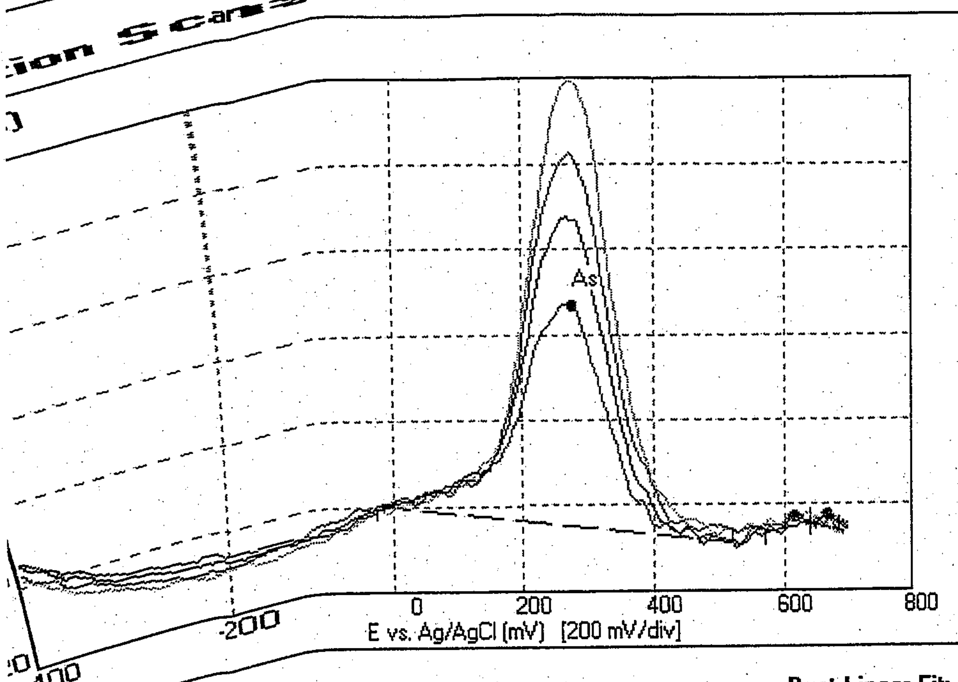
Background Scan Plate Time: 1 seconds

...SD
...am Files\TraceDetect\Nano-Band Explorer
...sions\00916CURX\AS III LCSD\AS III LCSD.tcl

CalibrationTime/Date:	03:20 PM on 16/Sep/2010
Software Version:	3.0.5
Operator:	402582

Calibration by Method of Standard Additions: Data Summary

...ion Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.750 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

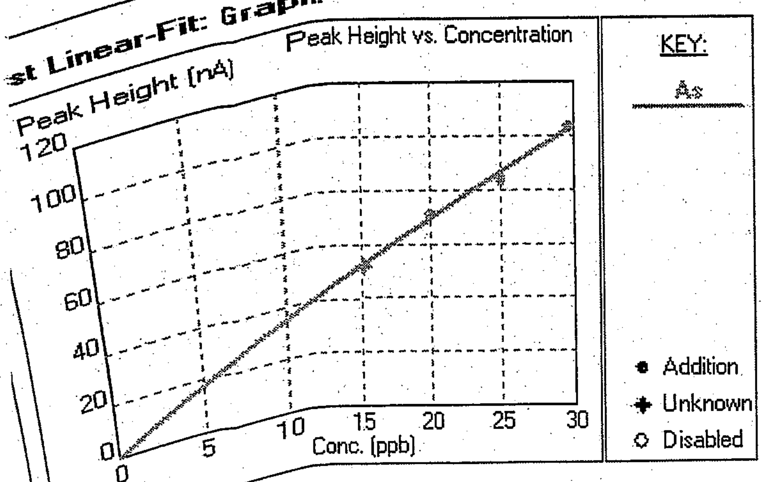
☐ Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

...st Linear-Fit Graph:



Best Linear-Fit Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9936	0.288 ppb/nA	15.1 ppb
	Area	0.9591	19.9 ppb/nC	16.2 ppb

Addition and Peak Data:

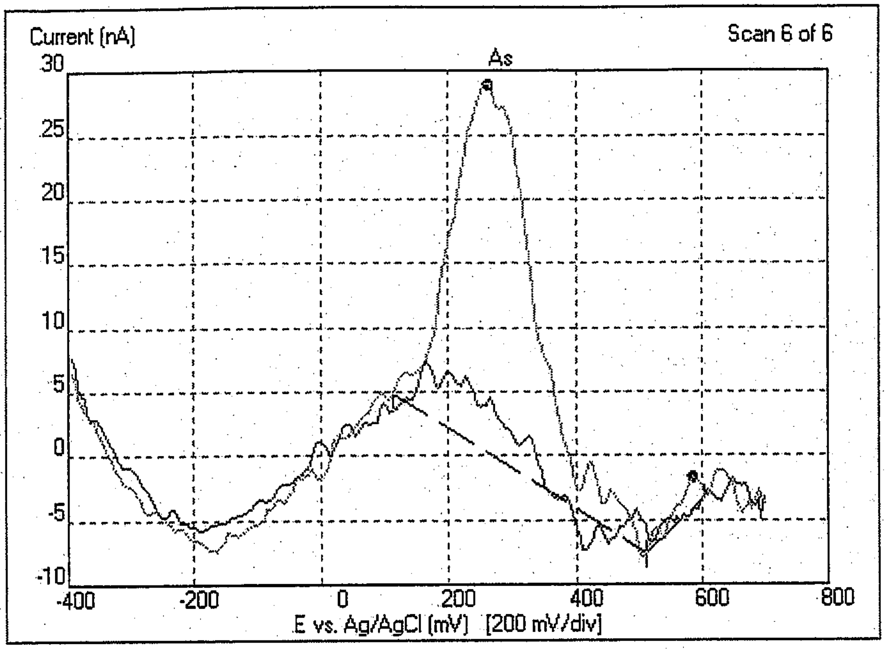
Addition	As Std (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			52.0 nA	
1st	1.00 ppm	250 uL	71.4 nA	Enabled
2nd	1.00 ppm	250 uL	84.2 nA	Enabled
3rd	1.00 ppm	250 uL	104 nA	Enabled

TraceDetect Measurement Report

Session Name:	AS III L6TKA1AA 5X	Report Time/Date:	03:25 PM on 16/Sep/2010
Data File Name:	AS III L6TKA1AA 5X_5.tds	Analysis Time/Date:	03:24 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III L6TKA1AA 5 X\AS III L6TKA1AA 5 X 5.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	L6TKA + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ND

ASV Measurement: Scan-Data Summary



Data Processing:

- ☑ Background Subtracted
- ☑ Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- ☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	260	250	28.8 nA	433 pC	140 mV	Auto	**6.76 ppb**	**40.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction — Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name: AS V L6TKA1AC 5X
Data File Name: AS V L6TKA1AC 5X_1.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6TKA1AC 5X\AS V L6TKA1AC 5X_1.tds

Session Description:

ND

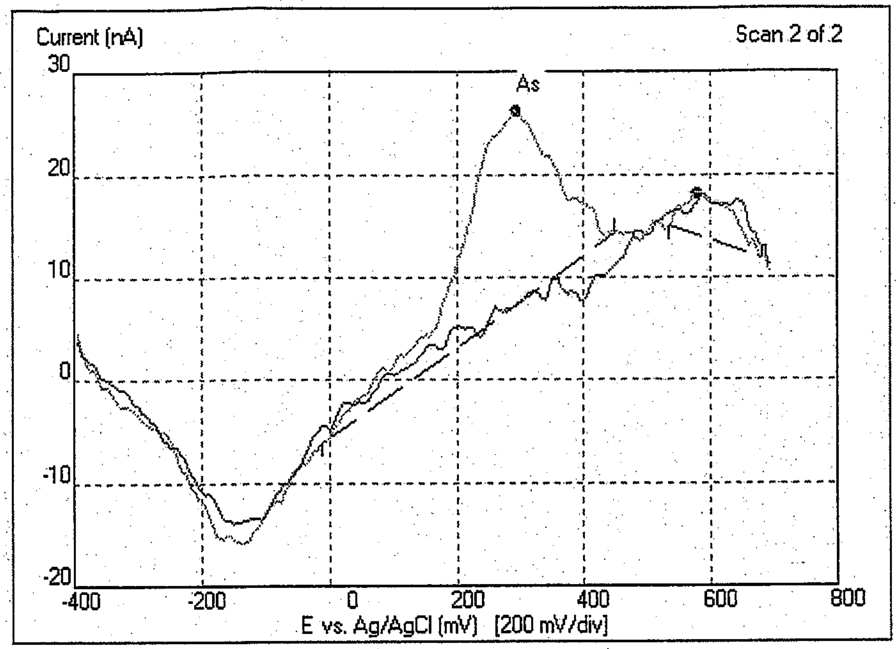
Scan ID: L6TKA1AC + 2PPB AS III

Report Time/Date: 03:31 PM on 16/Sep/2010
Analysis Time/Date: 03:30 PM on 16/Sep/2010
CalibrationTime/Date: n.a.
Software Version: 3.0.5

Operator: 402582

Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement
○ MSA Measurement used as Cal. Curve
○ Calibration Curve Used
◉ No Calibration Available
☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	290	250	19.0 nA	336 pC	155 mV	Auto	**4.45 ppb**	**26.5 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	μA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

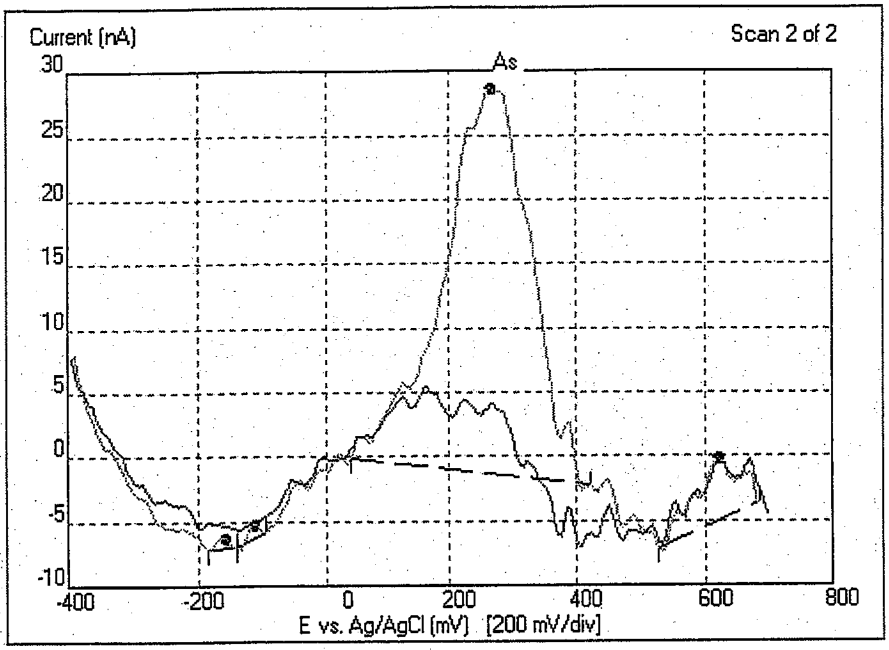
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	AS III L6JT81AA 5X	Report Time/Date:	03:28 PM on 16/Sep/2010
Data File Name:	AS III L6JT81AA 5X_1.tds	Analysis Time/Date:	03:27 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS III L6JT81AA 5X\AS III L6JT81AA 5X_1.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
	ND	Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	L6JT81AA + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	265	250	30.0 nA	480 pC	150 mV	Auto	**7.05 ppb**	**42.0 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

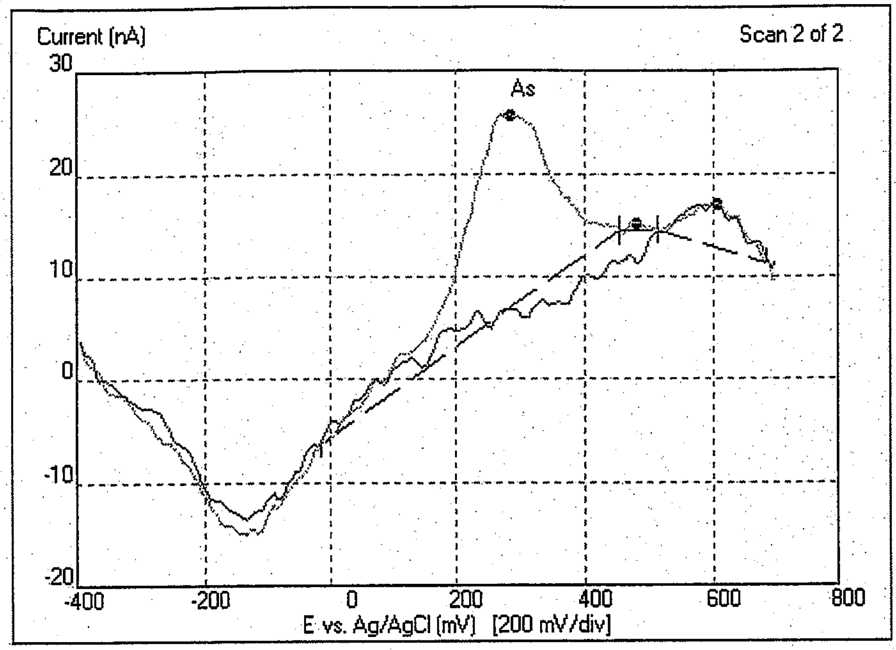
Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Measurement Report

Session Name:	AS V L6JT81AC 5X	Report Time/Date:	03:34 PM on 16/Sep/2010
Data File Name:	AS V L6JT81AC 5X_1.tds	Analysis Time/Date:	03:32 PM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6JT81AC 5X\AS V L6JT81AC 5X_1.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
	P.D	Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	L6JT81AC + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Scan-Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- ○ This Scan is part of a MSA Measurement
- ○ MSA Measurement used as Cal. Curve
- ○ Calibration Curve Used
- ◉ No Calibration Available
- [ ] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 5.952

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	285	250	18.8 nA	316 pC	150 mV	Auto	**4.41 ppb**	**26.2 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	μA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

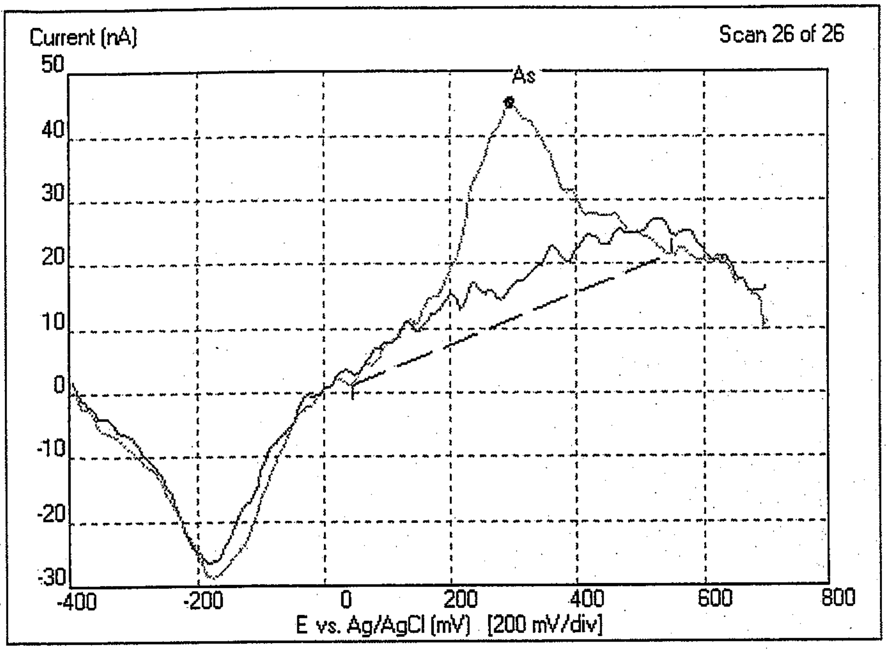
Background Scan Plate Time: 1 seconds

TraceDetect Measurement Report

Session Name:	GOLD PLATE 2	Report Time/Date:	11:04 AM on 16/Sep/2010
Data File Name:	GOLD PLATE 2_25.tds	Analysis Time/Date:	11:03 AM on 16/Sep/2010
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00915CURX\GOLD PLATE 2\GOLD PLATE 2_25.tds	CalibrationTime/Date:	n.a.
		Software Version:	3.0.5
Session Description:		Operator:	402582
		Electrode Type:	Carbon
		Electrode Thin Film:	Gold
Scan ID:	AS V BLANK CURX + 2PPB AS III	Electrode Serial #:	G 187 R 30 B 34

ND

ASV Measurement: Scan-Data Summary



Data Processing:

☑ Background Subtracted

☑ Smoothed

Concentration Calculation:

○ This Scan is part of a MSA Measurement

○ MSA Measurement used as Cal. Curve

○ Calibration Curve Used

◉ No Calibration Available

☐ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	250	34.1 nA	683 pC	185 mV	Auto	**9.27 ppb**	**11.0 ppb (Uncal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	40	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

Background Scan Plate Time: 1 seconds

☐ Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

Session Name: AS V LCS CURX
Data File Name: AS V LCS CURX_16.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCS CURX\AS V LCS CURX_16.tds

Session Description:

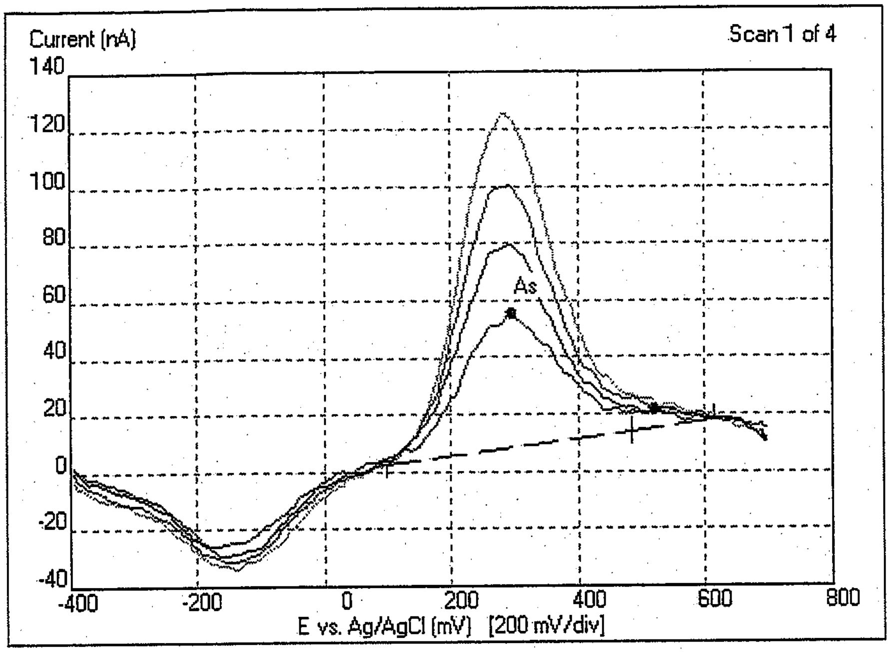
Scan ID: Scan of unknown sample

Report Time/Date: 11:19 AM on 16/Sep/2010
Analysis Time/Date: 11:18 AM on 16/Sep/2010
CalibrationTime/Date: 10:20 AM on 16/Sep/2010
Software Version: 3.0.5

Operator: 402582

Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

◉ This Scan is part of a MSA Measurement
○ MSA Measurement used as Cal. Curve
○ Calibration Curve Used
○ No Calibration Available
☑ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	300	47.0 nA	861 pC	180 mV	Auto	7.36 ppb (Cal.)	8.77 ppb (Cal.)

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	20	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

Background Scan Plate Time: 1 seconds

☐ Display measurement and background

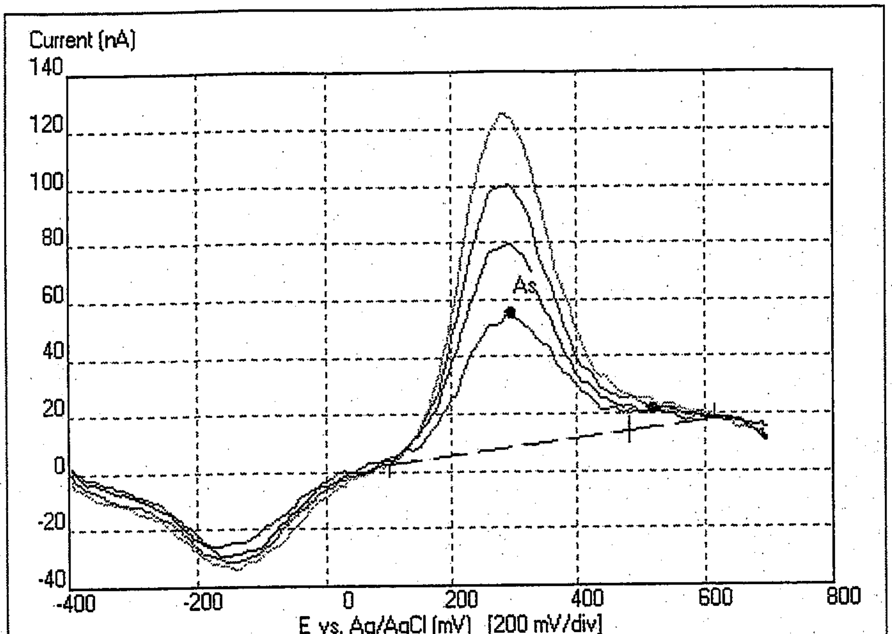
TraceDetect Method of Standard Additions Measurement Report

Session Name: AS V LCS CURX
Calibration File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCS CURX\AS V LCS CURX.tcl

CalibrationTime/Date: 11:19 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

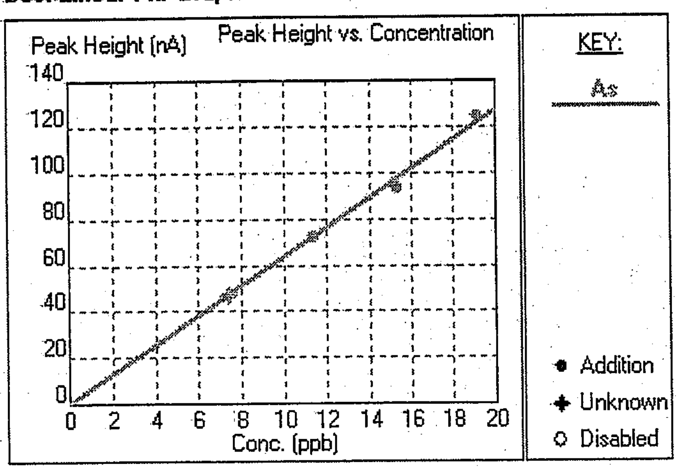
☐ Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9943	0.157 ppb/nA	7.36 ppb
	Area	0.9850	7.17 ppb/nC	6.00 ppb

Addition and Peak Data:

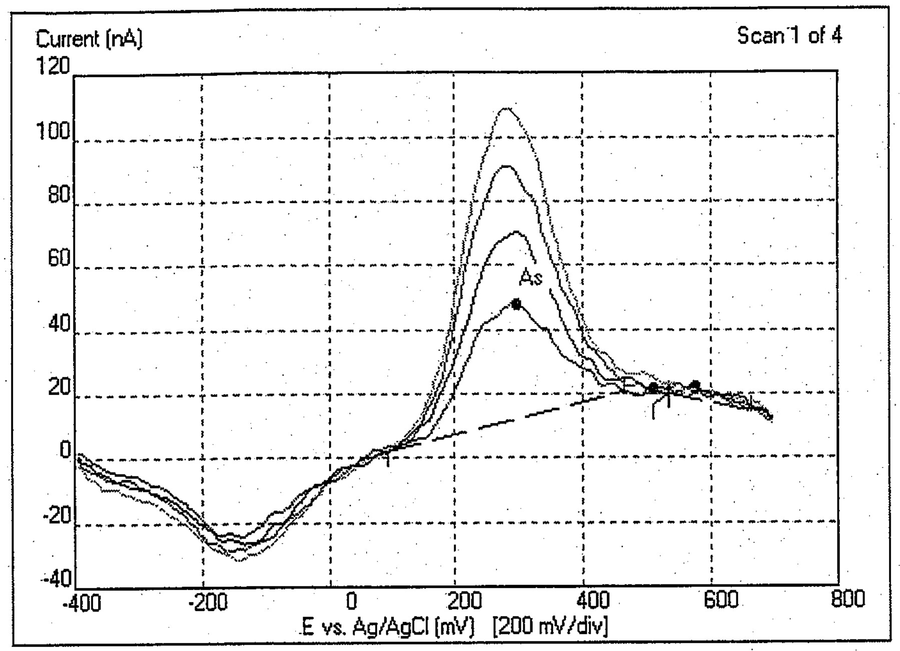
Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			47.0 nA	
1st	1.00 ppm	200 uL	73.0 nA	Enabled
2nd	1.00 ppm	200 uL	93.9 nA	Enabled
3rd	1.00 ppm	200 uL	125 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V LCSD
Data File Name:	AS V LCSD_15.tds
Data File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCSD\AS V LCSD_15.tds
Session Description:	
Scan ID:	Scan of unknown sample

Report Time/Date:	11:28 AM on 16/Sep/2010
Analysis Time/Date:	11:26 AM on 16/Sep/2010
CalibrationTime/Date:	11:27 AM on 16/Sep/2010
Software Version:	3.0.5
Operator:	402582
Electrode Type:	Carbon
Electrode Thin Film:	Gold
Electrode Serial #:	G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (•) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential (mV)	Expected Potential (mV)	Response Height (nA)	Response Area (nC)	Response FWHM (mV)	Baseline Man./Auto	Concentration in Test Sample (ppb)	Concentration in Original Sample (ppb)
As	295	300	36.4 nA	592 pC	155 mV	Manual	**7.07 ppb (Cal.)**	**8.42 ppb (Cal.)**

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	20	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

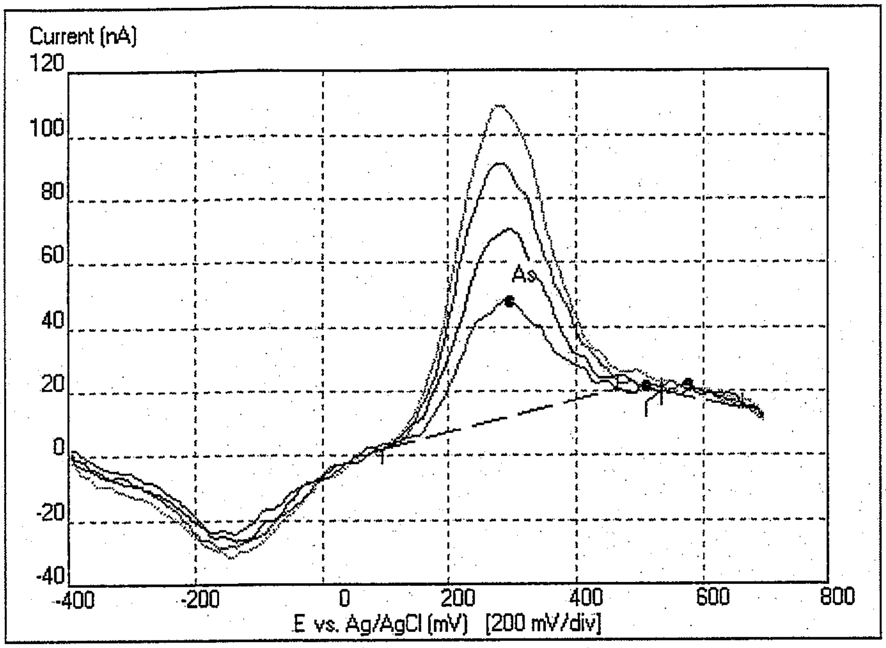
Background Scan Plate Time: 1 seconds

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V LCSD	CalibrationTime/Date:	11:28 AM on 16/Sep/2010
Calibration File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V LCSD\AS V LCSD.tcl	Software Version:	3.0.5
		Operator:	402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

◉ Individual Standards Used

○ Standard Mixture Used

Scans Skipped After Addition: **3**

Scans Averaged per Addition: **1**

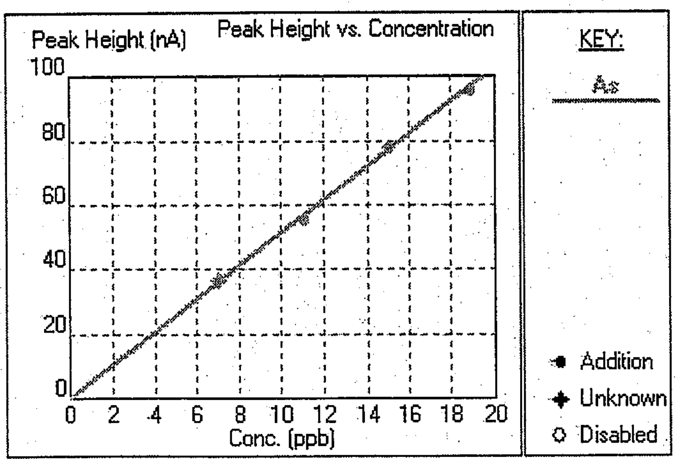
▣ Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	**Height**	0.9986	0.195 ppb/nA	7.07 ppb
	Area	0.9961	11.8 ppb/nC	6.84 ppb

Addition and Peak Data:

Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			36.4 nA	
1st	1.00 ppm	200 uL	56.1 nA	Enabled
2nd	1.00 ppm	200 uL	78.2 nA	Enabled
3rd	1.00 ppm	200 uL	96.1 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

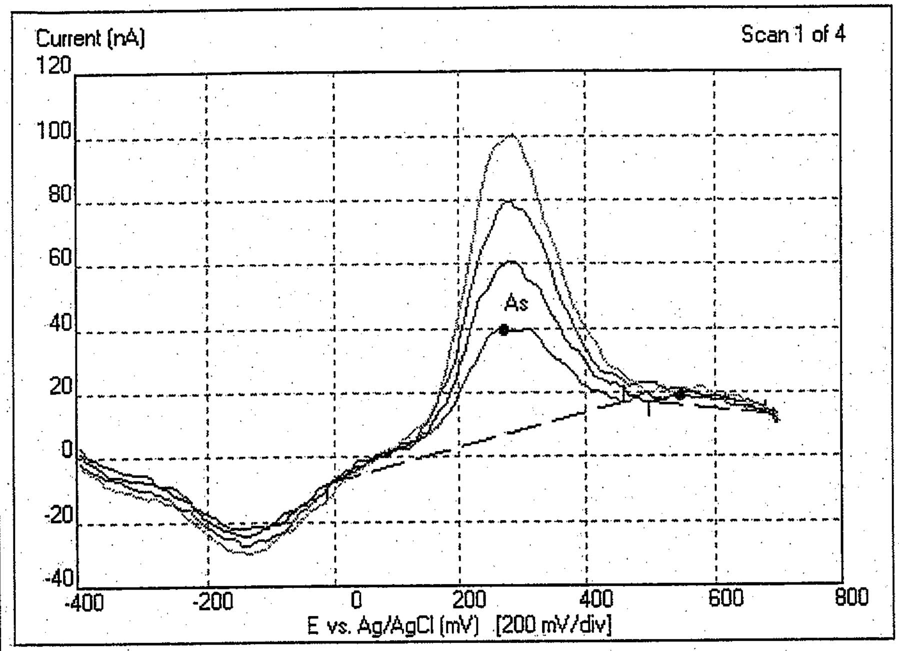
Session Name: AS V L6HQJMS
Data File Name: AS V L6HQJMS_16.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJMS\AS V L6HQJMS_16.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 11:54 AM on 16/Sep/2010
Analysis Time/Date: 11:53 AM on 16/Sep/2010
CalibrationTime/Date: 11:54 AM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

☑ Background Subtracted
☑ Smoothed

Concentration Calculation:

◉ This Scan is part of a MSA Measurement
○ MSA Measurement used as Cal. Curve
○ Calibration Curve Used
○ No Calibration Available
☑ Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190
Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:
Input 1 (mV):
Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	270	300	33.1 nA	621 pC	180 mV	Manual	6.49 ppb (Cal.)	7.72 ppb (Cal.)

Measurement Scan Settings:

Clean Time:	0.1	seconds	Clean Voltage:	500	mV
Plate Time:	20	seconds	Plate Voltage:	-400	mV
Start Voltage:	-400	mV	Signal Avg.	8	A/D conv
Stop Voltage:	700	mV	Frequency:	2000	Hz
Step Voltage:	5	mV	Range:	12.5	µA
Electrode:	Carbon		Waveform:	Staircase	
Thin Film:	Gold				
Cell Type:	Three Electrode				

Background Subtraction:

☑ Use Background subtraction

Background Scan Plate Time: 1 seconds

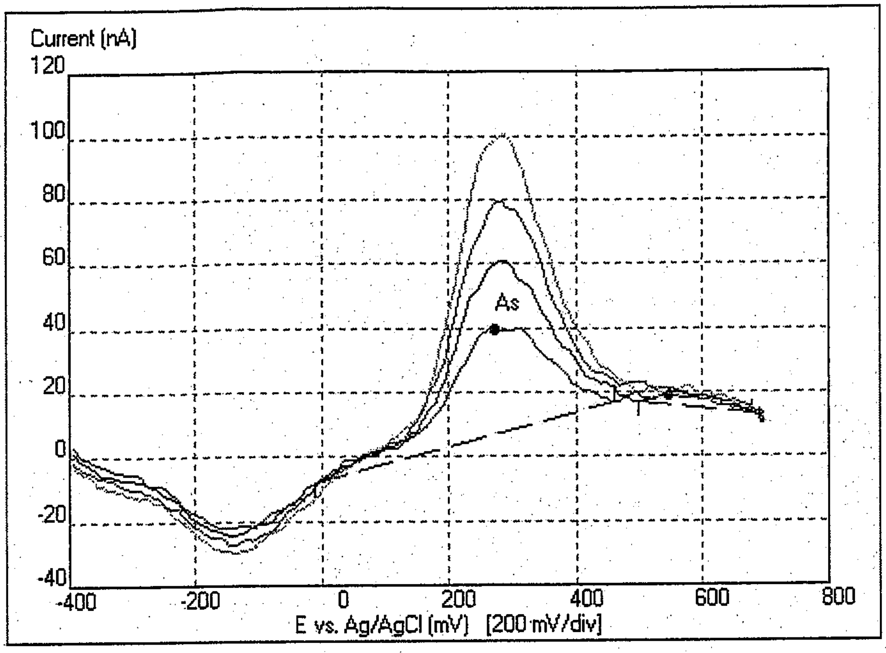
☐ Display measurement and background

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V L6HQJMS	CalibrationTime/Date:	11:54 AM on 16/Sep/2010
Calibration File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJMS\AS V L6HQJMS.tcl	Software Version:	3.0.5
		Operator:	402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

(•) Individual Standards Used

( ) Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

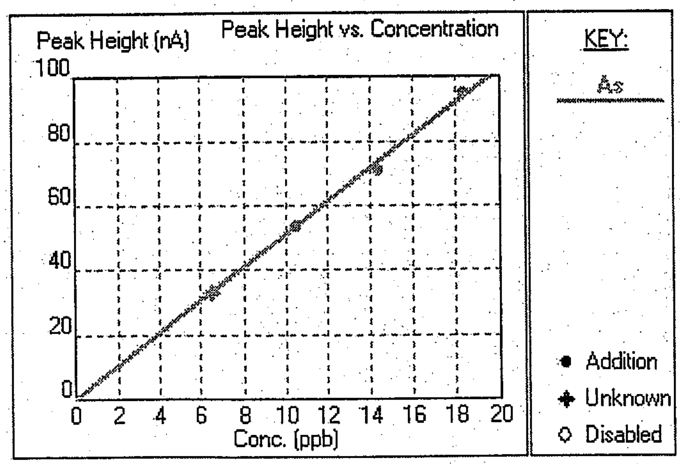
[ ] Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit Graph:



Best Linear-Fit Parameters:

Metal	Calib. Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9963	0.196 ppb/nA	6.49 ppb
	Area	0.9833	10.6 ppb/nC	6.51 ppb

Addition and Peak Data:

Addition	As			
	Std (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			33.1 nA	
1st	1.00 ppm	200 uL	53.9 nA	Enabled
2nd	1.00 ppm	200 uL	71.3 nA	Enabled
3rd	1.00 ppm	200 uL	95.1 nA	Enabled

TraceDetect Method of Standard Additions Measurement Report

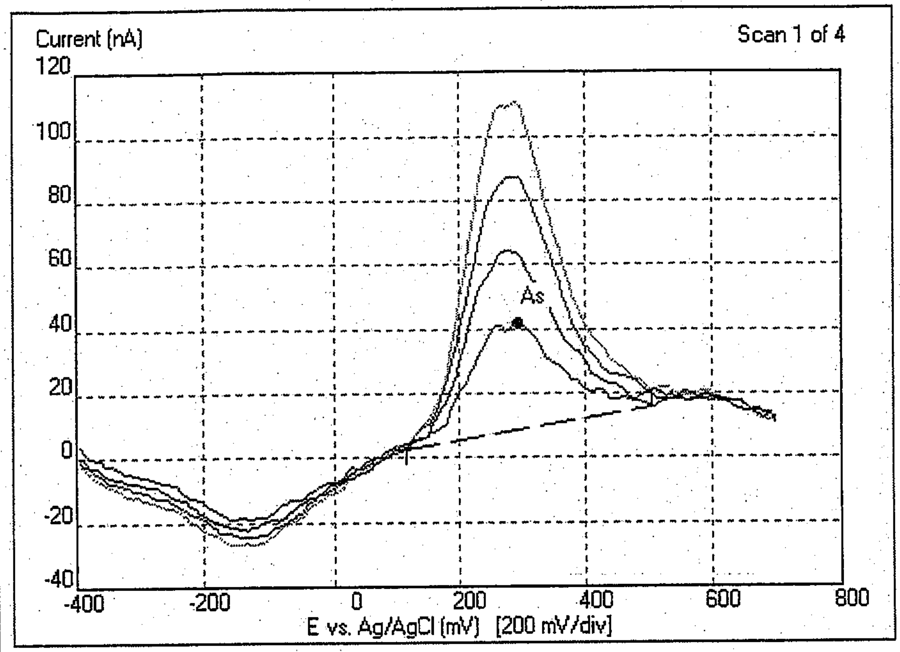
Session Name: AS V L6HQJ MSD
Data File Name: AS V L6HQJ MSD_15.tds
Data File Path: C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJ MSD\AS V L6HQJ MSD_15.tds

Session Description:

Scan ID: Scan of unknown sample

Report Time/Date: 12:02 PM on 16/Sep/2010
Analysis Time/Date: 12:01 PM on 16/Sep/2010
CalibrationTime/Date: 12:02 PM on 16/Sep/2010
Software Version: 3.0.5
Operator: 402582
Electrode Type: Carbon
Electrode Thin Film: Gold
Electrode Serial #: G 187 R 30 B 34

ASV Measurement: Unknown-Sample Data Summary



Data Processing:

- [x] Background Subtracted
- [x] Smoothed

Concentration Calculation:

- (•) This Scan is part of a MSA Measurement
- ( ) MSA Measurement used as Cal. Curve
- ( ) Calibration Curve Used
- ( ) No Calibration Available
- [x] Measurement and Calibration Scan Settings Match Exactly

Dilution Factor (D.F.):

D.F. = 1.190

Original Concentration = D.F. x Test Concentration

Other Measurements:

Temperature:

Input 1 (mV):

Input 2 (mV):

Peak-Data Summary:

Analyte	Stripping Potential	Expected Potential	Response			Baseline	Concentration in Test Sample	Concentration in Original Sample
	(mV)	(mV)	Height (nA)	Area (nC)	FWHM (mV)	Man./Auto	(ppb)	(ppb)
As	295	300	33.5 nA	572 pC	160 mV	Auto	5.12 ppb (Cal.)	6.10 ppb (Cal.)

Measurement Scan Settings:

Clean Time: 0.1 seconds
Plate Time: 20 seconds
Clean Voltage: 500 mV
Plate Voltage: -400 mV

Start Voltage: -400 mV
Stop Voltage: 700 mV
Step Voltage: 5 mV
Signal Avg.: 8 A/D conv
Frequency: 2000 Hz
Range: 12.5 µA

Electrode: Carbon
Thin Film: Gold
Cell Type: Three Electrode
Waveform: Staircase

Background Subtraction:

- [x] Use Background subtraction
- [ ] Display measurement and background

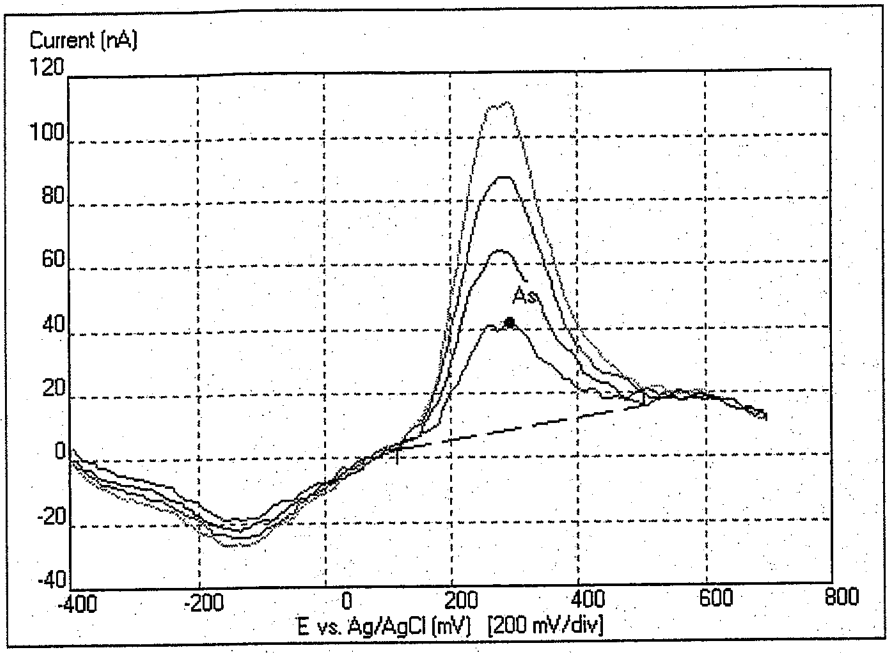
Background Scan Plate Time: 1 seconds

TraceDetect Method of Standard Additions Measurement Report

Session Name:	AS V L6HQJ MSD	CalibrationTime/Date:	12:02 PM on 16/Sep/2010
Calibration File Path:	C:\Program Files\TraceDetect\Nano-Band Explorer 3.0\Sessions\00916CURX\AS V L6HQJ MSD\AS V L6HQJ MSD.tcl	Software Version:	3.0.5
		Operator:	402582

Calibration by Method of Standard Additions: Data Summary

ASV Calibration Scans



Volumes:

Starting Volume: 50.000 mL

Final Volume: 50.600 mL

Options:

(•) Individual Standards Used

( ) Standard Mixture Used

Scans Skipped After Addition: 3

Scans Averaged per Addition: 1

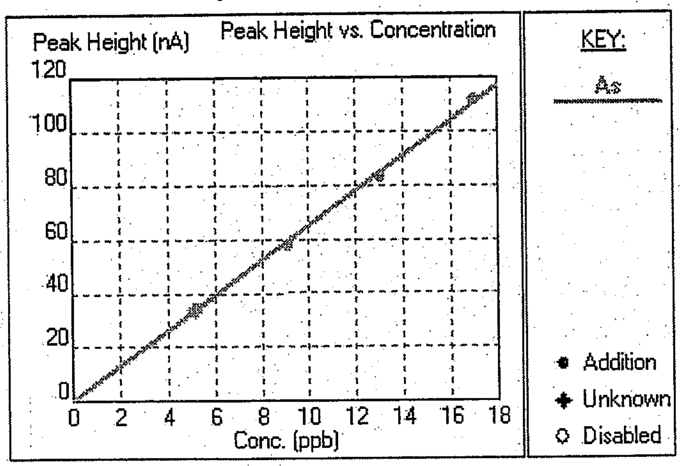
[ ] Calibration Curve Forced Through Origin

Dilutions:

Dilution Factor (D.F.): 1.190

Original Concentration = D.F. x Test Concentration

Best Linear-Fit: Graph:



Best Linear-Fit: Parameters:

Metal	Calib Mode	Fit Factor	Slope	Test Sample Concentration
As	Height	0.9987	0.154 ppb/nA	5.12 ppb
	Area	0.9937	6.84 ppb/nC	3.61 ppb

Addition and Peak Data:

Addition	As			
	Std. (ppm)	Vol. (uL)	Peak (nA)	Scan Status
Unknown			33.5 nA	
1st	1.00 ppm	200 uL	58.4 nA	Enabled
2nd	1.00 ppm	200 uL	83.7 nA	Enabled
3rd	1.00 ppm	200 uL	112 nA	Enabled

0259373 Arsenic (III) Speciation by ASV

Analyst: **Ray Shock**

Work Order	Result	Units	RL	PrepAnalysis	Analysis Time	dil	Inst	BlankRL	MDLChk	Expired	Expiration Prep -- Anl	MS Run#	Client
L6TJ8-1-AA	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07		
L6TKA-1-AA	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07		
L6311-1-AA B	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		10/07		

Work Order	Exc. Cod	True Spike	Measured Spike	Units	% Recovery	Control Limits	RPD	RPD Limit	Prep - Analysis
L6311 C		20	16.2	ug/L	81	(25 - 130)	10.52	(0-50)	09/16/10
L6311 C			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6311 L		20	18	ug/L	90	(25 - 130)	10.52	(0-50)	09/16/10
L6311 L			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10

0259371 Arsenic (V) Speciation by ASV

Analyst: **Ray Shock**

Work Order	Result	Units	RL	PrepAnalysis	Analysis Time	dil	Inst	BlankRL	MDLChk	Expired	Expiration Prep – Anl	MS Run#	Client
L6HQJ-1-AC	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		09/28	0259216	
L6HQJ-1-AC	NA	ug/L		09/16/10	00:00	1	AS35				09/28	0259216	
L6TJ8-1-AC	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07	0259216	
L6TKA-1-AC	ND	ug/L	10	09/16/10	00:00	5	AS35	Ok	Ok		10/07	0259216	
L631H-1-AA B	ND	ug/L	2	09/16/10	00:00	1	AS35	Ok	Ok		09/28		

Work Order	Exc. Cod	True Spike	Measured Spike	Units	% Recovery	Control Limits	RPD	RPD Limit	Prep - Analysis
L631H C		20	8.77	ug/L	43.85	(25 - 130)	4.07	(0-50)	09/16/10
L631H C			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L631H L		20	8.42	ug/L	42.1	(25 - 130)	4.07	(0-50)	09/16/10
L631H L			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6HQJ S		20	7.72	ug/L	38.6	(25 - 130)	23.44	(0-50)	09/16/10
L6HQJ S			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10
L6HQJ D		20	6.1	ug/L	30.5	(25 - 130)	23.44	(0-50)	09/16/10
L6HQJ D			NA	ug/L	0	(25 - 130)	0	(0-50)	09/16/10

North Canton

END OF REPORT

THE LEADER IN ENVIRONMENTAL TESTING

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Road
Nashville, TN 37204
Tel: 800-765-0980

TestAmerica Job ID: NTG0744
TestAmerica Sample Delivery Group: NTG0744
Client Project/Site: [none]
Client Project Description: Kingston Fossil Plant (Prior 091109)

For:
TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748

Attn: William Rogers

JAMitchell

Authorized for release by:
10/18/2010 12:29 PM

Johnny A. Mitchell
Laboratory Director
johnny.mitchell@testamericainc.com

Designee for

Mark Hollingsworth
Laboratory Director
mark.hollingsworth@testamericainc.com

LINKS

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Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Table of Contents

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
NTG0744-02	ASH-BT-001 (untreated)	Ash	07/07/10 10:15	07/09/10 09:50
NTG0744-03	ASH-BT-001 (treated)	Ash	07/07/10 10:15	07/09/10 09:50
NTG0744-04	BLK1	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-05	BLK2	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-06	BLK3	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-07	untreated DI Water leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-08	Untreated pH 5 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-09	untreated pH 7 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-10	untreated pH10 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-11	lime treated DI Water leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-12	Lime Treated pH 5 Leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-13	Lime Treated pH 7 Leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-14	Lime Treated pH 10 leachate	Leachate	07/07/10 10:15	07/09/10 09:50
NTG0744-15	Untreated- 10:1ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-16	untreated - 5:1 ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-17	untreated- 2:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-18	untreated- 1:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-19	Untreated - 1:2 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-20	Treated - 10:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-21	Treated - 5:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-22	Treated - 2:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-23	Treated - 1:1 Ratio	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-24	Blank	Leachate	08/09/10 13:20	07/09/10 09:50
NTG0744-25	Blank	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-26	T01 10:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-27	T02 5:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-28	T03 2:1	Leachate	09/09/10 00:01	07/09/10 09:50
NTG0744-29	T04 1:1	Leachate	09/09/10 00:01	07/09/10 09:50

Notes

None.

Qualifiers

WetChem

Qualifier	Qualifier Description
HT3	Sample received with insufficient holding time remaining for analysis to be performed within the method's holding time requirements.
M4	The MS/MSD required a dilution due to matrix interference. Because of this dilution, the matrix spike concentrations in the sample were reduced to a level where the recovery calculation does not provide useful information. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
RL1	Reporting limit raised due to sample matrix effects.

Glossary

Glossary	Glossary Description
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis.

Client Sample ID: ASH-BT-001 (untreated)

Lab Sample ID: NTG0744-02

Date Collected: 07/07/10 10:15

Matrix: Ash

Date Received: 07/09/10 09:50

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Phosphate	2850		30.6		mg/kg		07/14/10 12:20	07/16/10 11:55	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: ASH-BT-001 (treated)
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-03
Matrix: Ash

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Phosphate	2950		30.6		mg/kg		07/14/10 12:20	07/16/10 11:58	1

Client Sample ID: BLK1
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-04
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:53	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:53	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**428**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**7.38**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: BLK2
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-05
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:56	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:56	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	762	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	44.9		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	1.20		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: BLK3

Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-06

Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:59	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:59	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**751**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**18.6**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**1.39**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: untreated DI Water leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-07
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	16.3		2.00		ug/L		08/12/10 09:35	08/13/10 12:03	1
Selenium	0.0410		0.00200		mg/L		08/12/10 09:35	08/13/10 12:03	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	489	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	200		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.3		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Untreated pH 5 leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-08
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	18.2		2.00		ug/L		08/12/10 09:35	08/13/10 12:06	1
Selenium	0.0487		0.00200		mg/L		08/12/10 09:35	08/13/10 12:06	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	477	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	224		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.55		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: untreated pH 7 leachate

Lab Sample ID: NTG0744-09

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	26.5		2.00		ug/L		08/12/10 09:35	08/13/10 12:09	1
Selenium	0.0655		0.00200		mg/L		08/12/10 09:35	08/13/10 12:09	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	509	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	2740		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.13		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: untreated pH10 leachate

Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-10
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**85.7**		0.100		mg/L		08/12/10 09:00	08/12/10 15:22	1
Barium	**15.4**		0.100		mg/L		08/12/10 09:00	08/13/10 10:53	10
Beryllium	**0.0423**		0.00400		mg/L		08/12/10 09:00	08/12/10 15:22	1
Boron	**4.32**		0.500		mg/L		08/12/10 09:00	08/13/10 10:53	10
Cobalt	**0.126**		0.0200		mg/L		08/12/10 09:00	08/12/10 15:22	1
Iron	**9.10**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Magnesium	**62.2**		1.00		mg/L		08/12/10 09:00	08/12/10 15:22	1
Manganese	**0.727**		0.0150		mg/L		08/12/10 09:00	08/12/10 15:22	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Strontium	**14.3**		0.500		mg/L		08/12/10 09:00	08/13/10 10:53	10
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1
Titanium	**1.34**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:22	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.0148**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Chromium	**0.138**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Copper	**0.208**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:12	1
Lead	**0.0322**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1
Nickel	**0.209**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:12	1
Thallium	**0.0112**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:12	1

Method: EPA 200.8 - Total Metals by EPA 200.8 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Zinc	**0.881**		0.250		mg/L		08/12/10 09:00	08/13/10 11:30	5

Method: EPA 200.8 - Total Metals by EPA 200.8 - RE2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**0.416**		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100
Cadmium	ND		0.100		mg/L		08/12/10 09:00	08/13/10 11:33	100
Selenium	ND		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100
Silver	ND		0.200		mg/L		08/12/10 09:00	08/13/10 11:33	100

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	**0.214**		0.100		mg/L		08/06/10 13:00	08/09/10 11:24	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**568**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**5490**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND	RL1	5.00		mg/L		08/01/10 19:19	08/01/10 19:19	5
Sulfate	**23.3**		5.00		mg/L		08/01/10 19:19	08/01/10 19:19	5

Client Sample ID: untreated pH10 leachate

Lab Sample ID: NTG0744-10

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	0.655		0.306		mg/L		08/06/10 13:00	08/09/10 11:24	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.4		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: lime treated DI Water leachate

Lab Sample ID: NTG0744-11

Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 12:12	1
Selenium	**0.0121**		0.00200		mg/L		08/12/10 09:35	08/13/10 12:12	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**299**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**3980**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**12.0**		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: Lime Treated pH 5 Leachate

Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-12
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	18.9		2.00		ug/L		08/12/10 09:35	08/13/10 12:23	1
Selenium	0.0448		0.00200		mg/L		08/12/10 09:35	08/13/10 12:23	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	391	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	13800		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.75		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: Lime Treated pH 7 Leachate

Lab Sample ID: NTG0744-13

Date Collected: 07/07/10 10:15

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		08/12/10 09:00	08/12/10 15:26	1
Barium	**1.51**		0.0100		mg/L		08/12/10 09:00	08/12/10 15:26	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:26	1
Boron	**4.30**		0.500		mg/L		08/12/10 09:00	08/13/10 10:56	10
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:26	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Magnesium	**85.1**		1.00		mg/L		08/12/10 09:00	08/12/10 15:26	1
Manganese	**0.107**		0.0150		mg/L		08/12/10 09:00	08/12/10 15:26	1
Molybdenum	**0.104**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Strontium	**11.7**		0.500		mg/L		08/12/10 09:00	08/13/10 10:56	10
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:26	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.0298**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Arsenic	**0.0142**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:15	1
Chromium	**0.0632**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Copper	**0.00900**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:15	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Nickel	**0.0215**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:15	1
Selenium	**0.0610**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Thallium	**0.00295**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:15	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:15	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/06/10 13:00	08/09/10 11:25	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	**389**	**HT3**	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**9440**		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**14.0**		5.00		mg/L		08/01/10 20:20	08/01/10 20:20	5
Sulfate	**134**		5.00		mg/L		08/01/10 20:20	08/01/10 20:20	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	ND		0.306		mg/L		08/06/10 13:00	08/09/10 11:25	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Lime Treated pH 7 Leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-13
Matrix: Leachate

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	7.15		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Lime Treated pH 10 leachate
Date Collected: 07/07/10 10:15
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-14
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.99		2.00		ug/L		08/12/10 09:35	08/13/10 12:26	1
Selenium	0.0509		0.00200		mg/L		08/12/10 09:35	08/13/10 12:26	1

Method: SM 2580 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Oxidation/Reduction Potential	369	HT3	10.0		mV vs. NHE		07/30/10 14:15	08/01/10 18:30	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	6060		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/28/10 08:16	08/13/10 09:11	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	10.4		0.100		pH Units		07/28/10 08:16	08/13/10 09:11	1

Client Sample ID: Untreated- 10:1ratio

Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-15
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	4.49		0.100		mg/L		08/12/10 09:00	08/12/10 15:29	1
Barium	0.196		0.0100		mg/L		08/12/10 09:00	08/12/10 15:29	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:29	1
Boron	1.48		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:29	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Magnesium	2.14		1.00		mg/L		08/12/10 09:00	08/12/10 15:29	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:29	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Strontium	0.568		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:29	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.0103		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Arsenic	0.0582		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:18	1
Chromium	0.0197		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Copper	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:18	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:18	1
Selenium	0.0218		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:18	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:18	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	0.124		0.100		mg/L		08/13/10 12:23	08/16/10 09:45	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	109		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND	RL1	5.00		mg/L		08/12/10 23:58	08/12/10 23:58	5
Sulfate	13.1		5.00		mg/L		08/12/10 23:58	08/12/10 23:58	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	0.379		0.306		mg/L		08/13/10 12:23	08/16/10 09:45	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.75		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: untreated - 5:1 ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-16
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	49.5		2.00		ug/L		08/12/10 09:35	08/13/10 12:29	1
Selenium	0.0378		0.00200		mg/L		08/12/10 09:35	08/13/10 12:29	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	154		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.93		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: untreated- 2:1 Ratio

Lab Sample ID: NTG0744-17

Date Collected: 08/09/10 13:20

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	43.6		2.00		ug/L		08/12/10 09:35	08/13/10 12:33	1
Selenium	0.0589		0.00200		mg/L		08/12/10 09:35	08/13/10 12:33	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	222		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.86		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: untreated- 1:1 Ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-18
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	41.6		2.00		ug/L		08/12/10 09:35	08/13/10 12:36	1
Selenium	0.109		0.00200		mg/L		08/12/10 09:35	08/13/10 12:36	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	291		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.87		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Untreated - 1:2 Ratio
Lab Sample ID: NTG0744-19

Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	34.7		2.00		ug/L		08/12/10 09:35	08/13/10 12:39	1
Selenium	0.305		0.00200		mg/L		08/12/10 09:35	08/13/10 12:39	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	203		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	8.57		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Analytical Data

Client Sample ID: Treated - 10:1 Ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-20
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4.57**		0.100		mg/L		08/12/10 09:00	08/12/10 15:32	1
Barium	**5.53**		0.0100		mg/L		08/12/10 09:00	08/12/10 15:32	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:32	1
Boron	**0.0843**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:32	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Magnesium	ND		1.00		mg/L		08/12/10 09:00	08/12/10 15:32	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:32	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Strontium	**5.76**		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:32	1

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Arsenic	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:21	1
Chromium	**0.00621**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Copper	**0.0123**		0.00500		mg/L		08/12/10 09:00	08/13/10 11:21	1
Lead	**0.00226**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:21	1
Selenium	**0.0136**		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:21	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:21	1

Method: EPA 365.4 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	**1.63**		0.100		mg/L		08/13/10 12:23	08/16/10 09:46	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	**4460**		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: SW846 9056A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**7.62**		5.00		mg/L		08/13/10 00:52	08/13/10 00:52	5
Sulfate	ND	RL1	5.00		mg/L		08/13/10 00:52	08/13/10 00:52	5

Method: Total Phosphorus - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphate	**4.99**		0.306		mg/L		08/13/10 12:23	08/16/10 09:46	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**12.2**		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

1 2 3 4 5 6 7 8 9 10 11 12

Client Sample ID: Treated - 5:1 Ratio
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-21
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.02		2.00		ug/L		08/12/10 09:35	08/13/10 12:42	1
Selenium	0.0155		0.00200		mg/L		08/12/10 09:35	08/13/10 12:42	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5060		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Treated - 2:1 Ratio

Lab Sample ID: NTG0744-22

Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.50		2.00		ug/L		08/12/10 09:35	08/13/10 12:46	1
Selenium	0.0253		0.00200		mg/L		08/12/10 09:35	08/13/10 12:46	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5430		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Treated - 1:1 Ratio

Lab Sample ID: NTG0744-23

Date Collected: 08/09/10 13:20

Matrix: Leachate

Date Received: 07/09/10 09:50

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	2.54		2.00		ug/L		08/12/10 09:35	08/13/10 12:49	1
Selenium	0.0335		0.00200		mg/L		08/12/10 09:35	08/13/10 12:49	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	5560		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	22.5		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	12.2		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Client Sample ID: Blank
Date Collected: 08/09/10 13:20
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-24
Matrix: Leachate

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 12:52	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 12:52	1

Method: SW846 9050A - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Method: EPA 170.1 - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Temperature of pH determination	**22.5**		0.00		Deg C		07/23/10 23:59	08/13/10 09:21	1

Method: SW846 9040C - General Chemistry Parameters

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.14**		0.100		pH Units		07/23/10 23:59	08/13/10 09:21	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: Blank

Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-25
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**7.86**		0.100		mg/L		09/14/10 08:35	09/15/10 15:33	1
Barium	**2.83**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:33	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:33	1
Boron	**0.358**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:33	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:33	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:33	1
Molybdenum	**0.0537**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:33	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	**3.86**		0.250		mg/L		09/14/10 08:35	09/16/10 09:44	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00218**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Arsenic	**0.00357**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:07	1
Chromium	**0.0404**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Copper	**0.0268**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:07	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:07	1
Selenium	**0.0285**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:07	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:07	1

Client Sample ID: T01 10:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-26
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**19.4**		0.100		mg/L		09/14/10 08:35	09/15/10 15:37	1
Barium	**1.57**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:37	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:37	1
Boron	**1.44**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:37	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:37	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:37	1
Molybdenum	**0.0816**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:37	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Strontium	**4.39**		0.250		mg/L		09/14/10 08:35	09/16/10 09:47	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00342**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Arsenic	**0.00813**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:10	1
Chromium	**0.0600**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Copper	**0.0164**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:10	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:10	1
Selenium	**0.0727**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:10	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:10	1

Client Sample ID: T02 5:1

Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-27

Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**22.6**		0.100		mg/L		09/14/10 08:35	09/15/10 15:40	1
Barium	**1.24**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:40	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:40	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:40	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:40	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:40	1
Molybdenum	**0.112**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:40	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**1.99**		0.250		mg/L		09/14/10 08:35	09/16/10 09:50	5
Strontium	**4.34**		0.250		mg/L		09/14/10 08:35	09/16/10 09:50	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00326**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Arsenic	**0.00855**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:13	1
Chromium	**0.0793**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Copper	**0.0137**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:13	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:13	1
Selenium	**0.114**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:13	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:13	1

Client Sample ID: T03 2:1

Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-28

Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24.6**		0.100		mg/L		09/14/10 08:35	09/15/10 15:43	1
Barium	**0.640**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:43	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:43	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:43	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:43	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:43	1
Molybdenum	**0.178**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:43	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**3.83**		0.250		mg/L		09/14/10 08:35	09/16/10 09:53	5
Strontium	**3.03**		0.250		mg/L		09/14/10 08:35	09/16/10 09:53	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00540**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Arsenic	**0.0105**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:17	1
Chromium	**0.125**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Copper	**0.00911**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:17	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:17	1
Selenium	**0.201**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:17	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:17	1

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: T04 1:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-29
Matrix: Leachate

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**24.9**		0.100		mg/L		09/14/10 08:35	09/15/10 15:46	1
Barium	**0.531**		0.0100		mg/L		09/14/10 08:35	09/15/10 15:46	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:46	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:46	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:46	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:46	1
Molybdenum	**0.306**		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:46	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	**5.58**		0.250		mg/L		09/14/10 08:35	09/16/10 09:57	5
Strontium	**2.69**		0.250		mg/L		09/14/10 08:35	09/16/10 09:57	5

Method: EPA 200.8 - Total Metals by EPA 200.8

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.00688**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Arsenic	**0.0126**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:20	1
Chromium	**0.199**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Copper	**0.00768**		0.00500		mg/L		09/14/10 08:35	09/14/10 21:20	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:20	1
Selenium	**0.356**		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:20	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:20	1

Method: EPA 200.7 - Total Metals by EPA Method 200.7

Lab Sample ID: 10G4886-BLK1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BLK1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		08/12/10 09:00	08/12/10 15:13	1
Barium	ND		0.0100		mg/L		08/12/10 09:00	08/12/10 15:13	1
Beryllium	ND		0.00400		mg/L		08/12/10 09:00	08/12/10 15:13	1
Boron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Cobalt	ND		0.0200		mg/L		08/12/10 09:00	08/12/10 15:13	1
Iron	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Magnesium	ND		1.00		mg/L		08/12/10 09:00	08/12/10 15:13	1
Manganese	ND		0.0150		mg/L		08/12/10 09:00	08/12/10 15:13	1
Molybdenum	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Strontium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Tin	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1
Titanium	ND		0.0500		mg/L		08/12/10 09:00	08/12/10 15:13	1

Lab Sample ID: 10G4886-BS1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BS1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Aluminum	2.00	2.09		mg/L		104	85 - 115
Barium	2.00	2.18		mg/L		109	85 - 115
Beryllium	0.0500	0.0516		mg/L		103	85 - 115
Boron	1.00	1.06		mg/L		106	85 - 115
Cobalt	0.500	0.508		mg/L		102	85 - 115
Iron	1.00	0.998		mg/L		100	85 - 115
Magnesium	5.00	5.32		mg/L		106	85 - 115
Manganese	0.500	0.514		mg/L		103	85 - 115
Molybdenum	0.500	0.487		mg/L		97	85 - 115
Strontium	1.00	1.03		mg/L		103	85 - 115
Tin	1.00	1.11		mg/L		111	85 - 115
Titanium	1.00	1.07		mg/L		107	85 - 115

Lab Sample ID: 10G4886-BSD1
Matrix: Water
Analysis Batch: T012257

Client Sample ID: 10G4886-BSD1
Prep Type: total
Prep Batch: 10G4886_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Aluminum	2.00	2.09		mg/L		104	85 - 115	0.1	20
Barium	2.00	2.17		mg/L		108	85 - 115	0.7	20
Beryllium	0.0500	0.0514		mg/L		103	85 - 115	0.4	20
Boron	1.00	1.06		mg/L		106	85 - 115	0.7	20
Cobalt	0.500	0.504		mg/L		101	85 - 115	0.9	20
Iron	1.00	1.01		mg/L		101	85 - 115	1	20
Magnesium	5.00	5.30		mg/L		106	85 - 115	0.4	20
Manganese	0.500	0.517		mg/L		103	85 - 115	0.6	20
Molybdenum	0.500	0.494		mg/L		99	85 - 115	1	20
Strontium	1.00	1.03		mg/L		103	85 - 115	0.7	20
Tin	1.00	1.10		mg/L		110	85 - 115	1	20
Titanium	1.00	1.06		mg/L		106	85 - 115	0.7	20

Method: EPA 200.7 - Total Metals by EPA Method 200.7 (Continued)

Lab Sample ID: 10I1524-BLK1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BLK1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		09/14/10 08:35	09/15/10 15:24	1
Barium	ND		0.0100		mg/L		09/14/10 08:35	09/15/10 15:24	1
Beryllium	ND		0.00400		mg/L		09/14/10 08:35	09/15/10 15:24	1
Boron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Cobalt	ND		0.0200		mg/L		09/14/10 08:35	09/15/10 15:24	1
Iron	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Magnesium	ND		1.00		mg/L		09/14/10 08:35	09/15/10 15:24	1
Manganese	ND		0.0150		mg/L		09/14/10 08:35	09/15/10 15:24	1
Molybdenum	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Strontium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Tin	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1
Titanium	ND		0.0500		mg/L		09/14/10 08:35	09/15/10 15:24	1

Lab Sample ID: 10I1524-BS1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BS1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Aluminum	2.00	2.14		mg/L		107	85 - 115
Barium	2.00	2.08		mg/L		104	85 - 115
Beryllium	0.0500	0.0505		mg/L		101	85 - 115
Boron	1.00	1.05		mg/L		105	85 - 115
Cobalt	0.500	0.488		mg/L		98	85 - 115
Iron	1.00	1.05		mg/L		105	85 - 115
Magnesium	5.00	5.08		mg/L		102	85 - 115
Manganese	0.500	0.525		mg/L		105	85 - 115
Molybdenum	0.500	0.492		mg/L		98	85 - 115
Strontium	1.00	1.06		mg/L		106	85 - 115
Tin	1.00	1.03		mg/L		103	85 - 115
Titanium	1.00	0.996		mg/L		100	85 - 115

Lab Sample ID: 10I1524-BSD1
Matrix: Water
Analysis Batch: T014343

Client Sample ID: 10I1524-BSD1
Prep Type: total
Prep Batch: 10I1524_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Aluminum	2.00	2.14		mg/L		107	85 - 115	0.2	20
Barium	2.00	2.07		mg/L		103	85 - 115	0.8	20
Beryllium	0.0500	0.0503		mg/L		101	85 - 115	0.4	20
Boron	1.00	1.05		mg/L		105	85 - 115	0.1	20
Cobalt	0.500	0.485		mg/L		97	85 - 115	0.6	20
Iron	1.00	1.05		mg/L		105	85 - 115	0.1	20
Magnesium	5.00	5.07		mg/L		101	85 - 115	0.4	20
Manganese	0.500	0.524		mg/L		105	85 - 115	0.3	20
Molybdenum	0.500	0.496		mg/L		99	85 - 115	0.8	20
Strontium	1.00	1.06		mg/L		106	85 - 115	0.09	20
Tin	1.00	1.02		mg/L		102	85 - 115	1	20
Titanium	1.00	0.990		mg/L		99	85 - 115	0.6	20

Method: EPA 200.8 - Total Metals by EPA 200.8

Lab Sample ID: 10G4885-BLK1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BLK1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Arsenic	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Cadmium	ND		0.00100		mg/L		08/12/10 09:00	08/13/10 11:09	1
Chromium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Copper	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:09	1
Lead	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Nickel	ND		0.00500		mg/L		08/12/10 09:00	08/13/10 11:09	1
Selenium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Silver	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Thallium	ND		0.00200		mg/L		08/12/10 09:00	08/13/10 11:09	1
Zinc	ND		0.0500		mg/L		08/12/10 09:00	08/13/10 11:09	1

Lab Sample ID: 10G4885-BS1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BS1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	0.100	0.104		mg/L		104	85 - 115
Arsenic	0.100	0.0992		mg/L		99	85 - 115
Cadmium	0.100	0.102		mg/L		102	85 - 115
Chromium	0.100	0.100		mg/L		100	85 - 115
Copper	0.100	0.102		mg/L		102	85 - 115
Lead	0.100	0.105		mg/L		105	85 - 115
Nickel	0.100	0.102		mg/L		102	85 - 115
Selenium	0.100	0.0996		mg/L		100	85 - 115
Silver	0.100	0.111		mg/L		111	85 - 115
Thallium	0.100	0.0993		mg/L		99	85 - 115
Zinc	0.100	0.102		mg/L		102	85 - 115

Lab Sample ID: 10G4885-BSD1
Matrix: Water
Analysis Batch: T012279

Client Sample ID: 10G4885-BSD1
Prep Type: total
Prep Batch: 10G4885_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Antimony	0.100	0.104		mg/L		104	85 - 115	0.5	20
Arsenic	0.100	0.0972		mg/L		97	85 - 115	2	20
Cadmium	0.100	0.0999		mg/L		100	85 - 115	2	20
Chromium	0.100	0.102		mg/L		102	85 - 115	1	20
Copper	0.100	0.104		mg/L		104	85 - 115	2	20
Lead	0.100	0.104		mg/L		104	85 - 115	1	20
Nickel	0.100	0.102		mg/L		102	85 - 115	0.9	20
Selenium	0.100	0.0976		mg/L		98	85 - 115	2	20
Silver	0.100	0.108		mg/L		108	85 - 115	2	20
Thallium	0.100	0.0992		mg/L		99	85 - 115	0.1	20
Zinc	0.100	0.103		mg/L		103	85 - 115	1	20

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: EPA 200.8 - Total Metals by EPA 200.8 (Continued)

Lab Sample ID: 10I1528-BLK1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BLK1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Arsenic	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Cadmium	ND		0.00100		mg/L		09/14/10 08:35	09/14/10 21:03	1
Chromium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Copper	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:03	1
Lead	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Nickel	ND		0.00500		mg/L		09/14/10 08:35	09/14/10 21:03	1
Selenium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Silver	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Thallium	ND		0.00200		mg/L		09/14/10 08:35	09/14/10 21:03	1
Zinc	ND		0.0500		mg/L		09/14/10 08:35	09/14/10 21:03	1

Lab Sample ID: 10I1528-BS1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BS1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Antimony	0.100	0.101		mg/L		101	85 - 115
Arsenic	0.100	0.0906		mg/L		91	85 - 115
Cadmium	0.100	0.102		mg/L		102	85 - 115
Chromium	0.100	0.0976		mg/L		98	85 - 115
Copper	0.100	0.0989		mg/L		99	85 - 115
Lead	0.100	0.0983		mg/L		98	85 - 115
Nickel	0.100	0.0951		mg/L		95	85 - 115
Selenium	0.100	0.0965		mg/L		96	85 - 115
Silver	0.100	0.0991		mg/L		99	85 - 115
Thallium	0.100	0.0942		mg/L		94	85 - 115
Zinc	0.100	0.102		mg/L		102	85 - 115

Lab Sample ID: 10I1528-BSD1
Matrix: Water
Analysis Batch: T014236

Client Sample ID: 10I1528-BSD1
Prep Type: total
Prep Batch: 10I1528_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Antimony	0.100	0.102		mg/L		102	85 - 115	0.6	20
Arsenic	0.100	0.0926		mg/L		93	85 - 115	2	20
Cadmium	0.100	0.104		mg/L		104	85 - 115	3	20
Chromium	0.100	0.0984		mg/L		98	85 - 115	0.8	20
Copper	0.100	0.0991		mg/L		99	85 - 115	0.2	20
Lead	0.100	0.0976		mg/L		98	85 - 115	0.7	20
Nickel	0.100	0.0971		mg/L		97	85 - 115	2	20
Selenium	0.100	0.0982		mg/L		98	85 - 115	2	20
Silver	0.100	0.101		mg/L		101	85 - 115	2	20
Thallium	0.100	0.0944		mg/L		94	85 - 115	0.3	20
Zinc	0.100	0.102		mg/L		102	85 - 115	0.5	20

Method: SW846 6020 - Total Metals by Method 6020

Lab Sample ID: 10G4884-BLK1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BLK1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		2.00		ug/L		08/12/10 09:35	08/13/10 11:50	1
Selenium	ND		0.00200		mg/L		08/12/10 09:35	08/13/10 11:50	1

Lab Sample ID: 10G4884-BS1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BS1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Arsenic	100	98.1		ug/L		98	80 - 120
Selenium	0.100	0.100		mg/L		100	80 - 120

Lab Sample ID: 10G4884-BSD1
Matrix: Water
Analysis Batch: T012280

Client Sample ID: 10G4884-BSD1
Prep Type: total
Prep Batch: 10G4884_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Arsenic	100	99.2		ug/L		99	80 - 120	1	20
Selenium	0.100	0.0985		mg/L		99	80 - 120	2	20

Method: EPA 365.4 - General Chemistry Parameters

Lab Sample ID: 10H0891-BLK2
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BLK2
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/06/10 13:00	08/09/10 15:59	1

Lab Sample ID: 10H0891-BS1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BS1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	2.00	1.96		mg/L		98	90 - 110

Lab Sample ID: 10H0891-BSD1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: 10H0891-BSD1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	2.00	1.94		mg/L		97	90 - 110	1	20

Lab Sample ID: 10H0891-MS1
Matrix: Water
Analysis Batch: 10H0891

Client Sample ID: NTG2350-02
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	0.188		2.00	1.41	M8	mg/L		61	66 - 121

Method: EPA 365.4 - General Chemistry Parameters (Continued)

Lab Sample ID: 10H0891-MSD1
Matrix: Water
Analysis Batch: 10H0891
Client Sample ID: NTG2350-02
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	0.188		2.00	1.38	M8	mg/L		60	66 - 121	2	20

Lab Sample ID: 10H0891-DUP2
Matrix: Water
Analysis Batch: 10H0891
Client Sample ID: NTH0048-01RE1
Prep Type: total
Prep Batch: 10H0891_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Phosphorus	5980		5460		mg/L		9	20

Lab Sample ID: 10H1839-BLK1
Matrix: Water
Analysis Batch: 10H1839
Client Sample ID: 10H1839-BLK1
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Phosphorus	ND		0.100		mg/L		08/11/10 12:23	08/16/10 09:20	1

Lab Sample ID: 10H1839-BS1
Matrix: Water
Analysis Batch: 10H1839
Client Sample ID: 10H1839-BS1
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	2.00	1.85		mg/L		92	90 - 110

Lab Sample ID: 10H1839-MS1
Matrix: Water
Analysis Batch: 10H1839
Client Sample ID: NTH0821-06
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	% Rec	% Rec. Limits
Phosphorus	ND		2.00	1.91		mg/L		96	66 - 121

Lab Sample ID: 10H1839-MSD1
Matrix: Water
Analysis Batch: 10H1839
Client Sample ID: NTH0821-06
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Dup Result	Matrix Spike Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Phosphorus	ND		2.00	1.94		mg/L		97	66 - 121	2	20

Lab Sample ID: 10H1839-DUP1
Matrix: Water
Analysis Batch: 10H1839
Client Sample ID: NTH0821-16
Prep Type: total
Prep Batch: 10H1839_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Phosphorus	ND		0.164		mg/L			20

Quality Control Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Method: SM 2580 - General Chemistry Parameters

Lab Sample ID: 10G5315-DUP1
Matrix: Water
Analysis Batch: 10G5315

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G5315_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Oxidation/Reduction Potential	369	HT3	368		mV vs. NHE		0.3	20

Method: SW846 9050A - General Chemistry Parameters

Lab Sample ID: 10G5312-BLK1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: 10G5312-BLK1
Prep Type: total
Prep Batch: 10G5312_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		07/30/10 14:08	07/30/10 14:30	1

Lab Sample ID: 10G5312-BS1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: 10G5312-BS1
Prep Type: total
Prep Batch: 10G5312_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Specific conductance	1410	1390		umho/cm		99	90 - 110

Lab Sample ID: 10G5312-DUP1
Matrix: Water
Analysis Batch: 10G5312

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G5312_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Specific conductance	6060		6060		umho/cm		0	10

Lab Sample ID: 10H4167-BLK1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: 10H4167-BLK1
Prep Type: total
Prep Batch: 10H4167_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific conductance	ND		10.0		umho/cm		08/24/10 12:02	08/24/10 12:50	1

Lab Sample ID: 10H4167-BS1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: 10H4167-BS1
Prep Type: total
Prep Batch: 10H4167_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Specific conductance	1410	1400		umho/cm		99	90 - 110

Lab Sample ID: 10H4167-DUP1
Matrix: Water
Analysis Batch: 10H4167

Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H4167_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Specific conductance	109		108		umho/cm		0.9	10

Method: SW846 9056A - General Chemistry Parameters

Lab Sample ID: 10G4880-BLK1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: 10G4880-BLK1
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L		08/01/10 18:18	08/01/10 18:18	1
Sulfate	ND		1.00		mg/L		08/01/10 18:18	08/01/10 18:18	1

Lab Sample ID: 10G4880-BS1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: 10G4880-BS1
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Chloride	3.00	2.92	M4	mg/L		97	90 - 110
Sulfate	15.0	15.8		mg/L		105	90 - 110

Lab Sample ID: 10G4880-DUP1
Matrix: Water
Analysis Batch: 10G4880

Client Sample ID: Lime Treated pH 7 Leachate
Prep Type: total
Prep Batch: 10G4880_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Chloride	14.0		13.5		mg/L		4	20
Sulfate	134		127		mg/L		5	20

Lab Sample ID: 10H2079-BLK1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: 10H2079-BLK1
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L		08/12/10 23:05	08/12/10 23:05	1
Sulfate	ND		1.00		mg/L		08/12/10 23:05	08/12/10 23:05	1

Lab Sample ID: 10H2079-BS1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: 10H2079-BS1
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Chloride	3.00	3.09	M4	mg/L		103	90 - 110
Sulfate	15.0	16.5		mg/L		110	90 - 110

Lab Sample ID: 10H2079-DUP1
Matrix: Water
Analysis Batch: 10H2079

Client Sample ID: Treated - 10:1 Ratio
Prep Type: total
Prep Batch: 10H2079_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Chloride	7.62		7.56		mg/L		0.8	20
Sulfate	ND	RL1	3.52	RL1	mg/L		0.1	20

Method: EPA 170.1 - General Chemistry Parameters

Lab Sample ID: 10G4666-DUP1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: BLK1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Lab Sample ID: 10G4666-DUP2
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Lab Sample ID: 10H2208-DUP1
Matrix: Water
Analysis Batch: 10H2208

Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
Temperature of pH determination	22.5		22.5		Deg C		0	200

Method: SW846 9040C - General Chemistry Parameters

Lab Sample ID: 10G4666-BS1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: 10G4666-BS1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
pH	7.00	6.99		pH Units		100	95 - 105

Lab Sample ID: 10G4666-BSD1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: 10G4666-BSD1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
pH	7.00	6.98		pH Units		100	95 - 105	0.1	10

Lab Sample ID: 10G4666-DUP1
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: BLK1
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
pH	7.38		7.37		pH Units		0.1	10

Lab Sample ID: 10G4666-DUP2
Matrix: Water
Analysis Batch: 10G4666

Client Sample ID: Lime Treated pH 10 leachate
Prep Type: total
Prep Batch: 10G4666_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
pH	10.4		10.5		pH Units		0.1	10

Method: SW846 9040C - General Chemistry Parameters (Continued)

Lab Sample ID: 10H2208-BS1
Matrix: Water
Analysis Batch: 10H2208
Client Sample ID: 10H2208-BS1
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
pH		6.98		pH Units			95 - 105

Lab Sample ID: 10H2208-BSD1
Matrix: Water
Analysis Batch: 10H2208
Client Sample ID: 10H2208-BSD1
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
pH		7.01		pH Units			95 - 105	0.4	10

Lab Sample ID: 10H2208-DUP1
Matrix: Water
Analysis Batch: 10H2208
Client Sample ID: Untreated- 10:1ratio
Prep Type: total
Prep Batch: 10H2208_P

Analyte	Sample Result	Sample Qualifier	Duplicate Result	Duplicate Qualifier	Unit	D	RPD	RPD Limit
pH	8.75		8.75		pH Units		0	10

QC Association Summary

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Metals

Prep Batch: 10G4884_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4884-BS1	10G4884-BS1	total	Water	EPA 3010A / 6020	
10G4884-BSD1	10G4884-BSD1	total	Water	EPA 3010A / 6020	
10G4884-BLK1	10G4884-BLK1	total	Water	EPA 3010A / 6020	
NTG0744-04	BLK1	total	Leachate	EPA 3010A / 6020	
NTG0744-05	BLK2	total	Leachate	EPA 3010A / 6020	
NTG0744-06	BLK3	total	Leachate	EPA 3010A / 6020	
NTG0744-07	untreated DI Water leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-09	untreated pH 7 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-11	lime treated DI Water leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	EPA 3010A / 6020	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	EPA 3010A / 6020	
NTG0744-24	Blank	total	Leachate	EPA 3010A / 6020	

Prep Batch: 10G4885_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4885-BS1	10G4885-BS1	total	Water	EPA 200.8	
10G4885-BSD1	10G4885-BSD1	total	Water	EPA 200.8	
10G4885-BLK1	10G4885-BLK1	total	Water	EPA 200.8	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.8	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.8	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.8	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.8	
NTG0744-10 - RE1	untreated pH10 leachate	total	Leachate	EPA 200.8	
NTG0744-10 - RE2	untreated pH10 leachate	total	Leachate	EPA 200.8	

Prep Batch: 10G4886_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4886-BLK1	10G4886-BLK1	total	Water	EPA 200.7	
10G4886-BS1	10G4886-BS1	total	Water	EPA 200.7	
10G4886-BSD1	10G4886-BSD1	total	Water	EPA 200.7	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.7	

Metals (Continued)

Prep Batch: 10G4886_P (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.7	
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	

Prep Batch: 10I1524_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1524-BLK1	10I1524-BLK1	total	Water	EPA 200.7	
10I1524-BS1	10I1524-BS1	total	Water	EPA 200.7	
10I1524-BSD1	10I1524-BSD1	total	Water	EPA 200.7	
NTG0744-25	Blank	total	Leachate	EPA 200.7	
NTG0744-26	T01 10:1	total	Leachate	EPA 200.7	
NTG0744-27	T02 5:1	total	Leachate	EPA 200.7	
NTG0744-28	T03 2:1	total	Leachate	EPA 200.7	
NTG0744-29	T04 1:1	total	Leachate	EPA 200.7	
NTG0744-25 - RE1	Blank	total	Leachate	EPA 200.7	
NTG0744-26 - RE1	T01 10:1	total	Leachate	EPA 200.7	
NTG0744-27 - RE1	T02 5:1	total	Leachate	EPA 200.7	
NTG0744-28 - RE1	T03 2:1	total	Leachate	EPA 200.7	
NTG0744-29 - RE1	T04 1:1	total	Leachate	EPA 200.7	

Prep Batch: 10I1528_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1528-BS1	10I1528-BS1	total	Water	EPA 200.8	
10I1528-BSD1	10I1528-BSD1	total	Water	EPA 200.8	
10I1528-BLK1	10I1528-BLK1	total	Water	EPA 200.8	
NTG0744-25	Blank	total	Leachate	EPA 200.8	
NTG0744-26	T01 10:1	total	Leachate	EPA 200.8	
NTG0744-27	T02 5:1	total	Leachate	EPA 200.8	
NTG0744-28	T03 2:1	total	Leachate	EPA 200.8	
NTG0744-29	T04 1:1	total	Leachate	EPA 200.8	

Analysis Batch: T012257

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4886-BLK1	10G4886-BLK1	total	Water	EPA 200.7	10G4886_P
10G4886-BS1	10G4886-BS1	total	Water	EPA 200.7	10G4886_P
10G4886-BSD1	10G4886-BSD1	total	Water	EPA 200.7	10G4886_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.7	10G4886_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.7	10G4886_P

Analysis Batch: T012279

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4885-BS1	10G4885-BS1	total	Water	EPA 200.8	10G4885_P
10G4885-BSD1	10G4885-BSD1	total	Water	EPA 200.8	10G4885_P
10G4885-BLK1	10G4885-BLK1	total	Water	EPA 200.8	10G4885_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 200.8	10G4885_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 200.8	10G4885_P
NTG0744-10 - RE1	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P
NTG0744-10 - RE2	untreated pH10 leachate	total	Leachate	EPA 200.8	10G4885_P

Metals (Continued)

Analysis Batch: T012280

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4884-BS1	10G4884-BS1	total	Water	SW846 6020	10G4884_P
10G4884-BSD1	10G4884-BSD1	total	Water	SW846 6020	10G4884_P
10G4884-BLK1	10G4884-BLK1	total	Water	SW846 6020	10G4884_P
NTG0744-04	BLK1	total	Leachate	SW846 6020	10G4884_P
NTG0744-05	BLK2	total	Leachate	SW846 6020	10G4884_P
NTG0744-06	BLK3	total	Leachate	SW846 6020	10G4884_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 6020	10G4884_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 6020	10G4884_P
NTG0744-24	Blank	total	Leachate	SW846 6020	10G4884_P
T012280-SRD1	Blank	total	Water	SW846 6020	

Analysis Batch: T012345

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 200.7	10G4886_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 200.7	10G4886_P

Analysis Batch: T014236

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1528-BS1	10I1528-BS1	total	Water	EPA 200.8	10I1528_P
10I1528-BSD1	10I1528-BSD1	total	Water	EPA 200.8	10I1528_P
10I1528-BLK1	10I1528-BLK1	total	Water	EPA 200.8	10I1528_P
NTG0744-25	Blank	total	Leachate	EPA 200.8	10I1528_P
NTG0744-26	T01 10:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-27	T02 5:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-28	T03 2:1	total	Leachate	EPA 200.8	10I1528_P
NTG0744-29	T04 1:1	total	Leachate	EPA 200.8	10I1528_P

Analysis Batch: T014343

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10I1524-BLK1	10I1524-BLK1	total	Water	EPA 200.7	10I1524_P
10I1524-BS1	10I1524-BS1	total	Water	EPA 200.7	10I1524_P
10I1524-BSD1	10I1524-BSD1	total	Water	EPA 200.7	10I1524_P
NTG0744-25	Blank	total	Leachate	EPA 200.7	10I1524_P
NTG0744-26	T01 10:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-27	T02 5:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-28	T03 2:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-29	T04 1:1	total	Leachate	EPA 200.7	10I1524_P

Analysis Batch: T014345

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-25 - RE1	Blank	total	Leachate	EPA 200.7	10I1524_P

Metals (Continued)

Analysis Batch: T014345 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-26 - RE1	T01 10:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-27 - RE1	T02 5:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-28 - RE1	T03 2:1	total	Leachate	EPA 200.7	10I1524_P
NTG0744-29 - RE1	T04 1:1	total	Leachate	EPA 200.7	10I1524_P

WetChem

Analysis Batch: [CALC]

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-02	ASH-BT-001 (untreated)	total	Ash	Total Phosphorus	[CALC]_P
NTG0744-03	ASH-BT-001 (treated)	total	Ash	Total Phosphorus	[CALC]_P
NTG0744-10	untreated pH10 leachate	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	Total Phosphorus	[CALC]_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	Total Phosphorus	[CALC]_P

Prep Batch: [CALC]_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-02	ASH-BT-001 (untreated)	total	Ash	[CALC]	
NTG0744-03	ASH-BT-001 (treated)	total	Ash	[CALC]	
NTG0744-10	untreated pH10 leachate	total	Leachate	[CALC]	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	[CALC]	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	[CALC]	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	[CALC]	

Analysis Batch: 10G4880

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4880-BLK1	10G4880-BLK1	total	Water	SW846 9056A	10G4880_P
10G4880-BS1	10G4880-BS1	total	Water	SW846 9056A	10G4880_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9056A	10G4880_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9056A	10G4880_P
10G4880-DUP1	Lime Treated pH 7 Leachate	total	Water	SW846 9056A	10G4880_P

Prep Batch: 10G4880_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4880-BLK1	10G4880-BLK1	total	Water	NO PREP	
10G4880-BS1	10G4880-BS1	total	Water	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
10G4880-DUP1	Lime Treated pH 7 Leachate	total	Water	NO PREP	

Analysis Batch: 10G5312

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5312-BLK1	10G5312-BLK1	total	Water	SW846 9050A	10G5312_P
10G5312-BS1	10G5312-BS1	total	Water	SW846 9050A	10G5312_P
10G5312-DUP1	Lime Treated pH 10 leachate	total	Water	SW846 9050A	10G5312_P
NTG0744-04	BLK1	total	Leachate	SW846 9050A	10G5312_P
NTG0744-05	BLK2	total	Leachate	SW846 9050A	10G5312_P
NTG0744-06	BLK3	total	Leachate	SW846 9050A	10G5312_P

WetChem (Continued)

Analysis Batch: 10G5312 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9050A	10G5312_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 9050A	10G5312_P

Prep Batch: 10G5312_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5312-BLK1	10G5312-BLK1	total	Water	NO PREP	
10G5312-BS1	10G5312-BS1	total	Water	NO PREP	
10G5312-DUP1	Lime Treated pH 10 leachate	total	Water	NO PREP	
NTG0744-04	BLK1	total	Leachate	NO PREP	
NTG0744-05	BLK2	total	Leachate	NO PREP	
NTG0744-06	BLK3	total	Leachate	NO PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	NO PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	NO PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	NO PREP	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	NO PREP	

Analysis Batch: 10G5315

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5315-DUP1	Lime Treated pH 10 leachate	total	Water	SM 2580	10G5315_P
NTG0744-04	BLK1	total	Leachate	SM 2580	10G5315_P
NTG0744-05	BLK2	total	Leachate	SM 2580	10G5315_P
NTG0744-06	BLK3	total	Leachate	SM 2580	10G5315_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SM 2580	10G5315_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SM 2580	10G5315_P

Prep Batch: 10G5315_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G5315-DUP1	Lime Treated pH 10 leachate	total	Water	NO PREP	
NTG0744-04	BLK1	total	Leachate	NO PREP	
NTG0744-05	BLK2	total	Leachate	NO PREP	
NTG0744-06	BLK3	total	Leachate	NO PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	NO PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	NO PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	NO PREP	

WetChem (Continued)

Prep Batch: 10G5315_P (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	NO PREP	

Analysis Batch: 10H0891

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H0891-BS1	10H0891-BS1	total	Water	EPA 365.4	10H0891_P
10H0891-BSD1	10H0891-BSD1	total	Water	EPA 365.4	10H0891_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 365.4	10H0891_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 365.4	10H0891_P
10H0891-MS1	NTG2350-02	total	Water	EPA 365.4	10H0891_P
10H0891-MSD1	NTG2350-02	total	Water	EPA 365.4	10H0891_P
10H0891-BLK2	10H0891-BLK2	total	Water	EPA 365.4	10H0891_P
10H0891-DUP2	NTH0048-01RE1	total	Water	EPA 365.4	10H0891_P

Prep Batch: 10H0891_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H0891-BS1	10H0891-BS1	total	Water	NO PREP	
10H0891-BSD1	10H0891-BSD1	total	Water	NO PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	NO PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	NO PREP	
10H0891-MS1	NTG2350-02	total	Water	NO PREP	
10H0891-MSD1	NTG2350-02	total	Water	NO PREP	
10H0891-BLK2	10H0891-BLK2	total	Water	NO PREP	
10H0891-DUP2	NTH0048-01RE1	total	Water	NO PREP	

Analysis Batch: 10H1839

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H1839-BLK1	10H1839-BLK1	total	Water	EPA 365.4	10H1839_P
10H1839-BS1	10H1839-BS1	total	Water	EPA 365.4	10H1839_P
10H1839-MS1	NTH0821-06	total	Water	EPA 365.4	10H1839_P
10H1839-MSD1	NTH0821-06	total	Water	EPA 365.4	10H1839_P
10H1839-DUP1	NTH0821-16	total	Water	EPA 365.4	10H1839_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 365.4	10H1839_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 365.4	10H1839_P

Prep Batch: 10H1839_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H1839-BLK1	10H1839-BLK1	total	Water	NO PREP	
10H1839-BS1	10H1839-BS1	total	Water	NO PREP	
10H1839-MS1	NTH0821-06	total	Water	NO PREP	
10H1839-MSD1	NTH0821-06	total	Water	NO PREP	
10H1839-DUP1	NTH0821-16	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	

Analysis Batch: 10H2079

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-BLK1	10H2079-BLK1	total	Water	SW846 9056A	10H2079_P
10H2079-BS1	10H2079-BS1	total	Water	SW846 9056A	10H2079_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9056A	10H2079_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9056A	10H2079_P

WetChem (Continued)

Analysis Batch: 10H2079 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-DUP1	Treated - 10:1 Ratio	total	Water	SW846 9056A	10H2079_P

Prep Batch: 10H2079_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2079-BLK1	10H2079-BLK1	total	Water	NO PREP	
10H2079-BS1	10H2079-BS1	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	
10H2079-DUP1	Treated - 10:1 Ratio	total	Water	NO PREP	

Analysis Batch: 10H4167

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H4167-BLK1	10H4167-BLK1	total	Water	SW846 9050A	10H4167_P
10H4167-BS1	10H4167-BS1	total	Water	SW846 9050A	10H4167_P
10H4167-DUP1	Untreated- 10:1ratio	total	Water	SW846 9050A	10H4167_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 9050A	10H4167_P
NTG0744-24	Blank	total	Leachate	SW846 9050A	10H4167_P

Prep Batch: 10H4167_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H4167-BLK1	10H4167-BLK1	total	Water	NO PREP	
10H4167-BS1	10H4167-BS1	total	Water	NO PREP	
10H4167-DUP1	Untreated- 10:1ratio	total	Water	NO PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	NO PREP	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	NO PREP	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	NO PREP	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	NO PREP	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	NO PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	NO PREP	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	NO PREP	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	NO PREP	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	NO PREP	
NTG0744-24	Blank	total	Leachate	NO PREP	

TCLP

Analysis Batch: 10G4666

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4666-BS1	10G4666-BS1	total	Water	SW846 9040C	10G4666_P
10G4666-BSD1	10G4666-BSD1	total	Water	SW846 9040C	10G4666_P
10G4666-DUP1	BLK1	total	Water	SW846 9040C	10G4666_P
10G4666-DUP1	BLK1	total	Water	EPA 170.1	10G4666_P
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	SW846 9040C	10G4666_P
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	EPA 170.1	10G4666_P

TCLP (Continued)

Analysis Batch: 10G4666 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-04	BLK1	total	Leachate	SW846 9040C	10G4666_P
NTG0744-04	BLK1	total	Leachate	EPA 170.1	10G4666_P
NTG0744-05	BLK2	total	Leachate	SW846 9040C	10G4666_P
NTG0744-05	BLK2	total	Leachate	EPA 170.1	10G4666_P
NTG0744-06	BLK3	total	Leachate	SW846 9040C	10G4666_P
NTG0744-06	BLK3	total	Leachate	EPA 170.1	10G4666_P
NTG0744-07	untreated DI Water leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-07	untreated DI Water leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-08	Untreated pH 5 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-09	untreated pH 7 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-10	untreated pH10 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-10	untreated pH10 leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-11	lime treated DI Water leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	EPA 170.1	10G4666_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	SW846 9040C	10G4666_P
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	EPA 170.1	10G4666_P

Prep Batch: 10G4666_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10G4666-BS1	10G4666-BS1	total	Water	METHOD PREP	
10G4666-BSD1	10G4666-BSD1	total	Water	METHOD PREP	
10G4666-DUP1	BLK1	total	Water	METHOD PREP	
10G4666-DUP2	Lime Treated pH 10 leachate	total	Water	METHOD PREP	
NTG0744-04	BLK1	total	Leachate	METHOD PREP	
NTG0744-05	BLK2	total	Leachate	METHOD PREP	
NTG0744-06	BLK3	total	Leachate	METHOD PREP	
NTG0744-07	untreated DI Water leachate	total	Leachate	METHOD PREP	
NTG0744-08	Untreated pH 5 leachate	total	Leachate	METHOD PREP	
NTG0744-09	untreated pH 7 leachate	total	Leachate	METHOD PREP	
NTG0744-10	untreated pH10 leachate	total	Leachate	METHOD PREP	
NTG0744-11	lime treated DI Water leachate	total	Leachate	METHOD PREP	
NTG0744-12	Lime Treated pH 5 Leachate	total	Leachate	METHOD PREP	
NTG0744-13	Lime Treated pH 7 Leachate	total	Leachate	METHOD PREP	
NTG0744-14	Lime Treated pH 10 leachate	total	Leachate	METHOD PREP	

Analysis Batch: 10H2208

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2208-BS1	10H2208-BS1	total	Water	SW846 9040C	10H2208_P
10H2208-BSD1	10H2208-BSD1	total	Water	SW846 9040C	10H2208_P
10H2208-DUP1	Untreated- 10:1ratio	total	Water	SW846 9040C	10H2208_P
10H2208-DUP1	Untreated- 10:1ratio	total	Water	EPA 170.1	10H2208_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-15	Untreated- 10:1ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-16	untreated - 5:1 ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	SW846 9040C	10H2208_P

TCLP (Continued)

Analysis Batch: 10H2208 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	SW846 9040C	10H2208_P
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	EPA 170.1	10H2208_P
NTG0744-24	Blank	total	Leachate	SW846 9040C	10H2208_P
NTG0744-24	Blank	total	Leachate	EPA 170.1	10H2208_P

Prep Batch: 10H2208_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10H2208-BS1	10H2208-BS1	total	Water	METHOD PREP	
10H2208-BSD1	10H2208-BSD1	total	Water	METHOD PREP	
10H2208-DUP1	Untreated- 10:1ratio	total	Water	METHOD PREP	
NTG0744-15	Untreated- 10:1ratio	total	Leachate	METHOD PREP	
NTG0744-16	untreated - 5:1 ratio	total	Leachate	METHOD PREP	
NTG0744-17	untreated- 2:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-18	untreated- 1:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-19	Untreated - 1:2 Ratio	total	Leachate	METHOD PREP	
NTG0744-20	Treated - 10:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-21	Treated - 5:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-22	Treated - 2:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-23	Treated - 1:1 Ratio	total	Leachate	METHOD PREP	
NTG0744-24	Blank	total	Leachate	METHOD PREP	

Client Sample ID: ASH-BT-001 (untreated)
Lab Sample ID: NTG0744-02
Date Collected: 07/07/10 10:15
Matrix: Ash
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	[CALC]		0	[CALC]_P	07/14/10 12:20		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	07/16/10 11:55	SAB	TestAmerica Nashville

Client Sample ID: ASH-BT-001 (treated)
Lab Sample ID: NTG0744-03
Date Collected: 07/07/10 10:15
Matrix: Ash
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	Total Phosphorus		1	[CALC]	07/16/10 11:58	SAB	TestAmerica Nashville

Client Sample ID: BLK1
Lab Sample ID: NTG0744-04
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10G4884_P	08/12/10 09:35	MET	TestAmerica Nashville
total	Analysis	SW846 6020		1	T012280	08/13/10 11:53	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10G5315_P	07/30/10 14:15	TEM	TestAmerica Nashville
total	Analysis	SM 2580		1	10G5315	08/01/10 18:30	TEM	TestAmerica Nashville
total	Prep	NO PREP		1	10G5312_P	07/30/10 14:08	TEM	TestAmerica Nashville
total	Analysis	SW846 9050A		1	10G5312	07/30/10 14:30	TEM	TestAmerica Nashville
total	Analysis	EPA 170.1		1	10G4666	08/13/10 09:11	MSR	TestAmerica Nashville
total	Prep	METHOD PREP		1	10G4666_P	07/28/10 08:16	SJM	TestAmerica Nashville
total	Analysis	SW846 9040C		1	10G4666	08/13/10 09:11	MSR	TestAmerica Nashville

Client Sample ID: BLK2
Lab Sample ID: NTG0744-05
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 11:56	MET	TestAmerica Nashville

Client Sample ID: BLK3
Lab Sample ID: NTG0744-06
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 11:59	MET	TestAmerica Nashville

Client Sample ID: untreated DI Water leachate

Lab Sample ID: NTG0744-07
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:03	MET	TestAmerica Nashville

Client Sample ID: Untreated pH 5 leachate

Lab Sample ID: NTG0744-08
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:06	MET	TestAmerica Nashville

Client Sample ID: untreated pH 7 leachate

Lab Sample ID: NTG0744-09
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:09	MET	TestAmerica Nashville

Client Sample ID: untreated pH10 leachate

Lab Sample ID: NTG0744-10
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10G4886_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:22	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7		10	T012345	08/13/10 10:53	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Prep	EPA 200.8	RE1	1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Prep	EPA 200.8	RE2	1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:12	MET	TestAmerica Nashville
total	Analysis	EPA 200.8	RE1	5	T012279	08/13/10 11:30	MET	TestAmerica Nashville
total	Analysis	EPA 200.8	RE2	100	T012279	08/13/10 11:33	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10H0891_P	08/06/10 13:00	JDJ	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H0891	08/09/10 11:24	MLM	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10G4880	08/01/10 19:19	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10G4880_P	08/01/10 19:19	SKO	TestAmerica Nashville
total	Prep	[CALC]		0	[CALC]_P	08/06/10 13:00		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/09/10 11:24	MLM	TestAmerica Nashville

Client Sample ID: lime treated DI Water leachate

Lab Sample ID: NTG0744-11
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:12	MET	TestAmerica Nashville

Client Sample ID: Lime Treated pH 5 Leachate

Lab Sample ID: NTG0744-12
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:23	MET	TestAmerica Nashville

Client Sample ID: Lime Treated pH 7 Leachate

Lab Sample ID: NTG0744-13
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:26	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7		10	T012345	08/13/10 10:56	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:15	MET	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H0891	08/09/10 11:25	MLM	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10G4880	08/01/10 20:20	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10G4880_P	08/01/10 20:20	SKO	TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/09/10 11:25	MLM	TestAmerica Nashville

Client Sample ID: Lime Treated pH 10 leachate

Lab Sample ID: NTG0744-14
Date Collected: 07/07/10 10:15
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:26	MET	TestAmerica Nashville

Client Sample ID: Untreated- 10:1ratio

Lab Sample ID: NTG0744-15
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10G4886_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:29	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10G4885_P	08/12/10 09:00	jwd	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:18	MET	TestAmerica Nashville
total	Prep	NO PREP		1	10H1839_P	08/13/10 12:23	PRC	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H1839	08/16/10 09:45	SAB	TestAmerica Nashville
total	Prep	NO PREP		1	10H4167_P	08/24/10 12:02	JDJ	TestAmerica Nashville
total	Analysis	SW846 9050A		1	10H4167	08/24/10 12:50	JDJ	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10H2079	08/12/10 23:58	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10H2079_P	08/12/10 23:58	JHS	TestAmerica Nashville
total	Prep	[CALC]		0	[CALC]_P	08/13/10 12:23		TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/16/10 09:45	SAB	TestAmerica Nashville
total	Analysis	EPA 170.1		1	10H2208	08/13/10 09:21	MSR	TestAmerica Nashville
total	Prep	METHOD PREP		1	10H2208_P	07/23/10 23:59	MSR	TestAmerica Nashville
total	Analysis	SW846 9040C		1	10H2208	08/13/10 09:21	MSR	TestAmerica Nashville

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTG0744
SDG: NTG0744

Client Sample ID: untreated - 5:1 ratio
Lab Sample ID: NTG0744-16
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10G4884_P	08/12/10 09:35	jwd	TestAmerica Nashville
total	Analysis	SW846 6020		1	T012280	08/13/10 12:29	MET	TestAmerica Nashville

Client Sample ID: untreated- 2:1 Ratio
Lab Sample ID: NTG0744-17
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:33	MET	TestAmerica Nashville

Client Sample ID: untreated- 1:1 Ratio
Lab Sample ID: NTG0744-18
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:36	MET	TestAmerica Nashville

Client Sample ID: Untreated - 1:2 Ratio
Lab Sample ID: NTG0744-19
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:39	MET	TestAmerica Nashville

Client Sample ID: Treated - 10:1 Ratio
Lab Sample ID: NTG0744-20
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T012257	08/12/10 15:32	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T012279	08/13/10 11:21	MET	TestAmerica Nashville
total	Analysis	EPA 365.4		1	10H1839	08/16/10 09:46	SAB	TestAmerica Nashville
total	Analysis	SW846 9056A		5	10H2079	08/13/10 00:52	JHS	TestAmerica Nashville
total	Prep	NO PREP		1	10H2079_P	08/13/10 00:52	JHS	TestAmerica Nashville
total	Analysis	Total Phosphorus		1	[CALC]	08/16/10 09:46	SAB	TestAmerica Nashville

Client Sample ID: Treated - 5:1 Ratio
Lab Sample ID: NTG0744-21
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:42	MET	TestAmerica Nashville

Client Sample ID: Treated - 2:1 Ratio

Lab Sample ID: NTG0744-22
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:46	MET	TestAmerica Nashville

Client Sample ID: Treated - 1:1 Ratio

Lab Sample ID: NTG0744-23
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:49	MET	TestAmerica Nashville

Client Sample ID: Blank

Lab Sample ID: NTG0744-24
Date Collected: 08/09/10 13:20
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T012280	08/13/10 12:52	MET	TestAmerica Nashville

Client Sample ID: Blank

Lab Sample ID: NTG0744-25
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 200.7		1	10I1524_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Prep	EPA 200.7	RE1	1	10I1524_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:33	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:44	AVR	TestAmerica Nashville
total	Prep	EPA 200.8		1	10I1528_P	09/14/10 08:35	MET	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:07	MET	TestAmerica Nashville

Client Sample ID: T01 10:1

Lab Sample ID: NTG0744-26
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:37	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:47	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:10	MET	TestAmerica Nashville

Client Sample ID: T02 5:1

Lab Sample ID: NTG0744-27
Date Collected: 09/09/10 00:01
Matrix: Leachate
Date Received: 07/09/10 09:50

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:40	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:50	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:13	MET	TestAmerica Nashville

Client Sample ID: T03 2:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-28
Matrix: Leachate

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:43	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:53	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:17	MET	TestAmerica Nashville

Client Sample ID: T04 1:1
Date Collected: 09/09/10 00:01
Date Received: 07/09/10 09:50

Lab Sample ID: NTG0744-29
Matrix: Leachate

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	EPA 200.7		1	T014343	09/15/10 15:46	AVR	TestAmerica Nashville
total	Analysis	EPA 200.7	RE1	5	T014345	09/16/10 09:57	AVR	TestAmerica Nashville
total	Analysis	EPA 200.8		1	T014236	09/14/10 21:20	MET	TestAmerica Nashville

Method Summary

Method	Method Description	Protocol	Laboratory
EPA 200.7	Total Metals by EPA Method 200.7		TAL NSH
EPA 200.8	Total Metals by EPA 200.8		TAL NSH
SW846 6020	Total Metals by Method 6020		TAL NSH
EPA 365.4	General Chemistry Parameters		TAL NSH
SM 2580	General Chemistry Parameters		TAL NSH
SW846 9050A	General Chemistry Parameters		TAL NSH
SW846 9056A	General Chemistry Parameters		TAL NSH
Total Phosphorus	General Chemistry Parameters		TAL NSH
EPA 170.1	General Chemistry Parameters		TAL NSH
SW846 9040C	General Chemistry Parameters		TAL NSH

Protocol References:

=

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Road, Nashville, TN 37204, TEL 800-765-0980

1 2 3 4 5 6 7 8 9 10 11 12

Laboratory	Authority	Program	EPA Region	Certification ID	Expiration Date
TestAmerica Nashville		AIHA		100790	09/01/11
TestAmerica Nashville		USDA		S-48469	01/22/11
TestAmerica Nashville	A2LA	A2LA	0	0453.07	12/31/11
TestAmerica Nashville	A2LA	WY UST	0	453.07	12/31/11
TestAmerica Nashville	Alabama	State Program	4	41150	10/31/10
TestAmerica Nashville	Alaska	Alaska UST	10	UST-087	07/24/11
TestAmerica Nashville	Arizona	State Program	9	AZ0473	05/05/11
TestAmerica Nashville	Arkansas	State Program	6	88-0737	04/25/11
TestAmerica Nashville	California	NELAC	9	1168CA	10/31/10
TestAmerica Nashville	Colorado	State Program	8	N/A	02/28/11
TestAmerica Nashville	Connecticut	State Program	1	PH-0220	12/31/11
TestAmerica Nashville	Florida	NELAC	4	E87358	06/30/11
TestAmerica Nashville	Illinois	NELAC	5	200010	12/09/10
TestAmerica Nashville	Iowa	State Program	7	131	05/01/12
TestAmerica Nashville	Kansas	NELAC	7	E-10229	10/31/10
TestAmerica Nashville	Kentucky	State Program	4	2	07/13/12
TestAmerica Nashville	Kentucky	State Program	4	90038	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	LA100011	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	30613	06/30/11
TestAmerica Nashville	Maryland	State Program	3	316	03/31/11
TestAmerica Nashville	Massachusetts	State Program	1	M-TN032	06/30/11
TestAmerica Nashville	Minnesota	State Program	5	047-999-345	12/31/10
TestAmerica Nashville	Mississippi	State Program	4	N/A	06/30/11
TestAmerica Nashville	Montana	State Program	8	NA	01/01/15
TestAmerica Nashville	Nevada	State Program	9	TN00032	07/31/11
TestAmerica Nashville	New Jersey	NELAC	2	TN965	06/30/11
TestAmerica Nashville	New York	NELAC	2	11342	04/01/11
TestAmerica Nashville	North Carolina	State Program	4	387	12/31/10
TestAmerica Nashville	North Dakota	State Program	8	R-146	06/30/11
TestAmerica Nashville	Ohio	VAP	5	CL0033	04/01/12
TestAmerica Nashville	Oklahoma	State Program	6	9412	08/31/11
TestAmerica Nashville	Oregon	NELAC	10	TN200001	04/30/11
TestAmerica Nashville	Pennsylvania	NELAC	3	68-00585	06/30/11
TestAmerica Nashville	Rhode Island	State Program	1	LAO00268	12/30/10
TestAmerica Nashville	South Carolina	State Program	4	84009	02/28/11
TestAmerica Nashville	South Carolina	State Program	4	84009	03/19/11
TestAmerica Nashville	Tennessee	State Program	4	2008	03/19/11
TestAmerica Nashville	Texas	NELAC	6	T104704077-09-TX	08/31/11
TestAmerica Nashville	Utah	NELAC	8	TAN	06/30/11
TestAmerica Nashville	Virginia	State Program	3	00323	06/30/11
TestAmerica Nashville	Washington	State Program	10	C789	07/19/11
TestAmerica Nashville	West Virginia	State Program	3	219	02/28/11
TestAmerica Nashville	Wisconsin	State Program	5	998020430	08/31/11

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECEIPT FORM

NTG0744
07/20/10 23:59

Cooler Received/Opened On 7/23/2010 @ 0940

1. Tracking # 1Z939Ex20191517747

Courier: UPS IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 3.7 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front/back

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) PM

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) PM

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) M

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) P

I certify that I attached a label with the unique LIMS number to each container (intial) P

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

Additional sample for NTG0744 -01-03

BIS = Broken in shipment
Cooler Receipt Form.doc

LF-1
End of Form

Revised 6/24/09

1 2 3 4 5 6 7 8 9 10 11 12

NTG0744
07/20/10 23:59

TENNESSEE VALLEY AUTHORITY

HAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 1
Cooler # 1 of 1

COC # RSI-072210-001

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive, Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800 765 0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #:	Kingston Fossil Plant
Site Address	1134 Swan Pond Road
City	Harriman
State, Zip	TN 37748
Site PM Name	Bruce Haas
Phone/Fax:	865-717-1602
Site PM Email:	bjhaas@tva.gov

Required Sampler Information:

Sampler	Chad Fairchild
Sampling Company	TVA - Kingston Fossil Ash Recovery Operations
Address:	1134 Swan Pond Road
City/State	Harriman, TN
Phone #:	865 717 6542
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	bjhaas@tva.gov
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard X Rush Mark One

Filtered: NA
Preserve: NONE
Analysis: BATCH (SHAKE) TESTS, METHOD 1313, 1316

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: in)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	BATCH (SHAKE) TESTS, METHOD 1313, 1316
1	ASH - BT- 001	TVA-KIF	6	6	CA	G	~~N~~ AM 072210	07/22/2010	1140	2	32 oz CWM glass jar	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

CF 072210

Additional Comments/Special Instructions:

Ash and lime samples collected in support of Kingston Ash Recover Project, Non-Time-Critical Removal Action for the River System Investigation, Ash Leaching Test Plan Document No. RAWP-072.

THIS IS A NON-EQUIS CHAIN OF CUSTODY

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY AFFILIATION	DATE	TIME	ACCEPTED BY AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Chad Fairchild / RSI	072210	1500	Mark McLaren / RSI	072210	1500		Y / N	Y / N	Y / N
Mark McLaren / RSI	072210	1539	Anne Morris / RSI	072210	1539		Y / N	Y / N	Y / N
Anne Morris / RSI	072210	1550	[illegible]	7/23/10	0940	3.7	Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
						Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS / COURIER \ FEDEX / US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Chad Fairchild
SIGNATURE of SAMPLER: [signature]
DATE Signed: 072210
Time: 1151

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

September 14, 2010 4:35:04PM

Client:	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Nbr:	RSICA0902Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#8559
		Date Received:	09/03/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-RELIC_C1-T1-LH-081310	NTI0347-01	08/13/10 14:00
KIF-RELIC_C1-T2-LH-081710	NTI0347-02	08/17/10 11:00
KIF-RELIC_C1-T3-LH-082110	NTI0347-03	08/21/10 11:00
KIF-RELIC_C1-T4-LH-082510	NTI0347-04	08/25/10 11:00
KIF-RELIC_C1-T5-LH-082910	NTI0347-05	08/29/10 14:00
KIF-RELIC_C2-T1-LH-081310	NTI0347-06	08/13/10 14:00
KIF-RELIC_C2-T2-LH-081710	NTI0347-07	08/17/10 11:00
KIF-RELIC_C2-T3-LH-082110	NTI0347-08	08/21/10 11:00
KIF-RELIC_C2-T4-LH-082510	NTI0347-09	08/25/10 11:00
KIF-RELIC_C2-T5-LH-082910	NTI0347-10	08/29/10 14:00
KIF-RELIC_C3-T1-LH-081310	NTI0347-11	08/13/10 14:00
KIF-RELIC_C3-T2-LH-081710	NTI0347-12	08/17/10 11:00
KIF-RELIC_C3-T3-LH-082110	NTI0347-13	08/21/10 11:00
KIF-RELIC_C3-T4-LH-082510	NTI0347-14	08/25/10 11:00
KIF-RELIC_C3-T5-LH-082910	NTI0347-15	08/29/10 14:00
KIF-RELIC_MaterialBlank-A-090210	NTI0347-16	09/02/10 00:01

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

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Additional Laboratory Comments:
The client supplied a revised COC. It has been attached to the end of this report.

Tennessee Certification Number: 02008
The Chain(s) of Custody, 5 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

Mark Hollingsworth

Program Manager - National Accounts

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-01 (KIF-RELIC C1-T1-LH-081310 - Water) Sampled: 08/13/10 14:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.00957**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Arsenic	**0.00286**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Cadmium	**0.000420**	J	mg/L	0.000330	0.00100	1	09/13/10 22:12	EPA 200.8	10I0985
Chromium	**0.198**		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Copper	**0.00993**		mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Lead	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Manganese	**0.000380**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Molybdenum	**0.711**		mg/L	0.00165	0.0250	5	09/13/10 23:41	EPA 200.8	10I0985
Nickel	**0.00300**	J	mg/L	0.000330	0.00500	1	09/13/10 22:12	EPA 200.8	10I0985
Selenium	**0.778**		mg/L	0.00165	0.0100	5	09/13/10 23:41	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:12	EPA 200.8	10I0985
Vanadium	**0.0911**		mg/L	0.00100	0.00400	1	09/13/10 22:12	EPA 200.8	10I0985
Zinc	**0.00849**	J	mg/L	0.00830	0.0500	1	09/13/10 22:12	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**9.41**		mg/L	0.0500	0.100	1	09/09/10 21:29	EPA 200.7	10I0983
Barium	**0.0578**		mg/L	0.0100	0.0100	1	09/09/10 21:29	EPA 200.7	10I0983
Boron	**8.14**	MHA	mg/L	0.125	0.500	10	09/10/10 10:45	EPA 200.7	10I0983
Calcium	**78.6**	MHA	mg/L	0.500	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:29	EPA 200.7	10I0983
Magnesium	**0.375**	J	mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Potassium	**8.33**		mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Sodium	**13.8**		mg/L	0.250	1.00	1	09/09/10 21:29	EPA 200.7	10I0983
Strontium	**2.96**	M8	mg/L	0.125	0.500	10	09/10/10 10:45	EPA 200.7	10I0983

Sample ID: NTI0347-02 (KIF-RELIC C1-T2-LH-081710 - Water) Sampled: 08/17/10 11:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.0105**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Arsenic	**0.00514**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Cadmium	**0.000380**	J	mg/L	0.000330	0.00100	1	09/13/10 22:22	EPA 200.8	10I0985
Chromium	**0.273**		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Cobalt	**0.000390**	J	mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Copper	**0.00711**		mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Manganese	**0.000340**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Molybdenum	**0.694**		mg/L	0.00165	0.0250	5	09/13/10 23:45	EPA 200.8	10I0985
Nickel	**0.00297**	J	mg/L	0.000330	0.00500	1	09/13/10 22:22	EPA 200.8	10I0985
Selenium	**0.756**		mg/L	0.00165	0.0100	5	09/13/10 23:45	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:22	EPA 200.8	10I0985
Vanadium	**0.362**		mg/L	0.00100	0.00400	1	09/13/10 22:22	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:22	EPA 200.8	10I0985

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-02 (KIF-RELIC C1-T2-LH-081710 - Water) - cont. Sampled: 08/17/10 11:00									
Total Metals by EPA Method 200.7									
Aluminum	**20.5**	MHA	mg/L	0.0500	0.100	1	09/09/10 21:39	EPA 200.7	10I0983
Barium	**0.336**		mg/L	0.0100	0.0100	1	09/09/10 21:39	EPA 200.7	10I0983
Boron	**6.85**	MHA	mg/L	0.125	0.500	10	09/10/10 10:48	EPA 200.7	10I0983
Calcium	**84.6**	MHA	mg/L	0.500	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:39	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Potassium	**8.52**		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Sodium	**10.8**		mg/L	0.250	1.00	1	09/09/10 21:39	EPA 200.7	10I0983
Strontium	**2.72**		mg/L	0.125	0.500	10	09/10/10 10:48	EPA 200.7	10I0983
Sample ID: NTI0347-03 (KIF-RELIC C1-T3-LH-082110 - Water) Sampled: 08/21/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.00980**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Arsenic	**0.00656**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:32	EPA 200.8	10I0985
Chromium	**0.175**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Cobalt	**0.000390**	J	mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Copper	**0.0137**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Lead	**0.000750**	J	mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Manganese	**0.000370**	J, B	mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Molybdenum	**0.300**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Nickel	**0.0248**		mg/L	0.000330	0.00500	1	09/13/10 22:32	EPA 200.8	10I0985
Selenium	**0.378**		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:32	EPA 200.8	10I0985
Vanadium	**0.472**		mg/L	0.00100	0.00400	1	09/13/10 22:32	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:32	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**22.1**		mg/L	0.0500	0.100	1	09/09/10 21:48	EPA 200.7	10I0983
Barium	**0.416**		mg/L	0.0100	0.0100	1	09/09/10 21:48	EPA 200.7	10I0983
Boron	**7.75**		mg/L	0.125	0.500	10	09/10/10 10:52	EPA 200.7	10I0983
Calcium	**72.6**		mg/L	0.500	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:48	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Potassium	**6.84**		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Sodium	**7.80**		mg/L	0.250	1.00	1	09/09/10 21:48	EPA 200.7	10I0983
Strontium	**2.66**		mg/L	0.125	0.500	10	09/10/10 10:52	EPA 200.7	10I0983

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Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch

Sample ID: NTI0347-04 (KIF-RELIC C1-T4-LH-082510 - Water) Sampled: 08/25/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00908**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Arsenic	**0.00869**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:35	EPA 200.8	10I0985
Chromium	**0.0765**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Copper	**0.00681**		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Molybdenum	**0.0967**		mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Nickel	**0.00201**	J	mg/L	0.000330	0.00500	1	09/13/10 22:35	EPA 200.8	10I0985
Selenium	**0.0834**		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:35	EPA 200.8	10I0985
Vanadium	**0.498**		mg/L	0.00100	0.00400	1	09/13/10 22:35	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:35	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**23.9**		mg/L	0.0500	0.100	1	09/09/10 21:52	EPA 200.7	10I0983
Barium	**0.377**		mg/L	0.0100	0.0100	1	09/09/10 21:52	EPA 200.7	10I0983
Boron	**8.67**		mg/L	0.125	0.500	10	09/10/10 10:55	EPA 200.7	10I0983
Calcium	**61.9**		mg/L	0.500	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:52	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Potassium	**5.01**		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Sodium	**5.16**		mg/L	0.250	1.00	1	09/09/10 21:52	EPA 200.7	10I0983
Strontium	**2.35**		mg/L	0.125	0.500	10	09/10/10 10:55	EPA 200.7	10I0983

Sample ID: NTI0347-05 (KIF-RELIC C1-T5-LH-082910 - Water) Sampled: 08/29/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00762**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Arsenic	**0.00881**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:45	EPA 200.8	10I0985
Chromium	**0.0423**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Copper	**0.00795**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Lead	**0.00149**	J	mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Molybdenum	**0.0642**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Nickel	**0.0313**		mg/L	0.000330	0.00500	1	09/13/10 22:45	EPA 200.8	10I0985
Selenium	**0.0402**		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:45	EPA 200.8	10I0985
Vanadium	**0.465**		mg/L	0.00100	0.00400	1	09/13/10 22:45	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 22:45	EPA 200.8	10I0985

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-05 (KIF-RELIC C1-T5-LH-082910 - Water) - cont. Sampled: 08/29/10 14:00									
Total Metals by EPA Method 200.7									
Aluminum	**23.3**		mg/L	0.0500	0.100	1	09/09/10 21:55	EPA 200.7	10I0983
Barium	**0.326**		mg/L	0.0100	0.0100	1	09/09/10 21:55	EPA 200.7	10I0983
Boron	**7.28**		mg/L	0.125	0.500	10	09/10/10 10:58	EPA 200.7	10I0983
Calcium	**52.4**		mg/L	0.500	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:55	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Potassium	**3.60**		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Sodium	**3.42**		mg/L	0.250	1.00	1	09/09/10 21:55	EPA 200.7	10I0983
Strontium	**1.94**		mg/L	0.0125	0.0500	1	09/09/10 21:55	EPA 200.7	10I0983
Sample ID: NTI0347-06 (KIF-RELIC C2-T1-LH-081310 - Water) Sampled: 08/13/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.000740**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Arsenic	**0.00280**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:48	EPA 200.8	10I0985
Chromium	**0.00936**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Cobalt	**0.000520**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Copper	**0.0269**		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Lead	**0.000960**	J	mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Molybdenum	**0.0349**		mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Nickel	**0.00221**	J	mg/L	0.000330	0.00500	1	09/13/10 22:48	EPA 200.8	10I0985
Selenium	**0.0279**		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:48	EPA 200.8	10I0985
Vanadium	**0.00263**	J	mg/L	0.00100	0.00400	1	09/13/10 22:48	EPA 200.8	10I0985
Zinc	**0.0270**	J	mg/L	0.00830	0.0500	1	09/13/10 22:48	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**3.59**		mg/L	0.0500	0.100	1	09/09/10 21:58	EPA 200.7	10I0983
Barium	**34.2**		mg/L	0.100	0.100	10	09/10/10 11:01	EPA 200.7	10I0983
Boron	**0.123**		mg/L	0.0125	0.0500	1	09/09/10 21:58	EPA 200.7	10I0983
Calcium	**338**		mg/L	0.500	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 21:58	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Potassium	**456**		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Sodium	**77.6**		mg/L	0.250	1.00	1	09/09/10 21:58	EPA 200.7	10I0983
Strontium	**44.0**		mg/L	1.25	5.00	100	09/10/10 11:04	EPA 200.7	10I0983

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-07 (KIF-RELIC C2-T2-LH-081710 - Water) Sampled: 08/17/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.000930**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Arsenic	**0.00182**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:52	EPA 200.8	10I0985
Chromium	**0.00879**		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Cobalt	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Copper	**0.0240**		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Lead	**0.000680**	J	mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Molybdenum	**0.0304**		mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Nickel	**0.00167**	J	mg/L	0.000330	0.00500	1	09/13/10 22:52	EPA 200.8	10I0985
Selenium	**0.0229**		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:52	EPA 200.8	10I0985
Vanadium	**0.00154**	J	mg/L	0.00100	0.00400	1	09/13/10 22:52	EPA 200.8	10I0985
Zinc	**0.0254**	J	mg/L	0.00830	0.0500	1	09/13/10 22:52	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**3.62**		mg/L	0.0500	0.100	1	09/09/10 22:14	EPA 200.7	10I0983
Barium	**33.9**		mg/L	0.100	0.100	10	09/10/10 11:07	EPA 200.7	10I0983
Boron	**0.208**		mg/L	0.0125	0.0500	1	09/09/10 22:14	EPA 200.7	10I0983
Calcium	**341**		mg/L	0.500	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:14	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Potassium	**323**		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Sodium	**56.2**		mg/L	0.250	1.00	1	09/09/10 22:14	EPA 200.7	10I0983
Strontium	**44.6**		mg/L	1.25	5.00	100	09/10/10 11:11	EPA 200.7	10I0983
Sample ID: NTI0347-08 (KIF-RELIC C2-T3-LH-082110 - Water) Sampled: 08/21/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.000970**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Arsenic	**0.00111**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:55	EPA 200.8	10I0985
Chromium	**0.00808**		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Copper	**0.0269**		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Lead	**0.000510**	J	mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Molybdenum	**0.0272**		mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Nickel	**0.00178**	J	mg/L	0.000330	0.00500	1	09/13/10 22:55	EPA 200.8	10I0985
Selenium	**0.0174**		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:55	EPA 200.8	10I0985
Vanadium	**0.00140**	J	mg/L	0.00100	0.00400	1	09/13/10 22:55	EPA 200.8	10I0985
Zinc	**0.0289**	J	mg/L	0.00830	0.0500	1	09/13/10 22:55	EPA 200.8	10I0985

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-08 (KIF-RELIC C2-T3-LH-082110 - Water) - cont. Sampled: 08/21/10 11:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA Method 200.7									
Aluminum	**4.08**		mg/L	0.0500	0.100	1	09/09/10 22:17	EPA 200.7	10I0983
Barium	**38.5**		mg/L	0.100	0.100	10	09/10/10 11:14	EPA 200.7	10I0983
Boron	**0.318**		mg/L	0.0125	0.0500	1	09/09/10 22:17	EPA 200.7	10I0983
Calcium	**386**		mg/L	0.500	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:17	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Potassium	**170**		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Sodium	**31.9**		mg/L	0.250	1.00	1	09/09/10 22:17	EPA 200.7	10I0983
Strontium	**51.1**		mg/L	1.25	5.00	100	09/10/10 11:30	EPA 200.7	10I0983

Sample ID: NTI0347-09 (KIF-RELIC C2-T4-LH-082510 - Water) Sampled: 08/25/10 11:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.00115**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Arsenic	**0.000870**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 22:58	EPA 200.8	10I0985
Chromium	**0.00744**		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Copper	**0.0277**		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Lead	**0.000460**	J	mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Molybdenum	**0.0273**		mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Nickel	**0.00201**	J	mg/L	0.000330	0.00500	1	09/13/10 22:58	EPA 200.8	10I0985
Selenium	**0.0144**		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 22:58	EPA 200.8	10I0985
Vanadium	**0.00106**	J	mg/L	0.00100	0.00400	1	09/13/10 22:58	EPA 200.8	10I0985
Zinc	**0.0269**	J	mg/L	0.00830	0.0500	1	09/13/10 22:58	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**4.54**		mg/L	0.0500	0.100	1	09/09/10 22:21	EPA 200.7	10I0983
Barium	**37.5**		mg/L	0.100	0.100	10	09/10/10 11:33	EPA 200.7	10I0983
Boron	**0.352**		mg/L	0.0125	0.0500	1	09/09/10 22:21	EPA 200.7	10I0983
Calcium	**395**		mg/L	0.500	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:21	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Potassium	**102**		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Sodium	**18.9**		mg/L	0.250	1.00	1	09/09/10 22:21	EPA 200.7	10I0983
Strontium	**53.3**		mg/L	1.25	5.00	100	09/10/10 11:36	EPA 200.7	10I0983

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch

Sample ID: NTI0347-10 (KIF-RELIC C2-T5-LH-082910 - Water) Sampled: 08/29/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00104**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Arsenic	**0.000910**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:02	EPA 200.8	10I0985
Chromium	**0.00709**		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Copper	**0.0284**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Lead	**0.000760**	J	mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Molybdenum	**0.0257**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Nickel	**0.00667**		mg/L	0.000330	0.00500	1	09/13/10 23:02	EPA 200.8	10I0985
Selenium	**0.0134**		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:02	EPA 200.8	10I0985
Vanadium	**0.00112**	J	mg/L	0.00100	0.00400	1	09/13/10 23:02	EPA 200.8	10I0985
Zinc	**0.0253**	J	mg/L	0.00830	0.0500	1	09/13/10 23:02	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**4.92**		mg/L	0.0500	0.100	1	09/09/10 22:24	EPA 200.7	10I0983
Barium	**36.4**		mg/L	0.100	0.100	10	09/10/10 11:39	EPA 200.7	10I0983
Boron	**0.352**		mg/L	0.0125	0.0500	1	09/09/10 22:24	EPA 200.7	10I0983
Calcium	**389**		mg/L	0.500	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:24	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Potassium	**71.2**		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Sodium	**16.8**		mg/L	0.250	1.00	1	09/09/10 22:24	EPA 200.7	10I0983
Strontium	**49.4**		mg/L	1.25	5.00	100	09/10/10 11:43	EPA 200.7	10I0983

Sample ID: NTI0347-11 (KIF-RELIC C3-T1-LH-081310 - Water) Sampled: 08/13/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00987**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Arsenic	**0.00313**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:05	EPA 200.8	10I0985
Chromium	**0.238**		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Cobalt	**0.000330**	J	mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Copper	**0.0138**		mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Molybdenum	**0.664**		mg/L	0.00165	0.0250	5	09/13/10 23:48	EPA 200.8	10I0985
Nickel	**0.00393**	J	mg/L	0.000330	0.00500	1	09/13/10 23:05	EPA 200.8	10I0985
Selenium	**0.732**		mg/L	0.00165	0.0100	5	09/13/10 23:48	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:05	EPA 200.8	10I0985
Vanadium	**0.119**		mg/L	0.00100	0.00400	1	09/13/10 23:05	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:05	EPA 200.8	10I0985

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-11 (KIF-RELIC C3-T1-LH-081310 - Water) - cont. Sampled: 08/13/10 14:00

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**8.49**		mg/L	0.0500	0.100	1	09/09/10 22:28	EPA 200.7	10I0983
Barium	**0.104**		mg/L	0.0100	0.0100	1	09/09/10 22:28	EPA 200.7	10I0983
Boron	**7.21**		mg/L	0.125	0.500	10	09/10/10 11:46	EPA 200.7	10I0983
Calcium	**73.4**		mg/L	0.500	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:28	EPA 200.7	10I0983
Magnesium	**0.519**	J	mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Potassium	**10.8**		mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Sodium	**17.9**		mg/L	0.250	1.00	1	09/09/10 22:28	EPA 200.7	10I0983
Strontium	**2.47**		mg/L	0.125	0.500	10	09/10/10 11:46	EPA 200.7	10I0983

Sample ID: NTI0347-12 (KIF-RELIC C3-T2-LH-081710 - Water) Sampled: 08/17/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.0176**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Arsenic	**0.0236**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:08	EPA 200.8	10I0985
Chromium	**0.159**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Cobalt	**0.000480**	J	mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Copper	**0.0110**		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Molybdenum	**0.164**		mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Nickel	**0.00421**	J	mg/L	0.000330	0.00500	1	09/13/10 23:08	EPA 200.8	10I0985
Selenium	**0.231**		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:08	EPA 200.8	10I0985
Vanadium	**1.04**		mg/L	0.00500	0.0200	5	09/13/10 23:51	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:08	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**42.5**		mg/L	0.0500	0.100	1	09/09/10 22:31	EPA 200.7	10I0983
Barium	**0.177**		mg/L	0.0100	0.0100	1	09/09/10 22:31	EPA 200.7	10I0983
Boron	**14.8**		mg/L	0.125	0.500	10	09/10/10 11:49	EPA 200.7	10I0983
Calcium	**26.8**		mg/L	0.500	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:31	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Potassium	**94.8**		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Sodium	**37.9**		mg/L	0.250	1.00	1	09/09/10 22:31	EPA 200.7	10I0983
Strontium	**1.20**		mg/L	0.0125	0.0500	1	09/09/10 22:31	EPA 200.7	10I0983

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI0347-13 (KIF-RELIC C3-T3-LH-082110 - Water) Sampled: 08/21/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.0206**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Arsenic	**0.0828**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:12	EPA 200.8	10I0985
Chromium	**0.0387**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Cobalt	**0.000340**	J	mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Copper	**0.0157**		mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Manganese	**0.000880**	J, B	mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Molybdenum	**0.0453**		mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Nickel	**0.00431**	J	mg/L	0.000330	0.00500	1	09/13/10 23:12	EPA 200.8	10I0985
Selenium	**0.225**		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:12	EPA 200.8	10I0985
Vanadium	**2.59**		mg/L	0.0100	0.0400	10	09/13/10 23:54	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:12	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	**87.7**		mg/L	0.0500	0.100	1	09/09/10 22:34	EPA 200.7	10I0983
Barium	**0.0767**		mg/L	0.0100	0.0100	1	09/09/10 22:34	EPA 200.7	10I0983
Boron	**7.32**		mg/L	0.125	0.500	10	09/10/10 11:52	EPA 200.7	10I0983
Calcium	**4.81**		mg/L	0.500	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:34	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Potassium	**183**		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Sodium	**28.1**		mg/L	0.250	1.00	1	09/09/10 22:34	EPA 200.7	10I0983
Strontium	**0.268**		mg/L	0.0125	0.0500	1	09/09/10 22:34	EPA 200.7	10I0983
Sample ID: NTI0347-14 (KIF-RELIC C3-T4-LH-082510 - Water) Sampled: 08/25/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.0149**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Arsenic	**0.0503**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:15	EPA 200.8	10I0985
Chromium	**0.0204**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Copper	**0.0102**		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Molybdenum	**0.0313**		mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Nickel	**0.00186**	J	mg/L	0.000330	0.00500	1	09/13/10 23:15	EPA 200.8	10I0985
Selenium	**0.117**		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:15	EPA 200.8	10I0985
Vanadium	**1.76**		mg/L	0.0100	0.0400	10	09/14/10 00:05	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:15	EPA 200.8	10I0985

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Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch

Sample ID: NTI0347-14 (KIF-RELIC C3-T4-LH-082510 - Water) - cont. Sampled: 08/25/10 11:00

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**60.2**		mg/L	0.0500	0.100	1	09/09/10 22:37	EPA 200.7	10I0983
Barium	**0.0820**		mg/L	0.0100	0.0100	1	09/09/10 22:37	EPA 200.7	10I0983
Boron	**2.98**		mg/L	0.125	0.500	10	09/10/10 11:55	EPA 200.7	10I0983
Calcium	**7.92**		mg/L	0.500	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:37	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Potassium	**139**		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Sodium	**14.2**		mg/L	0.250	1.00	1	09/09/10 22:37	EPA 200.7	10I0983
Strontium	**0.430**		mg/L	0.0125	0.0500	1	09/09/10 22:37	EPA 200.7	10I0983

Sample ID: NTI0347-15 (KIF-RELIC C3-T5-LH-082910 - Water) Sampled: 08/29/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00924**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Arsenic	**0.0236**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:25	EPA 200.8	10I0985
Chromium	**0.00815**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Copper	**0.00723**		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Molybdenum	**0.0228**		mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Nickel	**0.00192**	J	mg/L	0.000330	0.00500	1	09/13/10 23:25	EPA 200.8	10I0985
Selenium	**0.0507**		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:25	EPA 200.8	10I0985
Vanadium	**0.866**		mg/L	0.00500	0.0200	5	09/14/10 00:08	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:25	EPA 200.8	10I0985

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**36.5**		mg/L	0.0500	0.100	1	09/09/10 22:40	EPA 200.7	10I0983
Barium	**0.112**		mg/L	0.0100	0.0100	1	09/09/10 22:40	EPA 200.7	10I0983
Boron	**1.81**		mg/L	0.0125	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983
Calcium	**14.0**		mg/L	0.500	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Potassium	**77.4**		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Sodium	**11.8**		mg/L	0.250	1.00	1	09/09/10 22:40	EPA 200.7	10I0983
Strontium	**0.783**		mg/L	0.0125	0.0500	1	09/09/10 22:40	EPA 200.7	10I0983

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

ANALYTICAL REPORT

Sample ID: NTI0347-16 (KIF-RELIC MaterialBlank-A-090210 - Water) Sampled: 09/02/10 00:01

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Arsenic	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Beryllium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Cadmium	ND		mg/L	0.000330	0.00100	1	09/13/10 23:28	EPA 200.8	10I0985
Chromium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Cobalt	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Copper	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Lead	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Manganese	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Nickel	ND		mg/L	0.000330	0.00500	1	09/13/10 23:28	EPA 200.8	10I0985
Selenium	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Silver	ND		mg/L	0.000330	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Thallium	ND		mg/L	0.000500	0.00200	1	09/13/10 23:28	EPA 200.8	10I0985
Vanadium	**0.00193**	J	mg/L	0.00100	0.00400	1	09/13/10 23:28	EPA 200.8	10I0985
Zinc	ND		mg/L	0.00830	0.0500	1	09/13/10 23:28	EPA 200.8	10I0985
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	09/09/10 22:43	EPA 200.7	10I0983
Barium	ND		mg/L	0.0100	0.0100	1	09/09/10 22:43	EPA 200.7	10I0983
Boron	ND		mg/L	0.0125	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983
Calcium	ND		mg/L	0.500	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Iron	ND		mg/L	0.0250	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983
Magnesium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Potassium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Sodium	ND		mg/L	0.250	1.00	1	09/09/10 22:43	EPA 200.7	10I0983
Strontium	ND		mg/L	0.0125	0.0500	1	09/09/10 22:43	EPA 200.7	10I0983

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-01RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-02RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-11RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-12RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-13RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-14RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-15RE1	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
EPA 200.8	10I0985	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-01	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-02	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-03	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-04	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-05	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-06	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-07	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-08	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-09	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-10	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-11	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-12	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-13	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-14	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-15	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7
EPA 200.7	10I0983	NTI0347-16	20.00	20.00	09/09/10 00:15	MET	EPA 200.7

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10I0985-BLK1						
Antimony	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Arsenic	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Beryllium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Cadmium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Chromium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Cobalt	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Copper	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Lead	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Manganese	0.000330	J	mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Molybdenum	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Nickel	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Selenium	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Silver	<0.000330		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Thallium	<0.000500		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Vanadium	<0.00100		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Zinc	<0.00830		mg/L	10I0985	10I0985-BLK1	09/13/10 22:09
Total Metals by EPA Method 200.7						
10I0983-BLK1						
Aluminum	<0.0500		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Barium	<0.0100		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Boron	<0.0125		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Calcium	<0.500		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Iron	<0.0250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Magnesium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Potassium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Sodium	<0.250		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11
Strontium	<0.0125		mg/L	10I0983	10I0983-BLK1	09/09/10 21:11

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10I0985-BS1								
Antimony	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Arsenic	0.100	0.0928		mg/L	93%	85 - 115	10I0985	09/13/10 22:06
Beryllium	0.100	0.103		mg/L	103%	85 - 115	10I0985	09/13/10 22:06
Cadmium	0.100	0.0981		mg/L	98%	85 - 115	10I0985	09/13/10 22:06
Chromium	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Cobalt	0.100	0.0989		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Copper	0.100	0.0992		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Lead	0.100	0.101		mg/L	101%	85 - 115	10I0985	09/13/10 22:06
Manganese	0.100	0.0942	B	mg/L	94%	85 - 115	10I0985	09/13/10 22:06
Molybdenum	0.100	0.104		mg/L	104%	85 - 115	10I0985	09/13/10 22:06
Nickel	0.100	0.0987		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Selenium	0.100	0.0976		mg/L	98%	85 - 115	10I0985	09/13/10 22:06
Silver	0.100	0.0988		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Thallium	0.100	0.0963		mg/L	96%	85 - 115	10I0985	09/13/10 22:06
Vanadium	0.100	0.0995		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Zinc	0.100	0.0994		mg/L	99%	85 - 115	10I0985	09/13/10 22:06
Total Metals by EPA Method 200.7								
10I0983-BS1								
Aluminum	2.00	2.12		mg/L	106%	85 - 115	10I0983	09/09/10 21:14
Barium	2.00	2.14		mg/L	107%	85 - 115	10I0983	09/09/10 21:14
Boron	1.00	1.05		mg/L	105%	85 - 115	10I0983	09/09/10 21:14
Calcium	5.00	5.16		mg/L	103%	85 - 115	10I0983	09/09/10 21:14
Iron	1.00	1.04		mg/L	104%	85 - 115	10I0983	09/09/10 21:14
Magnesium	5.00	5.19		mg/L	104%	85 - 115	10I0983	09/09/10 21:14
Potassium	5.00	5.16		mg/L	103%	85 - 115	10I0983	09/09/10 21:14
Sodium	5.00	5.25		mg/L	105%	85 - 115	10I0983	09/09/10 21:14
Strontium	1.00	1.04		mg/L	104%	85 - 115	10I0983	09/09/10 21:14

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI0347
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA 200.8										
10I0985-MS1										
Antimony	0.00957	0.115		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Arsenic	0.00286	0.101		mg/L	0.100	98%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Cadmium	0.000420	0.0992		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Chromium	0.198	0.300		mg/L	0.100	102%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Cobalt	ND	0.101		mg/L	0.100	101%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Copper	0.00993	0.106		mg/L	0.100	96%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Lead	0.000340	0.105		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Manganese	0.000380	0.0983	B	mg/L	0.100	98%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Molybdenum	0.756	0.855		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Nickel	0.00300	0.100		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Selenium	0.787	0.852	MHA	mg/L	0.100	65%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Silver	ND	0.0952		mg/L	0.100	95%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Thallium	ND	0.101		mg/L	0.100	101%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Vanadium	0.0911	0.194		mg/L	0.100	103%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
Zinc	0.00849	0.108		mg/L	0.100	100%	75 - 125	10I0985	NTI0347-01	09/13/10 22:15
10I0985-MS2										
Antimony	0.0105	0.117		mg/L	0.100	107%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Arsenic	0.00514	0.104		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Cadmium	0.000380	0.0991		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Chromium	0.273	0.362		mg/L	0.100	89%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Cobalt	0.000390	0.0992		mg/L	0.100	99%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Copper	0.00711	0.102		mg/L	0.100	95%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Lead	ND	0.105		mg/L	0.100	105%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Manganese	0.000340	0.0972	B	mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Molybdenum	0.764	0.824	MHA	mg/L	0.100	60%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Nickel	0.00297	0.0996		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Selenium	0.762	0.838		mg/L	0.100	76%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Silver	ND	0.0967		mg/L	0.100	97%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Thallium	ND	0.100		mg/L	0.100	100%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Vanadium	0.362	0.452		mg/L	0.100	90%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Zinc	ND	0.0980		mg/L	0.100	98%	75 - 125	10I0985	NTI0347-02	09/13/10 22:25
Total Metals by EPA Method 200.7										
10I0983-MS1										
Aluminum	9.41	11.4		mg/L	2.00	99%	70 - 130	10I0983	NTI0347-01	09/09/10 21:32

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike - Cont.

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA Method 200.7										
10I0983-MS1										
Barium	0.0578	2.19		mg/L	2.00	106%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Boron	8.14	8.18	MHA	mg/L	1.00	4%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Calcium	78.6	82.6	MHA	mg/L	5.00	81%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Iron	ND	1.07		mg/L	1.00	107%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Magnesium	0.375	5.54		mg/L	5.00	103%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Potassium	8.33	13.4		mg/L	5.00	100%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Sodium	13.8	18.9		mg/L	5.00	101%	75 - 125	10I0983	NTI0347-01	09/09/10 21:32
Strontium	2.96	3.62	M8	mg/L	1.00	66%	70 - 130	10I0983	NTI0347-01	09/09/10 21:32
10I0983-MS2										
Aluminum	20.5	21.2	MHA	mg/L	2.00	37%	70 - 130	10I0983	NTI0347-02	09/09/10 21:42
Barium	0.336	2.39		mg/L	2.00	103%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Boron	6.85	8.20	MHA	mg/L	1.00	134%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Calcium	84.6	84.0	MHA	mg/L	5.00	-12%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Iron	ND	1.05		mg/L	1.00	105%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Magnesium	ND	5.08		mg/L	5.00	102%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Potassium	8.52	13.0		mg/L	5.00	91%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Sodium	10.8	15.4		mg/L	5.00	91%	75 - 125	10I0983	NTI0347-02	09/09/10 21:42
Strontium	2.72	3.82		mg/L	1.00	110%	70 - 130	10I0983	NTI0347-02	09/09/10 21:42

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA

Matrix Spike Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10I0985-MSD1												
Antimony	0.00957	0.117		mg/L	0.100	108%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Arsenic	0.00286	0.105		mg/L	0.100	102%	75 - 125	4	20	10I0985	NTI0347-01	09/13/10 22:19
Beryllium	ND	0.109		mg/L	0.100	109%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Cadmium	0.000420	0.101		mg/L	0.100	101%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Chromium	0.198	0.308		mg/L	0.100	110%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Cobalt	ND	0.103		mg/L	0.100	103%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Copper	0.00993	0.109		mg/L	0.100	99%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Lead	0.000340	0.106		mg/L	0.100	105%	75 - 125	0.5	20	10I0985	NTI0347-01	09/13/10 22:19
Manganese	0.000380	0.101	B	mg/L	0.100	101%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Molybdenum	0.756	0.883	MHA	mg/L	0.100	127%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Nickel	0.00300	0.105		mg/L	0.100	102%	75 - 125	5	20	10I0985	NTI0347-01	09/13/10 22:19
Selenium	0.787	0.866		mg/L	0.100	79%	75 - 125	2	20	10I0985	NTI0347-01	09/13/10 22:19
Silver	ND	0.0984		mg/L	0.100	98%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Thallium	ND	0.102		mg/L	0.100	102%	75 - 125	0.4	20	10I0985	NTI0347-01	09/13/10 22:19
Vanadium	0.0911	0.200		mg/L	0.100	109%	75 - 125	3	20	10I0985	NTI0347-01	09/13/10 22:19
Zinc	0.00849	0.107		mg/L	0.100	99%	75 - 125	1	20	10I0985	NTI0347-01	09/13/10 22:19
10I0985-MSD2												
Antimony	0.0105	0.117		mg/L	0.100	107%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Arsenic	0.00514	0.104		mg/L	0.100	99%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Beryllium	ND	0.106		mg/L	0.100	106%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Cadmium	0.000380	0.102		mg/L	0.100	102%	75 - 125	3	20	10I0985	NTI0347-02	09/13/10 22:28
Chromium	0.273	0.367		mg/L	0.100	95%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Cobalt	0.000390	0.102		mg/L	0.100	101%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Copper	0.00711	0.102		mg/L	0.100	95%	75 - 125	0.2	20	10I0985	NTI0347-02	09/13/10 22:28
Lead	ND	0.105		mg/L	0.100	105%	75 - 125	0	20	10I0985	NTI0347-02	09/13/10 22:28
Manganese	0.000340	0.0984	B	mg/L	0.100	98%	75 - 125	1	20	10I0985	NTI0347-02	09/13/10 22:28
Molybdenum	0.764	0.840		mg/L	0.100	76%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Nickel	0.00297	0.101		mg/L	0.100	98%	75 - 125	2	20	10I0985	NTI0347-02	09/13/10 22:28
Selenium	0.762	0.844		mg/L	0.100	81%	75 - 125	0.6	20	10I0985	NTI0347-02	09/13/10 22:28
Silver	ND	0.0996		mg/L	0.100	100%	75 - 125	3	20	10I0985	NTI0347-02	09/13/10 22:28
Thallium	ND	0.101		mg/L	0.100	101%	75 - 125	0.8	20	10I0985	NTI0347-02	09/13/10 22:28
Vanadium	0.362	0.452		mg/L	0.100	90%	75 - 125	0.02	20	10I0985	NTI0347-02	09/13/10 22:28
Zinc	ND	0.0987		mg/L	0.100	99%	75 - 125	0.8	20	10I0985	NTI0347-02	09/13/10 22:28
Total Metals by EPA Method 200.7												
10I0983-MSD1												
Aluminum	9.41	11.6		mg/L	2.00	109%	70 - 130	2	20	10I0983	NTI0347-01	09/09/10 21:36
Barium	0.0578	2.18		mg/L	2.00	106%	75 - 125	0.4	20	10I0983	NTI0347-01	09/09/10 21:36
Boron	8.14	8.34	MHA	mg/L	1.00	21%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36
Calcium	78.6	84.2	MHA	mg/L	5.00	112%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup - Cont.

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA Method 200.7												
10I0983-MSD1												
Iron	ND	1.08		mg/L	1.00	108%	75 - 125	0.6	20	10I0983	NTI0347-01	09/09/10 21:36
Magnesium	0.375	5.55		mg/L	5.00	103%	75 - 125	0.1	20	10I0983	NTI0347-01	09/09/10 21:36
Potassium	8.33	13.5		mg/L	5.00	103%	75 - 125	1	20	10I0983	NTI0347-01	09/09/10 21:36
Sodium	13.8	19.2		mg/L	5.00	108%	75 - 125	2	20	10I0983	NTI0347-01	09/09/10 21:36
Strontium	2.96	3.67		mg/L	1.00	71%	70 - 130	1	20	10I0983	NTI0347-01	09/09/10 21:36
10I0983-MSD2												
Aluminum	20.5	22.2		mg/L	2.00	84%	70 - 130	4	20	10I0983	NTI0347-02	09/09/10 21:45
Barium	0.336	2.44		mg/L	2.00	105%	75 - 125	2	20	10I0983	NTI0347-02	09/09/10 21:45
Boron	6.85	8.58	MHA	mg/L	1.00	173%	75 - 125	5	20	10I0983	NTI0347-02	09/09/10 21:45
Calcium	84.6	88.8	MHA	mg/L	5.00	83%	75 - 125	5	20	10I0983	NTI0347-02	09/09/10 21:45
Iron	ND	1.06		mg/L	1.00	106%	75 - 125	0.9	20	10I0983	NTI0347-02	09/09/10 21:45
Magnesium	ND	5.11		mg/L	5.00	102%	75 - 125	0.6	20	10I0983	NTI0347-02	09/09/10 21:45
Potassium	8.52	13.6		mg/L	5.00	101%	75 - 125	4	20	10I0983	NTI0347-02	09/09/10 21:45
Sodium	10.8	15.9		mg/L	5.00	101%	75 - 125	3	20	10I0983	NTI0347-02	09/09/10 21:45
Strontium	2.72	3.95		mg/L	1.00	123%	70 - 130	3	20	10I0983	NTI0347-02	09/09/10 21:45

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

Client	TVA - Kingston Fossil	Work Order:	NTI0347
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0902Y10A
Attn	William Rogers	Received:	09/03/10 09:55

DATA QUALIFIERS AND DEFINITIONS

B	Analyte was detected in the associated Method Blank.
J	Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
ND	Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 1 of 2
Cooler # 1 of 1

COC # RSICA0902Y10A

RSICA0902Y10A

Required Ship to Lab:		Required Project Information:				Required Sampler Information:	
Lab Name:	Test America Nashville	Site ID #:	KIF			Sampler:	
Address:	2960 Foster Creighton Drive Nashville, TN 37204	Project #:	Kingston Fossil Plant			Sampling Company:	
						Address:	
		Site Address	714 Swan Pond Rd			City/State	Phone #:
Lab PM:	Mark Hollingsworth	City	Harriman	State, Zip		Reimbursement project?	Non-reimbursement project? Mark one
Phone/Fax:	800.765.0980	Site PM Name	Bill Rogers			Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax:	865-717-1627			CC Hardcopy report to	
Applicable Lab Quote #:		Site PM Email:	wjrogers@tva.gov			CC Hardcopy report to	

TAT: Standard 5 day **X** | Rush | Mark One

Preservative: N — HNO3

Depth Unit: NA

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. PAP 9/2/2010 Time	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 1, Test 1	X
2	KIF-RELIC_C1-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 1, Test 2	X
3	KIF-RELIC_C1-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 1, Test 3	X
4	KIF-RELIC_C1-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 1, Test 4	X
5	KIF-RELIC_C1-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 1, Test 5	X
6	KIF-RELIC_C2-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 2, Test 1	X
7	KIF-RELIC_C2-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 2, Test 2	X
8	KIF-RELIC_C2-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 2, Test 3	X
9	KIF-RELIC_C2-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 2, Test 4	X
10	KIF-RELIC_C2-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 2, Test 5	X
11	KIF-RELIC_C3-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	Column 3, Test 1	X
12	KIF-RELIC_C3-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	Column 3, Test 2	X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)		RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
		Paul A. Pier - TVA	9/2/2010	PAP 9/2/2010 11:42pm			
X	Investigatory						
	Split Comparison						
	Split Legal						
	Special Study						
	Plant Ops						
	Oth:						

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier | DATE Signed | Time:

Sample Receipt Conditions

Temp in OC	Samples on Ice?	Sample Intact?	Trip Blank?
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

PAP 9/2/2010

[redacted]

CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 2 of 2
Cooler # ~~#1~~ of 1

COC # RSI .0902Y10A
RSICA0902Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler #	
Sampling Company	
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard 5 day X | Rush | Mark One

Preservative: N / HNO3
Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. PAP 9/2/2010 Time	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	Column 3, Test 3	X
2	KIF-RELIC_C3-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	Column 3, Test 4	X
3	KIF-RELIC_C3-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	Column 3, Test 5	X
4	KIF-RELIC_MaterialBlank-A-090210	RELIC	NA	NA	A	G	N	09/02/2010		1	Material Blank	X
5												
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier - TVA	9/2/2010	PAP 9/2/2010 ~~12:42 pm~~ 11:42 pm			

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier
DATE Signed:
Time:

Sample Receipt Conditions

Temp in 0C	Samples on ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECE

NTI0347

Cooler Received/Opened On 9/3/2010 @ 0955

1. Tracking # 1Z331170 01 9238 7735

Courier: UPS IR Gun ID 97460373

2. Temperature of rep. sample or temp blank when opened: 4.4 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA
   If yes, how many and where: 2 front
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) B

7. Were custody seals on containers: YES NO and Intact YES...NO...NA
   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) M

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) D

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) B

I certify that I attached a label with the unique LIMS number to each container (intial) B

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

TENNESSEE VALLEY AUTHORITY

CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 1 of 2
Cooler # 1 of

NTI0347
09/13/10 23:59

COC # RSICA0902Y10A
RSICA0902Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	
Address:	2960 Foster Creighton Drive Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	
		Site Address	714 Swan Pond Rd	Address:	
Lab PM	Mark Hollingsworth	City	Harriman	City/State	Phone #:
Phone/Fax:	800.765.0980	State, Zip		Reimbursement project? / Non-reimbursement project?	Mark one
Lab PM email		Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Applicable Lab Quote #:		Phone/Fax:	865-717-1627	CC Hardcopy report to	
		Site PM Email:	wjrogers@tva.gov	CC Hardcopy report to	

TAT: Standard 5 day X | Rush | Mark One

Filtered: N | Preserve: HNO3 | Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. (PAP 9/2/2010 Time)	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	1 Column 1, Test 1	X
2	KIF-RELIC_C1-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	2 Column 1, Test 2	X
3	KIF-RELIC_C1-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	3 Column 1, Test 3	X
4	KIF-RELIC_C1-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	4 Column 1, Test 4	X
5	KIF-RELIC_C1-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	5 Column 1, Test 5	X
6	KIF-RELIC_C2-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	6 Column 2, Test 1	X
7	KIF-RELIC_C2-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	7 Column 2, Test 2	X
8	KIF-RELIC_C2-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	8 Column 2, Test 3	X
9	KIF-RELIC_C2-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	9 Column 2, Test 4	X
10	KIF-RELIC_C2-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	10 Column 2, Test 5	X
11	KIF-RELIC_C3-T1-LH-081310	RELIC	NA	NA	LH	G	N	08/13/2010	14 00	1	11 Column 3, Test 1	X
12	KIF-RELIC_C3-T2-LH-081710	RELIC	NA	NA	LH	G	N	08/17/2010	11 00	1	12 Column 3, Test 2	X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul H. Pier - TVA	9/2/2010	12:42pm	[signature] TA	9/3/10	0955

Sample Receipt Conditions

Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?
4.4	Y	Y	N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul H. Pier | DATE Signed: | Time:

PHP 9/2/2010

TENNESSEE VALLEY AUTHORITY

CHAIN-OF-CUSTODY / Analytical Request Document

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~~NTI0347~~

09/13/10 23:59

Page: 2 of 2

Cooler # ~~2~~ 1 of 1

COC # RSICA0902Y10A

RSICA0902Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler	
Sampling Company	
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard 5 day X Rush Mark One

Filtered: N — Preserve: HNO3 — Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D. (PHP 9/2/2010 Time)	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T3-LH-082110	RELIC	NA	NA	LH	G	N	08/21/2010	11 00	1	13 Column 3, Test 3	X
2	KIF-RELIC_C3-T4-LH-082510	RELIC	NA	NA	LH	G	N	08/25/2010	11 00	1	14 Column 3, Test 4	X
3	KIF-RELIC_C3-T5-LH-082910	RELIC	NA	NA	LH	G	N	08/29/2010	14 00	1	15 Column 3, Test 5	X
4	KIF-RELIC_MaterialBlank-A-090210	RELIC	NA	NA	A	G	N	09/02/2010		1	16 Material Blank	X
5												
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Paul A. Pier - TVA	9/2/2010	12:42 pm	TA	9/3/10	0955	4.4	Y/N (Y)	Y/N (Y)	Y/N (N)
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
						Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS / COURIER \ FEDEX / US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: Time:

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Road
Nashville, TN 37204
Tel: 800-765-0980

TestAmerica Job ID: NTI0751
TestAmerica Sample Delivery Group: NTI0751
Client Project/Site: [none]
Client Project Description: Kingston Fossil Plant 050710

For:
TVA - Kingston Fossil
714 Swan Pond Rd KFP-1A-KST
Harriman, TN 37748

Attn: Bruce Haas

Authorized for release by:
10/19/2010 5:53 PM
Johnny A. Mitchell
Laboratory Director
johnny.mitchell@testamericainc.com

Designee for

Mark Hollingsworth
Laboratory Director
mark.hollingsworth@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

Table of Contents

Sample Summary

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
NTI0751-03	pH 7	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-04	pH 8	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-05	pH 9	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-06	pH 10	Ash	09/09/10 12:51	09/09/10 16:30
NTI0751-07	pH 11	Ash	09/09/10 12:51	09/09/10 16:30

Glossary

Glossary	Glossary Description
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis.

Client Sample ID: pH 7

Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-03

Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0214		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:44	1
Selenium	0.0528		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:44	1

1 2 3 4 5 6 7 8 9 10 11

Client Sample ID: pH 8
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-04
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0482		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:47	1
Selenium	0.0554		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:47	1

1 2 3 4 5 6 7 8 9 10 11

Client Sample ID: pH 9

Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-05
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.0500		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:51	1
Selenium	0.0350		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:51	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Client Sample ID: pH 10
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-06
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.353		0.00200	0.0000600	mg/L		10/13/10 11:45	10/14/10 11:54	1
Selenium	0.129		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 11:54	1

Analytical Data

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Client Sample ID: pH 11
Date Collected: 09/09/10 12:51
Date Received: 09/09/10 16:30

Lab Sample ID: NTI0751-07
Matrix: Ash

Method: SW846 6020 - Total Metals by Method 6020

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	0.134		0.00200	0.0000700	mg/L		10/13/10 11:45	10/14/10 12:05	1

Method: SW846 6020 - Total Metals by Method 6020 - RE1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.702		0.0100	0.000300	mg/L		10/13/10 11:45	10/14/10 12:22	5

Client: TVA - Kingston Fossil
Project/Site: [none]

TestAmerica Job ID: NTI0751
SDG: NTI0751

Method: SW846 6020 - Total Metals by Method 6020

Lab Sample ID: 10J1832-BLK1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BLK1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.00200	0.000330	mg/L		10/13/10 11:45	10/14/10 11:33	1
Selenium	ND		0.00200	0.000330	mg/L		10/13/10 11:45	10/14/10 11:33	1

Lab Sample ID: 10J1832-BS1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BS1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	% Rec	% Rec. Limits
Arsenic	0.100	0.0868		mg/L		87	80 - 120
Selenium	0.100	0.0864		mg/L		86	80 - 120

Lab Sample ID: 10J1832-BSD1
Matrix: Water
Analysis Batch: T015999

Client Sample ID: 10J1832-BSD1
Prep Type: total
Prep Batch: 10J1832_P

Analyte	Spike Added	LCS Dup Result	LCS Dup Qualifier	Unit	D	% Rec	% Rec. Limits	RPD	RPD Limit
Arsenic	0.100	0.0839		mg/L		84	80 - 120	3	20
Selenium	0.100	0.0850		mg/L		85	80 - 120	2	20

QC Association Summary

Metals

Prep Batch: 10J1832_P

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10J1832-BLK1	10J1832-BLK1	total	Water	EPA 3010A / 6020	
10J1832-BS1	10J1832-BS1	total	Water	EPA 3010A / 6020	
10J1832-BSD1	10J1832-BSD1	total	Water	EPA 3010A / 6020	
NTI0751-03	pH 7	total	Ash	EPA 3010A / 6020	
NTI0751-04	pH 8	total	Ash	EPA 3010A / 6020	
NTI0751-05	pH 9	total	Ash	EPA 3010A / 6020	
NTI0751-06	pH 10	total	Ash	EPA 3010A / 6020	
NTI0751-07	pH 11	total	Ash	EPA 3010A / 6020	
NTI0751-07 - RE1	pH 11	total	Ash	EPA 3010A / 6020	

Analysis Batch: T015999

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
10J1832-BLK1	10J1832-BLK1	total	Water	SW846 6020	10J1832_P
10J1832-BS1	10J1832-BS1	total	Water	SW846 6020	10J1832_P
10J1832-BSD1	10J1832-BSD1	total	Water	SW846 6020	10J1832_P
NTI0751-03	pH 7	total	Ash	SW846 6020	10J1832_P
NTI0751-04	pH 8	total	Ash	SW846 6020	10J1832_P
NTI0751-05	pH 9	total	Ash	SW846 6020	10J1832_P
NTI0751-06	pH 10	total	Ash	SW846 6020	10J1832_P
NTI0751-07	pH 11	total	Ash	SW846 6020	10J1832_P
T015999-SRD1	pH 11	total	Water	SW846 6020	
NTI0751-07 - RE1	pH 11	total	Ash	SW846 6020	10J1832_P

Analysis Batch: N/A

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
NTI0751-07	pH 11	total	Ash	SW846 6020	

Client Sample ID: pH 7

Lab Sample ID: NTI0751-03

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020		1	10J1832_P	10/13/10 11:45	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		1	T015999	10/14/10 11:44	JWD	TestAmerica Nashville

Client Sample ID: pH 8

Lab Sample ID: NTI0751-04

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:47	JWD	TestAmerica Nashville

Client Sample ID: pH 9

Lab Sample ID: NTI0751-05

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:51	JWD	TestAmerica Nashville

Client Sample ID: pH 10

Lab Sample ID: NTI0751-06

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Analysis	SW846 6020		1	T015999	10/14/10 11:54	JWD	TestAmerica Nashville

Client Sample ID: pH 11

Lab Sample ID: NTI0751-07

Date Collected: 09/09/10 12:51

Matrix: Ash

Date Received: 09/09/10 16:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared Or Analyzed	Analyst	Lab
total	Prep	EPA 3010A / 6020	RE1	1	10J1832_P	10/13/10 11:45	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		1	T015999	10/14/10 12:05	JWD	TestAmerica Nashville
total	Analysis	SW846 6020	RE1	5	T015999	10/14/10 12:22	JWD	TestAmerica Nashville
total	Analysis	SW846 6020		5	N/A	10/14/10 12:08		TestAmerica Nashville

Method Summary

Method	Method Description	Protocol	Laboratory
SW846 6020	Total Metals by Method 6020		TAL NSH

Protocol References:

=

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Road, Nashville, TN 37204, TEL 800-765-0980

Laboratory	Authority	Program	EPA Region	Certification ID	Expiration Date
TestAmerica Nashville		AIHA		100790	09/01/11
TestAmerica Nashville		USDA		S-48469	01/22/11
TestAmerica Nashville	A2LA	A2LA	0	0453.07	12/31/11
TestAmerica Nashville	A2LA	WY UST	0	453.07	12/31/11
TestAmerica Nashville	Alabama	State Program	4	41150	10/31/10
TestAmerica Nashville	Alaska	Alaska UST	10	UST-087	07/24/11
TestAmerica Nashville	Arizona	State Program	9	AZ0473	05/05/11
TestAmerica Nashville	Arkansas	State Program	6	88-0737	04/25/11
TestAmerica Nashville	California	NELAC	9	1168CA	10/31/10
TestAmerica Nashville	Colorado	State Program	8	N/A	02/28/11
TestAmerica Nashville	Connecticut	State Program	1	PH-0220	12/31/11
TestAmerica Nashville	Florida	NELAC	4	E87358	06/30/11
TestAmerica Nashville	Illinois	NELAC	5	200010	12/09/10
TestAmerica Nashville	Iowa	State Program	7	131	05/01/12
TestAmerica Nashville	Kansas	NELAC	7	E-10229	10/31/10
TestAmerica Nashville	Kentucky	State Program	4	2	07/13/12
TestAmerica Nashville	Kentucky	State Program	4	90038	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	LA100011	12/31/10
TestAmerica Nashville	Louisiana	NELAC	6	30613	06/30/11
TestAmerica Nashville	Maryland	State Program	3	316	03/31/11
TestAmerica Nashville	Massachusetts	State Program	1	M-TN032	06/30/11
TestAmerica Nashville	Minnesota	State Program	5	047-999-345	12/31/10
TestAmerica Nashville	Mississippi	State Program	4	N/A	06/30/11
TestAmerica Nashville	Montana	State Program	8	NA	01/01/15
TestAmerica Nashville	Nevada	State Program	9	TN00032	07/31/11
TestAmerica Nashville	New Hampshire	NELAC	1	2963	10/09/10
TestAmerica Nashville	New Jersey	NELAC	2	TN965	06/30/11
TestAmerica Nashville	New York	NELAC	2	11342	04/01/11
TestAmerica Nashville	North Carolina	State Program	4	387	12/31/10
TestAmerica Nashville	North Dakota	State Program	8	R-146	06/30/11
TestAmerica Nashville	Ohio	VAP	5	CL0033	04/01/12
TestAmerica Nashville	Oklahoma	State Program	6	9412	08/31/11
TestAmerica Nashville	Oregon	NELAC	10	TN200001	04/30/11
TestAmerica Nashville	Pennsylvania	NELAC	3	68-00585	06/30/11
TestAmerica Nashville	Rhode Island	State Program	1	LAO00268	12/30/10
TestAmerica Nashville	South Carolina	State Program	4	84009	03/19/11
TestAmerica Nashville	South Carolina	State Program	4	84009	02/28/11
TestAmerica Nashville	Tennessee	State Program	4	2008	03/19/11
TestAmerica Nashville	Texas	NELAC	6	T104704077-09-TX	08/31/11
TestAmerica Nashville	Utah	NELAC	8	TAN	06/30/11
TestAmerica Nashville	Virginia	State Program	3	00323	06/30/11
TestAmerica Nashville	Washington	State Program	10	C789	07/19/11
TestAmerica Nashville	West Virginia	State Program	3	219	02/28/11
TestAmerica Nashville	Wisconsin	State Program	5	998020430	08/31/11

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECE

NTI0751

Cooler Received/Opened On 9/9/2010 @ 1630

1. Tracking # N/A

Courier: Off-Street IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 2.7 Degrees Celsius
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front / back
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) M

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES..NO..NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO..NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) A

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO..NA

16. Was residual chlorine present? YES...NO..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) A

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) A

I certify that I attached a label with the unique LIMS number to each container (intial) A

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

Cooler 1 of 1

BIS = Broken in shipment
Cooler Receipt Form.doc

RECORD COPY

CHAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

TENNESSEE VALLEY AUTHORITY

NTI0751
09/20/10 23:59

Page: 1 of 1
Cooler #: 1 of 1

COC # RSI-090910-003

Required Ship to Lab:

Lab Name	Test America Nashville
Address	2960 Foster Creighton Drive, Nashville, TN 37204
Lab PM	Mark Hollingsworth
Phone/Fax	800 765 0980
Lab PM email	
Applicable Lab Quote #	

Required Project Information:

Site ID #	KIF
Project #	Kingston Fossil Plant
Site Address	1134 Swan Pond Road
City	Harriman
State, Zip	TN 37748
Site PM Name	Bruce Haas
Phone/Fax	865-717-1602
Site PM Email	bjhaas@tva.gov

Required Sampler Information:

Sampler	Mark W. Greer
Sampling Company	TVA - Kingston Fossil Ash Recovery Operations
Address	1134 Swan Pond Road
City/State	Harriman, TN
Phone #	865.717.6542
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	bjhaas@tva.gov
CC Hardcopy report to	
CC Hardcopy report to	

TAT: Standard X | Rush | Mark One

Filtered: NA
Preserve: NONE
Analysis: BATCH TEST, METHOD 1313

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: in)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	BATCH TEST, METHOD 1313
1	ASH - BT- 002	TVA-KIF	0	6	CA	G	N	09/09/2010	1251	2	32 oz CWM glass jar 1/2	X
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

DA 090910

Additional Comments/Special Instructions:

Ash sample collected in support of Kingston Ash Recover Project, Non-Time-Critical Removal Action for the River System Investigation, Ash Leaching Test Plan Document No. RAWP-072.

THIS IS A NON-EQUIS CHAIN OF CUSTODY

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Mark W. Greer / RSI	090910	1337	/ RSI	090910	1337
/ RSI	090910	1443	/ TA	9/11/10	1630

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y / N	Y / N	Y / N
2.7	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N
	Y / N	Y / N	Y / N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL Sonic

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Mark W. Greer
SIGNATURE of SAMPLER: [signature] DATE Signed: 090910 Time: 1255

NTI0751
09/20/10 23:59

COURIER TRANSPORT DOCUMENTATION

DATE: 09/09/10

COURIER COMPANY:

Sonic Subcontractor

From:	To:
TVA c/o David Mathis 189 Lakeshore Drive Harriman, TN 37748 865-202-8313	Test America-Nashville c/o Mark Hollingsworth 2960 Foster Creighton Drive Nashville, TN 37204 800-765-0980

No. of Items:	Description:
24	Cooler(s) taped and custody sealed. Batches 23 of 23 containing surface water sample and 1 of 1 containing recovered ash and used oil samples.

Shippers Name/Company: David Mathis / RSI

Date / Time: 090910 / ~~1507~~ 1507 DM090910

Courier Signature/Company: Mike [illegible] / Direct Connections

Date / Time: 09-09-10 15:07

Receipt Signature/Company: [illegible] / TA

Date / Time: 9/9/10 1630 CST

Corresponding Chains of Custody:

- NTCSW0907Y10A p. 1 - 2
- RSISW0908Y10A p. 1 - 4
- NTCSW0908Y10B p. 1 of 1
- DISLO0909Y10A Page 1 of 1
- RSI-090910-003 Page 1 of 1

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

November 29, 2010 8:09:19AM

Client:	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Nbr:	RSICA0920Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#8559
		Date Received:	09/21/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-RELIC_C1-T10-LH-091810	NTI1887-01	09/18/10 14:00
KIF-RELIC_C1-T6-LH-090210	NTI1887-02	09/02/10 11:00
KIF-RELIC_C1-T7-LH-090610	NTI1887-03	09/06/10 12:30
KIF-RELIC_C1-T8-LH-091010	NTI1887-04	09/10/10 14:30
KIF-RELIC_C1-T9-LH-091410	NTI1887-05	09/14/10 12:00
KIF-RELIC_C2-T10-LH-091810	NTI1887-06	09/18/10 14:00
KIF-RELIC_C2-T6-LH-090210	NTI1887-07	09/02/10 11:00
KIF-RELIC_C2-T7-LH-090610	NTI1887-08	09/06/10 12:30
KIF-RELIC_C2-T8-LH-091010	NTI1887-09	09/10/10 14:30
KIF-RELIC_C2-T9-LH-091410	NTI1887-10	09/14/10 12:00
KIF-RELIC_C3-T10-LH-091810	NTI1887-11	09/18/10 14:00
KIF-RELIC_C3-T6-LH-090210	NTI1887-12	09/02/10 11:00
KIF-RELIC_C3-T7-LH-090610	NTI1887-13	09/06/10 12:30
KIF-RELIC_C3-T8-LH-091010	NTI1887-14	09/10/10 14:30
KIF-RELIC_C3-T9-LH-091410	NTI1887-15	09/14/10 12:00
KIF-MaterialBlank-A-092010	NTI1887-16	09/20/10 09:00
KIF-ProcessBlank-A-091810	NTI1887-17	09/18/10 15:00

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

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Additional Laboratory Comments: ***Revised Report***
The following report has been revised for the following reason(s):
The last sample ID was corrected. No further changes were made. This report replaces all previously generated reports.

Tennessee Certification Number: 02008
The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

Mark Hollingsworth

Program Manager - National Accounts

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-01 (KIF-RELIC C1-T10-LH-091810 - Water) Sampled: 09/18/10 14:00									
Total Metals by EPA 200.8									
Antimony	**0.00620**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Arsenic	**0.0100**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:25	EPA 200.8	10I3334
Chromium	**0.00806**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Copper	**0.00524**		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Molybdenum	**0.0322**		mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Nickel	**0.00171**	J	mg/L	0.000330	0.00500	1	09/23/10 12:25	EPA 200.8	10I3334
Selenium	**0.0331**		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:25	EPA 200.8	10I3334
Vanadium	**0.502**		mg/L	0.00500	0.0200	5	09/23/10 13:41	EPA 200.8	10I3334
Zinc	**0.0129**	J	mg/L	0.00830	0.0500	1	09/23/10 12:25	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**27.6**		mg/L	0.0500	0.100	1	09/22/10 18:34	EPA 200.7	10I3333
Barium	**0.332**		mg/L	0.0100	0.0100	1	09/22/10 18:34	EPA 200.7	10I3333
Boron	**3.35**		mg/L	0.0625	0.250	5	09/23/10 09:46	EPA 200.7	10I3333
Calcium	**51.4**		mg/L	0.500	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:34	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Potassium	**1.96**		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Sodium	**1.80**		mg/L	0.250	1.00	1	09/22/10 18:34	EPA 200.7	10I3333
Strontium	**1.89**		mg/L	0.0125	0.0500	1	09/22/10 18:34	EPA 200.7	10I3333
Sample ID: NTI1887-02 (KIF-RELIC C1-T6-LH-090210 - Water) Sampled: 09/02/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.00752**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Arsenic	**0.0104**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:28	EPA 200.8	10I3334
Chromium	**0.0313**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Copper	**0.0198**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Lead	**0.00176**	J	mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Manganese	**0.000920**	J	mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Molybdenum	**0.0548**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Nickel	**0.00943**		mg/L	0.000330	0.00500	1	09/23/10 12:28	EPA 200.8	10I3334
Selenium	**0.0384**		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:28	EPA 200.8	10I3334
Vanadium	**0.504**		mg/L	0.00500	0.0200	5	09/23/10 13:45	EPA 200.8	10I3334
Zinc	**8.22**		mg/L	0.415	2.50	50	09/23/10 13:48	EPA 200.8	10I3334

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-02 (KIF-RELIC C1-T6-LH-090210 - Water) - cont. Sampled: 09/02/10 11:00									
Total Metals by EPA Method 200.7									
Aluminum	**26.4**		mg/L	0.0500	0.100	1	09/22/10 18:37	EPA 200.7	10I3333
Barium	**0.364**		mg/L	0.0100	0.0100	1	09/22/10 18:37	EPA 200.7	10I3333
Boron	**7.69**		mg/L	0.125	0.500	10	09/23/10 09:49	EPA 200.7	10I3333
Calcium	**54.2**		mg/L	0.500	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:37	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Potassium	**3.49**		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Sodium	**3.10**		mg/L	0.250	1.00	1	09/22/10 18:37	EPA 200.7	10I3333
Strontium	**2.02**		mg/L	0.125	0.500	10	09/23/10 09:49	EPA 200.7	10I3333
Sample ID: NTI1887-03 (KIF-RELIC C1-T7-LH-090610 - Water) Sampled: 09/06/10 12:30									
Total Metals by EPA 200.8									
Antimony	**0.00717**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Arsenic	**0.00933**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:32	EPA 200.8	10I3334
Chromium	**0.0218**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Copper	**0.00471**	J	mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Molybdenum	**0.0459**		mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Nickel	**0.00116**	J	mg/L	0.000330	0.00500	1	09/23/10 12:32	EPA 200.8	10I3334
Selenium	**0.0362**		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:32	EPA 200.8	10I3334
Vanadium	**0.479**		mg/L	0.00100	0.00400	1	09/23/10 12:32	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 12:32	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**26.7**		mg/L	0.0500	0.100	1	09/22/10 18:40	EPA 200.7	10I3333
Barium	**0.352**		mg/L	0.0100	0.0100	1	09/22/10 18:40	EPA 200.7	10I3333
Boron	**6.37**		mg/L	0.125	0.500	10	09/23/10 09:52	EPA 200.7	10I3333
Calcium	**52.1**		mg/L	0.500	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:40	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Potassium	**2.61**		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Sodium	**2.49**		mg/L	0.250	1.00	1	09/22/10 18:40	EPA 200.7	10I3333
Strontium	**2.00**		mg/L	0.125	0.500	10	09/23/10 09:52	EPA 200.7	10I3333

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Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-04 (KIF-RELIC C1-T8-LH-091010 - Water) Sampled: 09/10/10 14:30									
Total Metals by EPA 200.8									
Antimony	**0.00694**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Arsenic	**0.00883**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:35	EPA 200.8	10I3334
Chromium	**0.0166**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Copper	**0.00478**	J	mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Molybdenum	**0.0397**		mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Nickel	**0.00115**	J	mg/L	0.000330	0.00500	1	09/23/10 12:35	EPA 200.8	10I3334
Selenium	**0.0350**		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:35	EPA 200.8	10I3334
Vanadium	**0.505**		mg/L	0.00500	0.0200	5	09/23/10 13:52	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 12:35	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**27.4**		mg/L	0.0500	0.100	1	09/22/10 18:43	EPA 200.7	10I3333
Barium	**0.334**		mg/L	0.0100	0.0100	1	09/22/10 18:43	EPA 200.7	10I3333
Boron	**5.34**		mg/L	0.125	0.500	10	09/23/10 09:55	EPA 200.7	10I3333
Calcium	**51.3**		mg/L	0.500	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:43	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Potassium	**2.36**		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Sodium	**2.22**		mg/L	0.250	1.00	1	09/22/10 18:43	EPA 200.7	10I3333
Strontium	**2.01**		mg/L	0.125	0.500	10	09/23/10 09:55	EPA 200.7	10I3333
Sample ID: NTI1887-05 (KIF-RELIC C1-T9-LH-091410 - Water) Sampled: 09/14/10 12:00									
Total Metals by EPA 200.8									
Antimony	**0.00649**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Arsenic	**0.00869**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:38	EPA 200.8	10I3334
Chromium	**0.0114**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Copper	**0.0343**		mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Lead	**0.00356**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Manganese	**0.000950**	J	mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Molybdenum	**0.0354**		mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Nickel	**0.00449**	J	mg/L	0.000330	0.00500	1	09/23/10 12:38	EPA 200.8	10I3334
Selenium	**0.0335**		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:38	EPA 200.8	10I3334
Vanadium	**0.487**		mg/L	0.00100	0.00400	1	09/23/10 12:38	EPA 200.8	10I3334
Zinc	**3.18**		mg/L	0.0830	0.500	10	09/23/10 13:55	EPA 200.8	10I3334

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-05 (KIF-RELIC C1-T9-LH-091410 - Water) - cont. Sampled: 09/14/10 12:00

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**27.5**		mg/L	0.0500	0.100	1	09/22/10 18:46	EPA 200.7	10I3333
Barium	**0.362**		mg/L	0.0100	0.0100	1	09/22/10 18:46	EPA 200.7	10I3333
Boron	**4.72**		mg/L	0.125	0.500	10	09/23/10 09:58	EPA 200.7	10I3333
Calcium	**50.9**		mg/L	0.500	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:46	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Potassium	**2.17**		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Sodium	**3.08**		mg/L	0.250	1.00	1	09/22/10 18:46	EPA 200.7	10I3333
Strontium	**1.97**		mg/L	0.125	0.500	10	09/23/10 09:58	EPA 200.7	10I3333

Sample ID: NTI1887-06 (KIF-RELIC C2-T10-LH-091810 - Water) Sampled: 09/18/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000650**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Arsenic	**0.000670**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:42	EPA 200.8	10I3334
Chromium	**0.00705**		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Copper	**0.0224**		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Lead	**0.000340**	J	mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Molybdenum	**0.0272**		mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Nickel	**0.00270**	J	mg/L	0.000330	0.00500	1	09/23/10 12:42	EPA 200.8	10I3334
Selenium	**0.0138**		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:42	EPA 200.8	10I3334
Vanadium	**0.00295**	J	mg/L	0.00100	0.00400	1	09/23/10 12:42	EPA 200.8	10I3334
Zinc	**0.0243**	J	mg/L	0.00830	0.0500	1	09/23/10 12:42	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**6.81**		mg/L	0.0500	0.100	1	09/22/10 18:49	EPA 200.7	10I3333
Barium	**21.4**		mg/L	0.0100	0.0100	1	09/22/10 18:49	EPA 200.7	10I3333
Boron	**0.319**		mg/L	0.0125	0.0500	1	09/22/10 18:49	EPA 200.7	10I3333
Calcium	**371**		mg/L	0.500	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:49	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Potassium	**32.0**		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Sodium	**9.48**		mg/L	0.250	1.00	1	09/22/10 18:49	EPA 200.7	10I3333
Strontium	**19.8**		mg/L	0.250	1.00	20	09/23/10 10:01	EPA 200.7	10I3333

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-07 (KIF-RELIC C2-T6-LH-090210 - Water) Sampled: 09/02/10 11:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000740**	J	mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Arsenic	**0.000510**	J	mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:45	EPA 200.8	10I3334
Chromium	**0.00658**		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Copper	**0.0246**		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Molybdenum	**0.0244**		mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Nickel	**0.00223**	J	mg/L	0.000330	0.00500	1	09/23/10 12:45	EPA 200.8	10I3334
Selenium	**0.0128**		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:45	EPA 200.8	10I3334
Vanadium	**0.00137**	J	mg/L	0.00100	0.00400	1	09/23/10 12:45	EPA 200.8	10I3334
Zinc	**0.377**		mg/L	0.00830	0.0500	1	09/23/10 12:45	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**5.19**		mg/L	0.0500	0.100	1	09/22/10 18:53	EPA 200.7	10I3333
Barium	**28.5**		mg/L	0.0100	0.0100	1	09/22/10 18:53	EPA 200.7	10I3333
Boron	**0.379**		mg/L	0.0125	0.0500	1	09/22/10 18:53	EPA 200.7	10I3333
Calcium	**373**		mg/L	0.500	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:53	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Potassium	**52.2**		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Sodium	**13.5**		mg/L	0.250	1.00	1	09/22/10 18:53	EPA 200.7	10I3333
Strontium	**44.3**		mg/L	1.25	5.00	100	09/23/10 10:04	EPA 200.7	10I3333

Sample ID: NTI1887-08 (KIF-RELIC C2-T7-LH-090610 - Water) Sampled: 09/06/10 12:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000690**	J	mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Arsenic	**0.000640**	J	mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:55	EPA 200.8	10I3334
Chromium	**0.00666**		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Copper	**0.0224**		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Molybdenum	**0.0236**		mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Nickel	**0.00210**	J	mg/L	0.000330	0.00500	1	09/23/10 12:55	EPA 200.8	10I3334
Selenium	**0.0130**		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:55	EPA 200.8	10I3334
Vanadium	**0.00241**	J	mg/L	0.00100	0.00400	1	09/23/10 12:55	EPA 200.8	10I3334
Zinc	**0.0145**	J	mg/L	0.00830	0.0500	1	09/23/10 12:55	EPA 200.8	10I3334

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-08 (KIF-RELIC C2-T7-LH-090610 - Water) - cont. Sampled: 09/06/10 12:30									
Total Metals by EPA Method 200.7									
Aluminum	**5.78**		mg/L	0.0500	0.100	1	09/22/10 18:56	EPA 200.7	10I3333
Barium	**26.9**		mg/L	0.0100	0.0100	1	09/22/10 18:56	EPA 200.7	10I3333
Boron	**0.356**		mg/L	0.0125	0.0500	1	09/22/10 18:56	EPA 200.7	10I3333
Calcium	**360**		mg/L	0.500	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 18:56	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Potassium	**43.6**		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Sodium	**11.9**		mg/L	0.250	1.00	1	09/22/10 18:56	EPA 200.7	10I3333
Strontium	**37.6**		mg/L	1.25	5.00	100	09/23/10 10:07	EPA 200.7	10I3333
Sample ID: NTI1887-09 (KIF-RELIC C2-T8-LH-091010 - Water) Sampled: 09/10/10 14:30									
Total Metals by EPA 200.8									
Antimony	**0.000700**	J	mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Arsenic	**0.000600**	J	mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 12:59	EPA 200.8	10I3334
Chromium	**0.00672**		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Copper	**0.0221**		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Molybdenum	**0.0248**		mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Nickel	**0.00271**	J	mg/L	0.000330	0.00500	1	09/23/10 12:59	EPA 200.8	10I3334
Selenium	**0.0132**		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 12:59	EPA 200.8	10I3334
Vanadium	**0.00145**	J	mg/L	0.00100	0.00400	1	09/23/10 12:59	EPA 200.8	10I3334
Zinc	**0.0132**	J	mg/L	0.00830	0.0500	1	09/23/10 12:59	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**6.23**		mg/L	0.0500	0.100	1	09/22/10 19:12	EPA 200.7	10I3333
Barium	**25.3**		mg/L	0.0100	0.0100	1	09/22/10 19:12	EPA 200.7	10I3333
Boron	**0.329**		mg/L	0.0125	0.0500	1	09/22/10 19:12	EPA 200.7	10I3333
Calcium	**367**		mg/L	0.500	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:12	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Potassium	**38.1**		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Sodium	**10.7**		mg/L	0.250	1.00	1	09/22/10 19:12	EPA 200.7	10I3333
Strontium	**29.8**		mg/L	1.25	5.00	100	09/23/10 10:10	EPA 200.7	10I3333

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch

Sample ID: NTI1887-10 (KIF-RELIC C2-T9-LH-091410 - Water) Sampled: 09/14/10 12:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000700**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Arsenic	**0.00106**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:02	EPA 200.8	10I3334
Chromium	**0.00677**		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Copper	**0.0249**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Lead	**0.000960**	J	mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Molybdenum	**0.0249**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Nickel	**0.00500**		mg/L	0.000330	0.00500	1	09/23/10 13:02	EPA 200.8	10I3334
Selenium	**0.0134**		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:02	EPA 200.8	10I3334
Vanadium	**0.00429**		mg/L	0.00100	0.00400	1	09/23/10 13:02	EPA 200.8	10I3334
Zinc	**0.272**		mg/L	0.00830	0.0500	1	09/23/10 13:02	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**6.48**		mg/L	0.0500	0.100	1	09/22/10 19:15	EPA 200.7	10I3333
Barium	**23.1**		mg/L	0.0100	0.0100	1	09/22/10 19:15	EPA 200.7	10I3333
Boron	**0.340**		mg/L	0.0125	0.0500	1	09/22/10 19:15	EPA 200.7	10I3333
Calcium	**363**		mg/L	0.500	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:15	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Potassium	**33.6**		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Sodium	**9.78**		mg/L	0.250	1.00	1	09/22/10 19:15	EPA 200.7	10I3333
Strontium	**21.2**		mg/L	1.25	5.00	100	09/23/10 10:14	EPA 200.7	10I3333

Sample ID: NTI1887-11 (KIF-RELIC C3-T10-LH-091810 - Water) Sampled: 09/18/10 14:00

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00155**	J	mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Arsenic	**0.00395**		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:06	EPA 200.8	10I3334
Chromium	**0.000420**	J	mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Copper	**0.0155**		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Molybdenum	**0.0363**		mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Nickel	**0.00126**	J	mg/L	0.000330	0.00500	1	09/23/10 13:06	EPA 200.8	10I3334
Selenium	**0.0234**		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:06	EPA 200.8	10I3334
Vanadium	**0.0782**		mg/L	0.00100	0.00400	1	09/23/10 13:06	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:06	EPA 200.8	10I3334

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-11 (KIF-RELIC C3-T10-LH-091810 - Water) - cont. Sampled: 09/18/10 14:00									
Total Metals by EPA Method 200.7									
Aluminum	**33.6**		mg/L	0.0500	0.100	1	09/22/10 19:19	EPA 200.7	10I3333
Barium	**3.41**		mg/L	0.0100	0.0100	1	09/22/10 19:19	EPA 200.7	10I3333
Boron	**1.55**		mg/L	0.0125	0.0500	1	09/22/10 19:19	EPA 200.7	10I3333
Calcium	**164**		mg/L	0.500	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:19	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Potassium	**24.3**		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Sodium	**5.86**		mg/L	0.250	1.00	1	09/22/10 19:19	EPA 200.7	10I3333
Strontium	**48.5**		mg/L	1.25	5.00	100	09/23/10 10:29	EPA 200.7	10I3333
Sample ID: NTI1887-12 (KIF-RELIC C3-T6-LH-090210 - Water) Sampled: 09/02/10 11:00									
Total Metals by EPA 200.8									
Antimony	**0.00646**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Arsenic	**0.0151**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:09	EPA 200.8	10I3334
Chromium	**0.00343**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Copper	**0.00780**		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Molybdenum	**0.0201**		mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Nickel	**0.00185**	J	mg/L	0.000330	0.00500	1	09/23/10 13:09	EPA 200.8	10I3334
Selenium	**0.0350**		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:09	EPA 200.8	10I3334
Vanadium	**0.626**		mg/L	0.00500	0.0200	5	09/23/10 13:58	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:09	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**30.4**		mg/L	0.0500	0.100	1	09/22/10 19:22	EPA 200.7	10I3333
Barium	**0.284**		mg/L	0.0100	0.0100	1	09/22/10 19:22	EPA 200.7	10I3333
Boron	**1.61**		mg/L	0.0125	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333
Calcium	**29.8**		mg/L	0.500	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Potassium	**50.9**		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Sodium	**8.88**		mg/L	0.250	1.00	1	09/22/10 19:22	EPA 200.7	10I3333
Strontium	**1.52**		mg/L	0.0125	0.0500	1	09/22/10 19:22	EPA 200.7	10I3333

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-13 (KIF-RELIC C3-T7-LH-090610 - Water) Sampled: 09/06/10 12:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00418**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Arsenic	**0.0105**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:13	EPA 200.8	10I3334
Chromium	**0.000880**	J	mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Copper	**0.00829**		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Molybdenum	**0.0214**		mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Nickel	**0.00112**	J	mg/L	0.000330	0.00500	1	09/23/10 13:13	EPA 200.8	10I3334
Selenium	**0.0288**		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:13	EPA 200.8	10I3334
Vanadium	**0.358**		mg/L	0.00100	0.00400	1	09/23/10 13:13	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:13	EPA 200.8	10I3334

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**30.4**		mg/L	0.0500	0.100	1	09/22/10 19:25	EPA 200.7	10I3333
Barium	**0.468**		mg/L	0.0100	0.0100	1	09/22/10 19:25	EPA 200.7	10I3333
Boron	**1.57**		mg/L	0.0125	0.0500	1	09/22/10 19:25	EPA 200.7	10I3333
Calcium	**59.6**		mg/L	0.500	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:25	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Potassium	**38.4**		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Sodium	**7.32**		mg/L	0.250	1.00	1	09/22/10 19:25	EPA 200.7	10I3333
Strontium	**3.15**		mg/L	0.125	0.500	10	09/23/10 10:32	EPA 200.7	10I3333

Sample ID: NTI1887-14 (KIF-RELIC C3-T8-LH-091010 - Water) Sampled: 09/10/10 14:30

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00259**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Arsenic	**0.00627**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:16	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Copper	**0.0121**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Lead	**0.00104**	J	mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Molybdenum	**0.0250**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Nickel	**0.0192**		mg/L	0.000330	0.00500	1	09/23/10 13:16	EPA 200.8	10I3334
Selenium	**0.0286**		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:16	EPA 200.8	10I3334
Vanadium	**0.192**		mg/L	0.00100	0.00400	1	09/23/10 13:16	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:16	EPA 200.8	10I3334

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-14 (KIF-RELIC C3-T8-LH-091010 - Water) - cont. Sampled: 09/10/10 14:30									
Total Metals by EPA Method 200.7									
Aluminum	**32.6**		mg/L	0.0500	0.100	1	09/22/10 19:28	EPA 200.7	10I3333
Barium	**1.33**		mg/L	0.0100	0.0100	1	09/22/10 19:28	EPA 200.7	10I3333
Boron	**1.56**		mg/L	0.0125	0.0500	1	09/22/10 19:28	EPA 200.7	10I3333
Calcium	**104**		mg/L	0.500	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:28	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Potassium	**31.0**		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Sodium	**6.55**		mg/L	0.250	1.00	1	09/22/10 19:28	EPA 200.7	10I3333
Strontium	**17.5**		mg/L	0.125	0.500	10	09/23/10 10:35	EPA 200.7	10I3333
Sample ID: NTI1887-15 (KIF-RELIC C3-T9-LH-091410 - Water) Sampled: 09/14/10 12:00									
Total Metals by EPA 200.8									
Antimony	**0.00199**	J	mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Arsenic	**0.00443**		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:19	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Copper	**0.0121**		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Molybdenum	**0.0306**		mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Nickel	**0.00172**	J	mg/L	0.000330	0.00500	1	09/23/10 13:19	EPA 200.8	10I3334
Selenium	**0.0262**		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:19	EPA 200.8	10I3334
Vanadium	**0.108**		mg/L	0.00100	0.00400	1	09/23/10 13:19	EPA 200.8	10I3334
Zinc	**0.0449**	J	mg/L	0.00830	0.0500	1	09/23/10 13:19	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	**33.5**		mg/L	0.0500	0.100	1	09/22/10 19:32	EPA 200.7	10I3333
Barium	**2.47**		mg/L	0.0100	0.0100	1	09/22/10 19:32	EPA 200.7	10I3333
Boron	**1.54**		mg/L	0.0125	0.0500	1	09/22/10 19:32	EPA 200.7	10I3333
Calcium	**136**		mg/L	0.500	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:32	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Potassium	**26.3**		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Sodium	**6.06**		mg/L	0.250	1.00	1	09/22/10 19:32	EPA 200.7	10I3333
Strontium	**40.4**		mg/L	1.25	5.00	100	09/23/10 10:38	EPA 200.7	10I3333

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI1887-16 (KIF-MaterialBlank-A-092010 - Water) Sampled: 09/20/10 09:00									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Arsenic	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:23	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Copper	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Nickel	ND		mg/L	0.000330	0.00500	1	09/23/10 13:23	EPA 200.8	10I3334
Selenium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:23	EPA 200.8	10I3334
Vanadium	ND		mg/L	0.00100	0.00400	1	09/23/10 13:23	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:23	EPA 200.8	10I3334
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	09/22/10 19:35	EPA 200.7	10I3333
Barium	ND		mg/L	0.0100	0.0100	1	09/22/10 19:35	EPA 200.7	10I3333
Boron	ND		mg/L	0.0125	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Calcium	ND		mg/L	0.500	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Potassium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Sodium	ND		mg/L	0.250	1.00	1	09/22/10 19:35	EPA 200.7	10I3333
Strontium	ND		mg/L	0.0125	0.0500	1	09/22/10 19:35	EPA 200.7	10I3333
Sample ID: NTI1887-17 (KIF-ProcessBlank-A-091810 - Water) Sampled: 09/18/10 15:00									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Arsenic	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Beryllium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Cadmium	ND		mg/L	0.000330	0.00100	1	09/23/10 13:26	EPA 200.8	10I3334
Chromium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Cobalt	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Copper	**0.000510**	J	mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Lead	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Manganese	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Molybdenum	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Nickel	ND		mg/L	0.000330	0.00500	1	09/23/10 13:26	EPA 200.8	10I3334
Selenium	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Silver	ND		mg/L	0.000330	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Thallium	ND		mg/L	0.000500	0.00200	1	09/23/10 13:26	EPA 200.8	10I3334
Vanadium	ND		mg/L	0.00100	0.00400	1	09/23/10 13:26	EPA 200.8	10I3334
Zinc	ND		mg/L	0.00830	0.0500	1	09/23/10 13:26	EPA 200.8	10I3334

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

ANALYTICAL REPORT

Sample ID: NTI1887-17 (KIF-ProcessBlank-A-091810 - Water) - cont. Sampled: 09/18/10 15:00

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA Method 200.7									
Aluminum	**0.160**		mg/L	0.0500	0.100	1	09/22/10 19:38	EPA 200.7	10I3333
Barium	**0.0264**		mg/L	0.0100	0.0100	1	09/22/10 19:38	EPA 200.7	10I3333
Boron	ND		mg/L	0.0125	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333
Calcium	**0.958**	J	mg/L	0.500	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Iron	ND		mg/L	0.0250	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333
Magnesium	ND		mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Potassium	**0.295**	J	mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Sodium	ND		mg/L	0.250	1.00	1	09/22/10 19:38	EPA 200.7	10I3333
Strontium	**0.219**		mg/L	0.0125	0.0500	1	09/22/10 19:38	EPA 200.7	10I3333

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Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-01RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-02RE2	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-04RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-05RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
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EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-12RE1	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
EPA 200.8	10I3334	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-01	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-02	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-03	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-04	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-05	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-06	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-07	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-08	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-09	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-10	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-11	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-12	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-13	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10I3333	NTI1887-14	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-15	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-16	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7
EPA 200.7	10I3333	NTI1887-17	50.00	50.00	09/22/10 08:40	MET	EPA 200.7

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10I3334-BLK1						
Antimony	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Arsenic	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Beryllium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Cadmium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Chromium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Cobalt	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Copper	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Lead	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Manganese	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Molybdenum	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Nickel	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Selenium	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Silver	<0.000330		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Thallium	<0.000500		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Vanadium	<0.00100		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Zinc	<0.00830		mg/L	10I3334	10I3334-BLK1	09/23/10 12:22
Total Metals by EPA Method 200.7						
10I3333-BLK1						
Aluminum	<0.0500		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Barium	<0.0100		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Boron	<0.0125		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Calcium	<0.500		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Iron	<0.0250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Magnesium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Potassium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Sodium	<0.250		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12
Strontium	<0.0125		mg/L	10I3333	10I3333-BLK1	09/22/10 18:12

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10I3334-BS1								
Antimony	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Arsenic	0.100	0.0958		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Beryllium	0.100	0.0968		mg/L	97%	85 - 115	10I3334	09/23/10 12:15
Cadmium	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Chromium	0.100	0.0926		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Cobalt	0.100	0.0931		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Copper	0.100	0.0963		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Lead	0.100	0.0935		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Manganese	0.100	0.0917		mg/L	92%	85 - 115	10I3334	09/23/10 12:15
Molybdenum	0.100	0.0980		mg/L	98%	85 - 115	10I3334	09/23/10 12:15
Nickel	0.100	0.0956		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Selenium	0.100	0.0959		mg/L	96%	85 - 115	10I3334	09/23/10 12:15
Silver	0.100	0.0933		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Thallium	0.100	0.0932		mg/L	93%	85 - 115	10I3334	09/23/10 12:15
Vanadium	0.100	0.0947		mg/L	95%	85 - 115	10I3334	09/23/10 12:15
Zinc	0.100	0.0954		mg/L	95%	85 - 115	10I3334	09/23/10 12:15
Total Metals by EPA Method 200.7								
10I3333-BS1								
Aluminum	2.00	2.13		mg/L	106%	85 - 115	10I3333	09/22/10 18:28
Barium	2.00	2.11		mg/L	106%	85 - 115	10I3333	09/22/10 18:28
Boron	1.00	1.04		mg/L	104%	85 - 115	10I3333	09/22/10 18:28
Calcium	5.00	5.01		mg/L	100%	85 - 115	10I3333	09/22/10 18:28
Iron	1.00	1.02		mg/L	102%	85 - 115	10I3333	09/22/10 18:28
Magnesium	5.00	5.07		mg/L	101%	85 - 115	10I3333	09/22/10 18:28
Potassium	5.00	4.99		mg/L	100%	85 - 115	10I3333	09/22/10 18:28
Sodium	5.00	5.26		mg/L	105%	85 - 115	10I3333	09/22/10 18:28
Strontium	1.00	1.04		mg/L	104%	85 - 115	10I3333	09/22/10 18:28

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI1887
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

PROJECT QUALITY CONTROL DATA
LCS Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10I3334-BSD1												
Antimony		0.100	MNR1	mg/L	0.100	100%	85 - 115	2	20	10I3334		09/23/10 12:18
Arsenic		0.0994	MNR1	mg/L	0.100	99%	85 - 115	4	20	10I3334		09/23/10 12:18
Beryllium		0.0980	MNR1	mg/L	0.100	98%	85 - 115	1	20	10I3334		09/23/10 12:18
Cadmium		0.101	MNR1	mg/L	0.100	101%	85 - 115	3	20	10I3334		09/23/10 12:18
Chromium		0.0932	MNR1	mg/L	0.100	93%	85 - 115	0.7	20	10I3334		09/23/10 12:18
Cobalt		0.0927	MNR1	mg/L	0.100	93%	85 - 115	0.5	20	10I3334		09/23/10 12:18
Copper		0.0953	MNR1	mg/L	0.100	95%	85 - 115	1	20	10I3334		09/23/10 12:18
Lead		0.0961	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Manganese		0.0928	MNR1	mg/L	0.100	93%	85 - 115	1	20	10I3334		09/23/10 12:18
Molybdenum		0.102	MNR1	mg/L	0.100	102%	85 - 115	4	20	10I3334		09/23/10 12:18
Nickel		0.0950	MNR1	mg/L	0.100	95%	85 - 115	0.6	20	10I3334		09/23/10 12:18
Selenium		0.0983	MNR1	mg/L	0.100	98%	85 - 115	2	20	10I3334		09/23/10 12:18
Silver		0.0959	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Thallium		0.0958	MNR1	mg/L	0.100	96%	85 - 115	3	20	10I3334		09/23/10 12:18
Vanadium		0.0939	MNR1	mg/L	0.100	94%	85 - 115	0.8	20	10I3334		09/23/10 12:18
Zinc		0.0948	MNR1	mg/L	0.100	95%	85 - 115	0.6	20	10I3334		09/23/10 12:18
Total Metals by EPA Method 200.7												
10I3333-BSD1												
Aluminum		2.12		mg/L	2.00	106%	85 - 115	0.5	20	10I3333		09/22/10 18:31
Barium		2.12		mg/L	2.00	106%	85 - 115	0.3	20	10I3333		09/22/10 18:31
Boron		1.04		mg/L	1.00	104%	85 - 115	0.2	20	10I3333		09/22/10 18:31
Calcium		5.00		mg/L	5.00	100%	85 - 115	0.08	20	10I3333		09/22/10 18:31
Iron		1.03		mg/L	1.00	103%	85 - 115	1	20	10I3333		09/22/10 18:31
Magnesium		5.06		mg/L	5.00	101%	85 - 115	0.3	20	10I3333		09/22/10 18:31
Potassium		5.00		mg/L	5.00	100%	85 - 115	0.4	20	10I3333		09/22/10 18:31
Sodium		5.32		mg/L	5.00	106%	85 - 115	1	20	10I3333		09/22/10 18:31
Strontium		1.05		mg/L	1.00	105%	85 - 115	0.8	20	10I3333		09/22/10 18:31

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

Client	TVA - Kingston Fossil	Work Order:	NTI1887
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0920Y10A
Attn	William Rogers	Received:	09/21/10 08:00

DATA QUALIFIERS AND DEFINITIONS

J Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

MNR1 There was no MS/MSD analyzed with this batch due to insufficient sample volume. See Blank Spike.

ND Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEI

NTI1887

Cooler Received/Opened On 9/21/2010 @ 0800

1. Tracking # 4288 (last 4 digits, FedEx)

Courier: FedEx IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 2.2 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) MJ

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? MJ 9/21/10 YES...NO...NA MJ 9/21/10

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) MJ

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) MJ

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) MJ

I certify that I attached a label with the unique LIMS number to each container (intial) MJ

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

TENNESSEE VALLEY AUTHORITY

NTI1887

09/28/10 23:59

CHAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 2

Cooler # ____ of ____

COC # RSICA0920Y10A

RSICA0920Y10A

Required Ship to Lab:

Lab Name: Test America Nashville

Address: 2960 Foster Creighton Drive, Nashville, TN 37204

Lab PM: Mark Hollingsworth

Phone/Fax: 800.765.0980

Lab PM email:

Applicable Lab Quote #:

Required Project Information:

Site ID #: KIF

Project #: Kingston Fossil Plant

Site Address: 714 Swan Pond Rd

City: Harriman State, Zip:

Site PM Name: Bill Rogers

Phone/Fax: 865-717-1627

Site PM Email: wjrogers@tva.gov

Required Sampler Information:

Sampler:

Sampling Company:

Address:

City/State: Phone #:

Reimbursement project? Non-reimbursement project? Mark one

Send EDD to: TVAEDD@envstd.com

CC Hardcopy report to:

CC Hardcopy report to:

TAT: NORMAL X Rush Mark One

Filtered: Y N — P.A.P. 9/20/10

Preserve: HNO3

Analysis: METALS_TVA_SW_TOTAL

Sample Depth — Depth Unit: NA

ITEM #	SAMPLE ID	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C1-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14 00	1	1 Column 1, Time 10	X
2	KIF-RELIC_C1-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11 00	1	2 Column 1, Time 6	X
3	KIF-RELIC_C1-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12 30	1	3 Column 1, Time 7	X
4	KIF-RELIC_C1-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14 30	1	4 Column 1, Time 8	X
5	KIF-RELIC_C1-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12 00	1	5 Column 1, Time 9	X
6	KIF-RELIC_C2-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14 00	1	6 Column 2, Time 10	X
7	KIF-RELIC_C2-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11 00	1	7 Column 2, Time 6	X
8	KIF-RELIC_C2-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12 30	1	8 Column 2, Time 7	X
9	KIF-RELIC_C2-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14 30	1	9 Column 2, Time 8	X
10	KIF-RELIC_C2-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12 00	1	10 Column 2, Time 9	X
11	KIF-RELIC_C3-T10-LH-091810	RELIC	NA	NA	LH	G	N	09/18/2010	14 00	1	11 Column 3, Time 10	X
12	KIF-RELIC_C3-T6-LH-090210	RELIC	NA	NA	LH	G	N	09/02/2010	11 00	1	12 Column 3, Time 6	X

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Paul A. Pier	9/20/2010	9:53am	TA	9/21/10	0800	2.2	Y/N	Y/N	Y/N
X Investigatory								Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study										
Plant Ops										
Oth:										

SHIPPING METHOD (mark as appropriate): UPS, COURIER \ FEDEX, US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: 9-20-2010 Time: 9:53am

TENNESSEE VALLEY AUTHORITY

NTI1887
09/28/10 23:59

ꟾAIN-OF-CUSTODY / Analytical Request Document

ꟾain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 2 of 2
Cooler # ____ of ____

COC # RSICA0920Y10A
RSICA0920Y10A

Required Ship to Lab:
Lab Name: Test America Nashville
Address: 2960 Foster Creighton Drive
Nashville, TN 37204
Lab PM: Mark Hollingsworth
Phone/Fax: 800.765.0980
Lab PM email:
Applicable Lab Quote #:

Required Project Information:
Site ID #: KIF
Project #: Kingston Fossil Plant
Site Address: 714 Swan Pond Rd
City: Hamman State, Zip:
Site PM Name: Bill Rogers
Phone/Fax: 865-717-1627
Site PM Email: wjrogers@tva.gov

Required Sampler Information:
Sampler:
Sampling Company:
Address:
City/State: Phone #:
Reimbursement project? Non-reimbursement project? Mark one
Send EDD to: TVAEDD@envstd.com
CC Hardcopy report to:
CC Hardcopy report to:

TAT: NORMAL X Rush Mark One

Filtered: Y N (Lee 09/20/10)
Preserve: HNO3
Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-RELIC_C3-T7-LH-090610	RELIC	NA	NA	LH	G	N	09/06/2010	12 30	1	13 Column 3, Time 7	X
2	KIF-RELIC_C3-T8-LH-091010	RELIC	NA	NA	LH	G	N	09/10/2010	14 30	1	14 Column 3, Time 8	X
3	KIF-RELIC_C3-T9-LH-091410	RELIC	NA	NA	LH	G	N	09/14/2010	12 00	1	15 Column 3, Time 9	X
4	KIF-MATERIALBLANK-A-092010	RELIC	NA	NA	A	G	N	09/20/2010	[illegible]	1	Material Blank ← 16	X — P Lee 09/20/10
5	KIF-PROCESSBLANK-A-091810	RELIC	NA	NA	A	G	N	09/18/2010	15 00	1	Process Blank ← 17	X — P Lee 09/20/10
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Paul A. Pier	9/20/2010	9:53am	[illegible] / TA	9/21/10	0800	2.2	Ⓨ/N	Ⓨ/N	Y/Ⓝ
X Investigatory								Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study										
Plant Ops										
Oth:										

SHIPPING METHOD: (mark as appropriate)
UPS COURIER \ FEDEX
US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: 9-20-2010 Time: 9:53am

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

October 11, 2010 9:21:06AM

Client:	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Nbr:	RSICA0928Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#8559
		Date Received:	09/29/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-AFA_122208-6-3-I-CA-122208	NTI2912-01	09/28/10 00:01
KIF-RELIC_CT-CA-070710	NTI2912-02	09/28/10 00:01
KIF-RELIC_CTLIME-CA-070710	NTI2912-03	09/28/10 00:01

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this material is strictly prohibited. If you have received this material in error, please notify us immediately at 615-726-0177.

Tennessee Certification Number: 02008

The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Mark Hollingsworth

Program Manager - National Accounts

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-01 (KIF-AFA 122208-6-3-I-CA-122208 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**81.9**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Sample ID: NTI2912-01 (KIF-AFA 122208-6-3-I-CA-122208 - Sediment) - cont. Sampled: 09/28/10 00:01

Total Metals by EPA Method 6010B

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**37300**	MHA	mg/kg dry	58.1	116	5	10/05/10 12:18	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Arsenic	**30.8**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Barium	**1290**	M8	mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Beryllium	**7.09**		mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Boron	**177**		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.581	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Calcium	**28100**	MHA	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Chromium	**54.2**		mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Cobalt	**27.5**		mg/kg dry	5.81	23.2	5	10/05/10 12:18	SW846 6010B	10I5294
Copper	**68.3**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Iron	**21400**	M8	mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Lead	**25.6**	M7	mg/kg dry	2.32	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Magnesium	**6130**	M8	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Manganese	**86.2**		mg/kg dry	5.81	17.4	5	10/05/10 12:18	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Nickel	**49.2**		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Potassium	**3340**		mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Silver	ND		mg/kg dry	2.91	5.81	5	10/05/10 12:18	SW846 6010B	10I5294
Sodium	**1060**	J	mg/kg dry	581	1160	5	10/05/10 12:18	SW846 6010B	10I5294
Strontium	**615**	M8	mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	5.81	11.6	5	10/05/10 12:18	SW846 6010B	10I5294
Vanadium	**132**		mg/kg dry	11.6	23.2	5	10/05/10 12:18	SW846 6010B	10I5294
Zinc	**62.4**		mg/kg dry	23.2	58.1	5	10/05/10 12:18	SW846 6010B	10I5294

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-02 (KIF-RELIC CT-CA-070710 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**74.4**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-02 (KIF-RELIC CT-CA-070710 - Sediment) - cont. Sampled: 09/28/10 00:01									
Total Metals by EPA Method 6010B									
Aluminum	**43700**		mg/kg dry	66.9	134	5	10/05/10 12:40	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Arsenic	**58.5**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Barium	**1170**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Beryllium	**8.03**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Boron	**177**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.669	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Calcium	**24500**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Chromium	**66.4**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Cobalt	**30.4**		mg/kg dry	6.69	26.8	5	10/05/10 12:40	SW846 6010B	10I5294
Copper	**95.0**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Iron	**18200**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Lead	**39.1**		mg/kg dry	2.68	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Magnesium	**5940**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Manganese	**93.4**		mg/kg dry	6.69	20.1	5	10/05/10 12:40	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Nickel	**56.9**		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Potassium	**4910**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Silver	ND		mg/kg dry	3.35	6.69	5	10/05/10 12:40	SW846 6010B	10I5294
Sodium	**1370**		mg/kg dry	669	1340	5	10/05/10 12:40	SW846 6010B	10I5294
Strontium	**626**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	6.69	13.4	5	10/05/10 12:40	SW846 6010B	10I5294
Vanadium	**154**		mg/kg dry	13.4	26.8	5	10/05/10 12:40	SW846 6010B	10I5294
Zinc	**93.4**		mg/kg dry	26.8	66.9	5	10/05/10 12:40	SW846 6010B	10I5294

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTI2912-03 (KIF-RELIC CTLIME-CA-070710 - Sediment) Sampled: 09/28/10 00:01								
General Chemistry Parameters								
% Dry Solids	**76.5**		%	0.500	1	10/01/10 08:19	SW-846	10I5271

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

ANALYTICAL REPORT

Sample ID: NTI2912-03 (KIF-RELIC CTLIME-CA-070710 - Sediment) - cont. Sampled: 09/28/10 00:01

Total Metals by EPA Method 6010B

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**44000**		mg/kg dry	64.4	129	5	10/05/10 12:43	SW846 6010B	10I5294
Antimony	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Arsenic	**56.6**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Barium	**1110**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Beryllium	**7.86**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Boron	**166**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Cadmium	ND		mg/kg dry	0.644	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Calcium	**50000**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Chromium	**67.1**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Cobalt	**30.0**		mg/kg dry	6.44	25.8	5	10/05/10 12:43	SW846 6010B	10I5294
Copper	**91.5**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Iron	**18100**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Lead	**39.4**		mg/kg dry	2.58	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Magnesium	**6600**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Manganese	**93.3**		mg/kg dry	6.44	19.3	5	10/05/10 12:43	SW846 6010B	10I5294
Molybdenum	ND		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Nickel	**55.9**		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Potassium	**5290**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Selenium	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Silver	ND		mg/kg dry	3.22	6.44	5	10/05/10 12:43	SW846 6010B	10I5294
Sodium	**1380**		mg/kg dry	644	1290	5	10/05/10 12:43	SW846 6010B	10I5294
Strontium	**616**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294
Thallium	ND		mg/kg dry	6.44	12.9	5	10/05/10 12:43	SW846 6010B	10I5294
Vanadium	**150**		mg/kg dry	12.9	25.8	5	10/05/10 12:43	SW846 6010B	10I5294
Zinc	**93.8**		mg/kg dry	25.8	64.4	5	10/05/10 12:43	SW846 6010B	10I5294

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA Method 6010B							
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-01	0.53	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-02	0.50	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010
SW846 6010B	10I5294	NTI2912-03	0.51	100.00	10/01/10 07:54	ALJ	EPA 3051A/6010

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA Method 6010B						
10I5294-BLK1						
Aluminum	<9.58		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Antimony	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Arsenic	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Barium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Beryllium	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Boron	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Cadmium	<0.0958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Calcium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Chromium	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Cobalt	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Copper	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Iron	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Lead	<0.383		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Magnesium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Manganese	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Molybdenum	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Nickel	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Potassium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Selenium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Silver	<0.479		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Sodium	<95.8		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Strontium	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Thallium	<0.958		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Vanadium	<1.92		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12
Zinc	<3.83		mg/kg wet	10I5294	10I5294-BLK1	10/05/10 12:12

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Duplicate

Analyte	Orig. Val.	Duplicate	Q	Units	RPD	Limit	Batch	Sample Duplicated	% Rec.	Analyzed Date/Time
General Chemistry Parameters										
10I5271-DUP1										
% Dry Solids	95.1	95.0		%	0.07	20	10I5271	NTI2889-01		10/01/10 08:19

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Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA Method 6010B								
10I5294-BS1								
Aluminum	778	777		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Antimony	38.9	40.0		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Arsenic	19.5	19.0		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Barium	778	805		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Beryllium	19.5	19.0		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Boron	389	393		mg/kg wet	101%	80 - 120	10I5294	10/05/10 12:15
Cadmium	19.5	19.2		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Calcium	1950	1930		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Chromium	77.8	74.9		mg/kg wet	96%	80 - 120	10I5294	10/05/10 12:15
Cobalt	195	190		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Copper	97.3	95.2		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Iron	389	397		mg/kg wet	102%	80 - 120	10I5294	10/05/10 12:15
Lead	19.5	19.6		mg/kg wet	101%	80 - 120	10I5294	10/05/10 12:15
Magnesium	1950	1950		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Manganese	195	195		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Molybdenum	195	198		mg/kg wet	102%	80 - 120	10I5294	10/05/10 12:15
Nickel	195	201		mg/kg wet	103%	80 - 120	10I5294	10/05/10 12:15
Potassium	1950	1860		mg/kg wet	95%	80 - 120	10I5294	10/05/10 12:15
Selenium	19.5	19.2		mg/kg wet	99%	80 - 120	10I5294	10/05/10 12:15
Silver	19.5	19.3		mg/kg wet	99%	75 - 125	10I5294	10/05/10 12:15
Sodium	1950	1950		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Strontium	389	389		mg/kg wet	100%	80 - 120	10I5294	10/05/10 12:15
Thallium	19.5	19.2		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Vanadium	195	191		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15
Zinc	195	191		mg/kg wet	98%	80 - 120	10I5294	10/05/10 12:15

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTI2912
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike

Total Metals by EPA Method 6010B

10I5294-MS1

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Aluminum	37300	39600	MHA	mg/kg dry	948	238%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Antimony	ND	42.4		mg/kg dry	47.4	89%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Arsenic	30.8	49.2		mg/kg dry	23.7	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Barium	1290	1920	M8	mg/kg dry	948	67%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Beryllium	7.09	26.7		mg/kg dry	23.7	83%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Boron	177	563		mg/kg dry	474	81%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Cadmium	ND	18.5		mg/kg dry	23.7	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Calcium	28100	27800	MHA	mg/kg dry	2370	-12%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Chromium	54.2	126		mg/kg dry	94.8	76%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Cobalt	27.5	272		mg/kg dry	237	103%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Copper	68.3	166		mg/kg dry	118	82%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Iron	21400	21900		mg/kg dry	474	117%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Lead	25.6	57.3	M7	mg/kg dry	23.7	134%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Magnesium	6130	7600	M8	mg/kg dry	2370	62%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Manganese	86.2	279		mg/kg dry	237	81%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Molybdenum	ND	202		mg/kg dry	237	85%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Nickel	49.2	309		mg/kg dry	237	110%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Potassium	3340	5860		mg/kg dry	2370	106%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Selenium	ND	23.0		mg/kg dry	23.7	97%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Silver	ND	20.7		mg/kg dry	23.7	88%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Sodium	1060	3100		mg/kg dry	2370	86%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Strontium	615	976		mg/kg dry	474	76%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Thallium	ND	23.4		mg/kg dry	23.7	99%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Vanadium	132	317		mg/kg dry	237	78%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33
Zinc	62.4	266		mg/kg dry	237	86%	75 - 125	10I5294	NTI2912-01	10/05/10 12:33

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup

Total Metals by EPA Method 6010B

10I5294-MSD1

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Aluminum	37300	39800	MHA	mg/kg dry	971	257%	75 - 125	0.6	20	10I5294	NTI2912-01	10/05/10 12:36
Antimony	ND	42.8		mg/kg dry	48.5	88%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Arsenic	30.8	49.6		mg/kg dry	24.3	77%	75 - 125	0.8	20	10I5294	NTI2912-01	10/05/10 12:36
Barium	1290	1910	M8	mg/kg dry	971	64%	75 - 125	0.8	20	10I5294	NTI2912-01	10/05/10 12:36
Beryllium	7.09	27.1		mg/kg dry	24.3	82%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Boron	177	570		mg/kg dry	485	81%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Cadmium	ND	18.9		mg/kg dry	24.3	78%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Calcium	28100	27500	MHA	mg/kg dry	2430	-26%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Chromium	54.2	131		mg/kg dry	97.1	79%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Cobalt	27.5	273		mg/kg dry	243	101%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Copper	68.3	167		mg/kg dry	121	81%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Iron	21400	21600	M8	mg/kg dry	485	55%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Lead	25.6	56.1	M7	mg/kg dry	24.3	126%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Magnesium	6130	7550	M8	mg/kg dry	2430	59%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Manganese	86.2	284		mg/kg dry	243	82%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Molybdenum	ND	206		mg/kg dry	243	85%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Nickel	49.2	311		mg/kg dry	243	108%	75 - 125	0.7	20	10I5294	NTI2912-01	10/05/10 12:36
Potassium	3340	5720		mg/kg dry	2430	98%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Selenium	ND	23.7		mg/kg dry	24.3	98%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Silver	ND	21.3		mg/kg dry	24.3	88%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Sodium	1060	3150		mg/kg dry	2430	86%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Strontium	615	964	M8	mg/kg dry	485	72%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36
Thallium	ND	24.0		mg/kg dry	24.3	99%	75 - 125	3	20	10I5294	NTI2912-01	10/05/10 12:36
Vanadium	132	322		mg/kg dry	243	78%	75 - 125	2	20	10I5294	NTI2912-01	10/05/10 12:36
Zinc	62.4	268		mg/kg dry	243	85%	75 - 125	1	20	10I5294	NTI2912-01	10/05/10 12:36

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
none	Soil			
SW846 6010B	Soil	N/A	X	N/A
SW-846	Soil			

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTI2912
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA0928Y10A
Attn	William Rogers	Received:	09/29/10 09:55

DATA QUALIFIERS AND DEFINITIONS

J	Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
M7	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).
ND	Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECE

NTI2912

Cooler Received/Opened On 9/29/2010 @ 0955

1. Tracking # N/A

Courier: Off-Street IR Gun ID Raynger

2. Temperature of rep. sample or temp blank when opened: 1.9 *Degrees Celsius*
3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA
4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 front / back
5. Were the seals intact, signed, and dated correctly? YES...NO...NA
6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) VJ

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA
8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None
9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None
10. Did all containers arrive in good condition (unbroken)? YES...NO...NA
11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA
12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) M

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) VJ

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA
18. Did you sign the custody papers in the appropriate place? YES...NO...NA
19. Were correct containers used for the analysis requested? YES...NO...NA
20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) VJ

I certify that I attached a label with the unique LIMS number to each container (intial) VJ

21. Were there Non-Conformance issues at login? YES..NO Was a PIPE generated? YES...NO...#

Cooler 17 of 17

BIS = Broken in shipment

TENNESSEE VALLEY AUTHORI

NTI2912
10/06/10 23:59

-OF-CUSTODY / Analytical Request Document

...ain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Cooler # 1 of 17

COC # RSICA0928Y10A

RSICA0928Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Hamman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler	Patrick Lee
Sampling Company	TVA
Address:	
City/State	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_P1D_SEDIMENT (Filtered: N; Preserve: none)	SR_S (Filtered: N; Preserve: none)
1	KIF-AFA_122208-6-3-I-CA-122208	AFA	NA	NA	CA	G	N	09/28/2010	NA	1	1	X	X
2	KIF-RELIC_CT-CA-070710	RELIC	NA	NA	CA	G	N	09/28/2010	NA	1	2	X	X
3	KIF-RELIC_CTLIME-CA-070710	RELIC	NA	NA	CA	G	N	09/28/2010	NA	1	3	X	X
4													
5													
6													
7													
8													
9													
10													
11													
12													

DM092810

Additional Comments/Special Instructions:

Item 1: ash sample

Item 2: ash from Relic used for column test

Item 3: ash from Relic mixed with lime (collected 07/08/10) used for column test

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Patrick Lee / TVA	09/28/10	1458	RSI	9-28-10	1453
RSI	9-28-10	1725	TA	9/29/10	0915

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
	Y/N	Y/N	Y/N
1.9	Y/N (Y circled)	Y/N (Y circled)	Y/N (N circled)
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS COURIER FEDEX US MAIL Sonic

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Lee

SIGNATURE of SAMPLER: Patrick Lee DATE Signed 9/28/10 Time: 1444

COURIER TRANSPORT DOCUMENTATION

NTI2912
10/06/10 23:59

DATE: 09/29/10

COURIER COMPANY:

Sonic Subcontractor

From:	To:
TVA c/o David Mathis 189 Lakeshore Drive Harriman, TN 37748 865-202-8313	Test America-Nashville c/o Mark Hollingsworth 2960 Foster Creighton Drive Nashville, TN 37204 800-765-0980

No. of Items:	Description:
17	Cooler(s) taped and custody sealed.

Shippers Name/Company: David Mathis / RSI

Date / Time: 092910 / 0759

Courier Signature/Company: Denise Braswell Whirlwind

Date / Time: 092910 / 0759

Receipt Signature/Company: [signature] / TA

Date / Time: 9/29/10 0955 CST

Corresponding Chains of Custody:

- DISBP0927Y10A p. 1 of 1
- RSIGEO0927Y10A p. 1 of 1
- RSIGW0927Y10A p. 1 of 1
- NTCSW0928Y10A p. 1 of 1
- RSICA0928Y10A p. 1 of 1
- RSIGEO0928Y10A p. 1 of 1
- RSIGW0928Y10A p. 1 of 1
- RSISW0928Y10A p. 1 - 6

Document No. RPT-072A

Kingston Ash Recovery Project
Non-Time-Critical Removal Action
for the River System

Supplemental Ash Leaching Test Results

Tennessee Valley Authority

Revision	**Description**	**Date**
00	Draft for TVA review	March 8, 2011
01	Final Report	April 7, 2011

1 INTRODUCTION

This report is a supplement to the *Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System, Ash Leaching Test Report*, Document No. RAWP-072A, (Jacobs 2010), presenting results of the Monolith Leaching Tests (Method 1315).

Construction of the foundation stabilization around the perimeter of the Dredge Cell and Ash Pond may involve deep soil mixing (DSM) of cement with the subsurface and native soil materials. A monolith leaching test was conducted on core samples taken from soil-cement columns constructed during a Deep Soil Mixing Pilot Test. The soil-cement columns were prepared using 10% Portland cement by weight and using in-place field mixing techniques. Two core samples were collected for testing in mid-September 2010. Samples were DSM Column Core 1A (depth 30 feet [ft]), which contained 10% Portland cement by weight, and Column 10 Run 9 (depth 40 to 45 ft), which contained 7.5% Portland cement by weight.

Samples were prepared and tests conducted in accordance with Method 1315. Each core was placed in a container filled with reagent water (unbuffered deionized water) to give a liquid-to-surface area ratio of 9±1 milliliter per square centimeter. The leaching water was exchanged with fresh reagent water at the end of each of the nine leaching intervals. Water samples were taken at the end of each leaching period, nitric acid was added as a preservative, and analysis was done by TestAmerica Laboratories, Inc. in Nashville, Tennessee (results attached. A third container with only reagent water was included in the study, and these samples were treated the same as the core samples. A complete metals scan, including arsenic and selenium, was done on each sample. Samples were not analyzed for mercury.

The results of the monolith leaching tests are listed in Table 1 and are presented graphically in Figures 1 and 2. Arsenic leachate concentrations for Column Core 1A reached the highest levels for the 7 to 28 day leaching period, up to 58 micrograms per liter (µg/L); concentrations then decreased down to 25 µg/L for the final leaching period ending at 63 days. Arsenic concentrations for Column 10 were approximately 5 to 10 times lower than for Column Core 1A. The maximum concentration (58 µg/L) is less than the Toxicity Characteristic Leaching Procedure (TCLP) limit for arsenic (5,000 µg/L), but higher than its maximum contaminant level MCL (10 µg/L).

Table 1. Results of the Method 1315 Monolith Tests for Arsenic and Selenium

Cumulative Leaching Time (days)	Interval Duration (days)	Arsenic Concentration (µg/L)		Selenium Concentration (µg/L)	
		Column Core 1A	Column 10 Run 9	Column Core 1A	Column 10 Run 9
2 hr	2 hr	6.99	5.82	1.93	1.24
1	1	21.3	5.68	6.12	4.83
2	1	23.6	3.48	5.35	3.12
7	5	48.9	6.24	10.6	9.33
14	7	57.9	5.62	8.85	8.23
28	14	53.6	4.64	8.13	10.4
42	14	40.2	4.04	5.33	8.46
49	7	21.8	4.12	2.12	3.38
63	14	24.8	4.29	3.45	5.44

Selenium leachate concentrations were similar for both Column Core 1A and Column 10. Leaching concentrations were highest for the 7 to 28 day period, with concentrations decreasing for the later leaching periods. The maximum concentrations (10.6 µg/L for Column Core 1A and 10.4 µg/L for Column 10) are less than the TCLP limit for selenium (1,000 µg/L) and lower than its MCL (50 µg/L).

Figure 1. Results of Monolith Leaching Test – Arsenic

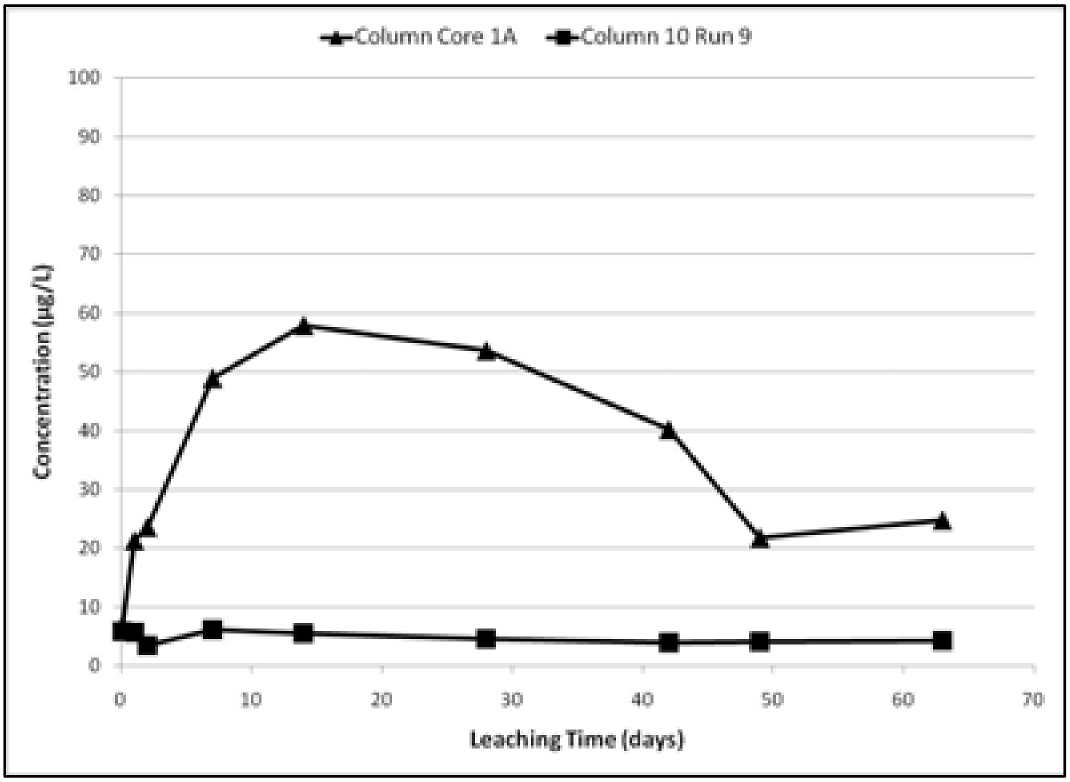
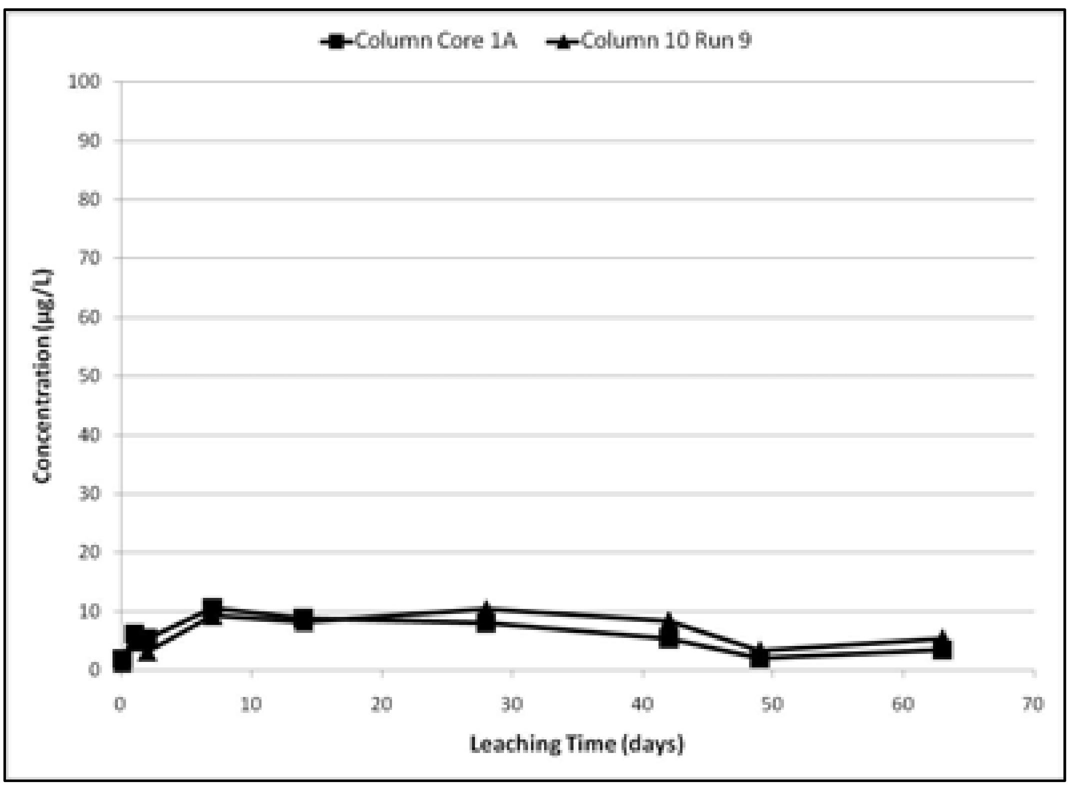


Figure 2. Results of Monolith Leaching Test – Selenium



Results of pH, conductivity, and oxidation-reduction potential measurements are shown in Table 2.

Table 2. Results of the Method 1315 Monolith Tests for pH, Conductivity, and Oxidation-Reduction Potential

Cumulative Leaching Time (days)	Interval Duration (days)	pH		Conductivity (µSiemens/cm)	
		Column Core 1A	Column 10 Run 9	Column Core 1A	Column 10 Run 9
2 hr	2 hr	8.73	10.08	126	80
1	1	9.60	10.72	192	244
2	1	8.84	10.65	200	163
7	5	9.97	11.11	265	194
14	7	10.23	11.12	155	420
28	14	10.40	11.13	193	478
42	14	9.94	11.00	162	333
49	7	10.03	10.70	95	207
63	14	10.15	10.92	106	256

Cumulative Leaching Time (days)	Interval Duration (days)	Oxidation-Reduction Potential (mV)	
		Column Core 1A	Column 10 Run 9
2 hr	2 hr	162	138
1	1	167	127
2	1	161	130
7	5	147	134
14	7	115	92
28	14	219	166
42	14	104	95
49	7	210	172
63	14	173	143

Notes:

cm = centimeter
mV = millivolt
µ = microgram

2 CONCLUSIONS

Results of the monolith leaching test indicate that leaching of arsenic from soil-cement may increase its concentration in the leachate, although results were inconsistent between the two tests. The higher arsenic concentrations initially observed in the Method 1315 test should not be environmentally detrimental, since these concentrations were transitory and subsequent arsenic levels decreased. Therefore, soil cement mixed at up to 10% Portland cement by weight is acceptable for use in constructing the soil-cement columns.

Results indicate that there is no effect on leaching of selenium from soil-cement.

TestAmerica Lab Reports

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

November 22, 2010 5:09:53PM

Client:	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Nbr:	RSICA1108Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#183781
		Date Received:	11/10/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-Monolith01_T1-LH-102510	NTK1248-01	10/25/10 13:40
KIF-Monolith01_T2-LH-102610	NTK1248-02	10/26/10 12:13
KIF-Monolith01_T3-LH-102710	NTK1248-03	10/27/10 14:43
KIF-Monolith01_T4-LH-110110	NTK1248-04	11/01/10 15:52
KIF-Monolith01_T5-LH-110810	NTK1248-05	11/08/10 11:11
KIF-Monolith02_T1-LH-102510	NTK1248-06	10/25/10 13:48
KIF-Monolith02_T2-LH-102610	NTK1248-07	10/26/10 12:20
KIF-Monolith02_T3-LH-102710	NTK1248-08	10/27/10 14:51
KIF-Monolith02_T4-LH-110110	NTK1248-09	11/01/10 15:59
KIF-Monolith02_T5-LH-110810	NTK1248-10	11/08/10 11:17
KIF-Monolith03_T1-LH-102510	NTK1248-11	10/25/10 13:55
KIF-Monolith03_T2-LH-102610	NTK1248-12	10/26/10 12:26
KIF-Monolith03_T3-LH-102710	NTK1248-13	10/27/10 14:56
KIF-Monolith03_T4-LH-110110	NTK1248-14	11/01/10 16:05
KIF-Monolith03_T5-LH-110810	NTK1248-15	11/08/10 11:19
KIF-Monolith_MatBlnk-A-MB-110810	NTK1248-16	11/08/10 14:59

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

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Tennessee Certification Number: 02008
The Chain(s) of Custody, 5 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Mark Hollingsworth

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

Program Manager - National Accounts

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTK1248-01 (KIF-Monolith01 T1-LH-102510 - Water) Sampled: 10/25/10 13:40									
Total Metals by EPA 200.8									
Antimony	**0.000550**	J	mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Arsenic	**0.00699**		mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 14:40	EPA 200.8	10K2066
Chromium	**0.000490**	J	mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Copper	**0.000780**	J	mg/L	0.000330	0.00500	1	11/15/10 14:40	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 14:40	EPA 200.8	10K2066
Molybdenum	**0.0168**		mg/L	0.000330	0.00500	1	11/15/10 14:40	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 14:40	EPA 200.8	10K2066
Selenium	**0.00193**	J	mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 14:40	EPA 200.8	10K2066
Vanadium	**0.00546**		mg/L	0.00100	0.00400	1	11/15/10 14:40	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 14:40	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	**0.284**		mg/L	0.0500	0.100	1	11/12/10 16:41	EPA 200.7	10K2065
Barium	**0.0128**		mg/L	0.0100	0.0100	1	11/12/10 16:41	EPA 200.7	10K2065
Boron	**0.0565**		mg/L	0.0125	0.0500	1	11/12/10 16:41	EPA 200.7	10K2065
Calcium	**3.17**		mg/L	0.500	1.00	1	11/12/10 16:41	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:41	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:41	EPA 200.7	10K2065
Potassium	**4.50**		mg/L	0.250	1.00	1	11/12/10 16:41	EPA 200.7	10K2065
Sodium	**1.17**		mg/L	0.250	1.00	1	11/12/10 16:41	EPA 200.7	10K2065
Strontium	**0.0324**	J	mg/L	0.0125	0.0500	1	11/12/10 16:41	EPA 200.7	10K2065
Sample ID: NTK1248-02 (KIF-Monolith01 T2-LH-102610 - Water) Sampled: 10/26/10 12:13									
Total Metals by EPA 200.8									
Antimony	**0.00219**		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Arsenic	**0.0213**		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 14:43	EPA 200.8	10K2066
Chromium	**0.00276**		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Copper	**0.00196**	J	mg/L	0.000330	0.00500	1	11/15/10 14:43	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 14:43	EPA 200.8	10K2066
Molybdenum	**0.0571**		mg/L	0.000330	0.00500	1	11/15/10 14:43	EPA 200.8	10K2066
Nickel	**0.000960**	J	mg/L	0.000330	0.00500	1	11/15/10 14:43	EPA 200.8	10K2066
Selenium	**0.00612**		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 14:43	EPA 200.8	10K2066
Vanadium	**0.0252**		mg/L	0.00100	0.00400	1	11/15/10 14:43	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 14:43	EPA 200.8	10K2066

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTK1248-02 (KIF-Monolith01 T2-LH-102610 - Water) - cont. Sampled: 10/26/10 12:13									
Total Metals by EPA Method 200.7									
Aluminum	**0.839**		mg/L	0.0500	0.100	1	11/12/10 16:44	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 16:44	EPA 200.7	10K2065
Boron	**0.182**		mg/L	0.0125	0.0500	1	11/12/10 16:44	EPA 200.7	10K2065
Calcium	**4.58**		mg/L	0.500	1.00	1	11/12/10 16:44	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:44	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:44	EPA 200.7	10K2065
Potassium	**15.1**		mg/L	0.250	1.00	1	11/12/10 16:44	EPA 200.7	10K2065
Sodium	**3.97**		mg/L	0.250	1.00	1	11/12/10 16:44	EPA 200.7	10K2065
Strontium	**0.0374**	J	mg/L	0.0125	0.0500	1	11/12/10 16:44	EPA 200.7	10K2065
Sample ID: NTK1248-03 (KIF-Monolith01 T3-LH-102710 - Water) Sampled: 10/27/10 14:43									
Total Metals by EPA 200.8									
Antimony	**0.00188**	J	mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Arsenic	**0.0236**		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 14:47	EPA 200.8	10K2066
Chromium	**0.00286**		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Copper	**0.00174**	J	mg/L	0.000330	0.00500	1	11/15/10 14:47	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 14:47	EPA 200.8	10K2066
Molybdenum	**0.0402**		mg/L	0.000330	0.00500	1	11/15/10 14:47	EPA 200.8	10K2066
Nickel	**0.000760**	J	mg/L	0.000330	0.00500	1	11/15/10 14:47	EPA 200.8	10K2066
Selenium	**0.00535**		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 14:47	EPA 200.8	10K2066
Vanadium	**0.0295**		mg/L	0.00100	0.00400	1	11/15/10 14:47	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 14:47	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	**1.00**		mg/L	0.0500	0.100	1	11/12/10 16:48	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 16:48	EPA 200.7	10K2065
Boron	**0.162**		mg/L	0.0125	0.0500	1	11/12/10 16:48	EPA 200.7	10K2065
Calcium	**4.50**		mg/L	0.500	1.00	1	11/12/10 16:48	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:48	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:48	EPA 200.7	10K2065
Potassium	**12.7**		mg/L	0.250	1.00	1	11/12/10 16:48	EPA 200.7	10K2065
Sodium	**3.08**		mg/L	0.250	1.00	1	11/12/10 16:48	EPA 200.7	10K2065
Strontium	**0.0340**	J	mg/L	0.0125	0.0500	1	11/12/10 16:48	EPA 200.7	10K2065

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Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTK1248-04 (KIF-Monolith01 T4-LH-110110 - Water) Sampled: 11/01/10 15:52									
Total Metals by EPA 200.8									
Antimony	**0.00388**		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Arsenic	**0.0489**		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 14:51	EPA 200.8	10K2066
Chromium	**0.00592**		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Copper	**0.00306**	J	mg/L	0.000330	0.00500	1	11/15/10 14:51	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 14:51	EPA 200.8	10K2066
Molybdenum	**0.0679**		mg/L	0.000330	0.00500	1	11/15/10 14:51	EPA 200.8	10K2066
Nickel	**0.00152**	J	mg/L	0.000330	0.00500	1	11/15/10 14:51	EPA 200.8	10K2066
Selenium	**0.0106**		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 14:51	EPA 200.8	10K2066
Vanadium	**0.0730**		mg/L	0.00100	0.00400	1	11/15/10 14:51	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 14:51	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	**1.93**		mg/L	0.0500	0.100	1	11/12/10 16:51	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 16:51	EPA 200.7	10K2065
Boron	**0.347**		mg/L	0.0125	0.0500	1	11/12/10 16:51	EPA 200.7	10K2065
Calcium	**8.07**		mg/L	0.500	1.00	1	11/12/10 16:51	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:51	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:51	EPA 200.7	10K2065
Potassium	**23.2**		mg/L	0.250	1.00	1	11/12/10 16:51	EPA 200.7	10K2065
Sodium	**5.78**		mg/L	0.250	1.00	1	11/12/10 16:51	EPA 200.7	10K2065
Strontium	**0.0565**		mg/L	0.0125	0.0500	1	11/12/10 16:51	EPA 200.7	10K2065
Sample ID: NTK1248-05 (KIF-Monolith01 T5-LH-110810 - Water) Sampled: 11/08/10 11:11									
Total Metals by EPA 200.8									
Antimony	**0.00369**		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Arsenic	**0.0579**		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 14:55	EPA 200.8	10K2066
Chromium	**0.00471**		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Copper	**0.00270**	J	mg/L	0.000330	0.00500	1	11/15/10 14:55	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 14:55	EPA 200.8	10K2066
Molybdenum	**0.0387**		mg/L	0.000330	0.00500	1	11/15/10 14:55	EPA 200.8	10K2066
Nickel	**0.00185**	J	mg/L	0.000330	0.00500	1	11/15/10 14:55	EPA 200.8	10K2066
Selenium	**0.00885**		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 14:55	EPA 200.8	10K2066
Vanadium	**0.0890**		mg/L	0.00100	0.00400	1	11/15/10 14:55	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 14:55	EPA 200.8	10K2066

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Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-05 (KIF-Monolith01 T5-LH-110810 - Water) - cont. Sampled: 11/08/10 11:11

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**2.52**		mg/L	0.0500	0.100	1	11/12/10 16:54	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 16:54	EPA 200.7	10K2065
Boron	**0.341**		mg/L	0.0125	0.0500	1	11/12/10 16:54	EPA 200.7	10K2065
Calcium	**7.78**		mg/L	0.500	1.00	1	11/12/10 16:54	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:54	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:54	EPA 200.7	10K2065
Potassium	**22.4**		mg/L	0.250	1.00	1	11/12/10 16:54	EPA 200.7	10K2065
Sodium	**4.91**		mg/L	0.250	1.00	1	11/12/10 16:54	EPA 200.7	10K2065
Strontium	**0.0549**		mg/L	0.0125	0.0500	1	11/12/10 16:54	EPA 200.7	10K2065

Sample ID: NTK1248-06 (KIF-Monolith02 T1-LH-102510 - Water) Sampled: 10/25/10 13:48

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Arsenic	**0.00582**		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:17	EPA 200.8	10K2066
Chromium	**0.00259**		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Copper	**0.00103**	J	mg/L	0.000330	0.00500	1	11/15/10 15:17	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:17	EPA 200.8	10K2066
Molybdenum	**0.0113**		mg/L	0.000330	0.00500	1	11/15/10 15:17	EPA 200.8	10K2066
Nickel	**0.000340**	J	mg/L	0.000330	0.00500	1	11/15/10 15:17	EPA 200.8	10K2066
Selenium	**0.00124**	J	mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:17	EPA 200.8	10K2066
Vanadium	**0.00443**		mg/L	0.00100	0.00400	1	11/15/10 15:17	EPA 200.8	10K2066
Zinc	**0.0154**	J, B	mg/L	0.00830	0.0500	1	11/15/10 15:17	EPA 200.8	10K2066

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**0.899**		mg/L	0.0500	0.100	1	11/12/10 16:57	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 16:57	EPA 200.7	10K2065
Boron	**0.0285**	J	mg/L	0.0125	0.0500	1	11/12/10 16:57	EPA 200.7	10K2065
Calcium	**1.26**		mg/L	0.500	1.00	1	11/12/10 16:57	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 16:57	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 16:57	EPA 200.7	10K2065
Potassium	**8.14**		mg/L	0.250	1.00	1	11/12/10 16:57	EPA 200.7	10K2065
Sodium	**1.62**		mg/L	0.250	1.00	1	11/12/10 16:57	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 16:57	EPA 200.7	10K2065

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-07 (KIF-Monolith02 T2-LH-102610 - Water) Sampled: 10/26/10 12:20

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000410**	J	mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Arsenic	**0.00568**		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:20	EPA 200.8	10K2066
Chromium	**0.00299**		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Copper	**0.00163**	J	mg/L	0.000330	0.00500	1	11/15/10 15:20	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:20	EPA 200.8	10K2066
Molybdenum	**0.0546**		mg/L	0.000330	0.00500	1	11/15/10 15:20	EPA 200.8	10K2066
Nickel	**0.000760**	J	mg/L	0.000330	0.00500	1	11/15/10 15:20	EPA 200.8	10K2066
Selenium	**0.00483**		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:20	EPA 200.8	10K2066
Vanadium	**0.0108**		mg/L	0.00100	0.00400	1	11/15/10 15:20	EPA 200.8	10K2066
Zinc	**0.0417**	J, B	mg/L	0.00830	0.0500	1	11/15/10 15:20	EPA 200.8	10K2066

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**3.00**		mg/L	0.0500	0.100	1	11/12/10 17:00	EPA 200.7	10K2065
Barium	**0.0102**		mg/L	0.0100	0.0100	1	11/12/10 17:00	EPA 200.7	10K2065
Boron	**0.0465**	J	mg/L	0.0125	0.0500	1	11/12/10 17:00	EPA 200.7	10K2065
Calcium	**8.60**		mg/L	0.500	1.00	1	11/12/10 17:00	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:00	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:00	EPA 200.7	10K2065
Potassium	**28.1**		mg/L	0.250	1.00	1	11/12/10 17:00	EPA 200.7	10K2065
Sodium	**5.15**		mg/L	0.250	1.00	1	11/12/10 17:00	EPA 200.7	10K2065
Strontium	**0.0922**		mg/L	0.0125	0.0500	1	11/12/10 17:00	EPA 200.7	10K2065

Sample ID: NTK1248-08 (KIF-Monolith02 T3-LH-102710 - Water) Sampled: 10/27/10 14:51

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Arsenic	**0.00348**		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:24	EPA 200.8	10K2066
Chromium	**0.00155**	J	mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Copper	**0.00118**	J	mg/L	0.000330	0.00500	1	11/15/10 15:24	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:24	EPA 200.8	10K2066
Molybdenum	**0.0328**		mg/L	0.000330	0.00500	1	11/15/10 15:24	EPA 200.8	10K2066
Nickel	**0.000410**	J	mg/L	0.000330	0.00500	1	11/15/10 15:24	EPA 200.8	10K2066
Selenium	**0.00312**		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:24	EPA 200.8	10K2066
Vanadium	**0.00668**		mg/L	0.00100	0.00400	1	11/15/10 15:24	EPA 200.8	10K2066
Zinc	**0.0227**	J, B	mg/L	0.00830	0.0500	1	11/15/10 15:24	EPA 200.8	10K2066

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-08 (KIF-Monolith02 T3-LH-102710 - Water) - cont. Sampled: 10/27/10 14:51

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**2.05**		mg/L	0.0500	0.100	1	11/12/10 17:15	EPA 200.7	10K2065
Barium	**0.0101**		mg/L	0.0100	0.0100	1	11/12/10 17:15	EPA 200.7	10K2065
Boron	**0.0326**	J	mg/L	0.0125	0.0500	1	11/12/10 17:15	EPA 200.7	10K2065
Calcium	**9.78**		mg/L	0.500	1.00	1	11/12/10 17:15	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:15	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:15	EPA 200.7	10K2065
Potassium	**17.0**		mg/L	0.250	1.00	1	11/12/10 17:15	EPA 200.7	10K2065
Sodium	**2.96**		mg/L	0.250	1.00	1	11/12/10 17:15	EPA 200.7	10K2065
Strontium	**0.0966**		mg/L	0.0125	0.0500	1	11/12/10 17:15	EPA 200.7	10K2065

Sample ID: NTK1248-09 (KIF-Monolith02 T4-LH-110110 - Water) Sampled: 11/01/10 15:59

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000660**	J	mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Arsenic	**0.00624**		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:28	EPA 200.8	10K2066
Chromium	**0.00446**		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Copper	**0.00260**	J	mg/L	0.000330	0.00500	1	11/15/10 15:28	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:28	EPA 200.8	10K2066
Molybdenum	**0.0873**		mg/L	0.000330	0.00500	1	11/15/10 15:28	EPA 200.8	10K2066
Nickel	**0.00135**	J	mg/L	0.000330	0.00500	1	11/15/10 15:28	EPA 200.8	10K2066
Selenium	**0.00933**		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:28	EPA 200.8	10K2066
Vanadium	**0.0177**		mg/L	0.00100	0.00400	1	11/15/10 15:28	EPA 200.8	10K2066
Zinc	**0.0365**	J, B	mg/L	0.00830	0.0500	1	11/15/10 15:28	EPA 200.8	10K2066

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**5.28**		mg/L	0.0500	0.100	1	11/12/10 17:18	EPA 200.7	10K2065
Barium	**0.0195**		mg/L	0.0100	0.0100	1	11/12/10 17:18	EPA 200.7	10K2065
Boron	**0.0689**		mg/L	0.0125	0.0500	1	11/12/10 17:18	EPA 200.7	10K2065
Calcium	**27.4**		mg/L	0.500	1.00	1	11/12/10 17:18	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:18	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:18	EPA 200.7	10K2065
Potassium	**37.9**		mg/L	0.250	1.00	1	11/12/10 17:18	EPA 200.7	10K2065
Sodium	**6.74**		mg/L	0.250	1.00	1	11/12/10 17:18	EPA 200.7	10K2065
Strontium	**0.249**		mg/L	0.0125	0.0500	1	11/12/10 17:18	EPA 200.7	10K2065

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-10 (KIF-Monolith02 T5-LH-110810 - Water) Sampled: 11/08/10 11:17

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.000640**	J	mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Arsenic	**0.00562**		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:32	EPA 200.8	10K2066
Chromium	**0.00430**		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Copper	**0.00212**	J	mg/L	0.000330	0.00500	1	11/15/10 15:32	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:32	EPA 200.8	10K2066
Molybdenum	**0.0614**		mg/L	0.000330	0.00500	1	11/15/10 15:32	EPA 200.8	10K2066
Nickel	**0.000990**	J	mg/L	0.000330	0.00500	1	11/15/10 15:32	EPA 200.8	10K2066
Selenium	**0.00823**		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:32	EPA 200.8	10K2066
Vanadium	**0.0179**		mg/L	0.00100	0.00400	1	11/15/10 15:32	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:32	EPA 200.8	10K2066

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	**5.04**		mg/L	0.0500	0.100	1	11/12/10 17:21	EPA 200.7	10K2065
Barium	**0.0197**		mg/L	0.0100	0.0100	1	11/12/10 17:21	EPA 200.7	10K2065
Boron	**0.0641**		mg/L	0.0125	0.0500	1	11/12/10 17:21	EPA 200.7	10K2065
Calcium	**31.8**		mg/L	0.500	1.00	1	11/12/10 17:21	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:21	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:21	EPA 200.7	10K2065
Potassium	**28.7**		mg/L	0.250	1.00	1	11/12/10 17:21	EPA 200.7	10K2065
Sodium	**4.64**		mg/L	0.250	1.00	1	11/12/10 17:21	EPA 200.7	10K2065
Strontium	**0.275**		mg/L	0.0125	0.0500	1	11/12/10 17:21	EPA 200.7	10K2065

Sample ID: NTK1248-11 (KIF-Monolith03 T1-LH-102510 - Water) Sampled: 10/25/10 13:55

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:35	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 15:35	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:35	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 15:35	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 15:35	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:35	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 15:35	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:35	EPA 200.8	10K2066

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTK1248-11 (KIF-Monolith03 T1-LH-102510 - Water) - cont. Sampled: 10/25/10 13:55									
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:24	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:24	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:24	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:24	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:24	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:24	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:24	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:24	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:24	EPA 200.7	10K2065
Sample ID: NTK1248-12 (KIF-Monolith03 T2-LH-102610 - Water) Sampled: 10/26/10 12:26									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:39	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 15:39	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:39	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 15:39	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 15:39	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:39	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 15:39	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:39	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:28	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:28	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:28	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:28	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:28	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:28	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:28	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:28	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:28	EPA 200.7	10K2065

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-13 (KIF-Monolith03 T3-LH-102710 - Water) Sampled: 10/27/10 14:56

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:43	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 15:43	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:43	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 15:43	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 15:43	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:43	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 15:43	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:43	EPA 200.8	10K2066

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:31	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:31	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:31	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:31	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:31	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:31	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:31	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:31	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:31	EPA 200.7	10K2065

Sample ID: NTK1248-14 (KIF-Monolith03 T4-LH-110110 - Water) Sampled: 11/01/10 16:05

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:46	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 15:46	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:46	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 15:46	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 15:46	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:46	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 15:46	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:46	EPA 200.8	10K2066

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTK1248-14 (KIF-Monolith03 T4-LH-110110 - Water) - cont. Sampled: 11/01/10 16:05									
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:34	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:34	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:34	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:34	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:34	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:34	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:34	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:34	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:34	EPA 200.7	10K2065
Sample ID: NTK1248-15 (KIF-Monolith03 T5-LH-110810 - Water) Sampled: 11/08/10 11:19									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 15:50	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 15:50	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 15:50	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 15:50	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 15:50	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 15:50	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 15:50	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 15:50	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:37	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:37	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:37	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:37	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:37	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:37	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:37	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:37	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:37	EPA 200.7	10K2065

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

ANALYTICAL REPORT

Sample ID: NTK1248-16 (KIF-Monolith MatBlnk-A-MB-110810 - Water) Sampled: 11/08/10 14:59

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Arsenic	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Beryllium	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Cadmium	ND		mg/L	0.000330	0.00100	1	11/15/10 16:01	EPA 200.8	10K2066
Chromium	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Cobalt	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Copper	ND		mg/L	0.000330	0.00500	1	11/15/10 16:01	EPA 200.8	10K2066
Lead	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Manganese	ND		mg/L	0.000330	0.00500	1	11/15/10 16:01	EPA 200.8	10K2066
Molybdenum	ND		mg/L	0.000330	0.00500	1	11/15/10 16:01	EPA 200.8	10K2066
Nickel	ND		mg/L	0.000330	0.00500	1	11/15/10 16:01	EPA 200.8	10K2066
Selenium	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Silver	ND		mg/L	0.000330	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Thallium	ND		mg/L	0.000500	0.00200	1	11/15/10 16:01	EPA 200.8	10K2066
Vanadium	ND		mg/L	0.00100	0.00400	1	11/15/10 16:01	EPA 200.8	10K2066
Zinc	ND		mg/L	0.00830	0.0500	1	11/15/10 16:01	EPA 200.8	10K2066
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	11/12/10 17:40	EPA 200.7	10K2065
Barium	ND		mg/L	0.0100	0.0100	1	11/12/10 17:40	EPA 200.7	10K2065
Boron	ND		mg/L	0.0125	0.0500	1	11/12/10 17:40	EPA 200.7	10K2065
Calcium	ND		mg/L	0.500	1.00	1	11/12/10 17:40	EPA 200.7	10K2065
Iron	ND		mg/L	0.0250	0.0500	1	11/12/10 17:40	EPA 200.7	10K2065
Magnesium	ND		mg/L	0.250	1.00	1	11/12/10 17:40	EPA 200.7	10K2065
Potassium	ND		mg/L	0.250	1.00	1	11/12/10 17:40	EPA 200.7	10K2065
Sodium	ND		mg/L	0.250	1.00	1	11/12/10 17:40	EPA 200.7	10K2065
Strontium	ND		mg/L	0.0125	0.0500	1	11/12/10 17:40	EPA 200.7	10K2065

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.8

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
EPA 200.8	10K2066	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-01	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-02	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-03	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-04	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-05	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-06	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-07	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-08	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-09	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-10	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-11	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-12	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-13	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-14	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-15	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7
EPA 200.7	10K2065	NTK1248-16	50.00	50.00	11/11/10 14:06	MET	EPA 200.7

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10K2066-BLK1						
Antimony	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Arsenic	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Beryllium	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Cadmium	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Chromium	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Cobalt	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Copper	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Lead	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Manganese	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Molybdenum	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Nickel	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Selenium	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Silver	<0.000330		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Thallium	<0.000500		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Vanadium	<0.00100		mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Zinc	0.0165	J	mg/L	10K2066	10K2066-BLK1	11/15/10 14:25
Total Metals by EPA Method 200.7						
10K2065-BLK1						
Aluminum	<0.0500		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Barium	<0.0100		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Boron	<0.0125		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Calcium	<0.500		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Iron	<0.0250		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Magnesium	<0.250		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Potassium	<0.250		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Sodium	<0.250		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14
Strontium	<0.0125		mg/L	10K2065	10K2065-BLK1	11/12/10 16:14

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10K2066-BS1								
Antimony	0.100	0.0970		mg/L	97%	85 - 115	10K2066	11/15/10 14:21
Arsenic	0.100	0.0959		mg/L	96%	85 - 115	10K2066	11/15/10 14:21
Beryllium	0.100	0.0916		mg/L	92%	85 - 115	10K2066	11/15/10 14:21
Cadmium	0.100	0.101		mg/L	101%	85 - 115	10K2066	11/15/10 14:21
Chromium	0.100	0.0983		mg/L	98%	85 - 115	10K2066	11/15/10 14:21
Cobalt	0.100	0.102		mg/L	102%	85 - 115	10K2066	11/15/10 14:21
Copper	0.100	0.102		mg/L	102%	85 - 115	10K2066	11/15/10 14:21
Lead	0.100	0.0970		mg/L	97%	85 - 115	10K2066	11/15/10 14:21
Manganese	0.100	0.0971		mg/L	97%	85 - 115	10K2066	11/15/10 14:21
Molybdenum	0.100	0.0995		mg/L	100%	85 - 115	10K2066	11/15/10 14:21
Nickel	0.100	0.102		mg/L	102%	85 - 115	10K2066	11/15/10 14:21
Selenium	0.100	0.0928		mg/L	93%	85 - 115	10K2066	11/15/10 14:21
Silver	0.100	0.106		mg/L	106%	85 - 115	10K2066	11/15/10 14:21
Thallium	0.100	0.0932		mg/L	93%	85 - 115	10K2066	11/15/10 14:21
Vanadium	0.100	0.100		mg/L	100%	85 - 115	10K2066	11/15/10 14:21
Zinc	0.100	0.106	B	mg/L	106%	85 - 115	10K2066	11/15/10 14:21
Total Metals by EPA Method 200.7								
10K2065-BS1								
Aluminum	2.00	2.05		mg/L	102%	85 - 115	10K2065	11/12/10 16:17
Barium	2.00	2.12		mg/L	106%	85 - 115	10K2065	11/12/10 16:17
Boron	1.00	1.04		mg/L	104%	85 - 115	10K2065	11/12/10 16:17
Calcium	5.00	5.10		mg/L	102%	85 - 115	10K2065	11/12/10 16:17
Iron	1.00	1.01		mg/L	101%	85 - 115	10K2065	11/12/10 16:17
Magnesium	5.00	5.10		mg/L	102%	85 - 115	10K2065	11/12/10 16:17
Potassium	5.00	4.86		mg/L	97%	85 - 115	10K2065	11/12/10 16:17
Sodium	5.00	5.16		mg/L	103%	85 - 115	10K2065	11/12/10 16:17
Strontium	1.00	1.03		mg/L	103%	85 - 115	10K2065	11/12/10 16:17

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA 200.8										
10K2066-MS1										
Antimony	0.00419	0.102		mg/L	0.100	98%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Arsenic	0.0702	0.163		mg/L	0.100	93%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Beryllium	ND	0.0943		mg/L	0.100	94%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Cadmium	ND	0.0964		mg/L	0.100	96%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Chromium	0.00196	0.100		mg/L	0.100	98%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Cobalt	0.00132	0.0992		mg/L	0.100	98%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Copper	0.00493	0.101		mg/L	0.100	96%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Lead	0.00270	0.101		mg/L	0.100	98%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Manganese	0.115	0.208		mg/L	0.100	93%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Molybdenum	0.0356	0.133		mg/L	0.100	97%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Nickel	0.00255	0.0998		mg/L	0.100	97%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Selenium	0.00861	0.0976		mg/L	0.100	89%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Silver	ND	0.100		mg/L	0.100	100%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Thallium	ND	0.0958		mg/L	0.100	96%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Vanadium	0.0811	0.179		mg/L	0.100	98%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
Zinc	0.0143	0.110	B	mg/L	0.100	96%	75 - 125	10K2066	NTK1047-01	11/15/10 14:32
10K2066-MS2										
Antimony	0.00278	0.102		mg/L	0.100	100%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Arsenic	0.0449	0.140		mg/L	0.100	95%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Beryllium	ND	0.0952		mg/L	0.100	95%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Cadmium	ND	0.0970		mg/L	0.100	97%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Chromium	0.000930	0.0989		mg/L	0.100	98%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Cobalt	0.000560	0.0977		mg/L	0.100	97%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Copper	0.00224	0.0972		mg/L	0.100	95%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Lead	0.000960	0.0993		mg/L	0.100	98%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Manganese	0.0700	0.166		mg/L	0.100	96%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Molybdenum	0.0313	0.130		mg/L	0.100	98%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Nickel	0.00109	0.0971		mg/L	0.100	96%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Selenium	0.00597	0.0991		mg/L	0.100	93%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Silver	ND	0.101		mg/L	0.100	101%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Thallium	ND	0.0957		mg/L	0.100	96%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Vanadium	0.0447	0.145		mg/L	0.100	100%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Zinc	ND	0.110	B	mg/L	0.100	110%	75 - 125	10K2066	NTK1308-02	11/15/10 16:13
Total Metals by EPA Method 200.7										
10K2065-MS1										
Aluminum	1.79	4.52	M7	mg/L	2.00	136%	70 - 130	10K2065	NTK1047-01	11/12/10 16:35

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA
Matrix Spike - Cont.

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA Method 200.7										
10K2065-MS1										
Barium	0.128	2.27		mg/L	2.00	107%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Boron	0.478	1.54		mg/L	1.00	106%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Calcium	48.1	52.4		mg/L	5.00	87%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Iron	0.680	1.90		mg/L	1.00	122%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Magnesium	12.9	17.7		mg/L	5.00	96%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Potassium	2.39	7.38		mg/L	5.00	100%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Sodium	2.24	7.56		mg/L	5.00	106%	75 - 125	10K2065	NTK1047-01	11/12/10 16:35
Strontium	0.573	1.62		mg/L	1.00	104%	70 - 130	10K2065	NTK1047-01	11/12/10 16:35
10K2065-MS2										
Aluminum	0.843	3.08		mg/L	2.00	112%	70 - 130	10K2065	NTK1308-02	11/12/10 18:02
Barium	0.102	2.20		mg/L	2.00	105%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Boron	0.397	1.45		mg/L	1.00	105%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Calcium	42.8	47.4		mg/L	5.00	93%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Iron	0.283	1.36		mg/L	1.00	107%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Magnesium	13.4	18.1		mg/L	5.00	95%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Potassium	1.90	6.78		mg/L	5.00	97%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Sodium	1.96	7.18		mg/L	5.00	104%	75 - 125	10K2065	NTK1308-02	11/12/10 18:02
Strontium	0.439	1.47		mg/L	1.00	103%	70 - 130	10K2065	NTK1308-02	11/12/10 18:02

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA

Matrix Spike Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10K2066-MSD1												
Antimony	0.00419	0.101		mg/L	0.100	97%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Arsenic	0.0702	0.162		mg/L	0.100	92%	75 - 125	0.6	20	10K2066	NTK1047-01	11/15/10 14:36
Beryllium	ND	0.0930		mg/L	0.100	93%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Cadmium	ND	0.0953		mg/L	0.100	95%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Chromium	0.00196	0.0990		mg/L	0.100	97%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Cobalt	0.00132	0.0978		mg/L	0.100	97%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Copper	0.00493	0.100		mg/L	0.100	95%	75 - 125	0.9	20	10K2066	NTK1047-01	11/15/10 14:36
Lead	0.00270	0.101		mg/L	0.100	98%	75 - 125	0.1	20	10K2066	NTK1047-01	11/15/10 14:36
Manganese	0.115	0.206		mg/L	0.100	91%	75 - 125	0.9	20	10K2066	NTK1047-01	11/15/10 14:36
Molybdenum	0.0356	0.132		mg/L	0.100	96%	75 - 125	0.8	20	10K2066	NTK1047-01	11/15/10 14:36
Nickel	0.00255	0.0977		mg/L	0.100	95%	75 - 125	2	20	10K2066	NTK1047-01	11/15/10 14:36
Selenium	0.00861	0.0972		mg/L	0.100	89%	75 - 125	0.3	20	10K2066	NTK1047-01	11/15/10 14:36
Silver	ND	0.0991		mg/L	0.100	99%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Thallium	ND	0.0969		mg/L	0.100	97%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
Vanadium	0.0811	0.178		mg/L	0.100	97%	75 - 125	0.3	20	10K2066	NTK1047-01	11/15/10 14:36
Zinc	0.0143	0.109	B	mg/L	0.100	94%	75 - 125	1	20	10K2066	NTK1047-01	11/15/10 14:36
10K2066-MSD2												
Antimony	0.00278	0.103		mg/L	0.100	100%	75 - 125	0.6	20	10K2066	NTK1308-02	11/15/10 16:16
Arsenic	0.0449	0.143		mg/L	0.100	98%	75 - 125	2	20	10K2066	NTK1308-02	11/15/10 16:16
Beryllium	ND	0.0956		mg/L	0.100	96%	75 - 125	0.4	20	10K2066	NTK1308-02	11/15/10 16:16
Cadmium	ND	0.0979		mg/L	0.100	98%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Chromium	0.000930	0.0976		mg/L	0.100	97%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Cobalt	0.000560	0.0966		mg/L	0.100	96%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Copper	0.00224	0.0960		mg/L	0.100	94%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Lead	0.000960	0.0996		mg/L	0.100	99%	75 - 125	0.3	20	10K2066	NTK1308-02	11/15/10 16:16
Manganese	0.0700	0.164		mg/L	0.100	94%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Molybdenum	0.0313	0.130		mg/L	0.100	99%	75 - 125	0.7	20	10K2066	NTK1308-02	11/15/10 16:16
Nickel	0.00109	0.0957		mg/L	0.100	95%	75 - 125	1	20	10K2066	NTK1308-02	11/15/10 16:16
Selenium	0.00597	0.100		mg/L	0.100	94%	75 - 125	0.9	20	10K2066	NTK1308-02	11/15/10 16:16
Silver	ND	0.102		mg/L	0.100	102%	75 - 125	0.8	20	10K2066	NTK1308-02	11/15/10 16:16
Thallium	ND	0.0974		mg/L	0.100	97%	75 - 125	2	20	10K2066	NTK1308-02	11/15/10 16:16
Vanadium	0.0447	0.143		mg/L	0.100	98%	75 - 125	2	20	10K2066	NTK1308-02	11/15/10 16:16
Zinc	ND	0.110	B	mg/L	0.100	110%	75 - 125	0.9	20	10K2066	NTK1308-02	11/15/10 16:16
Total Metals by EPA Method 200.7												
10K2065-MSD1												
Aluminum	1.79	4.47	M7	mg/L	2.00	134%	70 - 130	1	20	10K2065	NTK1047-01	11/12/10 16:38
Barium	0.128	2.27		mg/L	2.00	107%	75 - 125	0.2	20	10K2065	NTK1047-01	11/12/10 16:38
Boron	0.478	1.53		mg/L	1.00	105%	75 - 125	0.5	20	10K2065	NTK1047-01	11/12/10 16:38
Calcium	48.1	52.4		mg/L	5.00	87%	75 - 125	0	20	10K2065	NTK1047-01	11/12/10 16:38

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THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

PROJECT QUALITY CONTROL DATA

Matrix Spike Dup - Cont.

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA Method 200.7												
10K2065-MSD1												
Iron	0.680	1.88		mg/L	1.00	120%	75 - 125	0.7	20	10K2065	NTK1047-01	11/12/10 16:38
Magnesium	12.9	17.8		mg/L	5.00	97%	75 - 125	0.3	20	10K2065	NTK1047-01	11/12/10 16:38
Potassium	2.39	7.38		mg/L	5.00	100%	75 - 125	0.1	20	10K2065	NTK1047-01	11/12/10 16:38
Sodium	2.24	7.58		mg/L	5.00	107%	75 - 125	0.3	20	10K2065	NTK1047-01	11/12/10 16:38
Strontium	0.573	1.62		mg/L	1.00	104%	70 - 130	0	20	10K2065	NTK1047-01	11/12/10 16:38
10K2065-MSD2												
Aluminum	0.843	3.12		mg/L	2.00	114%	70 - 130	1	20	10K2065	NTK1308-02	11/12/10 18:05
Barium	0.102	2.23		mg/L	2.00	106%	75 - 125	1	20	10K2065	NTK1308-02	11/12/10 18:05
Boron	0.397	1.44		mg/L	1.00	104%	75 - 125	0.6	20	10K2065	NTK1308-02	11/12/10 18:05
Calcium	42.8	47.3		mg/L	5.00	89%	75 - 125	0.3	20	10K2065	NTK1308-02	11/12/10 18:05
Iron	0.283	1.35		mg/L	1.00	107%	75 - 125	0.4	20	10K2065	NTK1308-02	11/12/10 18:05
Magnesium	13.4	18.1		mg/L	5.00	94%	75 - 125	0.1	20	10K2065	NTK1308-02	11/12/10 18:05
Potassium	1.90	6.76		mg/L	5.00	97%	75 - 125	0.3	20	10K2065	NTK1308-02	11/12/10 18:05
Sodium	1.96	7.12		mg/L	5.00	103%	75 - 125	0.8	20	10K2065	NTK1308-02	11/12/10 18:05
Strontium	0.439	1.46		mg/L	1.00	102%	70 - 130	0.6	20	10K2065	NTK1308-02	11/12/10 18:05

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTK1248
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTK1248
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1108Y10A
Attn	William Rogers	Received:	11/10/10 08:15

DATA QUALIFIERS AND DEFINITIONS

B Analyte was detected in the associated Method Blank.

J Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

M7 The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).

ND Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TENNESSEE VALLEY AUTHORITY

NTK1248
11/17/10 23:59

:TODY / Analytical Request Document
:GAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 1 of 2
Cooler # 1 of 1

COC # RSICA1108Y10A

RSICA1108Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name:	Test America Nashville	Site ID #:	KIF	Sampler	
Address:	2960 Foster Creighton Drive Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	
		Site Address	714 Swan Pond Rd	Address:	
Lab PM:	Mark Hollingsworth	City	Harriman	City/State / Phone #	
		State, Zip		Reimbursement project? / Non-reimbursement project?	Mark one
Phone/Fax:	800.765.0980	Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax	865-717-1627	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email:	wjrogers@tva.gov	CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

Analysis: METALS_TVA_SW_TOTAL

PAP 11/9/10

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-MONOLITH01_T1-LH-102510	DSMPILOT_COL1A			LH		N	10/25/2010	13 40	1	1	X
2	KIF-MONOLITH01_T2-LH-102610	DSMPILOT_COL1A			LH		N	10/26/2010	12 13	1	2	X
3	KIF-MONOLITH01_T3-LH-102710	DSMPILOT_COL1A			LH		N	10/27/2010	14 43	1	3	X
4	KIF-MONOLITH01_T4-LH-110110	DSMPILOT_COL1A			LH		N	11/01/2010	15 52	1	4	X
5	KIF-MONOLITH01_T5-LH-110810	DSMPILOT_COL1A			LH		N	11/08/2010	11 11 PAP 11/9/10	1	5	X
6	KIF-MONOLITH02_T1-LH-102510	DSMPILOT_COL10			LH		N	10/25/2010	13 48	1	6	X
7	KIF-MONOLITH02_T2-LH-102610	DSMPILOT_COL1A			LH		N	10/26/2010	12 20	1	7	X
8	KIF-MONOLITH02_T3-LH-102710	DSMPILOT_COL1A			LH		N	10/27/2010	14 51	1	8	X
9	KIF-MONOLITH02_T4-LH-110110	DSMPILOT_COL1A			LH		N	11/01/2010	15 59	1	9	X
10	KIF-MONOLITH02_T5-LH-110810	DSMPILOT_COL1A			LH		N	11/08/2010	11 17 PAP 11/9/10	1	10	X
11	KIF-MONOLITH03_T1-LH-102510				A		LCB	10/25/2010	13 55	1	11	X
12	KIF-MONOLITH03_T2-LH-102610				A		LCB	10/26/2010	12 28	1	12	X

Additional Comments/Special Instructions:

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
X Investigatory	Paul A. Pier 11/9/2010		10:18 am		11/10/10	0815	1.0	Y/N	Y/N	Y/N
Split Comparison								Y/N	Y/N	Y/N
Split Legal								Y/N	Y/N	Y/N
Special Study								Y/N	Y/N	Y/N
Plant Ops							Temp in OC	Samples on Ice?	Sample Intact?	Trip Blank?
Oth:										

SHIPPING METHOD (mark as appropriate): UPS COURIER \ FEDEX US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: 11/9/2010 Time: 10:18 am

Environmental Standards, Inc-LastUpdated-031609

TENNESSEE VALLEY AUTHORITY

NTK1248
11/17/10 23:59

N-OF-CUSTODY / Analytical Request Document

of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 2 of 2
Cooler # 1 of 1

COC # RSICA1108Y10A

RSICA1108Y10A

Required Ship to Lab:

Lab Name:	Test America Nashville
Address:	2960 Foster Creighton Drive Nashville, TN 37204
Lab PM:	Mark Hollingsworth
Phone/Fax:	800.765.0980
Lab PM email:	
Applicable Lab Quote #:	

Required Project Information:

Site ID #:	KIF
Project #:	Kingston Fossil Plant
Site Address:	714 Swan Pond Rd
City:	Harriman
State, Zip:	
Site PM Name:	Bill Rogers
Phone/Fax:	865-717-1627
Site PM Email:	wjrogers@tva.gov

Required Sampler Information:

Sampler:	
Sampling Company:	
Address:	
City/State:	
Phone #:	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

PAP 11/9/2010

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Depth Unit: Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SR_TOTAL
1	KIF-MONOLITH03_T3-LH-102710				A		LCB	10/27/2010	14 56	1	13	X
2	KIF-MONOLITH03_T4-LH-110110				A		LCB	11/01/2010	16 05	1	14	X
3	KIF-MONOLITH03_T5-LH-110810				A		LCB	11/08/2010	11 19 PAP 11/9/10	1	15	X
4	KIF-MONOLITH_MatBlnk-A-MB-110810				A		MB	11/08/2010	14 59 PAP 11/9/2010	1	16 sample not filtered PAP 11/9/2010	X
5												
6												
7												
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier 11/9/2010		10:18 am	TA	11/10/10	0815

Sample Receipt Conditions

Temp in OC	Samples on Ice?	Sample Intact?	Trip Blank?
1.0	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD: (mark as appropriate)
UPS COURIER \ FEDEX
US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: 11/9/2010 Time: 10:18am

TestAmerica

Nashville, TN

COOLER RECE

NTK1248

Cooler Received/Opened On_11/10/10@ 08:15

1. Tracking # 0555 (last 4 digits, Fe

Courier: FED-EX IR Gun ID 97310166

2. Temperature of rep. sample or temp blank when opened: 1.0 Degrees Celsius

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where: 2 Front

5. Were the seals intact, signed, and dated correctly? YES..NO..NA X

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) KG

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES..NO..NA

b. Was there any observable headspace present in any VOA vial? YES...NO..NA

14. Was there a Trip Blank in this cooler? YES...NO..NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) JB

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES..NO...NA

16. Was residual chlorine present? YES...NO..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) JB

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) JB

I certify that I attached a label with the unique LIMS number to each container (intial) JB

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO.#

X NO DATE OR SIGNATURE

NTK1248
11/17/10 23:59

TENNESSEE VALLEY AUTHORITY

CUSTODY / Analytical Request Document

LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 2
Cooler # 1 of 1

COC # RSICA1108Y10A

RSICA1108Y10A

Required Ship to Lab:

Lab Name	Test America Nashville
Address	2960 Foster Creighton Drive, Nashville TN 37204
Lab PM	Mark Hollingsworth
Phone/Fax	[illegible]
Lab PM email	
Applicable Lab Quote #	

Required Project Information:

Site ID #	KIF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax	865-717-1627
Site PM Email	wrogers@tva.gov

Required Sampler Information:

Sampler	
Sampling Company	
Address	
City/State	
Phone #	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: STANDARD X Rush | Mark One

Filtered: Y X PAP 11/12/2010
Preserve: HNO3
Analysis: METALS TVA SW TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.
1	[illegible]	[illegible]			[illegible]		N	[illegible]	[illegible]		1
2	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]		2
3	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]	[illegible]		3
4	[illegible]	DSMP LOT COL1A			LH		N	[illegible]	[illegible]	1	4
5	[illegible]	[illegible]			LH		N	[illegible]	11 11 PAP 11/9/2010	1	5
6	KIF-MONOLITH02-T1LH-102510	DSMP LOT COL1A			LH		N	10 25 2010	13 28	1	6
7	KIF-MONOLITH02-T2LH-102610	DSMP LOT COL1A			LH		N	10 26 2010	12 20	1	7
8	KIF-MONOLITH02-T3LH-102710	DSMP LOT COL1A			LH		N	10 27 2010	14 51	1	8
9	KIF-MONOLITH02-T4LH-110110	DSMP LOT COL1A			LH		N	11 01 2010	15 58	1	9
10	[illegible]	DSMP LOT COL1A			LH		N	[illegible]	11 17 PAP 11/9/2010	1	10
11	[illegible]				[illegible]		[illegible]	[illegible]	[illegible]		11
12	[illegible]				[illegible]		[illegible]	[illegible]	[illegible]		12

Additional Comments/Special Instructions

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier 11/9/2010		10:18 am	[illegible] TA	11/10/10	0845

SHIPPING METHOD (mark as appropriate): UPS (circled) COURIER / FEDEX / US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier
DATE Signed: 11/9/2010
Time: 10:18 am

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
1.0	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

TENNESSEE VALLEY AUTHORITY

NTK1248

11/17/10 23:59

N-OF-CUSTODY / Analytical Request Document

n-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 2 of 2

Cooler # 1 of 1

COC # RSICA1108Y10A

RSICA1108Y10A

Required Ship to Lab:

Lab Name	Test America Nashville
Address	2960 Foster Creighton Drive, Nashville, TN 37204
Lab PM	Mark [illegible]
Phone/Fax	[illegible]
Lab PM email	
Applicable Lab Quote #	

Required Project Information:

Site ID #	KF
Project #	Kingston Fossil Plant
Site Address	714 Swan Pond Rd
City	Harriman
State, Zip	
Site PM Name	Bill Rogers
Phone/Fax	865-717-1627
Site PM Email	wjrogers@tva.gov

Required Sampler Information:

Sampler	
Sampling Company	
Address	
City/State	
Phone #	
Reimbursement project?	
Non-reimbursement project?	
Mark one	
Send EDD to	TVAEDD@envstd.com
CC Hardcopy report to	
CC Hardcopy report to	

TAT: STANDARD | X Rush | | Mark One

Filtered: Y | X | PAP 11/4/2010

Preserve: HNO3

Analysis: METALS TVA SW TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.
1	[illegible]				[illegible]		[illegible]	[illegible]	[illegible]		13
2	[illegible]						[illegible]	[illegible]	[illegible]		14
3	[illegible]						[illegible]	[illegible]	11 19 PAP 11/9/2010		15
4	[illegible]						[illegible]	[illegible]	14 59 PAP 11/9/2010		16 Sample not filtered PAP 11/9/2010
5											
6											
7											
8											
9											
10											
11											
12											

Additional Comments/Special Instructions

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier	11/9/2010	10:18am	[illegible] TA	11/10/10	0855

Sample Receipt Conditions

Temp in °C	Samples on Ice?	Sample intact?	Trip Blank?
1.0	Y/N (Y)	Y/N (Y)	Y/N (N)
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS (circled) | COURIER \ FEDEX | US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier | DATE Signed: 11/9/2010 | Time: 10:18am

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

December 22, 2010 10:38:13AM

Client:	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Nbr:	RSICA1206Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#183781
		Date Received:	12/09/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-MONOLITH_MaterialBlank-MB-120610	NTL1251-01	12/06/10 16:35
KIF-MONOLITH01_T6-LH-112210	NTL1251-02	11/22/10 14:15
KIF-MONOLITH01_T7-LH-120610	NTL1251-03	12/06/10 14:55
KIF-MONOLITH02_T6-LH-112210	NTL1251-04	11/22/10 14:23
KIF-MONOLITH02_T7-LH-120610	NTL1251-05	12/06/10 15:03
KIF-MONOLITH03_T6-LH-112210	NTL1251-06	11/22/10 14:32
KIF-MONOLITH03_T7-LH-120610	NTL1251-07	12/06/10 15:06

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this material is strictly prohibited. If you have received this material in error, please notify us immediately at 615-726-0177.

Additional Laboratory Comments: The client submitted a revised COC that has been attached to the end of the report. The necessary changes have been made to this workorder.
Tennessee Certification Number: 02008

The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.

These results relate only to the items tested. This report shall not be reproduced except in full and with permission of the laboratory.

All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Mark Hollingsworth

Program Manager - National Accounts

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL1251-01 (KIF-MONOLITH MaterialBlank-MB-120610 - Water) Sampled: 12/06/10 16:35									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Arsenic	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 17:49	EPA 200.8	10L2337
Chromium	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Copper	ND		mg/L	0.000330	0.00500	1	12/16/10 17:49	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 17:49	EPA 200.8	10L2337
Molybdenum	ND		mg/L	0.000330	0.00500	1	12/16/10 17:49	EPA 200.8	10L2337
Nickel	ND		mg/L	0.000330	0.00500	1	12/16/10 17:49	EPA 200.8	10L2337
Selenium	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 17:49	EPA 200.8	10L2337
Vanadium	ND		mg/L	0.00100	0.00400	1	12/16/10 17:49	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 17:49	EPA 200.8	10L2337
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	12/15/10 10:28	EPA 200.7	10L2334
Barium	ND		mg/L	0.0100	0.0100	1	12/15/10 10:28	EPA 200.7	10L2334
Boron	ND		mg/L	0.0125	0.0500	1	12/15/10 10:28	EPA 200.7	10L2334
Calcium	ND		mg/L	0.500	1.00	1	12/15/10 10:28	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:28	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:28	EPA 200.7	10L2334
Potassium	ND		mg/L	0.250	1.00	1	12/15/10 10:28	EPA 200.7	10L2334
Sodium	ND		mg/L	0.250	1.00	1	12/15/10 10:28	EPA 200.7	10L2334
Strontium	ND		mg/L	0.0125	0.0500	1	12/15/10 10:28	EPA 200.7	10L2334
Sample ID: NTL1251-02 (KIF-MONOLITH01 T6-LH-112210 - Water) Sampled: 11/22/10 14:15									
Total Metals by EPA 200.8									
Antimony	**0.00378**		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Arsenic	**0.0536**		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 17:52	EPA 200.8	10L2337
Chromium	**0.00589**		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Copper	**0.00230**	J	mg/L	0.000330	0.00500	1	12/16/10 17:52	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 17:52	EPA 200.8	10L2337
Molybdenum	**0.0302**		mg/L	0.000330	0.00500	1	12/16/10 17:52	EPA 200.8	10L2337
Nickel	**0.00141**	J	mg/L	0.000330	0.00500	1	12/16/10 17:52	EPA 200.8	10L2337
Selenium	**0.00813**		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 17:52	EPA 200.8	10L2337
Vanadium	**0.0975**		mg/L	0.00100	0.00400	1	12/16/10 17:52	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 17:52	EPA 200.8	10L2337

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL1251-02 (KIF-MONOLITH01 T6-LH-112210 - Water) - cont. Sampled: 11/22/10 14:15									
Total Metals by EPA Method 200.7									
Aluminum	**2.74**		mg/L	0.0500	0.100	1	12/15/10 10:31	EPA 200.7	10L2334
Barium	ND		mg/L	0.0100	0.0100	1	12/15/10 10:31	EPA 200.7	10L2334
Boron	**0.336**		mg/L	0.0125	0.0500	1	12/15/10 10:31	EPA 200.7	10L2334
Calcium	**9.75**		mg/L	0.500	1.00	1	12/15/10 10:31	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:31	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:31	EPA 200.7	10L2334
Potassium	**25.8**		mg/L	0.250	1.00	1	12/15/10 10:31	EPA 200.7	10L2334
Sodium	**4.87**		mg/L	0.250	1.00	1	12/15/10 10:31	EPA 200.7	10L2334
Strontium	**0.0645**		mg/L	0.0125	0.0500	1	12/15/10 10:31	EPA 200.7	10L2334
Sample ID: NTL1251-03 (KIF-MONOLITH01 T7-LH-120610 - Water) Sampled: 12/06/10 14:55									
Total Metals by EPA 200.8									
Antimony	**0.00270**		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Arsenic	**0.0402**		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 17:56	EPA 200.8	10L2337
Chromium	**0.00467**		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Copper	**0.00172**	J	mg/L	0.000330	0.00500	1	12/16/10 17:56	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 17:56	EPA 200.8	10L2337
Molybdenum	**0.0157**		mg/L	0.000330	0.00500	1	12/16/10 17:56	EPA 200.8	10L2337
Nickel	**0.00146**	J	mg/L	0.000330	0.00500	1	12/16/10 17:56	EPA 200.8	10L2337
Selenium	**0.00533**		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 17:56	EPA 200.8	10L2337
Vanadium	**0.0719**		mg/L	0.00100	0.00400	1	12/16/10 17:56	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 17:56	EPA 200.8	10L2337
Total Metals by EPA Method 200.7									
Aluminum	**2.58**		mg/L	0.0500	0.100	1	12/15/10 10:35	EPA 200.7	10L2334
Barium	ND		mg/L	0.0100	0.0100	1	12/15/10 10:35	EPA 200.7	10L2334
Boron	**0.233**		mg/L	0.0125	0.0500	1	12/15/10 10:35	EPA 200.7	10L2334
Calcium	**11.4**		mg/L	0.500	1.00	1	12/15/10 10:35	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:35	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:35	EPA 200.7	10L2334
Potassium	**19.0**		mg/L	0.250	1.00	1	12/15/10 10:35	EPA 200.7	10L2334
Sodium	**2.95**		mg/L	0.250	1.00	1	12/15/10 10:35	EPA 200.7	10L2334
Strontium	**0.0722**		mg/L	0.0125	0.0500	1	12/15/10 10:35	EPA 200.7	10L2334

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

ANALYTICAL REPORT

Sample ID: NTL1251-04 (KIF-MONOLITH02 T6-LH-112210 - Water) Sampled: 11/22/10 14:23

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.000890**	J	mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Arsenic	**0.00464**		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 18:00	EPA 200.8	10L2337
Chromium	**0.00683**		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Copper	**0.00226**	J	mg/L	0.000330	0.00500	1	12/16/10 18:00	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 18:00	EPA 200.8	10L2337
Molybdenum	**0.0600**		mg/L	0.000330	0.00500	1	12/16/10 18:00	EPA 200.8	10L2337
Nickel	**0.00169**	J	mg/L	0.000330	0.00500	1	12/16/10 18:00	EPA 200.8	10L2337
Selenium	**0.0104**		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 18:00	EPA 200.8	10L2337
Vanadium	**0.0250**		mg/L	0.00100	0.00400	1	12/16/10 18:00	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 18:00	EPA 200.8	10L2337
Total Metals by EPA Method 200.7									
Aluminum	**5.86**		mg/L	0.0500	0.100	1	12/15/10 10:38	EPA 200.7	10L2334
Barium	**0.0233**		mg/L	0.0100	0.0100	1	12/15/10 10:38	EPA 200.7	10L2334
Boron	**0.0839**		mg/L	0.0125	0.0500	1	12/15/10 10:38	EPA 200.7	10L2334
Calcium	**36.5**		mg/L	0.500	1.00	1	12/15/10 10:38	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:38	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:38	EPA 200.7	10L2334
Potassium	**29.2**		mg/L	0.250	1.00	1	12/15/10 10:38	EPA 200.7	10L2334
Sodium	**4.50**		mg/L	0.250	1.00	1	12/15/10 10:38	EPA 200.7	10L2334
Strontium	**0.354**		mg/L	0.0125	0.0500	1	12/15/10 10:38	EPA 200.7	10L2334

Sample ID: NTL1251-05 (KIF-MONOLITH02 T7-LH-120610 - Water) Sampled: 12/06/10 15:03

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	**0.000800**	J	mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Arsenic	**0.00404**		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 18:03	EPA 200.8	10L2337
Chromium	**0.00636**		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Cobalt	**0.000650**	J	mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Copper	**0.00150**	J	mg/L	0.000330	0.00500	1	12/16/10 18:03	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 18:03	EPA 200.8	10L2337
Molybdenum	**0.0326**		mg/L	0.000330	0.00500	1	12/16/10 18:03	EPA 200.8	10L2337
Nickel	**0.000930**	J	mg/L	0.000330	0.00500	1	12/16/10 18:03	EPA 200.8	10L2337
Selenium	**0.00846**		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 18:03	EPA 200.8	10L2337
Vanadium	**0.0252**		mg/L	0.00100	0.00400	1	12/16/10 18:03	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 18:03	EPA 200.8	10L2337

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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

ANALYTICAL REPORT

Sample ID: NTL1251-05 (KIF-MONOLITH02 T7-LH-120610 - Water) - cont. Sampled: 12/06/10 15:03

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA Method 200.7									
Aluminum	**4.85**		mg/L	0.0500	0.100	1	12/15/10 10:41	EPA 200.7	10L2334
Barium	**0.0194**		mg/L	0.0100	0.0100	1	12/15/10 10:41	EPA 200.7	10L2334
Boron	**0.0756**		mg/L	0.0125	0.0500	1	12/15/10 10:41	EPA 200.7	10L2334
Calcium	**34.6**		mg/L	0.500	1.00	1	12/15/10 10:41	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:41	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:41	EPA 200.7	10L2334
Potassium	**17.9**		mg/L	0.250	1.00	1	12/15/10 10:41	EPA 200.7	10L2334
Sodium	**2.41**		mg/L	0.250	1.00	1	12/15/10 10:41	EPA 200.7	10L2334
Strontium	**0.322**		mg/L	0.0125	0.0500	1	12/15/10 10:41	EPA 200.7	10L2334

Sample ID: NTL1251-06 (KIF-MONOLITH03 T6-LH-112210 - Water) Sampled: 11/22/10 14:32

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Arsenic	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 18:07	EPA 200.8	10L2337
Chromium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Copper	ND		mg/L	0.000330	0.00500	1	12/16/10 18:07	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 18:07	EPA 200.8	10L2337
Molybdenum	ND		mg/L	0.000330	0.00500	1	12/16/10 18:07	EPA 200.8	10L2337
Nickel	ND		mg/L	0.000330	0.00500	1	12/16/10 18:07	EPA 200.8	10L2337
Selenium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 18:07	EPA 200.8	10L2337
Vanadium	ND		mg/L	0.00100	0.00400	1	12/16/10 18:07	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 18:07	EPA 200.8	10L2337
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	12/15/10 10:44	EPA 200.7	10L2334
Barium	ND		mg/L	0.0100	0.0100	1	12/15/10 10:44	EPA 200.7	10L2334
Boron	ND		mg/L	0.0125	0.0500	1	12/15/10 10:44	EPA 200.7	10L2334
Calcium	ND		mg/L	0.500	1.00	1	12/15/10 10:44	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:44	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:44	EPA 200.7	10L2334
Potassium	ND		mg/L	0.250	1.00	1	12/15/10 10:44	EPA 200.7	10L2334
Sodium	ND		mg/L	0.250	1.00	1	12/15/10 10:44	EPA 200.7	10L2334
Strontium	ND		mg/L	0.0125	0.0500	1	12/15/10 10:44	EPA 200.7	10L2334

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL1251-07 (KIF-MONOLITH03 T7-LH-120610 - Water) Sampled: 12/06/10 15:06									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Arsenic	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Beryllium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Cadmium	ND		mg/L	0.000330	0.00100	1	12/16/10 18:11	EPA 200.8	10L2337
Chromium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Cobalt	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Copper	ND		mg/L	0.000330	0.00500	1	12/16/10 18:11	EPA 200.8	10L2337
Lead	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Manganese	ND		mg/L	0.000330	0.00500	1	12/16/10 18:11	EPA 200.8	10L2337
Molybdenum	ND		mg/L	0.000330	0.00500	1	12/16/10 18:11	EPA 200.8	10L2337
Nickel	ND		mg/L	0.000330	0.00500	1	12/16/10 18:11	EPA 200.8	10L2337
Selenium	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Silver	ND		mg/L	0.000330	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Thallium	ND		mg/L	0.000500	0.00200	1	12/16/10 18:11	EPA 200.8	10L2337
Vanadium	ND		mg/L	0.00100	0.00400	1	12/16/10 18:11	EPA 200.8	10L2337
Zinc	ND		mg/L	0.00830	0.0500	1	12/16/10 18:11	EPA 200.8	10L2337
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	12/15/10 10:47	EPA 200.7	10L2334
Barium	ND		mg/L	0.0100	0.0100	1	12/15/10 10:47	EPA 200.7	10L2334
Boron	ND		mg/L	0.0125	0.0500	1	12/15/10 10:47	EPA 200.7	10L2334
Calcium	ND		mg/L	0.500	1.00	1	12/15/10 10:47	EPA 200.7	10L2334
Iron	ND		mg/L	0.0250	0.0500	1	12/15/10 10:47	EPA 200.7	10L2334
Magnesium	ND		mg/L	0.250	1.00	1	12/15/10 10:47	EPA 200.7	10L2334
Potassium	ND		mg/L	0.250	1.00	1	12/15/10 10:47	EPA 200.7	10L2334
Sodium	ND		mg/L	0.250	1.00	1	12/15/10 10:47	EPA 200.7	10L2334
Strontium	ND		mg/L	0.0125	0.0500	1	12/15/10 10:47	EPA 200.7	10L2334

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-02	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
EPA 200.8	10L2337	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-01	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-02	30.00	30.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extracted Vol	Date	Analyst	Extraction Method
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-03	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-04	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-05	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-06	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7
EPA 200.7	10L2334	NTL1251-07	50.00	50.00	12/14/10 11:00	JWD	EPA 200.7

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
10L2337-BLK1						
Antimony	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Arsenic	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Beryllium	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Cadmium	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Chromium	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Cobalt	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Copper	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Lead	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Manganese	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Molybdenum	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Nickel	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Selenium	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Silver	<0.000330		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Thallium	<0.000500		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Vanadium	<0.00100		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Zinc	<0.00830		mg/L	10L2337	10L2337-BLK1	12/16/10 17:45
Total Metals by EPA Method 200.7						
10L2334-BLK1						
Aluminum	<0.0500		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Barium	<0.0100		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Boron	<0.0125		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Calcium	<0.500		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Iron	<0.0250		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Magnesium	<0.250		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Potassium	<0.250		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Sodium	<0.250		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22
Strontium	<0.0125		mg/L	10L2334	10L2334-BLK1	12/15/10 10:22

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
10L2337-BS1								
Antimony	0.100	0.0945		mg/L	95%	85 - 115	10L2337	12/16/10 17:41
Arsenic	0.100	0.0934		mg/L	93%	85 - 115	10L2337	12/16/10 17:41
Beryllium	0.100	0.0976		mg/L	98%	85 - 115	10L2337	12/16/10 17:41
Cadmium	0.100	0.0957		mg/L	96%	85 - 115	10L2337	12/16/10 17:41
Chromium	0.100	0.0961		mg/L	96%	85 - 115	10L2337	12/16/10 17:41
Cobalt	0.100	0.0988		mg/L	99%	85 - 115	10L2337	12/16/10 17:41
Copper	0.100	0.0988		mg/L	99%	85 - 115	10L2337	12/16/10 17:41
Lead	0.100	0.0956		mg/L	96%	85 - 115	10L2337	12/16/10 17:41
Manganese	0.100	0.0923		mg/L	92%	85 - 115	10L2337	12/16/10 17:41
Molybdenum	0.100	0.0946		mg/L	95%	85 - 115	10L2337	12/16/10 17:41
Nickel	0.100	0.0985		mg/L	98%	85 - 115	10L2337	12/16/10 17:41
Selenium	0.100	0.0922		mg/L	92%	85 - 115	10L2337	12/16/10 17:41
Silver	0.100	0.0927		mg/L	93%	85 - 115	10L2337	12/16/10 17:41
Thallium	0.100	0.0926		mg/L	93%	85 - 115	10L2337	12/16/10 17:41
Vanadium	0.100	0.0954		mg/L	95%	85 - 115	10L2337	12/16/10 17:41
Zinc	0.100	0.0997		mg/L	100%	85 - 115	10L2337	12/16/10 17:41
Total Metals by EPA Method 200.7								
10L2334-BS1								
Aluminum	2.00	2.02		mg/L	101%	85 - 115	10L2334	12/15/10 10:25
Barium	2.00	2.17		mg/L	108%	85 - 115	10L2334	12/15/10 10:25
Boron	1.00	1.03		mg/L	103%	85 - 115	10L2334	12/15/10 10:25
Calcium	5.00	5.12		mg/L	102%	85 - 115	10L2334	12/15/10 10:25
Iron	1.00	0.988		mg/L	99%	85 - 115	10L2334	12/15/10 10:25
Magnesium	5.00	5.16		mg/L	103%	85 - 115	10L2334	12/15/10 10:25
Potassium	5.00	4.84		mg/L	97%	85 - 115	10L2334	12/15/10 10:25
Sodium	5.00	5.17		mg/L	103%	85 - 115	10L2334	12/15/10 10:25
Strontium	1.00	1.02		mg/L	102%	85 - 115	10L2334	12/15/10 10:25

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL1251
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA 200.8										
10L2337-MS1										
Antimony	0.00181	0.0987		mg/L	0.100	97%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Arsenic	0.00255	0.0956		mg/L	0.100	93%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Beryllium	ND	0.0950		mg/L	0.100	95%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Cadmium	ND	0.0926		mg/L	0.100	93%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Chromium	0.000560	0.0948		mg/L	0.100	94%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Cobalt	0.00271	0.0991		mg/L	0.100	96%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Copper	0.00783	0.103		mg/L	0.100	95%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Lead	ND	0.0955		mg/L	0.100	96%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Manganese	0.0676	0.158		mg/L	0.100	90%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Molybdenum	0.0125	0.106		mg/L	0.100	94%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Nickel	0.0142	0.110		mg/L	0.100	96%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Selenium	0.00166	0.0925		mg/L	0.100	91%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Silver	ND	0.0879		mg/L	0.100	88%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Thallium	ND	0.0921		mg/L	0.100	92%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Vanadium	0.00415	0.0993		mg/L	0.100	95%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Zinc	0.00996	0.106		mg/L	0.100	96%	75 - 125	10L2337	NTL1270-01	12/16/10 18:25
Total Metals by EPA Method 200.7										
10L2334-MS1										
Aluminum	0.542	2.53		mg/L	2.00	99%	70 - 130	10L2334	NTL1270-01	12/15/10 11:05
Barium	0.115	2.24		mg/L	2.00	106%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Boron	0.188	1.21		mg/L	1.00	102%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Calcium	16.1	20.9		mg/L	5.00	95%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Iron	0.197	1.20		mg/L	1.00	100%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Magnesium	2.88	7.90		mg/L	5.00	101%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Potassium	2.40	7.16		mg/L	5.00	95%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Sodium	4.52	9.60		mg/L	5.00	102%	75 - 125	10L2334	NTL1270-01	12/15/10 11:05
Strontium	0.141	1.15		mg/L	1.00	101%	70 - 130	10L2334	NTL1270-01	12/15/10 11:05

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
10L2337-MSD1												
Antimony	0.00181	0.100		mg/L	0.100	98%	75 - 125	1	20	10L2337	NTL1270-01	12/16/10 18:29
Arsenic	0.00255	0.0969		mg/L	0.100	94%	75 - 125	1	20	10L2337	NTL1270-01	12/16/10 18:29
Beryllium	ND	0.0954		mg/L	0.100	95%	75 - 125	0.4	20	10L2337	NTL1270-01	12/16/10 18:29
Cadmium	ND	0.0949		mg/L	0.100	95%	75 - 125	2	20	10L2337	NTL1270-01	12/16/10 18:29
Chromium	0.000560	0.0949		mg/L	0.100	94%	75 - 125	0.1	20	10L2337	NTL1270-01	12/16/10 18:29
Cobalt	0.00271	0.0996		mg/L	0.100	97%	75 - 125	0.5	20	10L2337	NTL1270-01	12/16/10 18:29
Copper	0.00783	0.104		mg/L	0.100	96%	75 - 125	2	20	10L2337	NTL1270-01	12/16/10 18:29
Lead	ND	0.0968		mg/L	0.100	97%	75 - 125	1	20	10L2337	NTL1270-01	12/16/10 18:29
Manganese	0.0676	0.157		mg/L	0.100	89%	75 - 125	0.5	20	10L2337	NTL1270-01	12/16/10 18:29
Molybdenum	0.0125	0.109		mg/L	0.100	97%	75 - 125	2	20	10L2337	NTL1270-01	12/16/10 18:29
Nickel	0.0142	0.111		mg/L	0.100	97%	75 - 125	0.6	20	10L2337	NTL1270-01	12/16/10 18:29
Selenium	0.00166	0.0938		mg/L	0.100	92%	75 - 125	1	20	10L2337	NTL1270-01	12/16/10 18:29
Silver	ND	0.0894		mg/L	0.100	89%	75 - 125	2	20	10L2337	NTL1270-01	12/16/10 18:29
Thallium	ND	0.0937		mg/L	0.100	94%	75 - 125	2	20	10L2337	NTL1270-01	12/16/10 18:29
Vanadium	0.00415	0.0994		mg/L	0.100	95%	75 - 125	0.2	20	10L2337	NTL1270-01	12/16/10 18:29
Zinc	0.00996	0.106		mg/L	0.100	96%	75 - 125	0	20	10L2337	NTL1270-01	12/16/10 18:29
Total Metals by EPA Method 200.7												
10L2334-MSD1												
Aluminum	0.542	2.56		mg/L	2.00	101%	70 - 130	1	20	10L2334	NTL1270-01	12/15/10 11:08
Barium	0.115	2.28		mg/L	2.00	108%	75 - 125	2	20	10L2334	NTL1270-01	12/15/10 11:08
Boron	0.188	1.22		mg/L	1.00	103%	75 - 125	0.7	20	10L2334	NTL1270-01	12/15/10 11:08
Calcium	16.1	21.2		mg/L	5.00	102%	75 - 125	2	20	10L2334	NTL1270-01	12/15/10 11:08
Iron	0.197	1.21		mg/L	1.00	101%	75 - 125	1	20	10L2334	NTL1270-01	12/15/10 11:08
Magnesium	2.88	7.97		mg/L	5.00	102%	75 - 125	0.9	20	10L2334	NTL1270-01	12/15/10 11:08
Potassium	2.40	7.26		mg/L	5.00	97%	75 - 125	1	20	10L2334	NTL1270-01	12/15/10 11:08
Sodium	4.52	9.74		mg/L	5.00	104%	75 - 125	1	20	10L2334	NTL1270-01	12/15/10 11:08
Strontium	0.141	1.16		mg/L	1.00	102%	70 - 130	0.7	20	10L2334	NTL1270-01	12/15/10 11:08

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL1251
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1206Y10A
Attn	William Rogers	Received:	12/09/10 10:05

DATA QUALIFIERS AND DEFINITIONS

J Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.

ND Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TENNESSEE VALLEY AUTHORITY

NTL1251
12/16/10 23:59

CHAIN-OF-CUSTODY / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate.

Page: 1 of 1
Cooler # of

COC # RSICA1206Y10A REV 9/6/10 ~~12/10~~

RSICA1206Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	Paul Pier
Address	2960 Foster Creighton Drive Nashville, TN 37204	Project #	Kingston Fossil Plant	Sampling Company	TVA Muscle Shoals
		Site Address	714 Swan Pond Rd	Address	
Lab PM	Mark Hollingsworth	City	Harriman	City/State	Phone #
		State, Zip		Reimbursement project?	Non-reimbursement project? Mark one
Phone/Fax	800 765 0980	Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax	865-717-1627	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email	wjrogers@tva.gov	CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/Lab Sample I.D.	METALS, TVA, RW TOTAL
1	KIF-MONOLITH_MethodBlank-MB-120610		NA	NA	A	G	MB	12/06/2010	16 35 PAP 12/6/10	1	1	X
2	KIF-MONOLITH01_T0-LH-112210	DSMPILOT_COL1A	NA	NA	LH	G	N	11/22/2010	14 13	1	2	X
3	KIF-MONOLITH01_T7-LH-120610	DSMPILOT_COL1A	NA	NA	LH	G	N	12/06/2010	14 55 PAP 12/7/10	1	3	X
4	KIF-MONOLITH02_T0-LH-112210	DSMPILOT_COL1B	NA	NA	LH	G	N	11/22/2010	14 23	1	4	X
5	KIF-MONOLITH02_T7-LH-120610	DSMPILOT_COL1B	NA	NA	LH	G	N	12/05/2010 9/6/10 [illegible]	15 05 PAP 12/6/10	1	5	X
6	KIF-MONOLITH03_T0-LH-112210		NA	NA	A	G	LCB	11/22/2010	14 33	1	6	X
7	KIF-MONOLITH03_T7-LH-120610		NA	NA	A	G	LCB	12/06/2010	15 06 PAP 12/6/10	1	7	X
8												
9												
10												
11												
12												

Depth Unit: NA

Additional Comments/Special Instructions:
Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)
- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
Paul A. Pier - TVA	12/8/10	1215	[illegible] / TA	12/9/10	1005	0.6	Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
							Y / N	Y / N	Y / N
						Temp in OC	Samples on Ice?	Sample Intact?	Trip Blank?

SHIPPING METHOD (mark as appropriate): UPS COURIER \ FEDEX US MAIL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Paul A. Pier
SIGNATURE of SAMPLER: Paul A. Pier DATE Signed: 12/8/10 Time: 1215

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Nashville, TN

COOLER RECI

NTL1251

Cooler Received/Opened On 12/09/2010 @ 1005

1. Tracking # 1233 1700 1 9242 7396

Courier: UPS IR Gun ID 97460373

2. Temperature of rep. sample or temp blank when opened: 0.6 Degrees Celsius

3. If item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

   If yes, how many and where: 2 side

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) M

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

   Were these signed and dated correctly? YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? 12/9/10 YES...NO...NA

12. Did all container labels and tags agree with custody papers? M ~~YES~~...NO...NA

13a. Were VOA vials received? YES...NO...NA

   b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) M

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

   b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) M

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) M

I certify that I attached a label with the unique LIMS number to each container (intial) M

21. Were there Non-Conformance issues at login? YES..NO Was a PIPE generated? YES..NO...#

-05 has sample date of 12/6 on labels

BIS = Broken in shipment
Cooler Receipt Form.doc

LF-1
End of Form

Revised 6/24/09

NTL1251
12/16/10 23:59

TENNESSEE VALLEY AUTHORITY

AIN-OF-CUSTODY / Analytical Request Document

ain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Page: 1 of 1
Cooler # ____ of ____

COC # RSICA1206Y10A

RSICA1206Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	Paul Pier
Address:	2960 Foster Creighton Drive, Nashville TN 37204	Project #	Kingston Foss. Plant	Sampling Company	TVA Muscle Shoals
				Address:	
		Site Address	714 Swan Pond Rd	City/State	Phone #:
Lab PM	Mark Hollingsworth	City	Harriman	State, Zip	Reimbursement project? / Non-reimbursement project? / Mark one
Phone/Fax	800 765 0980	Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax:	865-717-1527	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email:	wrogers@tva.gov	CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

Filtered: N
Preserve: HNO3
Analysis: METALS_TVA_SW_TOTAL

Sample Depth — Depth Unit: NA

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-MONOLITH Material-Blank-MB-120610		NA	NA	A	G	MB	12/06/2010	12 35 PHP 12/15/10	1	1	X
2	KIF-MONOLITH01_T6-LH-112210	DSMPILOT_COL1A	NA	NA	LH	G	N	11/22/2010	14 15	1	2	X
3	KIF-MONOLITH01_T7-LH-120610	DSMPILOT_COL1A	NA	NA	LH	G	N	12/06/2010	14 55 PHP 12/15/10	1	3	X
4	KIF-MONOLITH02_T6-LH-112210	DSMPILOT_COL1C	NA	NA	LH	G	N	11/22/2010	14 23	1	4	X
5	KIF-MONOLITH02_T7-LH-120610	DSMPILOT_COL1C	NA	NA	LH	G	N	11/22/2010	15 05 PHP 12/15/10	1	5	X
6	KIF-MONOLITH03_T6-LH-112210		NA	NA	A	G	LCB	11/22/2010	14 32	1	6	X
7	KIF-MONOLITH03_T7-LH-120610		NA	NA	A	G	LCB	12/06/2010	15 06 PHP 12/15/10	1	7	X
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)		RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Sample Receipt Conditions			
X	Investigatory	Paul H Pier - TVA	12/13/10	1215	[signature] / TA	12/14/10	1005	0	(Y)/N	(Y)/N	Y/(N)
	Split Comparison								Y/N	Y/N	Y/N
	Split Legal								Y/N	Y/N	Y/N
	Special Study								Y/N	Y/N	Y/N
	Plant Ops							Temp in OC	Samples on Ice?	Sample intact?	Trip Blank?
	Oth:										

SHIPPING METHOD (mark as appropriate): (UPS) COURIER \ FEDEX US MAIL

SAMPLER NAME AND SIGNATURE:
PRINT Name of SAMPLER: Paul H. Pier
SIGNATURE of SAMPLER: Paul H. Pier DATE Signed: 12/13/10 Time: 1215

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

January 08, 2011 12:25:15PM

Client:	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Nbr:	RSICA1227Y10A
Attn:	William Rogers	P/O Nbr:	Contract #75140 PO#183781
		Date Received:	12/30/10

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION DATE AND TIME
KIF-MONOLITH_MaterialBlank-MB-122710	NTL3745-01	12/27/10 14:38
KIF-MONOLITH01_T8-LH-121310	NTL3745-02	12/13/10 11:07
KIF-MONOLITH01_T9-LH-122710	NTL3745-03	12/27/10 13:41
KIF-MONOLITH02_T8-LH-121310	NTL3745-04	12/13/10 11:09
KIF-MONOLITH02_T9-LH-122710	NTL3745-05	12/27/10 13:44
KIF-MONOLITH03_T8-LH-121310	NTL3745-06	12/13/10 11:13
KIF-MONOLITH03_T9-LH-122710	NTL3745-07	12/27/10 13:48

An executed copy of the chain of custody, the project quality control data, and the sample receipt form are also included as an addendum to this report. If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 1-800-765-0980. Any opinions, if expressed, are outside the scope of the Laboratory's accreditation.

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Tennessee Certification Number: 02008

The Chain(s) of Custody, 2 pages, are included and are an integral part of this report.

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All solids results are reported in wet weight unless specifically stated.
Estimated uncertainty is available upon request.
This report has been electronically signed.
Report Approved By:

Mark Hollingsworth

Program Manager - National Accounts

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order: Project Name: Project Number:	NTL3745 Kingston Fossil Plant 050710 RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

ANALYTICAL REPORT

Sample ID: NTL3745-01 (KIF-MONOLITH MaterialBlank-MB-122710 - Water) Sampled: 12/27/10 14:38

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Arsenic	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 13:54	EPA 200.8	11A0348
Chromium	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Copper	ND		mg/L	0.000330	0.00500	1	01/06/11 13:54	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 13:54	EPA 200.8	11A0348
Molybdenum	ND		mg/L	0.000330	0.00500	1	01/06/11 13:54	EPA 200.8	11A0348
Nickel	ND		mg/L	0.000330	0.00500	1	01/06/11 13:54	EPA 200.8	11A0348
Selenium	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 13:54	EPA 200.8	11A0348
Vanadium	ND		mg/L	0.00100	0.00400	1	01/06/11 13:54	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 13:54	EPA 200.8	11A0348

Total Metals by EPA Method 200.7

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Aluminum	ND		mg/L	0.0500	0.100	1	01/06/11 12:27	EPA 200.7	11A0354
Barium	ND		mg/L	0.0100	0.0100	1	01/06/11 12:27	EPA 200.7	11A0354
Boron	ND		mg/L	0.0125	0.0500	1	01/06/11 12:27	EPA 200.7	11A0354
Calcium	ND		mg/L	0.500	1.00	1	01/06/11 12:27	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:27	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:27	EPA 200.7	11A0354
Potassium	ND		mg/L	0.250	1.00	1	01/06/11 12:27	EPA 200.7	11A0354
Sodium	ND		mg/L	0.250	1.00	1	01/06/11 12:27	EPA 200.7	11A0354
Strontium	ND		mg/L	0.0125	0.0500	1	01/06/11 12:27	EPA 200.7	11A0354

Sample ID: NTL3745-02 (KIF-MONOLITH01 T8-LH-121310 - Water) Sampled: 12/13/10 11:07

Total Metals by EPA 200.8

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Antimony	**0.00108**	J	mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Arsenic	**0.0218**		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 13:58	EPA 200.8	11A0348
Chromium	**0.00169**	J	mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Copper	**0.000720**	J	mg/L	0.000330	0.00500	1	01/06/11 13:58	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 13:58	EPA 200.8	11A0348
Molybdenum	**0.00508**		mg/L	0.000330	0.00500	1	01/06/11 13:58	EPA 200.8	11A0348
Nickel	**0.000510**	J	mg/L	0.000330	0.00500	1	01/06/11 13:58	EPA 200.8	11A0348
Selenium	**0.00212**		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 13:58	EPA 200.8	11A0348
Vanadium	**0.0314**		mg/L	0.00100	0.00400	1	01/06/11 13:58	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 13:58	EPA 200.8	11A0348

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order: Project Name: Project Number:	NTL3745 Kingston Fossil Plant 050710 RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL3745-02 (KIF-MONOLITH01 T8-LH-121310 - Water) - cont. Sampled: 12/13/10 11:07									
Total Metals by EPA Method 200.7									
Aluminum	**1.91**		mg/L	0.0500	0.100	1	01/06/11 12:30	EPA 200.7	11A0354
Barium	ND		mg/L	0.0100	0.0100	1	01/06/11 12:30	EPA 200.7	11A0354
Boron	**0.0947**		mg/L	0.0125	0.0500	1	01/06/11 12:30	EPA 200.7	11A0354
Calcium	**7.44**		mg/L	0.500	1.00	1	01/06/11 12:30	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:30	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:30	EPA 200.7	11A0354
Potassium	**9.19**		mg/L	0.250	1.00	1	01/06/11 12:30	EPA 200.7	11A0354
Sodium	**1.14**		mg/L	0.250	1.00	1	01/06/11 12:30	EPA 200.7	11A0354
Strontium	**0.0494**	J	mg/L	0.0125	0.0500	1	01/06/11 12:30	EPA 200.7	11A0354
Sample ID: NTL3745-03 (KIF-MONOLITH01 T9-LH-122710 - Water) Sampled: 12/27/10 13:41									
Total Metals by EPA 200.8									
Antimony	**0.00149**	J	mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Arsenic	**0.0248**		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 14:02	EPA 200.8	11A0348
Chromium	**0.00246**		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Copper	**0.00251**	J	mg/L	0.000330	0.00500	1	01/06/11 14:02	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 14:02	EPA 200.8	11A0348
Molybdenum	**0.00787**		mg/L	0.000330	0.00500	1	01/06/11 14:02	EPA 200.8	11A0348
Nickel	**0.000930**	J	mg/L	0.000330	0.00500	1	01/06/11 14:02	EPA 200.8	11A0348
Selenium	**0.00345**		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 14:02	EPA 200.8	11A0348
Vanadium	**0.0392**		mg/L	0.00100	0.00400	1	01/06/11 14:02	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 14:02	EPA 200.8	11A0348
Total Metals by EPA Method 200.7									
Aluminum	**1.93**		mg/L	0.0500	0.100	1	01/06/11 12:33	EPA 200.7	11A0354
Barium	ND		mg/L	0.0100	0.0100	1	01/06/11 12:33	EPA 200.7	11A0354
Boron	**0.114**		mg/L	0.0125	0.0500	1	01/06/11 12:33	EPA 200.7	11A0354
Calcium	**11.4**		mg/L	0.500	1.00	1	01/06/11 12:33	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:33	EPA 200.7	11A0354
Magnesium	**0.283**	J	mg/L	0.250	1.00	1	01/06/11 12:33	EPA 200.7	11A0354
Potassium	**9.58**		mg/L	0.250	1.00	1	01/06/11 12:33	EPA 200.7	11A0354
Sodium	**1.22**		mg/L	0.250	1.00	1	01/06/11 12:33	EPA 200.7	11A0354
Strontium	**0.0711**		mg/L	0.0125	0.0500	1	01/06/11 12:33	EPA 200.7	11A0354

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL3745-04 (KIF-MONOLITH02 T8-LH-121310 - Water) Sampled: 12/13/10 11:09									
Total Metals by EPA 200.8									
Antimony	**0.000480**	J	mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Arsenic	**0.00412**		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 14:05	EPA 200.8	11A0348
Chromium	**0.00267**		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Copper	**0.00592**		mg/L	0.000330	0.00500	1	01/06/11 14:05	EPA 200.8	11A0348
Lead	**0.000580**	J	mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 14:05	EPA 200.8	11A0348
Molybdenum	**0.0105**		mg/L	0.000330	0.00500	1	01/06/11 14:05	EPA 200.8	11A0348
Nickel	**0.00501**		mg/L	0.000330	0.00500	1	01/06/11 14:05	EPA 200.8	11A0348
Selenium	**0.00338**		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 14:05	EPA 200.8	11A0348
Vanadium	**0.0146**		mg/L	0.00100	0.00400	1	01/06/11 14:05	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 14:05	EPA 200.8	11A0348
Total Metals by EPA Method 200.7									
Aluminum	**3.15**		mg/L	0.0500	0.100	1	01/06/11 12:36	EPA 200.7	11A0354
Barium	**0.0128**		mg/L	0.0100	0.0100	1	01/06/11 12:36	EPA 200.7	11A0354
Boron	**0.0382**	J	mg/L	0.0125	0.0500	1	01/06/11 12:36	EPA 200.7	11A0354
Calcium	**23.9**		mg/L	0.500	1.00	1	01/06/11 12:36	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:36	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:36	EPA 200.7	11A0354
Potassium	**7.24**		mg/L	0.250	1.00	1	01/06/11 12:36	EPA 200.7	11A0354
Sodium	**0.846**	J	mg/L	0.250	1.00	1	01/06/11 12:36	EPA 200.7	11A0354
Strontium	**0.207**		mg/L	0.0125	0.0500	1	01/06/11 12:36	EPA 200.7	11A0354
Sample ID: NTL3745-05 (KIF-MONOLITH02 T9-LH-122710 - Water) Sampled: 12/27/10 13:44									
Total Metals by EPA 200.8									
Antimony	**0.000660**	J	mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Arsenic	**0.00429**		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 14:09	EPA 200.8	11A0348
Chromium	**0.00450**		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Copper	**0.000950**	J	mg/L	0.000330	0.00500	1	01/06/11 14:09	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 14:09	EPA 200.8	11A0348
Molybdenum	**0.0143**		mg/L	0.000330	0.00500	1	01/06/11 14:09	EPA 200.8	11A0348
Nickel	**0.000620**	J	mg/L	0.000330	0.00500	1	01/06/11 14:09	EPA 200.8	11A0348
Selenium	**0.00544**		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 14:09	EPA 200.8	11A0348
Vanadium	**0.0206**		mg/L	0.00100	0.00400	1	01/06/11 14:09	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 14:09	EPA 200.8	11A0348

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

ANALYTICAL REPORT

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Sample ID: NTL3745-05 (KIF-MONOLITH02 T9-LH-122710 - Water) - cont. Sampled: 12/27/10 13:44									
Total Metals by EPA Method 200.7									
Aluminum	**3.56**		mg/L	0.0500	0.100	1	01/06/11 12:39	EPA 200.7	11A0354
Barium	**0.0145**		mg/L	0.0100	0.0100	1	01/06/11 12:39	EPA 200.7	11A0354
Boron	**0.0557**		mg/L	0.0125	0.0500	1	01/06/11 12:39	EPA 200.7	11A0354
Calcium	**26.8**		mg/L	0.500	1.00	1	01/06/11 12:39	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:39	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:39	EPA 200.7	11A0354
Potassium	**8.19**		mg/L	0.250	1.00	1	01/06/11 12:39	EPA 200.7	11A0354
Sodium	**1.02**		mg/L	0.250	1.00	1	01/06/11 12:39	EPA 200.7	11A0354
Strontium	**0.249**		mg/L	0.0125	0.0500	1	01/06/11 12:39	EPA 200.7	11A0354
Sample ID: NTL3745-06 (KIF-MONOLITH03 T8-LH-121310 - Water) Sampled: 12/13/10 11:13									
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Arsenic	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 14:12	EPA 200.8	11A0348
Chromium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Copper	**0.0261**		mg/L	0.000330	0.00500	1	01/06/11 14:12	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 14:12	EPA 200.8	11A0348
Molybdenum	ND		mg/L	0.000330	0.00500	1	01/06/11 14:12	EPA 200.8	11A0348
Nickel	ND		mg/L	0.000330	0.00500	1	01/06/11 14:12	EPA 200.8	11A0348
Selenium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 14:12	EPA 200.8	11A0348
Vanadium	ND		mg/L	0.00100	0.00400	1	01/06/11 14:12	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 14:12	EPA 200.8	11A0348
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	01/06/11 12:43	EPA 200.7	11A0354
Barium	ND		mg/L	0.0100	0.0100	1	01/06/11 12:43	EPA 200.7	11A0354
Boron	ND		mg/L	0.0125	0.0500	1	01/06/11 12:43	EPA 200.7	11A0354
Calcium	ND		mg/L	0.500	1.00	1	01/06/11 12:43	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:43	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:43	EPA 200.7	11A0354
Potassium	ND		mg/L	0.250	1.00	1	01/06/11 12:43	EPA 200.7	11A0354
Sodium	ND		mg/L	0.250	1.00	1	01/06/11 12:43	EPA 200.7	11A0354
Strontium	ND		mg/L	0.0125	0.0500	1	01/06/11 12:43	EPA 200.7	11A0354

Client	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

ANALYTICAL REPORT

Sample ID: NTL3745-07 (KIF-MONOLITH03 T9-LH-122710 - Water) Sampled: 12/27/10 13:48

Analyte	Result	Flag	Units	MDL	MRL	Dilution Factor	Analysis Date/Time	Method	Batch
Total Metals by EPA 200.8									
Antimony	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Arsenic	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Beryllium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Cadmium	ND		mg/L	0.000330	0.00100	1	01/06/11 14:16	EPA 200.8	11A0348
Chromium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Cobalt	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Copper	**0.000410**	J	mg/L	0.000330	0.00500	1	01/06/11 14:16	EPA 200.8	11A0348
Lead	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Manganese	ND		mg/L	0.000330	0.00500	1	01/06/11 14:16	EPA 200.8	11A0348
Molybdenum	ND		mg/L	0.000330	0.00500	1	01/06/11 14:16	EPA 200.8	11A0348
Nickel	ND		mg/L	0.000330	0.00500	1	01/06/11 14:16	EPA 200.8	11A0348
Selenium	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Silver	ND		mg/L	0.000330	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Thallium	ND		mg/L	0.000500	0.00200	1	01/06/11 14:16	EPA 200.8	11A0348
Vanadium	ND		mg/L	0.00100	0.00400	1	01/06/11 14:16	EPA 200.8	11A0348
Zinc	ND		mg/L	0.00830	0.0500	1	01/06/11 14:16	EPA 200.8	11A0348
Total Metals by EPA Method 200.7									
Aluminum	ND		mg/L	0.0500	0.100	1	01/06/11 12:46	EPA 200.7	11A0354
Barium	ND		mg/L	0.0100	0.0100	1	01/06/11 12:46	EPA 200.7	11A0354
Boron	ND		mg/L	0.0125	0.0500	1	01/06/11 12:46	EPA 200.7	11A0354
Calcium	ND		mg/L	0.500	1.00	1	01/06/11 12:46	EPA 200.7	11A0354
Iron	ND		mg/L	0.0250	0.0500	1	01/06/11 12:46	EPA 200.7	11A0354
Magnesium	ND		mg/L	0.250	1.00	1	01/06/11 12:46	EPA 200.7	11A0354
Potassium	ND		mg/L	0.250	1.00	1	01/06/11 12:46	EPA 200.7	11A0354
Sodium	ND		mg/L	0.250	1.00	1	01/06/11 12:46	EPA 200.7	11A0354
Strontium	ND		mg/L	0.0125	0.0500	1	01/06/11 12:46	EPA 200.7	11A0354

TestAmerica
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2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extract Vol	Date	Analyst	Extraction Method
Total Metals by EPA 200.8							
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extract Vol	Date	Analyst	Extraction Method
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extract Vol	Date	Analyst	Extraction Method
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
EPA 200.8	11A0348	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.8
Total Metals by EPA Method 200.7							
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-01	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-02	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7

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Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

SAMPLE EXTRACTION DATA

Parameter	Batch	Lab Number	Wt/Vol Extracted	Extract Vol	Date	Analyst	Extraction Method
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-03	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-04	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-05	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-06	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7
EPA 200.7	11A0354	NTL3745-07	50.00	50.00	01/05/11 13:30	JWD	EPA 200.7

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

PROJECT QUALITY CONTROL DATA
Blank

Analyte	Blank Value	Q	Units	Q.C. Batch	Lab Number	Analyzed Date/Time
Total Metals by EPA 200.8						
11A0348-BLK1						
Antimony	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Arsenic	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Beryllium	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Cadmium	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Chromium	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Cobalt	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Copper	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Lead	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Manganese	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Molybdenum	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Nickel	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Selenium	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Silver	<0.000330		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Thallium	<0.000500		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Vanadium	<0.00100		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Zinc	<0.00830		mg/L	11A0348	11A0348-BLK1	01/06/11 13:51
Total Metals by EPA Method 200.7						
11A0354-BLK1						
Aluminum	<0.0500		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Barium	<0.0100		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Boron	<0.0125		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Calcium	<0.500		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Iron	<0.0250		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Magnesium	<0.250		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Potassium	<0.250		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Sodium	<0.250		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20
Strontium	<0.0125		mg/L	11A0354	11A0354-BLK1	01/06/11 12:20

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order:	NTL3745
		Project Name:	Kingston Fossil Plant 050710
		Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

PROJECT QUALITY CONTROL DATA
LCS

Analyte	Known Val.	Analyzed Val	Q	Units	% Rec.	Target Range	Batch	Analyzed Date/Time
Total Metals by EPA 200.8								
11A0348-BS1								
Antimony	0.100	0.0996		mg/L	100%	85 - 115	11A0348	01/06/11 13:41
Arsenic	0.100	0.0986		mg/L	99%	85 - 115	11A0348	01/06/11 13:41
Beryllium	0.100	0.0981		mg/L	98%	85 - 115	11A0348	01/06/11 13:41
Cadmium	0.100	0.0973		mg/L	97%	85 - 115	11A0348	01/06/11 13:41
Chromium	0.100	0.0976		mg/L	98%	85 - 115	11A0348	01/06/11 13:41
Cobalt	0.100	0.0979		mg/L	98%	85 - 115	11A0348	01/06/11 13:41
Copper	0.100	0.0982		mg/L	98%	85 - 115	11A0348	01/06/11 13:41
Lead	0.100	0.0991		mg/L	99%	85 - 115	11A0348	01/06/11 13:41
Manganese	0.100	0.0962		mg/L	96%	85 - 115	11A0348	01/06/11 13:41
Molybdenum	0.100	0.0979		mg/L	98%	85 - 115	11A0348	01/06/11 13:41
Nickel	0.100	0.0989		mg/L	99%	85 - 115	11A0348	01/06/11 13:41
Selenium	0.100	0.0975		mg/L	97%	85 - 115	11A0348	01/06/11 13:41
Silver	0.100	0.0963		mg/L	96%	85 - 115	11A0348	01/06/11 13:41
Thallium	0.100	0.0971		mg/L	97%	85 - 115	11A0348	01/06/11 13:41
Vanadium	0.100	0.100		mg/L	100%	85 - 115	11A0348	01/06/11 13:41
Zinc	0.100	0.0999		mg/L	100%	85 - 115	11A0348	01/06/11 13:41
Total Metals by EPA Method 200.7								
11A0354-BS1								
Aluminum	2.00	2.08		mg/L	104%	85 - 115	11A0354	01/06/11 12:24
Barium	2.00	2.11		mg/L	105%	85 - 115	11A0354	01/06/11 12:24
Boron	1.00	1.05		mg/L	105%	85 - 115	11A0354	01/06/11 12:24
Calcium	5.00	5.01		mg/L	100%	85 - 115	11A0354	01/06/11 12:24
Iron	1.00	1.04		mg/L	104%	85 - 115	11A0354	01/06/11 12:24
Magnesium	5.00	5.19		mg/L	104%	85 - 115	11A0354	01/06/11 12:24
Potassium	5.00	4.89		mg/L	98%	85 - 115	11A0354	01/06/11 12:24
Sodium	5.00	5.26		mg/L	105%	85 - 115	11A0354	01/06/11 12:24
Strontium	1.00	1.02		mg/L	102%	85 - 115	11A0354	01/06/11 12:24

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil 714 Swan Pond Rd KFP-1A-KST Harriman, TN 37748	Work Order: Project Name: Project Number:	NTL3745 Kingston Fossil Plant 050710 RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

PROJECT QUALITY CONTROL DATA
Matrix Spike

Analyte	Orig. Val.	MS Val	Q	Units	Spike Conc	% Rec.	Target Range	Batch	Sample Spiked	Analyzed Date/Time
Total Metals by EPA 200.8										
11A0348-MS1										
Antimony	ND	0.0948		mg/L	0.100	95%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Arsenic	0.00561	0.0992		mg/L	0.100	94%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Beryllium	ND	0.0967		mg/L	0.100	97%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Cadmium	ND	0.0927		mg/L	0.100	93%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Chromium	0.00131	0.0957		mg/L	0.100	94%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Cobalt	0.00113	0.0935		mg/L	0.100	92%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Copper	0.00404	0.0939		mg/L	0.100	90%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Lead	0.00250	0.101		mg/L	0.100	98%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Manganese	0.201	0.274	M8	mg/L	0.100	73%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Molybdenum	0.00280	0.0943		mg/L	0.100	92%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Nickel	0.00179	0.0937		mg/L	0.100	92%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Selenium	0.000990	0.0904		mg/L	0.100	89%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Silver	ND	0.0895		mg/L	0.100	89%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Thallium	ND	0.0960		mg/L	0.100	96%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Vanadium	0.00575	0.103		mg/L	0.100	97%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Zinc	0.0194	0.109		mg/L	0.100	90%	75 - 125	11A0348	NUA0136-01	01/06/11 14:34
Total Metals by EPA Method 200.7										
11A0354-MS1										
Aluminum	1.51	5.26	M7	mg/L	2.00	187%	70 - 130	11A0354	NUA0136-01	01/06/11 13:05
Barium	0.0714	2.14		mg/L	2.00	103%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Boron	0.0737	1.11		mg/L	1.00	104%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Calcium	25.1	30.0		mg/L	5.00	98%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Iron	1.10	2.55	M7	mg/L	1.00	145%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Magnesium	9.58	14.7		mg/L	5.00	102%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Potassium	2.52	7.56		mg/L	5.00	101%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Sodium	7.64	12.9		mg/L	5.00	105%	75 - 125	11A0354	NUA0136-01	01/06/11 13:05
Strontium	0.109	1.13		mg/L	1.00	102%	70 - 130	11A0354	NUA0136-01	01/06/11 13:05

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

PROJECT QUALITY CONTROL DATA
Matrix Spike Dup

Analyte	Orig. Val.	Duplicate	Q	Units	Spike Conc	% Rec.	Target Range	RPD	Limit	Batch	Sample Duplicated	Analyzed Date/Time
Total Metals by EPA 200.8												
11A0348-MSD1												
Antimony	ND	0.0952		mg/L	0.100	95%	75 - 125	0.5	20	11A0348	NUA0136-01	01/06/11 14:38
Arsenic	0.00561	0.0993		mg/L	0.100	94%	75 - 125	0.1	20	11A0348	NUA0136-01	01/06/11 14:38
Beryllium	ND	0.0991		mg/L	0.100	99%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Cadmium	ND	0.0943		mg/L	0.100	94%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Chromium	0.00131	0.0971		mg/L	0.100	96%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Cobalt	0.00113	0.0956		mg/L	0.100	94%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Copper	0.00404	0.0954		mg/L	0.100	91%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Lead	0.00250	0.102		mg/L	0.100	99%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Manganese	0.201	0.281		mg/L	0.100	80%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Molybdenum	0.00280	0.0934		mg/L	0.100	91%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Nickel	0.00179	0.0955		mg/L	0.100	94%	75 - 125	2	20	11A0348	NUA0136-01	01/06/11 14:38
Selenium	0.000990	0.0909		mg/L	0.100	90%	75 - 125	0.5	20	11A0348	NUA0136-01	01/06/11 14:38
Silver	ND	0.0906		mg/L	0.100	91%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Thallium	ND	0.0971		mg/L	0.100	97%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Vanadium	0.00575	0.104		mg/L	0.100	99%	75 - 125	1	20	11A0348	NUA0136-01	01/06/11 14:38
Zinc	0.0194	0.113		mg/L	0.100	94%	75 - 125	4	20	11A0348	NUA0136-01	01/06/11 14:38
Total Metals by EPA Method 200.7												
11A0354-MSD1												
Aluminum	1.51	5.32	M7	mg/L	2.00	190%	70 - 130	1	20	11A0354	NUA0136-01	01/06/11 13:08
Barium	0.0714	2.12		mg/L	2.00	103%	75 - 125	0.5	20	11A0354	NUA0136-01	01/06/11 13:08
Boron	0.0737	1.10		mg/L	1.00	103%	75 - 125	0.6	20	11A0354	NUA0136-01	01/06/11 13:08
Calcium	25.1	29.6		mg/L	5.00	90%	75 - 125	1	20	11A0354	NUA0136-01	01/06/11 13:08
Iron	1.10	2.59	M7	mg/L	1.00	150%	75 - 125	2	20	11A0354	NUA0136-01	01/06/11 13:08
Magnesium	9.58	14.5		mg/L	5.00	98%	75 - 125	1	20	11A0354	NUA0136-01	01/06/11 13:08
Potassium	2.52	7.52		mg/L	5.00	100%	75 - 125	0.6	20	11A0354	NUA0136-01	01/06/11 13:08
Sodium	7.64	12.7		mg/L	5.00	102%	75 - 125	1	20	11A0354	NUA0136-01	01/06/11 13:08
Strontium	0.109	1.13		mg/L	1.00	102%	70 - 130	0.7	20	11A0354	NUA0136-01	01/06/11 13:08

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

CERTIFICATION SUMMARY

TestAmerica Nashville

Method	Matrix	AIHA	Nelac	Tennessee
EPA 200.7	Water	N/A	X	
EPA 200.8	Water		X	
none	Water			

2960 Foster Creighton Road Nashville, TN 37204 * 800-765-0980 * Fax 615-726-3404

Client	TVA - Kingston Fossil	Work Order:	NTL3745
	714 Swan Pond Rd KFP-1A-KST	Project Name:	Kingston Fossil Plant 050710
	Harriman, TN 37748	Project Number:	RSICA1227Y10A
Attn	William Rogers	Received:	12/30/10 10:00

DATA QUALIFIERS AND DEFINITIONS

J	Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). Concentrations within this range are estimated.
M7	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).
ND	Not detected at the reporting limit (or method detection limit if shown)

METHOD MODIFICATION NOTES

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECE

NTI 3745

Cooler Received/Opened On 12/30/2010 @ 1000

1. Tracking # 1Z 3 3117 001 9933 8434

Courier: UPS IR Gun ID 95610068

2. Temperature of rep. sample or temp blank when opened: 0.8 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO...NA

4. Were custody seals on outside of cooler? YES...NO...NA

If yes, how many and where: 2 front

5. Were the seals intact, signed, and dated correctly? YES...NO...NA

6. Were custody papers inside cooler? YES...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) D

7. Were custody seals on containers: YES NO and Intact YES...NO...NA

Were these signed and dated correctly? 12/31 YES...NO...NA

8. Packing mat'l used? Bubblewrap Plastic bag Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: Ice Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? YES...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? YES...NO...NA

12. Did all container labels and tags agree with custody papers? YES...NO...NA

13a. Were VOA vials received? YES...NO...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...NA

14. Was there a Trip Blank in this cooler? YES...NO...NA If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) D

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? YES..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used YES...NO...NA

16. Was residual chlorine present? YES...NO...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) D

17. Were custody papers properly filled out (ink, signed, etc)? YES...NO...NA

18. Did you sign the custody papers in the appropriate place? YES...NO...NA

19. Were correct containers used for the analysis requested? YES...NO...NA

20. Was sufficient amount of sample sent in each container? YES...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) m

I certify that I attached a label with the unique LIMS number to each container (intial) D

21. Were there Non-Conformance issues at login? YES...NO Was a PIPE generated? YES...NO...#

NTL3745

01/07/11 23:59

TENNESSEE VALLEY AUTHORITY

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT All relevant fields must be completed and accurate

Cooler # 1 of 1

COC # RSICA1227Y10A

RSICA1227Y10A

Required Ship to Lab:		Required Project Information:		Required Sampler Information:	
Lab Name	Test America Nashville	Site ID #	KIF	Sampler	Paul Pier/staff
Address:	2960 Foster Creighton Drive Nashville TN 37204	Project #	Kingston Fossil Plant	Sampling Company	TVA Muscle Shoals
		Site Address	714 Swan Pond Rd	Address:	
				City/State	Phone #:
Lab PM	Mark Hollingsworth	City	Harriman State, Zip	Reimbursement project?	Non-reimbursement project? Mark one
Phone/Fax	800 765 0980	Site PM Name	Bill Rogers	Send EDD to	TVAEDD@envstd.com
Lab PM email		Phone/Fax:	865-717-1627	CC Hardcopy report to	
Applicable Lab Quote #		Site PM Email	wjrogers@tva.gov	CC Hardcopy report to	

TAT: STANDARD X Rush Mark One

Filtered: N — Preserve: HNO3 — Analysis: METALS_TVA_SW_TOTAL

ITEM #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Start Depth (Depth Unit: NA)	End Depth	MATRIX CODE	G=GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	#OF CONTAINERS	Comments/Lab Sample I.D.	METALS_TVA_SW_TOTAL
1	KIF-MONOLITH_MaterialBlank-MB-122710	-------	NA	NA	A	G	MB	12/27/2010	14.38 PAP 12/29/10	1	1	X
2	KIF-MONOLITH01_T8-LH-121310	DSMPLOT_COL1A	NA	NA	LH	G	N	12/13/2010	11 07	1	2	X
3	KIF-MONOLITH01_T9-LH-122710	DSMPLOT_COL1A	NA	NA	LH	G	N	12/27/2010	13 41 PAP 12/29/10	1	3	X
4	KIF-MONOLITH02_T8-LH-121310	DSMPLOT_COL10	NA	NA	LH	G	N	12/13/2010	11 09	1	4	X
5	KIF-MONOLITH02_T9-LH-122710	DSMPLOT_COL10	NA	NA	LH	G	N	12/27/2010	13 44 PAP 12/29/10	1	5	X
6	KIF-MONOLITH03_T8-LH-121310	-------	NA	NA	A	G	LCB	12/13/2010	11 13	1	6	X
7	KIF-MONOLITH03_T9-LH-122710	-------	NA	NA	A	G	LCB	12/27/2010	13 46 PAP 12/29/10	1	7	X
8												
9												
10												
11												
12												

Additional Comments/Special Instructions:

Samples are associated to the Kingston Ash Recovery Project NTC Removal Action for RSI Ash Leaching Test Plan

SAMPLE REASON (check only one)

- X Investigatory
- Split Comparison
- Split Legal
- Special Study
- Plant Ops
- Oth:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Paul A. Pier - TVA	12/29/10	1142	[illegible] TA	[illegible]	[illegible]

Sample Receipt Conditions

Temp in 0C	Samples on Ice?	Sample intact?	Trip Blank?
[illegible]	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N
	Y/N	Y/N	Y/N

SHIPPING METHOD (mark as appropriate): UPS — COURIER \ FEDEX — US MAIL

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Paul A. Pier

SIGNATURE of SAMPLER: Paul A. Pier — DATE Signed: 12/29/10 — Time: 1142

APPENDIX B

TVA (2010) – Field Hydraulic Testing

Appendix B - Field Hydraulic Testing

1. Purpose/Scope

The purpose of the field hydraulic testing effort is to support groundwater modeling associated with the Emory River Risk Assessment. This appendix describes field testing and in-situ results collected for assisting in the designation of model properties and calibration. Test results allow application of site-specific data and verification of historical site and regional data. Data types collected for this effort include site-wide temporal water level measurements, vertical gradient measurements, in-situ hydraulic conductivity measurements, and laboratory-based hydraulic properties of undisturbed samples.

The planned testing design is outlined in the Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan Data Quality Objectives for Environmental Media Appendix A (Jacobs, 2010), and modified by the field change notices listed in the Kingston Ash Recovery Project Non-Time Critical Removal Action River System and Analysis Plan Task Completion Technical Memorandum Groundwater Sampling (Jacobs, 2011).

2. Water Level Measurements

2.1. Water Level Measurements Methodology

Groundwater readings of water levels within wells and piezometers, together with surface water body elevations, were surveyed in and surrounding the study area across all hydrostratigraphic units in a finite timeframe. Groundwater readings were collected by field environmental personnel reading a direct measurement of the depth to water surface from a known reference point utilizing a water level indicator in accordance with standard operating procedure TVA-KIF-SOP-02 *Groundwater Sampling* for manual measurement techniques, or from observation of a mechanical gauge. This included wells, temporary well points, conventional piezometers, and vibrating wire piezometers. Surface water readings were collected by surveyors using a real-time kinematic global positioning system (GPS).

Automated groundwater instrumentation readings were collected from a subset of piezometers located within the Ash Processing Area that collect data in real-time and transmit data to a data repository using radio telemetry.

2.2. Water Level Measurement Results

A site-wide snapshot of water levels was performed between July 28 and July 30, 2010 involving 180 wells and piezometers, and 34 surface water control points. Measurement locations were selected to ensure adequate optimal spatial coverage. Several groups were involved in collecting this data, including:

- TVA environmental sampling personnel (measuring monitoring wells exterior to the study area and interior temporary well points)
- TVA surveyors (collecting designated surface water control points)
- Stantec personnel (measuring piezometers along impoundment dikes mirroring the extents of the study area and piezometers within the study area)
- Geosyntec personnel (Ash Processing Area or automated interior piezometers)
- MACTEC personnel (Ash Processing Area manually-read perimeter piezometers)

Maps showing water level sampling locations can be found in Section 3.6 of the main body report. All information collected consisted of instantaneous water level measurements, except for the automated readings from selected wells in the Ash Processing Area that provided three-day time-weighted average measurements. Water surface information was used to create groundwater potentiometric contour maps for each hydrostratigraphic layer, which in turn were used to calibrate the groundwater flow model. Potentiometric contour maps by geologic layer are provided in the main body of the report, in Section 3.6.

3. Vertical Gradient Estimates

3.1. Vertical Gradient Methodology

Vertical gradient data was collected from across the study domain to investigate potential groundwater exchange between the bedrock and natural (non-ash) overburden materials. Data to support vertical gradient calculations was collected from paired wells/piezometers in and around the proposed Closed Ash Landfill with at least one well screened in the upper bedrock and one well screened in the lower section of the (non-ash) overburden. Vertical gradient calculations are the difference in measured water level surface (total hydraulic head) from paired locations, divided by the vertical distance between the bottom elevations of the two screened intervals, to estimate vertical flow direction and magnitude. All locations of paired wells/piezometers inside and surrounding the proposed Closed Ash Landfill, both existing and abandoned, were included in this data collection to maximize the number of comparison locations. This expands upon the original scope defined in the Sampling and Analysis Plan (Jacobs, 2010) to spatially define vertical gradients across the site.

Manual measurement information came from manual water level measurements in wells and piezometers were collected by either AECOM or Stantec field personnel from January 2009 through February 2011, on a bi-weekly interval. Historical manual measurements were collected by TVA environmental personnel from January 1989 through December 1998, in various intervals (quarterly, semi-annually, or annually).

Pressure transducers were installed in several well pairings to examine temporal variations in vertical gradients; these instruments were installed in several well pairings inside and upgradient of the proposed Closed Ash Landfill during January 2011 by TVA environmental personnel, and collected readings in two-hour intervals through February 2011. Equipment was downloaded bi-weekly, and removed at the end of February 2011 as no further data recording for the transducers was deemed necessary due to consistency in the readings and agreement with manually measured water level elevations at these locations.

A borehole flowmeter (BFM) was used to measure the ambient vertical flow rate within the screened interval (or open borehole) of selected wells screened in the non-ash overburden or upper bedrock, to infer the direction of vertical flow within these strata. Direction of natural flow within a well under ambient conditions is a direct means of assessing vertical components of the hydraulic gradient at the time of the study. Borehole flow meter testing was conducted in August and September, 2010 by TVA personnel. Measurements were collected in one-foot increments, over the length of the screen or open borehole, to determine incremental flow through the exposed intervals.

Information relating to vertical gradient measurement locations, results, and data set characteristics are given in Table 3-1. Locations and inferred gradients are shown in Figure 3-1. Gradients are presented as unitless vectors, indicating a degree of inclination of the water table, with positive values inferring upward flow and negative values inferring downward flow. Each vertical gradient presented in Table 3-1 and Figure 3-1 is an average of comparisons between paired wells/piezometers during the entire period of record.

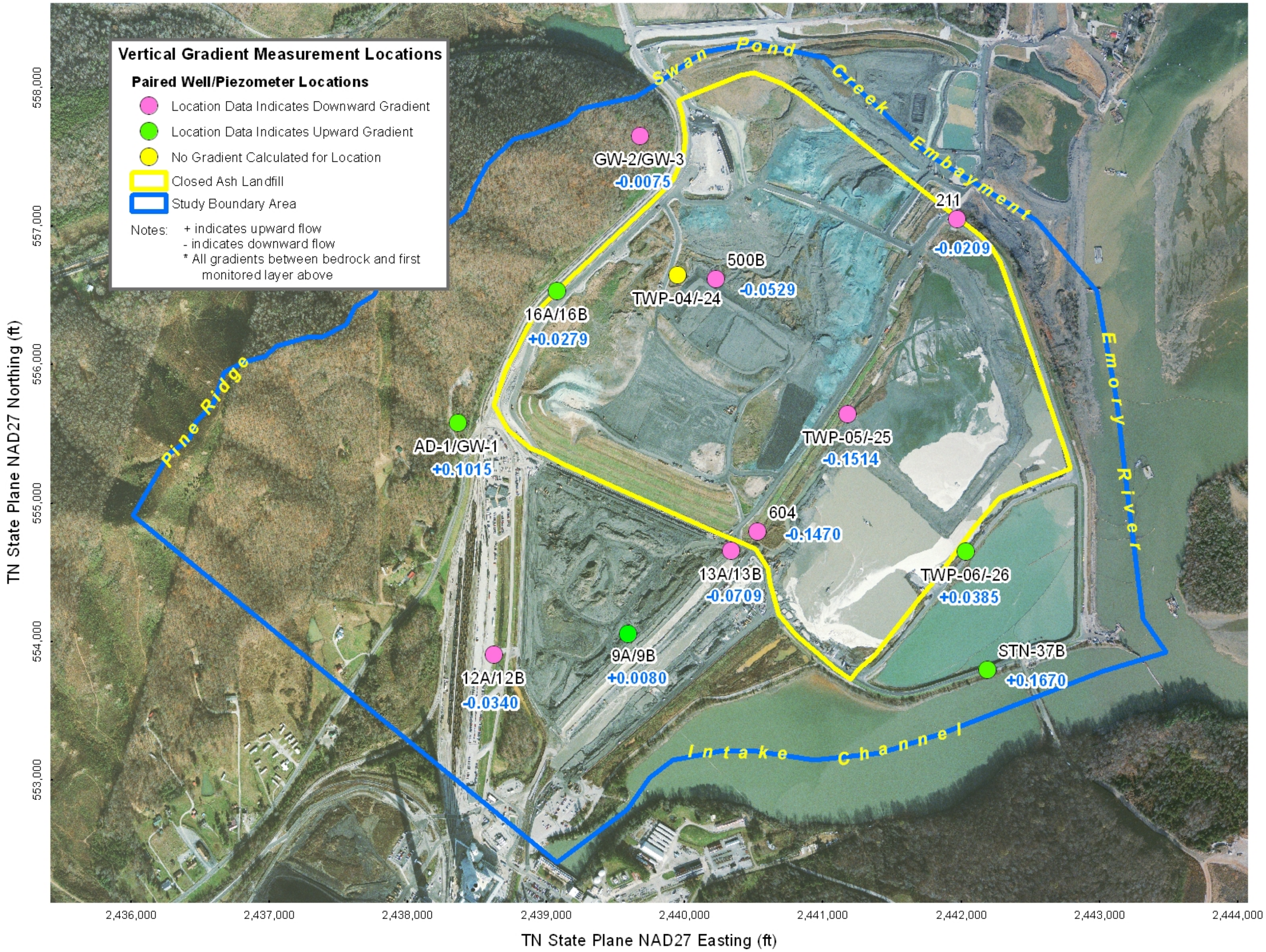
3.2. *Vertical Gradient Results*

Table 3-1. Summary of Paired Well/Piezometer Locations and Data for Vertical Gradient Analysis

Inside/Outside Closed Ash Landfill	Well Pairing	Average Vertical Gradient*	Source	Sample Collection	Sample Population	Sample Period	Length of samples	Approximate Ground Elevation (ft)	Upper Well Screened Material	Lower well material
Outside (upgradient)	AD-1/GW-1	0.0998	TVA Transducers	Pressure Transducer (2 hr interval)	625	01/11-02/11	6 weeks	780	Weathered Shale	Shale
Outside (upgradient)	GW-2/GW-3	-0.0088	TVA Transducers	Pressure Transducer (2 hr interval)	565	01/11-02/11	6 weeks	766	Clay/Weathered Shale	Shale
Inside	TWP-05/TWP-25	-0.1781	TVA Transducers	Pressure Transducer (2 hr interval)	561	01/11-02/11	6 weeks	789	Sand	Shale
Inside	TWP-06/TWP-26	0.0384	TVA Transducers	Pressure Transducer (2 hr interval)	629	01/11-02/11	6 weeks	767	Clay/Sand	Shale
Outside (cross-gradient)	9A/9B	0.0080	TVA Historical	Quarterly/Semi-Annual/Annual Grabs	27	01/89-12/98	10 years	769	Ash	Shale
Outside (cross-gradient)	12A/12B	-0.0340	TVA Historical	Quarterly/Semi-Annual/Annual Grabs	24	01/89-12/98	10 years	764	Clay	Shale
Outside (cross-gradient)	13A/13B	-0.0709	TVA Historical	Quarterly/Semi-Annual/Annual Grabs	24	01/89-12/98	10 years	770	Clay	Shale
Outside (upgradient)	16A/16B	0.0279	TVA Historical	Quarterly/Semi-Annual/Annual Grabs	27	01/89-12/98	10 years	769	Clay	Shale
Inside	211	-0.0209	Stantec	Bi-weekly grabs	61	01/09-02/11	26 months	765	Sand	Shale
Inside	500B	-0.0529	Stantec	Bi-weekly grabs	58	01/09-02/11	26 months	758	Clay	Shale
Inside (cross-gradient)	604	-0.1470	Stantec	Bi-weekly grabs	58	01/09-02/11	26 months	782	Clay	Shale
Outside (downgradient)	STN-37(PZ-15->PZ-16)	0.1670	Stantec	Bi-weekly grabs	62	05/09-02/11	22 months	763	Gravel	Shale

*A negative sign indicated downward gradient

Figure 3-1. Paired Well/Piezometer Locations and Average Vertical Gradients



Locations investigated along Pine Ridge, upgradient of the proposed Closed Ash Landfill, include existing well pairings AD-1/GW-1 and GW-2/GW-3, and historical well pairing 16A/16B (destroyed in the Dredge Cell Failure in 2008). Data from these wells show mostly upward vertical gradients at the foot of Pine Ridge, the primary source of lateral groundwater inflow to the shallow aquifer beneath the proposed Closed Ash Landfill study area, inferred from movement of water based on site groundwater gradients. Calculated gradients at well pairings AD-1/GW-1 (+0.1015) and 16A/16B (+0.0279) show strong upward gradients, as opposed to the more neutral gradient observed at wells GW-2/GW-3 (-0.0075). Movement of water beneath Pine Ridge and into the proposed Closed Ash Landfill study area is expected to be predominantly through deeper bedrock fractures and confined by the overlying clay residuum.

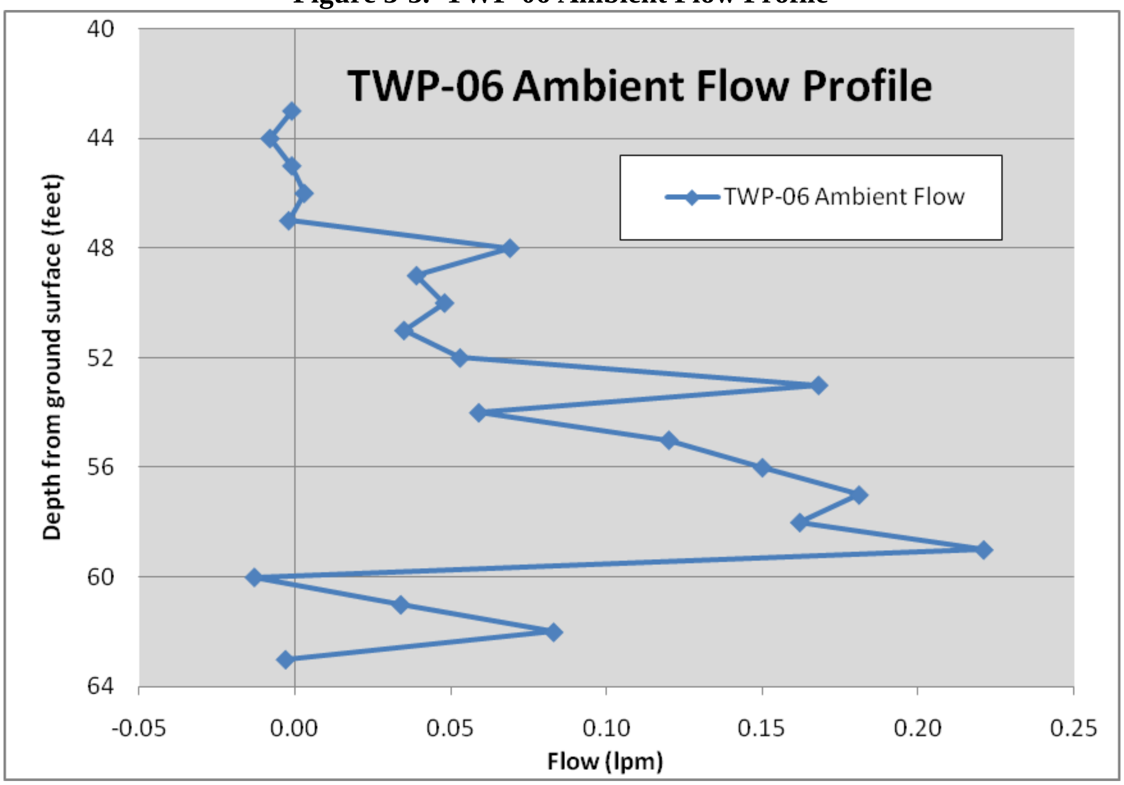
Locations investigated within the proposed Closed Ash Landfill include nested piezometers 211 (211 and 211A), 500B (500-34' and 500-51'), 604 (604 and 604A), and temporary well points TWP-05/TWP-25. Most of the well/piezometer pairings within the proposed Closed Ash Landfill exhibit downward gradients, likely due to the presence of existing ash impoundments and legacy effects of wet-stacking operations. It would be expected that the localized regions surrounding impounded water, either surface water bodies or retained water within large stacks, would be subject to a downward gradients by gravity-induced seepage. The most significant downward gradients are observed in the two pairings that are installed in the relic portion of the Dredge Cell, which are the 604 piezometers and the TWP-05/TWP-25 wells; these pairings are located at topographically higher elevations across the site of any pairings examined for vertical gradients. Data from these piezometers shows the relic portion of the Dredge Cell has retained elevated saturated moisture levels through the stack which provides a mechanism for downward hydraulic gradients.

Lesser downward hydraulic gradients were observed at 211 and 500B, which are still nominally elevated (as part of the Test Embankment Area and Dike C), but still some forty feet below the locations of 604 and TWP-05/TWP-25. These two locations could be influenced by the presence of impounded water in the neighboring Lateral Expansion Area (for 211) or retained saturated water levels within the adjacent Test Embankment (500B). It is likely that once areas of impounded water within and surrounding the proposed Closed Ash Landfill are dewatered and capped, recharge will be drastically reduced to eliminate dominant downward gradients. In this circumstance, potentiometric head in the bedrock provided by recharge from Pine Ridge should be the dominant hydraulic force in the system, encouraging upward gradients.

Locations along the Intake Channel, downgradient of the proposed Closed Ash Landfill, include temporary well pairing TWP-06/TWP-26 and piezometer pairing STN 37B (PZ-15 and PZ-16). These two locations are on both screened under surface water impoundments (the Ash Pond and Stilling Pond), but still show upward gradients from the bedrock to the overburden. The magnitude of the discharge from bedrock at these locations is enough to overcome leakage from the overlying surface impoundment. The ambient profile of well TWP-06 shown in Figure 3-3 infers upward gradients.

Locations in the Ash Processing ("Ball Field") Area analyzed include historical well pairings 9A/9B and 12A/12B (both abandoned in 2007), and 13A/13B (abandoned in 2007 and destroyed during 2009, respectively). Generally these locations exhibit downward gradients during the monitoring period from January 1989 to December 1998. This period predated the current operations at the Ball Field; during this period, a chemical holding pond was in operation adjacent to the 9A/9B, and a sluice channel that extends to the southeast of pairings 9A/9B and 13A/13B. Ash dewatering operations of the past several years have temporarily stored wet ash for dewatering at the Ball Field facility. The strongest downward vertical gradients observed in this area were at well pairing 13A/13B, which could be influenced by leakage from proximate water bodies including the expanded Ash Pond area, the ash sluice channel, and the neighboring Dredge Cell. Well pairing 12A/12B indicates a mild downward gradient, but would not appear to be influenced by a surface water body; historical documents have shown the bedding (ballast) of the nearby railroad tracks (Railroad Loaded Yard) were backfilled with large amounts of stone, allowing for enhanced drainage of rainfall.

Figure 3-3. TWP-06 Ambient Flow Profile



4. In-Situ Hydraulic Conductivity Measurements

4.1. Rationale for Selecting Location and Applicable Testing

Historical hydraulic conductivity (K) measurements were used to create a range of applicable values for each hydrostratigraphic layer. For those layers lacking an adequate quantity of values, or adequate spatial coverage, additional wells/piezometers were selected or installed for testing.

Picking an appropriate hydraulic test for selected wells and piezometers depended on the characteristics of the well. Pump testing was the preferred method of hydraulic conductivity testing, but for wells/piezometers that could not sustain pumping with time or whose diameter was too small to install the pumping equipment downhole, slug testing was utilized. For selected wells, BFM surveys were performed following a standard well pump test.

4.2. In-Situ Hydraulic Conductivity Measurement Methods

TVA environmental sampling personnel conducted the hydraulic conductivity testing during selected dates in August and September, 2010. Data for pump tests and slug tests were analyzed using Aquifer Test Pro version 3.5 (Waterloo Hydrogeologic, 2002, "AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software", Waterloo, Ontario, Canada) and utilizing a variety of analysis methods; the analysis that best fit conditions in the field or provided the best fit to the data was selected as a representative value. Data from BFM testing was analyzed per the EPA document EPA/600/R-98/058: Application of the Electromagnetic Borehole Flowmeter procedure (Young et. al., 1998).

4.2.1. Single-Well and Multiple-Well Pump Tests

Single-well and multiple-well pump tests involve stressing a well by changing the quantity of water within the well at a constant rate and observing the corresponding change in the potentiometric head over some minimum period of time (typically one hour or more). Measurements are always collected from the stressed well, but when available, it is preferred to get measurements from a nearby affected well (thus becoming a multi-well test). The corresponding change in head over time can be analyzed to obtain the bulk hydraulic conductivity (K) for the local area around the well. Execution of pump tests followed the procedure set out in ASTM D 4050 – 96. Data evaluated was from pressure transducers installed in the well collecting water level measurements every two seconds for the duration of the tests. Each well was analyzed by traditional pump-testing evaluation methods (Cooper-Jacob, Theis, and Neumann methodologies) depending on assumed fit of aquifer characteristics and quality of interpretation. Five wells screened fully or partially in the alluvium sand were pump-tested (TWP-04, TWP-05, TWP-06, 6AR, 22), along with four wells (GW-3, TWP-24, TWP-25, TWP-26) that were screened in either competent or weathered bedrock.

4.2.2. Slug Tests

Slug tests were executed by instantaneously introducing or removing a given volume of water in the well, and observing potentiometric head changes over a period of time. The corresponding change in head over time can be analyzed to estimate the bulk hydraulic conductivity for the immediate area around the well. Typically wells selected for slug testing have a relatively low yield and/or small diameter casing/screen diameter, eliminating conventional pumping as an option. After a slug was deployed, the rebound of the water column was observed by a pressure transducer collecting data each second for the duration of the test. Two slug tests were typically employed at each location, and the best quality data was used for interpretation. Slug testing was executed per site standard operating procedure TVA-KIF-SOP-42: *Slug Testing.* Curve matching/fitting was employed for analysis of each set of results, using the techniques of Bouwer and Rice, Cooper-Bredehoeft-Papadopolos, and Hvorslev based on the assumed aquifer characteristics and the quality of fit.

A total of three piezometers (STN-27A (PZ-11), STN-27B (PZ-12), and STN-48A (PZ-19)) screened in the alluvial clay-silt were tested, all within the Proposed Closed Ash Landfill along Dike C, typically immediately underlying areas of fill. Only one well was tested that was screened in the residuum (AD-2), which was outside of the Proposed Closed Ash Landfill, located downgradient of the Ash Processing Area on a dike bordering the Intake Channel. Four bedrock wells were tested (AD-1, AD-3, GW-1, GW-2) either screened in competent or weathered bedrock.

4.2.3. Borehole Flowmeter Method

The BFM provides direct information concerning the mix of water that enters a well under either ambient or pumping conditions. The instrument allows for measurement of the natural (ambient) vertical flow that exists in many wells and can assess the flow distribution that is entering the well from the surrounding medium (at a pseudo-steady pumping rate). Ambient flow distributions provide information on the direction of the vertical component of the hydraulic gradient, and on the location of hydraulically active fractures in the case of a fractured formation. If certain conditions are met, flow distributions during pumping provide information on the relative differences in the permeability of selected aquifer zones or additional information on fracture hydraulic characteristics.

Surveys typically began with an ambient flow profile, followed by a single-well test to collect data for estimating an average horizontal hydraulic conductivity for the screened well interval, and to establish a stable drawdown of the water surface within the well. A flow profile of vertical flow within the well was then conducted during pumping to measure vertical flow in the well in vertical increments (e.g., one-foot). BFM surveys were to be conducted on all six temporary wells within the Proposed Closed Ash Landfill, but well TWP-05 had an uncorrectable bend within the top five feet of the well casing which would not allow the equipment down the well. This follows the procedure laid out by EPA/600/R-98/058: Application of the Electromagnetic Borehole Flowmeter (Young et. al., 1998).

4.3. *In-situ Hydraulic Conductivity Measurement Results*

4.3.1. *Data Summary*

Table 4-1 gives a summary of single well hydraulic test results, including characteristics of the well and computed aquifer properties for the screened interval of the well/piezometer; Figure 4-1 gives the locations of the single-well hydraulic tests.

Table 4-1. Summary of Single-Well Hydraulic Tests

Location	*Type*	*Diameter (in)*	*Test Date*	*Type of Test*	*Static Water Level BGS (ft)*	*Saturated Aquifer Thickness (ft)*	*Average Pumping Rate (gpm)*	*Horizontal Hydraulic Conductivity (cm/s)*	*Storativity*	*Screened Media*
AD-1	Well	2	09/15/10	Slug	6.9	29	Slug	1.1E-05	N/A	Residual Silty-Clay / Weathered Shale
AD-2	Well	2	08/27/10	Pump	9.0	19	0.5	1.3E-04	N/A	Residual Silty-Clay (Fill)
AD-3	Well	2	08/30/10	Slug	7.9	10	Slug	1.1E-03	N/A	Residual Silty-Clay / Weathered Shale (Fill)
GW-1	Well	2	09/15/10	Slug	6.4	30	Slug	1.7E-06	N/A	Bedrock
GW-2	Well	2	09/02/10	Slug	18.6	4	Slug	2.4E-04	N/A	Residual Clay/ Weathered Shale
GW-3	Well	2	09/02/10	Pump	24.9	28	1.0	4.0E-03	N/A	Bedrock
KIF-22	Well	2	09/02/10	Pump	16.5	36	2.7	5.2E-03	4.58E-03	Alluvial Clay-Silt/Sand
KIF-6AR	Well	2	08/26/10	Pump	11.9	10	1.1	4.1E-04	1.82E-03	Alluvial Clay-Silt/Sand
STN-27A (PZ-11)	Piezometer	1.25	08/27/10	Slug	18.3	15	Slug	1.5E-05	N/A	Alluvial Clay-Silt (Fill)
STN-27B (PZ-12)	Piezometer	1.25	08/27/10	Slug	23.2	34	Slug	9.3E-06	N/A	Alluvial Clay-Silt
STN-48A (PZ-19)	Piezometer	1.25	08/27/10	Slug	18.6	3	Slug	*	N/A	Alluvial Clay-Silt (Fill)
TWP-04	Well	2	08/22/10	Pump	22.4	75	2.8	8.1E-04	4.71E-03	Alluvial Clay-Silt/Sand
TWP-05	Well	2	08/24/10	Pump	27.4	20	1.3	9.9E-05	1.66E-03	Alluvial Sand
TWP-06	Well	2	08/23/10	Pump	12.3	20	0.2	3.8E-04	4.13E-03	Alluvial Clay-Silt/Sand
TWP-24	Well	2	08/22/10	Pump	23.4	30	0.8	6.5E-05	1.30E-03	Bedrock
TWP-25	Well	2	08/24/10	Pump	26.7	30	0.5	1.1E-05	2.80E-04	Bedrock
TWP-26	Well	2	09/02/10	Pump	11.4	30	0.8	2.0E-05	9.55E-03	Bedrock

*Data not fittable

Figure 4-1. Locations of Single-Well Hydraulic Tests and Undisturbed Sampling Locations for Laboratory Analysis of Hydraulic Parameters

4.3.2. Alluvial Clay-Silt K Variation Discussion

Both STN-27A (PZ-11) and STN-27B (PZ-12) were evaluated using the Bouwer and Rice method, yielding K results of 1.5E-05 cm/sec and 9.3E-06 cm/sec, respectively. The data for STN-48A (PZ-19) was non-interpretable by any method applied, apparently due to some unknown recharge condition. The value for STN-27A (PZ-11) was ultimately discarded from use in the computer model, due to concern that the piezometer was screened in Dike C fill material.

4.3.3. Alluvial Sand K Variation Discussion

This category of well testing includes those wells that were screened in alluvial sands, or wells screened across both the alluvial clay-silt and sands, due to the likelihood of the permeability of the sand dominating flow through the layer. These are typically the strata that immediately overlie the bedrock. Data from TWP-06 (3.8E-04 cm/sec) was evaluated with the Cooper-Jacob straight line method, test data from TWP-04 (8.1E-04 cm/sec) and 6AR (4.1E-04 cm/sec) were evaluated using the Theis type curve matching, data from TWP-05 (9.9E-05 cm/sec) was evaluated using Neumann's curve fitting method. The individual well values are generally in agreement. Data from well 22 analyzed by these results did not have a sufficient result of fit, nor did it fully satisfy conditions for each test; a satisfactory result was achieved by using the Hantush Method resulting in a K of 5.2E-03 cm/sec to account for a leaking condition. The very permeable sandy material surrounding the well screen, combined with its close proximity to both the ash pond and the river, makes it likely that there was a source of surface water recharge to this well.

4.3.4. Residuum K Variation Discussion

All curve matching/fitting techniques yielded very similar results for well AD-1, but the chosen method was the Bouwer and Rice method, yielding a K result of 1.1E-05 cm/sec.

4.3.5. Bedrock K Variation Discussion

This category of well testing includes those wells that were screened in bedrock, whether competent or weathered. Pump-test wells GW-3 (4.0E-02 cm/sec), TWP-24 (6.5E-05 cm/sec), TWP-25 (1.1E-05 cm/sec), and TWP-26 (2.0E-05 cm/sec) were evaluated with the Cooper-Jacob straight line method. Slug-tested wells AD-1 and GW-1 were evaluated using the Bouwer and Rice Method, yielding K results of 1.1E-05[5] cm/sec and 1.7E-06 cm/sec, respectively; AD-3 and GW-2 were evaluated using the Cooper-Bredehoeft-Papadopolos method, yielding K results of 1.1E-03 cm/sec and 2.4E-04 cm/sec, respectively.

Values of wells within the Rome formation generally agree with each other, and concur with the K range expected for fractured or weathered bedrock as indicated in the well boring logs for these locations. These data include results from AD-1 (1.1E-05 cm/sec), GW-1 (1.7E-06 cm/sec), and GW-2 (2.4E-04 cm/sec). Well GW-3 exhibits a higher value than all other wells for this formation (4.0E-03 cm/sec), apparently due to a recharge condition at this well that was not observed in well GW-2. Though nothing stands out different from the logging of well GW-3's compared to other wells screened within the Rome formation, the possibility of extensive fracturing around the screened interval combined with the steep grade of Pine Ridge could provide a ready source of recharge, and explain the unexpectedly highly permeable K value.

Results from wells screened in the Conasauga formation generally agree with each other, including TWP-24 (6.5E-05 cm/sec), TWP-25 (6.3E-06 cm/sec), and TWP-26 (6.0E-06 cm/sec). These values are generally in line with expected values for the competent bedrock noted within the well logs. Well AD-3 (1.1E-03 cm/sec) is two orders of magnitude above this range, but well logs indicate excessive weathering and fracturing which would account for the increase in observed permeability.

4.4. Borehole Flowmeter Testing Results

BFM results for each of the tested wells are graphically summarized in Figures 4-2 through 4-6. The first set of graphs for each test well shows the measured flow profile under ambient and steady-state pumping conditions, along with the net flow profile (i.e., the pumping profile with ambient flow removed). The second graph shows the incremental hydraulic conductivity profile for the well computed from the net flow profile in accordance with methods described in Young et al. (1998). Monitoring well installation field logs for the temporary well points (TWP) can be found in Appendix E.

4.4.1. Data Interpretation

The TWP-04 screen interval spans a ten-foot section of the lower alluvial overburden on the relic Dredge Cell, just above bedrock. The more permeable zone of this well is the lowest three feet, which is a mix of silty sand, clayey gravel, and clayey silt; the thin lenses of clayey gravel appear to be the most permeable zone, exhibiting a horizontal hydraulic conductivity (K_h) in the 10^{-2} cm/sec range. The upper six feet of this screened section is a mixture of clays and silty clay, with a K_h in the order of 10^{-4} cm/sec.

TWP-24 is screened across the upper fifteen feet of bedrock, adjacent to well TWP-04. The screened material is entirely shale, with the upper eight feet containing interbedded limestone; the very top of the screen spans a short section (up to three feet) of weathered bedrock. Within the very top four feet of shale with interbedded limestone, is the most permeable layer with a K_h in the order of 10^{-3} cm/sec. The permeable nature of this zone is likely due to enhanced secondary porosity produced by limestone/shale weathering. The rest of the screened bedrock, which is competent and without limestone, shows lower permeability with K_h in the range of 10^{-7} to 10^{-6} cm/sec.

Borehole flowmeter testing of TWP-05 was not completed as intended due to a bend in the riser pipe near the top of the casing that prevented installation of the borehole flowmeter. TWP-25, located adjacent to TWP-05, has an open borehole spanning nearly seventeen feet of shale over the upper bedrock. There is no evidence of weather bedrock in the screened section; this interval is cased off by an outer-casing installed above to separate the overburden. The upper 13 feet of the bedrock exhibits interbedded limestone seams within the shale. Calculated K_h values through the length of the column are fairly homogeneous, with observed values typically ranging from 10^{-6} to 10^{-5} cm/sec.

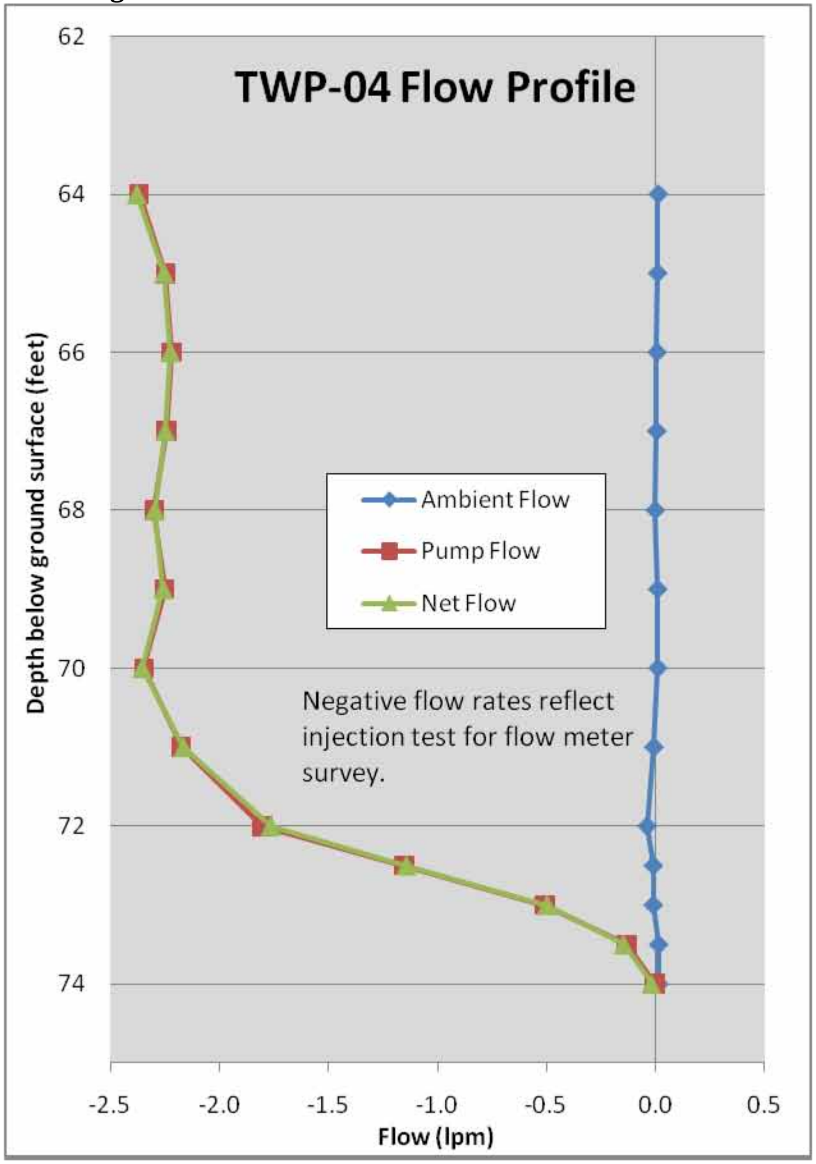
TWP-06 has a 20 foot screen spanning the lower alluvium just above bedrock. The flow profile indicates a slightly more permeable zone in the upper portion of the screen (from 45 feet to 48 feet) compared to the rest of the column, which is otherwise fairly uniform. The flow in this section is at least an order of magnitude higher (10^{-3} cm/sec) than the rest of the well; the silty clay section indicated here typically shows a lower hydraulic conductivity than that observed for this interval, so it is possible the measurements at this vertical horizon are really attributable to gravels observed above and below the silty clay section.

TWP-26, located adjacent to TWP-06, has an open borehole spanning 25 feet in length, screening upper bedrock consisting of thin, interbedded shale and limestone layers. Flow into the well is fairly uniform, as is the K_h distribution through the open interval; increases in flow at 105 feet and 96 below ground could be due to pumping variation during the test, as flow would be expected to stay constant or increase within the well monotonically as you move up the borehole. The loss of observed flow through the BFM from the top of the open borehole at 88 feet to a point 95 feet below the ground surface is likely due to irregularities within the borehole which prevents the equipment from being able to make a tight seal, allowing for flow to bypass the instrument, and precluding accurate measurements of this interval.

4.4.2. Data Outliers

There are two sets (TWP-25, TWP-26) of ambient flow profile data that are questionable based on the reported range of values within those sets. Ambient flows within well TWP-25 and TWP-26 fall below the lower flow threshold of each one-inch internal diameter instrument used (0.16 L/min and 0.40 L/min, respectively); pumped flow profiles from this well are within the threshold range of the instrument, and the maximum flow in the well generally agrees with the observed pumped flow rate. The half-inch diameter meter used for conducting flow profiles on the other TWP wells is generally more reliable and more accurate at flow values below the threshold indicated above, but was damaged before the surveys of TWP-25 and TWP-26 were conducted.

Figure 4-2. TWP-04 Borehole Flowmeter Vertical Flow Profiles and Incremental Horizontal Hydraulic Conductivity



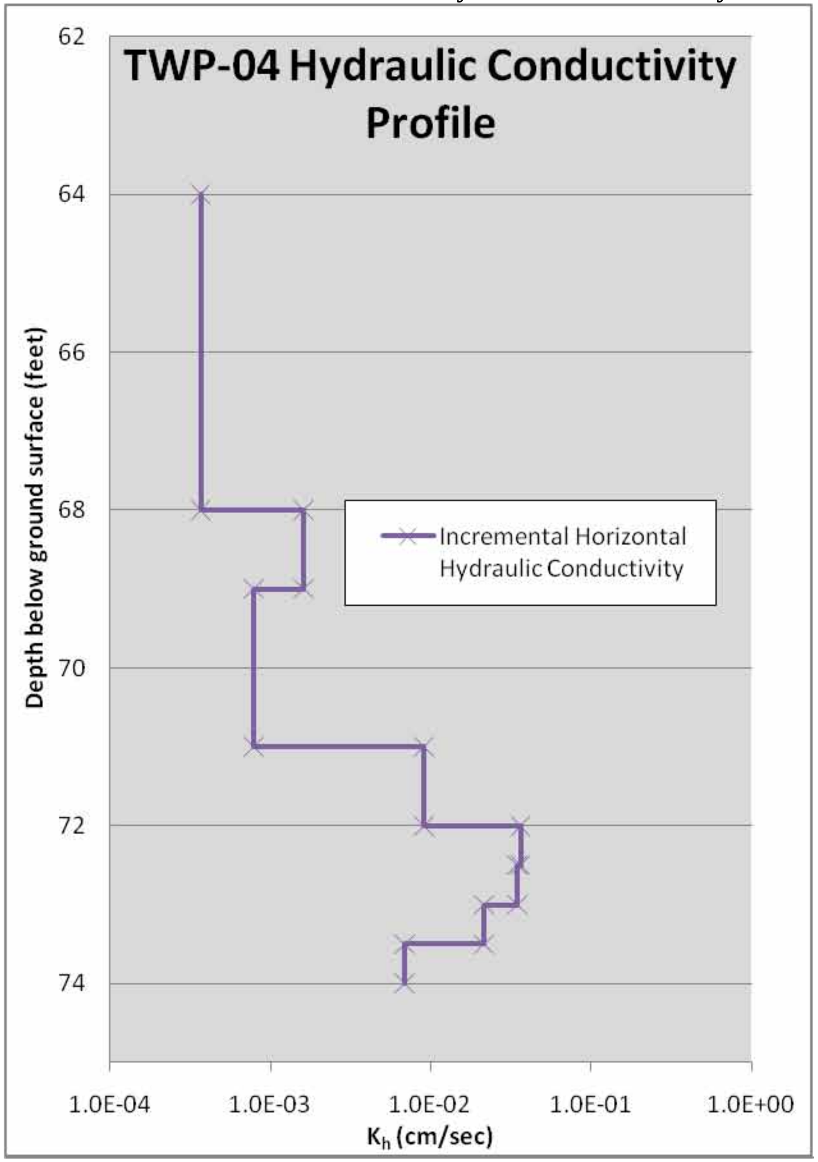


Figure 4-3. TWP-24 Borehole Flowmeter Vertical Flow Profiles and Incremental Horizontal Hydraulic Conductivity

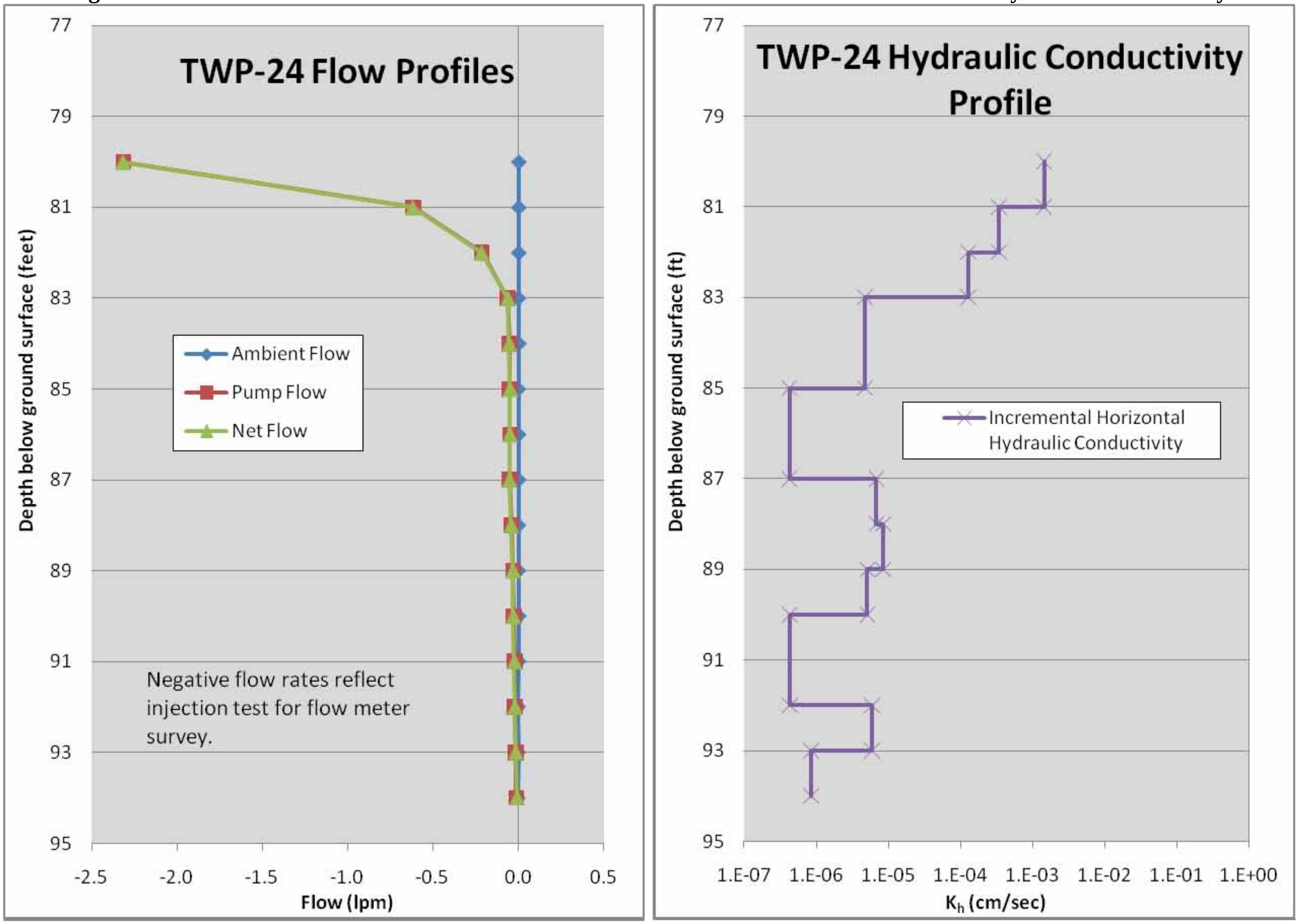


Figure 4-4. TWP-25 Borehole Flowmeter Vertical Flow Profiles and Incremental Horizontal Hydraulic Conductivity

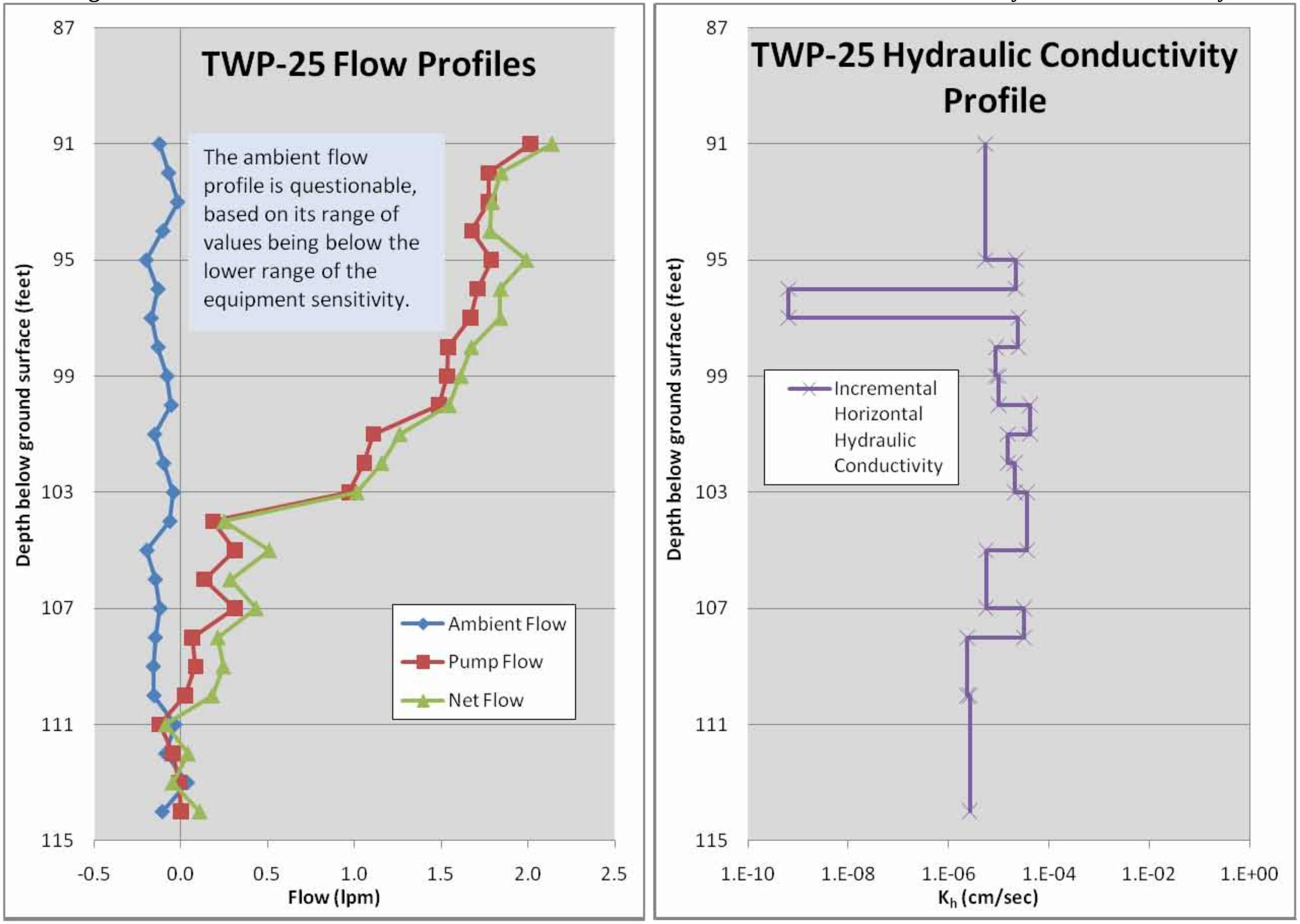


Figure 4-5. TWP-06 Borehole Flowmeter Vertical Flow Profiles and Incremental Horizontal Hydraulic Conductivity

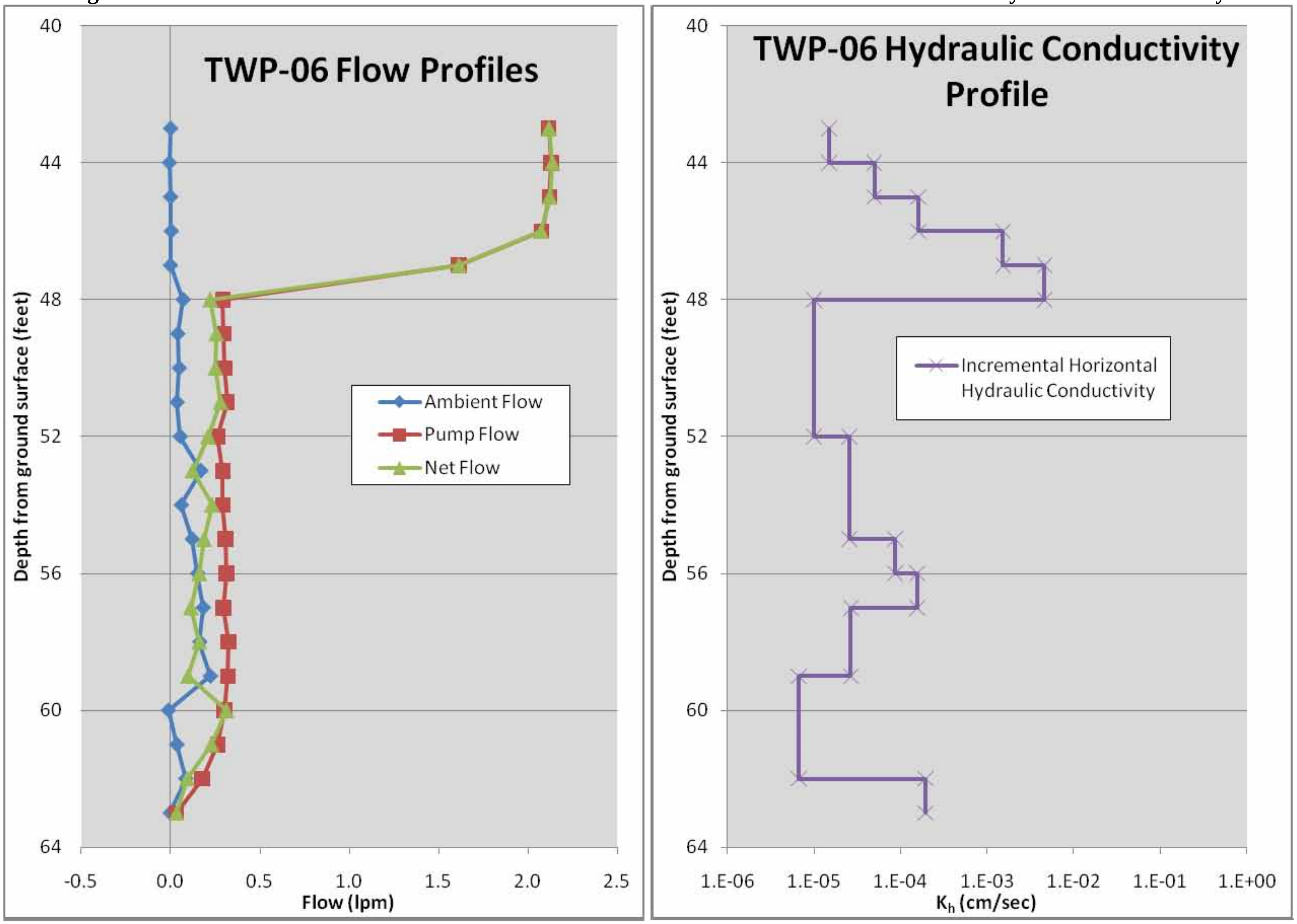
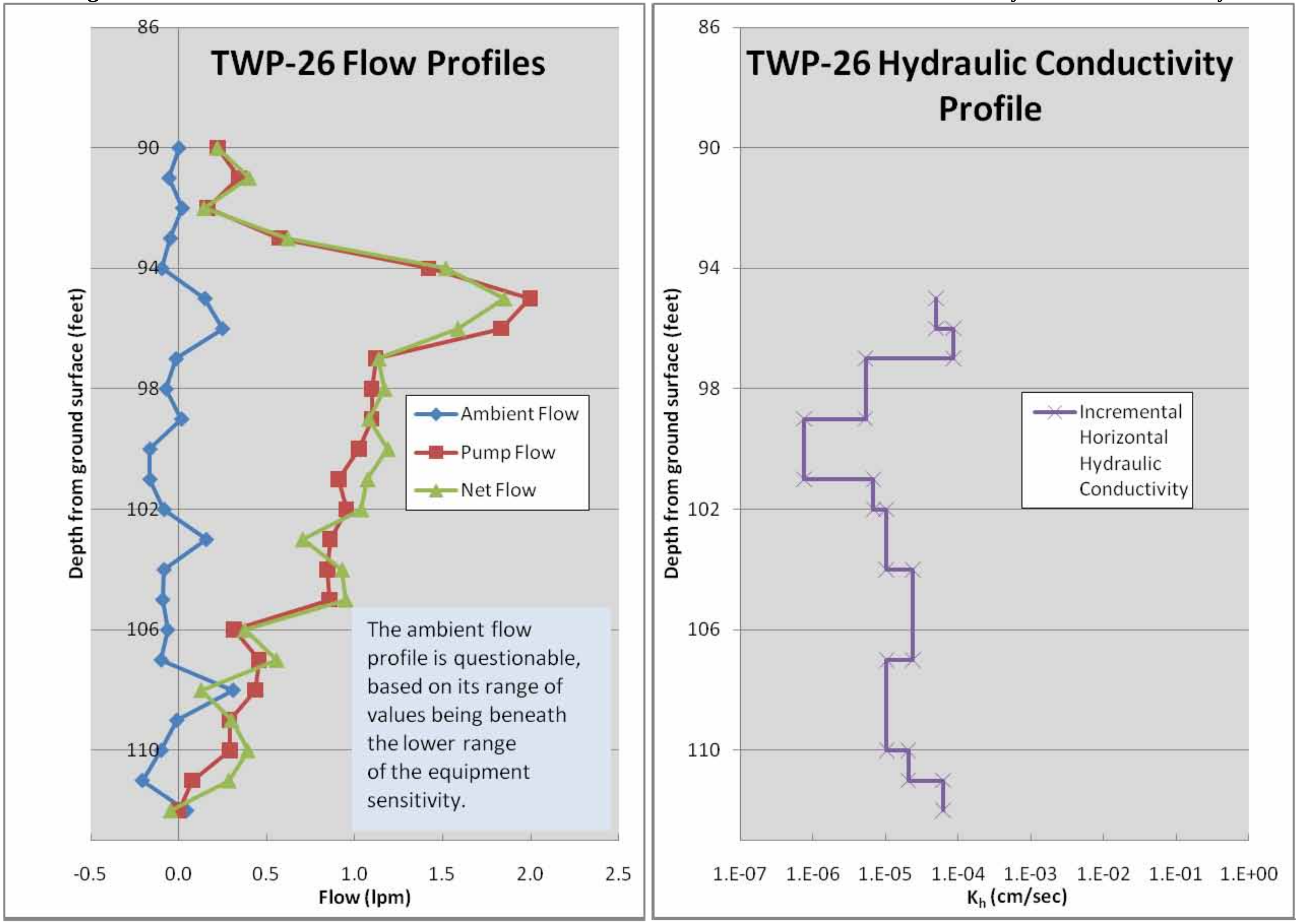


Figure 4-6. TWP-26 Borehole Flowmeter Vertical Flow Profiles and Incremental Horizontal Hydraulic Conductivity



5. Laboratory-Based Hydraulic Properties of Undisturbed Samples

5.1. Methods

5.1.1. Field Collection Methods

Undisturbed soil samples were collected in the field utilizing Shelby tubes, collected using hollow stem and rotasonic drill rigs from specified target strata. Samples were catalogued, preserved (some through temperature control and/or being maintained in an upright position), and then shipped to the applicable lab for analysis.

Soil samples were collected between April and September, 2010, by MACTEC using either hollow-stem augers or rotasonic drilling methods. Samples were collected continuously in two-foot intervals, and then documented by RSI personnel. Shelby tube samples from drilling activities were preserved and shipped to Daniel B. Stephens & Associates for hydraulic parameter analyses and to Pittsburgh Mineral & Environmental Technology, Inc. for geochemical and mineralogical analyses.

5.1.2. Laboratory Analysis Methods

Shelby tube samples from drilling activities were analyzed by Daniel B. Stephens & Associates for gravimetric and volumetric moisture content, dry bulk density, vertical saturated hydraulic conductivity, total and effective porosity, and specific gravity. Mineralogical characterization and geochemical analyses of soil samples were conducted by Pittsburgh Mineral & Environmental Technology, Inc. Laboratory analysis methods are as indicated:

- Dry bulk density (ASTM D7263)
- Moisture content (ASTM D7263)
- Calculated porosity (ASTM D7263)
- Saturated hydraulic conductivity (ASTM D2434)
- Water potential method (ASTM D6836)
- Specific gravity calculation for fine material (ASTM D854)
- Specific gravity calculation for coarse material (ASTM C127)
- Effective porosity calculation (Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, CO; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165 A Comparison of Estimated and Calculated Effective Porosity)
- Mineral composition (XRD and polarized light microscopy)
- Free iron oxide (Chao, T.T., and Zhou, L., 1983, Extraction techniques for selective dissolution of amorphous iron oxides from soils and sediments: Soil Science Society of America Journal, v. 47, p. 225-232)

- CEC, exchangable cations, calcite equivalent, soluble salts, soil pH (American Society of Agronomy (ASA). 1996. *Methods of soil analysis. Part 1. Physical and mineralogical properties including statistics of measurement and sampling*, Methods 14, 15, 16, and 40. Madison, WI.)

5.2. Data Summary

Figure 4-1 shows the locations of undisturbed samples collected for laboratory hydraulic and geotechnical analysis. Figure 5-1 shows the locations of undisturbed samples collected for geochemical and mineralogical lab analyses. Results from laboratory methods are published in the reports from each lab, reported in Appendices C and D.

Figure 5-1. Locations of Samples Collected for Geochemical and Mineralogical Sample Analysis

6. References

ASTM D 4050 Standard Test Method for (Field Procedure) for Withdrawal and Injection Well Tests for Determining Hydraulic Properties of Aquifer Systems.

Fetter, C.W. Applied Hydrogeology. Prentice Hall, Upper Saddle River, NJ. 2001.

Kruseman, G.P. and N.A. de Ridder. *Analysis and Evaluation of Pumping Test Data*. ILRI publication 47, The Netherlands. 1991.

Jacobs. Kingston Ash Recovery Project Non-Time-Critical Removal Action for the River System Sampling and Analysis Plan Data Quality Objectives for Environmental Media, February 2010.

Jacobs. Kingston Ash Recovery Project Non-Time Critical Removal Action River System and Analysis Plan Task Completion Technical Memorandum Groundwater Sampling, May 2011.

TVA-KIF-SOP-02: *Groundwater Sampling.*

TVA-KIF-SOP-42: *Slug Testing.*

Waterloo Hydrogeologic, 2002, “AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software”, Waterloo, Ontario, Canada.

Young, S.C., H. E. Julian, H. S. Pearson, F. J. Molz, and G. K. Boman. EPA/600/R-98/058: Application of the Electromagnetic Borehole Flowmeter. 1998.

APPENDIX C

PMET (2010) – Chemical and Mineralogical Characterization of Core Samples

Pittsburgh
Mineral &
Environmental
Technology, Inc.

August 11, 2010

J. Mark Boggs
TVA WT 9D-K
400 West Summit Hill Drive
Knoxville, TN 37902

Dear Mr. Boggs:

The report summarizes and concludes PMET's work on the mineralogical and geochemical analysis of nine core samples from the Kingston Fossil Plant in Tennessee. Please contact us if you require additional information or further services on this project. We appreciate this opportunity to work with you and look forward to serving your future needs.

Sincerely,

Randolph W. Shannon
Laboratory Manager

Attachment

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PREPARED FOR:

TENNESSEE VALLEY AUTHORITY

CHEMICAL AND MINERALOGICAL CHARACTERIZATION OF CORE SAMPLES FROM KINGSTON FOSSIL PLANT

By

Randolph W. Shannon

Project 0M35
August 11, 2010

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BACKGROUND AND OBJECTIVE

On April 20, 2010 pursuant to a request from Mr. Matthew Williams, PE of the Tennessee Valley Authority (TVA) PMET, Inc. submitted a proposal for soil analysis of nine drill core samples from the Kingston Fossil Plant.

The laboratory work was summarized in PMET's quotation to Mr. Williams and included the following:

Mineralogical Characterization

1. quantitative bulk mineralogy by x-ray diffraction and Rietveld whole pattern refinement
2. polarized light microscopy of polished sections

Chemical Characterization

3. percent free iron oxide per Chao & Zhou
4. cation exchange capacity
5. exchangeable cations
6. calcite equivalent soluble salts
7. soil pH

SAMPLES RECEIVED

The drill core samples were received in five separate shipments under chain-of-custody from Ramona Josefczyk at the Kingston Fossil Ash Recovery Operations. A copy of the chain-of-custody documents is attached to this report.

Each sample was logged in the PMET, Inc. chain-of-custody file and RFA logbook and given a unique identification number. The sample identification and COC is shown in the table below.

Table 1
Sample Identification

PMET I.D.	TVA KIF-	COC#	Received
5575-1	GP23-16-38-SL-042610	TVA-MWI-042610	04/28/10
5575-2	GP16-28.0-32.0-SL-050310	TVA-MWI-050310	05/06/10
5575-3	GP16-42.0-52.0-SL-050410	TVA-MWI-505310	05/06/10
5575-4	TWP04A-58-68-SL-051010	TVA-MWI-051010A	05/14/10
5575-5	TWP04A-72-78-SL-051010	TVA-MWI-051010A	05/14/10
5575-6	TWP05-78-85-SL-051810	TVAMWI0518Y10A	05/24/10
5575-7	TWP05-61-66-SL-051710	TVAMWI0518Y10A	05/24/10
5575-8	TWP06-38-51-SL-052010	TVAMWI0520Y10A	05/27/10
5575-9	TWP06-51-60-SL-052410	TVAMWI0524Y10A	05/27/10

DISCUSSION OF RESULTS

Sample Preparation

The samples were received in quart jars at ambient temperature. The sample material was removed to stainless steel pans and dried at 50°C to determine moisture content.

Table 2
Moisture Content

Sample I.D.	As-received Wt.	Dry Wt.	% Moisture
5575-1	6711.8	5204.5	22.5%
5575-2	7156.6	5851.0	18.2%
5575-3	7821.3	6315.8	18.7%
5575-4	7139.7	5855.5	18.0%
5575-5	4524.6	3797.0	16.1%
5575-6	7356.0	6081.3	17.3%
5575-7	7779.1	6491.8	16.6%
5575-8	5543.8	4419.9	20.3%
5575-9	8012.2	6597.4	17.7%

The dried material was deagglomerated using a large ceramic mortar and pestle. The sample material was split into analytical aliquots using a rotary riffle splitter. The reject material was returned to the original container.

Mineralogical Characterization

Sample material for x-ray diffraction was pulverized in a tungsten carbide ring and puck mill. The pulped material was then spiked with calcium fluoride. The samples were scanned from 5° to 58° two-theta using a Siemens D500 diffractometer operating at 35ma and 45 kv. The diffractograms were analyzed for phase composition using Bruker AXS proprietary search/match software. The phases were quantified using Bruker AXS proprietary Rietveld whole pattern refinement software. The amorphous content was calculated using a ratio of the fluorite spike to the analytical result. An image of each diffractogram with the Rietveld refinement result is attached to this report. The results of mineralogical analysis are shown in Table 3 below.

The results show that the soil samples consist of mostly quartz with trace amounts of feldspar and plagioclase in a micaceous silt to clay matrix. The clay contains small amounts of crystalline kaolinite and mica with large amounts of non-crystalline amorphous clay material. A clay analysis was not requested for this project. There may be small amounts of glass along with the clay in the amorphous fraction.

Sample 5575-1 is an exception to the general character of the soil samples. This sample appears to mostly contain common fly ash minerals and a high concentration of amorphous glassy phases, which is also typical of fly ash. There are also iron sulfides present, which are usually found in uncombusted coal.

Table 3
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	**Nominal Atomic Formula**	**5575-1**	**5575-8**
Quartz	SiO_2	5.5	55.8
K-feldspar	$KAlSi_3O_8$	0.0	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.0	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	0.0	6.7
Kaolinite	$Al_2Si_2O_5(OH)_4$	0.0	4.0
Anatase	TiO_2	0.0	0.4
Hematite	Fe_2O_3	3.4	0.3
Magnetite	Fe_3O_4	4.4	0.2
Mullite	$Al_6Si_2O_{13}$	17.3	1.1
Pyrite	FeS_2	2.0	0.2
Marcasite	FeS_2	1.3	0.0
Amorphous	Glass/clay	66.1	28.7

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	**Nominal Atomic Formula**	**5575-2**	**5575-3**	**5575-4**	**5575-5**
Quartz	SiO_2	63.3	77.5	59.7	81.4
K-feldspar	$KAlSi_3O_8$	1.3	0.4	5.3	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.2	0.0	1.6	0.6
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	5.9	2.4	6.1	1.4
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.5	0.7	3.1	1.1
Anatase	TiO_2	0.2	0.0	0.2	0.1
Hematite	Fe_2O_3	0.4	0.2	0.3	0.0
Amorphous	Glass/clay	25.2	18.8	23.7	14.0

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	Nominal Atomic Formula	5575-6	5575-7	5575-9
Quartz	SiO_2	76.7	67.5	72.3
K-feldspar	$KAlSi_3O_8$	1.2	2.1	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.7	0.7	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	1.8	4.9	3.9
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.1	2.6	2.2
Anatase	TiO_2	0.3	0.3	0.2
Hematite	Fe_2O_3	0.0	0.3	0.2
Amorphous	Glass/clay	17.2	21.6	18.6

A mineralogical analysis of the sample material was also conducted using optical microscopy of polished cross sections. The sample material was deslimed and mounted in epoxy to obtain polished sections. The sections were examined using an ore microscope with reflected light and an air objective with a polarizer. Images of opaque materials were recorded with a digital camera and are shown at the end of this report.

The optical microscopy analysis found that ash particles were present in most samples. The table below contains estimates of the volume of opaque materials contained in the sample. Estimation was based on method derived from Williams,H., Turner,F.J., Gilbert,C.M., 1982, Petrography, p.593-597.

Table 4
Optical Microscopy Results
Opaque Mineral Content
Estimated Volume %

Mineral Phase	5575-1	5575-2	5575-3	5575-4	5575-5	5575-6	5575-7	5575-8	5575-9
Anatase	-	0.2	0.05	0.15	0.1	0.1	0.1	0.1	0.4
Iron oxide spheres	10	00.1	0.02	0.2	0.05	0.1	0.3	0.5	0.2
Iron fragments	-	0.01	-	0.03	-	-	-	0.05	-
Pyrite/Marcasite	2.5	0.02	-	-	-	-	-	0.7	-
Graphite	-	0.01	-	-	-	-	-	0.03	0.05
Glassy ash	80	-	0.02	15	-	0.01	1	11	1
Ceramic stone	-	-	-	-	0.1	-	-	-	-

Geochemical Analysis

A five hundred gram aliquot was split from the head sample for geochemical analysis. This sample was submitted to Activation Laboratories, LTD for chemical analysis under chain-of-custody. The results are summarized in Table 4 below. A copy of the original report of results from Activation Labs is attached at the end of this report.

Table 4
Results of Chemical Analysis

PMET I.D.	Soil	Free FeOx	CEC	Exchangeable Cations meq/100g				
	pH	%	meq/100g	Na	Mg	Al	K	Ca
5575-1	6.02	0.0741	0.4	<0.1	<0.1	<0.1	<0.1	0.7
5575-2	5.12	0.0232	0.4	<0.1	0.2	0.1	<0.1	0.5
5575-3	4.69	0.0187	0.1	<0.1	<0.1	<0.1	<0.1	0.1
5575-4	7.15	0.0625	0.2	<0.1	0.5	<0.1	<0.1	1.0
5575-5	6.40	0.0503	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-6	5.75	0.0498	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-7	5.39	0.0406	<0.1	<0.1	0.1	0.2	<0.1	0.2
5575-8	6.09	0.1390	0.3	<0.1	0.4	<0.1	<0.1	0.5
5575-9	4.90	0.1140	<0.1	<0.1	0.1	<0.1	<0.1	0.2

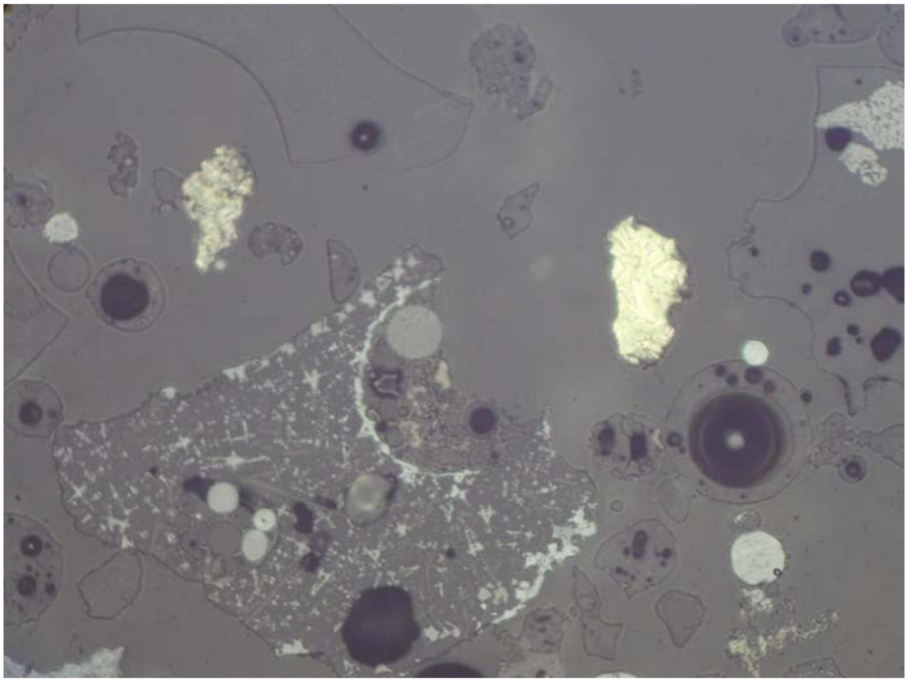
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts					
	Ca	Mg	Na	K	Al	Mn
	mg/L	mg/L	mg/L	mg/L	%	ppm
5575-1	138	7.91	1.29	4.94	<0.01	0.99
5575-2	10.4	2.57	0.75	1.14	0.02	0.88
5575-3	8.23	1.85	0.51	1.05	0.05	0.94
5575-4	6.24	2.36	8.91	0.63	<0.01	0.09
5575-5	3.56	0.66	2.76	1.26	0.05	0.15
5575-6	<0.1	0.4	1.0	0.9	0.07	0.05
5575-7	<0.1	0.1	0.5	0.4	<0.01	0.30
5575-8	3.7	10.0	2.2	5.3	<0.01	1.48
5575-9	1.0	0.4	4.1	1.5	<0.01	0.07

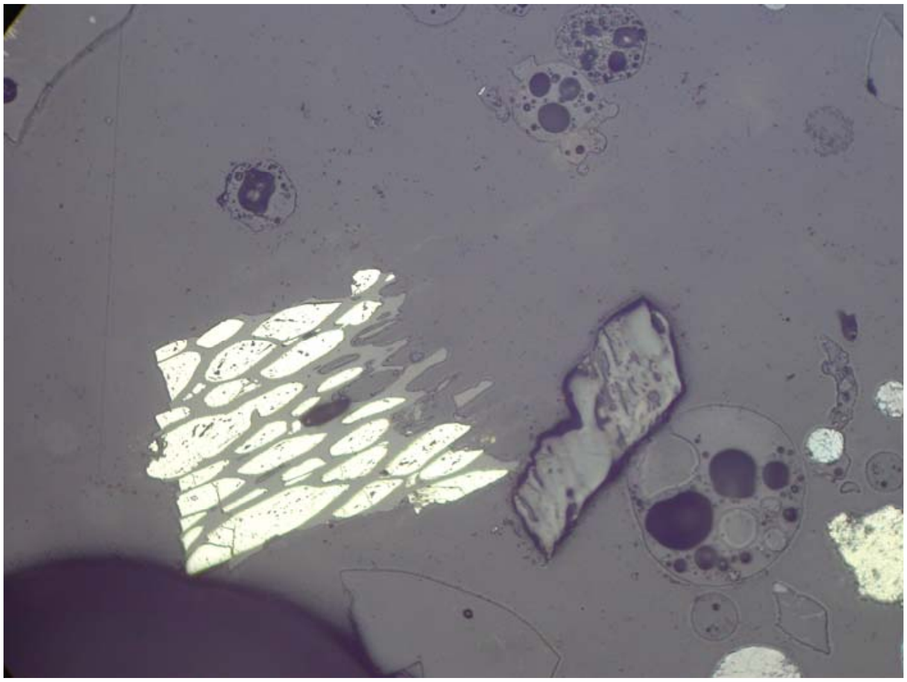
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts						
	BO_3^{-3}	Cl^{-1}	NO_3^{-1} (as N)	SO_4^{-2}	$CaCO_3$	CO_3^{-2}	HCO_3^{-1}
	µg/L	µg/g	µg/g	µg/g	mg/L	mg/L	mg/L
5575-1	<500	3.56	0.23	1900	7	<1	7
5575-2	<500	3.22	0.17	185	<2	<1	2
5575-3	<500	2.72	0.07	153	<2	<1	1
5575-4	<500	1.81	<0.05	96.1	15	<1	15
5575-5	<500	2.18	0.05	65.5	5	<1	5
5575-6	<500	3.93	0.18	26.5	6	<1	6
5575-7	600	2.35	0.12	9.54	5	<1	5
5575-8	8100	2.88	0.07	315	8	<1	8
5575-9	<500	1.42	0.09	38.2	5	<1	5

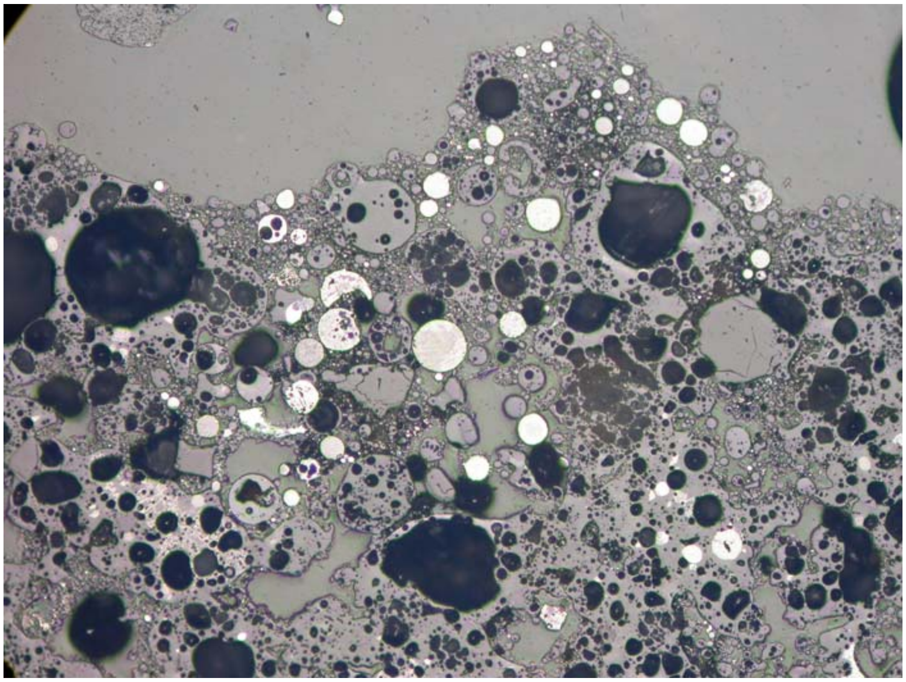
Polarized Light Microscopy Optical Images



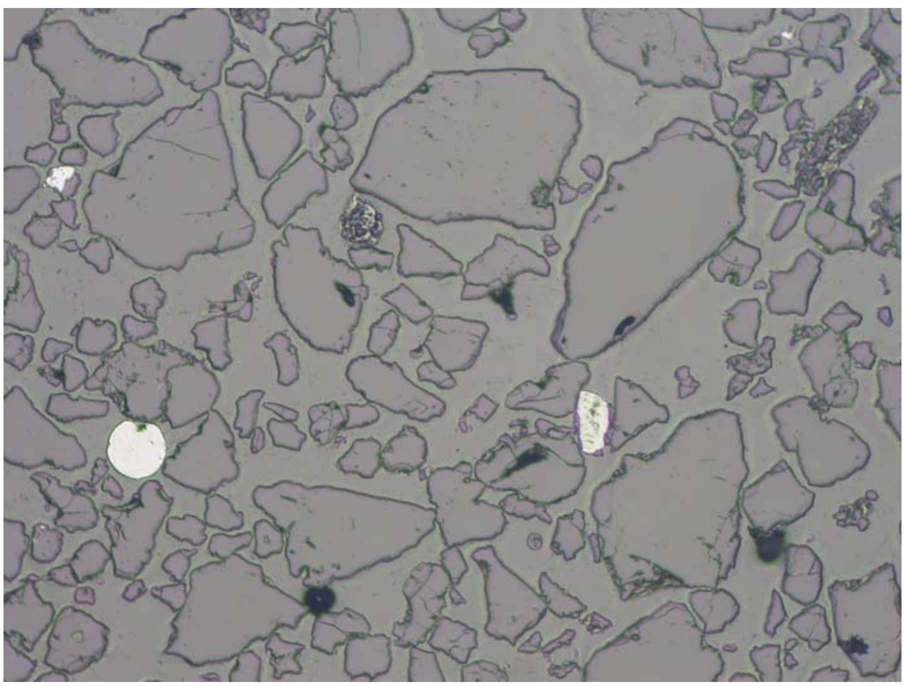
Light Optical Image Figure 1 Scale 1cm = 600µ
5575-1 Ash particles with iron oxide and glass spheres (center), marcasite grains (yellow)



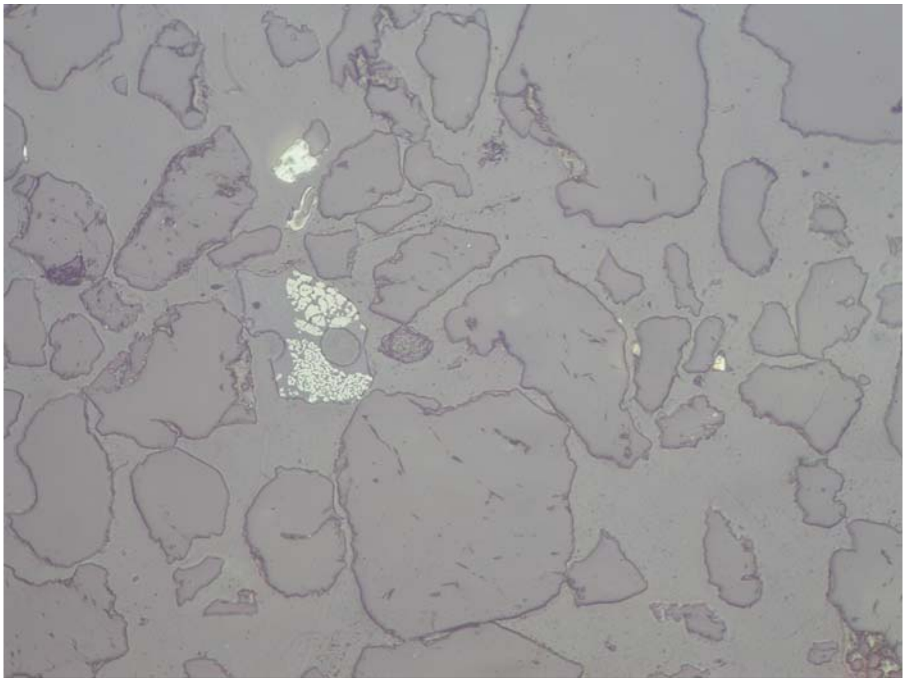
Light Optical Image Figure 2 Scale 1cm = 600µ
5575-1 Pyrite replacement in wood structure (light yellow), ash particles with spherical voids, rock fragment (right center)



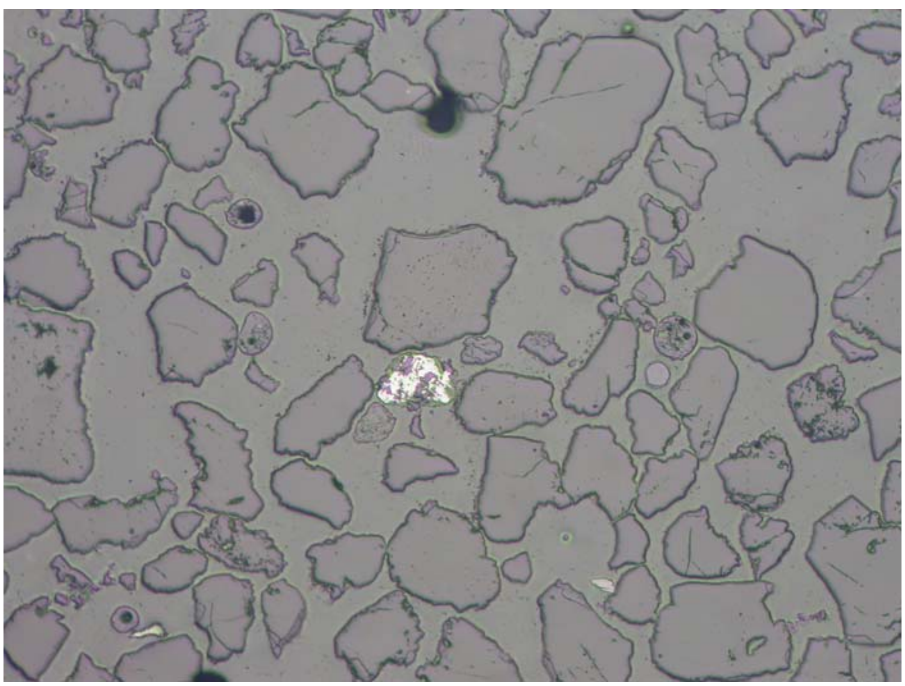
Light Optical Image Figure 3 Scale 1cm = 1300μ
5575-1 Composite ash particle with spherical voids (black), glass spheres (gray), and iron oxide spheres (white)



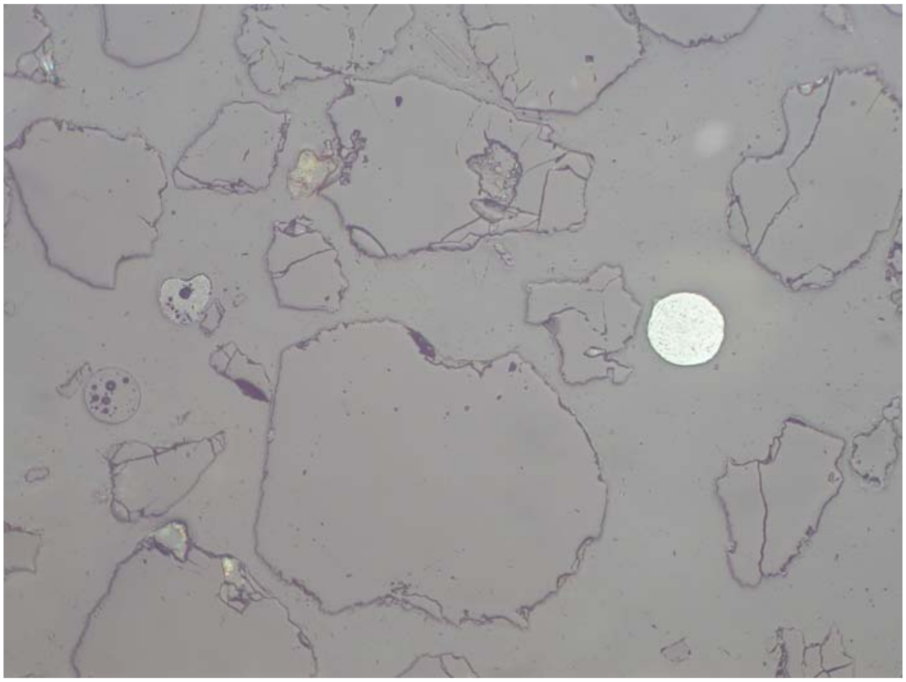
Light Optical Image Figure 4 Scale 1cm = 1300μ
5575-2 Anatase grain (right center)
spherical iron oxide (left center)
with optically transparent minerals (gangue)



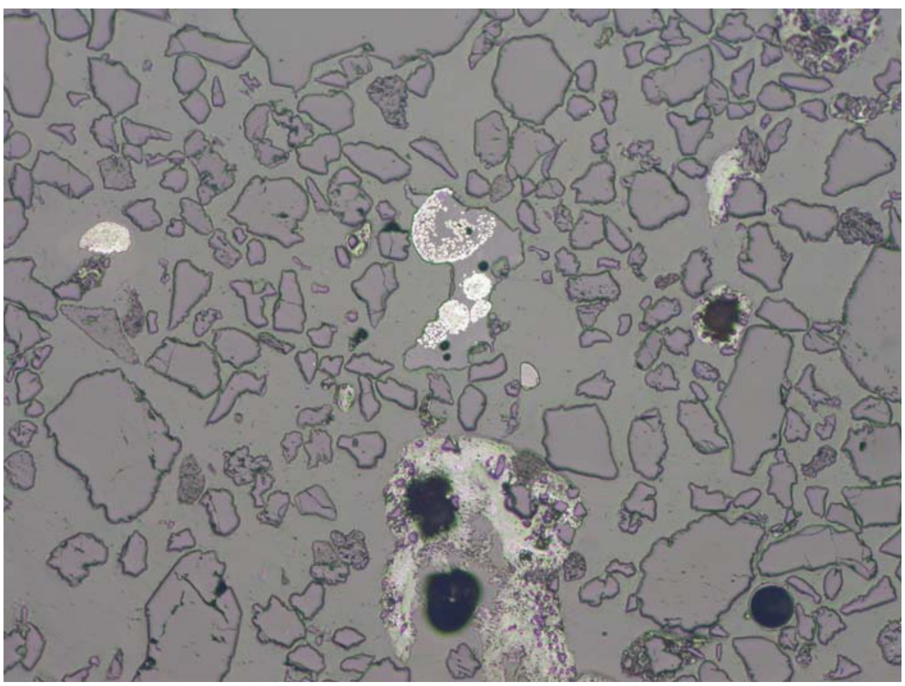
Light Optical Image Figure 5 Scale 1cm = 600μ
5575-2 Anatase grain (top center),
glassy ash particles (center), gangue



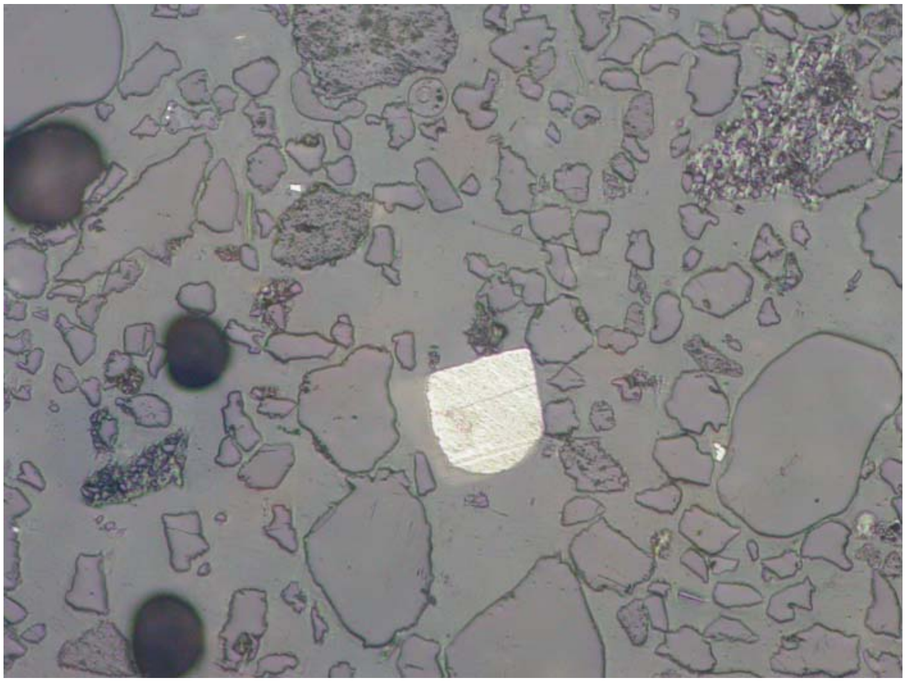
Light Optical Image Figure 6 Scale 1cm = 1300μ
5575-3 Anatase grain (center),
spherical ash particles (right center, left center), gangue



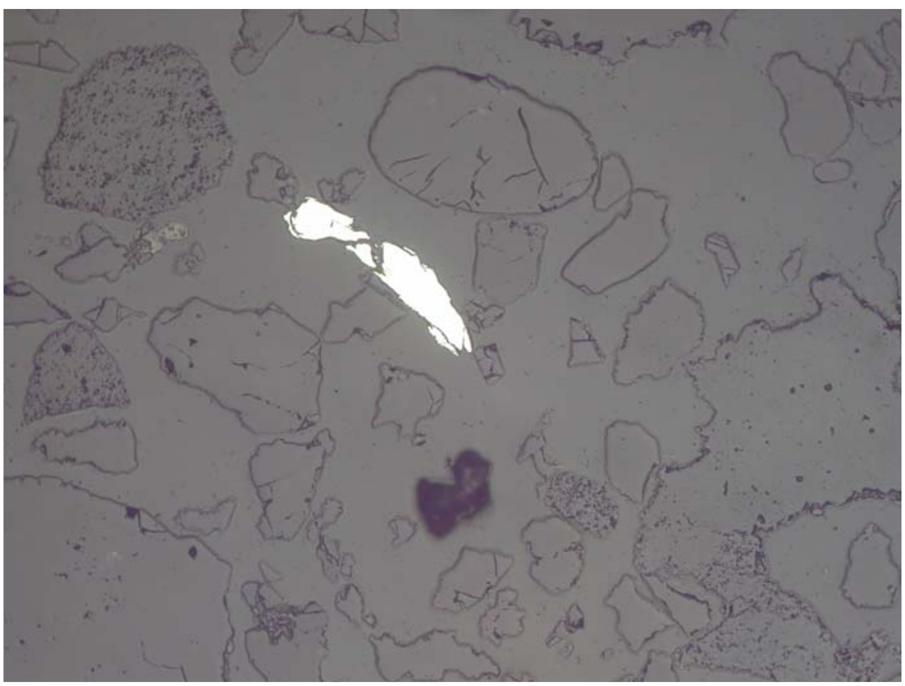
Light Optical Image Figure 7 Scale 1cm = 600μ
5575-4 Spherical iron oxide, gangue



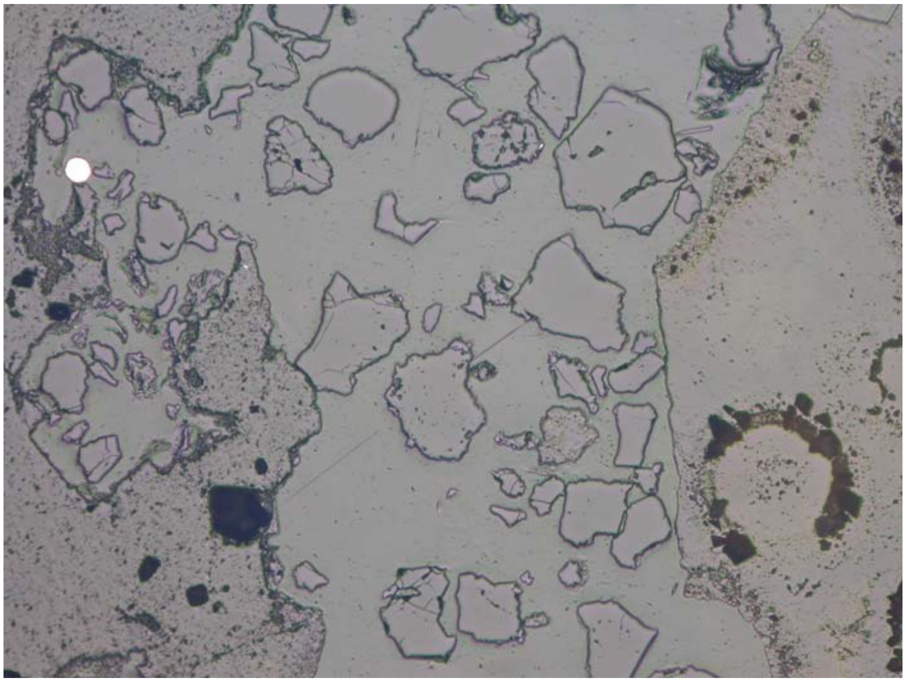
Light Optical Image Figure 18 Scale 1cm = 1300μ
5575-4 Ash particles and spherical iron oxide, gangue



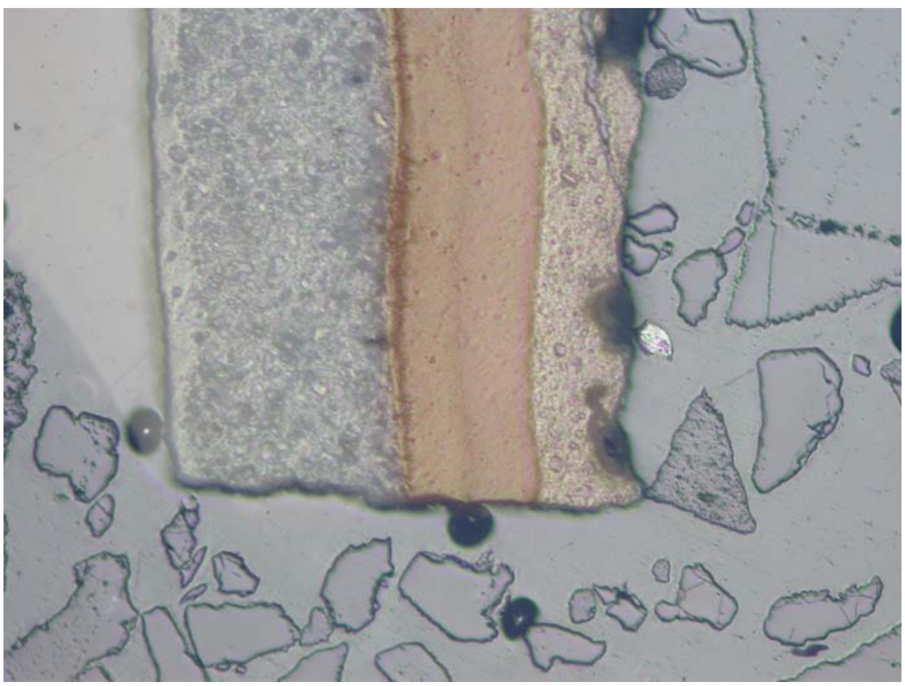
Light Optical Image Figure 9 Scale 1cm = 600μ
5575-4 Anatase particle (center),
ash sphere (top center), gangue



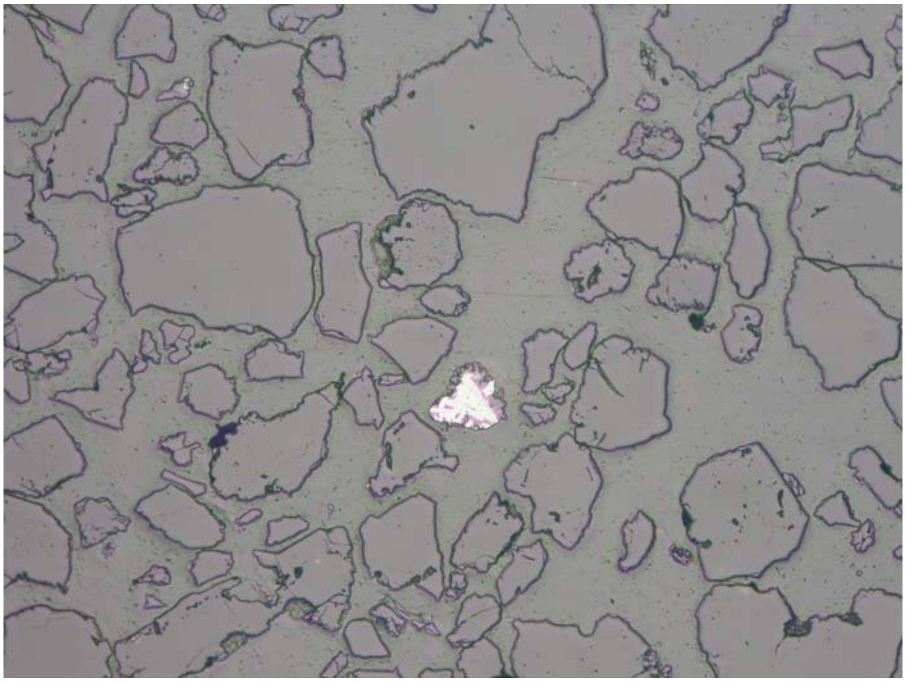
Light Optical Image Figure 10 Scale 1cm = 600μ
5575-4 Iron fragment, gangue



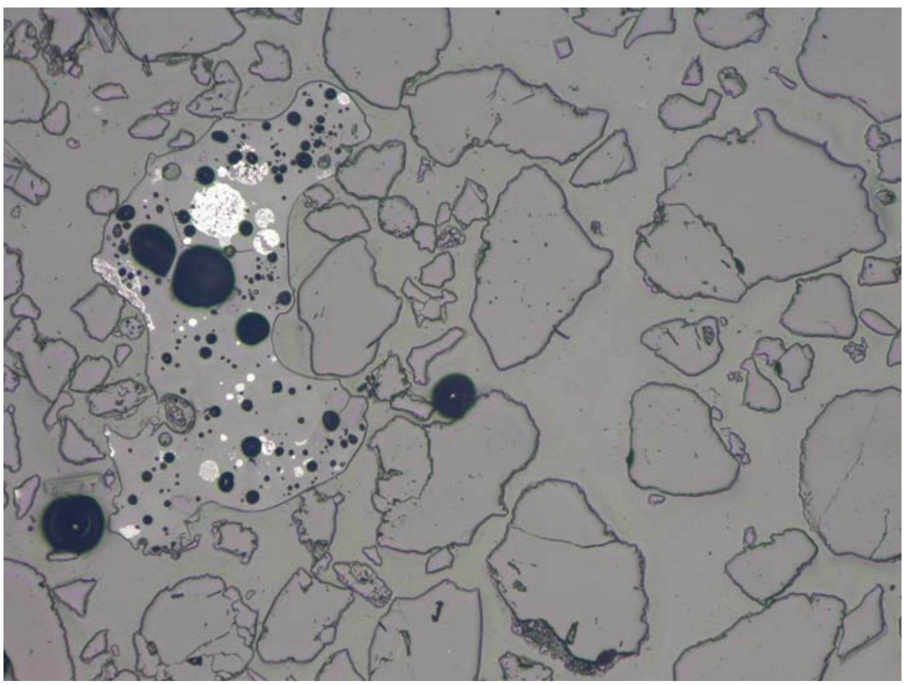
Light Optical Image Figure 11 Scale 1cm = 1300μ
5575-5 Iron oxide sphere (top left),
large glass particle with spherical voids (right), gangue



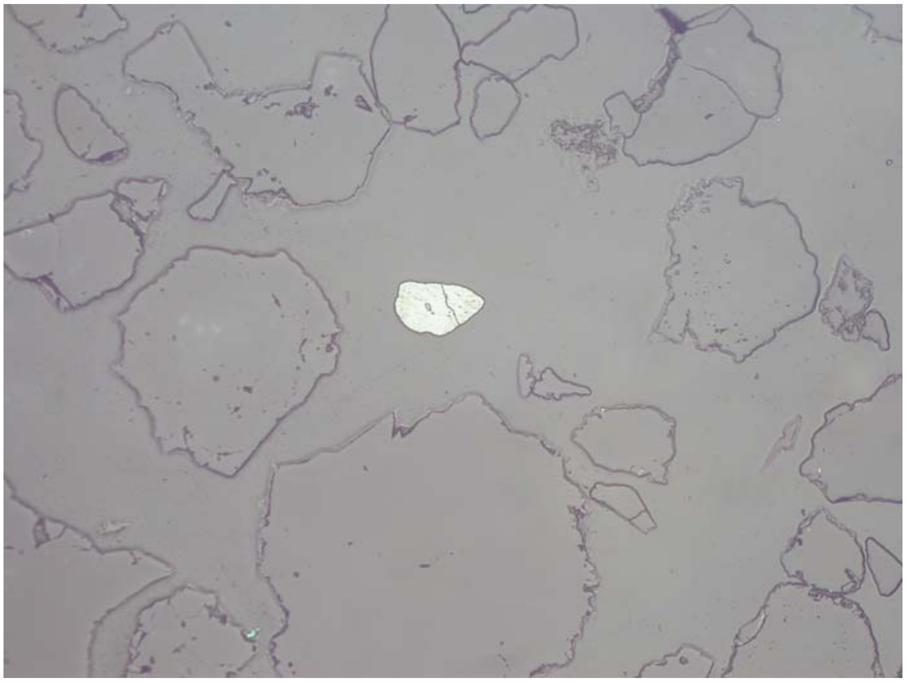
Light Optical Image Figure 12 Scale 1cm = 1300μ
5575-5 Large ceramic composite fragment,
spherical hematite particle (right center), gangue



Light Optical Image Figure 13 Scale 1cm = 1300µ
5575-6 Anatase particle, gangue

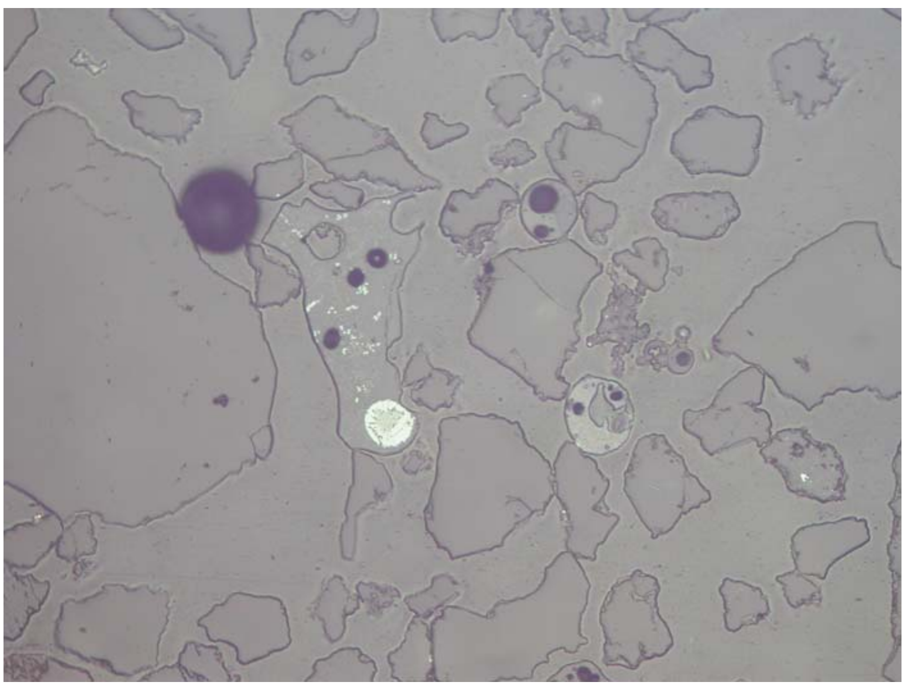


Light Optical Image Figure 14 Scale 1cm = 1300µ
5575-7 Large ash particle with iron oxide spheres and voids, gangue



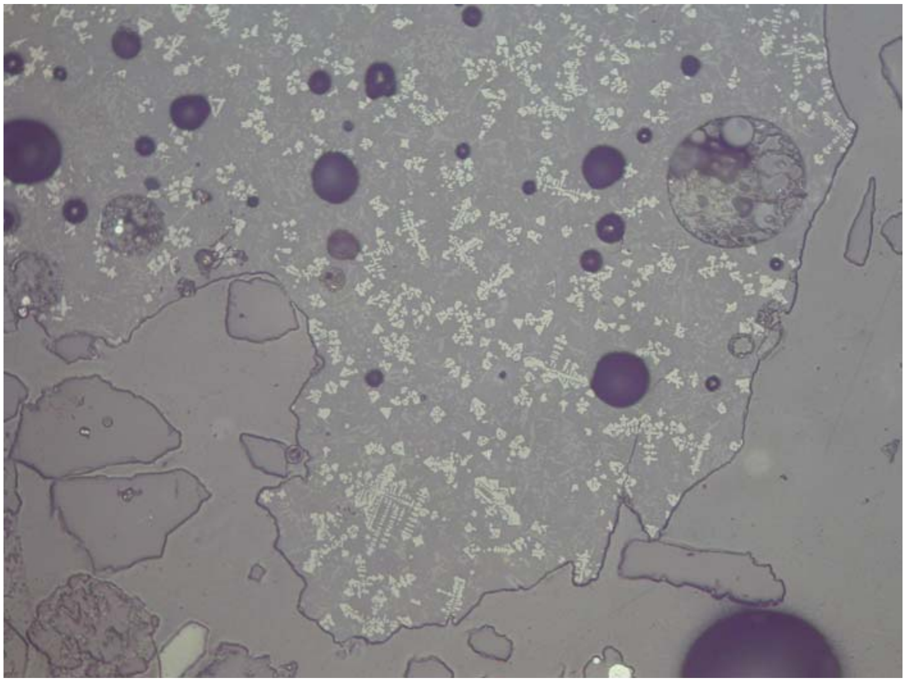
Light Optical Image Figure 15 Scale 1cm = 600μ

5575-7 Anatase particle, gangue

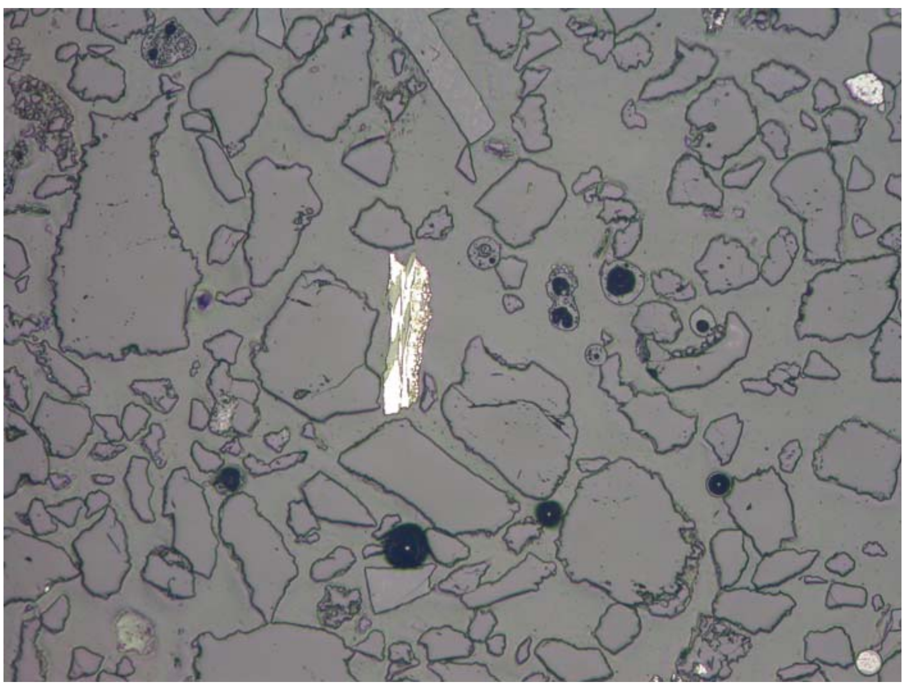


Light Optical Image Figure 16 Scale 1cm = 600μ

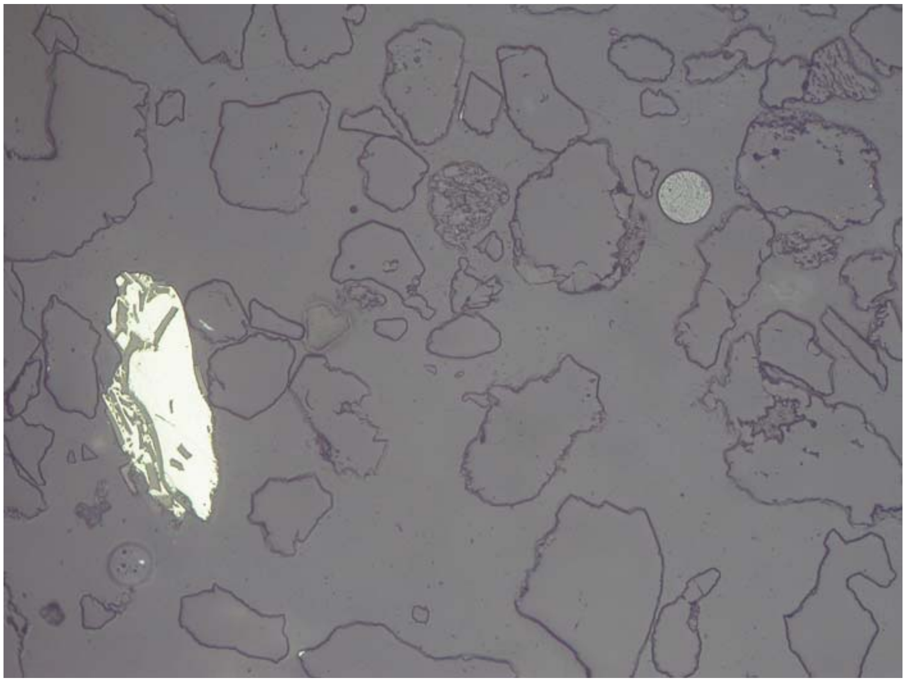
5575-8 Glassy ash particle containing magnetite crystallites, iron oxide spheres, and voids (center), glass sphere (center right), gangue



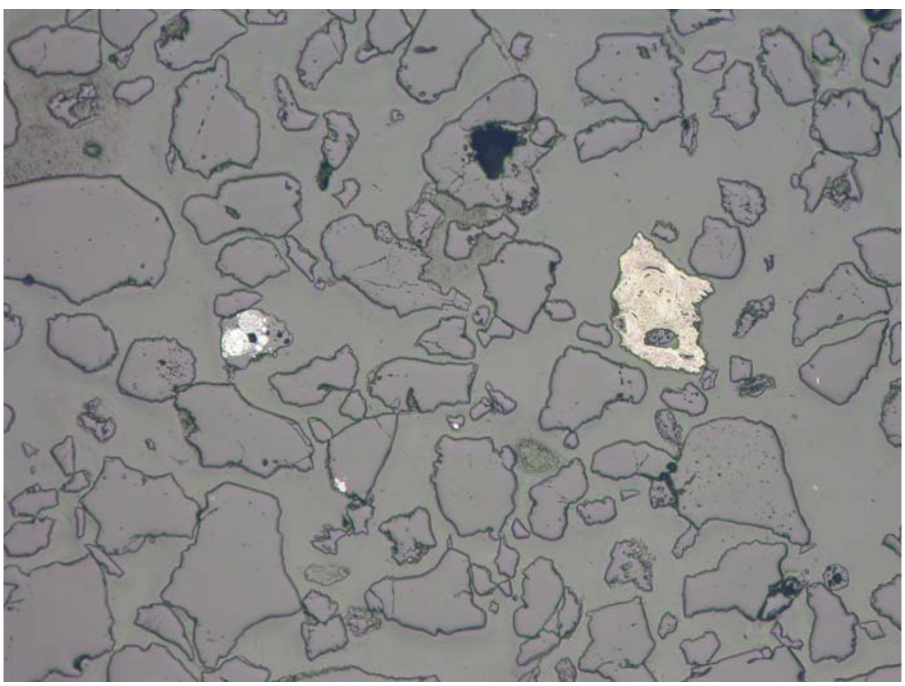
Light Optical Image Figure 17 Scale 1cm = 600μ
5575-8 Large glassy ash particle containing magnetite crystals (light gray), voids, and ash-filled void (top right), gangue



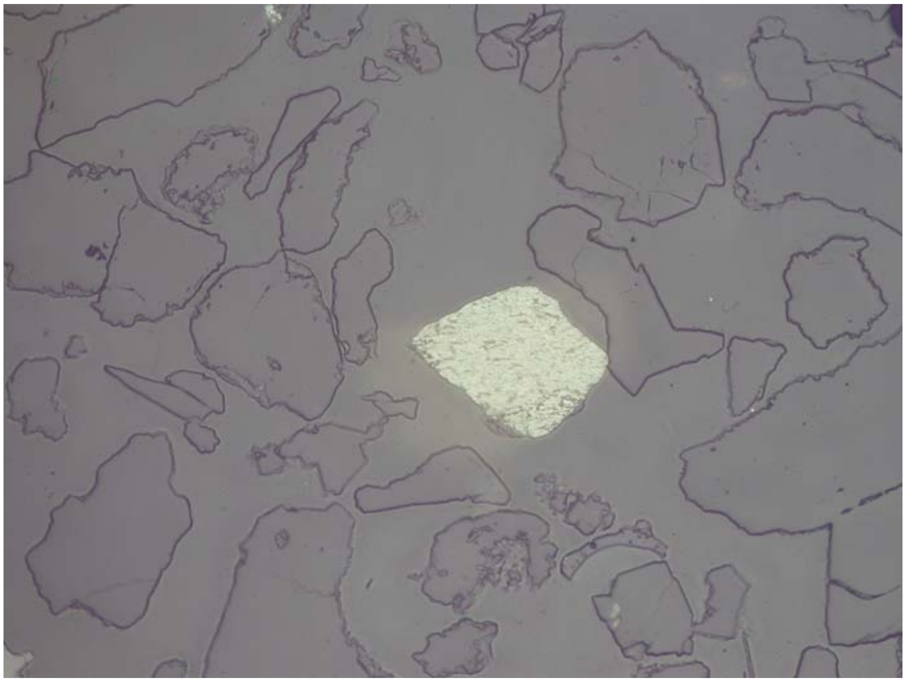
Light Optical Image Figure 18 Scale 1cm = 600μ
5575-8 Elongated pyrite (center), ash spheres (center right), gangue



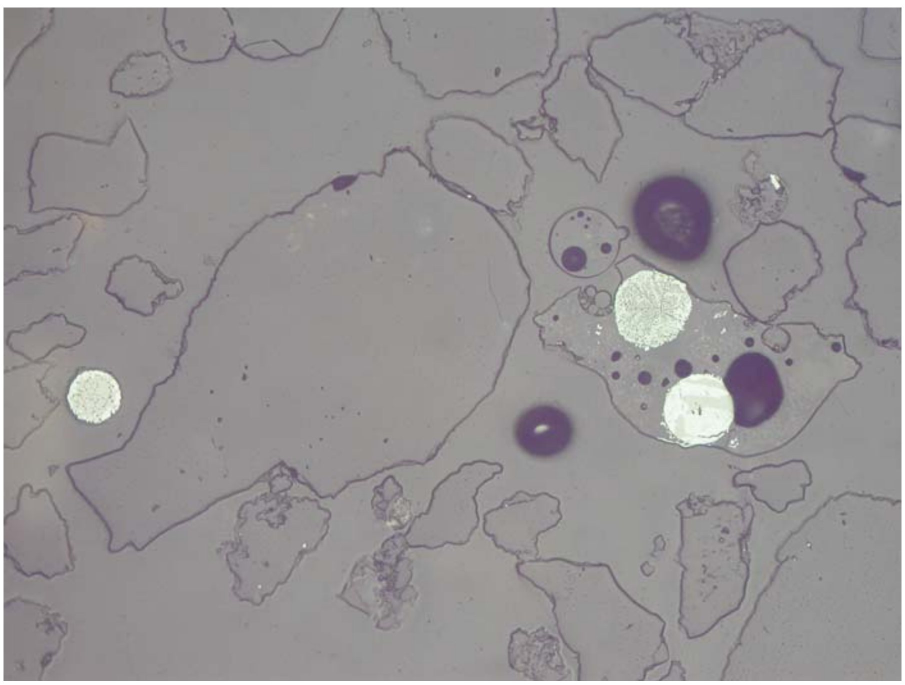
Light Optical Image Figure 19 Scale 1cm = 600µ
5575-8 Large pyrite particle (left), spherical iron oxide (rght), gangue



Light Optical Image Figure 20 Scale 1cm = 1300µ
5575-9 Large graphite particle with ash-filled void (center right), ash particle with iron oxide crystals (center left)
gangue



Light Optical Image Figure 21 Scale 1cm = 600µ
5575-9 Large anatase grain, gangue



Light Optical Image Figure 22 Scale 1cm = 600µ
5575-9 Ash particle with spherical voids and iron oxide spheres (center right), iron oxide sphere (center left), gangue

APPENDIX

Optical microscope scale

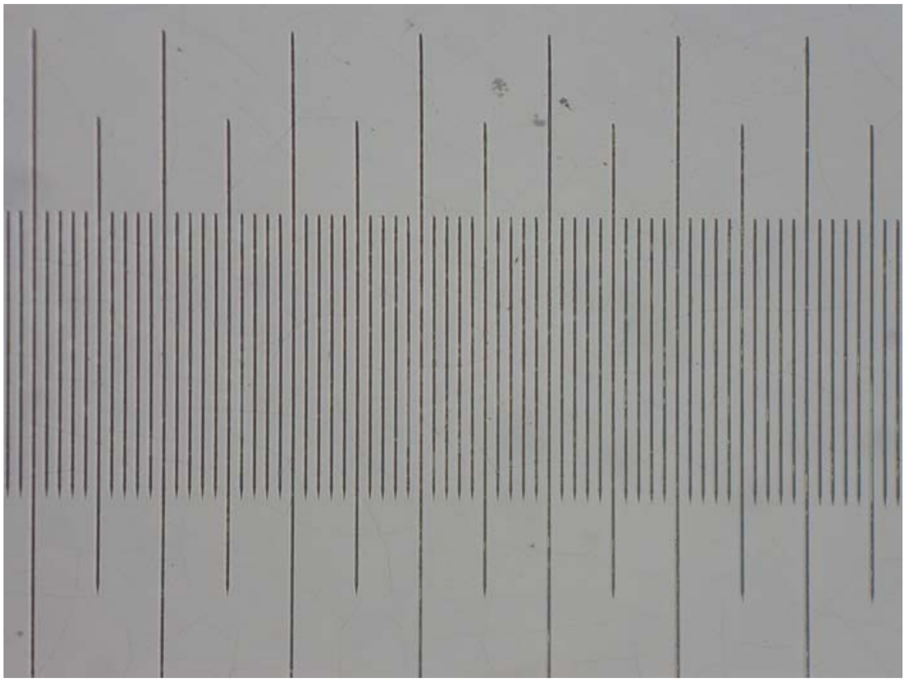


Figure 1
Scale: Reflected light, 20X air objective, 0.64 zoom, polarized

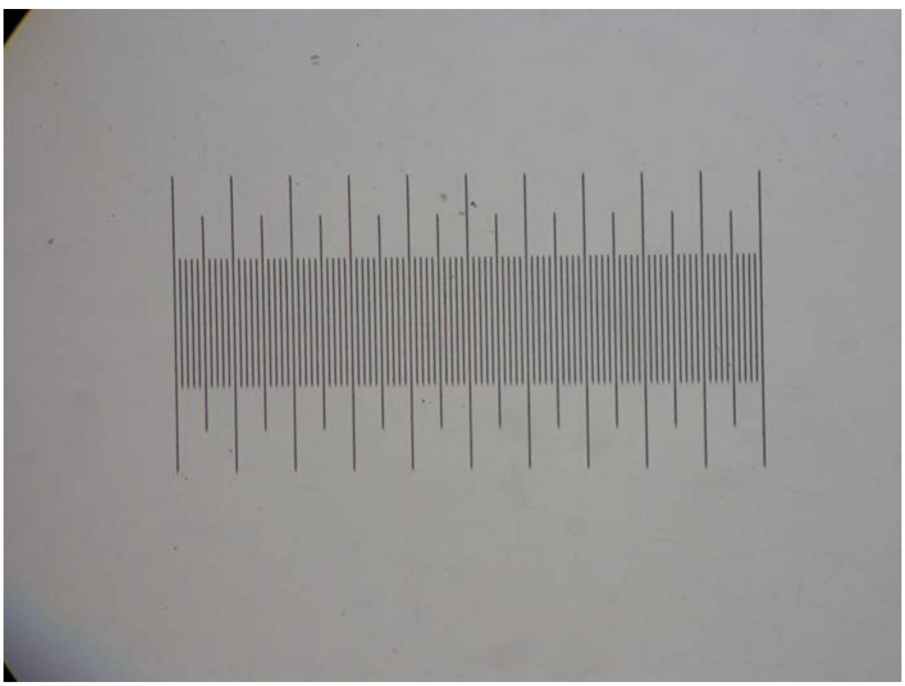
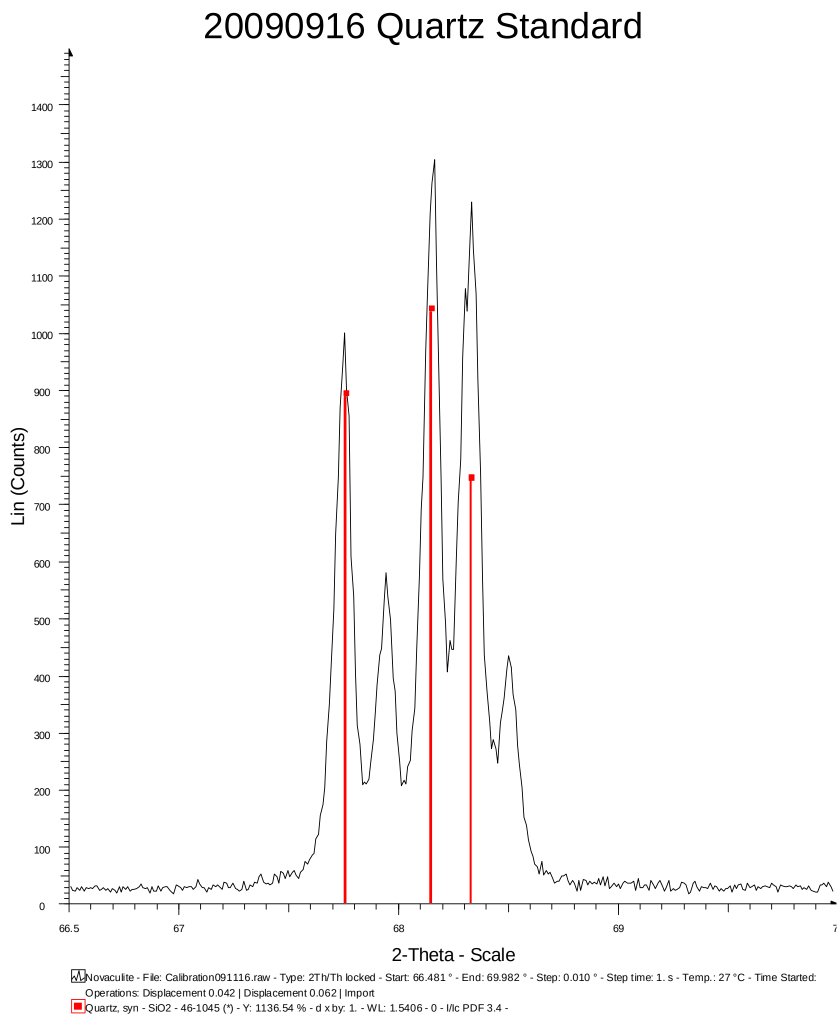


Figure 2
Scale: Reflected light, 10X air objective, 1.56 zoon, polarized

XRD Calibration Standard



Pittsburgh Mineral & Environmental Technology, Inc.

Standard Field Sampling Protocol for Geochemical Testing of Soils

1. Client must provide a representative sample consisting of drill core splits. Splits may consist of half or quartered core length or interval segments.

2. For sieve analysis one separate five-gallon bucket of material is required.

3. For geochemical properties a one to two kilogram sample is required.

4. As-is material should be removed immediately to a wide mouth polyethylene bottle and sealed with a screw cap to prevent sample reaction with atmospheric gases.

5. Sample container must be labeled with identification that is identical to the chain-of-custody log.

PMET Lab Sampling Protocol for Geochemical Testing

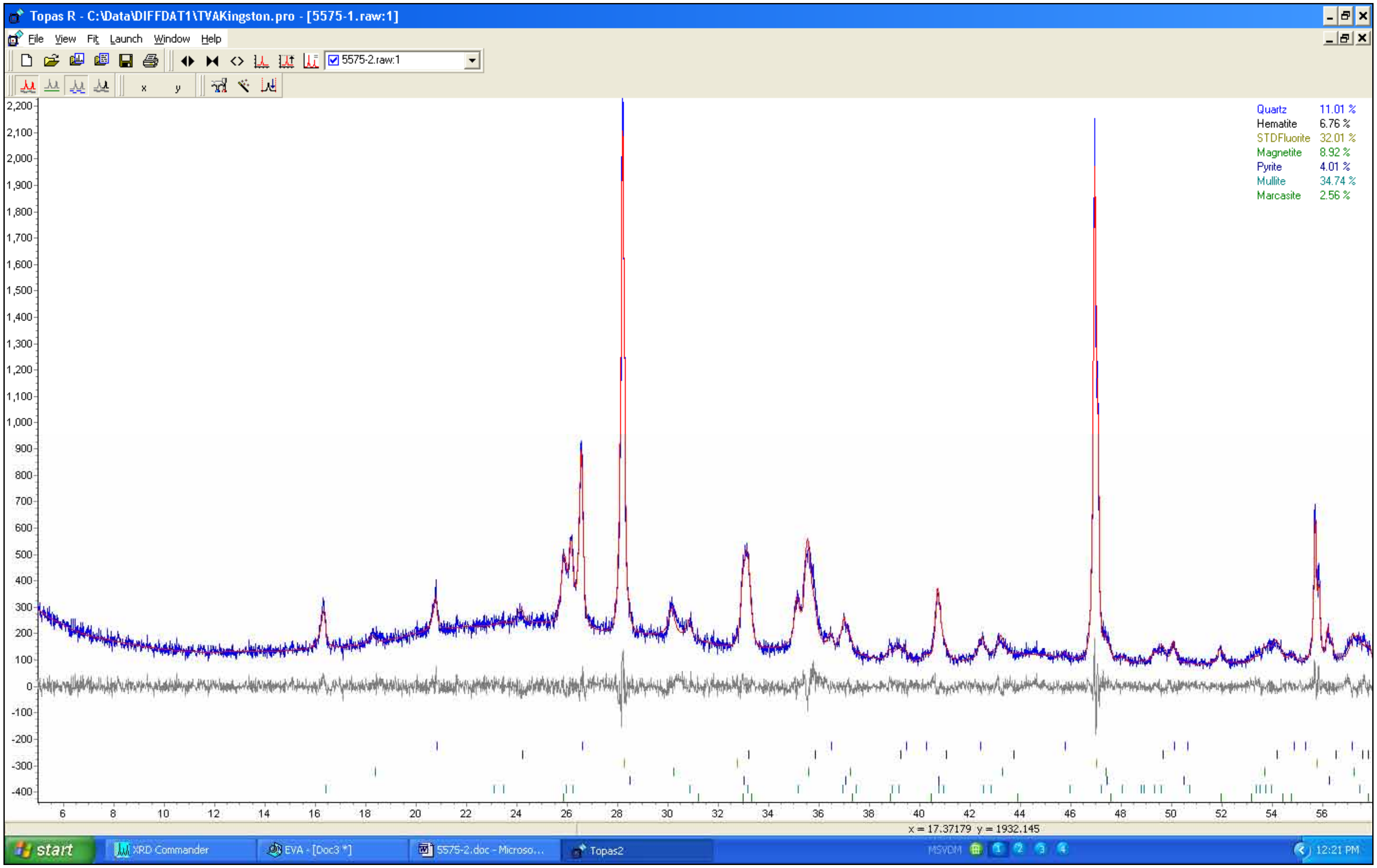
1. PMET lab personnel will verify samples with chain-of-custody document, inspect containers for integrity, and log samples into PMET chain-of-custody logbook.

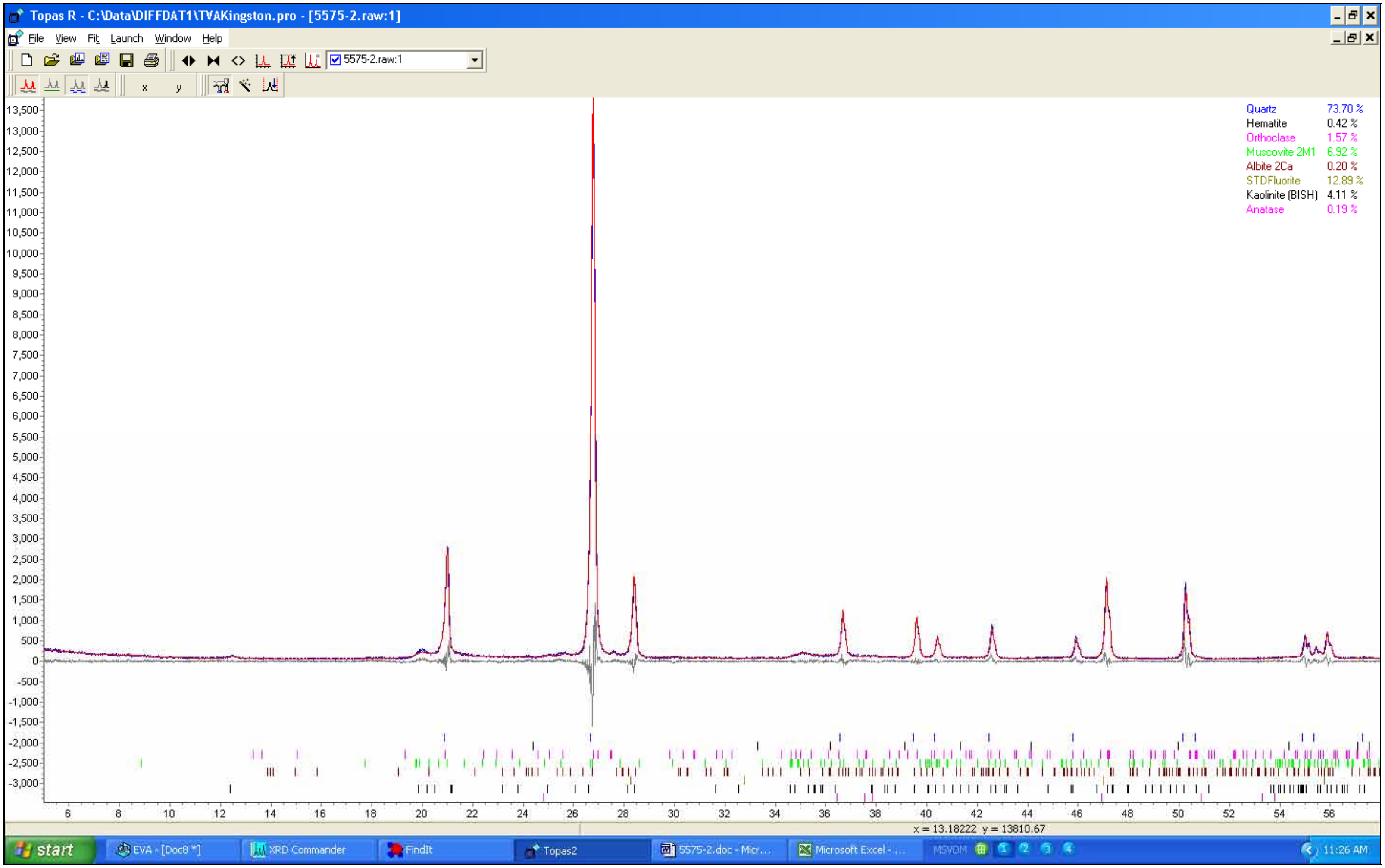
2. Moisture content will be determined by drying in tared pans at 45°C.

3. Rock fragments over one inch will be removed by screening.

4. Sample will be stage crushed to –10 mesh and blended and split for analysis using a rotary riffle splitter.

Randolph W. Shannon, Laboratory Manager


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-1.raw:1]
Quartz 11.01 %
Hematite 6.76 %
STDFluorite 32.01 %
Magnetite 8.92 %
Pyrite 4.01 %
Mullite 34.74 %
Marcasite 2.56 %
x = 17.37179 y = 1932.145


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-2.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 73.70 %
Hematite 0.42 %
Orthoclase 1.57 %
Muscovite 2M1 6.92 %
Albite 2Ca 0.20 %
STDFluorite 12.89 %
Kaolinite (BISH) 4.11 %
Anatase 0.19 %
x = 13.18222 y = 13810.67
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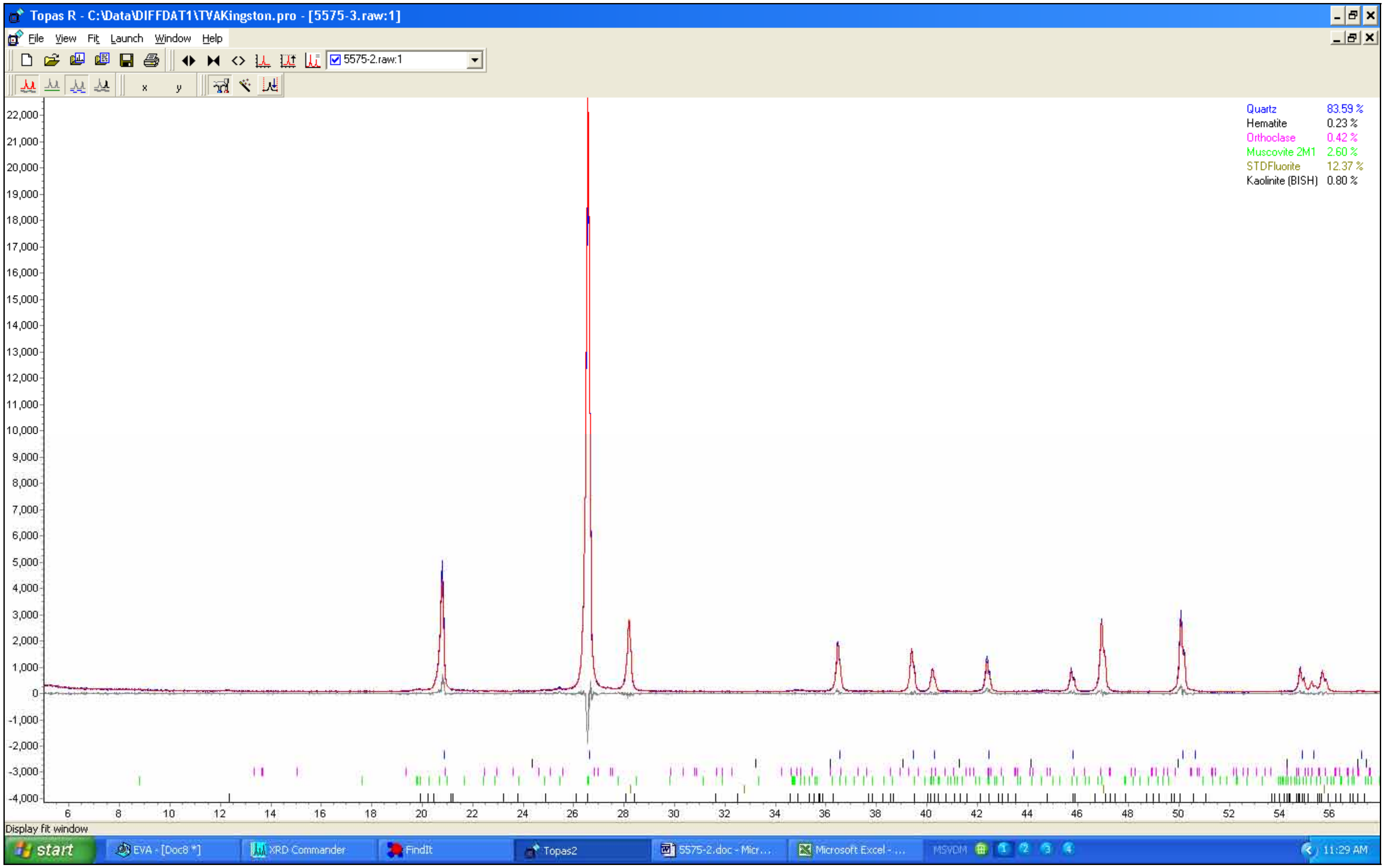
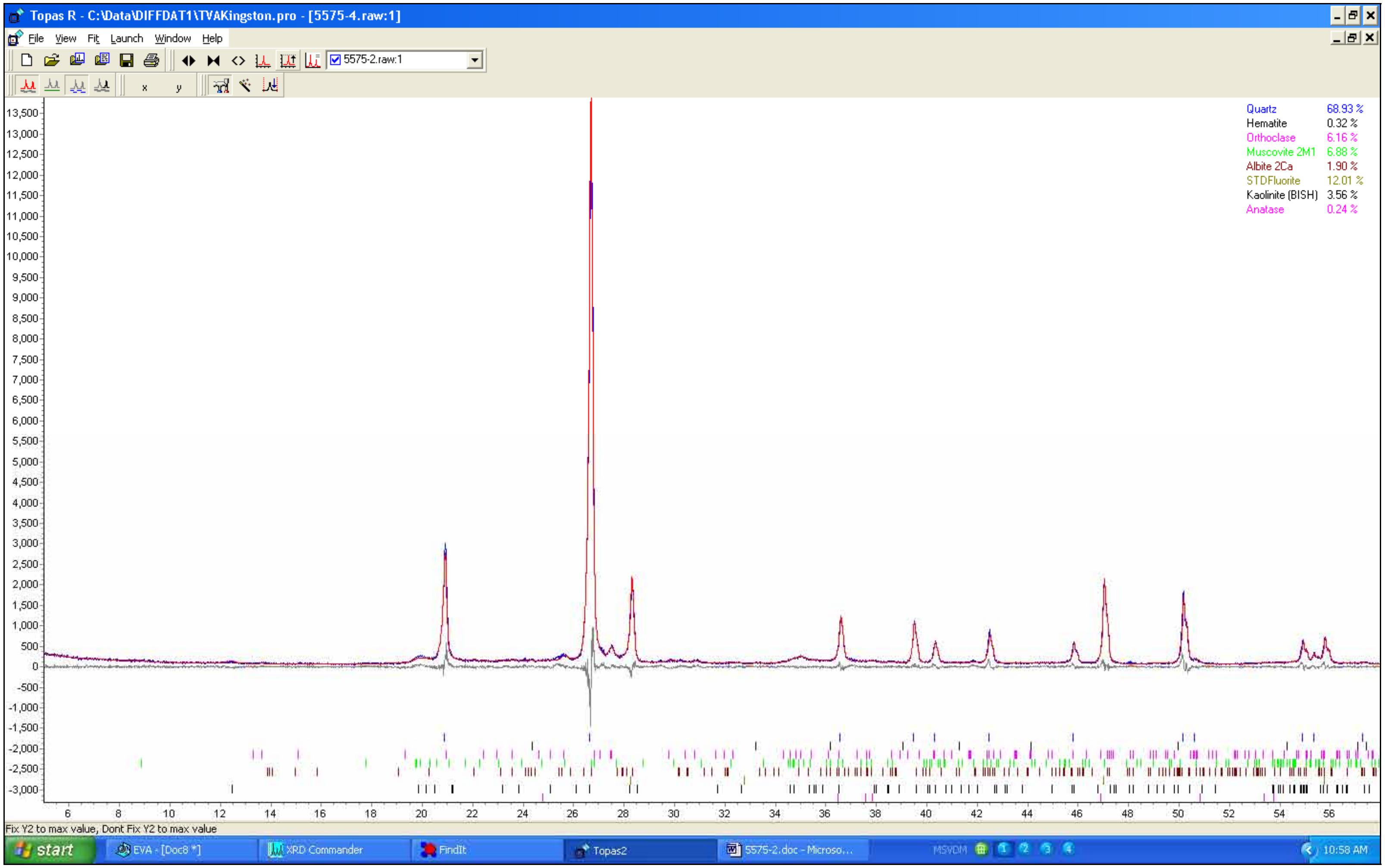
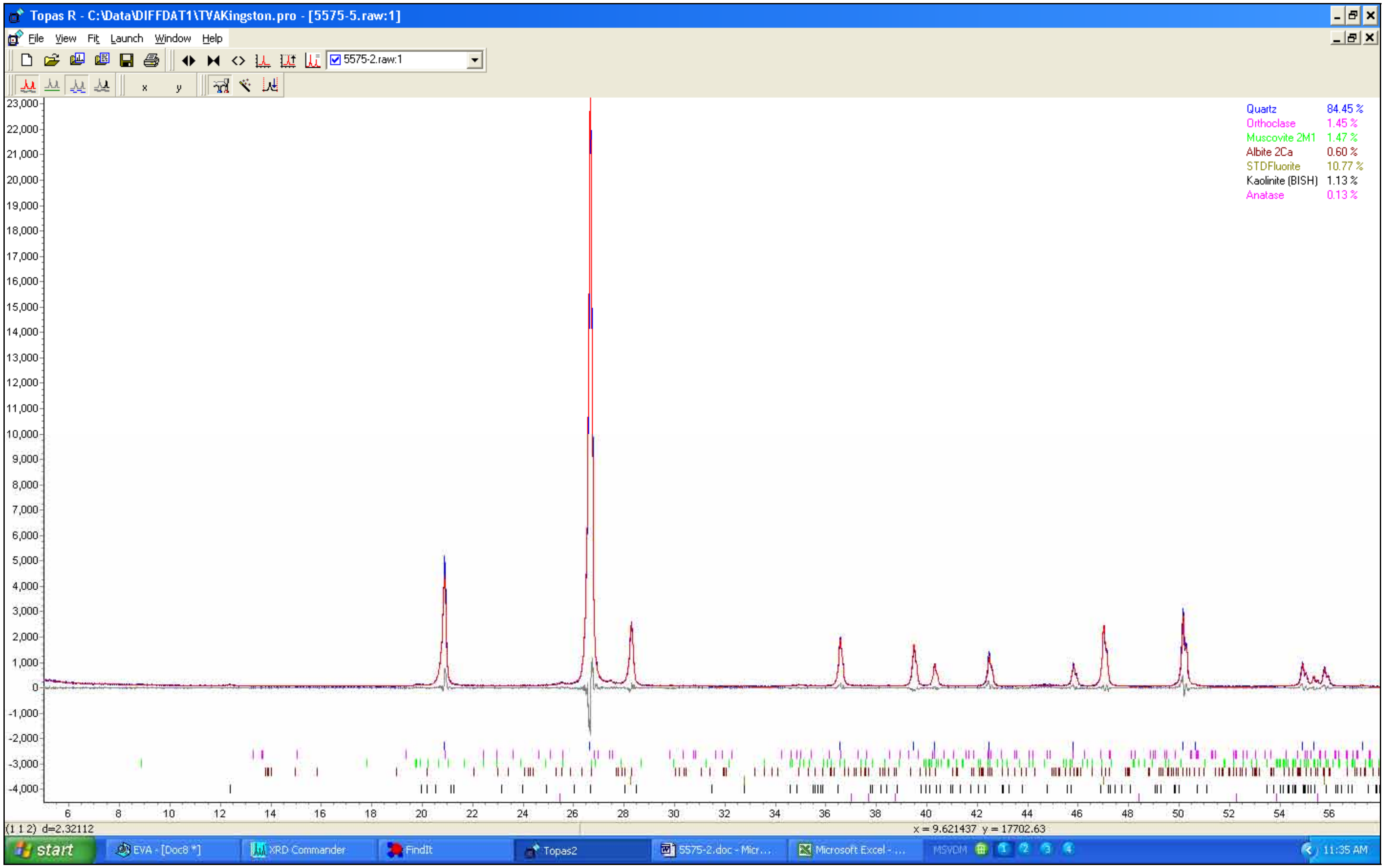
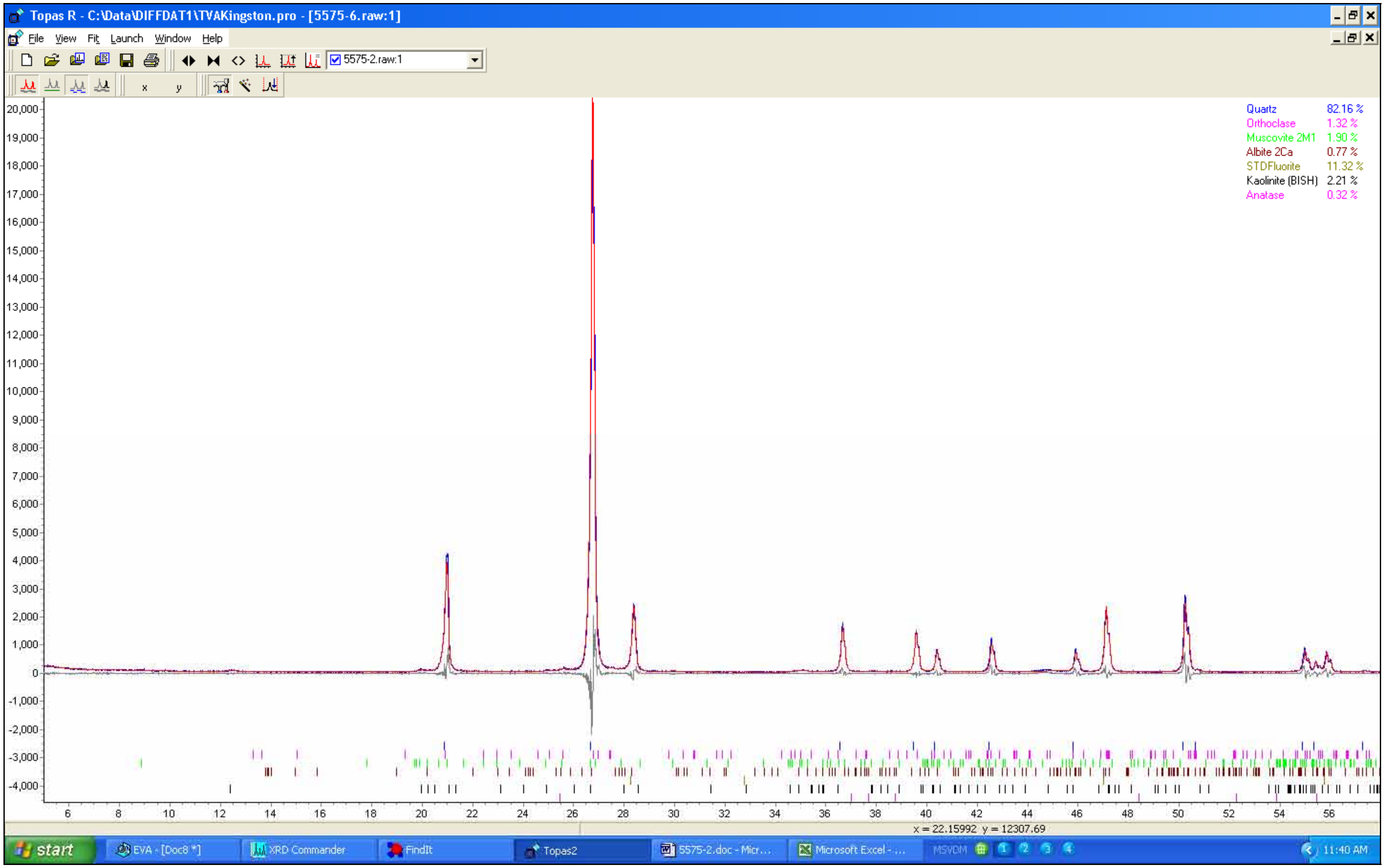
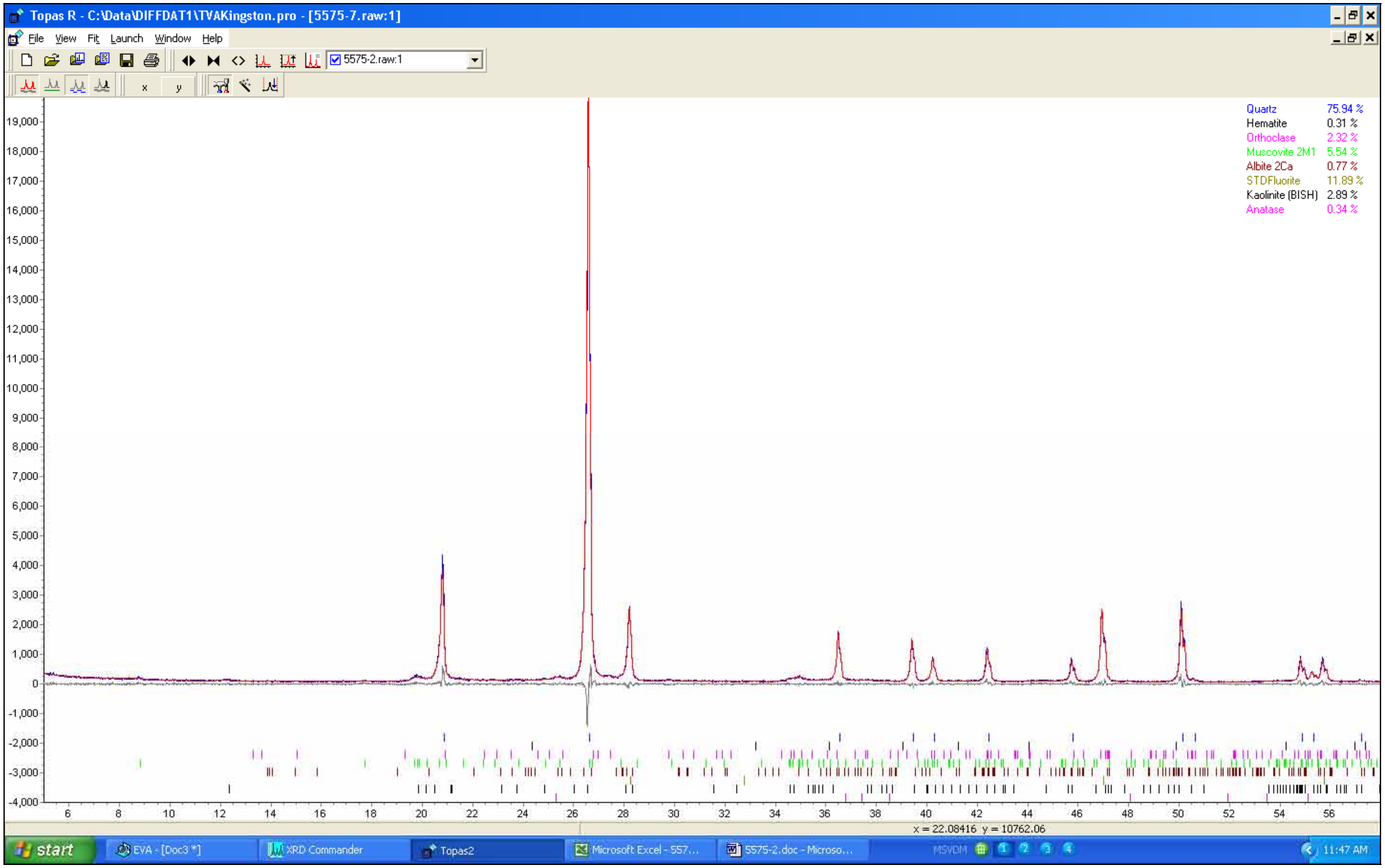
EVA - [Doc8 *]
XRD Commander
FindIt
Topas2
5575-2.doc - Micr...
Microsoft Excel - ...
11:26 AM

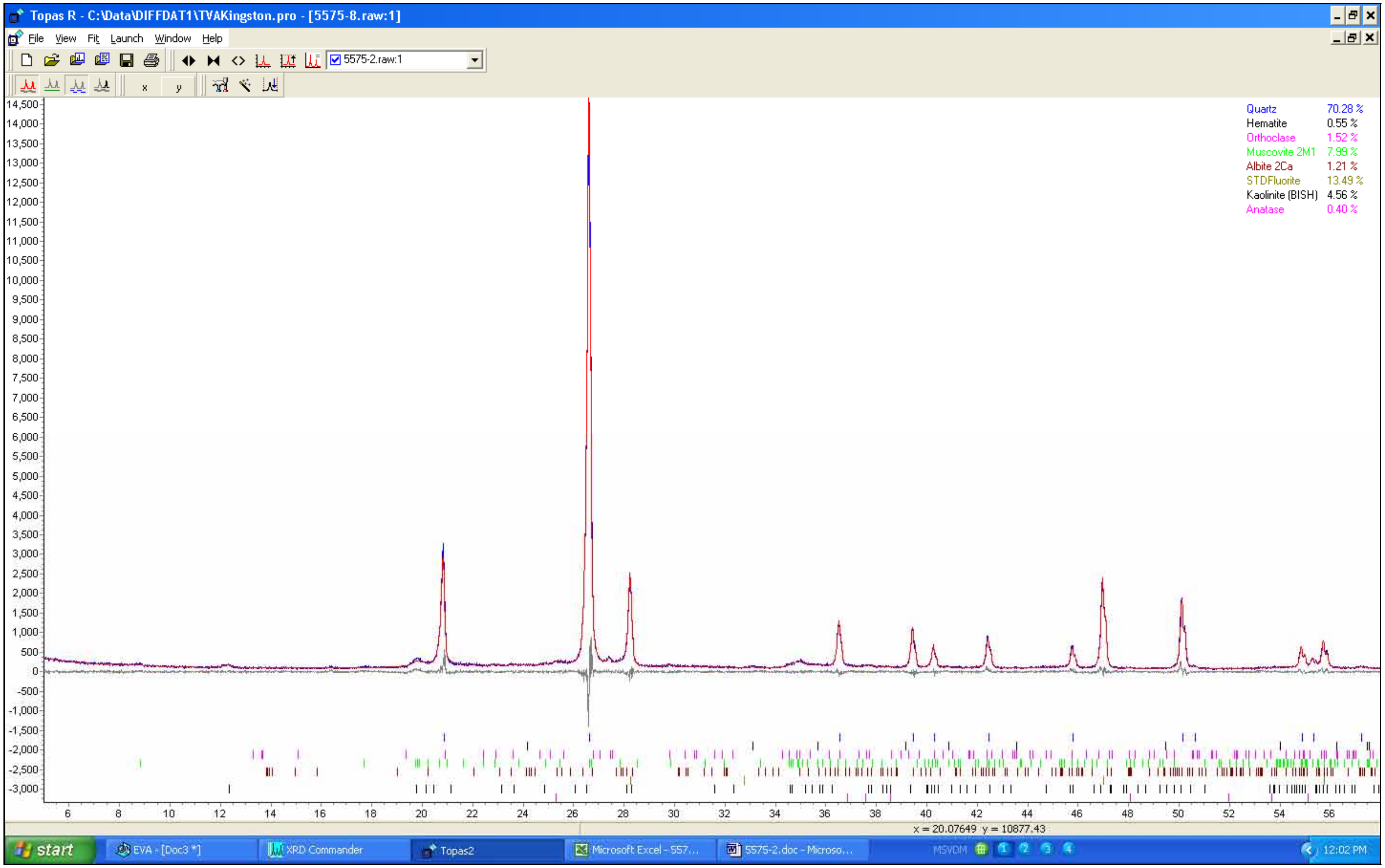

Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-3.raw:1]
Quartz 83.59 %
Hematite 0.23 %
Orthoclase 0.42 %
Muscovite 2M1 2.60 %
STDFluorite 12.37 %
Kaolinite (BISH) 0.80 %
Display fit window


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-4.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 68.93 %
Hematite 0.32 %
Orthoclase 6.16 %
Muscovite 2M1 6.88 %
Albite 2Ca 1.90 %
STDFluorite 12.01 %
Kaolinite (BISH) 3.56 %
Anatase 0.24 %
Fix Y2 to max value, Dont Fix Y2 to max value
start
EVA - [Doc8 *]
XRD Commander
FindIt
Topas2
5575-2.doc - Microso...
10:58 AM


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-5.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 84.45 %
Orthoclase 1.45 %
Muscovite 2M1 1.47 %
Albite 2Ca 0.60 %
STDFluorite 10.77 %
Kaolinite (BISH) 1.13 %
Anatase 0.13 %
(1 1 2) d=2.32112
x = 9.621437 y = 17702.63
start
EVA - [Doc8 *]
XRD Commander
FindIt
Topas2
5575-2.doc - Micr...
Microsoft Excel - ...
11:35 AM


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-6.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 82.16 %
Orthoclase 1.32 %
Muscovite 2M1 1.90 %
Albite 2Ca 0.77 %
STDFluorite 11.32 %
Kaolinite (BISH) 2.21 %
Anatase 0.32 %
x = 22.15992 y = 12307.69


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-7.raw:1]
5575-2.raw:1
Quartz 75.94 %
Hematite 0.31 %
Orthoclase 2.32 %
Muscovite 2M1 5.54 %
Albite 2Ca 0.77 %
STDFluorite 11.89 %
Kaolinite (BISH) 2.89 %
Anatase 0.34 %
x = 22.08416 y = 10762.06


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-8.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 70.28 %
Hematite 0.55 %
Orthoclase 1.52 %
Muscovite 2M1 7.99 %
Albite 2Ca 1.21 %
STDFluorite 13.49 %
Kaolinite (BISH) 4.56 %
Anatase 0.40 %
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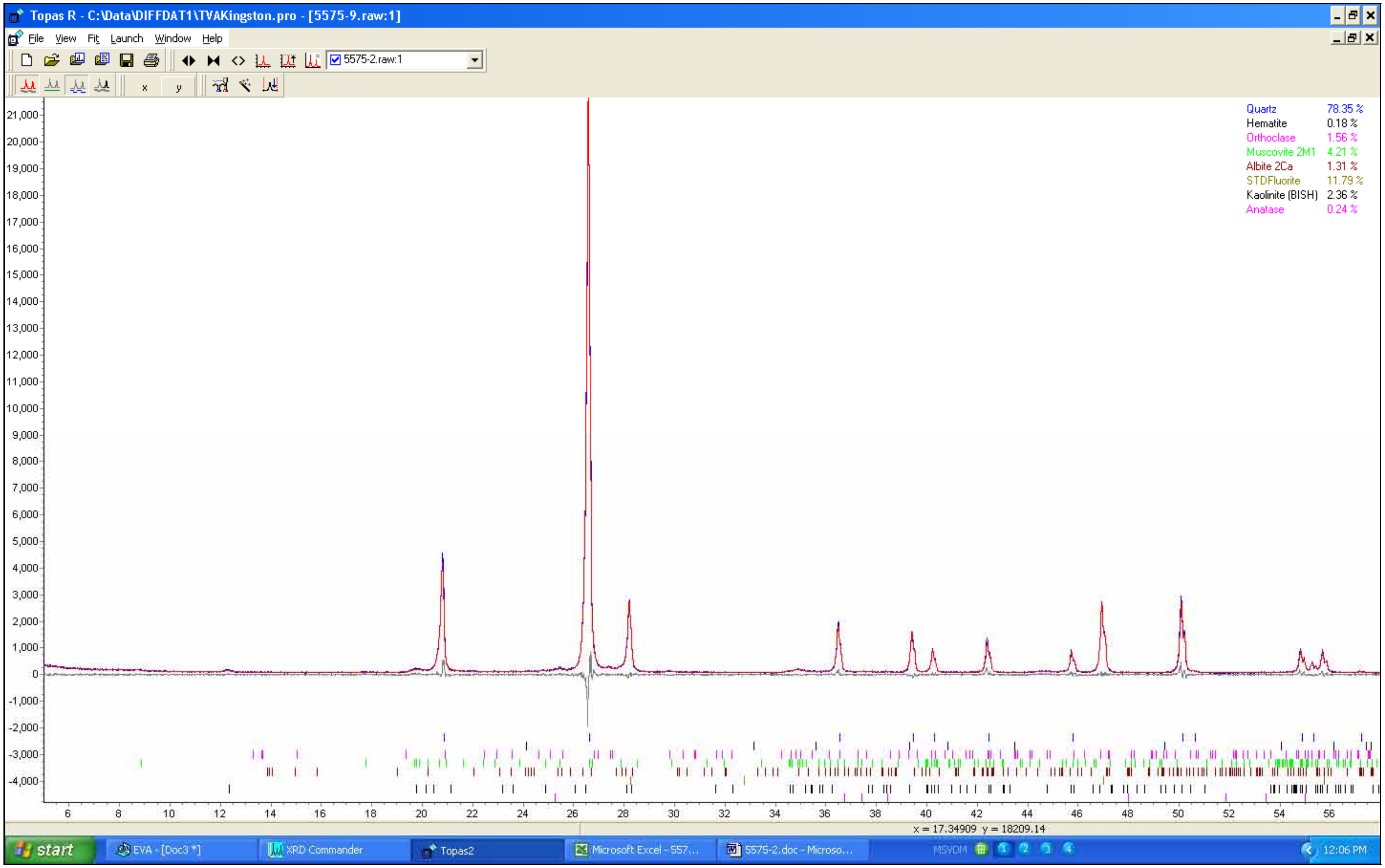
EVA - [Doc3 *]
XRD Commander
Topas2
Microsoft Excel - 557...
5575-2.doc - Microso...
12:02 PM


Topas R - C:\Data\DIFFDAT1\TVAKingston.pro - [5575-9.raw:1]
File View Fit Launch Window Help
5575-2.raw:1
Quartz 78.35 %
Hematite 0.18 %
Orthoclase 1.56 %
Muscovite 2M1 4.21 %
Albite 2Ca 1.31 %
STDFluorite 11.79 %
Kaolinite (BISH) 2.36 %
Anatase 0.24 %
x = 17.34909 y = 18209.14
start
EVA - [Doc3 *]
XRD Commander
Topas2
Microsoft Excel - 557...
5575-2.doc - Microso...
12:06 PM

APPENDIX D

DBS (2010) – Laboratory Characterization of Native Soils and Ash

Laboratory Report for

Jacobs Engineering

TVA-Kingston Ash Recovery Project

August 6, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

August 6, 2010

Bruce Haas
Jacobs Engineering
1134 Swan Pond Road
Harriman, TN 37748
(865) 659-5108

Re: DBS&A Laboratory Report for Jacobs Engineering TVA-Kingston Ash Recovery Project

Dear Mr. Haas:

Enclosed is the final report for the Jacobs Engineering TVA-Kingston Ash Recovery Project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Jacobs Engineering and the Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
ASH-HC-001	X	X			X																	
ASH-HC-001 treated	X	X			X																	
ASH-HC-002	X	X			X																	
ASH-HC-002 treated	X	X			X																	
ASH-HC-003	X	X		X																		
ASH-HC-003 treated	X	X			X																	

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Sample Preparation

		Target Remold Parameters[1]		Actual Remold Data		
Sample Number	As Recieved Moisture Content (%, g/g)	Moisture Content (%, g/g)	Dry Bulk Density (g/cm^3)	Moisture Content (%, g/g)	Dry Bulk Density (g/cm^3)	Dry Bulk Density (pcf)
ASH-HC-001	33.7	24.5	'Extra Firm'	23.3	1.23	77.0
ASH-HC-001 treated	33.7	24.5	'Extra Firm'	23.1	1.25	77.8
ASH-HC-002	26.0	24.5	'Extra Firm'	24.1	1.36	85.1
ASH-HC-002 treated	26.0	24.5	'Extra Firm'	23.6	1.37	85.5
ASH-HC-003	19.0	24.5	'Extra Firm'	19.0*	1.43	89.1
ASH-HC-003 treated	19.0	24.5	'Extra Firm'	24.3	1.36	85.1

[1]Target Remold Parameters: Provided by the client: Remold to 'extra firm' at 24.5 % moisture content.

*Sample to wet to remold at 24.5%

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded				
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
ASH-HC-001	33.7	NA	23.3	28.7	1.23	1.52	53.4
ASH-HC-001 treated	33.7	NA	23.1	28.7	1.25	1.53	53.0
ASH-HC-002	26.0	NA	24.1	32.8	1.36	1.69	48.5
ASH-HC-002 treated	26.0	NA	23.6	32.3	1.37	1.69	48.3
ASH-HC-003	19.0	NA	19.0	27.2	1.43	1.70	46.2
ASH-HC-003 treated	19.0	NA	24.3	33.1	1.36	1.69	48.5

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
ASH-HC-001	2.5E-05	NA		X
ASH-HC-001 treated	5.4E-06	NA		X
ASH-HC-002	5.0E-05	NA		X
ASH-HC-002 treated	1.9E-05	NA		X
ASH-HC-003	9.7E-04	NA	X	
ASH-HC-003 treated	6.0E-05	NA		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
ASH-HC-001	33.7	NA	23.3	28.7	1.23	1.52	53.4
ASH-HC-001 treated	33.7	NA	23.1	28.7	1.25	1.53	53.0
ASH-HC-002	26.0	NA	24.1	32.8	1.36	1.69	48.5
ASH-HC-002 treated	26.0	NA	23.6	32.3	1.37	1.69	48.3
ASH-HC-003	19.0	NA	19.0	27.2	1.43	1.70	46.2
ASH-HC-003 treated	19.0	NA	24.3	33.1	1.36	1.69	48.5

NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: ASH-HC-001
Project Name: Kingston Ash Recovery Project
Container Type: 32 oz Jar (x2)

	As Received	Remoded
Test Date:	12-Jul-10	21-Jul-10
Field weight of sample* (g):	458.30	306.25
Tare weight, ring (g):	0.00	91.01
Tare weight, pan/plate (g):	270.76	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	140.32	174.60
Sample volume (cm^3):	NA	141.51
Assumed particle density (g/cm^3):	2.65	2.65

	As Received	Remolded
Gravimetric Moisture Content (% g/g):	33.7	23.3
Volumetric Moisture Content (% vol):	NA	28.7
Dry bulk density (g/cm^3):	NA	1.23
Wet bulk density (g/cm^3):	NA	1.52
Calculated Porosity (% vol):	NA	53.4
Percent Saturation:	NA	53.7

Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	ASH-HC-001 treated
Project Name:	Kingston Ash Recovery Project
Container Type:	32 oz Jar (x2)

	As Received	Remolded
Test Date:	12-Jul-10	20-Jul-10
Field weight of sample* (g):	458.30	306.59
Tare weight, ring (g):	0.00	89.30
Tare weight, pan/plate (g):	270.76	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	140.32	176.58
Sample volume (cm^3):	NA	141.72
Assumed particle density (g/cm^3):	2.65	2.65
Gravimetric Moisture Content (% g/g):	33.7	23.1
Volumetric Moisture Content (% vol):	NA	28.7
Dry bulk density (g/cm^3):	NA	1.25
Wet bulk density (g/cm^3):	NA	1.53
Calculated Porosity (% vol):	NA	53.0
Percent Saturation:	NA	54.2
Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: ASH-HC-002
Project Name: Kingston Ash Recovery Project
Container Type: 32 oz Jar (x2)

	As Received	Remolded
Test Date:	12-Jul-10	21-Jul-10
Field weight of sample* (g):	516.64	331.09
Tare weight, ring (g):	0.00	91.82
Tare weight, pan/plate (g):	269.45	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	196.22	192.83
Sample volume (cm^3):	NA	141.39
Assumed particle density (g/cm^3):	2.65	2.65

Gravimetric Moisture Content (% g/g):	26.0	24.1
Volumetric Moisture Content (% vol):	NA	32.8
Dry bulk density (g/cm^3):	NA	1.36
Wet bulk density (g/cm^3):	NA	1.69
Calculated Porosity (% vol):	NA	48.5
Percent Saturation:	NA	67.7

Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: ASH-HC-002 treated
Project Name: Kingston Ash Recovery Project
Container Type: 32 oz Jar (x2)

	As Received	Remolded
Test Date:	12-Jul-10	20-Jul-10
Field weight of sample* (g):	516.64	344.71
Tare weight, ring (g):	0.00	110.00
Tare weight, pan/plate (g):	269.45	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	196.22	189.95
Sample volume (cm^3):	NA	138.72
Assumed particle density (g/cm^3):	2.65	2.65
Gravimetric Moisture Content (% g/g):	26.0	23.6
Volumetric Moisture Content (% vol):	NA	32.3
Dry bulk density (g/cm^3):	NA	1.37
Wet bulk density (g/cm^3):	NA	1.69
Calculated Porosity (% vol):	NA	48.3
Percent Saturation:	NA	66.8
Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: ASH-HC-003
Project Name: Kingston Ash Recovery Project
Container Type: 32 oz Jar (x2)

	As Received	Remolded
Test Date:	12-Jul-10	21-Jul-10
Field weight of sample* (g):	508.48	332.05
Tare weight, ring (g):	0.00	89.50
Tare weight, pan/plate (g):	270.63	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	199.90	203.76
Sample volume (cm^3):	NA	142.84
Assumed particle density (g/cm^3):	2.65	2.65
Gravimetric Moisture Content (% g/g):	19.0	19.0
Volumetric Moisture Content (% vol):	NA	27.2
Dry bulk density (g/cm^3):	NA	1.43
Wet bulk density (g/cm^3):	NA	1.70
Calculated Porosity (% vol):	NA	46.2
Percent Saturation:	NA	58.8
Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	ASH-HC-003 treated
Project Name:	Kingston Ash Recovery Project
Container Type:	32 oz Jar (x2)

	As Received	Remolded
Test Date:	12-Jul-10	20-Jul-10
Field weight of sample* (g):	508.48	327.76
Tare weight, ring (g):	0.00	89.90
Tare weight, pan/plate (g):	270.63	0.00
Tare weight, other (g):	0.00	0.00
Dry weight of sample (g):	199.90	191.37
Sample volume (cm^3):	NA	140.35
Assumed particle density (g/cm^3):	2.65	2.65
Gravimetric Moisture Content (% g/g):	19.0	24.3
Volumetric Moisture Content (% vol):	NA	33.1
Dry bulk density (g/cm^3):	NA	1.36
Wet bulk density (g/cm^3):	NA	1.69
Calculated Porosity (% vol):	NA	48.5
Percent Saturation:	NA	68.2
Laboratory analysis by:	D. O'Dowd	D. O'Dowd
Data entered by:	D. O'Dowd	D. O'Dowd
Checked by:	J. Hines	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
ASH-HC-001	2.5E-05	NA		X
ASH-HC-001 treated	5.4E-06	NA		X
ASH-HC-002	5.0E-05	NA		X
ASH-HC-002 treated	1.9E-05	NA		X
ASH-HC-003	9.7E-04	NA	X	
ASH-HC-003 treated	6.0E-05	NA		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

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Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	ASH-HC-001	*Offset* (cm)*:*	3.2
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.63
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2)*:*	18.56
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
23-Jul-10	10:20:00	23.0	19.4	16.2	1650	2.8E-05	2.6E-05
23-Jul-10	10:47:30	23.0	17	13.8			
Test # 2:							
23-Jul-10	10:47:30	23.0	17	13.8	1590	2.8E-05	2.6E-05
23-Jul-10	11:14:00	23.0	15.05	11.9			
Test # 3:							
23-Jul-10	11:14:00	23.0	15.05	11.9	3300	2.6E-05	2.5E-05
23-Jul-10	12:09:00	23.0	11.95	8.8			

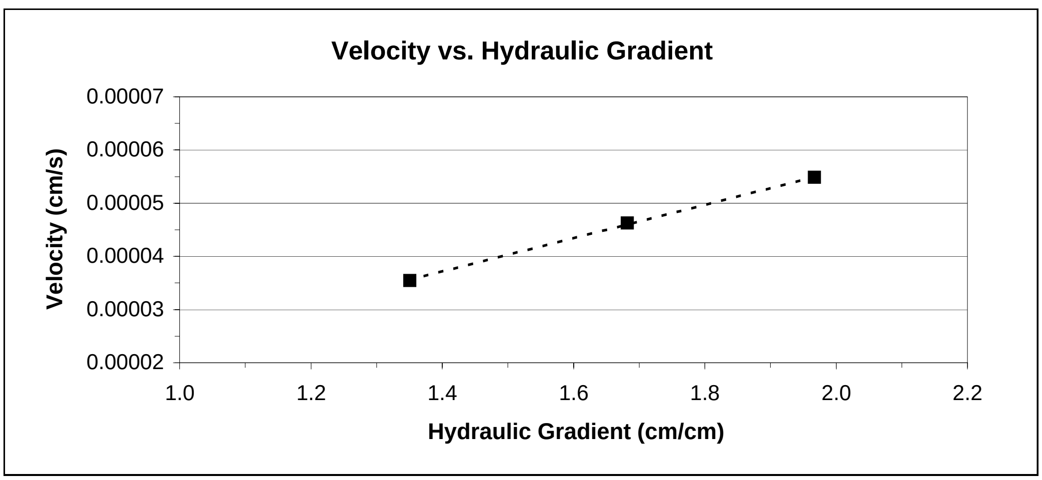
***Average Ksat* (cm/sec):** **2.5E-05**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

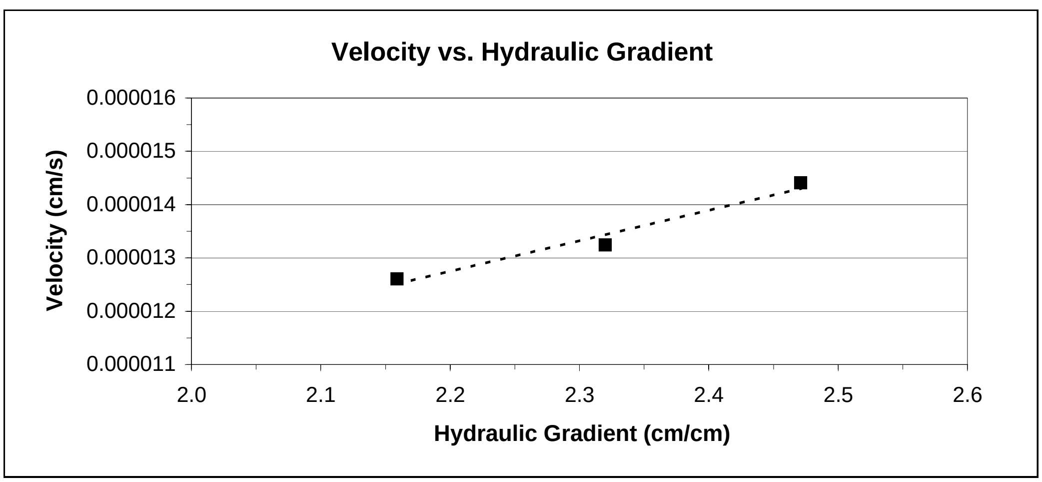
Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	ASH-HC-001 treated	*Offset* (cm)*:*	3.2
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.61
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2)*:*	18.63
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
23-Jul-10	8:40:45	23.0	22.3	19.1	1565	5.8E-06	5.4E-06
23-Jul-10	9:06:50	23.0	21.7	18.5			
Test # 2:							
23-Jul-10	9:31:20	23.0	21.05	17.9	1135	5.7E-06	5.3E-06
23-Jul-10	9:50:15	23.0	20.65	17.5			
Test # 3:							
23-Jul-10	10:19:00	23.0	19.9	16.7	1640	5.8E-06	5.4E-06
23-Jul-10	10:46:20	23.0	19.35	16.2			

***Average Ksat* (cm/sec):** **5.4E-06**
***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not analyzed



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	ASH-HC-002	*Offset* (cm)*:*	2.5
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.63
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2)*:*	18.54
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
23-Jul-10	9:30:45	23.0	24	21.5	1140	5.3E-05	5.0E-05
23-Jul-10	9:49:45	23.0	19.9	17.4			
Test # 2:							
23-Jul-10	9:49:45	23.0	19.9	17.4	1735	5.4E-05	5.1E-05
23-Jul-10	10:18:40	23.0	15.05	12.6			
Test # 3:							
23-Jul-10	10:18:40	23.0	15.05	12.6	1580	5.5E-05	5.1E-05
23-Jul-10	10:45:00	23.0	11.8	9.3			

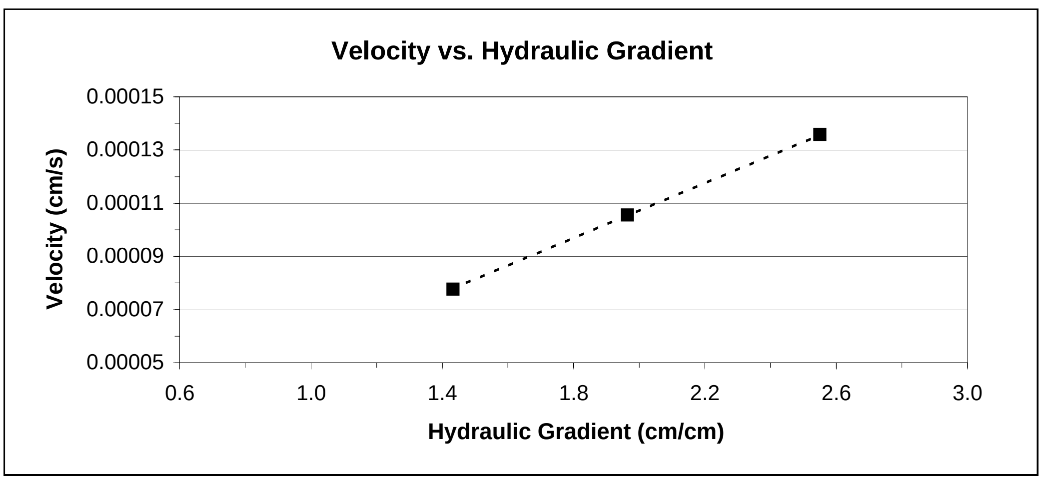
***Average Ksat* (cm/sec):** **5.0E-05**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi):	0.0
Sample number:	ASH-HC-002 treated	*Offset* (cm):	2.7
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm):	7.59
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2):	18.27
		Reservoir x-sectional area (cm^2):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
23-Jul-10	10:19:30	23.0	25.1	22.4	1650	2.1E-05	1.9E-05
23-Jul-10	10:47:00	23.0	22.6	19.9			
Test # 2:							
23-Jul-10	10:47:00	23.0	22.6	19.9	1590	2.0E-05	1.9E-05
23-Jul-10	11:13:30	23.0	20.5	17.8			
Test # 3:							
23-Jul-10	11:13:30	23.0	20.5	17.8	3300	2.0E-05	1.9E-05
23-Jul-10	12:08:30	23.0	16.85	14.2			

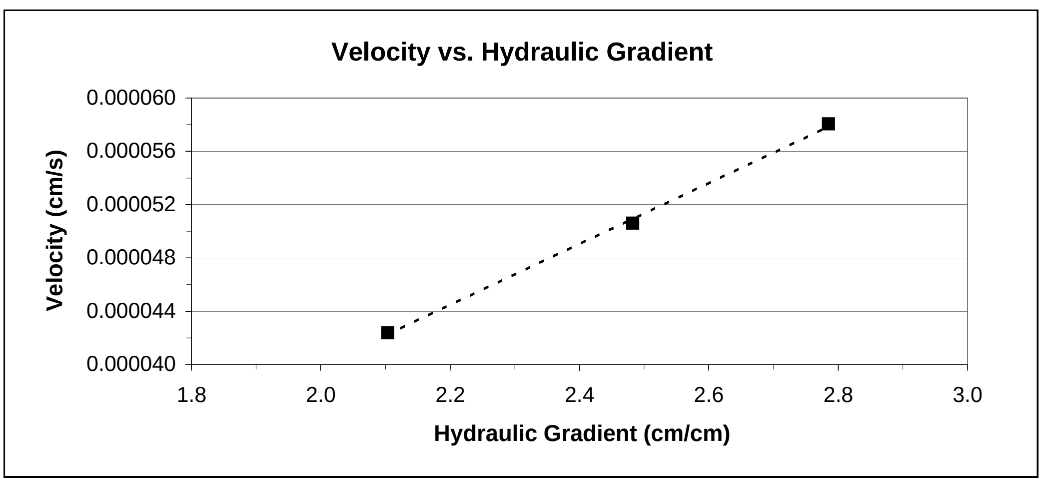
***Average Ksat* (cm/sec): 1.9E-05**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.92
Sample number:	ASH-HC-003	*Sample length* (cm)*:*	7.62
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	4.89
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2)*:*	18.75

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
23-Jul-10	9:51:37	23.0	3.5	14.08	3.2	347	1.1E-03	9.8E-04
23-Jul-10	9:57:24							
Test # 2:								
23-Jul-10	10:17:51	23.0	3.4	13.79	2.9	329	1.0E-03	9.7E-04
23-Jul-10	10:23:20							
Test # 3:								
23-Jul-10	10:45:09	23.0	3.2	13.82	2.9	356	1.0E-03	9.6E-04
23-Jul-10	10:51:05							

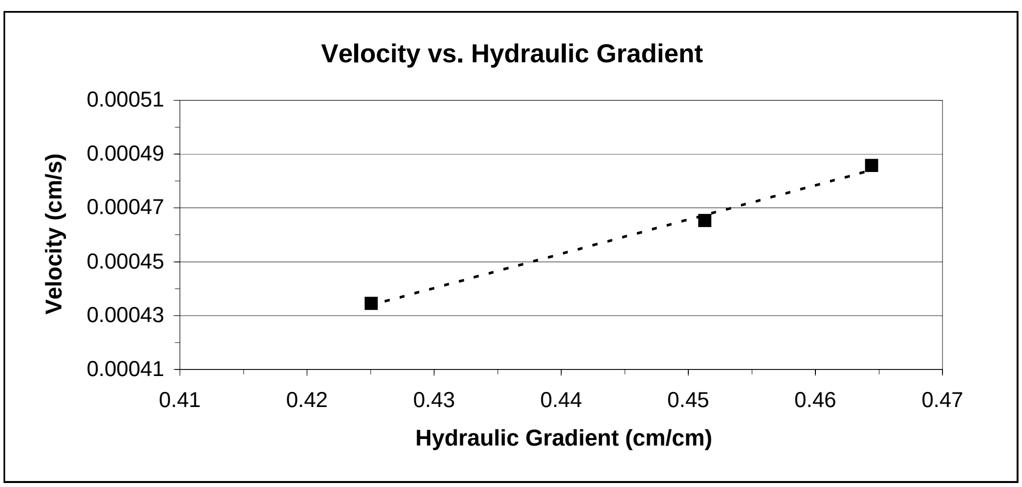
Average Ksat* (cm/sec)*: **9.7E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	ASH-HC-003 treated	*Offset* (cm)*:*	3.0
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.60
Container Type:	32 oz Jar (x2)	*Sample x-sectional area* (cm^2)*:*	18.47
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
23-Jul-10	9:32:40	23.0	17.8	14.8	1115	6.5E-05	6.1E-05
23-Jul-10	9:51:15	23.0	14.5	11.5			
Test # 2:							
23-Jul-10	9:51:15	23.0	14.5	11.5	1745	6.4E-05	6.0E-05
23-Jul-10	10:20:20	23.0	10.8	7.8			
Test # 3:							
23-Jul-10	10:20:20	23.0	10.8	7.8	1650	6.4E-05	6.0E-05
23-Jul-10	10:47:50	23.0	8.4	5.4			

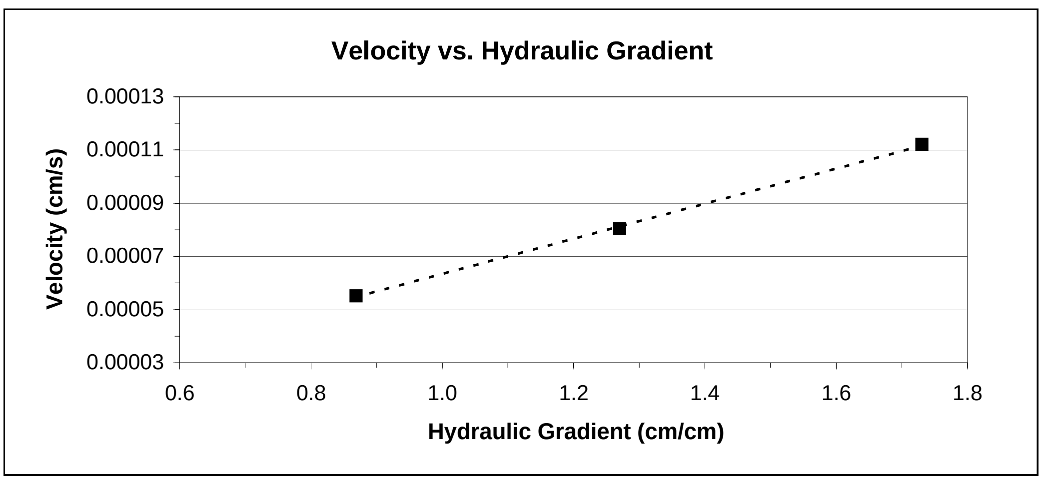
***Average Ksat* (cm/sec):** **6.0E-05**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Falling Head: (Rigid Wall)	Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI

Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

August 6, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

August 6, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GP-16A, 46-48	X	X		X								X						X				
GP-16, 34-36	X	X		X								X						X				
GP-23, 34-36	X	X		X								X						X				
GP-23, 54-56	X	X			X							X						X				
GW-01, 20-22	X	X			X							X						X				
TWP-04A, 60-62	X	X										X						X				
TWP-04A, 70-72	X	X		X								X						X				
TWP-05, 66-68	X	X			X							X						X				
TWP-05, 76-78	X	X			X							X						X				
TWP-06, 40-42	X	X		X								X						X				
TWP-06, 54-56	X	X		X								X						X				

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample TWP-04A, 60-62 pulled away from the wall of the testing ring (decreased in volume) during the saturated hydraulic conductivity (Ksat) test. This anomalous behavior created an annulus and therefore, wall flow. Since the rigid wall Ksat method was no longer appropriate due to the wall flow and since the structural integrity of the sample had increased slightly; the sample was taken out of the rigid wall apparatus and was placed in a flexible membrane for Ksat testing via the flexible wall apparatus. This test was also unsuccessful. Even though the integrity of the sample had increased slighlty, it was still not strong enough to withhold structural change under standard confining pressures. Thus, we are unable to report a saturated hydraulic conductivity result for sample TWP-04A, 60-62.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed
--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Specific Gravity Tests

Sample Number	<4.75mm Material Specific Gravity	<4.75mm Material Percent of Bulk Sample	>4.75mm Material Specific Gravity	>4.75mm Material Percent of Bulk Sample	Bulk Sample Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass
* = Based on specific gravity of material < 4.75 mm
NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected Calculated Total Porosity (%)	Oversize Corrected -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16A, 46-48
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	412.21	
Tare weight, ring (g):	75.48	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	289.88	
Sample volume (cm^3):	165.99	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	16.2	
Volumetric Moisture Content (% vol):	28.2	
Dry bulk density (g/cm^3):	1.75	
Wet bulk density (g/cm^3):	2.03	
Calculated Porosity (% vol):	33.9	
Percent Saturation:	83.3	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	587.56	
Tare weight, ring (g):	133.17	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	369.43	
Sample volume (cm^3):	222.06	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	23.0	
Volumetric Moisture Content (% vol):	38.3	
Dry bulk density (g/cm^3):	1.66	
Wet bulk density (g/cm^3):	2.05	
Calculated Porosity (% vol):	37.1	
Percent Saturation:	103.0	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	492.27	
Tare weight, ring (g):	129.62	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	253.36	
Sample volume (cm^3):	225.35	
Measured particle density (g/cm^3):	2.49	
Gravimetric Moisture Content (% g/g):	43.1	
Volumetric Moisture Content (% vol):	48.5	
Dry bulk density (g/cm^3):	1.12	
Wet bulk density (g/cm^3):	1.61	
Calculated Porosity (% vol):	54.8	
Percent Saturation:	88.4	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	576.85	
Tare weight, ring (g):	124.91	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	361.41	
Sample volume (cm^3):	226.76	
Measured particle density (g/cm^3):	2.67	

Gravimetric Moisture Content (% g/g):	25.0	
Volumetric Moisture Content (% vol):	39.9	
Dry bulk density (g/cm^3):	1.59	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	40.2	
Percent Saturation:	99.3	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GW-01, 20-22
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	891.40	
Tare weight, ring (g):	208.78	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	574.50	
Sample volume (cm^3):	317.35	
Measured particle density (g/cm^3):	2.74	

Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	33.8	
Percent Saturation:	100.8	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-04A, 60-62
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	573.29	
Tare weight, ring (g):	130.10	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	353.41	
Sample volume (cm^3):	225.77	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	25.4	
Volumetric Moisture Content (% vol):	39.8	
Dry bulk density (g/cm^3):	1.57	
Wet bulk density (g/cm^3):	1.96	
Calculated Porosity (% vol):	40.7	
Percent Saturation:	97.6	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-04A, 70-72
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	382.34	
Tare weight, ring (g):	72.90	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	260.41	
Sample volume (cm^3):	163.05	
Measured particle density (g/cm^3):	2.63	
Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	30.1	
Dry bulk density (g/cm^3):	1.60	
Wet bulk density (g/cm^3):	1.90	
Calculated Porosity (% vol):	39.2	
Percent Saturation:	76.8	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 66-68
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	600.99	
Tare weight, ring (g):	133.42	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	390.88	
Sample volume (cm^3):	224.95	
Measured particle density (g/cm^3):	2.65	

Gravimetric Moisture Content (% g/g):	19.6	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	2.08	
Calculated Porosity (% vol):	34.5	
Percent Saturation:	98.9	

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

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Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	457.59	
Tare weight, ring (g):	95.05	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	311.70	
Sample volume (cm^3):	168.52	
Measured particle density (g/cm^3):	2.64	

Gravimetric Moisture Content (% g/g):	16.3	
Volumetric Moisture Content (% vol):	30.2	
Dry bulk density (g/cm^3):	1.85	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	30.0	
Percent Saturation:	100.7	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	360.46	
Tare weight, ring (g):	61.94	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	247.52	
Sample volume (cm^3):	144.65	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	20.6	
Volumetric Moisture Content (% vol):	35.3	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.06	
Calculated Porosity (% vol):	35.5	
Percent Saturation:	99.4	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	522.75	
Tare weight, ring (g):	109.23	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	350.20	
Sample volume (cm^3):	197.26	
Measured particle density (g/cm^3):	2.66	
Gravimetric Moisture Content (% g/g):	18.1	
Volumetric Moisture Content (% vol):	32.1	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	2.10	
Calculated Porosity (% vol):	33.2	
Percent Saturation:	96.6	

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.94
Sample number:	GP-16A, 46-48	*Sample length* (cm)*:*	5.44
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.23
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.51

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:36	23.0	4.4	15.57	4.6	507	3.7E-04	3.4E-04
15-Jul-10	10:50:03							
Test # 2:								
15-Jul-10	11:14:28	23.0	4.1	14.41	3.5	413	3.7E-04	3.4E-04
15-Jul-10	11:21:21							
Test # 3:								
15-Jul-10	12:35:25	23.0	3.7	14.84	3.9	499	3.8E-04	3.5E-04
15-Jul-10	12:43:44							

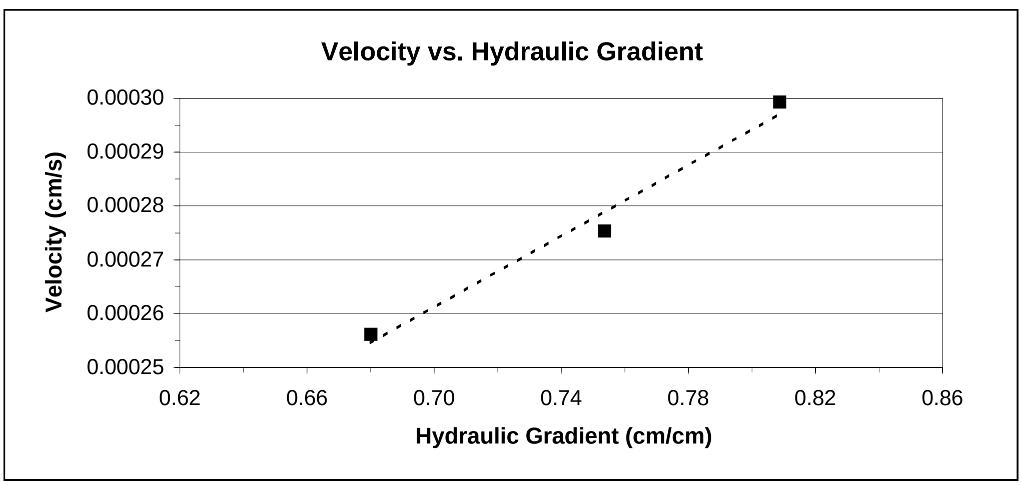
***Average Ksat* (cm/sec): 3.5E-04**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.94
Sample number:	GP-16, 34-36	*Sample length* (cm)*:*	7.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.11
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.31

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
18-Jul-10	10:27:28	23.0	6.3	16.15	5.2	356	6.0E-04	5.6E-04
18-Jul-10	10:33:24							
Test # 2:								
18-Jul-10	10:53:57	23.0	6.1	15.25	4.3	302	6.0E-04	5.6E-04
18-Jul-10	10:58:59							
Test # 3:								
18-Jul-10	11:18:13	23.0	5.8	16.15	5.2	387	6.0E-04	5.6E-04
18-Jul-10	11:24:40							

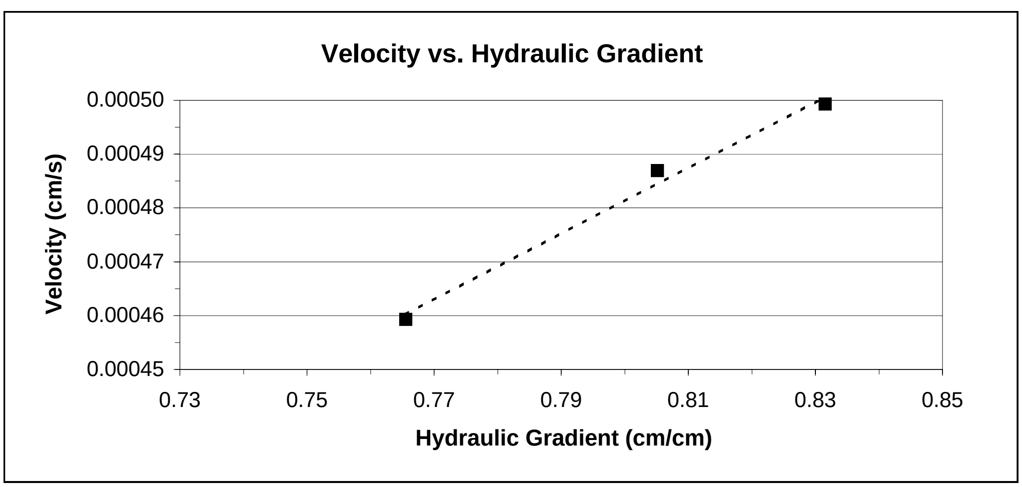
Average Ksat* (cm/sec)*: **5.6E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	11.02
Sample number:	GP-23, 34-36	*Sample length* (cm)*:*	7.61
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.14
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.63

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:52	23.0	7.3	20.79	9.8	560	6.1E-04	5.7E-04
15-Jul-10	10:51:12							
Test # 2:								
15-Jul-10	11:14:46	23.0	7.1	18.88	7.9	473	6.0E-04	5.6E-04
15-Jul-10	11:22:39							
Test # 3:								
15-Jul-10	12:35:43	23.0	6.8	19.66	8.6	552	5.9E-04	5.5E-04
15-Jul-10	12:44:55							

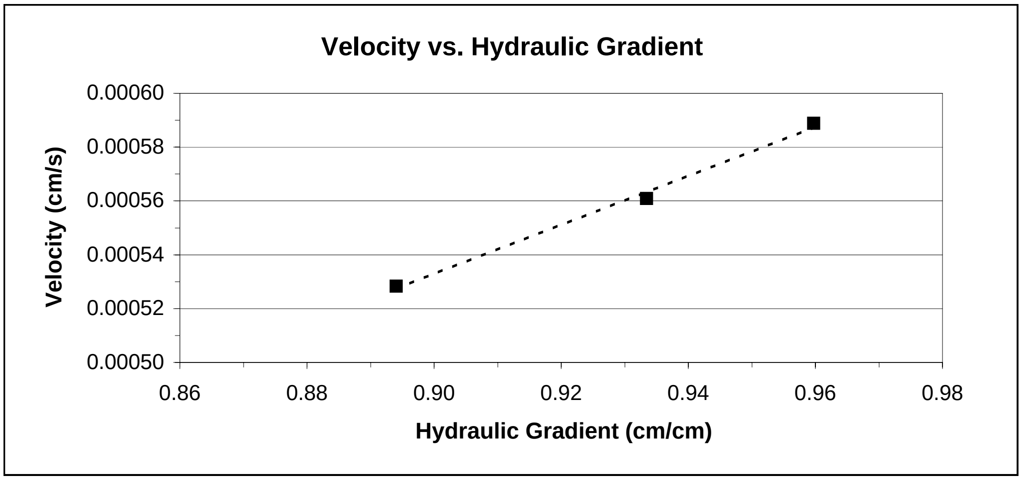
***Average Ksat* (cm/sec): 5.6E-04**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	2.0
Sample number:	GP-23, 54-56	*Offset* (cm)*:*	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.60
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.84
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	15:44:45	23.0	96.8	234.6	60345	1.2E-08	1.1E-08
22-Jul-10	8:30:30	23.0	95.85	233.7			
Test # 2:							
22-Jul-10	8:30:30	23.0	95.85	233.7	352680	1.1E-08	1.1E-08
26-Jul-10	10:28:30	22.5	90.7	228.5			
Test # 3:							
26-Jul-10	10:28:30	22.5	90.7	228.5	100095	1.1E-08	1.1E-08
27-Jul-10	14:16:45	23.0	89.25	227.1			

Average Ksat* (cm/sec):** **≤1.1E-08

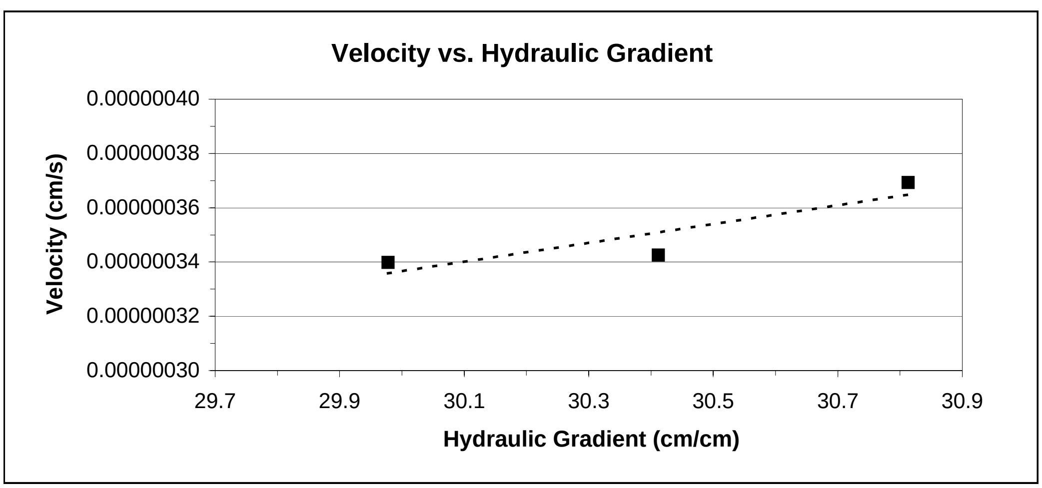
***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed

* = Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	GW-01, 20-22	*Offset* (cm)*:*	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.57
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	41.90
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:30	23.0	49.1	46.3	2040	5.4E-07	5.0E-07
21-Jul-10	9:59:30	23.0	48.7	45.9			
Test # 2:							
21-Jul-10	9:59:30	23.0	48.7	45.9	3390	5.7E-07	5.3E-07
21-Jul-10	10:56:00	23.0	48	45.2			
Test # 3:							
21-Jul-10	11:43:30	23.0	47.65	44.9	5730	5.5E-07	5.1E-07
21-Jul-10	13:19:00	23.0	46.55	43.8			

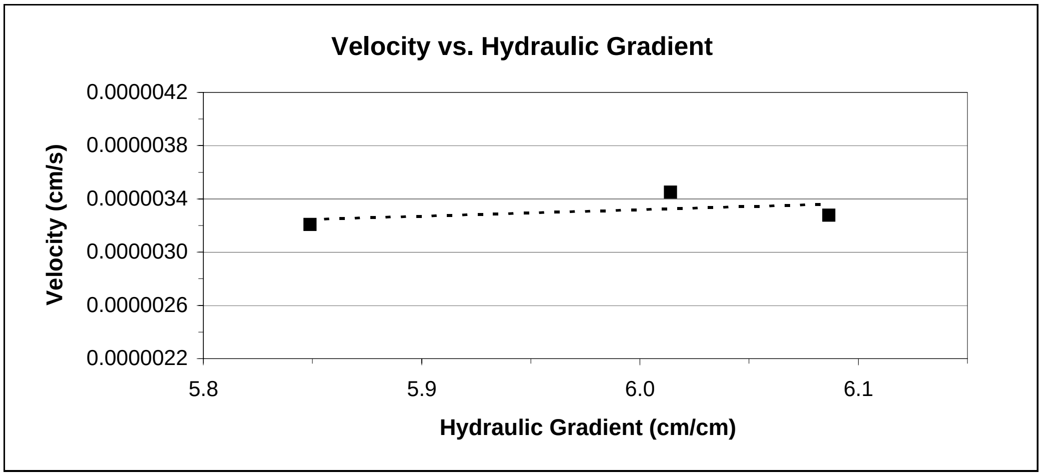
***Average Ksat* (cm/sec):** **5.2E-07**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.93
Sample number:	TWP-04A, 70-72	*Sample length* (cm)*:*	5.36
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.22
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.42

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:16	23.0	1.3	18.31	7.4	485	2.1E-03	1.9E-03
15-Jul-10	10:49:21							
Test # 2:								
15-Jul-10	11:14:16	23.0	1.2	15.70	4.8	372	1.9E-03	1.8E-03
15-Jul-10	11:20:28							
Test # 3:								
15-Jul-10	12:35:10	23.0	1	15.92	5.0	464	1.9E-03	1.8E-03
15-Jul-10	12:42:54							

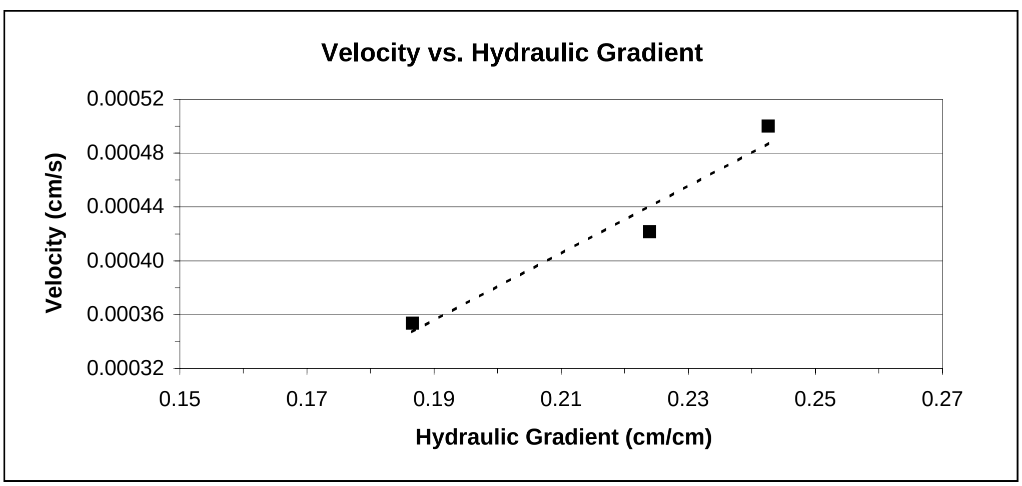
Average Ksat* (cm/sec)*: **1.8E-03**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 66-68	*Offset* (cm)*:*	2.7
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.59
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.64
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
18-Jul-10	8:23:30	23.0	53.9	51.2	86700	4.4E-07	4.1E-07
19-Jul-10	8:28:30	23.0	44.15	41.5			
Test # 2:							
19-Jul-10	8:28:30	23.0	44.15	41.5	10950	4.6E-07	4.3E-07
19-Jul-10	11:31:00	23.0	43	40.3			
Test # 3:							
19-Jul-10	11:31:00	23.0	43	40.3	76390	4.3E-07	4.0E-07
20-Jul-10	8:44:10	23.0	36.2	33.5			

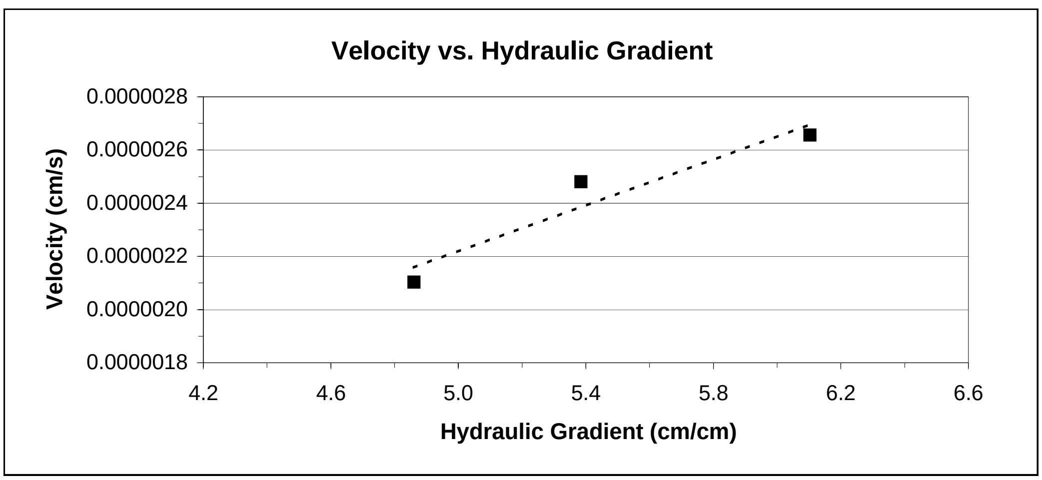
***Average Ksat* (cm/sec): 4.1E-07**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 76-78	*Offset* (cm)*:*	1.0
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	5.63
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.94
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:55	23.0	33.15	32.2	1745	3.7E-06	3.5E-06
21-Jul-10	9:55:00	23.0	31.6	30.6			
Test # 2:							
21-Jul-10	9:55:00	23.0	31.6	30.6	3645	3.5E-06	3.2E-06
21-Jul-10	10:55:45	23.0	28.8	27.8			
Test # 3:							
21-Jul-10	10:55:45	23.0	28.8	27.8	2825	3.8E-06	3.6E-06
21-Jul-10	11:42:50	23.0	26.6	25.6			

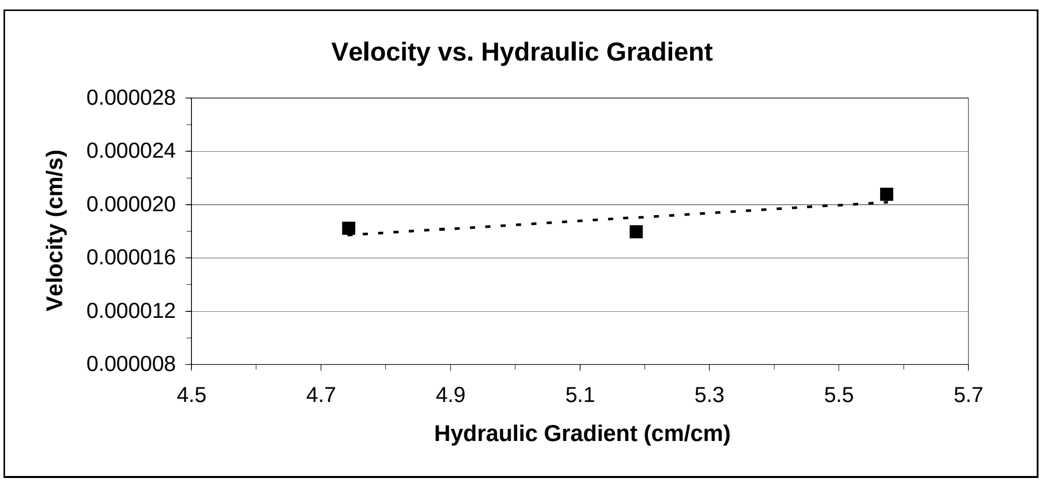
Average Ksat* (cm/sec)*: **3.4E-06**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.96
Sample number:	TWP-06, 40-42	*Sample length* (cm)*:*	4.74
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.24
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.54

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:43	23.0	4.5	18.65	7.7	534	5.0E-04	4.6E-04
15-Jul-10	10:50:37							
Test # 2:								
15-Jul-10	11:14:36	23.0	4.2	16.86	5.9	447	4.9E-04	4.5E-04
15-Jul-10	11:22:03							
Test # 3:								
15-Jul-10	12:35:32	23.0	4	17.50	6.5	528	4.8E-04	4.5E-04
15-Jul-10	12:44:20							

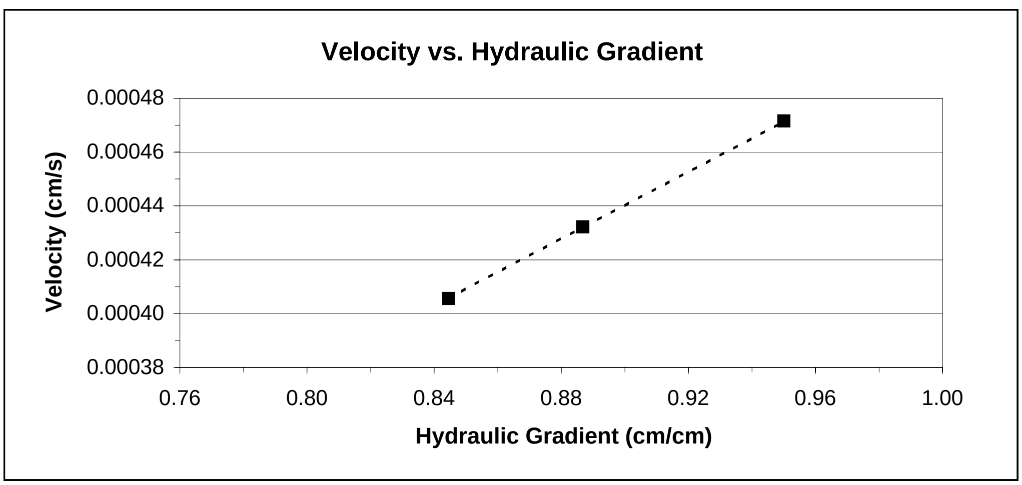
Average Ksat* (cm/sec)*: **4.5E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.92
Sample number:	TWP-06, 54-56	*Sample length* (cm):	6.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.18
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.00

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:42:06	23.0	6.4	20.62	9.7	584	5.7E-04	5.3E-04
15-Jul-10	10:51:50							
Test # 2:								
15-Jul-10	11:14:55	23.0	6.1	18.56	7.6	497	5.5E-04	5.1E-04
15-Jul-10	11:23:12							
Test # 3:								
15-Jul-10	12:35:51	23.0	5.8	19.21	8.3	577	5.4E-04	5.1E-04
15-Jul-10	12:45:28							

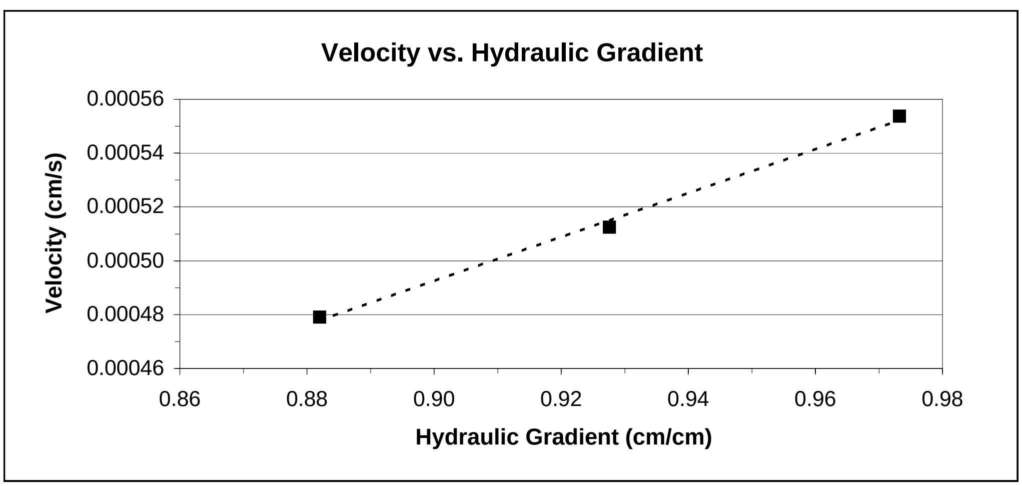
***Average Ksat* (cm/sec): 5.2E-04**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Data for Specific Gravity for Sample: GP-16A, 46-48

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16A, 46-48
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	95.95	94.22
Weight of pycnometer filled w/soil (g):	146.03	144.43
Weight of pycnometer filled w/soil & water (g):	376.30	374.63
Weight of pycnometer filled w/water (g):	345.15	343.37
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.64	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.64	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---
Percent of Test Sample (% g/g):	0.00
Percent of Bulk Sample (% g/g):	0.00
Tare Weight (g):	---
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---
Saturated Apparent mass in Water & Tare (g):	---
Oven Dry (OD) mass in Air & Tare (g):	---
Observed Temperature (°C):	---
Density of water at observed temperature (g/m^3):	---
SSD Specific Gravity (g/g):	---
Apparent Specific Gravity (g/g):	---
OD Specific Gravity (g/g):	---
Percent Absorption (%):	---
Correction Factor, K:	---
Average Specific Gravity (Apparent) at 20°C:*	---
Average Particle Density (Apparent) at 20°C (g/cm^3)*:	---

--- = Test unnecessary since specified fraction <5% of composite mass.

Specific Gravity (Apparent) at 20°C*:	**2.65**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: GP-16, 34-36

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.22	95.42
Weight of pycnometer filled w/soil (g):	145.76	146.42
Weight of pycnometer filled w/soil & water (g):	375.70	376.34
Weight of pycnometer filled w/water (g):	343.57	344.58
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: GP-23, 34-36

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	99.80	
Percent of Bulk Sample (% g/g):	99.80	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.53
Weight of pycnometer filled w/soil (g):	143.86	143.44
Weight of pycnometer filled w/soil & water (g):	372.79	371.50
Weight of pycnometer filled w/water (g):	342.52	339.80
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.50	2.49
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.49	2.49
Average Specific Gravity at 20°C (g/g):	2.49	
Average Particle Density at 20°C (g/cm^3):	2.49	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.20	
Percent of Bulk Sample (% g/g):	0.20	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.49**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.49	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
GP-23, 54-56

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.08	94.81
Weight of pycnometer filled w/soil (g):	146.17	146.91
Weight of pycnometer filled w/soil & water (g):	375.49	376.68
Weight of pycnometer filled w/water (g):	342.30	344.04
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.67	2.68
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity at 20°C (g/g):	2.67	
Average Particle Density at 20°C (g/cm^3):	2.67	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.67**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.67	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
GW-01, 20-22

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GW-01, 20-22
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	50.02	
Percent of Bulk Sample (% g/g):	50.02	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.90	93.70
Weight of pycnometer filled w/soil (g):	142.47	143.81
Weight of pycnometer filled w/soil & water (g):	373.72	374.70
Weight of pycnometer filled w/water (g):	342.16	342.94
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.75	2.73
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.75	2.73
Average Specific Gravity at 20°C (g/g):	2.74	
Average Particle Density at 20°C (g/cm^3):	2.74	

ASTM C127 (>4.75mm Fraction)

Test Date:	NA
Percent of Test Sample (% g/g):	49.98
Percent of Bulk Sample (% g/g):	49.98
Tare Weight (g):	NA
Saturated Surface Dry (SSD) mass in Air & Tare (g):	NA
Saturated Apparent mass in Water & Tare (g):	NA
Oven Dry (OD) mass in Air & Tare (g):	NA
Observed Temperature (°C):	NA
Density of water at observed temperature (g/m^3):	NA
SSD Specific Gravity (g/g):	NA
Apparent Specific Gravity (g/g):	NA
OD Specific Gravity (g/g):	NA
Percent Absorption (%):	NA
Correction Factor, K:	NA
Average Specific Gravity (Apparent) at 20°C:*	NA
Average Particle Density (Apparent) at 20°C (g/cm^3):*	NA

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Specific Gravity (Apparent) at 20°C*:	**2.74**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.74

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
TWP-04A, 60-62

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-04A, 60-62
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	98.56	
Percent of Bulk Sample (% g/g):	98.56	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.25	92.80
Weight of pycnometer filled w/soil (g):	144.63	146.01
Weight of pycnometer filled w/soil & water (g):	374.78	375.19
Weight of pycnometer filled w/water (g):	343.42	342.08
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	1.44	
Percent of Bulk Sample (% g/g):	1.44	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
TWP-04A, 70-72

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-04A, 70-72
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.29	92.22
Weight of pycnometer filled w/soil (g):	144.12	143.44
Weight of pycnometer filled w/soil & water (g):	373.56	373.15
Weight of pycnometer filled w/water (g):	341.43	341.39
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.63	2.63
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.63	2.63
Average Specific Gravity at 20°C (g/g):	2.63	
Average Particle Density at 20°C (g/cm^3):	2.63	

ASTM C127 (>4.75mm Fraction)

Test Date:	---
Percent of Test Sample (% g/g):	0.00
Percent of Bulk Sample (% g/g):	0.00
Tare Weight (g):	---
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---
Saturated Apparent mass in Water & Tare (g):	---
Oven Dry (OD) mass in Air & Tare (g):	---
Observed Temperature (°C):	---
Density of water at observed temperature (g/m^3):	---
SSD Specific Gravity (g/g):	---
Apparent Specific Gravity (g/g):	---
OD Specific Gravity (g/g):	---
Percent Absorption (%):	---
Correction Factor, K:	---
Average Specific Gravity (Apparent) at 20°C:*	---
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---

--- = Test unnecessary since specified fraction <5% of composite mass.

Specific Gravity (Apparent) at 20°C*:	**2.63**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.63

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-05, 66-68

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 66-68
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.56	92.11
Weight of pycnometer filled w/soil (g):	143.72	143.25
Weight of pycnometer filled w/soil & water (g):	374.14	373.28
Weight of pycnometer filled w/water (g):	342.86	341.36
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-05, 76-78

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 76-78
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.39	93.51
Weight of pycnometer filled w/soil (g):	143.90	145.76
Weight of pycnometer filled w/soil & water (g):	374.47	375.26
Weight of pycnometer filled w/water (g):	343.65	342.75
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
TWP-06, 40-42

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 40-42
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	91.07	90.89
Weight of pycnometer filled w/soil (g):	141.85	142.83
Weight of pycnometer filled w/soil & water (g):	371.87	372.59
Weight of pycnometer filled w/water (g):	340.22	340.17
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)**:*	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-06, 54-56

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	93.26
Weight of pycnometer filled w/soil (g):	144.97	145.25
Weight of pycnometer filled w/soil & water (g):	374.80	374.82
Weight of pycnometer filled w/water (g):	342.59	342.30
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.67
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.66	2.67
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.66	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.66	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Effective Porosity

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

				Oversize Corrected		
Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16A, 46-48
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 33.88
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.75
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 153.46
Tare weight, jar (g): 113.12

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:10	154.39	10504	4.03
	14-Jul-10	15:50	154.25	16419	3.40

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	10504	---	---	---	---
	16419	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 3.5

***Effective Porosity* (% cm^3/cm^3): 30.4**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 37.13
Measured particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.66
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 162.10
Tare weight, jar (g): 116.40

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	20-Jul-10	15:50	163.16	15093	3.85
	20-Jul-10	15:00	162.95	26413	3.09

Volume Adjusted Data[1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change[2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	26413	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 3.8

***Effective Porosity* (% cm^3/cm^3): 33.3**

***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

1 Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

2 Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 54.83
Measured particle density (g/cm^3): 2.49

Initial sample bulk density (g/cm^3): 1.12
Fraction of bulk sample used (<2.00mm fraction) (%): 99.80

Dry weight of dew point potentiometer sample* (g): 158.40
Tare weight, jar (g): 112.19

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	15:30	159.79	4997	3.38
	15-Jul-10	9:15	159.03	16317	1.52

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4997	---	---	---	---
	16317	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 1.7

***Effective Porosity* (% cm^3/cm^3): 53.1**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 40.22
Measured particle density (g/cm^3): 2.67

Initial sample bulk density (g/cm^3): 1.59
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 152.17
Tare weight, jar (g): 113.30

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	16:00	157.19	16215	20.57
	14-Jul-10	14:37	156.65	24883	18.35

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16215	---	---	---	---
	24883	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 20.8

***Effective Porosity* (% cm^3/cm^3): 19.4**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 33.81
Measured particle density (g/cm^3): 2.74

Initial sample bulk density (g/cm^3): 1.81
Fraction of bulk sample used (<2.00mm fraction) (%): 46.80

Dry weight of dew point potentiometer sample* (g): 143.65
Tare weight, jar (g): 114.29

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	20-Jul-10	16:05	146.07	14685	6.96
	20-Jul-10	15:15	145.55	34979	5.46

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14685	---	---	---	---
	34979	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 6.9

***Effective Porosity* (% cm^3/cm^3): 26.9**

***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 40.75
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.57
Fraction of bulk sample used (<2.00mm fraction) (%): 92.78

Dry weight of dew point potentiometer sample* (g): 157.31
Tare weight, jar (g): 113.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:12	160.28	13257	9.79
	14-Jul-10	14:50	160.21	16215	9.54

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	13257	---	---	---	---
	16215	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 9.6

***Effective Porosity* (% cm^3/cm^3): 31.1**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 39.17
Measured particle density (g/cm^3): 2.63

Initial sample bulk density (g/cm^3): 1.60
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 170.23
Tare weight, jar (g): 117.83

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	20-Jul-10	16:20	171.29	15093	3.24
	20-Jul-10	15:33	171.05	28350	2.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	28350	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 3.2

***Effective Porosity* (% cm^3/cm^3): 35.9**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 34.48
Measured particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.74
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 154.97
Tare weight, jar (g): 112.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:40	157.21	15399	9.08

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15399	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 9.1

***Effective Porosity* (% cm^3/cm^3): 25.4**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 29.97
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.85
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 162.57
Tare weight, jar (g): 113.23

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	16:05	164.52	14481	7.31
	14-Jul-10	14:50	164.44	19682	7.01

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14481	---	---	---	---
	19682	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 7.3

***Effective Porosity* (% cm^3/cm^3): 22.7**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 35.47
Measured particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.71
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 167.58
Tare weight, jar (g): 117.89

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	15:40	170.11	16113	8.71
	14-Jul-10	15:00	169.95	21824	8.17

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16113	---	---	---	---
	21824	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 8.8

***Effective Porosity* (% cm^3/cm^3): 26.7**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 33.23
Measured particle density (g/cm^3): 2.66

Initial sample bulk density (g/cm^3): 1.78
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 158.62
Tare weight, jar (g): 112.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	13:47	160.23	14175	6.16
	14-Jul-10	14:30	160.15	18254	5.86

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14175	---	---	---	---
	18254	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 6.1

***Effective Porosity* (% cm^3/cm^3): 27.2**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Daniel B. Stephens & Associates, Inc.

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Falling Head: (Rigid Wall)	Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.

Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

September 14, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

September 14, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project sample. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GW-02, 10-11	X	X		X								X						X	X			

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received: Gravimetric (%, g/g)	Moisture Content: As Received: Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded: Gravimetric (%, g/g)	Moisture Content: Remolded: Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed
--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Summary of Moisture Retention (Effective Porosity)

Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded				
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	26-Aug-10	---
Field weight of sample* (g):	816.70	
Tare weight, ring (g):	228.70	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	504.09	
Sample volume (cm^3):	294.16	
Measured particle density (g/cm^3):	2.69	
Gravimetric Moisture Content (% g/g):	16.6	
Volumetric Moisture Content (% vol):	28.5	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	36.3	
Percent Saturation:	78.6	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	11.03
Sample number:	GW-02, 10-11	*Sample length* (cm)*:*	7.24
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	7.19
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	40.61

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
1-Sep-10	9:48:01	22.2	6.5	15.89	4.9	350	3.8E-04	3.6E-04
1-Sep-10	9:53:51							
Test # 2:								
1-Sep-10	10:18:40	22.2	6.3	15.87	4.8	355	3.9E-04	3.7E-04
1-Sep-10	10:24:35							
Test # 3:								
1-Sep-10	10:58:07	22.3	6.1	14.72	3.7	279	3.9E-04	3.7E-04
1-Sep-10	11:02:46							

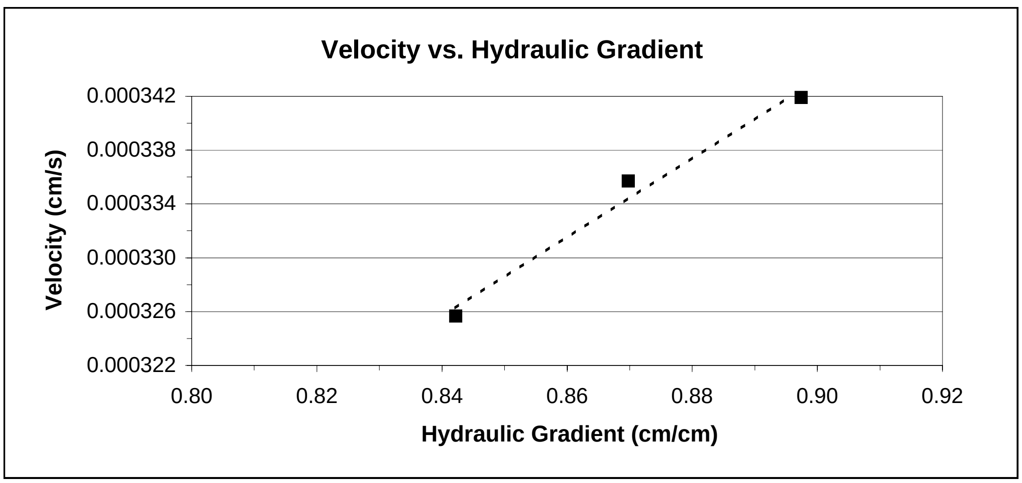
Average Ksat* (cm/sec)*: **3.7E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Data for Specific Gravity for Sample: GW-02, 10-11

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GW-02, 10-11
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	1-Sep-10	
Percent of Test Sample (% g/g):	80.64	
Percent of Bulk Sample (% g/g):	80.64	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.52
Weight of pycnometer filled w/soil (g):	145.91	141.44
Weight of pycnometer filled w/soil & water (g):	375.63	371.82
Weight of pycnometer filled w/water (g):	342.55	339.82
Observed temperature (°C):	22.00	22.00
Density of water at observed temperature (g/cm^3):	0.9978	0.9978
Specific Gravity (g/g):	2.70	2.69
Correction factor, K:	0.9996	0.9996
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity at 20°C (g/g):	2.69	
Average Particle Density at 20°C (g/cm^3):	2.69	

ASTM C127 (>4.75mm Fraction)

Test Date:	3-Sep-10
Percent of Test Sample (% g/g):	19.36
Percent of Bulk Sample (% g/g):	19.36
Tare Weight (g):	0.0
Saturated Surface Dry (SSD) mass in Air & Tare (g):	63.23
Saturated Apparent mass in Water & Tare (g):	37.09
Oven Dry (OD) mass in Air & Tare (g):	58.59
Observed Temperature (°C):	22.0
Density of water at observed temperature (g/m^3):	0.9978
SSD Specific Gravity (g/g):	2.42
Apparent Specific Gravity (g/g):	2.73
OD Specific Gravity (g/g):	2.24
Percent Absorption (%):	7.3
Correction Factor, K:	0.9996
Average Specific Gravity (Apparent) at 20°C:*	2.72
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	2.72

Specific Gravity (Apparent) at 20°C*:	**2.70**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.70

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Effective Porosity

Summary of Moisture Retention (Effective Porosity)

Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 36.29
Assumed particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.71
Fraction of bulk sample used (<2.00mm fraction) (%): 47.20

Dry weight of dew point potentiometer sample* (g): 165.04
Tare weight, jar (g): 114.81

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	3-Sep-10	15:00	169.21	14787	6.72
	3-Sep-10	14:25	169.08	19172	6.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14787	---	---	---	---
	19172	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 6.7

***Effective Porosity* (% cm^3/cm^3): 29.6**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Specific Gravity Coarse	ASTM C127
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.

APPENDIX E

Jacobs (2010) – Porewater and Groundwater Sampling

Document No. EPA-RPT-021C

Kingston Ash Recovery Project
Non-Time-Critical Removal Action

River System Sampling and Analysis Plan
Task Completion Technical Memorandum
Groundwater Sampling

Prepared by:
Jacobs

for the Tennessee Valley Authority

Revision	Description	Date
00	Issued for TVA Review	May 10, 2011
01	Issued for TVA to forward to EPA / TDEC	May 24, 2011

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List of Acronyms

ASTM	American Society for Testing and Materials
COC	chain-of-custody
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	Engineering Evaluation/Cost Estimate
EPA	U.S. Environmental Protection Agency
FCN	Field Change Notice
ft	foot
GEL	GEL Laboratories
GPS	global positioning system
KIF	Kingston Fossil Plant
MDL	method detection limit
mg/L	milligram per liter
NAD	North American Datum
ND	not detected
pCi/L	picocurie per liter
PVC	polyvinyl chloride
QC	quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TDS	total dissolved solid
TM	Technical Memorandum
TSS	total suspended solid
TVA	Tennessee Valley Authority
TWP	temporary well point

1. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the completion of the groundwater task as described in the approved *Kingston Ash Recovery Project Non-Time Critical Removal Action for the River System Sampling and Analysis Plan* (SAP), Rev. 3, May 24, 2010, Document No. EPA-AO-021. This TM is one of a series being prepared to summarize the field work and data collection activities as SAP tasks are completed. The TM series is intended to provide interim presentations of data that will become the basis for the nature and extent of contamination section of the River System Engineering Evaluation/Cost Estimate (EE/CA) Report. No data evaluation or conclusions are presented.

2. BACKGROUND

The data quality objective (DQO) problem statement for groundwater is:

> Naturally-occurring metals (e.g., arsenic, chromium, mercury, selenium) and radionuclides (e.g., radium-226, thorium-228) within the ash may be mobilized as a result of infiltration of precipitation, and may be transported downgradient in the groundwater to the Emory River, where exposure to humans or ecological receptors (fish, benthos) may occur.

Section 2.2.6 of the SAP presents the design of the groundwater sampling study.

Stratigraphy, water level measurements, flow rates, geochemical attenuation properties, concentrations of ash-related constituents in groundwater, and concentrations within the mixing zones of groundwater and the river were the targeted data collected to determine if the flux of ash-related constituents from groundwater to the Emory River could potentially result in unacceptable risk to human or ecological receptors. These data support the development of a computer model to facilitate groundwater transport analysis. The model's purpose is described in the second paragraph of Background and Purpose, Appendix C of the SAP. A separate report on the groundwater model results will be available around the end of June 2011.

3. SAMPLING AND ANALYSIS ACTIVITIES

This phase of the overall work effort included: 1) drilling, 2) borehole logging, 3) geochemical and geotechnical sampling, 4) well installation and development, and 5) groundwater sampling and analysis, and 6) aquifer testing. Table 1 summarizes applicable sampling procedures and field testing methods.

Table 1. Applicable Standard Operating Procedures, Industry Standards, and Other Work Control Documents

Document Number	Document Title	Author
ASTM D 1586 – 08a	Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils	ASTM
ASTM D 1587 – 08	Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes	ASTM
ASTM D 2488 – 09a	Standard Practice for Description and Identification of Soils (Visual –Manual) Procedure	ASTM
ASTM D 4050 – 96	(Reapproved 2008) Standard Test Method for (Field Procedure) for Withdrawal and Injection Well Tests for Determining Hydraulic Properties of Aquifer Systems	ASTM

Table 1. Applicable Standard Operating Procedures, Industry Standards, and Other Work Control Documents (continued)

Document Number	Document Title	Author
ASTM D 4220 – 95	(Reapproved 2007) Standard Practices for Preserving and Transporting Soil Samples	ASTM
ASTM D 4448 – 01	(Reapproved 2007) Standard Guide for Sampling Ground-Water Monitoring Wells	ASTM
ASTM D 4793 – 09	Standard Test Method for Sequential Batch Extraction of Waste with Water	ASTM
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method	ASTM
ASTM D6836	Standard Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, or Centrifuge	ASTM
ASTM D4404 - 10	Standard Test Method for Determination of Pore Volume and Pore Volume Distribution of Soil and Rock by Mercury Intrusion Porosimetry	ASTM
ASTM D2216 - 10	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	ASTM
ASTM D5126 / D5126M - 90(2010)e1	Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone	ASTM
EPA/600/R-98/058	Application of the Electromagnetic Borehole Flowmeter	EPA
WP-1016	Well Installation, Sampling, and Logging	TVA
WP-1056	Non-Time-Critical Geoprobe® Sampling	TVA
TVA-KIF-SOP-02, Revision 1	Standard Operating Procedure For: Groundwater Sampling	TVA
TVA-KIF-SOP-04	Standard Operating Procedure For: Soil Sampling For Inorganic Analyses	TVA
TVA-KIF-SOP-06	Standard Operating Procedure For: Field Documentation	TVA
TVA-KIF-SOP-07, Revision 2	Standard Operating Procedure For: Sample Labeling, Packing, and Shipping	TVA
TVA-KIF-SOP-08, Revision 1	Standard Operating Procedure For: Decontamination of Equipment	TVA
TVA-KIF-SOP-12	Standard Operating Procedure For: Management of Investigation-Derived Waste	TVA
TVA-KIF-SOP-14, Revision 2	Standard Operating Procedure For: Hydrolab Standardization	TVA
TVA-KIF-SOP-18	Standard Operating Procedure For: Management And Implementation of EQuIS™-Based Chain of Custody	TVA
TVA-KIF-SOP-26	Standard Operating Procedure For: Photography Management	TVA
TVA-KIF-SOP-39	Standard Operating Procedure For: Monitoring Well and Piezometer Installation and Completion	TVA
TVA-KIF-SOP-42	Standard Operating Procedure For: Slug Testing	TVA
TVA-KIF-SOP-46	Standard Operating Procedure For: Groundwater Monitoring Well Abandonment	TVA
TVA-KIF-SOP-47	Standard Operating Procedure For: Groundwater and Leachate Sampling Using Direct-Push System	TVA

Note: For definitions, see the Acronyms section.

3.1 Monitoring Well Installation and Sampling

To support the groundwater modeling, three new permanent monitoring wells were installed to collect data on upgradient stratigraphy, hydraulic conductivity, water level elevations, and dissolved aqueous-phase concentrations in residuum and bedrock groundwater. Six new Temporary Well Points (TWPs) were installed within the Dredge Cell, Ash Pond, Stilling Pond, and Ash Processing Area to collect additional data on hydraulic conductivity, ash and soil contaminant attenuation capacity, and dissolved aqueous phase concentrations in alluvium and bedrock. Two new temporary boreholes were installed in the Lateral Expansion Area and the Ash Processing Area. Seven TWPs were planned; six of which were installed. TWP-22 was not installed due to insufficient overburden thickness and water yield. See Figure 1 for groundwater sampling and aquifer testing locations. Previously installed monitoring wells, newly installed permanent monitoring wells, TWP sampling locations, and borings/Geoprobe® sampling locations are also presented on Figure 1.

From April 22 through September 31, 2010, a combination of hollow stem auger and rotosonic drilling methods were used to install the boreholes, TWPs, and permanent wells. Soil samples were collected continuously (split spoon, Shelby tubes, Rotosonic core) every 2 feet and documented on a boring log, in accordance with TVA-KIF-SOP-39 *Monitoring Well and Piezometer Installation and Completion*. Bedrock cores were taken at TWP-24, TWP-25, and TWP-26. Rock cores and cuttings were examined to determine rock type and recorded on a field boring log (boring logs are presented as Appendix A). Permanent monitoring wells and temporary well points were installed and developed in accordance with TVA-KIF-SOP-39. Well diagrams are presented in Appendix B.

Shelby tube samples from drilling activities were analyzed by Daniel B. Stephens & Associates for vertical hydraulic conductivity, porosity, and geotechnical analyses. Mineralogocial characterization and geochemical analyses were conducted by Pittsburgh Mineral &Environmental Technology, Inc. Results are presented in Appendix C.

Difficulties were encountered during the drilling and installation activities at location TWP-04. A summary of actions performed is presented below:

- Initial location TWP-04B required re-drilling and a localized offset due to auger and drill rig mechanical issues.

- Off-set location TWP-04A was drilled and a well was installed. After the well was set at TWP-04A, grout breached the polyvinyl chloride (PVC) casing and filled the well to approximately 7 feet below ground surface. The cause of this breach has not been determined. TWP-04A was abandoned in accordance with TVA-KIF-SOP-46 *Groundwater Monitoring Well Abandonment*.

- The third and final offset location resulted in successful installation of TWP-04.

Permanent groundwater monitoring wells and TWPs were developed using surge-block techniques and purged using low-flow development techniques. Temperature, pH, turbidity, and specific conductance were measured and used to assist in determining well development in accordance with TVA-KIF-SOP-39 *Monitoring Well and Piezometer Installation and Completion*. Open boreholes TWP-25 and TWP-26 were constructed with a well casing installed from the ground surface to the top of the bedrock zone. Development of the open boreholes was performed by setting the submersible pump to approximately 1 foot above the bottom of the well casing, not within the open bedrock zone, to avoid possible borehole collapse. The open boreholes were not surged. Development water was containerized and disposed of in the Ash Pond in accordance with TVA-KIF-SOP-12 *Management of Investigation-Derived Waste*.

3.2 Direct Push Sampling

Direct push technology (Geoprobe®) was utilized to collect porewater in contact with ash (previously referred to in the SAP as groundwater and aqueous-phase constituent concentrations of groundwater in contact with the ash) from the borehole in support of Data Quality Objectives for Environmental Media, Appendix A of the SAP.

Samples of porewater in contact with ash were collected within the Dredge Cell, Lateral Expansion Area, and Ash Processing Area at a total of 11 locations (see Figure 1). Four locations were sampled within the Ash Processing Area (GP-07, GP-08, GP-09, and GP-10). Five locations were sampled on the Dredge Cell (GP-11, GP-12, GP-13, GP-14, and GP-15). Two locations sampled within the Lateral Expansion Area (GP-16 and GP-18). Since the Geoprobe® locations involved ash only, no formal logs were prepared. Table 2 summarizes the Geoprobe® elevations and sampling intervals.

Table 2. Geoprobe® Sampling

Sample Point ID	Coordinates (U.S. State Plane NAD 1927)			Sample Collection Date	Sampling Interval (below ground surface)
	Northing (feet)	Easting (feet)	Elevation (approximate)		
GP-07	553718.10	2439135.66	774.22 ft	9/30/2010	13.55 to 17.55 ft
GP-08	554285.84	2438941.65	769.10 ft	10/6/2010	12.55 to 17.85 ft
GP-09	554075.91	2439517.60	777.89 ft	10/5/2010	13.55 to 17.55 ft
GP-10	554915.52	2439572.79	776.31 ft	10/4/2010	14.45 to 18.45 ft
GP-11	555887.17	2439242.71	806.69 ft	10/14/2010	48.00 to 52.00 ft
GP-12	555240.43	2439956.60	807.50 ft	10/20/2010	49.85 to 53.85 ft
GP-13	556183.67	2440981.43	784.23 ft	10/12/2010	32.00 to 40.00 ft
GP-14	557530.21	2440495.73	755.16 ft	9/27/2010	12.25 to 16.25 ft
GP-15	557053.07	2441030.44	735.00 ft	9/28/2010	13.28 to 17.28 ft
GP-16	556624.33	2441998.71	766.85 ft	9/29/2010	10.84 to 14.28 ft
GP-18	555244.84	2442156.58	760.72 ft	10/21/2010	9.40 to 13.40 ft

Notes:

Geoprobe® sample location coordinates were collected with a Trimble® GeoXH GPS unit (sub-foot real-time accuracy)

For definitions, see the Acronyms section.

Field sampling activities began on September 23, 2010 and concluded on October 21, 2010. Sample collection was performed using a Geoprobe® 54DT in accordance with Work Package 1056: Non-Time Critical Geoprobe Sampling. Sampling activities and field descriptions were logged in accordance with TVA-KIF-SOP-06 *Field Documentation.* Depending on subsurface material characteristics, an open or closed Macro-Core® sampler with an acetate liner was advanced in 3 or 4 foot increments. Ash consistency and moisture content were logged in the field logbook. Advancement of the Macro-Core® sampler was performed until a saturated zone suitable for sampling was achieved. In order to prevent cross contamination of porewater in contact with ash and native soils, historic data from well installations were utilized to ensure that cores were not advanced into native soils. Once the saturated zone within the ash was encountered, the Geoprobe was offset 2 feet and the stainless steel Screen Point 15 sampler was deployed into the saturated zone for sample collection in accordance with TVA-KIF-SOP-47 *Groundwater Leachate Sampling Using Direct Push Technologies*. Screen depth and water level were recorded at each location in the field logbook. See Table 2 for sampling details.

Porewater samples were collected using a Geotech Geopump peristaltic pump model 900-1280 with new tubing (Teflon/silicon) at each site. Porewater was collected based on hierarchy of the bottle set according to the availability of collectable water for the following constituents at each location: dissolved metals (field-filtered with 0.45 micron filter), total suspended solids (TSS), total dissolved solids (TDS), anions, ammonia, and radionuclides. The hierarchy of the bottle set was based upon groundwater modeling data needs. GP-13 did not produce enough porewater to collect a full bottle set; only dissolved metals were collected.

Equipment was decontaminated prior to sampling commencement at each location in accordance with TVA-KIF-SOP-08 *Decontamination of Equipment*.

Following sample collection, a standardized HACH® Hydrolab® DS5x, in accordance with TVA-KIF-SOP-14 *Hydrolab Standardization*, was used to measure water quality parameters for temperature, pH, dissolved oxygen, oxidation reduction potential, and specific conductance per SAP. Water quality parameters were not collected at locations GP-10, GP-13, and GP-16 due to an insufficient volume of porewater.

Each borehole was abandoned and filled to ground surface with bentonite chips (Tennessee Department of Environment and Conservation Rule 1200-4-9.16) following sampling.

Samples were shipped to TestAmerica (TestAmerica-Nashville) of Nashville, Tennessee, for metals, TSS, TDS, anions, and ammonia analysis. All radionuclide samples were shipped to GEL Laboratories (GEL) of Charleston, South Carolina. Quality assurance samples were collected per the *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* hereinafter referred to as the TVA-KIF-QAPP (matrix spike, matrix spike duplicate, and equipment blanks).

3.3 Groundwater Sampling and Aquifer Testing

Groundwater sampling and aquifer testing were performed to estimate hydraulic conductivity and concentrations of ash-related constituents in the groundwater. Groundwater sampling or aquifer testing purposes varied at each monitoring location. Table 3.1 of the SAP summarizes the monitoring locations and the specific sampling or testing performed at each location. Appendix D of the SAP further defines the specific sampling or testing performed at each location.

Aquifer testing included water level measurements, hydraulic head pressure measurements, borehole flowmeter measurements, and aquifer (slug) tests. Water level measurements were measured in the newly installed and existing monitoring wells and piezometers; using a water level meter per TVA-KIF-SOP-02 *Groundwater Sampling.* Additional aquifer testing for characteristics such as porosity, hydraulic conductivity, and geochemical parameters was conducted only at selected monitoring locations (see Attachment C of the SAP), utilizing American Society for Testing Materials methods.

Water level measurements, groundwater parameters, and groundwater samples were collected between September 23 and October 12, 2010. On January 20, 2011, wells AD1, AD2, and AD3 were re-sampled for dissolved radiological constituents, as these samples were not filtered during the initial sampling event. See Appendix D of SAP for the required analysis and details.

TVA Engineering Services tested the nine new wells and temporary well points, five existing wells, and three previously installed piezometers to determine groundwater flow characteristics using pumping, slug, and electromagnetic borehole flowmeter techniques in single well and multiple well tests. Data are to be included in the groundwater model report. Locations of previously existing wells along with newly installed wells, TWPs, and boreholes, are shown on Figure 1.

Groundwater analytical results are summarized below in Section 7, Data Summary, of this TM.

4. SUMMARY OF CHANGES

Field Change Notices (FCNs) were prepared to document deviations from the SAP. FCNs are summarized in the following paragraphs.

FCN-001: This change added soil samples for metals analysis (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) that were collected from the center of the screened interval in wells GW-01, GW-02, TWP-04, TWP-05, and TWP-06. The purpose of this change was to characterize metals that might be present in soil within the screened zone of the aquifer and affect groundwater quality in a well. Samples were collected using stainless steel split spoons. Quality control (QC) samples were collected, including one equipment rinsate and one duplicate sample.

FCN-002: This change added three samples of ash and one of lime, to obtain permeability characteristics of compacted ash and lime-treated ash. Results of the permeability characteristics samples were used in determining hydraulic conductivity within the groundwater model, in lieu of column leaching tests.

FCN-003: This change specified the use of rotosonic drilling and open borehole installation techniques. Per the SAP, TWPs were proposed to be installed using hollow-stem auger techniques. Use of rotosonic drilling techniques reduced vibrations that were undesirable within the Dredge Cell dikes.

FCN-004: This change added 35 locations to the water level measurement data set. The SAP specified four locations for water level measurements. The addition of 35 locations provides for better definition of the boundary conditions for site groundwater model.

FCN-005: This change altered equipment rinsate frequency from one rinsate per duration of project to one rinsate sample for each type of equipment used. Due to changes in types of drilling equipment used (see FCN-003), additional sampling was needed.

FCN-006: This changed the material of construction for GW-01 and GW-03 from 6.25 inch steel outer casing to Schedule 40 PVC (6.25 inch diameter) in order to minimize potential metals contamination during groundwater sampling.

FCN-007: This change addresses several aspects of the Geoprobe® sampling tasks as summarized below.

- The SAP-proposed groundwater sample from alluvium at GP-9, GP-12, and GP-15 were eliminated, as Geoprobe® equipment will not adequately seal off the alluvium from the overlying ash porewater. A sufficient number of monitoring wells provide adequate locations for groundwater samples from the alluvium. Several SAP-proposed Geoprobe® locations could not be safely accessed as they were in the Stilling Pond or Ash Pond. A Geoprobe® rig could not be safely mobilized to these locations (e.g., barge). Permanent monitoring wells and TWPs generated sufficient data to represent porewater in ash below the ponds and meet DQOs. Samples at proposed locations GP-17, GP-19, GP-20, and GP-21 were eliminated.

- Ash samples for column test leaching to be collected during the Geoprobe® investigation were not necessary, as the column testing with lime-treated and untreated ash samples collected from the Dredge Cell generated sufficient data to meet DQOs.

- Geoprobe® sample locations were not surveyed by a licensed land surveyor as stated in the SAP. The locations are not permanent and will not be used for subsequent data collection. Handheld GPS units were used to record the elevation and coordinates at each location.

- Table 3-1 of the SAP cites 15 locations, Appendix D of the SAP cites 18 locations, and Section 2.0 of the SAP cites 16 locations. The total number of locations sampled by Geoprobe® is 11. These locations were: GP-7, GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, GP-14, GP-15, GP-16, and GP-18.

- Section 5.0 of the SAP proposed that boring logs would be completed for Geoprobe® locations. Boring logs were not prepared for these locations as the borings were through ash only and did not encounter alluvium. Boring descriptions of the ash were documented in the field logbook.

FCN-011: This change added strontium to the SAP analyte list in support of ecological evaluations. Strontium is an indicator of potential exposure of organisms to ash.

KRP-CN-001: This change addresses several aspects of the monitoring well installation that were not documented in-progress by FCNs, but have been compiled in a change notice from field logbook records.

- Due to the drilling company's inability to acquire plastic liners, decontaminated stainless steel split spoons were used for sampling in lieu of plastic liners. Equipment rinsate samples were collected and analyzed to determine the effectiveness of the decontamination process.

- A rotary drill rig and water and polymer-based drilling fluid were used at GW-01 and GW-03 instead of an air rotary drill rig. The access road to these well locations would not safely allow access of the larger air rotary rig. The polymer-based fluid had less potential to impact subsequent flow measurements.

- A 20-foot section of Schedule 40 PVC screen was installed instead of 10 feet of Schedule 40 PVC screen at GW-01 and GW-03 in order to maximize the amount of data collected with the borehole flow meter.

5. ANALYTICAL DATA REVIEW

TVA's contracted laboratories were required to submit three types of data deliverables: a limited (Level 1) data package containing sample results and batch QC sample results; a fully documented (Level 4) data package including raw data for all analyses; and electronic data deliverables (EDDs) for storage in TVA's EarthSoft EQuIS® database.

EDDs were subjected to completeness and correctness testing during loading to TVA's EQuIS database; once loaded to the EQuIS database, the data were subjected to verification. As defined in the TVA-KIF-QAPP, data verification involved comparison of the data loaded in the EQuIS database to the results reported in the Level 1 data package. In addition, data verification included review of the batch QC summary forms for compliance with the applicable methods and for data usability with respect to the project DQOs and the TVA-KIF-QAPP.

Following receipt of the Level 4 data package, data were subjected to validation. As defined in the TVA-KIF-QAPP, data validation included review of raw data and associated QC summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. As stated in the TVA-KIF-QAPP: "Initially, 100% of the chemical analysis data will be reported in full documentation data packages for independent data validation. Depending on the nature and frequency of issues identified during data validation, the percentage of data undergoing full data validation may be reduced to a lesser percentage (such as 20%) or data verification may be substituted. The reduction in full data validation may be matrix specific, laboratory specific, or analyte specific. If after the percentage of full data validation has decreased, a trend in frequency of reporting issues, method non-compliances, or data usability issues is identified, data validation will be conducted for specific data points or the percentage of full data validation percentage may be increased until the issues have been minimized to their initial frequency." Data validation expands upon the completeness, correctness, and usability assessment performed during verification to include evaluation of instrumental QC analyses, review of sample preparation information, and recalculation of reported results from raw data.

TestAmerica-Nashville has analyzed aqueous samples for TVA since March 2009; aqueous data from TestAmerica-Nashville is considered to be a mature data stream. A mature data stream will primarily undergo verification. GEL is new to the project having been contracted during 2010; therefore, 100% of data generated from GEL were validated. Table 3 summarizes the data from the three laboratories.

Table 3. Data Review Summary

Laboratory	Matrix	No. COCs	No. Normal and Field Duplicates by Lab	No. of Equipment Blanks by Lab	No. Analytical Results	Percentage Final-Verified	Percentage Validated
TestAmerica-Nashville	Groundwater	12	19	2	757	50%	50%
	Porewater	12	12	1	409		
GEL	Groundwater	12	17	3	360	0%	100%
	Porewater	11	11	1	216		
	Total Count	**47**	**34***	**4***	**1,742**	-	-

Notes:

*"Total Count" for normal, field duplicate and equipment blank samples is the number of discrete samples sent to each lab. Each sample requiring metals speciation (Frontier) and/or radiological (GEL) analyses in addition to metals analysis (TAN) was split, with each split counted in this table as one sample per receiving lab ("Number of Samples by Lab").

For definitions, see the Acronyms section.

6. DATA QUALITY SUMMARY

Data verification and/or validation was performed based on the sample results, summary QC data, and raw data provided by the laboratory. Data verification and validation includes a review of the following QC measures (where applicable):

- Sample condition upon laboratory receipt;
- Initial calibration linearity (data validation only);
- Field and equipment blank analysis results than the method detection limit (MDL);
- Blank analysis results greater than the MDL (data validation only);
- Sample preparation and holding times;
- Initial calibration verification/continuing calibration verification standard recoveries (data validation only);
- Inductively coupled plasma interference check standard results (data validation only);
- MDLs and linear ranges (data validation only);
- Internal standard recoveries (data validation only);
- Matrix spike/matrix spike duplicate;
- Laboratory and field duplicate precision;

- Quantitation of positive results (data validation only);
- Laboratory control sample/laboratory control sample duplicate recoveries and precision;
- Total vs. dissolved sample precision;
- Analytical sequence (data validation only);
- Reporting limit standard recoveries (data validation only); and
- MDL verification standards (data validation only).

The data met the DQOs defined for this task and are acceptable for use. Table 4 summarizes the data quality based on the review performed and as compared to the data quality measures identified in the TVA-KIF-QAPP. The text of the data validation reports for the samples included in this TM will be included in the EE/CA Report.

Table 4. Summary of Surface Water Data Quality

Laboratory	Matrix	Analytical Results (Total) Count)	Acceptable (No Qualification)		Acceptable (Estimated)		Blank Qualified		Rejected	
TestAmerica -Nashville	Groundwater	757	618	82%	130	17%	7	1%	2	<1%
	Porewater	409	351	86%	56	14%	2	<1%	0	0%
GEL	Groundwater	360	355	99%	2	<1%	3	1%	0	0%
	Porewater	216	214	99%	1	<1%	1	<1%	0	0%

Notes:

[a]Acceptable, No Qualification – Qualification of data was not warranted based on a review of the applicable QC measures.

[b]Acceptable, Estimated – Quantitation or detection limit is approximate due to limitations or bias identified during a review of the applicable QC measures.

[c]Blank Qualified – Result is considered "not-detected" because it was detected in an associated blank at a similar level.

[d]Rejected – Unreliable result or detection limit; analyte may or may not be present in sample.

[e]Rejected results were due to dissolved metals results that were significantly greater than the associated total metals results. Therefore, both results were rejected.

For definitions, see the Acronyms section.

Results for geotechnical and geochemical sampling are included as Appendix C.

7. DATA SUMMARY

Summary statistics are provided in Tables 5 through 7. Table 5 summarizes data from permanent groundwater wells; Table 6 summarizes data from temporary well locations; and, Table 7 summarizes data from boring and Geoprobe® locations.

Table 5. Summary of Data from Permanent Groundwater Wells

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.114	0.234	GW-01	10/05/2010	3 / 13	0.164
Aluminum, Total	mg/L	0.05 / 0.05	0.0611	0.252	22	09/29/2010	7 / 10	0.1649
Ammonia, as N	mg/L	0.1 / 0.205	0.121	1.08	22	12/15/2010	9 / 13	0.5248
Antimony, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Antimony, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Arsenic, Dissolved	mg/L	0.00033 / 0.00033	0.00037	0.00254	GW-01	10/05/2010	7 / 13	0.001054
Arsenic, Total	mg/L	0.00033 / 0.00033	0.0004	0.00334	AD2	12/16/2010	5 / 10	0.0013
Barium, Dissolved	mg/L		0.0255	0.0834	GW-03	10/12/2010	13 / 13	0.04554
Barium, Total	mg/L		0.0262	0.0592	AD-1	12/16/2010	10 / 10	0.04091
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	0.00056	0.00066	6AR	09/28/2010	2 / 13	0.00061
Beryllium, Total	mg/L	0.00033 / 0.00033	0.00034	0.00059	6AR	12/15/2010	3 / 11	0.00045
Boron, Dissolved	mg/L		0.0228	1.44	GW-02	10/12/2010	13 / 13	0.6501
Boron, Total	mg/L		0.128	1.13	22	12/15/2010	10 / 10	0.6773
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	0.00219	0.00237	6AR	09/28/2010	2 / 13	0.00228
Cadmium, Total	mg/L	0.00033 / 0.00033	0.00212	0.0024	6AR	11/29/2010	3 / 11	0.002237
Calcium, Dissolved	mg/L		4.29	178	AD-3	09/23/2010	13 / 13	59.82
Calcium, Total	mg/L		4.47	179	AD-3	12/17/2010	10 / 10	67.61
Chloride	mg/L	1 / 1.85	1.24	10.8	AD-2	12/16/2010	12 / 13	5.73
Chromium, Dissolved	mg/L	0.00033 / 0.0005	0.00042	0.00154	GW-01	10/05/2010	3 / 13	0.0008233
Chromium, Total	mg/L	0.00033 / 0.0005	0.00043	0.00043	22	09/29/2010	1 / 10	0.00043
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00034	0.105	6AR	12/15/2010	9 / 13	0.0249
Cobalt, Total	mg/L	0.00033 / 0.00033	0.00124	0.106	6AR	11/29/2010	10 / 12	0.0331

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00072	0.00072	GW-01	10/05/2010	1 / 13	0.00072
Copper, Total	mg/L	0.00033 / 0.00033	0.00033	0.00037	22	09/29/2010	2 / 10	0.00035
Fluoride	mg/L	0.1 / 0.1	0.124	0.496	GW-01	10/05/2010	11 / 13	0.2771
Iron, Dissolved	mg/L	0.025 / 0.025	0.0396	1.75	AD-2	12/16/2010	9 / 13	0.4996
Iron, Total	mg/L		0.0575	2.92	AD-2	12/16/2010	10 / 10	0.6658
Lead, Dissolved	mg/L	0.00033 / 0.0005	ND	ND			0 / 13	0
Lead, Total	mg/L	0.00033 / 0.00033	0.00033	0.00127	AD-2	12/16/2010	2 / 10	0.0008
Magnesium, Dissolved	mg/L		0.639	22.6	AD-3	09/23/2010	13 / 13	11.13
Magnesium, Total	mg/L		1.07	23.4	AD-3	12/17/2010	10 / 10	12.09
Manganese, Dissolved	mg/L	0.00033 / 0.00154	0.078	34.2	6AR	12/15/2010	12 / 13	7.205
Manganese, Total	mg/L		0.0985	33.2	6AR	12/15/2010	10 / 10	8.666
Mercury, Dissolved	mg/L	0.00015 / 0.0002	ND	ND			0 / 13	0
Mercury, Total	mg/L	0.00015 / 0.0002	ND	ND			0 / 10	0
Molybdenum, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00261	GW-01	10/05/2010	5 / 12	0.00093
Molybdenum, Total	mg/L	0.00033 / 0.00033	0.00034	0.00235	AD-2	12/16/2010	5 / 9	0.000778
Nickel, Dissolved	mg/L	0.00033 / 0.001	0.00087	0.0438	6AR	12/15/2010	9 / 13	0.01069
Nickel, Total	mg/L	0.00033 / 0.00033	0.00114	0.0443	6AR	11/29/2010	9 / 11	0.01544
Nitrate-Nitrite Nitrogen	mg/L	0.1 / 0.1	ND	ND			0 / 10	0
Potassium, Dissolved	mg/L		0.763	5.6	AD-2	12/16/2010	13 / 13	2.983
Potassium, Total	mg/L		0.744	5.48	AD2-	12/16/2010	10 / 10	3.057
Selenium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Selenium, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Silver, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Sodium, Dissolved	mg/L		3.57	115	GW-01	10/05/2010	13 / 13	30.76

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sodium, Total	mg/L		6.76	92.9	AD-1	12/16/2010	10 / 10	26.27
Strontium, Dissolved	mg/L		0.115	0.948	AD-3	12/17/2010	13 / 13	0.4355
Strontium, Total	mg/L		0.117	0.978	AD-3	12/17/2010	10 / 10	0.4894
Sulfate	mg/L		23.6	267	AD-3	12/17/2010	13 / 13	149.6
Thallium, Dissolved	mg/L	0.0005 / 0.00065	0.00058	0.00058	22	09/29/2010	1 / 13	0.00058
Thallium, Total	mg/L	0.0005 / 0.0005	0.0006	0.0006	AD-3	09/23/2010	1 / 10	0.0006
Total Dissolved Solids	mg/L		155	698	AD-3	09/23/2010	13 / 13	346.8
Total Inorganic Carbon	mg/L		15.1	76.1	AD-3	09/23/2010	10 / 10	42.7
Total Kjeldahl Nitrogen	mg/L	0.1 / 0.1	0.197	1.27	22	09/29/2010	8 / 10	0.6724
Total Suspended Solids	mg/L	1 / 1	1.3	14	22	09/29/2010	7 / 13	5.143
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.00834	0.00834	GW-01	10/05/2010	1 / 13	0.00834
Vanadium, Total	mg/L	0.001 / 0.001	ND	ND			0 / 10	0
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.0333	0.0374	6AR	12/15/2010	2 / 13	0.03535
Zinc, Total	mg/L	0.0083 / 0.0083	0.0327	0.0378	6AR	12/15/2010	2 / 10	0.03525
Actinium-228	pCi/L	12.2 / 17.9	ND	ND			0 / 10	0
Americium-241	pCi/L	11.6 / 31.9	ND	ND			0 / 10	0
Bismuth-214	pCi/L	5.95 / 31.2	28.6	86.1	AD-2	01/20/2011	9 / 10	46.86
Cesium-137	pCi/L	2.9 / 4.17	ND	ND			0 / 10	0
Cobalt-60	pCi/L	3.42 / 4.36	ND	ND			0 / 10	0
Lead-212	pCi/L	6.57 / 11.5	ND	ND			0 / 10	0
Lead-214	pCi/L	6.56 / 45.6	14.7	91.8	AD-2	01/20/2011	10 / 10	49.86
Potassium-40	pCi/L	22.9 / 60	ND	ND			0 / 10	0
Radium-226	pCi/L	0.468 / 0.738	0.629	1.58	GW-02	10/12/2010	6 / 10	0.9413
Radium-228	pCi/L	0.471 / 1.41	0.75	0.843	22	09/29/2010	3 / 10	0.782
Thallium-208	pCi/L	3.52 / 5.78	ND	ND			0 / 10	0

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Thorium-228	pCi/L	0.0324 / 0.154	ND	ND			0 / 10	0
Thorium-230	pCi/L	0.0236 / 0.102	0.107	0.107	AD-2	09/22/2010	1 / 10	0.107
Thorium-232	pCi/L	0.0408 / 0.0881	ND	ND			0 / 10	0
Thorium-234	pCi/L	126 / 274	ND	ND			0 / 10	0
Uranium-234	pCi/L	0.0565 / 0.171	0.0923	0.92	AD-3	09/23/2010	4 / 10	0.4871
Uranium-235	pCi/L	0.0531 / 0.145	ND	ND			0 / 10	0
Uranium-238	pCi/L	0.0355 / 0.12	0.0709	0.439	GW-01	10/05/2010	5 / 10	0.2494

Note: For definitions, see the Acronyms section.

Table 6. Summary of Data from Temporary Well Locations

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.921	1.18	TWP-26	10/04/2010	2 / 6	1.051
Ammonia, as N	mg/L		0.418	2.44	TWP-04	10/06/2010	6 / 6	0.9565
Antimony, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.00063	TWP-04	10/06/2010	3 / 6	0.0004567
Arsenic, Dissolved	mg/L	0.00033 / 0.00033	0.00076	0.594	TWP-04	10/06/2010	5 / 6	0.1468
Barium, Dissolved	mg/L		0.0947	0.544	TWP-25	10/07/2010	6 / 6	0.2511
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Boron, Dissolved	mg/L		0.0347	2.75	TWP-04	10/06/2010	6 / 6	1.18
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Calcium, Dissolved	mg/L		12.5	156	TWP-04	10/06/2010	6 / 6	54.58
Chloride	mg/L		1.5	5.31	TWP-24	10/06/2010	6 / 6	3.48
Chromium, Dissolved	mg/L	0.00033 / 0.0005	0.00033	0.00064	TWP-25	10/07/2010	2 / 6	0.000485
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00077	0.00983	TWP-06	09/30/2010	3 / 6	0.004027
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00034	0.00034	TWP-25	10/07/2010	1 / 6	0.00034
Fluoride	mg/L		0.247	1.78	TWP-26	10/04/2010	6 / 6	0.661
Iron, Dissolved	mg/L	0.025 / 0.025	1.16	52.3	TWP-06	09/30/2010	4 / 6	16.84
Lead, Dissolved	mg/L	0.00033 / 0.0005	ND	ND			0 / 6	0
Magnesium, Dissolved	mg/L	0.25 / 0.25	4.3	47.2	TWP-04	10/06/2010	4 / 6	17.19
Manganese, Dissolved	mg/L	0.00033 / 0.00033	0.00104	11	TWP-06	09/30/2010	5 / 6	2.868
Mercury, Dissolved	mg/L	0.00015 / 0.0002	ND	ND			0 / 6	0
Molybdenum, Dissolved	mg/L	0.00033 / 0.00127	0.00161	0.61	TWP-04	10/06/2010	5 / 6	0.202
Nickel, Dissolved	mg/L	0.00033 / 0.001	0.00123	0.00123	TWP-05	10/07/2010	1 / 6	0.00123
Potassium, Dissolved	mg/L		1.73	10.7	TWP-25	10/07/2010	6 / 6	5.565
Selenium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Sodium, Dissolved	mg/L		11.6	104	TWP-26	10/04/2010	6 / 6	43.75
Strontium, Dissolved	mg/L		0.151	3.4	TWP-04	10/06/2010	6 / 6	1.052

Table 6. Summary of Data from Temporary Well Locations (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sulfate	mg/L		1.91	387	TWP-04	10/06/2010	6 / 6	79.76
Thallium, Dissolved	mg/L	0.0005 / 0.0005	ND	ND			0 / 6	0
Total Dissolved Solids	mg/L		120	722	TWP-04	10/06/2010	6 / 6	301.3
Total Suspended Solids	mg/L		20.6	127	TWP-05	10/07/2010	6 / 6	60.13
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.00263	0.00705	TWP-26	10/04/2010	2 / 6	0.00484
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.013	0.013	TWP-24	10/06/2010	1 / 6	0.013
Actinium-228	pCi/L	12.7 / 15.6	ND	ND			0 / 6	0
Americium-241	pCi/L	11.9 / 28.7	ND	ND			0 / 6	0
Bismuth-214	pCi/L	5.95 / 12.4	17.7	53.8	TWP-06	09/30/2010	5 / 6	36.2
Cesium-137	pCi/L	3.03 / 4.23	ND	ND			0 / 6	0
Cobalt-60	pCi/L	3.25 / 3.99	ND	ND			0 / 6	0
Lead-212	pCi/L	6.5 / 8.96	ND	ND			0 / 6	0
Lead-214	pCi/L	6.02 / 16.7	12.4	53.7	TWP-06	09/30/2010	4 / 6	36.35
Potassium-40	pCi/L	43.7 / 54.3	ND	ND			0 / 6	0
Radium-226	pCi/L	0.216 / 0.645	0.283	1.02	TWP-04	10/06/2010	3 / 6	0.706
Radium-228	pCi/L	0.586 / 1.12	ND	ND			0 / 6	0
Thallium-208	pCi/L	3.46 / 4.57	ND	ND			0 / 6	0
Thorium-228	pCi/L	0.0806 / 0.0938	ND	ND			0 / 6	0
Thorium-230	pCi/L	0.0411 / 0.0553	0.0778	0.0944	TWP-25	10/07/2010	2 / 6	0.0861
Thorium-232	pCi/L	0.0379 / 0.111	ND	ND			0 / 6	0
Thorium-234	pCi/L	128 / 250	ND	ND			0 / 6	0
Uranium-234	pCi/L	0.0576 / 0.148	0.483	1.01	TWP-04	10/06/2010	2 / 6	0.7465
Uranium-235	pCi/L	0.0568 / 0.108	ND	ND			0 / 6	0
Uranium-238	pCi/L	0.0818 / 0.133	0.174	0.849	TWP-04	10/06/2010	3 / 6	0.4933

Note: For definitions, see the Acronyms section.

Table 7. Summary of Data from Geoprobe Locations

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.064	57.1	GP-18	10/21/2010	5 / 11	11.57
Ammonia, as N	mg/L	0.1 / 0.329	0.495	5.36	GP-15	09/28/2010	9 / 10	1.869
Antimony, Dissolved	mg/L	0.00033 / 0.00033	0.00068	0.0225	GP-13	10/12/2010	10 / 11	0.004059
Arsenic, Dissolved	mg/L		0.00393	0.915	GP-12	10/20/2010	11 / 11	0.2987
Barium, Dissolved	mg/L		0.0271	6.8	GP-18	10/21/2010	11 / 11	0.6949
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Boron, Dissolved	mg/L		1.2	12.2	GP-18	10/21/2010	11 / 11	4.272
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Calcium, Dissolved	mg/L		92.5	578	GP-14	09/27/2010	11 / 11	292.5
Chloride	mg/L		2.99	31.4	GP-09	10/05/2010	10 / 10	10.92
Chromium, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00051	GP-13	10/12/2010	8 / 11	0.0004025
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.00423	GP-08	10/06/2010	9 / 11	0.00253
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00041	0.0093	GP-18	10/21/2010	4 / 11	0.002915
Fluoride	mg/L	0.1 / 0.1	0.168	2.96	GP-18	10/21/2010	10 / 10	1.091
Iron, Dissolved	mg/L	0.025 / 0.025	0.0351	126	GP-08	10/06/2010	8 / 11	49.06
Lead, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00033	GP-18	10/21/2010	1 / 11	0.00033
Magnesium, Dissolved	mg/L	0.25 / 0.25	18	68.8	GP-15	09/28/2010	10 / 11	40.93
Manganese, Dissolved	mg/L	0.00033 / 0.00033	0.136	4.47	GP-10	10/04/2010	10 / 11	1.962
Mercury, Dissolved	mg/L	0.00015 / 0.00015	ND	ND			0 / 10	0
Molybdenum, Dissolved	mg/L		0.0074	3.01	GP-15	09/28/2010	11 / 11	0.5139
Nickel, Dissolved	mg/L		0.00046	0.0691	GP-07	09/30/2010	11 / 11	0.02629
Potassium, Dissolved	mg/L		0.338	47.9	GP-08	10/06/2010	11 / 11	18.4
Selenium, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.0196	GP-18	10/21/2010	7 / 11	0.00561
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Sodium, Dissolved	mg/L	0.25 / 1.06	1.77	25.8	GP-09	10/05/2010	10 / 11	11.07
Strontium, Dissolved	mg/L		1.84	15.8	GP-18	10/21/2010	11 / 11	4.382

Table 7. Summary of Data from Geoprobe Locations (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sulfate	mg/L		1.45	1560	GP-14	09/27/2010	10 / 10	758.9
Thallium, Dissolved	mg/L	0.0005 / 0.0005	0.00051	0.00178	GP-13	10/12/2010	6 / 11	0.0008817
Total Dissolved Solids	mg/L		412	2430	GP-14	09/27/2010	10 / 10	1210
Total Suspended Solids	mg/L		2480	249000	GP-11	10/14/2010	10 / 10	30812
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.001	0.15	GP-13	10/12/2010	9 / 11	0.02518
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.0996	0.745	GP-08	10/06/2010	6 / 11	0.3371
Actinium-228	pCi/L	`	ND	ND			0 / 10	0
Americium-241	pCi/L	10.5 / 23.7	ND	ND			0 / 10	0
Bismuth-214	pCi/L	6.01 / 8.8	9.24	24.7	GP-10	10/04/2010	4 / 10	15.66
Cesium-137	pCi/L	2.87 / 3.73	ND	ND			0 / 10	0
Cobalt-60	pCi/L	2.8 / 3.73	ND	ND			0 / 10	0
Lead-212	pCi/L	5.89 / 8.67	ND	ND			0 / 10	0
Lead-214	pCi/L	6.53 / 17.4	19.8	19.8	GP-10	10/04/2010	1 / 10	19.8
Potassium-40	pCi/L	26.2 / 56.3	59.7	91	GP-10	10/04/2010	1 / 10	91
Radium-226	pCi/L	0.346 / 0.707	0.617	2.28	GP-18	10/21/2010	3 / 10	1.253
Radium-228	pCi/L	0.508 / 1.22	0.773	3.74	GP-18	10/21/2010	2 / 10	2.257
Thallium-208	pCi/L	3.16 / 4.49	ND	ND			0 / 10	0
Thorium-228	pCi/L	0.0433 / 0.152	0.298	0.298	GP-18	10/21/2010	1 / 10	0.298
Thorium-230	pCi/L	0.0283 / 0.113	0.185	0.185	GP-18	10/21/2010	1 / 10	0.185
Thorium-232	pCi/L	0.0334 / 0.106	ND	ND			0 / 10	0
Thorium-234	pCi/L	112 / 223	ND	ND			0 / 10	0
Uranium-234	pCi/L		0.225	6	GP-11	10/14/2010	10 / 10	1.617
Uranium-235	pCi/L	0.0702 / 0.13	0.304	0.347	GP-15	09/28/2010	2 / 10	0.3255
Uranium-238	pCi/L		0.341	6.45	GP-11	10/14/2010	10 / 10	1.64

Note: For definitions, see the Acronyms section.

Figures

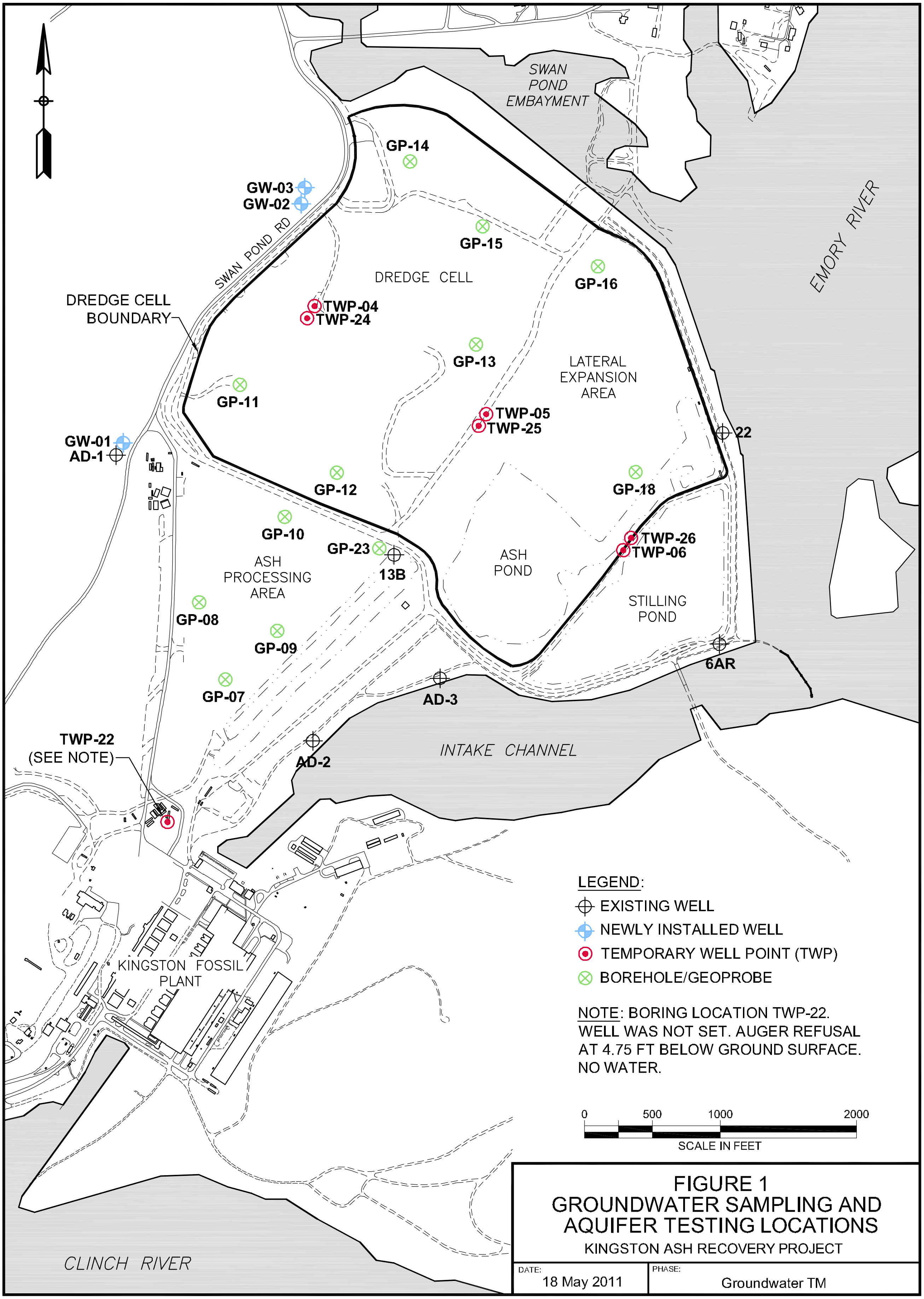

FIGURE 1
GROUNDWATER SAMPLING AND AQUIFER TESTING LOCATIONS
KINGSTON ASH RECOVERY PROJECT

APPENDIX A

Boring Logs

GP-16

Drilling Company: Tri-State Drilling	Start Date: 042910	Logged By:
Driller: S.Snow	End Date: 043010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	5 10 9 13	2.1	0.0			ASH (FA) dark gray (5Y4/1) silt sized particles, 10% gravel, homogenous, well sorted, slightly moist
	5 9 7 7	2.0	0.0			
	4 6 7 8	2.0	0.0	5		
	2 4 4 6	2.0	0.0			
	3 4 4 4	2.0	0.0			ASH (FA) dark gray (5Y4/1) silt and clay sized particles, homogenous, well sorted, slightly moist
	2 3 3 1	2.0	0.0	10		
	woh woh 1 woh	2.0	0.0			
	woh woh woh 3	1.7	0.0	15		
	woh woh 1 1	2.0	0.0			ASH (FA)dark gray (5Y5/1) and black (5Y2.51) silt sized and very fine sand sized particles, wet
	2 1 2 1	1.7	0.0			ASH (FA) dark gray (5Y4/1) clay with silt sized particles, wet
	woh woh woh 1	1.7	0.0	20		
	1 1 1 1	1.9	0.0			
	wot	1.2	0.0	25		SILTY CLAY (CL) dark yellowish brown (10YR3/6)
	wot wot woh woh	1.7	0.0			CLAY (CL)dark yellowish brown (10YR4/6) lean clay
	2 3 3 6	2.0	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/6) very uniform
	3 3 3 3	2.0	0.0	30		
	2 2 3 2	1.5	0.0			
		1.3	0.0	35		shelby tube collected-no visual description
	3 1 1 1	1.1	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/6) very uniform
	woh woh 1 1	1.2	0.0			

Notes:

2-inch split spoons used for SPT
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Augers
Total Depth (ft bgs):	61.1ft bgs
1st Water Encountered (ft bgs):	6.3 ft bgs
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-16

Drilling Company: Tri-State Drilling	Start Date: 042910	Logged By:
Driller: S.Snow	End Date: 043010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	woh woh 1 1	1.4	0.0			SAND(SC) dark yellowish brown (10YR4/6)very fine sand, some silt, clay
	2 1 1 1	1.75	0.0			
	woh 1 1 2	1.2	0.0	45		
	2 2 1 2	1.4	0.0			
	2 2 3 2	1.6	0.0			
	3 4 2 2	1.7	0.0	50		
	woh 1 1 4	1.3	0.0			SAND (SW) olive brown (5YR4/3) very fine SAND (SW) yellowish brown (10YR5/6) very fine SAND (SW) pale yellow (2.5Y7/4) medium grained
	4 4 7 12	1.7	0.0	55		SAND (SW) light gray (2.5Y7/2) medium grained SAND (SW) light gray (2.5Y7/2) medium grained drilled through
		0	0.0			
		0	0.0			shelby tube collected-no visual description
	5 9 8 24	1.1	0.0	60		SAND (SW) yellowish brown (10YR5/6) very fine
						shale dark grayish brown (2.5R4/2) auger refusal at 61.1 ft bgs
				65		
				70		
				75		

Notes:

2-inch split spoons used for SPT
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Augers
Total Depth (ft bgs):	61.1ft bgs
1st Water Encountered (ft bgs):	6.3 ft bgs
Water Level after 24 hr (ft bgs):	NA

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GP-16A

Drilling Company: Tri-State Drilling	Start Date: 050310	Logged By:
Driller: S.Snow	End Date: 050410	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				0–28		Augered to 28' no sample. See boring log GP-16 for description of 0'-28' bgs
	3 5 7 10	2.2	0.0	28–30		SILTY CLAY (CL) yellowish brown (10YR5/6)
	3 3 3 7	2.2	0.0	30–32		
				32–		drilled through to keep boring stable- no SPT, no visual description

Notes:

3-inch stainless steel split spoons used for SPT
augered through 0-28 ft bgs
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	52 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

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GP-16A

Drilling Company: Tri-State Drilling	Start Date: 050310	Logged By:
Driller: S.Snow	End Date: 050410	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	woh woh 1 1	NR	0.0			no recovery
	5 3 3 2	1.2	0.0			SAND (SW) yellowish brown (10YR5/6) fine with minor silt
	4 2 2 1	1.3	0.0	45		
	NA	1.55	0.0			shelby tube collected-no visual description
	21 10 8 5	1.9	0.0			SAND (SW) yellowish brown (10YR5/6) fine with trace silt
	5 4 4 8	1.4	0.0	50		
				55		
				60		
				65		
				70		
				75		

Notes:

3-inch stainless steel split spoons used for SPT
augered through 0-28 ft bgs
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	52 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

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GP-23

Drilling Company: Tri-State Drilling	Start Date: 042610	Logged By:
Driller: S.Snow	End Date: 042810	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)
	50/5	1.0	0.0	
	13 30 28 17	2.0	0.0	
	2 4 15 18	1.2	0.0	5
	6 24 10 9	2.0	0.0	
	4 5 7 9	1.3	0.0	
				10
	2 2 7 17	1.8	0.0	
	10 13 18 25	2.0	0.0	
	NA	poor	0.0	15
	17 37 46 66	2.0	0.0	
	NA	NR		
				20
	33 45 29 38	1.4	0.0	
	8 11 10 9	2.0	0.0	
	3 5 8 8	1.7	0.0	25
	4 6 7 7	2.0	0.0	
	3 3 2 3	1.5	0.0	
				30
	4 3 2 2	0.2	0.0	
	NA	NR		
	NA	1.7	0.0	35
	3 3 3 5	1.8	0.0	
	3 3 2 3	2.0	0.0	

Lithology / Description

- GRAVEL (GC)
- ASH (FA) dark gray (5Y4/1) yellowish red (5YR4/6) SILT intermixed
- CLAY (CH) yellowish red (5YR4/6) fat clay with chert GRAVEL (fill)
- ASH (FA) dark gray (5Y4/1)and GRAVEL
- CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
- ASH (FA) very dark gray (2.5Y3/1) silt
- ASH (FA) very dark gray (2.5Y3/1) silt with shale chips
- CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
- GRAVEL (GC)
- CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
- ASH (FA) very dark gray (2.5Y3/1) silt
- CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
- ASH (FA) dark gray (5Y4/1) silty sand
- ASH (FA) dark gray (5Y4/1) silty sand very moist 1 cm rounded rock fragments fining downward
- ASH (FA)dark gray (5Y4/1) silty sand becoming more uniform
- shelby tube collected-no visual description
- ASH (FA) dark gray (5Y4/1) fine to medium sand very homogenous moist
- shelby tube collected-no visual description
- ASH (FA) dark gray (5Y4/1) fine to medium sand very dense
- BOTTOM ASH (BA) dark gray (5Y4/1) medium to coarse sand with minor gravel 2-3 cm
- ASH (FA) dark gray (5Y4/1) fine sand with lenses of coarse sand and gravel
- BOTTOM ASH (BA) dark gray (5Y4/1) medium to coarse sand with some gravel throughout upto 1 cm
- ASH (FA) dark gray (5Y4/1)basket failed. Poor recovery.
- drilled through- boring too unstable to sample
- shelby tube collected-no visual description
- ASH (FA) SAND very dark gray (10YR3/1) fine sand, no gravel, no fines, uniform
- ASH (FA) fine sand very dark gray (10YR3/1)

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 69.0 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

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GP-23

Drilling Company: Tri-State Drilling	Start Date: 042610	Logged By: R. Josefczyk, R. Lee
Driller: S.Snow	End Date: 042810	

Sample	Blow Counts	Recovery (ft)	PID (ppm)
	1 1 1 1	2.0	0.0
	1 1 1	2.0	0.0
	1 1 1 1	1.7	0.0
	woh	1.7	0.0
	1 1 1	2.0	0.0
	2 2 4 5	2.0	0.1 0.0 0.3
	wot woh woh 4	1.4	0.0
	NA	1.85	0.0
	woh woh 3 3	1.8	0.0
	3 3 4 3	2.0	0.0
	woh woh woh 2	2.0	0.0
	wot wot woh woh	2.0	0.0
	woh woh 3 10	1.8	0.0
	15 7 9 7	2.0	0.0
	NA	poor	0.0
	100/5	0.7	0.0

Depth (ft bgs): 45, 50, 55, 60, 65, 70, 75

Lithology

Description

- ASH (FA) fine sand very dark gray (10YR3/1) with silt
- ASH (FA) fine sand very dark gray (10YR3/1) with<5% gravel
- ASH (FA) fine sand very dark gray (5YR3/1) with<5% gravel
- CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay
- CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay bioturbated, minor organics
- CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay, trace organics, interspersed chert nodules (5%), trace manganese reduced fragments.
- CLAY (CH) fat clay gray (5/5/1)
- shelby tube collected-no visual description
- CLAY (CH) olive gray (5Y4/2) fat clay with oxidized manganese fragments, very linear and platy
- SAND (SW) fine to medium (slough)
- CLAY (CL) strong brown (7.5YR5/8) lean
- CLAY (CH) strong brown (7.5YR5/8) fat clay
- CLAY (CH) dark gray (10YR4/1) fat clay
- CLAY (CH) dark gray (10YR4/1) fat clay <5% silt
- CLAY (CH) dark gray (10YR4/1) fat clay grading to lean clay at 1 ft no gravel
- SILTY SAND (SM) silty fine sand dark gary (10YR4/1) no organics well sorted
- SAND (SM) fine grained silty sand well sorted very consistent grayish brown (2.5Y5/2)
- shelby tube collected-no visual description
- SAND (SW) fine to medium sand greenish brown (2.5Y5/2)
- limestone (2.5Y5/2) gray

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 69.0 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

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GW-01

Drilling Company:	Tri-State Drilling	Start Date:	082410	Logged By:
Driller:	G.Akins, S.Snow	End Date:	090310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				0		See boring log GW-01A for description of 0'-28' bgs
				5		
				10		
				15		
				20		
				25		
				28		shale dark grayish brown (2.5YR4/2) with thin interspersed beds of limestone
				30		
				35		

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig:	CME 55 & Diedrich D-50
Drilling Method:	Hollow Stem Auger and Rotary with Fluids
Total Depth (ft bgs):	55.0 ft bgs
1st Water Encountered (ft bgs):	4 ft bgs
Water Level after 24 hr (ft bgs):	

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GW-01

Drilling Company:	Tri-State Drilling	Start Date:	082410	Logged By:
Driller:	G.Akins, S.Snow	End Date:	090310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
				75		

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig:	CME 55 & Diedrich D-50
Drilling Method:	Hollow Stem Auger and Rotary with Fluids
Total Depth (ft bgs):	55.0 ft bgs
1st Water Encountered (ft bgs):	4 ft bgs
Water Level after 24 hr (ft bgs):	

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GW-01A

Drilling Company: Tri-State Drilling	Start Date: 060210	Logged By:
Driller: S.Snow	End Date: 060210	R.Josefczyk

Blow Counts	Recovery (ft)	PID (ppm)
2 1 3 4	1.4	0.0
2 1 1 2	1.7	0.0
woh woh 2 2	1.7	0.0
3 6 7 11	2.0	0.0
4 9 15 23	2.3	0.0
2 2 3 5	1.7	0.0
2 3 2 4	1.5	0.0
2 1 1 3	0.8	0.0
100/3	0.6	0.0
woh 1 1 2	1.9	0.0
NA	1.98	0.0
17 33 59 100/5	1.9	0.0
78 100/3	1.1	0.0
100/5	0.7	0.0
100/5	0.6	0.0
100/3	0.6	0.0

Depth (ft bgs): 5, 10, 15, 20, 25, 30, 35

Lithology

Description
topsoil
SILTY CLAY (CL)brown (10YR4/3) with minor shale fragments
SILTY CLAY (CL)brown (10YR4/3) with minor shale fragments
shale reddish brown (5YR4/4) wet
shale reddish brown (5YR4/4) wet
SILTY CLAY (CL) strong brown (7.5YR4/6) with shale fragments
SILTY CLAY dark brown (10YR3/3) with shale fragments
SILTY CLAY (CL) dark yellowish brown (10YR4/4) with shale fragments and orangish-red mottling
SILTY CLAY (CL) dark yellowish brown (10YR4/4) with shale and sandstone fragments and orangish-red mottling
SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, wet
SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, minow shale fragments, wet
SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, minow shale and sandstone fragments, wet
SILTY CLAY (CL) brown (10YR5/3) with some shale fragments, wet
SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet
SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet
CLAY and SILT (CL) dark yellowish brown (10YR4/4)
SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet
shelby tube collected-no visual description
shale very dark gray (10YR3/1), weathered, relect bedding present
shale very dark gray (10YR3/1), weathered
shale black (2.5Y2.5/1) bottom 0.2 dry, weathered
shale very dark gray (7.5YR3/1)
shale very dark gray (7.5YR3/1)
shale black (2.5Y2.5/1)
auger refusal at 30.5 ft bgs

Notes:

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Augers
Total Depth (ft bgs): 30.5 ft bgs
1st Water Encountered (ft bgs): 4 ft bgs
Water Level after 24 hr (ft bgs):

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GW-02

Drilling Company:	Tri-State Drilling	Start Date:	080910	Logged By:
Driller:	G.Akins	End Date:	082310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)
	6 6 5 6	1.6	0.0
	5 6 7 5	1.4	0.0
	2 4 4 3	1.2	0.0
	3 5 8 8	1.8	0.0
	2 5 7 9	1.8	0.0
	NA	1.0	0.0
	5 7 7 10	2.2	0.0
	8 9 15 21	1.9	0.0
	5 13 17 7	1.9	0.0
	7 7 6 9	1.4	0.0
	9 50/4"	1.2	0.0

Depth (ft bgs) | Lithology | Description

- gravel (GP) fill
- gravel (GP) fill
- SILTY CLAY (CL) dark yellowish brown (10YR4/4) with less than 10% gravel, damp.
- SILTY CLAY (CL) dark yellowish brown (10YR4/4) with less than 10% gravel, damp.
- SILTY CLAY (CL) dark yellowish brown (10YR4/4) and yellowish brown (10YR5/4) with less than 10% gravel, damp.
- SILTY CLAY (CL) dark yellowish brown (10YR4/4) and light brownish gray (10YR6/2) with less than 10% gravel, damp.
- shelby tube
- SILTY CLAY (CL) yellowish red (5YR4/6) manganese staining, with approximately 25% sandstone gravel.
- CLAY (CL) brown (7.5 YR4/4) minor silt
- shale dark grayish brown (2.5YR4/2) weathered, friable
- slough
- shale dark grayish brown (2.5YR4/2) weathered, friable
- sandstone olive brown (2.5Y4/3) fine-medium grained
- shale dark grayish brown (2.5YR4/2) weathered
- auger refusal at 20 ft bgs

Notes:

NA = not applicable
solid sample = shelby tube
2-inch steel split spoons used for SPT

Drill Rig:	Central Mining Equipment 55
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	20 ft bgs
1st Water Encountered (ft bgs):	17 ft bgs
Water Level after 24 hr (ft bgs):	NA

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GW-03

Drilling Company:	Tri-State Drilling	Start Date:	082310	Logged By:
Driller:	G.Akins, S.Snow	End Date:	090110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				0–13		See boring log GW-02 for description of 0'-13' bgs
				13–18		shale dark grayish brown (2.5YR4/2)
				18–		shale dark grayish brown (2.5YR4/2) with thin interspersed layers of limestone

Depth scale: 5, 10, 15, 20, 25, 30, 35

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig: CME 55 & Diedrich D-50
Drilling Method: Hollow Stem Auger & Rotary with fluids
Total Depth (ft bgs): 45.1ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

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GW-03

Drilling Company:	Tri-State Drilling	Start Date:	082310	Logged By:
Driller:	G.Akins, S.Snow	End Date:	090110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
				75		

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig:	CME 55 & Diedrich D-50
Drilling Method:	Hollow Stem Auger & Rotary with fluids
Total Depth (ft bgs):	45.1ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

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TWP-04

Drilling Company:	Tri-State Drilling	Start Date:	052710	Logged By:	
Driller:	S.Snow	End Date:	060110	R. Josefczyk & R. Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5 10 15 20 25 30 35		See boring logTWP-04B for description of 0'-30' bgs and boring log TWP-04A for description of 30'-81' bgs

Notes:

3-inch stainless steel split spoon used for SPT

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger and Casing Advacer
Total Depth (ft bgs):	74.1 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

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TWP-04

Drilling Company: Tri-State Drilling	Start Date: 052710	Logged By:
Driller: S.Snow	End Date: 060110	R. Josefczyk & R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
	17 33 43 43	2.0	0.0			COARSE SAND (GW) and GRAVEL dark grayish brown (10YR4/2)
						sandstone and shale bedrock greenish gray (GLEY 1 5/1)
				75		auger refusal at 74.1

Notes:

3-inch stainless steel split spoon used for SPT

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger and Casing Advacer
Total Depth (ft bgs): 74.1 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

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TWP-04A

Drilling Company: Tri-State Drilling	Start Date: 050710	Logged By:
Driller: S.Snow	End Date: 051110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				0–30		see boring log TWP-04B for description of 0'-30' bgs
	3 1 0 3	1.6	0.0	30		BOTTOM ASH (BA) very dark gray (10YR3/1)
	2 2 4 3	1.6	0.0			ASH (FA) very dark gray (10YR3/1)silt and clay sized particles
	2 0 0 1	0.6	0.0	35		
	4 3 2 3	1.9	0.0			
	4 5 3 5	1.9	0.0			

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs): 80 ft bgs
1st Water Encountered (ft bgs): 6 ft bgs
Water Level after 24 hr (ft bgs):

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TWP-04A

Drilling Company: Tri-State Drilling	Start Date: 050710	Logged By:	
Driller: S.Snow	End Date: 051110	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	3 2 1 1	1.8	0.0			ASH (FA) dark gray (10YR4/1) clay sized particles ASH (FA) very dark gray (10YR3/1)silt sized particles
	4 2 1 1	1.5	0.0			ASH (FA) very dark gray (10YR3/1) clay sized particles, very dense
	3 2 1 1	1.3	0.0	45		SILT (ML) olive brown (2.5Y4/3) with mottled black silt ASH (FA) alternating layers of very dark gray (10YR3/1) clayey ash and silty ash
	2 1 0 1	2.0	0.0			ASH (FA) very dark gray (10YR3/1) clay sized particles
	woh woh woh 1	1.9	0.0			
	1 1 1 1	1.9	0.0	50		ASH (FA) dark gray (10YR4/1) clay sized particles
	woh woh woh 3	2.0	0.0			
	4 2 2 2	1.2	0.0	55		CLAY (CL) olive brown (2.5Y5/4) ASH (FA) dark gray (10YR4/1) clay sized particles
	1 3 4 6	1.9	0.0			CLAY (CH) dark gray (GLEY 1 4/1) and olive brown (2.5Y4/3)intermixed fat clay, some gravel 1-2cm varies from angular to round
	2 3 3 4	1.5	0.0			CLAY (CH) dark gray (GLEY 1 4/1) and olive brown (2.5Y4/3) intermixed, fat
	NA	2.0	0.0	60		shelby tube collected-no visual description
	8 6 8 12	2.2	0.0			CLAY (CH) dark gray (GLEY1 4/1) CLAY (GC) yellowish brown (10YR5/6) and gray (10YR6/11) with 50% GRAVEL, some sandstone up to 4 cm, angular
	5 11 16 21	2.2	0.0	65		fat CLAY (CH) gray (10YR6/1) intermixed with CLAY () yellowish brown (10YR5/6), no silt, no sand, no gravel. CLAY (CH) yellowish brown (10YR5/6) and gray (10YR6/1) with 50% GRAVEL, some sandstone up to 4 cm, angular
	3 5 6 7	2.3	0.0			CLAY (CH) gray (10YR6/1) fat, intermixed with yellowish brown (10YR5/6) fat clay
	11 18 28 24	2.0	0.0			
	NA	2.0	0.0	70		CLAYEY SILT (ML) gray (2.5Y5/1) SILTY SAND (SM) gray (2.5Y5/1) fine, well sorted, no gravel shelby tube collected-no visual description
	11 10 13 10	1.3	0.0			CLAYEY SILTY GRAVEL (GC) gray (2.5Y5/1), angular gravel, abundant chert
	30 32 40 50/3	1.4	0.0	75		CLAYEY SILT (ML) gray (2.5Y4/1) with minor rock fragments CLAYEY GRAVEL (GC) dark gray (2.5Y4/1) large, angular gravel in a fat clay matrix, some fine grained SAND
	81 100	0.7	0.0			SAND (SW) dark gray (2.5Y4/1) fine grained CLAY (CL) dark grayish brown (10YR3/2) fat clay with some gravel
	37 100	NR	0.0			SAND (SW) greenish gray (GLEY1 6/1) medium grained

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs):	80 ft bgs
1st Water Encountered (ft bgs):	6 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04A

Drilling Company: Tri-State Drilling	Start Date: 050710	Logged By:
Driller: S.Snow	End Date: 051110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	11 45 31 53	1.5	0.0			NO RECOVERY sandstone, brown (2.5Y6/1) fine to medium grained quartz shale, olive brown (2.5Y4/3) and strong brown (7.5YR4/4) laminated auger refusal
				85		
				90		
				95		
				100		
				105		
				110		
				115		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs):	80 ft bgs
1st Water Encountered (ft bgs):	6 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04B

Drilling Company: Tri-State Drilling	Start Date: 050510	Logged By:
Driller: S.Snow	End Date: 050510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	2 1 1 3	1.9	0.0			ASH (FA) very dark gray (10YR3/1) silty, some organics, dry
	2 4 5 6	2.3	0.0			ASH (FA) very dark gray (10YR3/1) silty, dry
	2 4 4 3	2.0	0.0	5		ASH (FA) very dark gray (10YR3/1) fine sand sized particles, no silt, dry
	2 1 1 1	1.9	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles, moist
	1 0 1 1	1.7	0.0			
	1 1 0 1	1.5	0.0	10		
	woh woh woh 1	1.6	0.0			
	woh woh 3 4	1.7	0.0	15		ASH (FA) very dark gray (10YR3/1) fine sand sized particles, very wet
	5 7 16 13	2.0	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles mix with medium sand sized particles, well sorted, <5% gravel, very wet
	woh 4 10 10	1.75	0.0			ASH (FA) very dark gray (10YR3/1) medium grained sand sized particles, wet
	7 8 12 15	2.0	0.1	20		BOTTOM ASH (BA) very dark gray (10YR3/1)medium to coarse grained sand sized particles
	9 9 10 10	1.8	0.2			ASH (FA) very dark gray (10YR3/1)silt sized particles, wet
	woh 5 6 7	1.8	0.0	25		
	1 1 3 3	1.95	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles, grading to silty sandy ASH (FA) in lower 0.7 feet
	1 3 3 2	1.3	0.0			ASH (FA) very dark gray (10YR3/1) fine, homgenous sand sized particles, wet
				30		ASH (FA) very dark gray (10YR3/1)silty clay sized particles, wet
				35		

Notes:

2-inch steel split spoons used for STP

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 30 ft bgs
1st Water Encountered (ft bgs): NA
Water Level after 24 hr (ft bgs): NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-05

Drilling Company:	Tri-State Drilling	Start Date:	051410	Logged By:	
Driller:	S.Snow	End Date:	052010	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)
	4 6 6 8	2.0	0.0
	5 4 4 4	2.0	0.0
	2 3 7 10	2.0	0.0
	5 11 14 16	2.0	0.0
	9 14 14 18	2.0	0.0
	9 11 12 13	2.3	0.0
	6 7 8 10	2.0	0.0
	5 6 7 7	2.0	0.0
	3 3 3 4	2.0	0.0
	2 2 2 1	2.0	0.0
	woh woh woh 4	2.0	0.0
	2 4 6 6	1.5	0.0
	5 5 5 5	1.5	0.0
	3 3 3 3	1.5	0.0
	2 1 1 3	1.8	0.0
	woh 1 0 1	2.0	0.0
	woh woh woh woh	2.0	0.0
	woh woh woh woh	2.0	0.0
	woh woh woh 1	2.0	0.0
	wot wot 2 1	2.2	0.0

Depth (ft bgs): 5, 10, 15, 20, 25, 30, 35

Lithology

Description

- ASH (FA) dark gray (10YR4/1) with some limestone gravel
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark gray (10YR4/1) with trace limestone gravel
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
- ASH (FA) dark grayish brown (10YR4/2) silt sized texture, dry
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark grayish brown (10YR4/2) silt sized texture, dry
- ASH (FA) dark gray (10YR4/1) silt sized texture, moist
- ASH (FA) dark gray (10YR4/1) clayey, moist
- ASH (FA) dark gray (10YR4/1) silt sized texture, dry
- ASH (FA) dark gray (10YR4/1) silt sized texture, slightly moist
- ASH (FA) dark gray (10YR4/1) clayey, moist
- BOTTOM ASH (BA) dark grayish brown (10YR4/2) med sized sand texture, with trace organics, moist
- BOTTOM ASH (BA) dark gray (10YR4/1) med sized sand texture, wet
- GRAVEL (GC) gray (10YR6/1) angular, fabric on the bottom, very moist
- ASH (FA) dark gray (10YR4/1) clayey silty, wet
- ASH (FA) dark gray (10YR4/1) clayey, wet
- ASH (FA) dark gray (10YR4/1) clayey, trace gravel
- ASH (FA) dark gray (10YR4/1) clayey, wet

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs):	86 ft bgs
1st Water Encountered (ft bgs):	15.9 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-05

Drilling Company: Tri-State Drilling	Start Date: 051410	Logged By:
Driller: S.Snow	End Date: 052010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)
	wot wot 4 3	2.0	0.0
	wot wot wot 1	0.75	0.0
	3 3 3 4	1.9	0.0
	4 1 1 2	2.0	0.0
	wot wot wot wot	2.0	0.0
	woh 3 3 4	2.0	0.0
	6 4 4 4	2.0	0.0
	4 4 5 4	1.6	0.0
	2 1 4 2	1.7	0.0
	wot 2 2 1	1.5	0.0
hatched	wot 3 4 7	2.2	0.0
hatched	woh 2 5 8	2.3	0.0
hatched	5 7 11 10	2.2	0.0
solid	NA	2.08	
	7 6 6 7	0.9	0.0
	4 4 5 4	2.0	0.0
	4 3 2 4	2.0	0.0
hatched	4 4 3 3	2.0	0.0
solid	NA	2.0	
hatched	11 12 12 16	1.1	0.0

Depth (ft bgs): 45, 50, 55, 60, 65, 70, 75

Description:

- BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse grained sand sized particles, wet
- ASH (FA)very dark gray (10YR3/1) clayey, wet
- ASH (FA) dark gray (10YR4/1) clayey, wet
- BOTTOM ASH (BA) very dark gray (10YR3/1)silty medium grained sand sized particles, <% gravel,wet
- ASH (FA) dark gray (10YR4/1) clayey, wet
- CLAYEY SILTY (CL) light olive brown (2.5Y5/4) wet
- ASH (FA) dark gray (10YR4/1) silty, wet
- SILTY CLAY (CL) yellowish brown (10YR5/6) dry
- SLITY SANDY CLAY (ML) yellowish brown (10YR5/6), fine sand, dry
- shelby tube collected-no visual description
- SANDY SILT(GM) yellowish brown (10YR5/4) fine grained sand, with 70% gravel, geotextile present
- SANDY SILT(ML) yellowish brown (10YR5/4) fine grained sand
- SAND (SW) yellowish brown(10YR5/4) silty, fine grained sand with minor clay, 50% gravel, moist
- SAND (SW) yellowish brown (10YR5/4) silty, fine grained sand with minor clay, moist
- SAND (SW) dark gray (10YR4/1) silty, fine grained sand with minor clay, moist
- SAND(SW) yellowish brown (10YR5/4) silty, fine grained sand, with minor clay, wet
- shelby tube collected-no visual description
- SAND (SW) brownish gray (2.5YR6/2) fine grained sand,

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs):	86 ft bgs
1st Water Encountered (ft bgs):	15.9 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-05

Drilling Company: Tri-State Drilling	Start Date: 051410	Logged By:
Driller: S.Snow	End Date: 052010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
						with trace silt
	21 10 12 13	1.2	0.0			SAND (SW) yellowish brown (10YR5/6) fine grained
	19 20 20 27	1.3	0.0			
	9 19 44 40	1.4	0.0	85		sandstone greenish gray (GLEY 1 5/1) fine grained with interbedded greenish gray (GLEY 1 5/1) shale
						auger refusal at 86.0 ft bgs
				90		
				95		
				100		
				105		
				110		
				115		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs): 86 ft bgs
1st Water Encountered (ft bgs): 15.9 ft bgs
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

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TWP-06

Drilling Company: Tri-State Drilling	Start Date: 052010	Logged By:
Driller: S.Snow	End Date: 052510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)
	NA	NA	0.0	
	2 8 11 8	1.95	0.0	
	4 7 7 5	1.9	0.0	5
	5 4 2 3	1.45	0.0	
	7 24 26 24	1.9	0.0	
	6 19 20 18	2.0	0.0	10
	8 11 12 11	2.0	0.0	
	5 4 1 1	1.75	0.0	15
	woh woh woh woh	2.0	0.0	
	woh woh woh woh	0.3	0.0	
	woh woh 2 4	1.0	0.0	20
	2 1 1 0	1.6	0.0	
	2 2 2 2	1.2	0.0	25
	woh 2 1 0	2.0	0.0	
	1 1 1 2	2.0	0.0	
	2 1 1 2	2.0	0.0	30
	2 1 1 3	2.0	0.0	
	2 2 1 1	2.0	0.0	35
	wot woh 2 1	2.0	0.0	
	woh woh woh 3	2.0	0.0	

Lithology / Description

- BOTTOM ASH (BA) very dark gray (10YR3/1) dry
- ASH (FA) very dark gray (10YR3/1)silty texture, <10% limestone gravel
- BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, with varying amounts of gravel
- ASH (FA) very dark gray (10YR3/1)silty texture, <10% limestone gravel, dry
- BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, 50% limestone gravel, wet
- ASH (FA) very dark gray (10YR3/1)silty texture, moist
- BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, abundant limestone gravel, dry
- BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, abundant limestone gravel, wet
- BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, <%5 limestone gravel, dry
- ASH (FA) very dark gray (10YR3/1) silty texture, <%5 limestone gravel, minor clay and sand wet
- ASH (FA) very dark gray (10YR3/1)silty texture, with medium yellowish red (5YR4/6) clay, dry
- BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, <%5 limestone gravel, dry
- ASH (FA) very dark gray (10YR3/1)silty texture, dry
- BOTTOM ASH (BA) very dark gray (10YR3/1)silty sandy texture, 50% limestone gravel, very wet
- ASH (FA) very dark gray (10YR3/1)silty sandy texture, <10% gravel wet
- ASH (FA) very dark gray (10YR3/1)silty texture, wet
- BOTTOM ASH (BA) very dark gray (10YR3/1) coarse sandy texture, some limestone gravel, wet
- ASH (FA) dark gray (10YR4/1)silty texture, minor clay, wet
- BOTTOM ASH (BA) dark gray (10YR4/1) coarse sandy texture, wet
- ASH (FA) dark gray (10YR4/1)silty texture, wet
- ASH (FA) dark gray (10YR4/1) clayey texture, wet
- ASH (FA) dark gray (10YR4/1)silty texture, wet
- ASH (FA) dark gray (10YR4/1)silty texture, minor clay, wet
- SILT (ML) black (10YR2/1) with intermixed clay olive (5Y5/3)
- CLAY (CL) olive (5Y5/3)

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	63.2 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	11.36 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-06

Drilling Company: Tri-State Drilling	Start Date: 052010	Logged By:
Driller: S.Snow	End Date: 052510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
solid	NA	2.0	0.0			shelby tube collected-no visual description
	woh woh woh woh	0.15	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 100% gravel (slough)
	wot wot wot wot	0.25	0.0	45		ASH (FA) dark gray (2.5YR4/1)silty texture, minor clay, wet (slough)
hatched	woh woh woh 1	1.2	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 75% gravel, wet (slough)
						SILTY CLAY (ML) light brownish gray (10YR5/8) with yellowish brown (10YR5/8) staining, wet
	NA	NR	0.0	50		drilled through, no recovery* (see notes)
hatched	2 4 4 4	2.1	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 100% gravel (slough)
						SILTY CLAY (ML) light brownish gray (10YR5/8) with yellowish brown (10YR5/8) staining, trace fine sand, wet
hatched	woh woh woh 3	2.1	0.0	55		SAND (SM) with minor clay and silt, yellowish brown (10YR5/6)
						SAND (SM) with minor silt, dark gray (2.5YR4/1)
solid	NA	2.0	0.0			shelby tube collected-no visual description
hatched	woh woh 4 5	2.3	0.0			SAND with SILT (SM)dark gray (2.5YR4/1) fine to medium grained, minor silt, wet
hatched	wot	2.0	0.0	60		SAND with SILT (SM)dark gray (2.5YR4/1) fine to medium grained, minor silt, with lenses of clay yellowish brown (10YR5/8), wet
	33 43	0.9	0.0			sandstone
						shale
						auger refusal at 63.2 ft bgs
				65		
				70		
				75		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	63.2 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	11.36 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-22

Drilling Company: Tri-State Drilling	Start Date: 042310	Logged By:
Driller: F.Jones	End Date: 042310	R.Josefczyk & R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	8 5 10 11	1.8	0.0			GRAVEL (GP) light gray (N7/1)
						SILTY SANDY CLAY (CL) dark yellowish brown (10 YR3/6) grading to greenish black (10GY2.5/1) dry
	6 25 26 50/3"	2.0	0.0			CLAY (CL) and SILTY SAND (SC) intermixed, yellowish brown (10YR4/3) dry
	25 58 100/2"	1.6	0.0	5		SHALE greenish gray (10GY5/1) friable, dry
						auger refusal at 4.75"
				10		
				15		
				20		
				25		
				30		
				35		

Notes:

2-inch split spoons used for SPT

Drill Rig: Central Mining Equipment 45B
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 4.75 ft bgs
1st Water Encountered (ft bgs): NA
Water Level after 24 hr (ft bgs): NA

Tennessee Valley Authority

Kingston Fossil Plant

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TWP-24

Drilling Company: Tri-State Drilling	Start Date: 072910	Logged By:
Driller: S.Snow	End Date: 080210	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5 10 15 20 25 30 35		see boring log TWP-04B for description of 0'-30' bgs and boring log TWP-04B for description of 30'-69' bgs

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig:	Diedrich D-50
Drilling Method:	HSA, Casing Advancer, Coring
Total Depth (ft bgs):	97.18 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-24

Drilling Company: Tri-State Drilling	Start Date: 072910	Logged By:	
Driller: S.Snow	End Date: 080210	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
						CLAY (CL) yellowish brown (10YR5/4) soft
	10 8 6 7	2.2	0.0	70		SAND (SW) very dark grayish brown (10YR3/2) medium grained
						CLAY (CL) black (2.5Y2.5/1) soft
	6 6 12 11	1.5	0.0			SAND (SW) dark grayish brown (10YR4/2) coarse grained and gravel
	9 10 11 12	1.2	0.0			SAND (SW) dark grayish brown (10YR4/2) coarse grained and gravel
				75		SAND (SW) olive green (5Y4/2) fine to medium grained
	7 4 11 29	1.4	0.0			SAND (SW) dark greenish gray (gley 1 4/1) coarse grained and gravel
	30 32 44 50/5"	0	0.0			SAND (SW) dark grayish brown (10YR4/2)coarse grained and gravel

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig: Diedrich D-50
Drilling Method: HSA, Casing Advancer, Coring
Total Depth (ft bgs): 97.18 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-24

Drilling Company:	Tri-State Drilling	Start Date:	072910	Logged By:
Driller:	S.Snow	End Date:	080210	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	Run 1	0.3	0.0			SAND (SW) dark greenish gray (gley 1 4/1) coarse grained and gravel
						no recovery
						limestone dark gray (2.5Y4/1) begin coring
	Run 2	3.8	0.0	85		chert
						no recovery
						shale reddish brown (5YR4/4) with interbedded limestone dark gray (2.54/1)
						shale reddish brown (5YR4/4)
	Run 3	4.1	0.0	90		
	Run 4	4.5	0.0	95		
				100		
				105		
				110		
				115		

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig: Diedrich D-50
Drilling Method: HSA, Casing Advancer, Coring
Total Depth (ft bgs): 97.18 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-25

Drilling Company: Major Drilling / Tri-State Drilling	Start Date: 072610	Logged By:
Driller: D.Chamblee / S.Snow	End Date: 080510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	5.0	0.0			ASH (FA) dark gray (10YR4/1) clay and silt sized particles, dry
	NA	4.6	0.0	5		ASH (FA) dark gray (10YR4/1) clay and silt sized particles, (drilling with water)
	NA	2.3	0.0	10		ASH (FA) dark gray (10YR4/1) clay and silt sized particles
	NA	4.5	0.0	15		BOTTOM ASH (BA) grayish brown (10YR4/2) ASH (FA) dark gray (10YR4/1) clay and silt sized particles ASH (FA) dark gray (10YR4/4)fine sand sized particles BOTTOM ASH (BA)grayish brown (10YR4/2)
	NA	3.9	0.0	20		ASH (FA) dark gray (10YR4/1) clay and silt sized particles ASH (FA) dark gray (10YR4/4)fine sand sized particles, <5% gravel
	NA	4.5	0.0	25		ASH (FA) dark gray (10YR4/1) clay and silt sized particles, <5% gravel
	NA	5.3	0.0	30		BOTTOM ASH (BA)grayish brown (10YR4/2) ASH (FA) dark gray (10YR4/1) clay and silt sized particles
	NA	4.8	0.0	35		

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig: Geoprobe 8140 DT & Deidrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 115.5 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs): 26 ft bgs

Tennessee Valley Authority
Kingston Fossil Plant
KIF
Harriman, TN, 37748

TWP-25

Drilling Company: Major Drilling / Tri-State Drilling	Start Date: 072610	Logged By:
Driller: D.Chamblee / S.Snow	End Date: 080510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	4.2	0.0			
				45		
	NA	5.0	0.0			
				50		No Recovery
	NA	0	0.0			
				55		ASH (FA) dark gray (10YR4/1) fine sand sized particles, <5% gravel
	NA	3.2	0.0			
				60		ASH (FA) dark gray (10YR4/1) silt sized particles
						SILTY CLAY (CL) olive brown (2.5YR5/4) intermixed light yellowish brown (2.5YR6/3)
	NA	3.5	0.0			
				65		
						SAND (SC) dark yellowish brown (10YR4/4) intermixed with light yellow (2.5YR6/4) fine sand
	NA	3.9	0.0			
				70		SILTY SAND (SM) gray (5Y5/1) some clay
	NA	3.4	0.0			
						SAND (SW) gray (5Y5/1) fine grained
				75		SAND (SW) olive gray (5Y5/2) fine grained, well sorted
	NA	3.4	0.0			

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig:	Geoprobe 8140 DT & Deidrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	115.5 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	26 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-25

Drilling Company: Major Drilling / Tri-State Drilling	Start Date: 072610	Logged By: R.Josefczyk, R.Lee
Driller: D.Chamblee / S.Snow	End Date: 080510	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	4.4	0.0			
				85		SAND (SW) olive gray (5Y4/2) fine to medium grained, minor gravel
						sandstone greenish gray (Gley 1 5/1)
						shale greenish gray (Gley 1 5/1)
	NA	4.1	0.0			
	Run 5	5.0	0.0	90		
						shale black (Gley 1 2.5/N)
	Run 6	1.0	0.0			limestone dark gray (2.5Y4/1)
						shale black (Gley 1 2.5/N) vertically bedded with interbedded limestone beds dark gray (2.5Y4/1), approximately 1 inch thick
	Run 7	4.7	0.0	95		shale black (Gley 1 2.5/N) vertically bedded with interbedded limestone beds dark gray (2.5Y4/1), approximately 1 inch thick
	Run 8	2.5	0.0	100		
						shale black (Gley 1 2.5/N) vertically bedded, friable
	Run 9	3.1	0.0	105		
	Run 10	4.1	0.0	110		
	Run 11	2.9	0.0			
				115		

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig: Geoprobe 8140 DT & Deidrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 115.5 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs): 26 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company: Major Drilling / Tri-State Drilling	Start Date: 072010 / 072710	Logged By:
Driller: W.Casteel, D.Chamblee / S.Snow	End Date: 072310 / 072810	R.Josefczyk, R. Lee, and M.Martin

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	NR	0.0	0–5		No Recovery
	NA	0.6	0.0	5–10		ASH (FA) black (10YR2/1) silt and fine sand sized particles, 10% gravel
	NA	4.35	0.0	10–15		BOTTOM ASH (FA) black (10YR2/1) silt and very coarse sand sized particles, 10% gravel, very uniform
	NA	5.6	0.0	15–20		BOTTOM ASH (BA) very dark gray (10YR3/1) very coarse sand sized particles, some silt, 10% gravel, very uniform ASH (FA) very dark gray (10YR3/1)fine sand sized particles ASH (FA) gray (10YR5/1) silt and fine sand sized particles
	NA	NR	0.0	20–25		No Recovery
	NA	NR	0.0	25–30		
	NA	0.85	0.0	30–35		BOTTOM ASH (BA) dark grayish brown (10YR4/2) very coarse sand and gravel sized particles
	NA	3.25	0.0	35–40		ASH (FA) gray (10YR5/1) silt sized particles

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig: Geoprobe 8140 DT and Diedrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 113 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company: Major Drilling / Tri-State Drilling	Start Date: 072010 / 072710	Logged By:
Driller: W.Casteel, D.Chamblee / S.Snow	End Date: 072310 / 072810	R.Josefczyk, R. Lee, and M.Martin

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	5.2	0.0			SILT (ML) greenish brown (2.5Y5/2) <5% gravel
						SILT (ML) greenish brown (2.5Y5/2) and yellowish brown (10YR5/6) <5% gravel
				45		SAND (SW) dark yellowish brown (10YR3/6) very fine
	NA	4.0	0.0			SAND (SW) dark yellowish brown (10YR3/6) very fine, <5% gravel, <5% coarse materials
						SILTY SAND (SM) gray (10YR5/1) fine sand, very well sorted with minor silt
				50		SAND (SM) gray (10YR5/1) fine sand with lenses of dark yellowish brown (10YR3/6) clayey silt (approx 10%) <5% small gravel
	NA	4.5	0.0			
				55		SAND (SW) gray (10YR5/1) fine sand
	NA	3.1	0.0			SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand
				60		SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand with large cobbles of compacted sand
	NA	0.4	0.0			
				65		SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand (poor recovery)
	NA	4.5	0.0			
				70		No Recovery
	NA	NR	0.0			
				75		
	NA	NR	0.0			

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig: Geoprobe 8140 DT and Diedrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 113 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company:	Major Drilling / Tri-State Drilling	Start Date:	072010 / 072710	Logged By:
Driller:	W.Casteel, D.Chamblee / S.Snow	End Date:	072310 / 072810	R.Josefczyk, R. Lee, and M.Martin

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
						CLAY (GC) gray (10YR5/1) with 45% conglomerate (slough)
	NA	5.7	0.0			
						shale, bluish gray (GLEY 2 2.5/1),
						shale, greenish black (GLEY 2 2.5/1)
				85		
	NA	4.0	0.0			
						limestone dark greenish gray (N 4/1) fine grained, with black fine partings
	Run 2	2.1	0.0	90		shale very dark gray (N 3/1) platy, wavy shale bedding, trace reddish black staining/oxidation
						limestone dark greenish gray (N 4/1) fine grained, some vertical calcite filled fractures
	Run 3	4.9	0.0	95		shale very dark gray (N 3/1) competent, unweathered, platy, calcite veins,apparent, shale bedding planes completely overturned
						shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 4	5.0	0.0			limestone dark greenish gray (N 4/1) fine grained, some vertical and horizontal calcite filled fractures
				100		shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 5	3.2	0.0			limestone dark greenish gray (N 4/1) fine grained, thin bedded (approximately 0.01'-0.03' thick) with very fine clay/shale between bedrock partings
				105		shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 6	4.7	0.0	110		
	Run 7	0.8	0.0			limestone coarse grained, crystalline textured, red staining red (10R4/8) thin bedded (10mm-30mm) thin shale lenses in partings, calcite veins (1mm-3mm)
						shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
				115		limestone coarse grained, crystalline textured, red staining red (10R4/8) thin bedded (10mm-30mm) thin shale lenses in partings, calcite veins (1mm-3mm)

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Geoprobe 8140 DT and Diedrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	113 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

APPENDIX B

Well Construction Diagrams

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: GW-01
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Rotary with Fluids	LOCATION/COORDINATES: 2438382.699E, 555459.854N
WEATHER: Sunny TEMPERATURE: 92° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 082410 0845 COMPLETED: 090310 1050
DRILLER(s): G. Akins & S. Snow	DRILL RIG(s): CME 55 & Diedrich D-50	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
SEE GW-01A BORING LOG FOR DETAILS 0.0' - 13.0' BGS	0, 10		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 13.0' - 55.0' BGS	20, 30, 40, 50		
*For Further Lithology Detail, See Attached Boring Log	60		

WELL CONSTRUCTION

Depth (feet BGS) Details

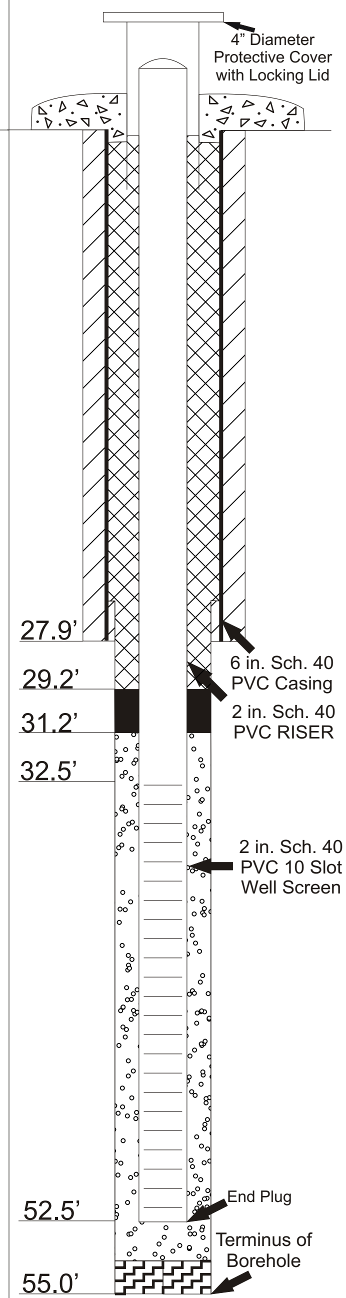

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 29.2 Ft. BGS	BOTTOM: 31.2 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 31.2 Ft. BGS	BOTTOM: 55.0 Ft. BGS
GROUT QUANTITY: Approximately 69 & 38 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 29.2 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear feet 20.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear feet 32.5'
To Ground Surface	
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 3.465 Ft.	
BOREHOLE (In. DIAMETER) 6" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 55.0 Ft.	
ELEVATION (FT ABOVE MSL): 777.837 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: GW-02
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES: 2439721.211E, 557337.716N
WEATHER: Partly Cloudy TEMPERATURE: 95° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 080910 1014 COMPLETED: 082310 1600
DRILLER(s): G. Akins	DRILL RIG(s): CME 55	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
	0		
GRAVEL(Fill) 0.0' - 2.4' BGS			
SILTY CLAY 2.4' - 13.0' BGS	5		
	10		
CLAY with Minor SILT 13.0' - 14.1' BGS			
CLAY with WEATHERED SHALE 14.1' - 20.0' BGS	15		
	20		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

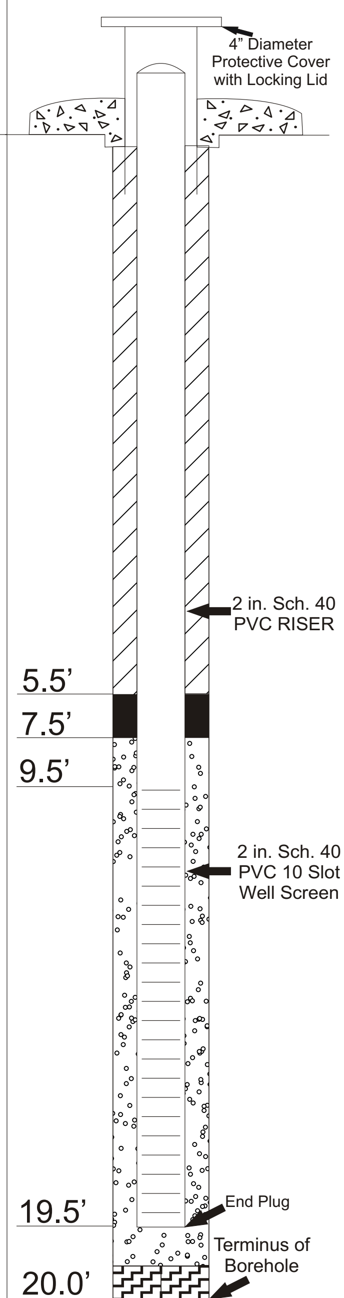

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 5.5 Ft. BGS BOTTOM: 7.5 Ft. BGS

FILTER PACK GRAINSIZE: #2 Sand

FILTER PACK: TOP: 7.5 Ft. BGS BOTTOM: 20.0 Ft. BGS

GROUT QUANTITY: Approximately 5 Gallons

GROUT: TOP: 0.0 Ft. BOTTOM: 5.5 Ft. BGS

GROUT TYPE: 5% Bentonite Cement by Weight

SCREEN TYPE: Sch. 40 PVC

WELL SCREEN: Inches In Diameter: 2" Linear Feet: 10.0'

SLOT SIZE: 10 Slot

WELL CASING: Inches In Diameter: 2" Linear Feet: 10.0' To Ground Surface

CASING TYPE: Sch. 40 PVC

TOP OF CASING (AGS): 3.247 Ft.

BOREHOLE (In. DIAMETER) 8"

BOTTOM OF BOREHOLE (FT BGS): 20.0 Ft.

ELEVATION (FT ABOVE MSL): 766.543 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: GW-03
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Rotary with Fluids	LOCATION/COORDINATES: 2439734.358E, 557353.636N
WEATHER: Sunny TEMPERATURE: 90° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED #1: 082310 - 0900 COMPLETED #1: 082310 - 1600
DRILLER(s): G. Akins & S. Snow	DRILL RIG(s): CME 55 & Diedrich D-50	STARTED #2: 082410 - 1600 COMPLETED #2: 090110 - 0956

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
SEE GW-02 BORING LOG FOR DETAILS 0.0' - 13.0' BGS	0 – 10		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 13.0' - 45.1' BGS	20 – 40		
*For Further Lithology Detail, See Attached Boring Log	50 – 60		

WELL CONSTRUCTION

Depth (feet BGS) Details

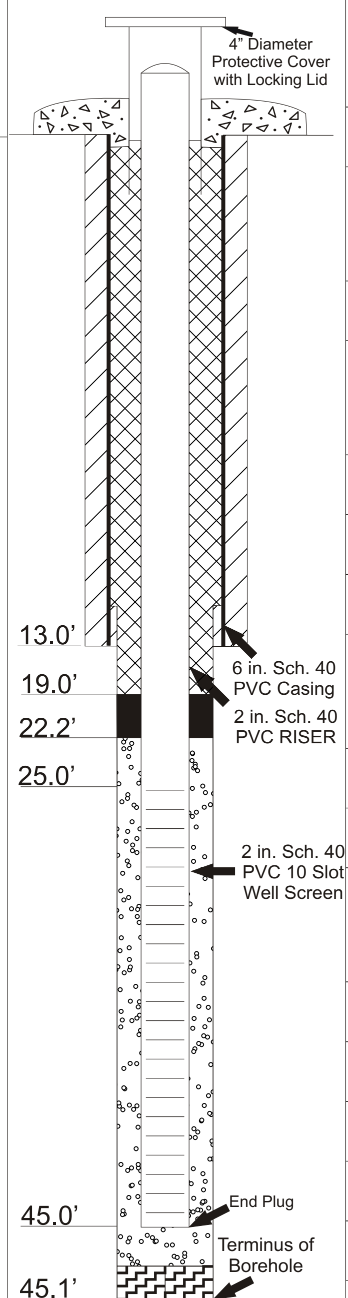

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL:	TOP: 19.0 Ft. BGS	BOTTOM: 22.2 Ft. BGS
FILTER PACK GRAINSIZE:	#2 Sand	
FILTER PACK:	TOP: 22.2 Ft. BGS	BOTTOM: 45.0 Ft. BGS
GROUT QUANTITY:	Approximately 52 & 25 Gallons	
GROUT:	TOP: 0.0 Ft.	BOTTOM: 19.0 Ft. BGS
GROUT TYPE:	5% Bentonite Cement by Weight	
SCREEN TYPE:	Sch. 40 PVC	
WELL SCREEN:	Inches In Diameter: 2"	Linear Feet: 20.0'
SLOT SIZE:	10 Slot	
WELL CASING:	Inches In Diameter: 2"	Linear Feet: 25.0' To Ground Surface
CASING TYPE:	Sch. 40 PVC	
TOP OF CASING (AGS):	3.184 Ft.	
BOREHOLE (In. DIAMETER)	6" Nominal	
BOTTOM OF BOREHOLE (FT BGS):	45.1 Ft.	
ELEVATION (FT ABOVE MSL):	766.632 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-04
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Casing Advancer	LOCATION/COORDINATES: 2439792.803E, 556466.750N
WEATHER: Sunny TEMPERATURE: 88° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 052710 1602 COMPLETED: 060110 1200
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
Lithologic Description Based on Adjacent Well TWP-04A, Except as Noted Below			
ASH 0.0' - 16.8' BGS			
BOTTOM ASH 16.8' - 21.1' BGS			
ASH 21.1' - 30.0' BGS			
BOTTOM ASH 30.0' - 32.5' BGS			
ASH 32.5' - 58.0' BGS			
CLAY 58.0' - 69.5' BGS			
CLAYEY SILT 69.5' - 74.0' BGS			
CLAYEY GRAVEL 74.0'-74.2'BGS			
SAND 74.2' - 78.0' BGS			
SANDSTONE 78.0' - 78.4' BGS			
SHALE 78.4' - 79.5' BGS			
ONLY TWP-04 DESCRIPTION: COARSE SAND and GRAVEL 72.0' - 74.0' BGS			

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) Details

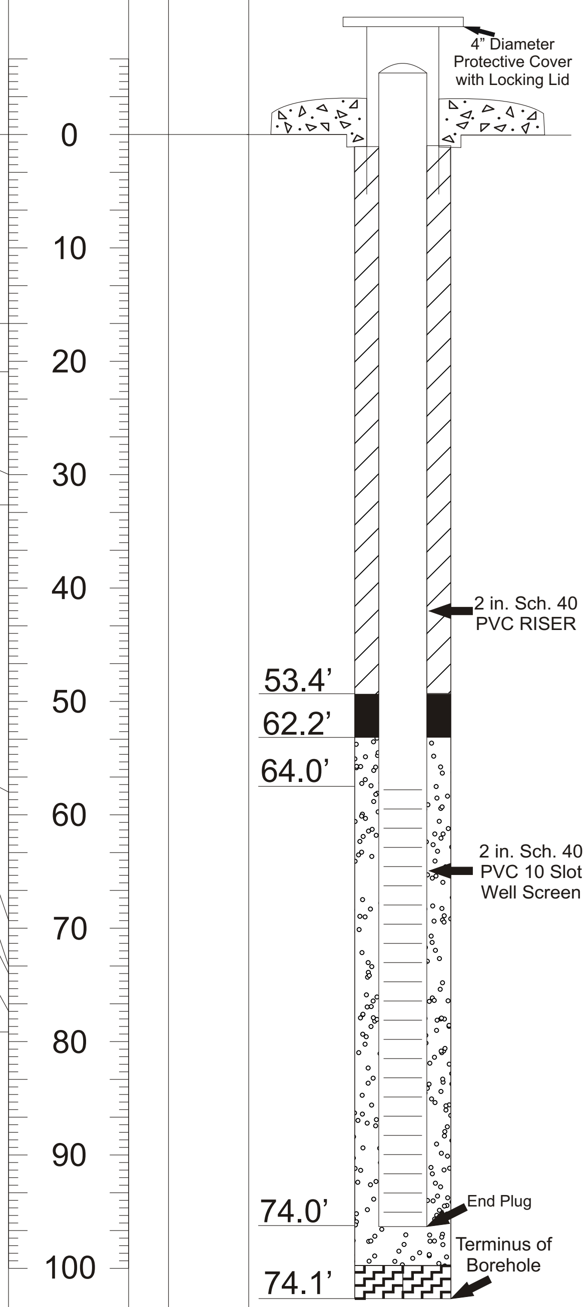

Diagram Not To Scale

MATERIALS INVENTORY

- BENTONITE SEAL: TOP: 53.4 Ft. BGS BOTTOM: 62.2 Ft. BGS
- FILTER PACK GRAINSIZE: #2 Sand
- FILTER PACK: TOP: 62.2 Ft. BGS BOTTOM: 74.1 Ft. BGS
- GROUT QUANTITY: Approximately 46 Gallons
- GROUT: TOP: 0.0 Ft. BOTTOM: 53.4 Ft. BGS
- GROUT TYPE: 5% Bentonite Cement by Weight
- SCREEN TYPE: Sch. 40 PVC
- WELL SCREEN: Inches In Diameter: 2" Linear Feet: 10.0'
- SLOT SIZE: 10 Slot
- WELL CASING: Inches In Diameter: 2" Linear Feet: 64.0' To Ground Surface
- CASING TYPE: Sch. 40 PVC
- TOP OF CASING (AGS): 3.240 Ft.
- BOREHOLE (In. DIAMETER): 5" Nominal
- BOTTOM OF BOREHOLE (FT BGS): 74.1 Ft.
- ELEVATION (FT ABOVE MSL): 782.913 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-05
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Casing Advancer	LOCATION/COORDINATES: 2441056.620E, 555670.828N
WEATHER: Mostly Cloudy; TEMPERATURE: 72° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME: STARTED: 051410 1425; COMPLETED: 052010 1103
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
	0		
	10		
	20		
ASH 0.0' - 60.5' BGS	30		
	40		
	50		
SILTY CLAY 60.5' - 64.0' BGS	60		
SANDY CLAY 64.0' - 68.0' BGS			
SANDY SILT 68.0' - 70.0' BGS	70		
SAND 70.0' - 85.1' BGS			
SANDSTONE & SHALE 85.1' - 86.0' BGS	80		
	90		
	100		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) Details

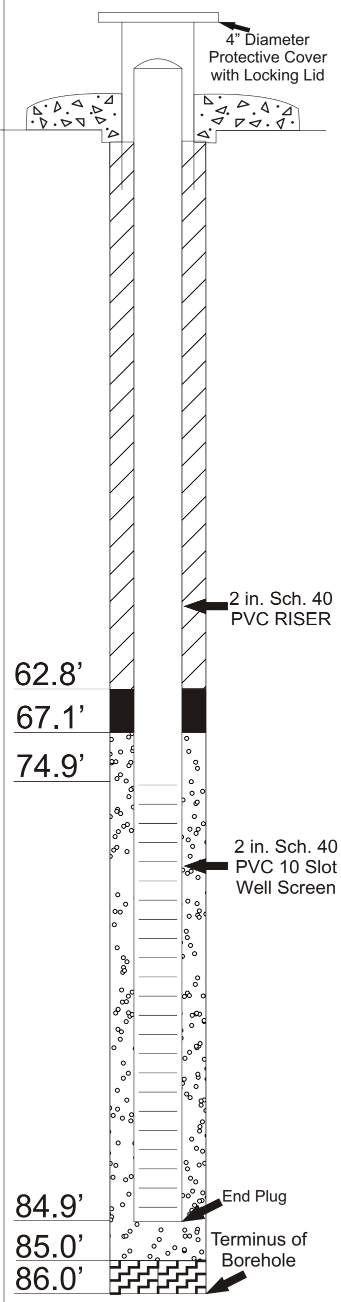

Diagram Not To Scale

MATERIALS INVENTORY

- BENTONITE SEAL: TOP: 62.8 Ft. BGS; BOTTOM: 67.1 Ft. BGS
- FILTER PACK GRAINSIZE: #2 Sand
- FILTER PACK: TOP: 67.1 Ft. BGS; BOTTOM: 86.0 Ft. BGS
- GROUT QUANTITY: Approximately 102 Gallons
- GROUT: TOP: 0.0 Ft.; BOTTOM: 62.8 Ft. BGS
- GROUT TYPE: 5% Bentonite Cement by Weight
- SCREEN TYPE: Sch. 40 PVC
- WELL SCREEN: Inches In Diameter: 2"; Linear Feet: 10.0'
- SLOT SIZE: 10 Slot
- WELL CASING: Inches In Diameter: 2"; Linear Feet: 74.9' To Ground Surface
- CASING TYPE: Sch. 40 PVC
- TOP OF CASING (AGS): 2.986 Ft.
- BOREHOLE (In. DIAMETER): 5" Nominal
- BOTTOM OF BOREHOLE (FT BGS): 86.0 Ft.
- ELEVATION (FT ABOVE MSL): 789.010 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-06
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES: 2442123.765E, 554760.469N
WEATHER: Clear TEMPERATURE: 84° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 052010 1135 COMPLETED: 052510 1130
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.	WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION*

ASH 0.0' - 36.8' BGS

SILTY CLAY 36.8' - 38.0' BGS

CLAY 38.0' - 42.0' BGS

POOR RECOVERY 42.0'-46.0' BGS

SILTY CLAY 46.0' - 48.0' BGS

POOR RECOVERY 48.0'-52.5' BGS

SILTY CLAY 52.5' - 53.2' BGS

SAND 53.2' - 62.5' BGS

SANDSTONE 62.5' - 62.7' BGS

SHALE 62.7' - 63.2' BGS

*For Further Lithology Detail, See Attached Boring Log

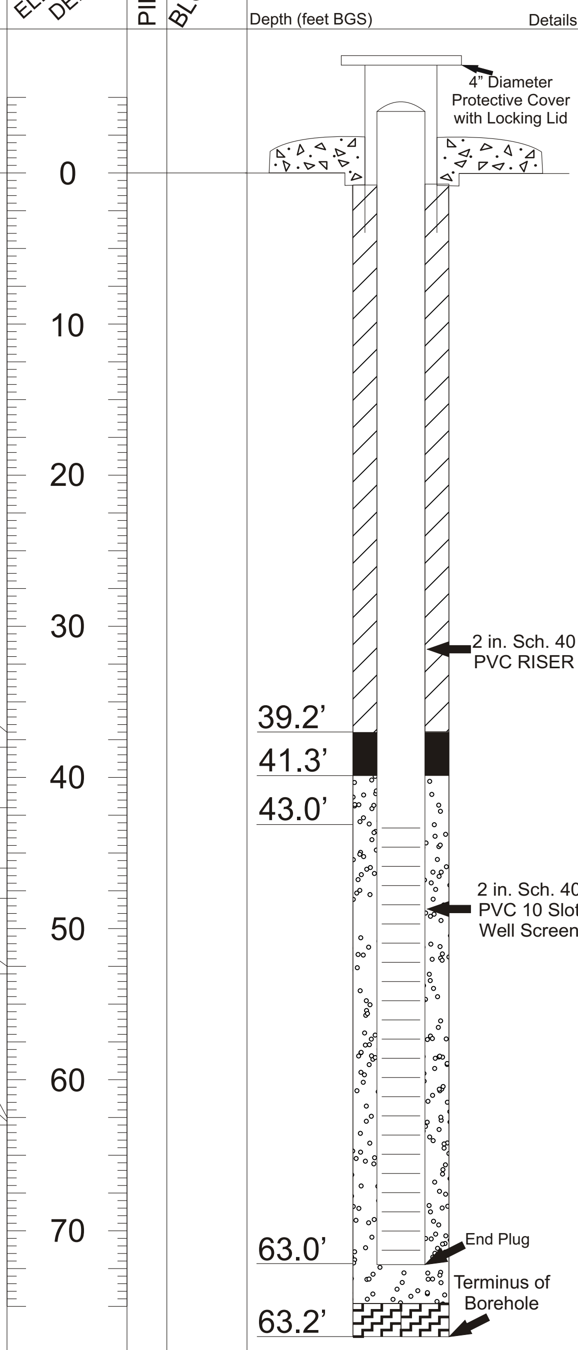

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 39.2 Ft. BGS BOTTOM: 41.3 Ft. BGS

FILTER PACK GRAINSIZE: #2 Sand

FILTER PACK: TOP: 41.3 Ft. BGS BOTTOM: 63.0 Ft. BGS

GROUT QUANTITY: Approximately 81 Gallons

GROUT: TOP: 0.0 Ft. BOTTOM: 39.2 Ft. BGS

GROUT TYPE: 5% Bentonite Cement by Weight

SCREEN TYPE: Sch. 40 PVC

WELL SCREEN: Inches In Diameter: 2" Linear Feet: 20.0'

SLOT SIZE: 10 Slot

WELL CASING: Inches In Diameter: 2" Linear Feet: 43.0' To Ground Surface

CASING TYPE: Sch. 40 PVC

TOP OF CASING (AGS): 2.716 Ft.

BOREHOLE (In. DIAMETER): 5" Nominal

BOTTOM OF BOREHOLE (FT BGS): 63.2 Ft.

ELEVATION (FT ABOVE MSL): 766.959 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-24
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger, Casing Advancer, Coring	LOCATION/COORDINATES: 2439786.537E, 556447.091N
WEATHER: Thunderstorms TEMPERATURE: 93° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME 072910 080210
DRILLER(s): S. Snow	DRILL RIG(s): Diedrich D-50	STARTED: 1647 COMPLETED: 1757

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.	WELL CONSTRUCTION
SEE TWP-04A and TWP-04B FOR DESCRIPTION 0.0' - 69.0' BGS	0 – 60			
CLAY 69.0' - 69.7' BGS				
SAND 69.7' - 71.0' BGS	70			
CLAY 71.0' - 71.45' BGS				
SAND 71.45' - 77.0' BGS				
NO RECOVERY 77.0' - 79.4' BGS				
LIMESTONE 79.4' - 79.6' BGS				
CHERT 79.6' - 82.18' BGS	80			
SHALE with INTERBEDDED LIMESTONE 82.18' - 87.18' BGS				
SHALE 87.18' - 97.18' BGS	90			
*For Further Lithology Detail, See Attached Boring Log	100			

WELL CONSTRUCTION — Depth (feet BGS) / Details

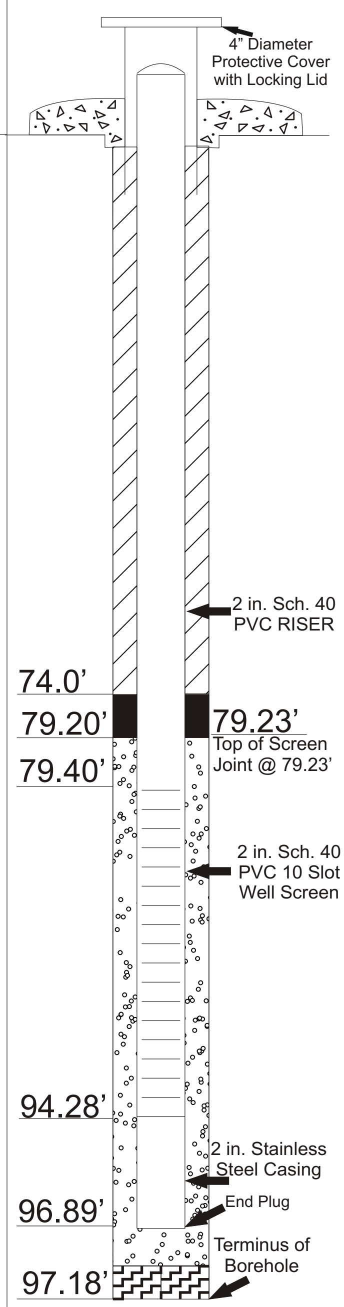

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 74.0 Ft. BGS	BOTTOM: 79.20 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 79.20 Ft. BGS	BOTTOM: 97.18 Ft. BGS
GROUT QUANTITY: Approx. 35 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 74.0 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear Feet 15.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear Feet 82.47' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 2.806 Ft.	
BOREHOLE (In. DIAMETER) 4" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 97.18 Ft.	
ELEVATION (FT ABOVE MSL): 783.208 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-25
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Rotosonic & Coring	LOCATION/COORDINATES: 2441047.078E, 555658.059N
WEATHER: Cloudy — TEMPERATURE: 90° F	DRILLING COMPANY: Tri-State Drilling & Major Drilling	DATE/TIME — STARTED #1: 072610 - 1308; COMPLETED #1: 072810 - 1210
DRILLER(s): S. Snow & D. Chamblee	DRILL RIG(s): Geoprobe 8140 DT & Diedrich D-50	STARTED #2: 080310 - 1355; COMPLETED #2: 080510 - 1710

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
	0		
ASH 0.0' - 50.0' BGS	10, 20, 30, 40		
NO RECOVERY 50.0' - 55.0' BGS	50		
ASH 55.0' - 61.9' BGS			
SILTY CLAY 61.9' - 66.2' BGS	60		
SAND 66.2' - 70.0' BGS			
SILTY SAND 70.0' - 72.7' BGS	70		
SAND 72.7' - 85.3' BGS	80		
SANDSTONE 85.3' - 85.5' BGS			
SHALE 85.5' - 91.5' BGS			
LIMESTONE 91.5' - 91.8' BGS	90		
SHALE 91.8' - 115.5' BGS	100, 110		
*For Further Lithology Detail, See Attached Boring Log	120		

WELL CONSTRUCTION

Depth (feet BGS) — Details

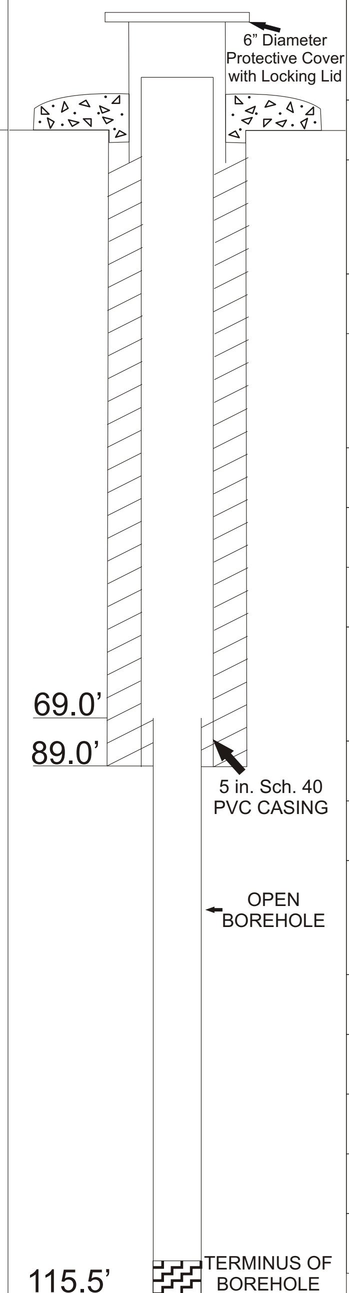

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: Not Applicable	BOTTOM: Not Applicable
FILTER PACK GRAINSIZE: Not Applicable	
FILTER PACK: TOP: Not Applicable	BOTTOM: Not Applicable
GROUT QUANTITY: Approximately 141 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 89.0 Ft. Bgs
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Not Applicable	
WELL SCREEN: Inches In Diameter: Not Applicable	Linear Feet: N/A
SLOT SIZE: Not Applicable	
WELL CASING: Inches In Diameter: 5"	Linear Feet: 89.0' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): .050 Ft.	
BOREHOLE (In. DIAMETER): 4" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 115.5 Ft.	
ELEVATION (FT ABOVE MSL): 788.926 Ft.	

Legend: SLOUGH — FIRST STAGE GROUT — SECOND STAGE GROUT — SAND — CEMENT PAD — BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-26
GEOLOGIST: R. Josefczyk, R. Lee, & M. Martin	DRILLING METHOD: Rotosonic & Coring	LOCATION/COORDINATES: 2442112.667E, 554745.915N
WEATHER: Partly Cloudy — TEMPERATURE: 86° F	DRILLING COMPANY: Major Drilling & Tri-State Drilling	DATE/TIME — STARTED #1: 072010 - 1409; COMPLETED #1: 072310 - 1000
DRILLER(s): W. Casteel, D. Chamblee, & S. Snow	DRILL RIG(s): Geoprobe 8140 DT & Diedrich D-50	STARTED #2: 072710 - 1539; COMPLETED #2: 072910 - 1412

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
NO RECOVERY 0.0' - 5.0' BGS	0		
ASH 5.0' - 10.0' BGS			
BOTTOM ASH 10.0' - 17.5' BGS	10		
ASH 17.5' - 20.0' BGS	20		
NO RECOVERY 20.0' - 30.0' BGS			
BOTTOM ASH 30.0' - 35.0' BGS	30		
ASH 35.0' - 40.0' BGS			
SILT 40.0' - 44.8' BGS	40		
SAND 44.8' - 70.0' BGS	50, 60		
NO RECOVERY 70.0' - 80.0' BGS	70		
CLAY 80.0' - 83.0' BGS	80		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 83.0' - 113.0'BGS	90, 100, 110		
*For Further Lithology Detail, See Attached Boring Log	120		

WELL CONSTRUCTION

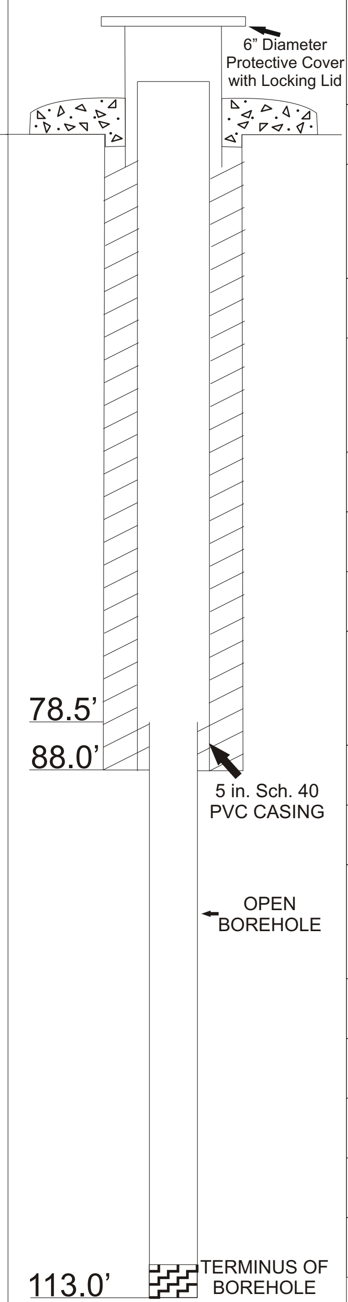

Diagram Not To Scale

MATERIALS INVENTORY

- BENTONITE SEAL: TOP: Not Applicable; BOTTOM: Not Applicable
- FILTER PACK GRAINSIZE: Not Applicable
- FILTER PACK: TOP: Not Applicable; BOTTOM: Not Applicable
- GROUT QUANTITY: Approximately 140 Gallons
- GROUT: TOP: 0.0 Ft.; BOTTOM: 88.0 Ft. BGS
- GROUT TYPE: 5% Bentonite Cement by Weight
- SCREEN TYPE: Not Applicable
- WELL SCREEN: Inches In Diameter: Not Applicable; Linear Feet: N/A
- SLOT SIZE: Not Applicable
- WELL CASING: Inches In Diameter: 5"; Linear Feet: 88.0' To Ground Surface
- CASING TYPE: Sch. 40 PVC
- TOP OF CASING (AGS): 3.343 Ft.
- BOREHOLE (In. DIAMETER): 4" Nominal
- BOTTOM OF BOREHOLE (FT BGS): 113.0 Ft.
- ELEVATION (FT ABOVE MSL): 767.125 Ft.

SLOUGH — FIRST STAGE GROUT — SECOND STAGE GROUT — SAND — CEMENT PAD — BENTONITE

APPENDIX C

Geochemical and Geotechnical Lab Results

Chemical and Mineralogical Characterization of Core Samples from Kingston Fossil Plant. Randolph W. Shannon. Pittsburgh Mineral & Environmental Technology, Inc. August 11, 2010

Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project. Daniel B. Stephens & Associates, Inc. August 6, 2010

Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project. Daniel B. Stephens & Associates, Inc. September 14, 2010

Pittsburgh
Mineral &
Environmental
Technology, Inc.

August 11, 2010

J. Mark Boggs
TVA WT 9D-K
400 West Summit Hill Drive
Knoxville, TN 37902

Dear Mr. Boggs:

The report summarizes and concludes PMET's work on the mineralogical and geochemical analysis of nine core samples from the Kingston Fossil Plant in Tennessee. Please contact us if you require additional information or further services on this project. We appreciate this opportunity to work with you and look forward to serving your future needs.

Sincerely,

Randolph W. Shannon
Laboratory Manager

Attachment

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New Brighton, PA
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www.pmet-inc.com

PREPARED FOR:

TENNESSEE VALLEY AUTHORITY

CHEMICAL AND MINERALOGICAL CHARACTERIZATION OF CORE SAMPLES FROM KINGSTON FOSSIL PLANT

By

Randolph W. Shannon

Project 0M35
August 11, 2010

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BACKGROUND AND OBJECTIVE

On April 20, 2010 pursuant to a request from Mr. Matthew Williams, PE of the Tennessee Valley Authority (TVA) PMET, Inc. submitted a proposal for soil analysis of nine drill core samples from the Kingston Fossil Plant.

The laboratory work was summarized in PMET's quotation to Mr. Williams and included the following:

Mineralogical Characterization

1. quantitative bulk mineralogy by x-ray diffraction and Rietveld whole pattern refinement
2. polarized light microscopy of polished sections

Chemical Characterization

3. percent free iron oxide per Chao & Zhou
4. cation exchange capacity
5. exchangeable cations
6. calcite equivalent soluble salts
7. soil pH

SAMPLES RECEIVED

The drill core samples were received in five separate shipments under chain-of-custody from Ramona Josefczyk at the Kingston Fossil Ash Recovery Operations. A copy of the chain-of-custody documents is attached to this report.

Each sample was logged in the PMET, Inc. chain-of-custody file and RFA logbook and given a unique identification number. The sample identification and COC is shown in the table below.

Table 1
Sample Identification

PMET I.D.	TVA KIF-	COC#	Received
5575-1	GP23-16-38-SL-042610	TVA-MWI-042610	04/28/10
5575-2	GP16-28.0-32.0-SL-050310	TVA-MWI-050310	05/06/10
5575-3	GP16-42.0-52.0-SL-050410	TVA-MWI-505310	05/06/10
5575-4	TWP04A-58-68-SL-051010	TVA-MWI-051010A	05/14/10
5575-5	TWP04A-72-78-SL-051010	TVA-MWI-051010A	05/14/10
5575-6	TWP05-78-85-SL-051810	TVAMWI0518Y10A	05/24/10
5575-7	TWP05-61-66-SL-051710	TVAMWI0518Y10A	05/24/10
5575-8	TWP06-38-51-SL-052010	TVAMWI0520Y10A	05/27/10
5575-9	TWP06-51-60-SL-052410	TVAMWI0524Y10A	05/27/10

DISCUSSION OF RESULTS

Sample Preparation

The samples were received in quart jars at ambient temperature. The sample material was removed to stainless steel pans and dried at 50°C to determine moisture content.

Table 2
Moisture Content

Sample I.D.	As-received Wt.	Dry Wt.	% Moisture
5575-1	6711.8	5204.5	22.5%
5575-2	7156.6	5851.0	18.2%
5575-3	7821.3	6315.8	18.7%
5575-4	7139.7	5855.5	18.0%
5575-5	4524.6	3797.0	16.1%
5575-6	7356.0	6081.3	17.3%
5575-7	7779.1	6491.8	16.6%
5575-8	5543.8	4419.9	20.3%
5575-9	8012.2	6597.4	17.7%

The dried material was deagglomerated using a large ceramic mortar and pestle. The sample material was split into analytical aliquots using a rotary riffle splitter. The reject material was returned to the original container.

Mineralogical Characterization

Sample material for x-ray diffraction was pulverized in a tungsten carbide ring and puck mill. The pulped material was then spiked with calcium fluoride. The samples were scanned from 5° to 58° two-theta using a Siemens D500 diffractometer operating at 35ma and 45 kv. The diffractograms were analyzed for phase composition using Bruker AXS proprietary search/match software. The phases were quantified using Bruker AXS proprietary Rietveld whole pattern refinement software. The amorphous content was calculated using a ratio of the fluorite spike to the analytical result. An image of each diffractogram with the Rietveld refinement result is attached to this report. The results of mineralogical analysis are shown in Table 3 below.

The results show that the soil samples consist of mostly quartz with trace amounts of feldspar and plagioclase in a micaceous silt to clay matrix. The clay contains small amounts of crystalline kaolinite and mica with large amounts of non-crystalline amorphous clay material. A clay analysis was not requested for this project. There may be small amounts of glass along with the clay in the amorphous fraction.

Sample 5575-1 is an exception to the general character of the soil samples. This sample appears to mostly contain common fly ash minerals and a high concentration of amorphous glassy phases, which is also typical of fly ash. There are also iron sulfides present, which are usually found in uncombusted coal.

Table 3
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	Nominal Atomic Formula	5575-1	5575-8
Quartz	SiO_2	5.5	55.8
K-feldspar	$KAlSi_3O_8$	0.0	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.0	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	0.0	6.7
Kaolinite	$Al_2Si_2O_5(OH)_4$	0.0	4.0
Anatase	TiO_2	0.0	0.4
Hematite	Fe_2O_3	3.4	0.3
Magnetite	Fe_3O_4	4.4	0.2
Mullite	$Al_6Si_2O_{13}$	17.3	1.1
Pyrite	FeS_2	2.0	0.2
Marcasite	FeS_2	1.3	0.0
Amorphous	Glass/clay	66.1	28.7

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	Nominal Atomic Formula	5575-2	5575-3	5575-4	5575-5
Quartz	SiO_2	63.3	77.5	59.7	81.4
K-feldspar	$KAlSi_3O_8$	1.3	0.4	5.3	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.2	0.0	1.6	0.6
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	5.9	2.4	6.1	1.4
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.5	0.7	3.1	1.1
Anatase	TiO_2	0.2	0.0	0.2	0.1
Hematite	Fe_2O_3	0.4	0.2	0.3	0.0
Amorphous	Glass/clay	25.2	18.8	23.7	14.0

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	Nominal Atomic Formula	5575-6	5575-7	5575-9
Quartz	SiO_2	76.7	67.5	72.3
K-feldspar	$KAlSi_3O_8$	1.2	2.1	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.7	0.7	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	1.8	4.9	3.9
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.1	2.6	2.2
Anatase	TiO_2	0.3	0.3	0.2
Hematite	Fe_2O_3	0.0	0.3	0.2
Amorphous	Glass/clay	17.2	21.6	18.6

A mineralogical analysis of the sample material was also conducted using optical microscopy of polished cross sections. The sample material was deslimed and mounted in epoxy to obtain polished sections. The sections were examined using an ore microscope with reflected light and an air objective with a polarizer. Images of opaque materials were recorded with a digital camera and are shown at the end of this report.

The optical microscopy analysis found that ash particles were present in most samples. The table below contains estimates of the volume of opaque materials contained in the sample. Estimation was based on method derived from Williams,H., Turner,F.J., Gilbert,C.M., 1982, Petrography, p.593-597.

Table 4
Optical Microscopy Results
Opaque Mineral Content
Estimated Volume %

Mineral Phase	5575-1	5575-2	5575-3	5575-4	5575-5	5575-6	5575-7	5575-8	5575-9
Anatase	-	0.2	0.05	0.15	0.1	0.1	0.1	0.1	0.4
Iron oxide spheres	10	00.1	0.02	0.2	0.05	0.1	0.3	0.5	0.2
Iron fragments	-	0.01	-	0.03	-	-	-	0.05	-
Pyrite/Marcasite	2.5	0.02	-	-	-	-	-	0.7	-
Graphite	-	0.01	-	-	-	-	-	0.03	0.05
Glassy ash	80	-	0.02	15	-	0.01	1	11	1
Ceramic stone	-	-	-	-	0.1	-	-	-	-

Geochemical Analysis

A five hundred gram aliquot was split from the head sample for geochemical analysis. This sample was submitted to Activation Laboratories, LTD for chemical analysis under chain-of-custody. The results are summarized in Table 4 below. A copy of the original report of results from Activation Labs is attached at the end of this report.

Table 4
Results of Chemical Analysis

PMET I.D.	Soil	Free FeOx	CEC	Exchangeable Cations meq/100g				
	pH	%	meq/100g	Na	Mg	Al	K	Ca
5575-1	6.02	0.0741	0.4	<0.1	<0.1	<0.1	<0.1	0.7
5575-2	5.12	0.0232	0.4	<0.1	0.2	0.1	<0.1	0.5
5575-3	4.69	0.0187	0.1	<0.1	<0.1	<0.1	<0.1	0.1
5575-4	7.15	0.0625	0.2	<0.1	0.5	<0.1	<0.1	1.0
5575-5	6.40	0.0503	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-6	5.75	0.0498	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-7	5.39	0.0406	<0.1	<0.1	0.1	0.2	<0.1	0.2
5575-8	6.09	0.1390	0.3	<0.1	0.4	<0.1	<0.1	0.5
5575-9	4.90	0.1140	<0.1	<0.1	0.1	<0.1	<0.1	0.2

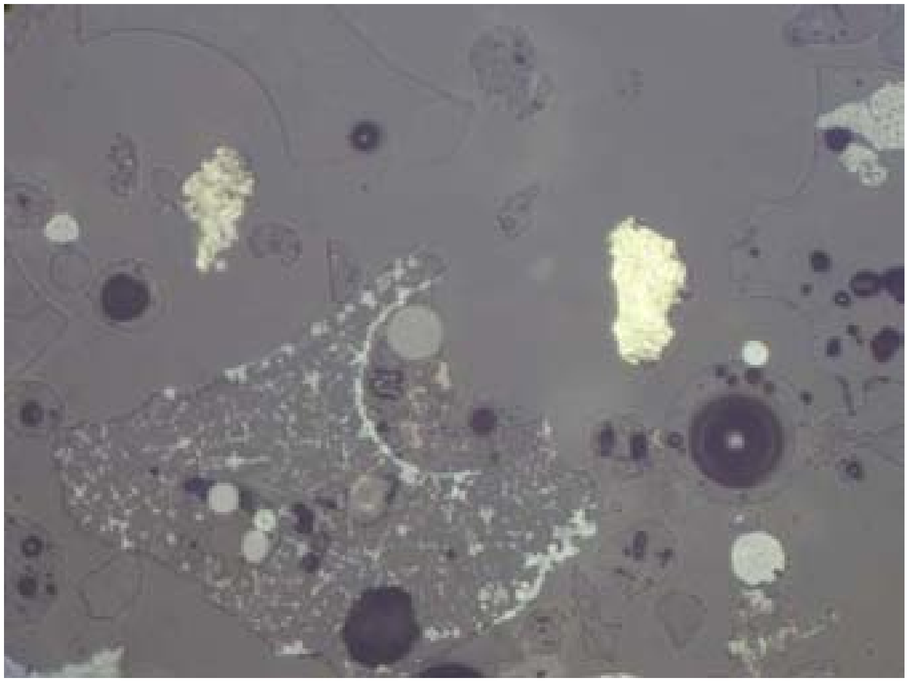
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts					
	Ca	Mg	Na	K	Al	Mn
	mg/L	mg/L	mg/L	mg/L	%	ppm
5575-1	138	7.91	1.29	4.94	<0.01	0.99
5575-2	10.4	2.57	0.75	1.14	0.02	0.88
5575-3	8.23	1.85	0.51	1.05	0.05	0.94
5575-4	6.24	2.36	8.91	0.63	<0.01	0.09
5575-5	3.56	0.66	2.76	1.26	0.05	0.15
5575-6	<0.1	0.4	1.0	0.9	0.07	0.05
5575-7	<0.1	0.1	0.5	0.4	<0.01	0.30
5575-8	3.7	10.0	2.2	5.3	<0.01	1.48
5575-9	1.0	0.4	4.1	1.5	<0.01	0.07

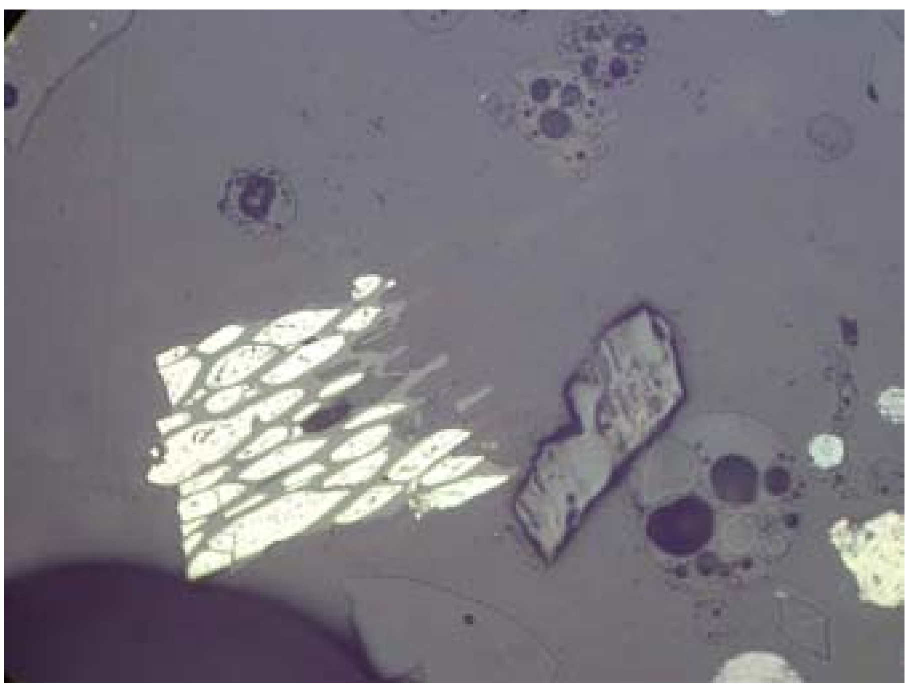
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts						
	BO_3^{-3}	Cl^{-1}	NO_3^{-1} (as N)	SO_4^{-2}	$CaCO_3$	CO_3^{-2}	HCO_3^{-1}
	µg/L	µg/g	µg/g	µg/g	mg/L	mg/L	mg/L
5575-1	<500	3.56	0.23	1900	7	<1	7
5575-2	<500	3.22	0.17	185	<2	<1	2
5575-3	<500	2.72	0.07	153	<2	<1	1
5575-4	<500	1.81	<0.05	96.1	15	<1	15
5575-5	<500	2.18	0.05	65.5	5	<1	5
5575-6	<500	3.93	0.18	26.5	6	<1	6
5575-7	600	2.35	0.12	9.54	5	<1	5
5575-8	8100	2.88	0.07	315	8	<1	8
5575-9	<500	1.42	0.09	38.2	5	<1	5

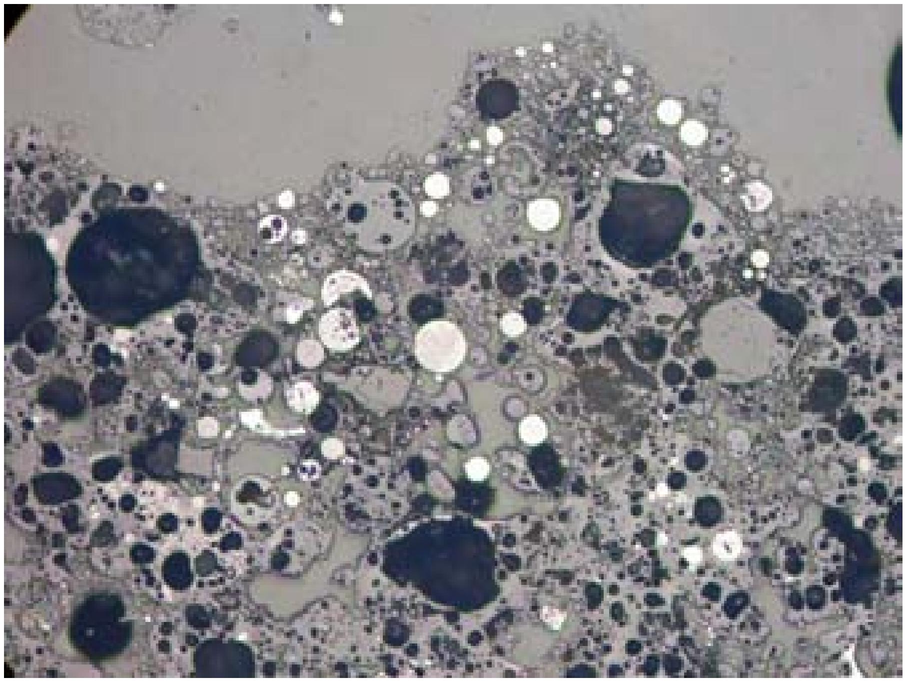
Polarized Light Microscopy Optical Images



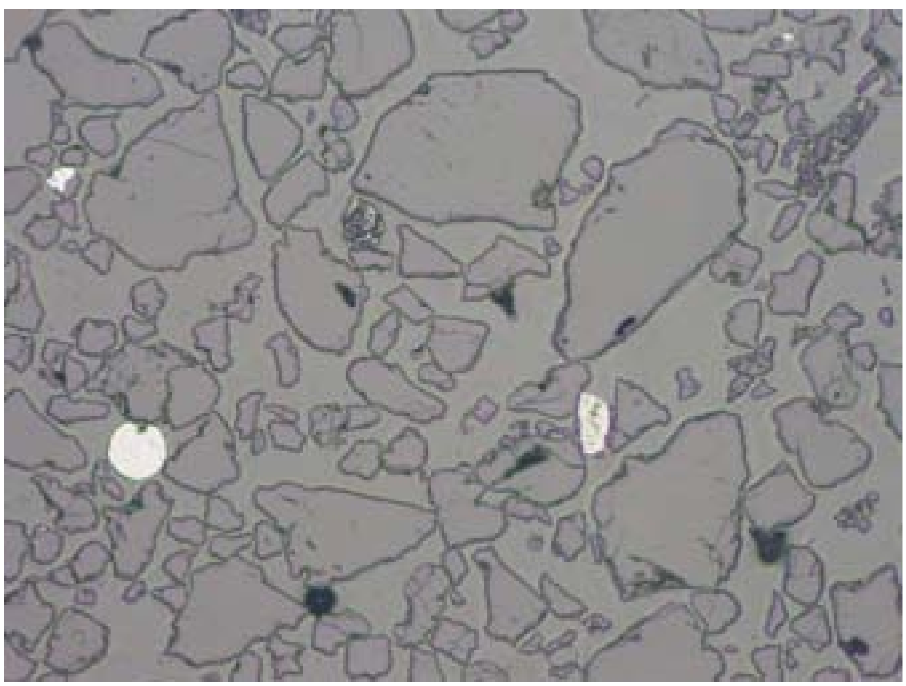
Light Optical Image Figure 1 Scale 1cm = 600µ
5575-1 Ash particles with iron oxide and glass spheres (center), marcasite grains (yellow)



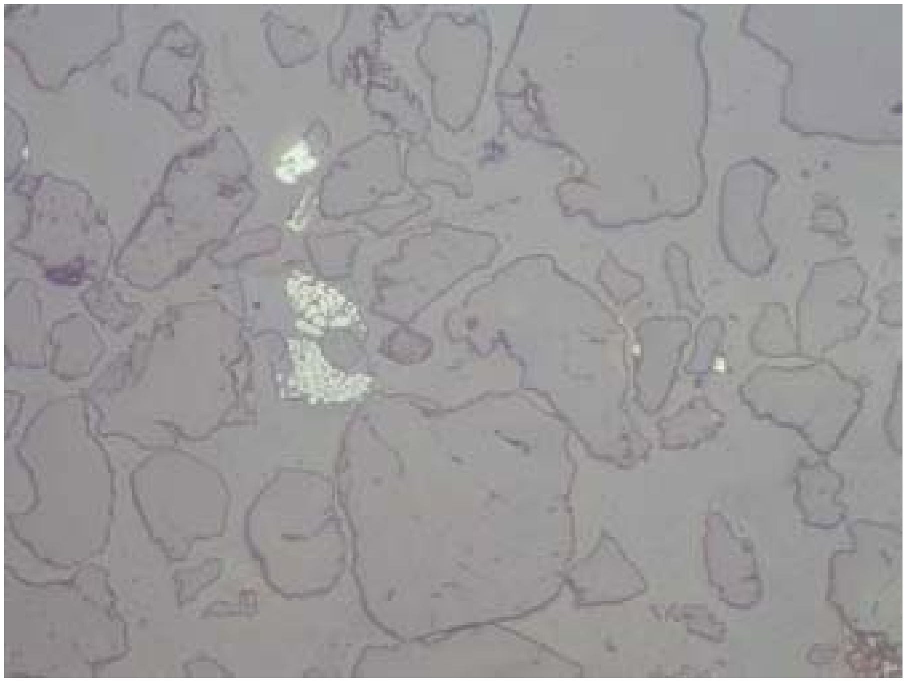
Light Optical Image Figure 2 Scale 1cm = 600µ
5575-1 Pyrite replacement in wood structure (light yellow), ash particles with spherical voids, rock fragment (right center)



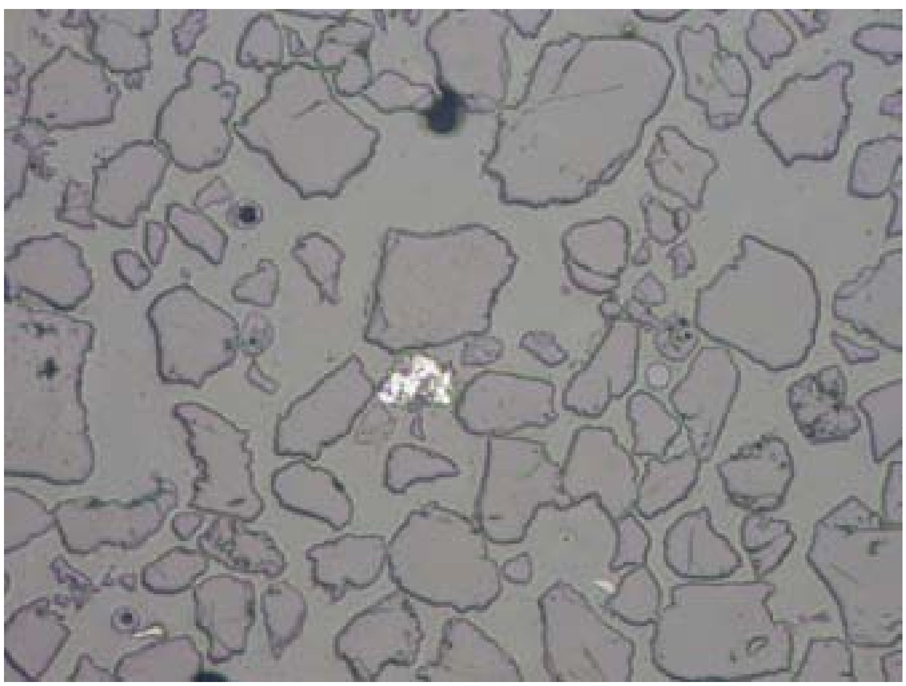
Light Optical Image Figure 3 Scale 1cm = 1300μ
5575-1 Composite ash particle with spherical voids (black),
glass spheres (gray), and iron oxide spheres (white)



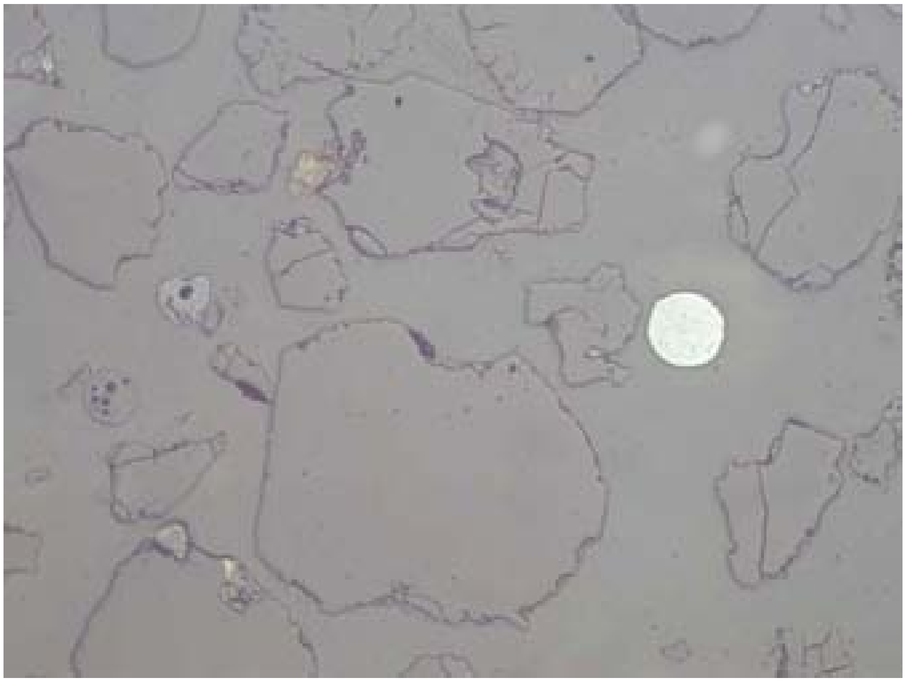
Light Optical Image Figure 4 Scale 1cm = 1300μ
5575-2 Anatase grain (right center)
spherical iron oxide (left center)
with optically transparent minerals (gangue)



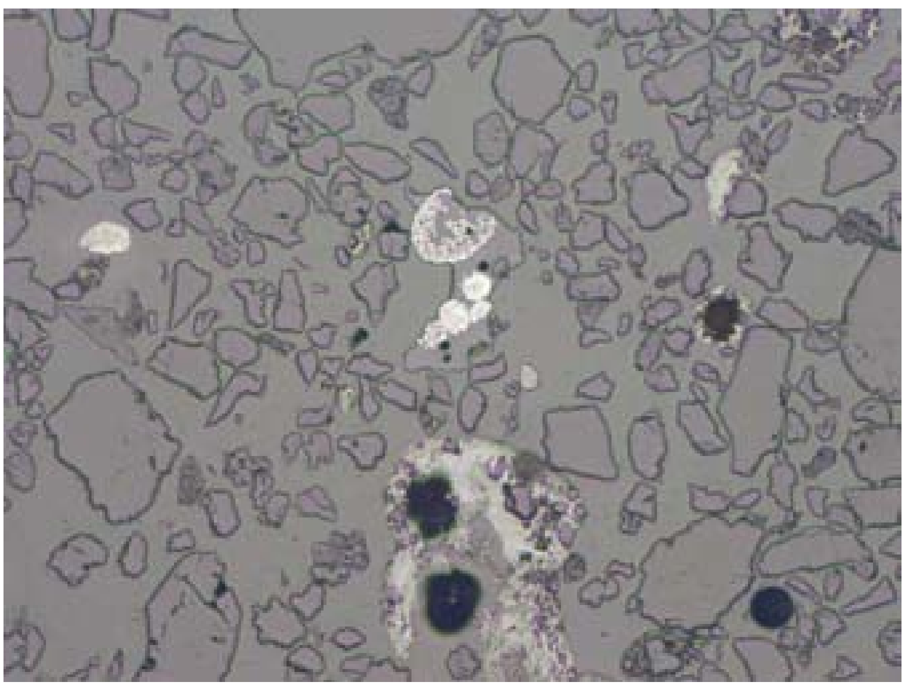
Light Optical Image Figure 5 Scale 1cm = 600μ
5575-2 Anatase grain (top center),
glassy ash particles (center), gangue



Light Optical Image Figure 6 Scale 1cm = 1300μ
5575-3 Anatase grain (center),
spherical ash particles (right center, left center), gangue

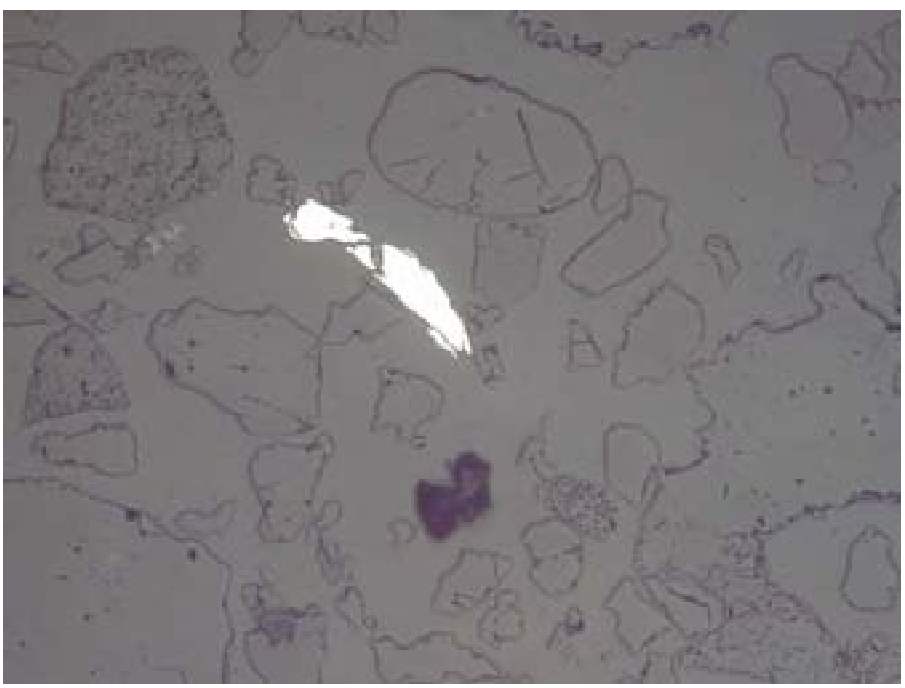


Light Optical Image Figure 7 Scale 1cm = 600µ
5575-4 Spherical iron oxide, gangue

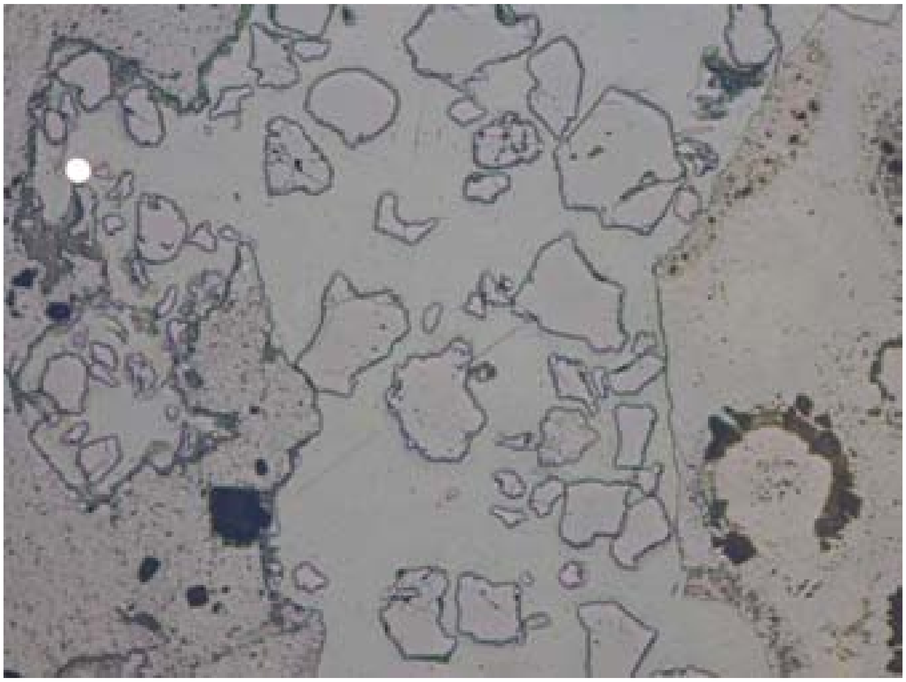


Light Optical Image Figure 18 Scale 1cm = 1300µ
5575-4 Ash particles and spherical iron oxide, gangue

Light Optical Image Figure 9 Scale 1cm = 600μ
5575-4 Anatase particle (center),
ash sphere (top center), gangue

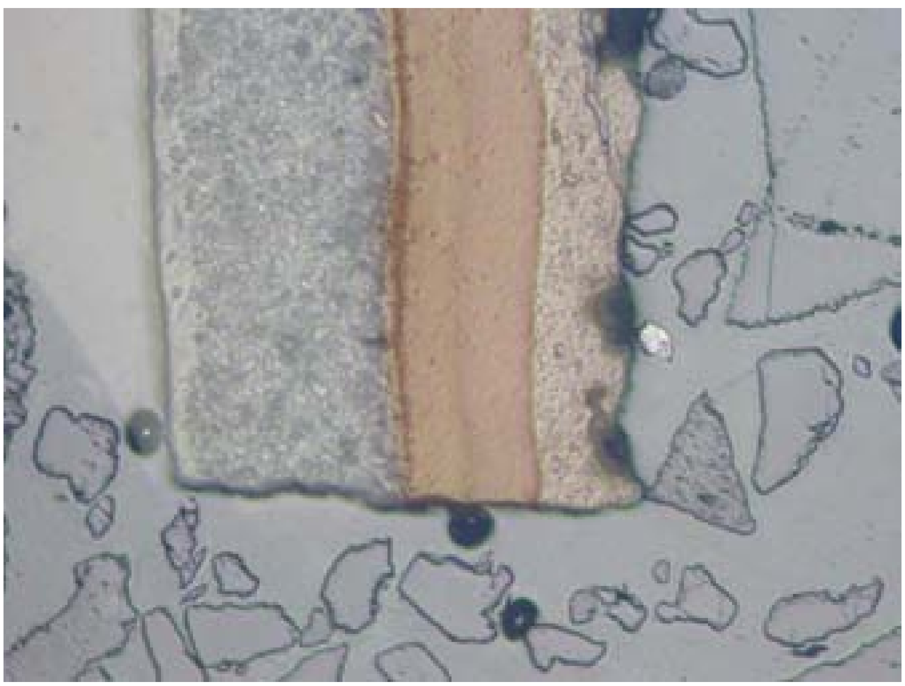


Light Optical Image Figure 10 Scale 1cm = 600μ
5575-4 Iron fragment, gangue



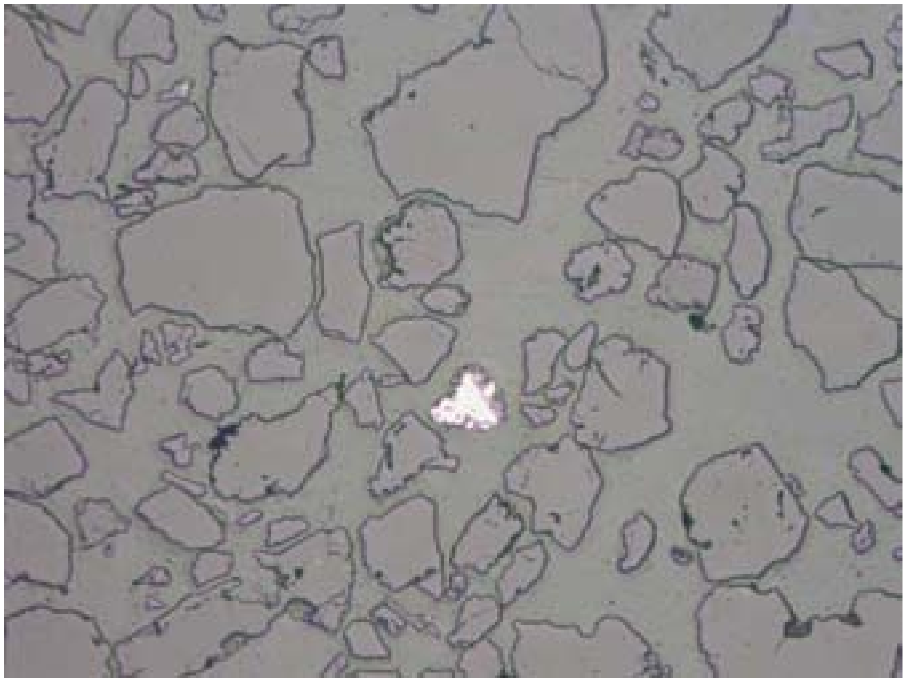
Light Optical Image Figure 11 Scale 1cm = 1300µ

5575-5 Iron oxide sphere (top left),
large glass particle with spherical voids (right), gangue

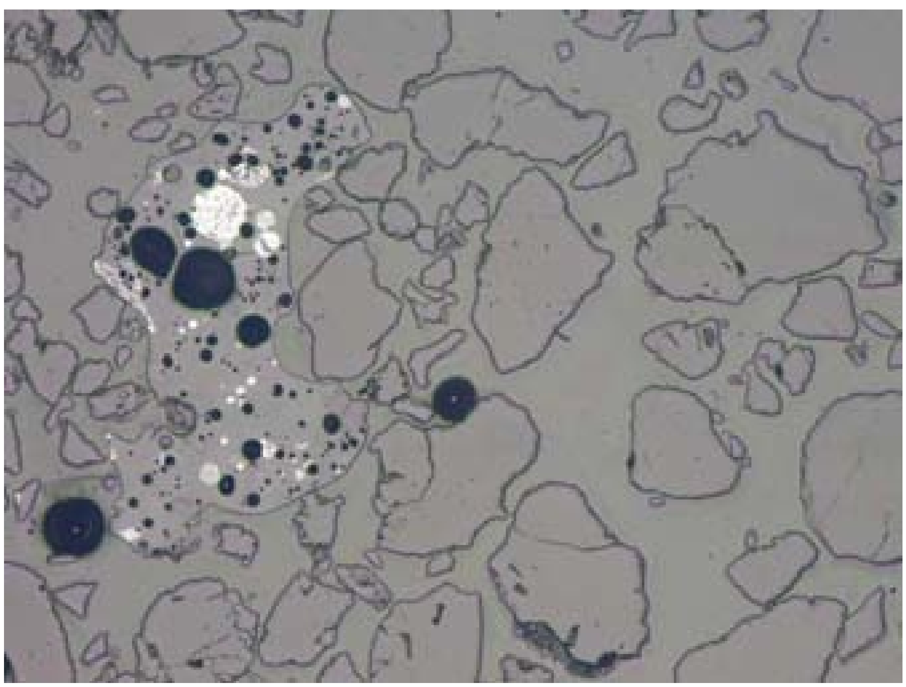


Light Optical Image Figure 12 Scale 1cm = 1300µ

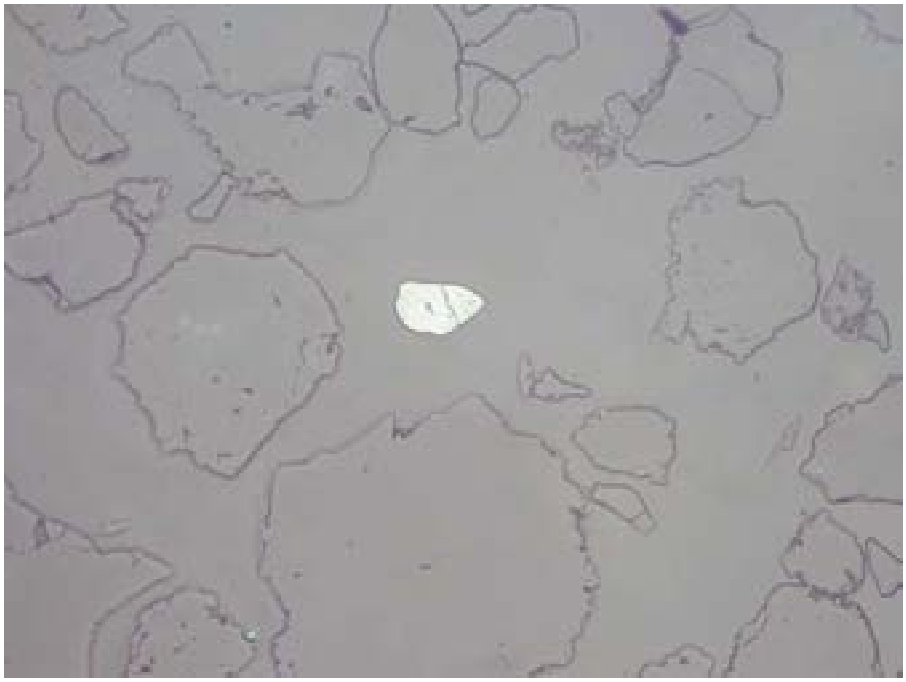
5575-5 Large ceramic composite fragment,
spherical hematite particle (right center), gangue



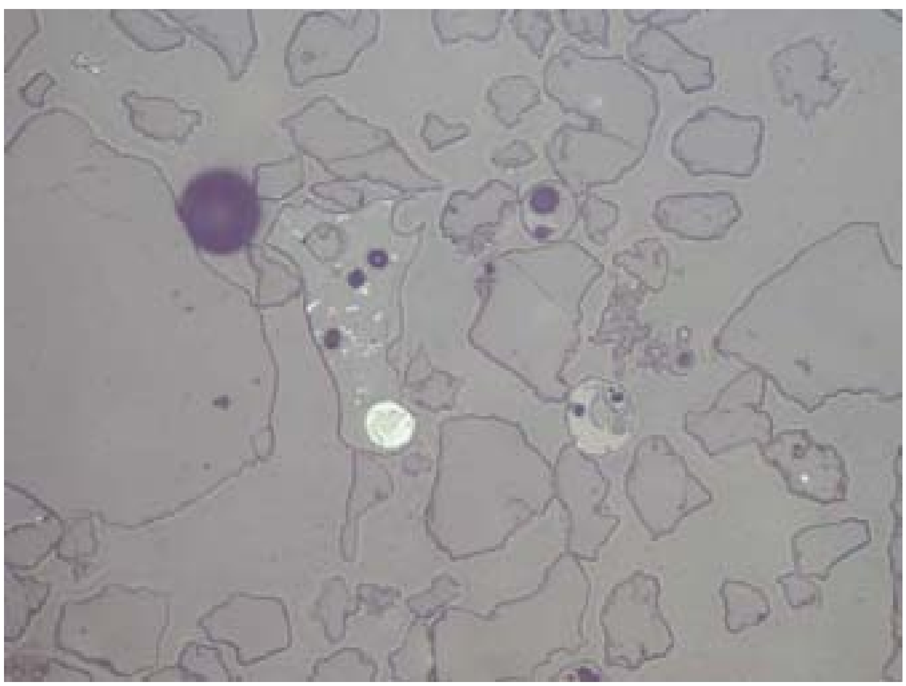
Light Optical Image Figure 13 Scale 1cm = 1300µ
5575-6 Anatase particle, gangue



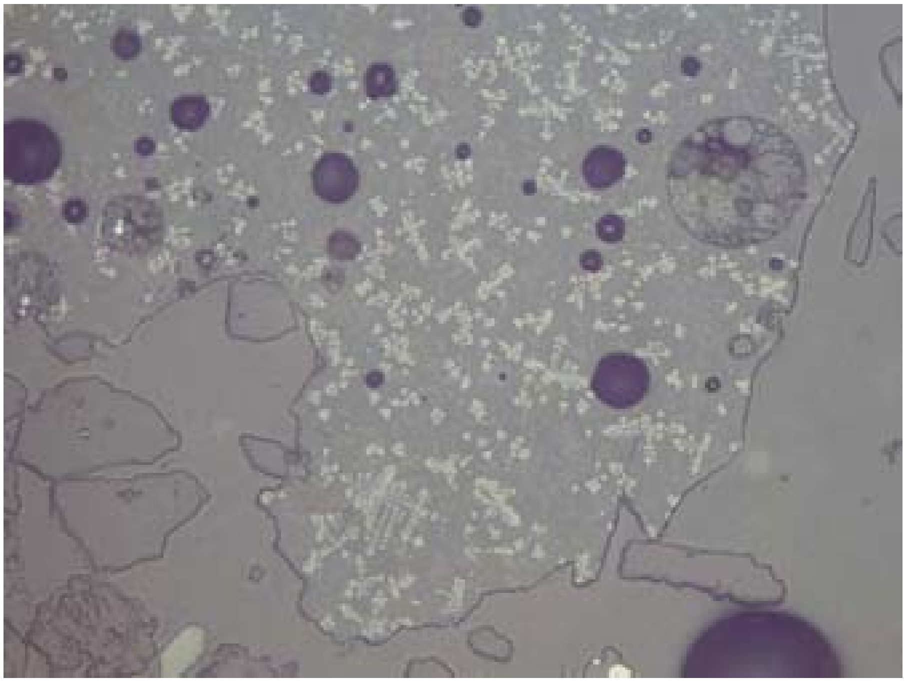
Light Optical Image Figure 14 Scale 1cm = 1300µ
5575-7 Large ash particle with iron oxide spheres and voids, gangue



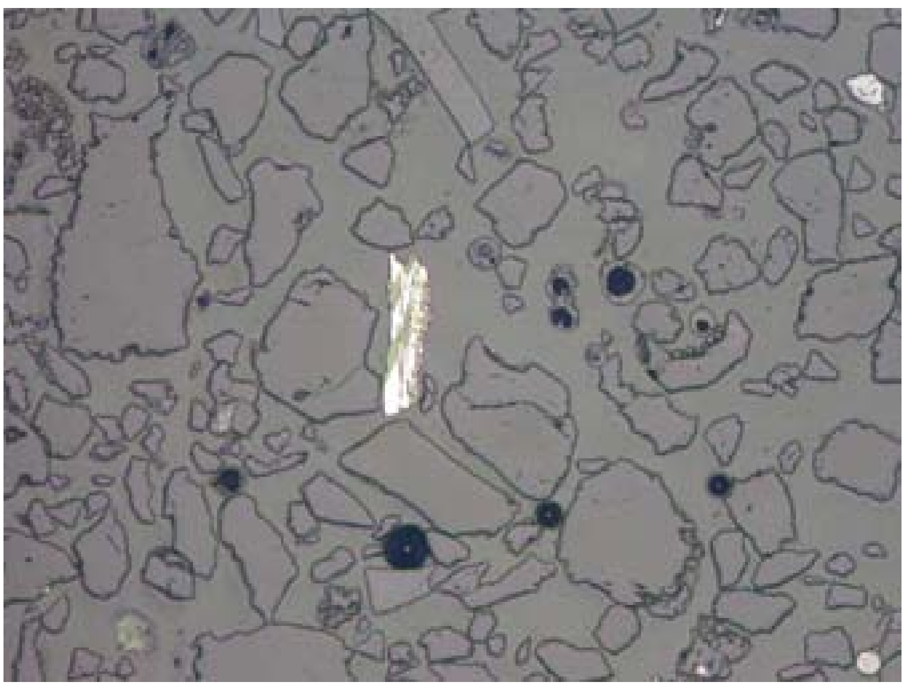
Light Optical Image Figure 15 Scale 1cm = 600µ
5575-7 Anatase particle, gangue



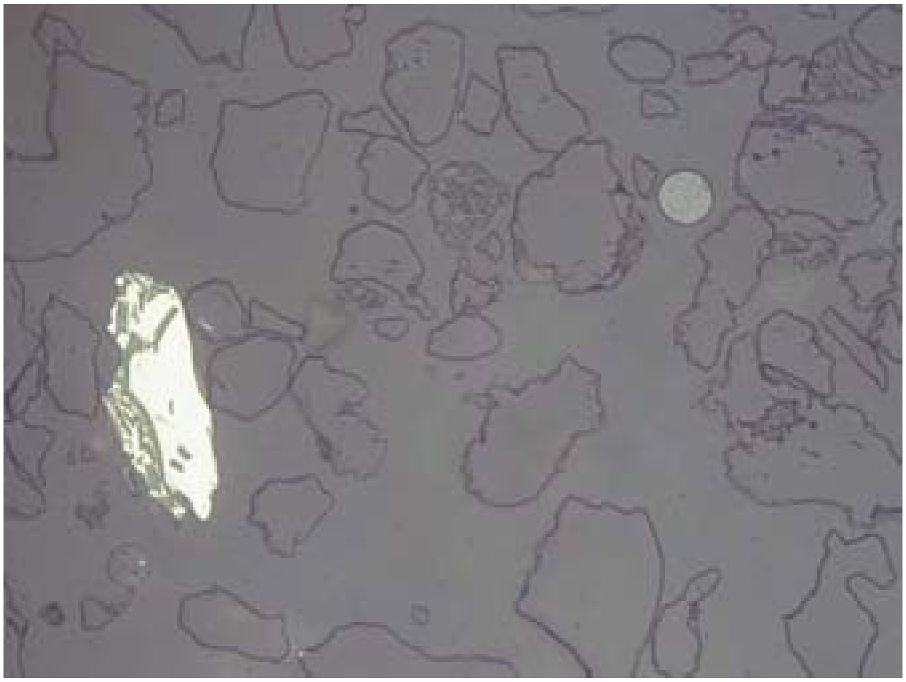
Light Optical Image Figure 16 Scale 1cm = 600µ
5575-8 Glassy ash particle containing magnetite crystallites, iron oxide spheres, and voids (center), glass sphere (center right), gangue



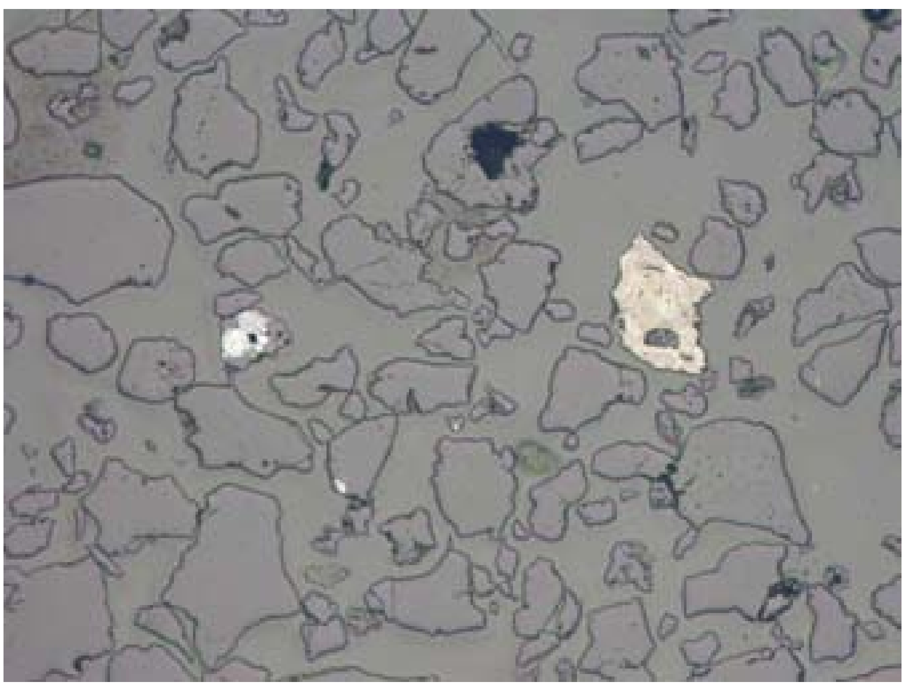
Light Optical Image Figure 17 Scale 1cm = 600µ
5575-8 Large glassy ash particle containing magnetite crystals (light gray), voids, and ash-filled void (top right), gangue



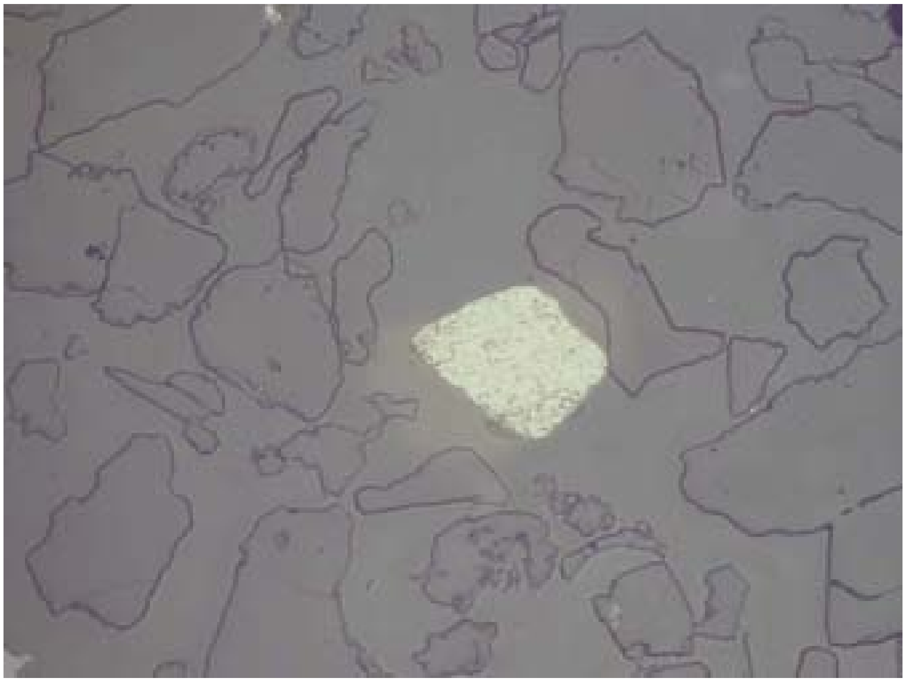
Light Optical Image Figure 18 Scale 1cm = 600µ
5575-8 Elongated pyrite (center), ash spheres (center right), gangue



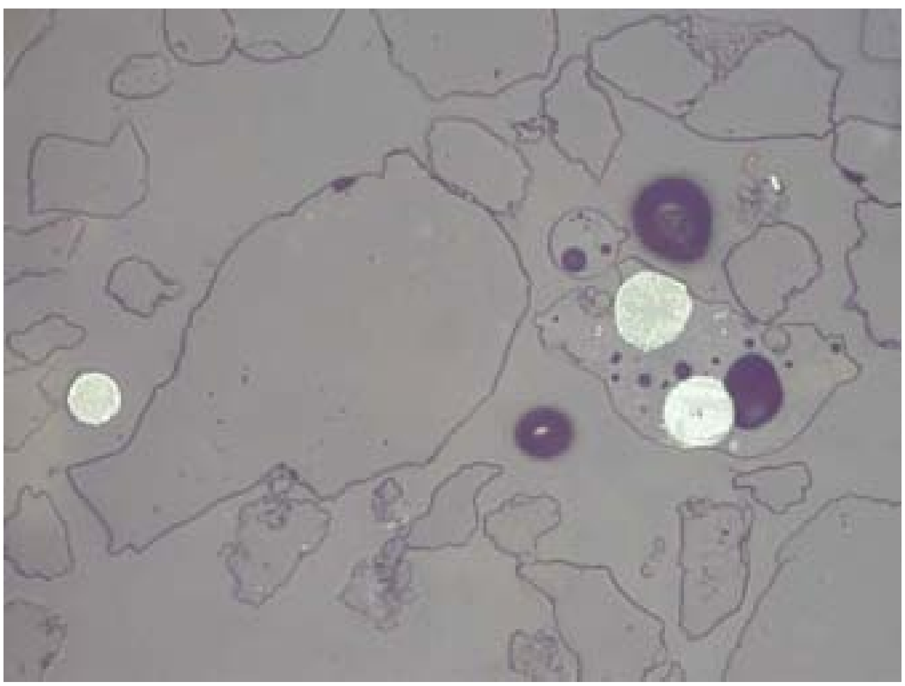
Light Optical Image　　Figure 19　　Scale 1cm = 600µ
5575-8 Large pyrite particle (left), spherical iron oxide (rght),
gangue



Light Optical Image　　Figure 20　　Scale 1cm = 1300µ
5575-9 Large graphite particle with ash-filled void (center right),
ash particle with iron oxide crystals (center left)
gangue



Light Optical Image Figure 21 Scale 1cm = 600μ
5575-9 Large anatase grain, gangue



Light Optical Image Figure 22 Scale 1cm = 600μ
5575-9 Ash particle with spherical voids and iron oxide spheres (center right), iron oxide sphere (center left), gangue

APPENDIX

Optical microscope scale

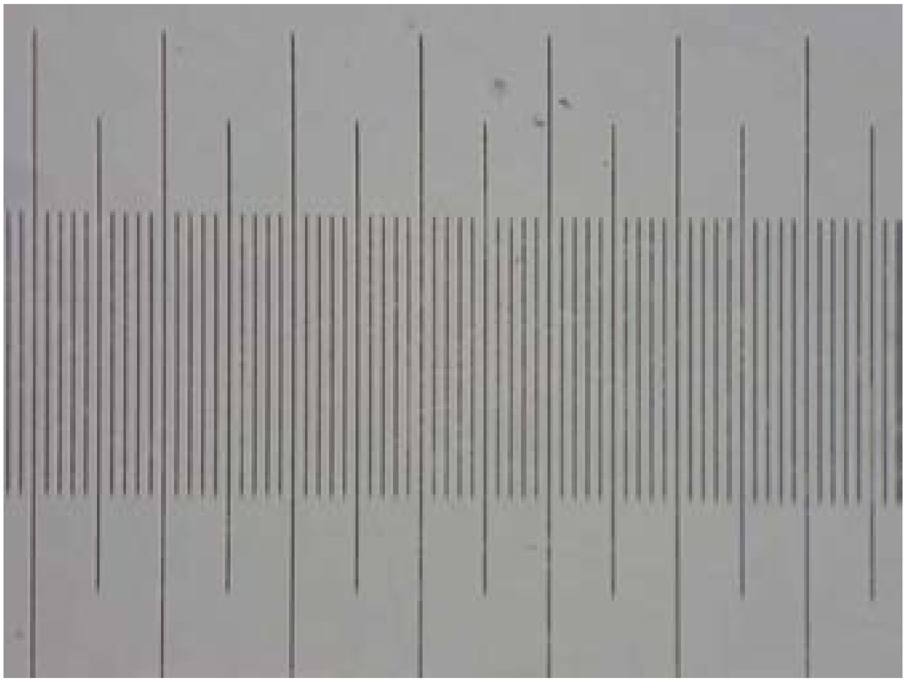


Figure 1
Scale: Reflected light, 20X air objective, 0.64 zoom, polarized

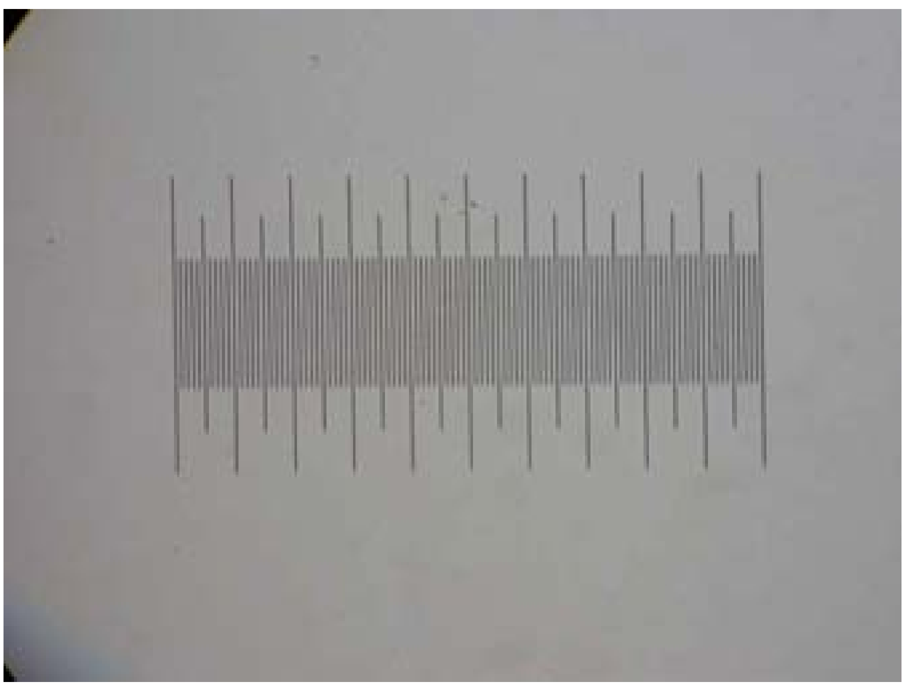
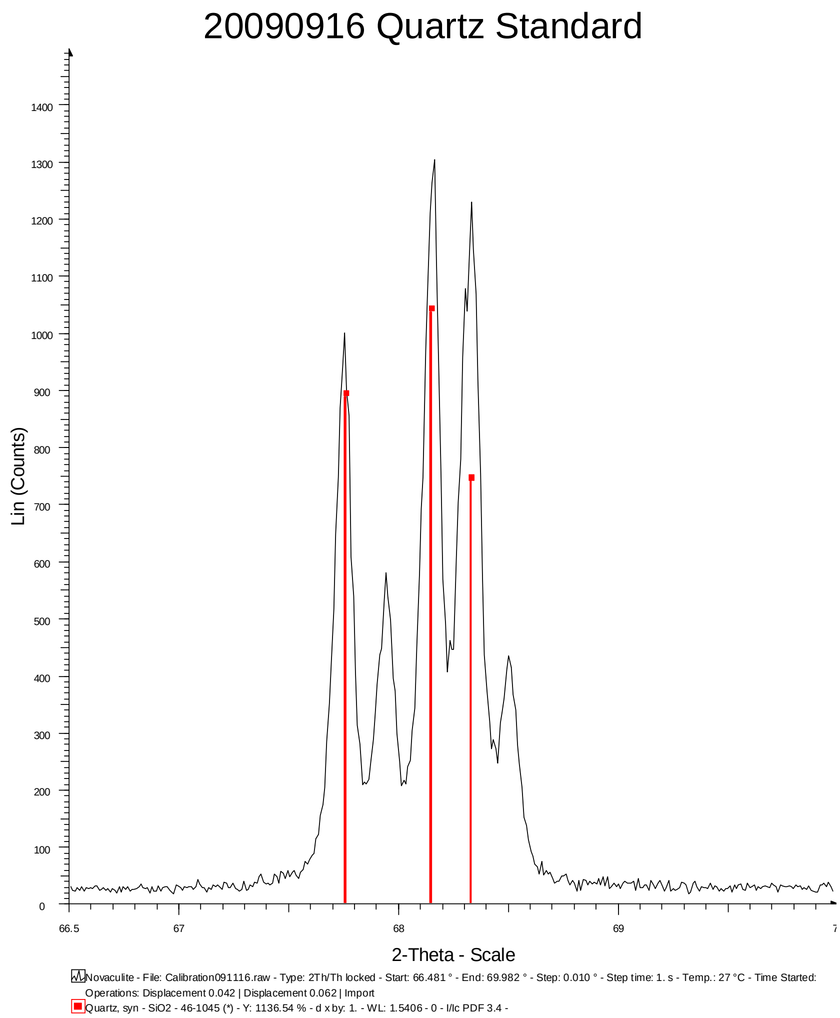


Figure 2
Scale: Reflected light, 10X air objective, 1.56 zoon, polarized

XRD Calibration Standard



Pittsburgh Mineral & Environmental Technology, Inc.

Standard Field Sampling Protocol for Geochemical Testing of Soils

1. Client must provide a representative sample consisting of drill core splits. Splits may consist of half or quartered core length or interval segments.

2. For sieve analysis one separate five-gallon bucket of material is required.

3. For geochemical properties a one to two kilogram sample is required.

4. As-is material should be removed immediately to a wide mouth polyethylene bottle and sealed with a screw cap to prevent sample reaction with atmospheric gases.

5. Sample container must be labeled with identification that is identical to the chain-of-custody log.

PMET Lab Sampling Protocol for Geochemical Testing

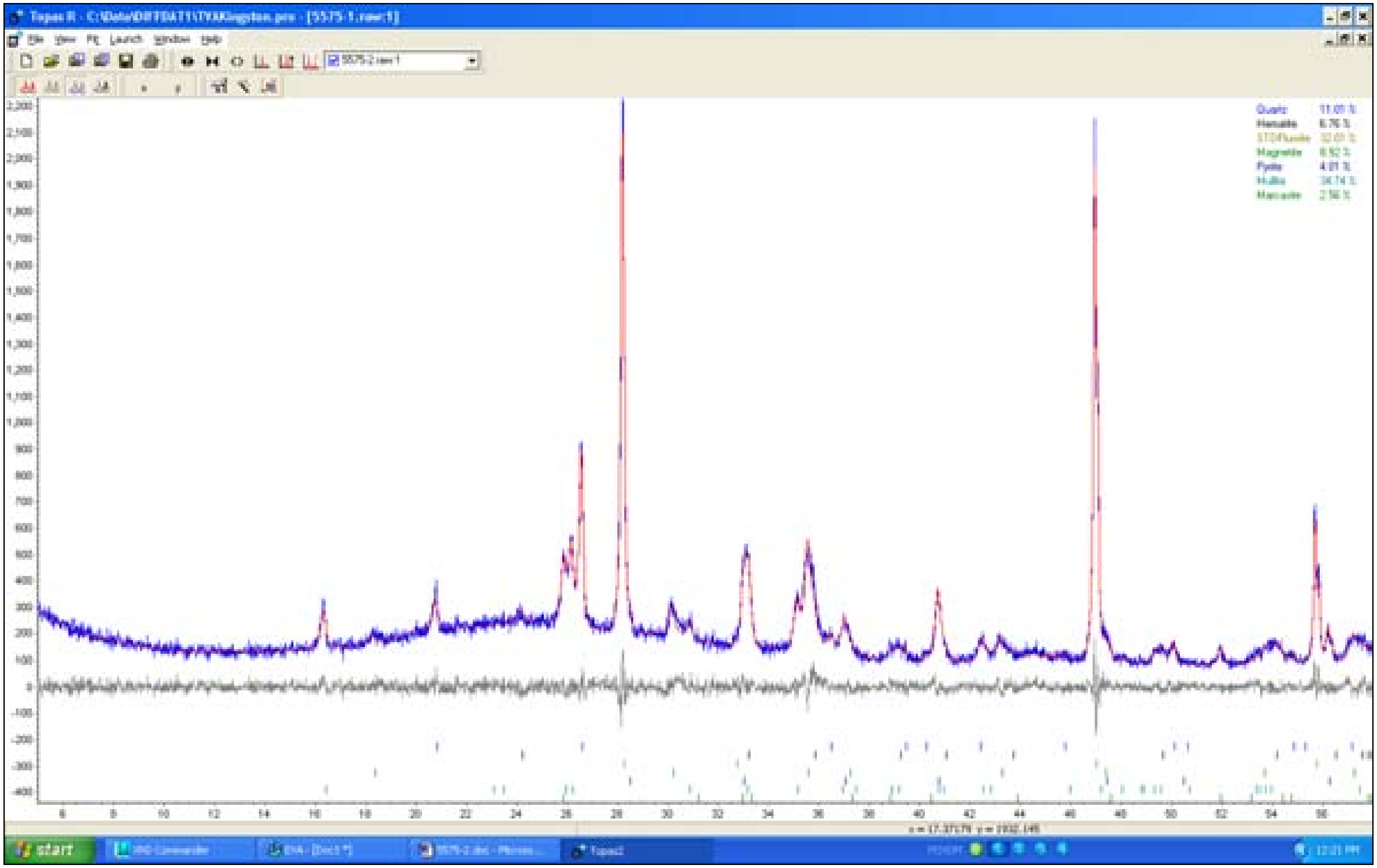
1. PMET lab personnel will verify samples with chain-of-custody document, inspect containers for integrity, and log samples into PMET chain-of-custody logbook.

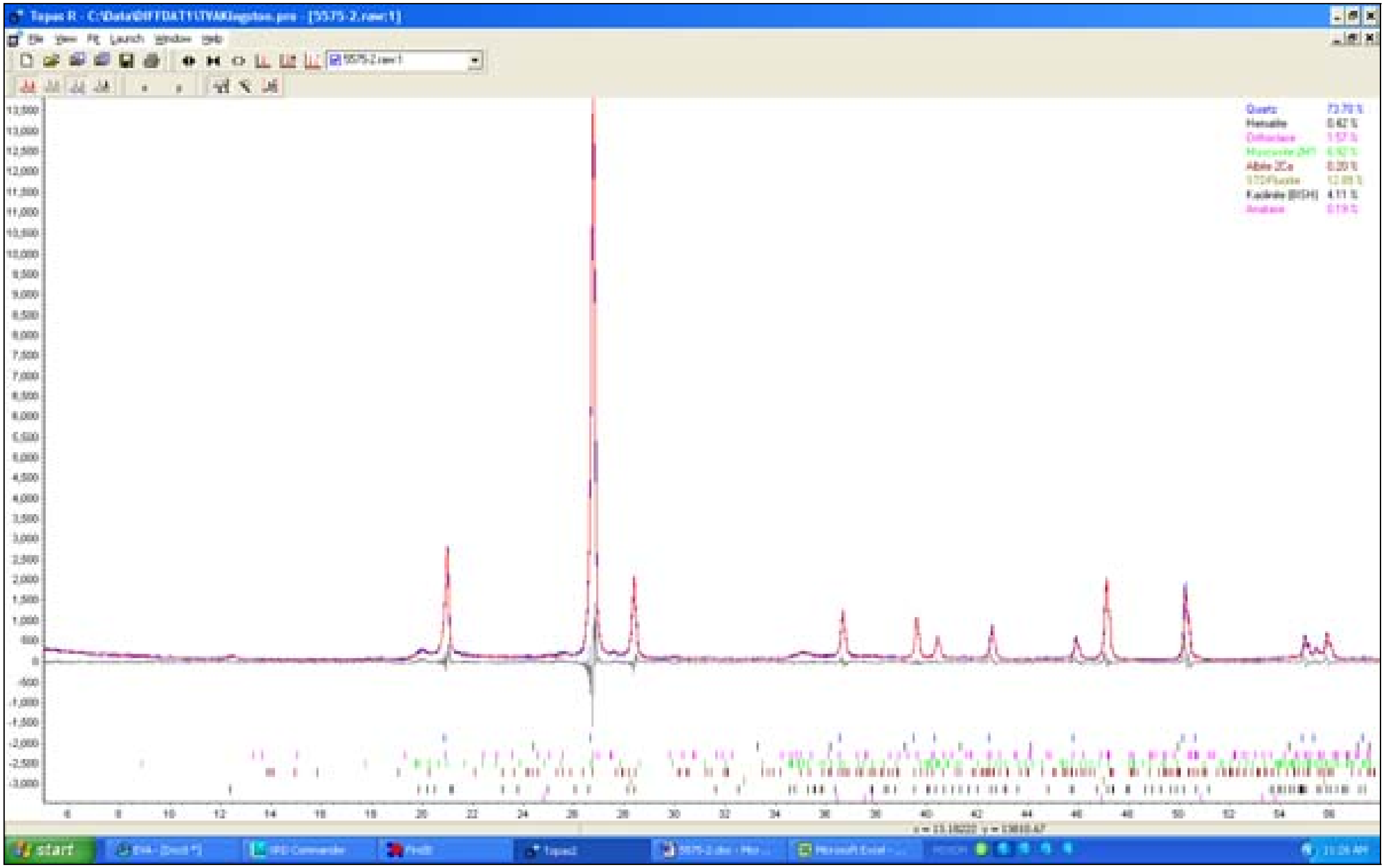
2. Moisture content will be determined by drying in tared pans at 45°C.

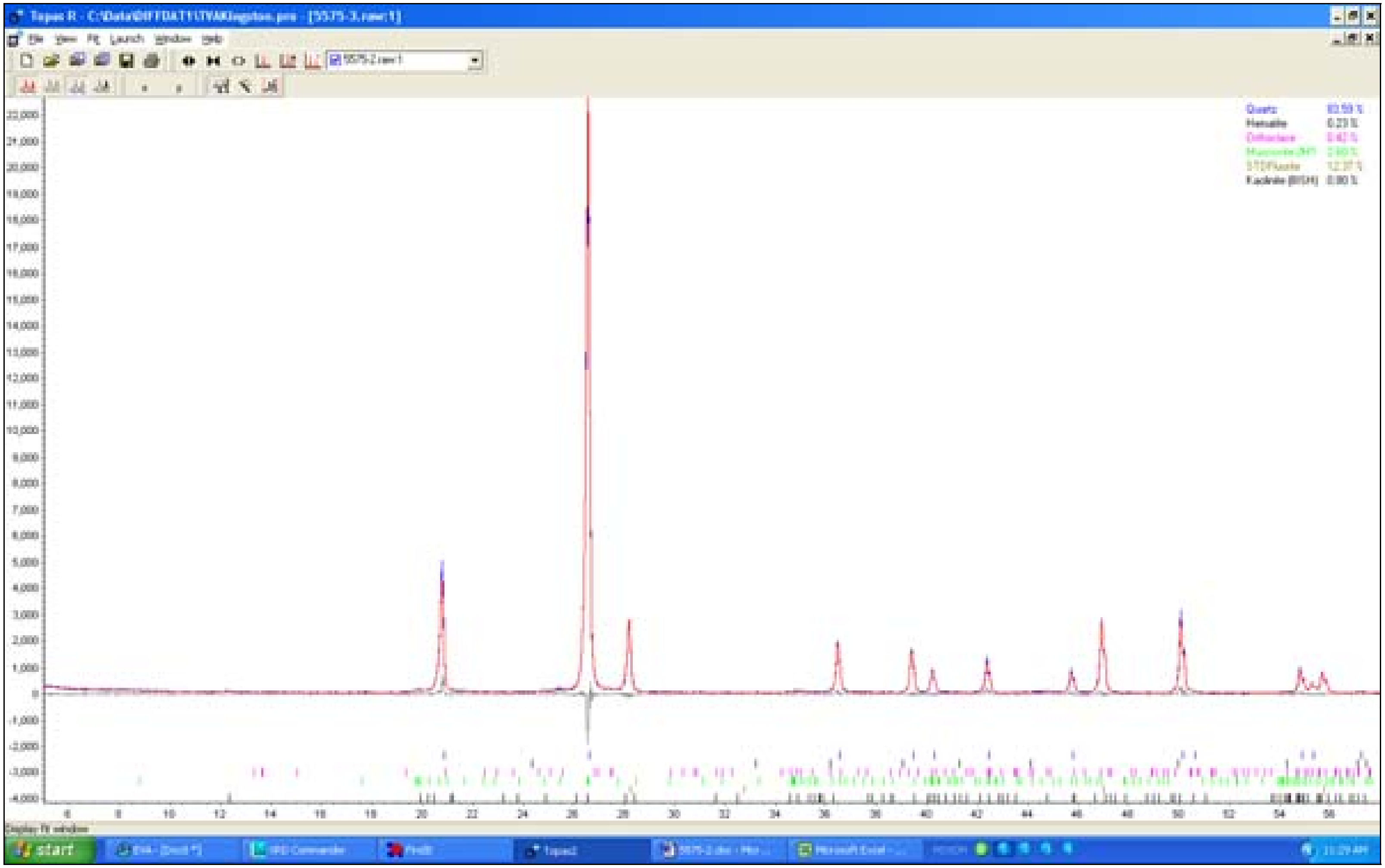
3. Rock fragments over one inch will be removed by screening.

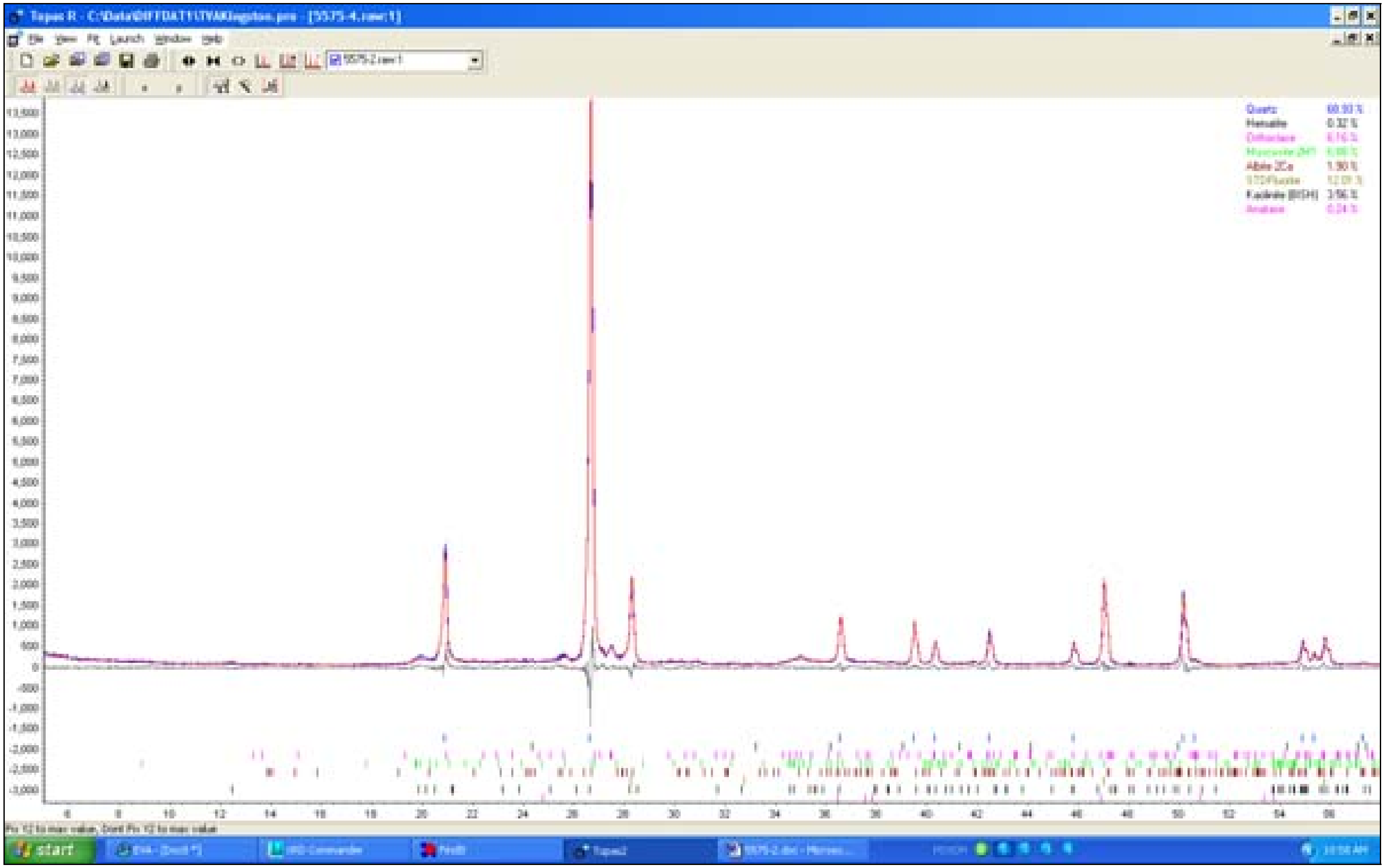
4. Sample will be stage crushed to –10 mesh and blended and split for analysis using a rotary riffle splitter.

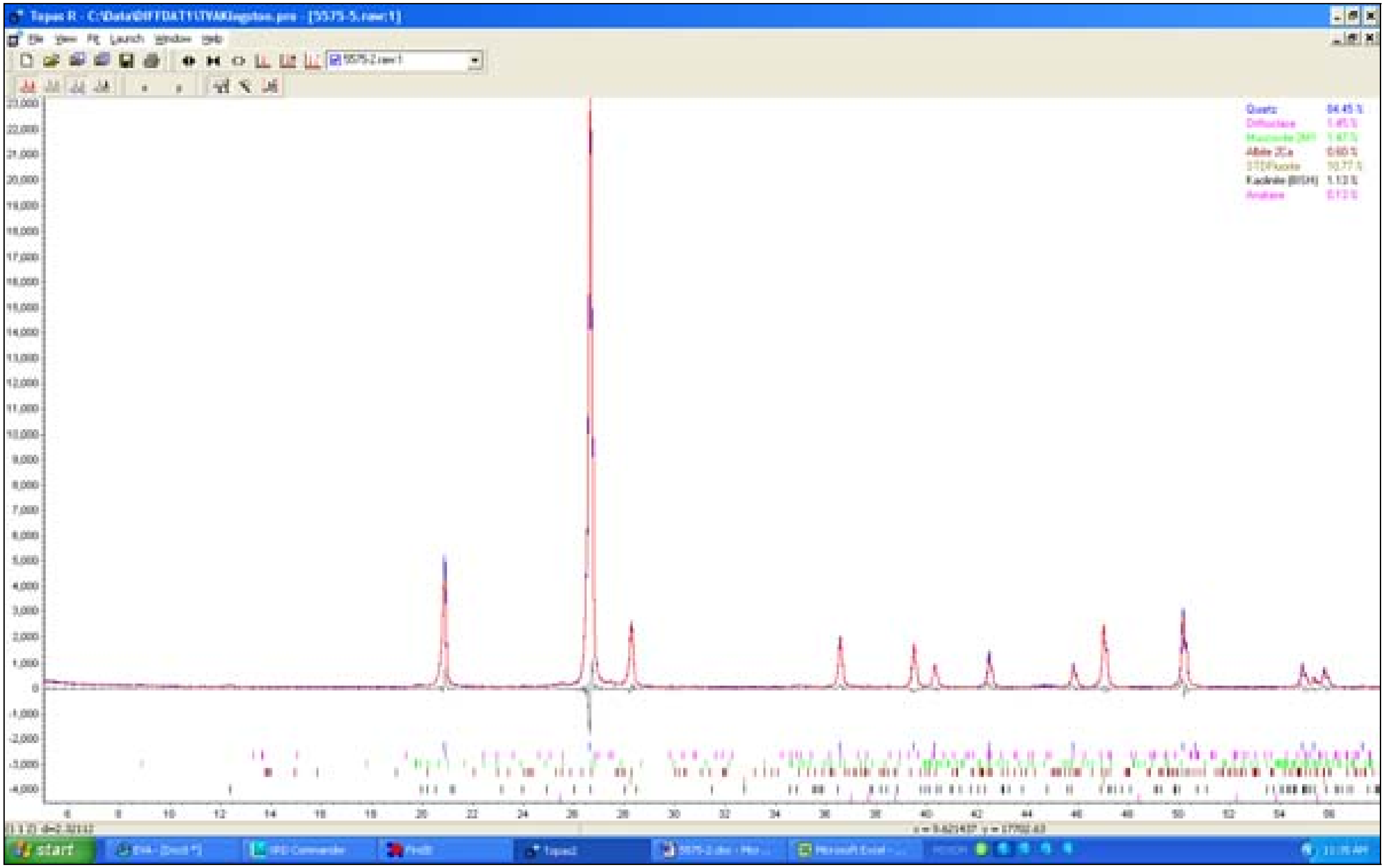
Randolph W. Shannon, Laboratory Manager

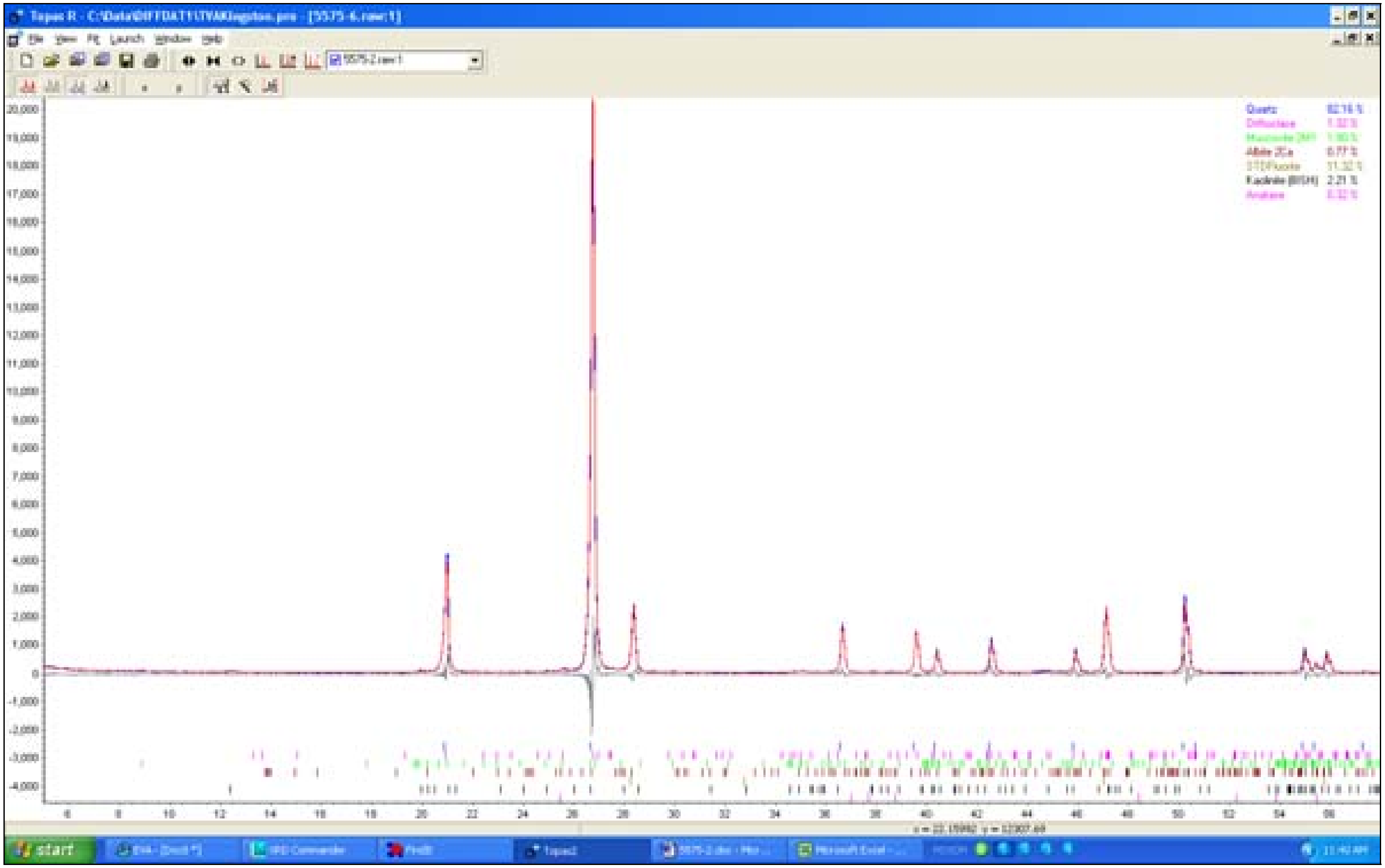


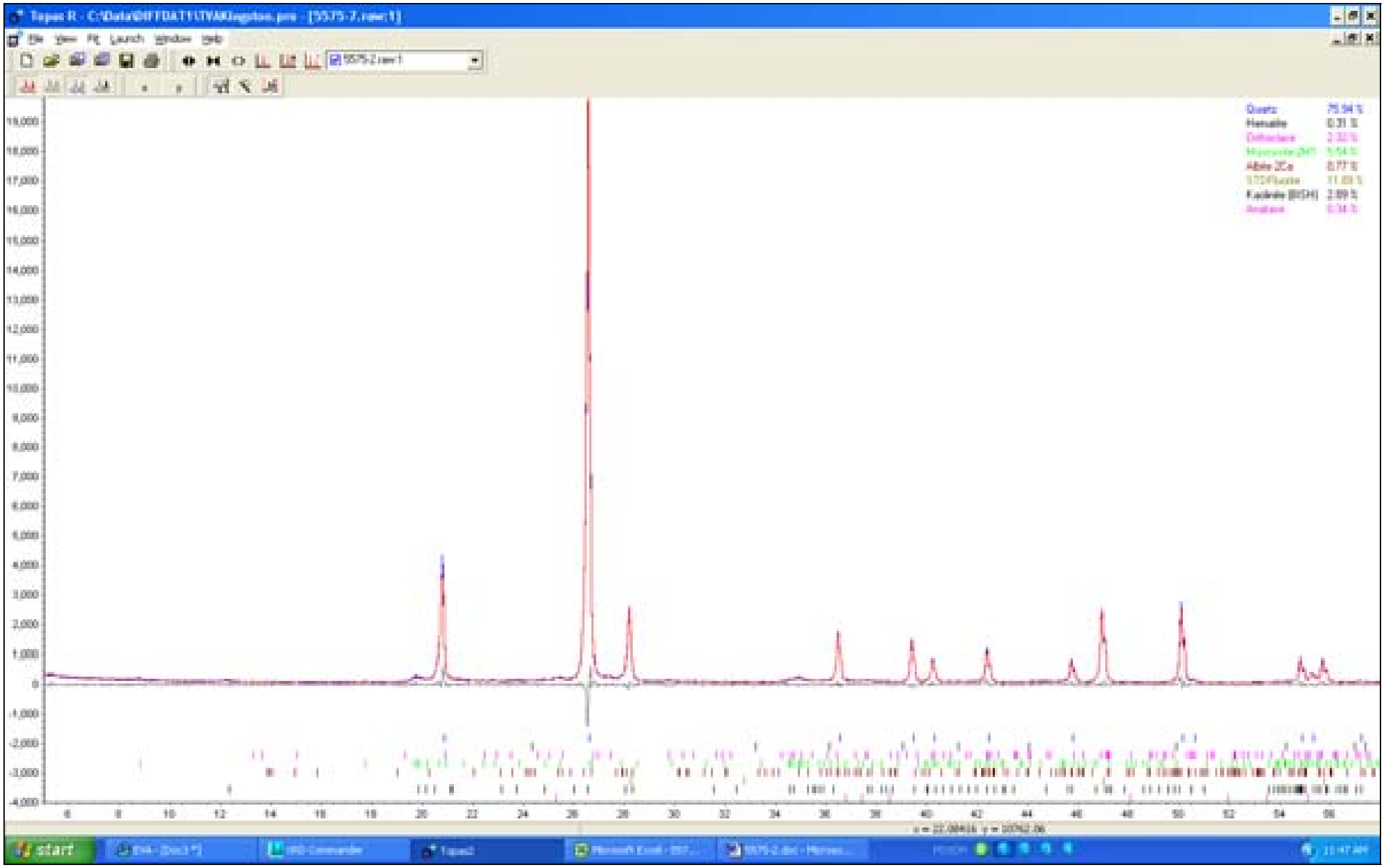

File
View
Fit
Launch
Window
Help
start

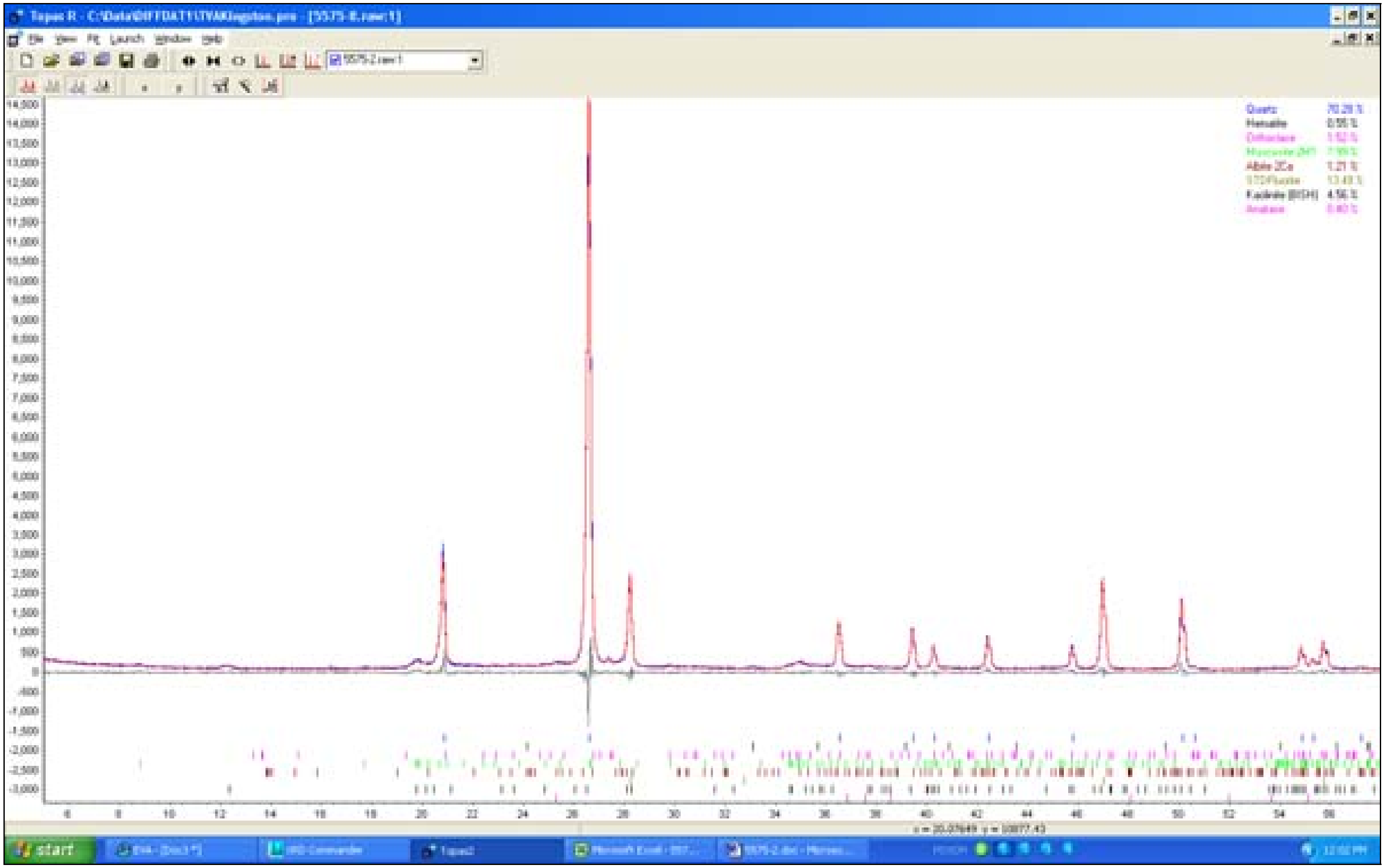


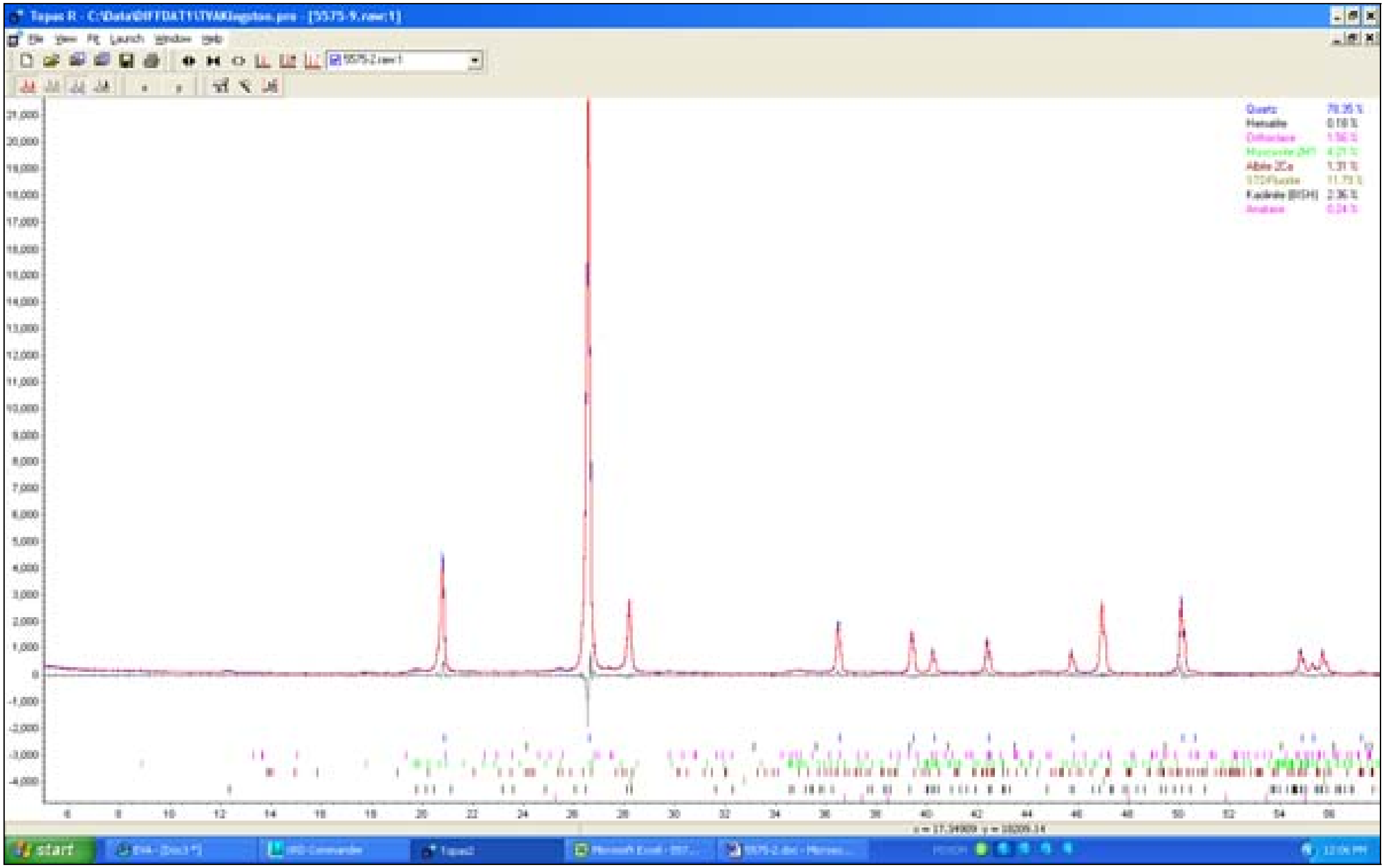







Quartz 75.94 %
Hematite 0.31 %
Albite 2Ca 0.77 %
Kaolinite (BISH) 2.89 %
start





Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

August 6, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

August 6, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GP-16A, 46-48	X	X		X								X						X				
GP-16, 34-36	X	X		X								X						X				
GP-23, 34-36	X	X		X								X						X				
GP-23, 54-56	X	X			X							X						X				
GW-01, 20-22	X	X			X							X						X				
TWP-04A, 60-62	X	X										X						X				
TWP-04A, 70-72	X	X		X								X						X				
TWP-05, 66-68	X	X			X							X						X				
TWP-05, 76-78	X	X			X							X						X				
TWP-06, 40-42	X	X		X								X						X				
TWP-06, 54-56	X	X		X								X						X				

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample TWP-04A, 60-62 pulled away from the wall of the testing ring (decreased in volume) during the saturated hydraulic conductivity (Ksat) test. This anomalous behavior created an annulus and therefore, wall flow. Since the rigid wall Ksat method was no longer appropriate due to the wall flow and since the structural integrity of the sample had increased slightly; the sample was taken out of the rigid wall apparatus and was placed in a flexible membrane for Ksat testing via the flexible wall apparatus. This test was also unsuccessful. Even though the integrity of the sample had increased slighlty, it was still not strong enough to withhold structural change under standard confining pressures. Thus, we are unable to report a saturated hydraulic conductivity result for sample TWP-04A, 60-62.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
	Gravimetric	Volumetric	Gravimetric	Volumetric	Density	Density	Porosity
Sample Number	(%, g/g)	(%, cm^3/cm^3)	(%, g/g)	(%, cm^3/cm^3)	(g/cm^3)	(g/cm^3)	(%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed
--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Specific Gravity Tests

Sample Number	<4.75mm Material Specific Gravity	<4.75mm Material Percent of Bulk Sample	>4.75mm Material Specific Gravity	>4.75mm Material Percent of Bulk Sample	Bulk Sample Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

				Oversize Corrected		
Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received Gravimetric (%, g/g)	Moisture Content: As Received Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded Gravimetric (%, g/g)	Moisture Content: Remolded Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16A, 46-48
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	412.21	
Tare weight, ring (g):	75.48	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	289.88	
Sample volume (cm^3):	165.99	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	16.2	
Volumetric Moisture Content (% vol):	28.2	
Dry bulk density (g/cm^3):	1.75	
Wet bulk density (g/cm^3):	2.03	
Calculated Porosity (% vol):	33.9	
Percent Saturation:	83.3	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	587.56	
Tare weight, ring (g):	133.17	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	369.43	
Sample volume (cm^3):	222.06	
Measured particle density (g/cm^3):	2.65	

Gravimetric Moisture Content (% g/g):	23.0	
Volumetric Moisture Content (% vol):	38.3	
Dry bulk density (g/cm^3):	1.66	
Wet bulk density (g/cm^3):	2.05	
Calculated Porosity (% vol):	37.1	
Percent Saturation:	103.0	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	492.27	
Tare weight, ring (g):	129.62	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	253.36	
Sample volume (cm^3):	225.35	
Measured particle density (g/cm^3):	2.49	
Gravimetric Moisture Content (% g/g):	43.1	
Volumetric Moisture Content (% vol):	48.5	
Dry bulk density (g/cm^3):	1.12	
Wet bulk density (g/cm^3):	1.61	
Calculated Porosity (% vol):	54.8	
Percent Saturation:	88.4	

Laboratory analysis by:	K. Wright
Data entered by:	M. Vigil
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	576.85	
Tare weight, ring (g):	124.91	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	361.41	
Sample volume (cm^3):	226.76	
Measured particle density (g/cm^3):	2.67	
Gravimetric Moisture Content (% g/g):	25.0	
Volumetric Moisture Content (% vol):	39.9	
Dry bulk density (g/cm^3):	1.59	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	40.2	
Percent Saturation:	99.3	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	891.40	
Tare weight, ring (g):	208.78	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	574.50	
Sample volume (cm^3):	317.35	
Measured particle density (g/cm^3):	2.74	
Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	33.8	
Percent Saturation:	100.8	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	573.29	
Tare weight, ring (g):	130.10	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	353.41	
Sample volume (cm^3):	225.77	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	25.4	
Volumetric Moisture Content (% vol):	39.8	
Dry bulk density (g/cm^3):	1.57	
Wet bulk density (g/cm^3):	1.96	
Calculated Porosity (% vol):	40.7	
Percent Saturation:	97.6	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	382.34	
Tare weight, ring (g):	72.90	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	260.41	
Sample volume (cm^3):	163.05	
Measured particle density (g/cm^3):	2.63	

Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	30.1	
Dry bulk density (g/cm^3):	1.60	
Wet bulk density (g/cm^3):	1.90	
Calculated Porosity (% vol):	39.2	
Percent Saturation:	76.8	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	600.99	
Tare weight, ring (g):	133.42	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	390.88	
Sample volume (cm^3):	224.95	
Measured particle density (g/cm^3):	2.65	

Gravimetric Moisture Content (% g/g):	19.6	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	2.08	
Calculated Porosity (% vol):	34.5	
Percent Saturation:	98.9	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 76-78
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	457.59	
Tare weight, ring (g):	95.05	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	311.70	
Sample volume (cm^3):	168.52	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	16.3	
Volumetric Moisture Content (% vol):	30.2	
Dry bulk density (g/cm^3):	1.85	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	30.0	
Percent Saturation:	100.7	

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 40-42
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	360.46	
Tare weight, ring (g):	61.94	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	247.52	
Sample volume (cm^3):	144.65	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	20.6	
Volumetric Moisture Content (% vol):	35.3	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.06	
Calculated Porosity (% vol):	35.5	
Percent Saturation:	99.4	

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	522.75	
Tare weight, ring (g):	109.23	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	350.20	
Sample volume (cm^3):	197.26	
Measured particle density (g/cm^3):	2.66	
Gravimetric Moisture Content (% g/g):	18.1	
Volumetric Moisture Content (% vol):	32.1	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	2.10	
Calculated Porosity (% vol):	33.2	
Percent Saturation:	96.6	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.94
Sample number:	GP-16A, 46-48	*Sample length* (cm)*:*	5.44
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.23
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.51

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:36	23.0	4.4	15.57	4.6	507	3.7E-04	3.4E-04
15-Jul-10	10:50:03							
Test # 2:								
15-Jul-10	11:14:28	23.0	4.1	14.41	3.5	413	3.7E-04	3.4E-04
15-Jul-10	11:21:21							
Test # 3:								
15-Jul-10	12:35:25	23.0	3.7	14.84	3.9	499	3.8E-04	3.5E-04
15-Jul-10	12:43:44							

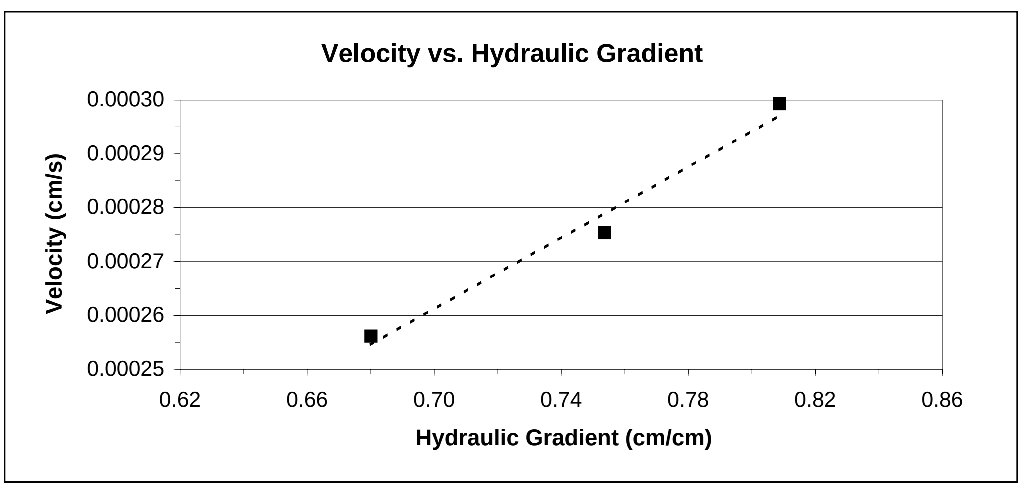
***Average Ksat* (cm/sec): 3.5E-04**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.94
Sample number:	GP-16, 34-36	*Sample length* (cm)*:*	7.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.11
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.31

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
18-Jul-10	10:27:28	23.0	6.3	16.15	5.2	356	6.0E-04	5.6E-04
18-Jul-10	10:33:24							
Test # 2:								
18-Jul-10	10:53:57	23.0	6.1	15.25	4.3	302	6.0E-04	5.6E-04
18-Jul-10	10:58:59							
Test # 3:								
18-Jul-10	11:18:13	23.0	5.8	16.15	5.2	387	6.0E-04	5.6E-04
18-Jul-10	11:24:40							

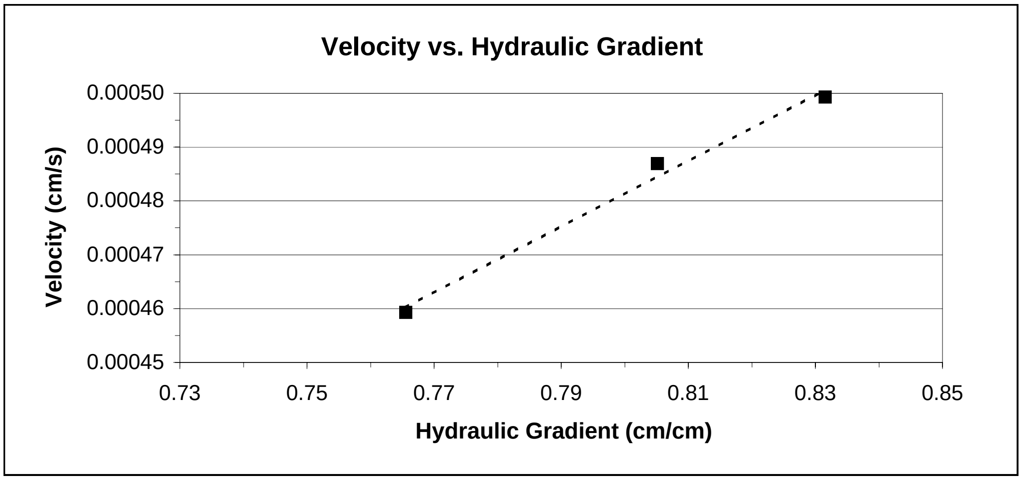
Average Ksat* (cm/sec)*: **5.6E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

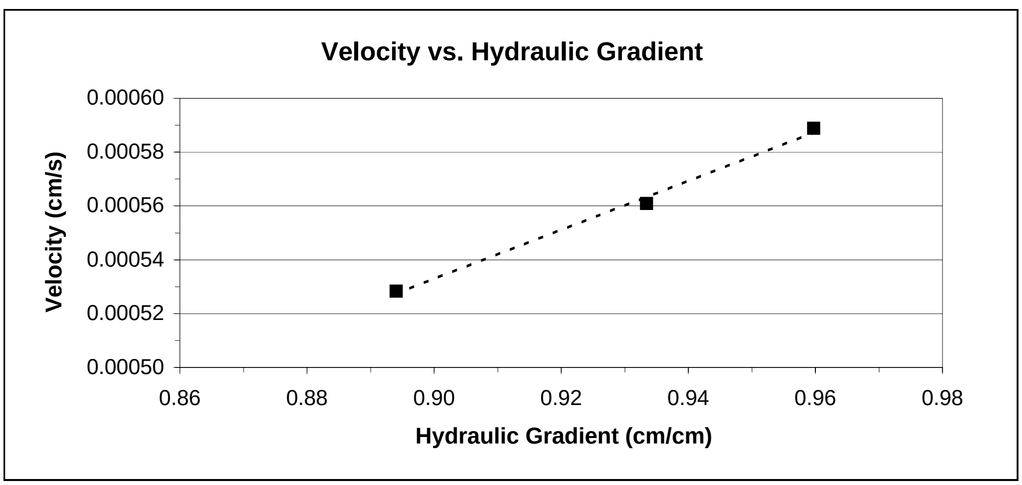
Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	11.02
Sample number:	GP-23, 34-36	*Sample length* (cm)*:*	7.61
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.14
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.63

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:52	23.0	7.3	20.79	9.8	560	6.1E-04	5.7E-04
15-Jul-10	10:51:12							
Test # 2:								
15-Jul-10	11:14:46	23.0	7.1	18.88	7.9	473	6.0E-04	5.6E-04
15-Jul-10	11:22:39							
Test # 3:								
15-Jul-10	12:35:43	23.0	6.8	19.66	8.6	552	5.9E-04	5.5E-04
15-Jul-10	12:44:55							

Average Ksat* (cm/sec)*: **5.6E-04**
Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi):	2.0
Sample number:	GP-23, 54-56	*Offset* (cm):	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm):	7.60
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	29.84
		Reservoir x-sectional area (cm^2):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	15:44:45	23.0	96.8	234.6	60345	1.2E-08	1.1E-08
22-Jul-10	8:30:30	23.0	95.85	233.7			
Test # 2:							
22-Jul-10	8:30:30	23.0	95.85	233.7	352680	1.1E-08	1.1E-08
26-Jul-10	10:28:30	22.5	90.7	228.5			
Test # 3:							
26-Jul-10	10:28:30	22.5	90.7	228.5	100095	1.1E-08	1.1E-08
27-Jul-10	14:16:45	23.0	89.25	227.1			

Average Ksat* (cm/sec): ≤1.1E-08

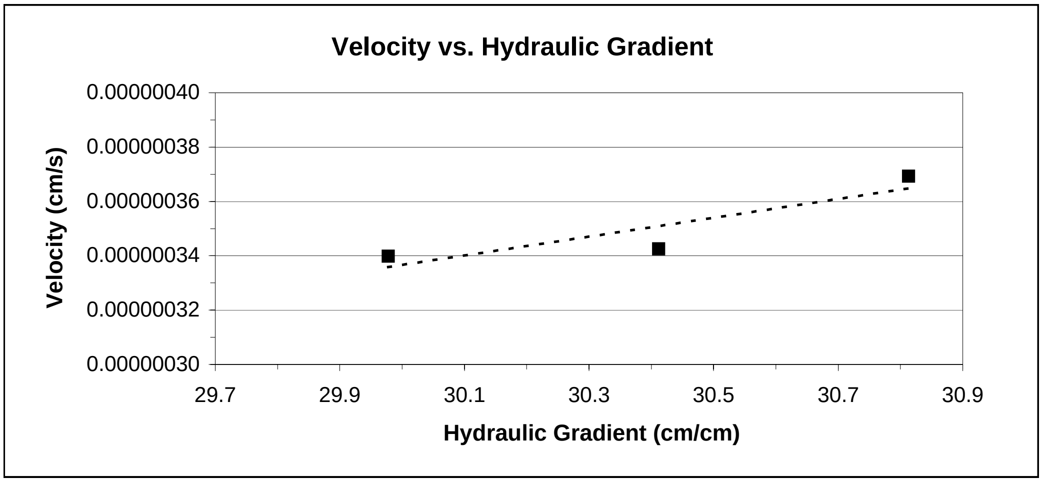
***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed

* = Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	GW-01, 20-22	*Offset* (cm)*:*	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.57
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	41.90
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:30	23.0	49.1	46.3	2040	5.4E-07	5.0E-07
21-Jul-10	9:59:30	23.0	48.7	45.9			
Test # 2:							
21-Jul-10	9:59:30	23.0	48.7	45.9	3390	5.7E-07	5.3E-07
21-Jul-10	10:56:00	23.0	48	45.2			
Test # 3:							
21-Jul-10	11:43:30	23.0	47.65	44.9	5730	5.5E-07	5.1E-07
21-Jul-10	13:19:00	23.0	46.55	43.8			

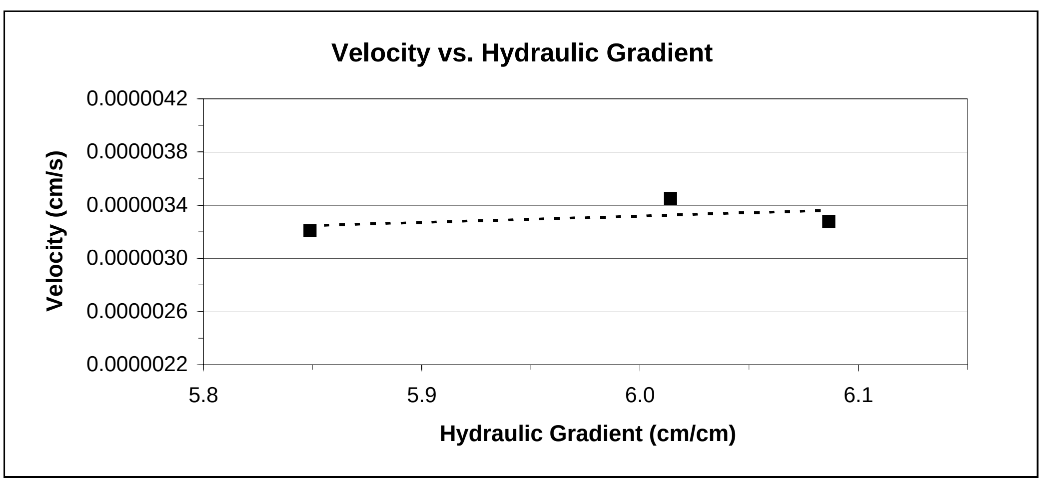
***Average Ksat* (cm/sec): 5.2E-07**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

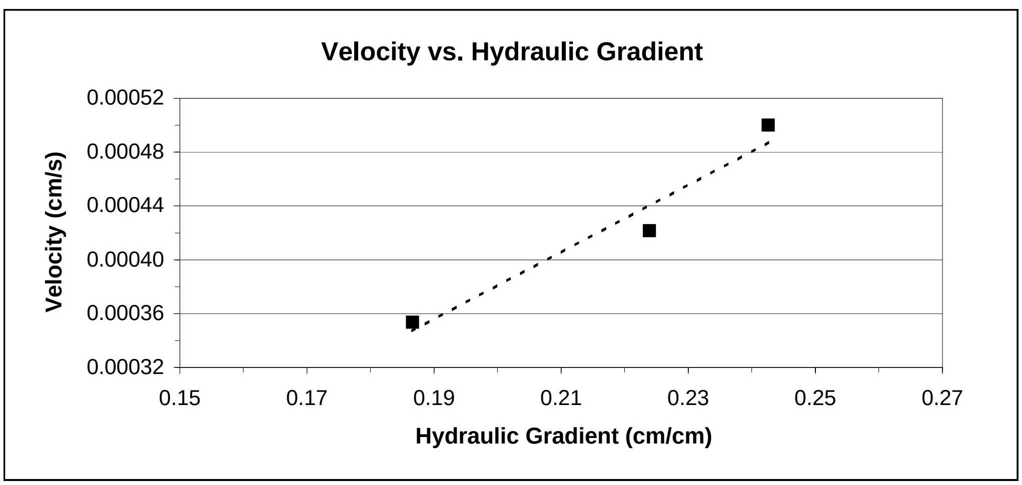
Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.93
Sample number:	TWP-04A, 70-72	*Sample length* (cm)*:*	5.36
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.22
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.42

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:16	23.0	1.3	18.31	7.4	485	2.1E-03	1.9E-03
15-Jul-10	10:49:21							
Test # 2:								
15-Jul-10	11:14:16	23.0	1.2	15.70	4.8	372	1.9E-03	1.8E-03
15-Jul-10	11:20:28							
Test # 3:								
15-Jul-10	12:35:10	23.0	1	15.92	5.0	464	1.9E-03	1.8E-03
15-Jul-10	12:42:54							

Average Ksat* (cm/sec)*: **1.8E-03**
Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 66-68	*Offset* (cm)*:*	2.7
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.59
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.64
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
18-Jul-10	8:23:30	23.0	53.9	51.2	86700	4.4E-07	4.1E-07
19-Jul-10	8:28:30	23.0	44.15	41.5			
Test # 2:							
19-Jul-10	8:28:30	23.0	44.15	41.5	10950	4.6E-07	4.3E-07
19-Jul-10	11:31:00	23.0	43	40.3			
Test # 3:							
19-Jul-10	11:31:00	23.0	43	40.3	76390	4.3E-07	4.0E-07
20-Jul-10	8:44:10	23.0	36.2	33.5			

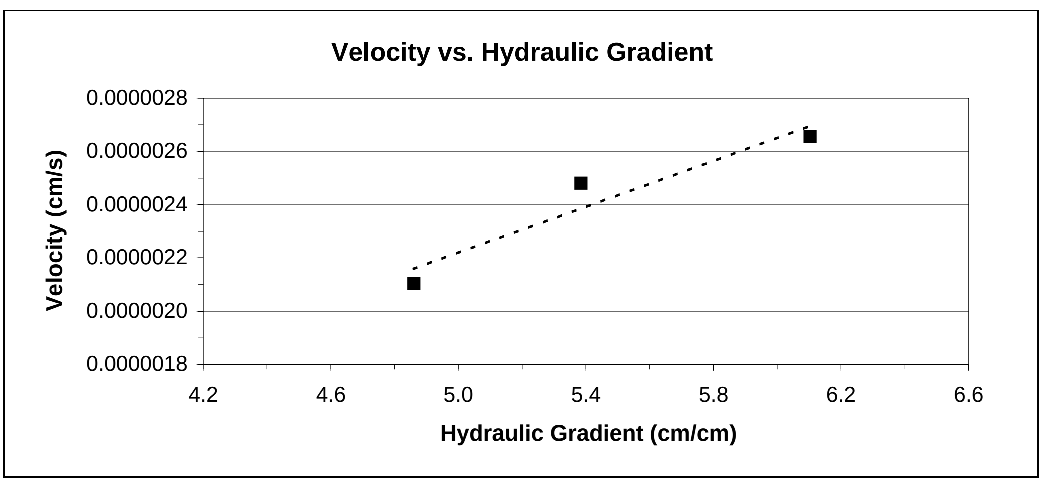
***Average Ksat* (cm/sec):** **4.1E-07**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 76-78	*Offset* (cm)*:*	1.0
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	5.63
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.94
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:55	23.0	33.15	32.2	1745	3.7E-06	3.5E-06
21-Jul-10	9:55:00	23.0	31.6	30.6			
Test # 2:							
21-Jul-10	9:55:00	23.0	31.6	30.6	3645	3.5E-06	3.2E-06
21-Jul-10	10:55:45	23.0	28.8	27.8			
Test # 3:							
21-Jul-10	10:55:45	23.0	28.8	27.8	2825	3.8E-06	3.6E-06
21-Jul-10	11:42:50	23.0	26.6	25.6			

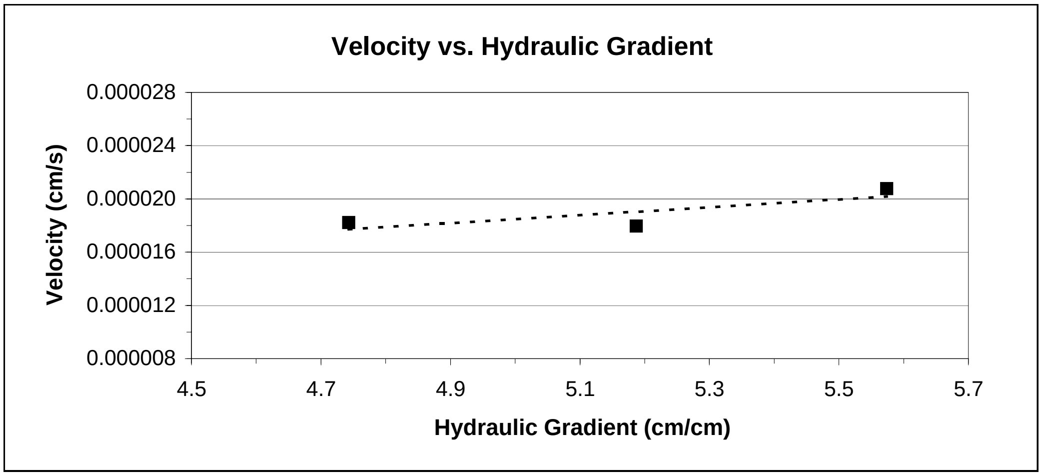
***Average Ksat* (cm/sec):** **3.4E-06**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	10.96
Sample number:	TWP-06, 40-42	*Sample length* (cm)*:*	4.74
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	6.24
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	30.54

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:43	23.0	4.5	18.65	7.7	534	5.0E-04	4.6E-04
15-Jul-10	10:50:37							
Test # 2:								
15-Jul-10	11:14:36	23.0	4.2	16.86	5.9	447	4.9E-04	4.5E-04
15-Jul-10	11:22:03							
Test # 3:								
15-Jul-10	12:35:32	23.0	4	17.50	6.5	528	4.8E-04	4.5E-04
15-Jul-10	12:44:20							

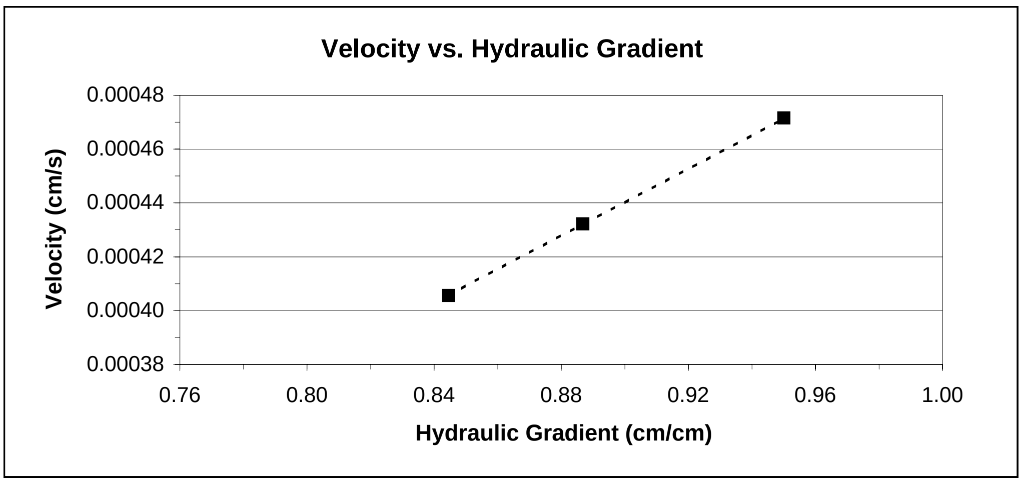
Average Ksat* (cm/sec)*: **4.5E-04**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.92
Sample number:	TWP-06, 54-56	*Sample length* (cm):	6.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.18
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.00

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:42:06	23.0	6.4	20.62	9.7	584	5.7E-04	5.3E-04
15-Jul-10	10:51:50							
Test # 2:								
15-Jul-10	11:14:55	23.0	6.1	18.56	7.6	497	5.5E-04	5.1E-04
15-Jul-10	11:23:12							
Test # 3:								
15-Jul-10	12:35:51	23.0	5.8	19.21	8.3	577	5.4E-04	5.1E-04
15-Jul-10	12:45:28							

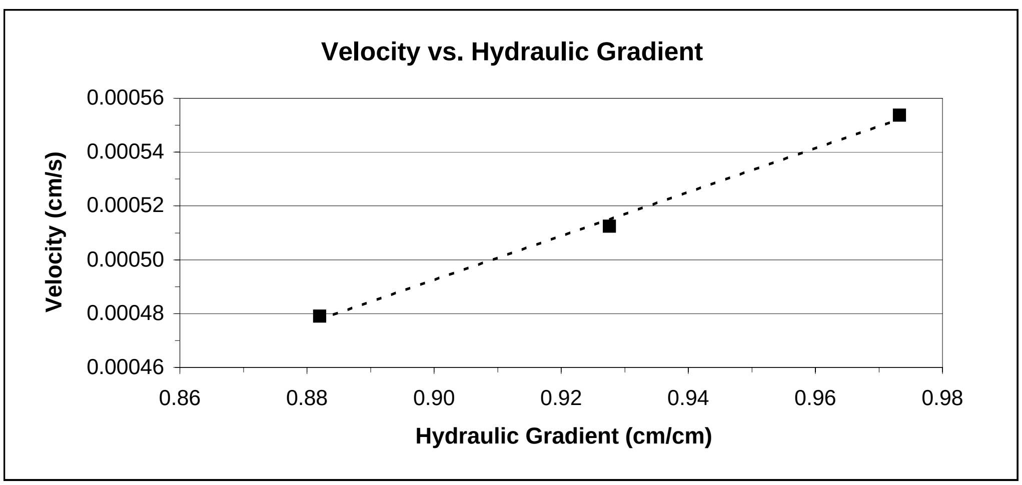
***Average Ksat* (cm/sec): 5.2E-04**

***Oversize Corrected Ksat* (cm/sec): NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Daniel B. Stephens & Associates, Inc.

Data for Specific Gravity for Sample: GP-16A, 46-48

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16A, 46-48
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	95.95	94.22
Weight of pycnometer filled w/soil (g):	146.03	144.43
Weight of pycnometer filled w/soil & water (g):	376.30	374.63
Weight of pycnometer filled w/water (g):	345.15	343.37
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.64	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.64	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---
Percent of Test Sample (% g/g):	0.00
Percent of Bulk Sample (% g/g):	0.00
Tare Weight (g):	---
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---
Saturated Apparent mass in Water & Tare (g):	---
Oven Dry (OD) mass in Air & Tare (g):	---
Observed Temperature (°C):	---
Density of water at observed temperature (g/m^3):	---
SSD Specific Gravity (g/g):	---
Apparent Specific Gravity (g/g):	---
OD Specific Gravity (g/g):	---
Percent Absorption (%):	---
Correction Factor, K:	---
Average Specific Gravity (Apparent) at 20°C:*	---
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---

--- = Test unnecessary since specified fraction <5% of composite mass.

Specific Gravity (Apparent) at 20°C*:	**2.65**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample:
GP-16, 34-36

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-16, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.22	95.42
Weight of pycnometer filled w/soil (g):	145.76	146.42
Weight of pycnometer filled w/soil & water (g):	375.70	376.34
Weight of pycnometer filled w/water (g):	343.57	344.58
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: GP-23, 34-36

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 34-36
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	99.80	
Percent of Bulk Sample (% g/g):	99.80	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.53
Weight of pycnometer filled w/soil (g):	143.86	143.44
Weight of pycnometer filled w/soil & water (g):	372.79	371.50
Weight of pycnometer filled w/water (g):	342.52	339.80
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.50	2.49
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.49	2.49
Average Specific Gravity at 20°C (g/g):	2.49	
Average Particle Density at 20°C (g/cm^3):	2.49	

ASTM C127 (>4.75mm Fraction)

Test Date:	---
Percent of Test Sample (% g/g):	0.20
Percent of Bulk Sample (% g/g):	0.20
Tare Weight (g):	---
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---
Saturated Apparent mass in Water & Tare (g):	---
Oven Dry (OD) mass in Air & Tare (g):	---
Observed Temperature (°C):	---
Density of water at observed temperature (g/m^3):	---
SSD Specific Gravity (g/g):	---
Apparent Specific Gravity (g/g):	---
OD Specific Gravity (g/g):	---
Percent Absorption (%):	---
Correction Factor, K:	---
Average Specific Gravity (Apparent) at 20°C:*	---
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---

--- = Test unnecessary since specified fraction <5% of composite mass.

Specific Gravity (Apparent) at 20°C*:	**2.49**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.49

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
GP-23, 54-56

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GP-23, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.08	94.81
Weight of pycnometer filled w/soil (g):	146.17	146.91
Weight of pycnometer filled w/soil & water (g):	375.49	376.68
Weight of pycnometer filled w/water (g):	342.30	344.04
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.67	2.68
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity at 20°C (g/g):	2.67	
Average Particle Density at 20°C (g/cm^3):	2.67	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.67**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.67	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
GW-01, 20-22

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GW-01, 20-22
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	50.02	
Percent of Bulk Sample (% g/g):	50.02	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.90	93.70
Weight of pycnometer filled w/soil (g):	142.47	143.81
Weight of pycnometer filled w/soil & water (g):	373.72	374.70
Weight of pycnometer filled w/water (g):	342.16	342.94
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.75	2.73
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.75	2.73
Average Specific Gravity at 20°C (g/g):	2.74	
Average Particle Density at 20°C (g/cm^3):	2.74	

ASTM C127 (>4.75mm Fraction)

Test Date:	NA
Percent of Test Sample (% g/g):	49.98
Percent of Bulk Sample (% g/g):	49.98
Tare Weight (g):	NA
Saturated Surface Dry (SSD) mass in Air & Tare (g):	NA
Saturated Apparent mass in Water & Tare (g):	NA
Oven Dry (OD) mass in Air & Tare (g):	NA
Observed Temperature (°C):	NA
Density of water at observed temperature (g/m^3):	NA
SSD Specific Gravity (g/g):	NA
Apparent Specific Gravity (g/g):	NA
OD Specific Gravity (g/g):	NA
Percent Absorption (%):	NA
Correction Factor, K:	NA
Average Specific Gravity (Apparent) at 20°C:*	NA
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	NA

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Specific Gravity (Apparent) at 20°C*:	**2.74**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.74

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-04A, 60-62

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	98.56	
Percent of Bulk Sample (% g/g):	98.56	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.25	92.80
Weight of pycnometer filled w/soil (g):	144.63	146.01
Weight of pycnometer filled w/soil & water (g):	374.78	375.19
Weight of pycnometer filled w/water (g):	343.42	342.08
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	1.44	
Percent of Bulk Sample (% g/g):	1.44	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-04A, 70-72

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-04A, 70-72
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.29	92.22
Weight of pycnometer filled w/soil (g):	144.12	143.44
Weight of pycnometer filled w/soil & water (g):	373.56	373.15
Weight of pycnometer filled w/water (g):	341.43	341.39
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.63	2.63
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.63	2.63
Average Specific Gravity at 20°C (g/g):	2.63	
Average Particle Density at 20°C (g/cm^3):	2.63	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3):*	---	

Specific Gravity (Apparent) at 20°C*:	**2.63**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.63	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-05, 66-68

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 66-68
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.56	92.11
Weight of pycnometer filled w/soil (g):	143.72	143.25
Weight of pycnometer filled w/soil & water (g):	374.14	373.28
Weight of pycnometer filled w/water (g):	342.86	341.36
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-05, 76-78

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-05, 76-78
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.39	93.51
Weight of pycnometer filled w/soil (g):	143.90	145.76
Weight of pycnometer filled w/soil & water (g):	374.47	375.26
Weight of pycnometer filled w/water (g):	343.65	342.75
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample:
TWP-06, 40-42

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 40-42
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	91.07	90.89
Weight of pycnometer filled w/soil (g):	141.85	142.83
Weight of pycnometer filled w/soil & water (g):	371.87	372.59
Weight of pycnometer filled w/water (g):	340.22	340.17
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Data for Specific Gravity for Sample: TWP-06, 54-56

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	TWP-06, 54-56
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	93.26
Weight of pycnometer filled w/soil (g):	144.97	145.25
Weight of pycnometer filled w/soil & water (g):	374.80	374.82
Weight of pycnometer filled w/water (g):	342.59	342.30
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.67
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.66	2.67
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.66	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	---	

Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.66	

Laboratory analysis by:	K. Wright
Data entered by:	K. Wright
Checked by:	J. Hines

Effective Porosity

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16A, 46-48
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 33.88
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.75
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 153.46
Tare weight, jar (g): 113.12

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:10	154.39	10504	4.03
	14-Jul-10	15:50	154.25	16419	3.40

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	10504	---	---	---	---
	16419	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 3.5

***Effective Porosity* (% cm^3/cm^3): 30.4**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 37.13
Measured particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.66
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 162.10
Tare weight, jar (g): 116.40

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	20-Jul-10	15:50	163.16	15093	3.85
	20-Jul-10	15:00	162.95	26413	3.09

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	26413	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 3.8

Effective Porosity **(% cm^3/cm^3):** **33.3**
Oversize Corrected Effective Porosity **(% cm^3/cm^3):** **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3)*:* 54.83
Measured particle density (g/cm^3)*:* 2.49

Initial sample bulk density (g/cm^3)*:* 1.12
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 99.80

Dry weight of dew point potentiometer sample* (g)*:* 158.40
Tare weight, jar (g)*:* 112.19

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	15:30	159.79	4997	3.38
	15-Jul-10	9:15	159.03	16317	1.52

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4997	---	---	---	---
	16317	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 1.7

Effective Porosity* (% cm^3/cm^3)*: **53.1**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 40.22
Measured particle density (g/cm^3): 2.67

Initial sample bulk density (g/cm^3): 1.59
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 152.17
Tare weight, jar (g): 113.30

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	16:00	157.19	16215	20.57
	14-Jul-10	14:37	156.65	24883	18.35

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16215	---	---	---	---
	24883	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 20.8

***Effective Porosity* (% cm^3/cm^3):** **19.4**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3):** **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3)*:* 33.81
Measured particle density (g/cm^3)*:* 2.74

Initial sample bulk density (g/cm^3)*:* 1.81
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 46.80

Dry weight of dew point potentiometer sample* (g)*:* 143.65
Tare weight, jar (g)*:* 114.29

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	20-Jul-10	16:05	146.07	14685	6.96
	20-Jul-10	15:15	145.55	34979	5.46

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14685	---	---	---	---
	34979	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 6.9

Effective Porosity* (% cm^3/cm^3)*: **26.9**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

1 Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

2 Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 40.75
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.57
Fraction of bulk sample used (<2.00mm fraction) (%): 92.78

Dry weight of dew point potentiometer sample* (g): 157.31
Tare weight, jar (g): 113.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:12	160.28	13257	9.79
	14-Jul-10	14:50	160.21	16215	9.54

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	13257	---	---	---	---
	16215	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 9.6

***Effective Porosity* (% cm^3/cm^3): 31.1**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3)*:* 39.17
Measured particle density (g/cm^3)*:* 2.63

Initial sample bulk density (g/cm^3)*:* 1.60
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 170.23
Tare weight, jar (g)*:* 117.83

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	20-Jul-10	16:20	171.29	15093	3.24
	20-Jul-10	15:33	171.05	28350	2.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	28350	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 3.2

Effective Porosity* (% cm^3/cm^3)*: **35.9**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm³): 34.48
Measured particle density (g/cm³): 2.65

Initial sample bulk density (g/cm³): 1.74
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 154.97
Tare weight, jar (g): 112.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	14:40	157.21	15399	9.08

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm³)	% Volume Change [2] (%)	Adjusted Density (g/cm³)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15399	---	---	---	---

Moisture content at -15 bars (% cm³/cm³): 9.1

***Effective Porosity* (% cm³/cm³):** **25.4**
***Oversize Corrected Effective Porosity* (% cm³/cm³):** **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm³.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 29.97
Measured particle density (g/cm^3): 2.64

Initial sample bulk density (g/cm^3): 1.85
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 162.57
Tare weight, jar (g): 113.23

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	16:05	164.52	14481	7.31
	14-Jul-10	14:50	164.44	19682	7.01

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14481	---	---	---	---
	19682	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 7.3

***Effective Porosity* (% cm^3/cm^3):** **22.7**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3):** **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 35.47
Measured particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.71
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 167.58
Tare weight, jar (g): 117.89

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	15:40	170.11	16113	8.71
	14-Jul-10	15:00	169.95	21824	8.17

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16113	---	---	---	---
	21824	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 8.8

***Effective Porosity* (% cm^3/cm^3): 26.7**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 33.23
Measured particle density (g/cm^3): 2.66

Initial sample bulk density (g/cm^3): 1.78
Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight of dew point potentiometer sample* (g): 158.62
Tare weight, jar (g): 112.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	14-Jul-10	13:47	160.23	14175	6.16
	14-Jul-10	14:30	160.15	18254	5.86

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14175	---	---	---	---
	18254	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 6.1

***Effective Porosity* (% cm^3/cm^3): 27.2**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Falling Head: (Rigid Wall)	Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.

Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

September 14, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

September 14, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project sample. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager
Enclosure

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GW-02, 10-11	X	X		X								X						X	X			

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Initial Moisture Content, Dry Bulk Density
Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded				
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed
--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Summary of Moisture Retention (Effective Porosity)

				Oversize Corrected		
Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Moisture Content						
	As Received		Remolded		Dry Bulk	Wet Bulk	Calculated
	Gravimetric	Volumetric	Gravimetric	Volumetric	Density	Density	Porosity
Sample Number	(%, g/g)	(%, cm^3/cm^3)	(%, g/g)	(%, cm^3/cm^3)	(g/cm^3)	(g/cm^3)	(%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	26-Aug-10	---
Field weight of sample* (g):	816.70	
Tare weight, ring (g):	228.70	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	504.09	
Sample volume (cm^3):	294.16	
Measured particle density (g/cm^3):	2.69	
Gravimetric Moisture Content (% g/g):	16.6	
Volumetric Moisture Content (% vol):	28.5	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	36.3	
Percent Saturation:	78.6	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis: Constant Head	Method of Analysis: Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Saturated Hydraulic Conductivity
Constant Head Method

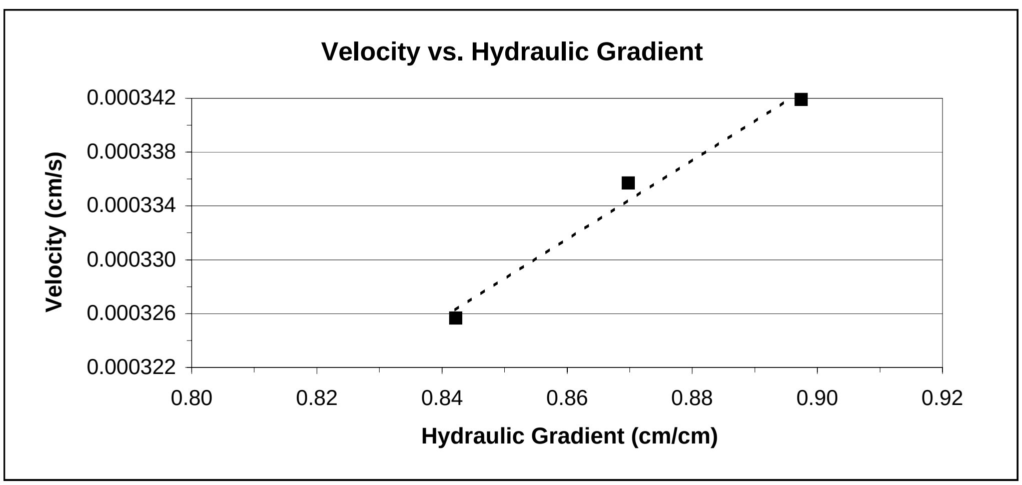
Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g)*:*	11.03
Sample number:	GW-02, 10-11	*Sample length* (cm)*:*	7.24
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm)*:*	7.19
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	40.61

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
1-Sep-10	9:48:01	22.2	6.5	15.89	4.9	350	3.8E-04	3.6E-04
1-Sep-10	9:53:51							
Test # 2:								
1-Sep-10	10:18:40	22.2	6.3	15.87	4.8	355	3.9E-04	3.7E-04
1-Sep-10	10:24:35							
Test # 3:								
1-Sep-10	10:58:07	22.3	6.1	14.72	3.7	279	3.9E-04	3.7E-04
1-Sep-10	11:02:46							

Average Ksat* (cm/sec)*: **3.7E-04**
Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not analyzed



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Data for Specific Gravity for Sample:
GW-02, 10-11

Job Name:	Tennessee Valley Authority
Job Number:	LB10.0147.00
Sample Number:	GW-02, 10-11
Project Name:	Kingston Ash Recovery Project
Container Type:	Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	1-Sep-10	
Percent of Test Sample (% g/g):	80.64	
Percent of Bulk Sample (% g/g):	80.64	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.52
Weight of pycnometer filled w/soil (g):	145.91	141.44
Weight of pycnometer filled w/soil & water (g):	375.63	371.82
Weight of pycnometer filled w/water (g):	342.55	339.82
Observed temperature (°C):	22.00	22.00
Density of water at observed temperature (g/cm^3):	0.9978	0.9978
Specific Gravity (g/g):	2.70	2.69
Correction factor, K:	0.9996	0.9996
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity at 20°C (g/g):	2.69	
Average Particle Density at 20°C (g/cm^3):	2.69	

ASTM C127 (>4.75mm Fraction)

Test Date:	3-Sep-10
Percent of Test Sample (% g/g):	19.36
Percent of Bulk Sample (% g/g):	19.36
Tare Weight (g):	0.0
Saturated Surface Dry (SSD) mass in Air & Tare (g):	63.23
Saturated Apparent mass in Water & Tare (g):	37.09
Oven Dry (OD) mass in Air & Tare (g):	58.59
Observed Temperature (°C):	22.0
Density of water at observed temperature (g/m^3):	0.9978
SSD Specific Gravity (g/g):	2.42
Apparent Specific Gravity (g/g):	2.73
OD Specific Gravity (g/g):	2.24
Percent Absorption (%):	7.3
Correction Factor, K:	0.9996
Average Specific Gravity (Apparent) at 20°C:*	2.72
Average Particle Density (Apparent) at 20° C (g/cm^3)*:	2.72

Specific Gravity (Apparent) at 20°C*:	**2.70**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.70

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by:	K. Wright
Data entered by:	C. Krous
Checked by:	J. Hines

Effective Porosity

Summary of Moisture Retention (Effective Porosity)

Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Moisture Retention Data
Dew Point Potentiometer
(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3): 36.29
Assumed particle density (g/cm^3): 2.65

Initial sample bulk density (g/cm^3): 1.71
Fraction of bulk sample used (<2.00mm fraction) (%): 47.20

Dry weight of dew point potentiometer sample* (g): 165.04
Tare weight, jar (g): 114.81

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content † (% vol)
Dew point potentiometer:	3-Sep-10	15:00	169.21	14787	6.72
	3-Sep-10	14:25	169.08	19172	6.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14787	---	---	---	---
	19172	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3): 6.7

***Effective Porosity* (% cm^3/cm^3): 29.6**
***Oversize Corrected Effective Porosity* (% cm^3/cm^3): NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. ‘Volume Adjusted’ values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares
† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.
‡‡ Volume adjustments are applicable at this matric potential (see comment #1).
NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Specific Gravity Coarse	ASTM C127
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.

APPENDIX F

RECON (2010) – Mix Design Evaluation, Perimeter Wall Stabilization

TVA DSM DEMONSTARTAION PROGRAM

AT KINGSTON ASH RECOVERY PROJECT

1134 SWAN POND ROAD, HARRIMAN, TN 37748

REPORT ON MIX DESIGN PROPOSED TO BE USED FOR THE ABOVE PROGRAM

BASED ON BENCH TESTS CONDUCTED BY RECON

REMEDIAL CONSTRUCTION SERVICES, L.P.

9720 DERRINGTON

HOUSTON, TX 77064

Ph:281-955-2442

Fax: 281-890-5172

www.reconservices.com

TVA awarded, Remedial Construction Services, L.P. Contract for **Deep Soil Mixing Demonstration Program**, at their Kingston Ash Recovery Project on 04.29.2010.

Section 3.3.1 of Requirements document –DSMDR-A, states- "*The conceptual design unconfined compressive strength requirement of the soilcrete column is 150 pounds per square inch (psi) following 28 days curing. The DSM Contractor shall submit an initial mix design to meet this requirement and make adjustments in the field based on results obtained.*"

RECON is pleased to submit the final report of bench tests conducted by Timely Engineering Soil Test, LLC and RECON's recommendation for the design mix proposed to be used for the DSM Demonstration Program

***

After award of the work Ash, Clay and Siltysand (material found at site) samples were collected by TVA and sent to Timely Engineering Soil Tests, LLC (TEST), 1874 Forge Street, Tucker, and GA 30084.

TEST was selected by RECON as TEST has conducted bench tests for similar DSM programs for earlier RECON projects.

RECON advised TEST to determine the properties of various samples sent by TVA.

RECON advised TEST to try 3 different dosages of Portland cement with the materials sent by TVA.

The dosages selected by RECON were-

> **7.5%, 10.0% & 12.0% by dry weight of the materials.**
>
> **In the lab a W/C of ~1.0 was used. However at site depending on the conditions this may be varied.**

The lab molded a number of samples from –

1. Ash (9012)
2. Clay (9013)
3. Siltysand, (9014)&
4. A blend of all three above (9012+9013+9014), with the 3 recommended dosages of Portland cement and cast 7 cylindrical molds of 3" x 6" from each mix design.

The lab tested 2 cylinders from each mix design for 7, 14 7 28 days UCS as per ASTM D 1633. One cylinder from each of the mix designs was tested for Hydraulic Conductivity after 28 days of curing.

The Summary of the various tests and details of all tests conducted in the lab are enclosed.

Based on the results of various tests conducted for various mix designs RECON proposes to use a mix design of 10% cement by weight (dry) of the material at site for the DSM demonstration program.

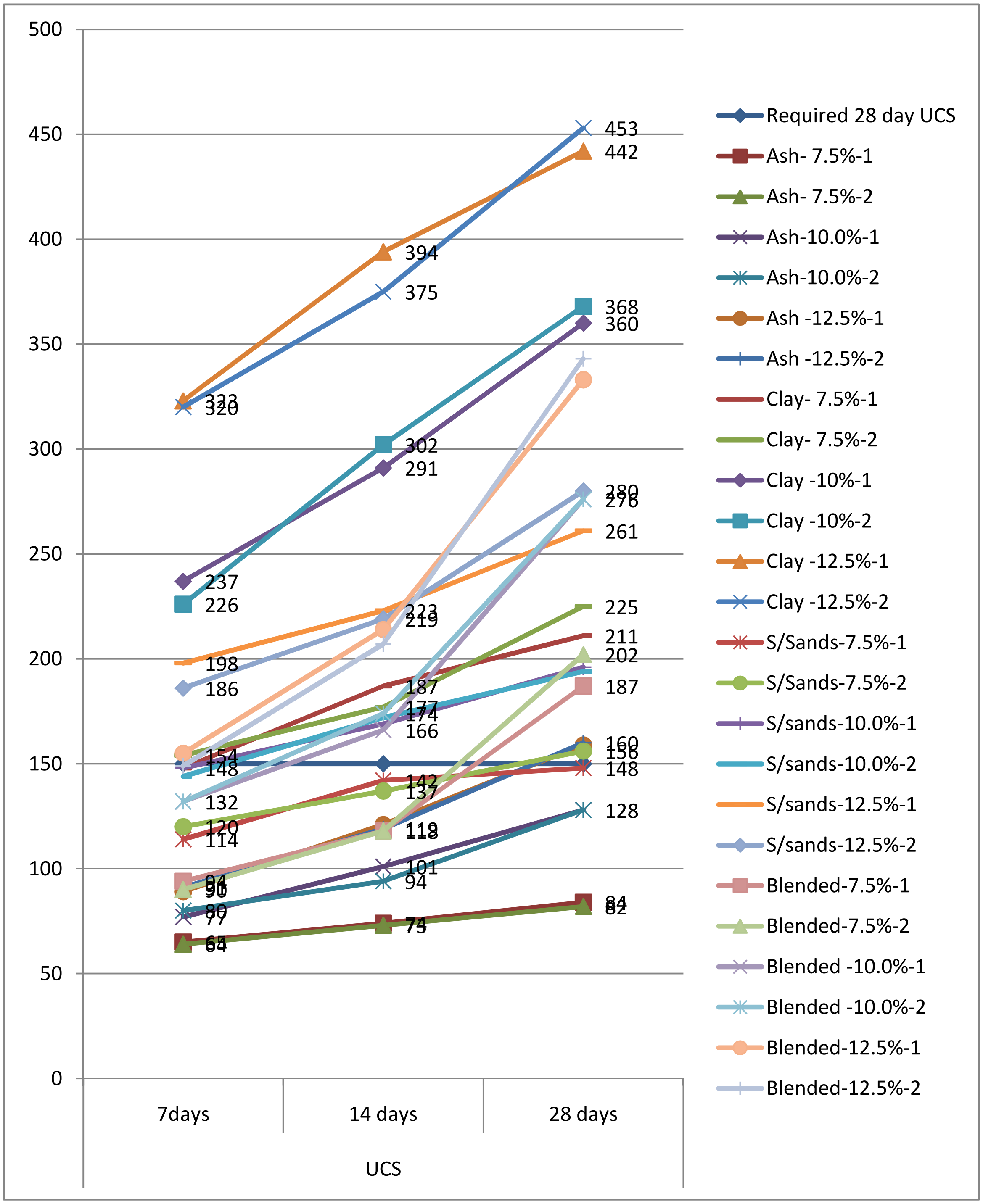
RECON

TVA DSM Bench Test Report- Summary

Material- Cement Dosage %-Sample Set	***Sample I.D***	**UCS**		
		7days	**14 days**	**28 days**
Required 28 day UCS	**Required 28 day UCS**	**150**	**150**	**150**
Ash- 7.5%-1	9012-1-1-1	65	74	84
Ash- 7.5%-2	9012-1-1-2	64	73	82
Ash-10.0%-1	9012-2-1-1	77	101	128
Ash-10.0%-2	9012-2-1-2	80	94	128
Ash -12.5%-1	9012-3-1-1	89	121	159
Ash -12.5%-2	9012-3-1-2	91	119	160
Clay- 7.5%-1	9013-1-1-1	148	187	211
Clay- 7.5%-2	9013-1-1-2	154	177	225
Clay -10%-1	9013-2-1-1	237	291	360
Clay -10%-2	9013-2-1-2	226	302	368
Clay -12.5%-1	9013-3-1-1	323	394	442
Clay -12.5%-2	9013-3-1-2	320	375	453
S/Sands-7.5%-1	9014-1-1-1	114	142	148
S/Sands-7.5%-2	9014-1-1-2	120	137	156
S/sands-10.0%-1	9014-2-1-1	148	169	196
S/sands-10.0%-2	9014-2-1-2	144	172	194
S/sands-12.5%-1	9014-3-1-1	198	223	261
S/sands-12.5%-2	9014-3-1-2	186	219	280
Blended-7.5%-1	9012/13/14-1-1-1	94	118	187
Blended-7.5%-2	9012/13/14-1-1-2	90	118	202
Blended -10.0%-1	9012/13/14-2-1-1	132	166	276
Blended -10.0%-2	9012/13/14-2-1-2	132	174	276
Blended-12.5%-1	9012/13/14-3-1-1	155	214	333
Blended-12.5%-2	9012/13/14-3-1-2	149	207	343

RECON

TVA DSM Bench Test Report- Summary Chart



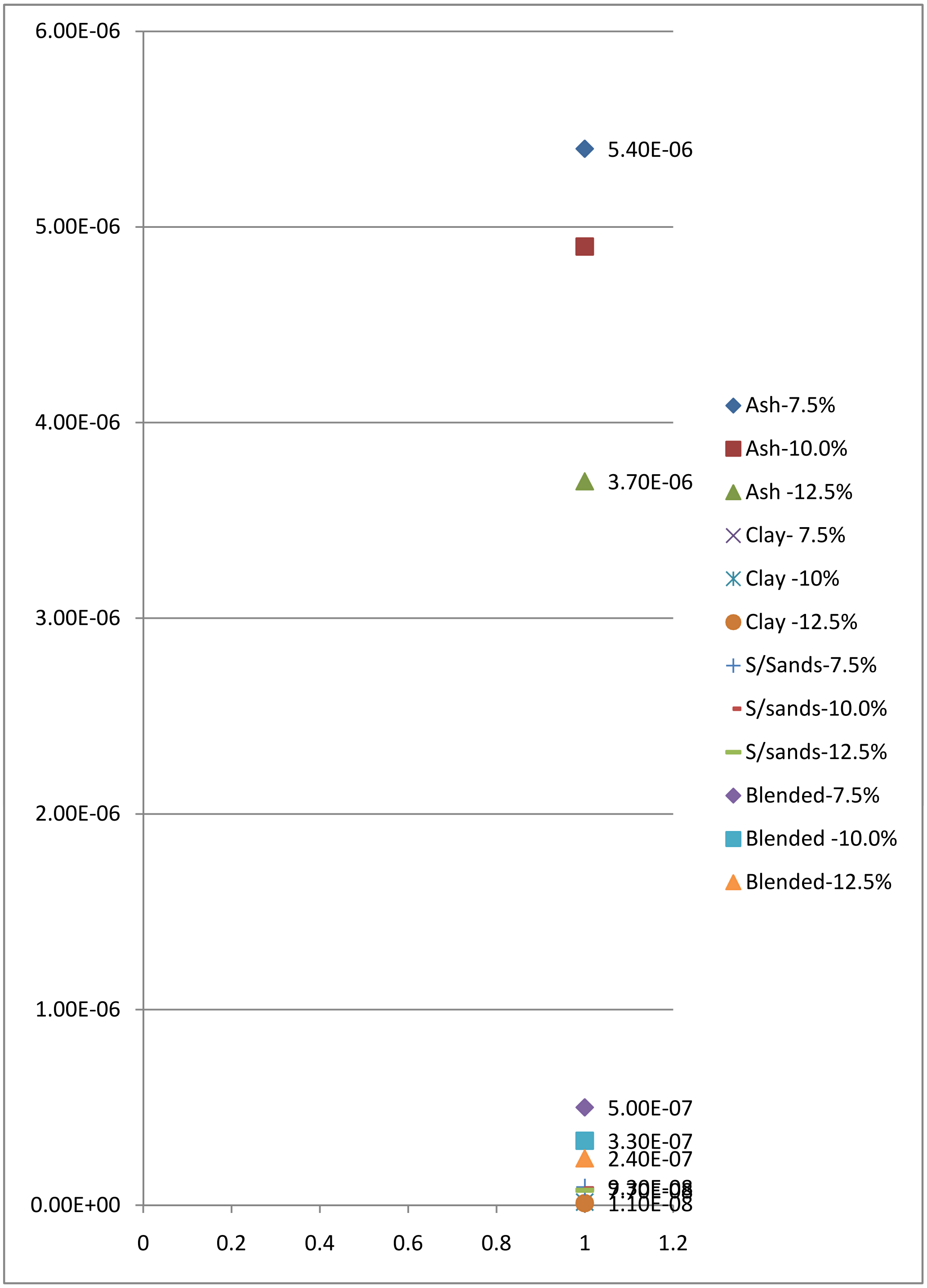
RECON

TVA DSM Bench Test Report- Summary

Material- Cement Dosage %-Sample Set	***Sample I.D***	**28 Day Hydraulic Conductivity**
Ash-7.5%	9012-1-1-7	5.40E-06
Ash-10.0%	9012-2-1-7	4.90E-06
Ash -12.5%	9012-3-1-7	3.70E-06
Clay- 7.5%	9013-1-1-7	1.70E-08
Clay -10%	9013-2-1-7	1.60E-08
Clay -12.5%	9013-3-1-7	1.10E-08
S/Sands-7.5%	9014-1-1-7	9.30E-08
S/sands-10.0%	9014-2-1-7	8.40E-08
S/sands-12.5%	9014-3-1-7	7.70E-08
Blended-7.5%	9012/13/14-1-1-7	5.00E-07
Blended -10.0%	9012/13/14-2-1-7	3.30E-07
Blended-12.5%	9012/13/14-3-1-7	2.40E-07

RECON

TVA DSM Bench Test Report- Summary



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SUMMARY of TESTING

T.E.S.T. Project Number: **1003-03**
Project Name: **Kingston Fossil Plant**

Sample Identification					Mixing Date	Curing Age, days	Testing Date	UCS, psi	Moisture Content, %	Grain Size Distribution		Atterberg Limits			Unit Weight		Hydraulic Conduct. cm/sec
T.E.S.T. Sample No.	Client Base Material No.	Mix Design No.	Batch No.	Spec. No.						% Finer #200 Sieve	% Finer 0.005mm	LL, %	PL, %	PI, %	Wet Density, pcf	Dry Density, pcf	
1003-03-1																	
9012	Bulk Ash 050610	-	-	-		-		-	35.1	73.3	12.2	NP	NP	NP	109.9	81.4	-
9012	Bulk Ash 050610	1	1	1	05/20/10	7	05/27/10	65	33.4	-	-	-	-	-	110.3	82.6	-
9012	Bulk Ash 050610	1	1	2	05/20/10	7	05/27/10	64	34.3	-	-	-	-	-	110.3	82.1	-
9012	Bulk Ash 050610	1	1	3	05/20/10	14	06/03/10	74	33.8	-	-	-	-	-	109.9	82.1	-
9012	Bulk Ash 050610	1	1	4	05/20/10	14	06/03/10	73	33.7	-	-	-	-	-	110.0	82.3	-
9012	Bulk Ash 050610	1	1	5	05/20/10	28	06/17/10	84	33.2	-	-	-	-	-	109.5	82.2	-
9012	Bulk Ash 050610	1	1	6	05/20/10	28	06/17/10	82	32.9	-	-	-	-	-	110.3	83.0	-
9012	Bulk Ash 050610	1	1	7	05/20/10	28	06/17/10	-	32.4	-	-	-	-	-	110.2	83.2	5.4E-06
9012	Bulk Ash 050610	2	1	1	05/20/10	7	05/27/10	77	34.2	-	-	-	-	-	110.5	82.3	-
9012	Bulk Ash 050610	2	1	2	05/20/10	7	05/27/10	80	34.0	-	-	-	-	-	109.9	82.0	-
9012	Bulk Ash 050610	2	1	3	05/20/10	14	06/03/10	101	33.9	-	-	-	-	-	110.4	82.4	-
9012	Bulk Ash 050610	2	1	4	05/20/10	14	06/03/10	94	33.4	-	-	-	-	-	110.3	82.7	-
9012	Bulk Ash 050610	2	1	5	05/20/10	28	06/17/10	126	32.9	-	-	-	-	-	109.6	82.5	-
9012	Bulk Ash 050610	2	1	6	05/20/10	28	06/17/10	128	32.9	-	-	-	-	-	108.9	81.9	-
9012	Bulk Ash 050610	2	1	7	05/20/10	28	06/17/10	-	31.5	-	-	-	-	-	110.3	83.9	4.9E-06
9012	Bulk Ash 050610	3	1	1	05/20/10	7	05/27/10	89	34.8	-	-	-	-	-	110.2	81.7	-
9012	Bulk Ash 050610	3	1	2	05/20/10	7	05/27/10	91	34.7	-	-	-	-	-	110.0	81.6	-
9012	Bulk Ash 050610	3	1	3	05/20/10	14	06/03/10	121	33.5	-	-	-	-	-	111.3	83.3	-
9012	Bulk Ash 050610	3	1	4	05/20/10	14	06/03/10	119	34.5	-	-	-	-	-	110.7	82.3	-
9012	Bulk Ash 050610	3	1	5	05/20/10	28	06/17/10	159	33.9	-	-	-	-	-	110.0	82.2	-
9012	Bulk Ash 050610	3	1	6	05/20/10	28	06/17/10	160	33.4	-	-	-	-	-	109.9	82.3	-
9012	Bulk Ash 050610	3	1	7	05/20/10	28	06/17/10	-	32.9	-	-	-	-	-	109.8	82.6	3.7E-06
9013	Bulk Sed. 050510A	-	-	-		-		-	19.7	56.6	18.4	23	17	6	128.1	107.3	-
9013	Bulk Sed. 050510A	1	1	1	05/18/10	7	05/25/10	148	29.3	-	-	-	-	-	118.1	91.3	-
9013	Bulk Sed. 050510A	1	1	2	05/18/10	7	05/25/10	154	29.4	-	-	-	-	-	117.9	91.1	-

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SUMMARY of TESTING

T.E.S.T. Project Number: 1003-03
Project Name: Kingston Fossil Plant

Sample Identification					Mixing Date	Curing Age, days	Testing Date	UCS, psi	Moisture Content, %	Grain Size Distribution		Atterberg Limits			Unit Weight		Hydraulic Conduct. cm/sec
T.E.S.T. Sample No.	Client Base Material No.	Mix Design No.	Batch No.	Spec. No.						% Finer #200 Sieve	% Finer 0.005mm	LL, %	PL, %	PI, %	Wet Density, pcf	Dry Density, pcf	
9013	Bulk Sed. 050510A	1	1	3	05/18/10	14	06/01/10	187	28.8	-	-	-	-	-	117.9	91.5	-
9013	Bulk Sed. 050510A	1	1	4	05/18/10	14	06/01/10	177	28.8	-	-	-	-	-	117.8	91.4	-
9013	Bulk Sed. 050510A	1	1	5	05/18/10	28	06/15/10	211	28.9	-	-	-	-	-	118.4	91.8	-
9013	Bulk Sed. 050510A	1	1	6	05/18/10	28	06/15/10	225	28.0	-	-	-	-	-	118.0	92.2	-
9013	Bulk Sed. 050510A	1	1	7	05/18/10	28	06/15/10	-	28.6	-	-	-	-	-	116.3	90.4	1.7E-08
9013	Bulk Sed. 050510A	2	1	1	05/18/10	7	05/25/10	237	28.3	-	-	-	-	-	118.9	92.6	-
9013	Bulk Sed. 050510A	2	1	2	05/18/10	7	05/25/10	226	28.2	-	-	-	-	-	118.9	92.7	-
9013	Bulk Sed. 050510A	2	1	3	05/18/10	14	06/01/10	291	27.9	-	-	-	-	-	118.8	92.8	-
9013	Bulk Sed. 050510A	2	1	4	05/18/10	14	06/01/10	302	27.8	-	-	-	-	-	119.1	93.2	-
9013	Bulk Sed. 050510A	2	1	5	05/18/10	28	06/15/10	360	27.0	-	-	-	-	-	118.5	93.2	-
9013	Bulk Sed. 050510A	2	1	6	05/18/10	28	06/15/10	368	27.1	-	-	-	-	-	118.6	93.2	-
9013	Bulk Sed. 050510A	2	1	7	05/18/10	28	06/15/10	-	27.3	-	-	-	-	-	119.2	93.6	1.6E-08
9013	Bulk Sed. 050510A	3	1	1	05/18/10	7	05/25/10	323	27.8	-	-	-	-	-	119.4	93.4	-
9013	Bulk Sed. 050510A	3	1	2	05/18/10	7	05/25/10	320	28.0	-	-	-	-	-	118.9	92.9	-
9013	Bulk Sed. 050510A	3	1	3	05/18/10	14	06/01/10	394	27.4	-	-	-	-	-	119.1	93.4	-
9013	Bulk Sed. 050510A	3	1	4	05/18/10	14	06/01/10	375	27.3	-	-	-	-	-	119.0	93.4	-
9013	Bulk Sed. 050510A	3	1	5	05/18/10	28	06/15/10	442	26.8	-	-	-	-	-	118.1	93.1	-
9013	Bulk Sed. 050510A	3	1	6	05/18/10	28	06/15/10	453	26.8	-	-	-	-	-	119.3	94.0	-
9013	Bulk Sed. 050510A	3	1	7	05/18/10	28	06/15/10	-	27.1	-	-	-	-	-	119.3	93.9	1.1E-08
9014	Bulk Sed. 050610B	-	-	-		-		-	22.0	26.0	10.3	NP	NP	NP	121.7	99.8	-
9014	Bulk Sed. 050610B	1	1	1	05/19/10	7	05/26/10	114	25.3	-	-	-	-	-	119.3	95.2	-
9014	Bulk Sed. 050610B	1	1	2	05/19/10	7	05/26/10	120	25.3	-	-	-	-	-	119.9	95.7	-
9014	Bulk Sed. 050610B	1	1	3	05/19/10	14	06/02/10	142	25.3	-	-	-	-	-	120.0	95.7	-
9014	Bulk Sed. 050610B	1	1	4	05/19/10	14	06/02/10	137	25.3	-	-	-	-	-	119.1	95.0	-
9014	Bulk Sed. 050610B	1	1	5	05/19/10	28	06/16/10	148	24.6	-	-	-	-	-	118.8	95.3	-
9014	Bulk Sed. 050610B	1	1	6	05/19/10	28	06/16/10	156	24.9	-	-	-	-	-	119.9	96.0	-

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SUMMARY of TESTING

T.E.S.T. Project Number: 1003-03
Project Name: Kingston Fossil Plant

Sample Identification										Grain Size Distribution		Atterberg Limits			Unit Weight		
T.E.S.T. Sample No.	Client Base Material No.	Mix Design No.	Batch No.	Spec. No.	Mixing Date	Curing Age, days	Testing Date	UCS, psi	Moisture Content, %	% Finer #200 Sieve	% Finer 0.005mm	LL, %	PL, %	PI, %	Wet Density, pcf	Dry Density, pcf	Hydraulic Conduct. cm/sec
9014	Bulk Sed. 050610B	1	1	7	05/19/10	28	06/16/10	-	24.9	-	-	-	-	-	118.7	95.0	9.3E-08
9014	Bulk Sed. 050610B	2	1	1	05/19/10	7	05/26/10	148	26.1	-	-	-	-	-	120.0	95.1	-
9014	Bulk Sed. 050610B	2	1	2	05/19/10	7	05/26/10	144	26.2	-	-	-	-	-	118.7	94.0	-
9014	Bulk Sed. 050610B	2	1	3	05/19/10	14	06/02/10	169	26.1	-	-	-	-	-	119.3	94.5	-
9014	Bulk Sed. 050610B	2	1	4	05/19/10	14	06/02/10	172	26.1	-	-	-	-	-	119.9	95.1	-
9014	Bulk Sed. 050610B	2	1	5	05/19/10	28	06/16/10	196	25.7	-	-	-	-	-	119.3	94.8	-
9014	Bulk Sed. 050610B	2	1	6	05/19/10	28	06/16/10	194	25.5	-	-	-	-	-	119.0	94.8	-
9014	Bulk Sed. 050610B	2	1	7	05/19/10	28	06/16/10	-	25.1	-	-	-	-	-	119.3	95.4	8.4E-08
9014	Bulk Sed. 050610B	3	1	1	05/19/10	7	05/26/10	198	26.0	-	-	-	-	-	119.9	95.2	-
9014	Bulk Sed. 050610B	3	1	2	05/19/10	7	05/26/10	186	25.9	-	-	-	-	-	119.5	94.9	-
9014	Bulk Sed. 050610B	3	1	3	05/19/10	14	06/02/10	223	26.1	-	-	-	-	-	119.2	94.5	-
9014	Bulk Sed. 050610B	3	1	4	05/19/10	14	06/02/10	219	26.0	-	-	-	-	-	119.6	94.8	-
9014	Bulk Sed. 050610B	3	1	5	05/19/10	28	06/16/10	261	25.3	-	-	-	-	-	119.8	95.6	-
9014	Bulk Sed. 050610B	3	1	6	05/19/10	28	06/16/10	280	25.3	-	-	-	-	-	120.3	95.9	-
9014	Bulk Sed. 050610B	3	1	7	05/19/10	28	06/16/10	-	24.8	-	-	-	-	-	119.2	95.5	7.7E-08
9012+9013 +9014	Ash+Sed.A+Sed.B	-	-	-		-		-	27.5	53.4	15.2	18	15	3	118.8	93.2	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	1	05/21/10	7	05/28/10	94	28.4	-	-	-	-	-	117.6	91.5	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	2	05/21/10	7	05/28/10	90	28.5	-	-	-	-	-	115.9	90.2	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	3	05/21/10	14	06/04/10	118	28.3	-	-	-	-	-	116.0	90.4	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	4	05/21/10	14	06/04/10	118	28.5	-	-	-	-	-	116.2	90.4	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	5	05/21/10	28	06/18/10	187	27.7	-	-	-	-	-	116.0	90.8	-
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	6	05/21/10	28	06/18/10	202	27.5	-	-	-	-	-	115.7	90.8	-

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SUMMARY of TESTING

T.E.S.T. Project Number: 1003-03
Project Name: Kingston Fossil Plant

Sample Identification: T.E.S.T. Sample No.	Sample Identification: Client Base Material No.	Sample Identification: Mix Design No.	Sample Identification: Batch No.	Sample Identification: Spec. No.	Mixing Date	Curing Age, days	Testing Date	UCS, psi	Moisture Content, %	Grain Size Distribution: % Finer #200 Sieve	Grain Size Distribution: % Finer 0.005mm	Atterberg Limits: LL, %	Atterberg Limits: PL, %	Atterberg Limits: PI, %	Unit Weight: Wet Density, pcf	Unit Weight: Dry Density, pcf	Hydraulic Conduct. cm/sec
9012+9013 +9014	Ash+Sed.A+Sed.B	1	1	7	05/21/10	28	06/18/10	-	27.6	-	-	-	-	-	116.6	91.4	5.0E-07
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	1	05/21/10	7	05/28/10	132	28.7	-	-	-	-	-	117.7	91.4	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	2	05/21/10	7	05/28/10	132	28.9	-	-	-	-	-	117.0	90.7	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	3	05/21/10	14	06/04/10	166	28.3	-	-	-	-	-	117.0	91.0	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	4	05/21/10	14	06/04/10	174	28.6	-	-	-	-	-	116.8	90.8	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	5	05/21/10	28	06/18/10	276	27.8	-	-	-	-	-	115.8	90.6	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	6	05/21/10	28	06/18/10	276	27.9	-	-	-	-	-	116.2	90.9	-
9012+9013 +9014	Ash+Sed.A+Sed.B	2	1	7	05/21/10	28	06/18/10	-	28.0	-	-	-	-	-	115.8	90.5	3.3E-07
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	1	05/21/10	7	05/28/10	155	29.5	-	-	-	-	-	116.6	90.1	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	2	05/21/10	7	05/28/10	149	29.6	-	-	-	-	-	116.6	90.0	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	3	05/21/10	14	06/04/10	214	29.0	-	-	-	-	-	116.2	90.0	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	4	05/21/10	14	06/04/10	207	29.0	-	-	-	-	-	116.6	90.3	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	5	05/21/10	28	06/18/10	333	28.1	-	-	-	-	-	115.0	89.7	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	6	05/21/10	28	06/18/10	343	28.1	-	-	-	-	-	116.1	90.6	-
9012+9013 +9014	Ash+Sed.A+Sed.B	3	1	7	05/21/10	28	06/18/10	-	28.6	-	-	-	-	-	115.9	90.1	2.4E-07

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Tested By	RI
Date	06/17/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.541	in	6.45	cm
Diameter	3.010	in	7.65	cm
Area	7.12	in^2	45.91	cm^2
Volume	296.30	cm^3	0.0105	ft^3
Mass	522.80	g	1.15	lb
Specific Gravity	2.500	(Assumed)		
Dry Density	83.2	pcf		

Moisture Content

Mass of wet sample & tare	522.80	g
Mass of dry sample & tare	394.90	g
Mass of tare	0.00	g
% Moisture	32.4	

Test Data

Speed	7	
Board Number	7	
Cell Number	2	
Flow Pump Number	2A	
Flow Pump Rate	1.79E-03	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	39.39	cm
Min Head	38.69	cm
Maximum Gradient	6.10	
Minimum Gradient	5.99	

Final Data (After Test)

Average Height of Sample			2.541	in	6.45	cm
Average Diameter of Sample			3.010	in	7.65	cm
Area	7.12	in^2	45.91	cm^2		
Volume	296.30	cm^3	0.0105	ft^3		
Mass	526.70	g	1.16	lb		

Dry Density	83.2	pcf
Vol. of Voids	138.28	cm^3
Vol. of Solids	158.02	cm^3
Void Ratio	0.88	
Saturation	95.2	%

Moisture Content

Mass of wet sample & tare	625.20	g
Mass of dry sample & tare	493.60	g
Mass of tare	98.70	g
% Moisture	33.3	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/17/10	8	40	-	0.56	39.39	6.10	27.5	-	-	-	
06/17/10	8	50	600	0.55	38.69	5.99	27.5	6.45E-06	0.841	5.43E-06	
06/17/10	9	0	600	0.56	39.39	6.10	27.5	6.45E-06	0.841	5.43E-06	
06/17/10	9	10	600	0.55	38.69	5.99	27.5	6.45E-06	0.841	5.43E-06	*
06/17/10	9	20	600	0.56	39.39	6.10	27.5	6.45E-06	0.841	5.43E-06	*
06/17/10	9	30	600	0.56	39.39	6.10	27.5	6.40E-06	0.841	5.38E-06	*
06/17/10	9	40	600	0.56	39.39	6.10	27.5	6.40E-06	0.841	5.38E-06	*

Reported Average Hydraulic Conductivity* 5.4E-06 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	245			Pore Pressure Transducer ID #	28

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1874 Forge Street Tucker, GA 30084
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Web: www.test-llc.com

Tested By	RI
Date	05/27/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.830
Initial Diameter, in	3.012
Height-to-Diameter Ratio	1.94
Area, in^2	7.13
Volume, in^3	41.54
Mass of Sample, g	1202.50
Wet Density, pcf	110.3
Dry Density, pcf	82.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1362.20
Mass of Dry Sample and Tare, g	1061.40
Mass of Tare, g	161.50
Moisture, %	33.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

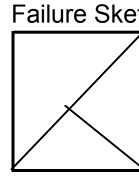
Maximum Load at Failure, lbf	460
Specimen Cross-sectional Area, in^2	7.13
Compressive Strength at Failure, psi	65
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**65**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Sketch



Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	05/27/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.824
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.94
Area, in^2	7.07
Volume, in^3	41.17
Mass of Sample, g	1192.30
Wet Density, pcf	110.3
Dry Density, pcf	82.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1340.90
Mass of Dry Sample and Tare, g	1036.90
Mass of Tare, g	150.80
Moisture, %	34.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

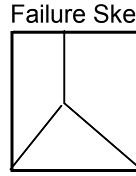
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	451
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	64
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**64**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.817
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.94
Area, in^2	7.07
Volume, in^3	41.12
Mass of Sample, g	1186.70
Wet Density, pcf	109.9
Dry Density, pcf	82.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1341.70
Mass of Dry Sample and Tare, g	1042.30
Mass of Tare, g	156.70
Moisture, %	33.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

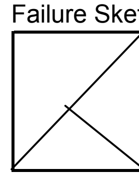
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	524
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	74
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**74**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.805
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.93
Area, in^2	7.08
Volume, in^3	41.09
Mass of Sample, g	1186.60
Wet Density, pcf	110.0
Dry Density, pcf	82.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1330.20
Mass of Dry Sample and Tare, g	1031.90
Mass of Tare, g	145.80
Moisture, %	33.7

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

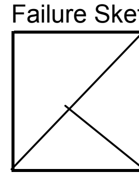
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	520
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	73
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**73**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.849
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.95
Area, in^2	7.09
Volume, in^3	41.48
Mass of Sample, g	1192.30
Wet Density, pcf	109.5
Dry Density, pcf	82.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.85

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1351.40
Mass of Dry Sample and Tare, g	1055.00
Mass of Tare, g	161.60
Moisture, %	33.2

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

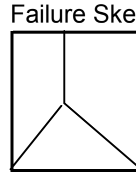
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	594
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	84
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**84**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-1-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.773
Initial Diameter, in	2.997
Height-to-Diameter Ratio	1.93
Area, in^2	7.05
Volume, in^3	40.73
Mass of Sample, g	1179.00
Wet Density, pcf	110.3
Dry Density, pcf	83.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1333.00
Mass of Dry Sample and Tare, g	1042.00
Mass of Tare, g	156.70
Moisture, %	32.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

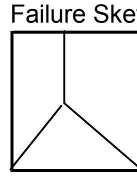
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	579
Specimen Cross-sectional Area, in^2	7.05
Compressive Strength at Failure, psi	82
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**82**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 06/17/10 Checked By:

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.517	in	6.39	cm
Diameter	3.006	in	7.64	cm
Area	7.10	in^2	45.79	cm^2
Volume	292.72	cm^3	0.0103	ft^3
Mass	517.70	g	1.14	lb
Specific Gravity	2.500	(Assumed)		
Dry Density	83.9	pcf		

Moisture Content

Mass of wet sample & tare	517.70	g
Mass of dry sample & tare	393.70	g
Mass of tare	0.00	g
% Moisture	31.5	

Test Data

Speed	7	
Board Number	8	
Cell Number	19	
Flow Pump Number	2A	
Flow Pump Rate	1.79E-03	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	42.91	cm
Min Head	42.20	cm
Maximum Gradient	6.71	
Minimum Gradient	6.60	

Final Data (After Test)

Average Height of Sample			2.517	in	6.39	cm
Average Diameter of Sample			3.006	in	7.64	cm
Area	7.10	in^2	45.79	cm^2		
Volume	292.72	cm^3	0.0103	ft^3		
Mass	522.50	g	1.15	lb		

Dry Density	84.0	pcf
Vol. of Voids	135.18	cm^3
Vol. of Solids	157.54	cm^3
Void Ratio	0.86	
Saturation	95.2	%

Moisture Content

Mass of wet sample & tare	663.00	g
Mass of dry sample & tare	534.40	g
Mass of tare	140.70	g
% Moisture	32.7	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x (°C)	@ T_x	R_T	@ 20 °C	
06/17/10	8	40	-	0.60	42.20	6.60	27.5	-	-	-	
06/17/10	8	50	600	0.61	42.91	6.71	27.5	5.88E-06	0.841	4.94E-06	
06/17/10	9	0	600	0.60	42.20	6.60	27.5	5.88E-06	0.841	4.94E-06	
06/17/10	9	10	600	0.61	42.91	6.71	27.5	5.88E-06	0.841	4.94E-06	*
06/17/10	9	20	600	0.60	42.20	6.60	27.5	5.88E-06	0.841	4.94E-06	*
06/17/10	9	30	600	0.61	42.91	6.71	27.5	5.88E-06	0.841	4.94E-06	*
06/17/10	9	40	600	0.61	42.91	6.71	27.5	5.83E-06	0.841	4.90E-06	*

Reported Average Hydraulic Conductivity* 4.9E-06 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION: NA

USCS (ASTM D2487;2488): NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	245			Pore Pressure Transducer ID #	28

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Tested By	RI
Date	05/27/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.786
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.93
Area, in^2	7.06
Volume, in^3	40.84
Mass of Sample, g	1185.10
Wet Density, pcf	110.5
Dry Density, pcf	82.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1328.50
Mass of Dry Sample and Tare, g	1026.80
Mass of Tare, g	145.80
Moisture, %	34.2

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

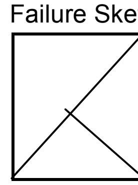
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	545
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	77
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**77**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	05/27/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.829
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.94
Area, in^2	7.06
Volume, in^3	41.15
Mass of Sample, g	1187.20
Wet Density, pcf	109.9
Dry Density, pcf	82.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1392.10
Mass of Dry Sample and Tare, g	1091.00
Mass of Tare, g	206.70
Moisture, %	34.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

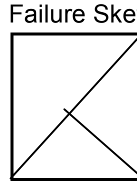
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	567
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	80
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**80**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.811
Initial Diameter, in	2.999
Height-to-Diameter Ratio	1.94
Area, in^2	7.06
Volume, in^3	41.05
Mass of Sample, g	1189.10
Wet Density, pcf	110.4
Dry Density, pcf	82.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1359.70
Mass of Dry Sample and Tare, g	1059.30
Mass of Tare, g	172.10
Moisture, %	33.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

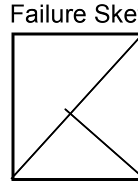
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	711
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	101
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**101**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.829
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.94
Area, in^2	7.09
Volume, in^3	41.34
Mass of Sample, g	1197.20
Wet Density, pcf	110.3
Dry Density, pcf	82.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1385.40
Mass of Dry Sample and Tare, g	1086.30
Mass of Tare, g	190.60
Moisture, %	33.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

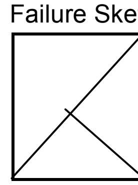
Maximum Load at Failure, lbf	665
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	94
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**94**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Sketch



Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.844
Initial Diameter, in	3.009
Height-to-Diameter Ratio	1.94
Area, in^2	7.11
Volume, in^3	41.56
Mass of Sample, g	1196.10
Wet Density, pcf	109.6
Dry Density, pcf	82.5
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1349.70
Mass of Dry Sample and Tare, g	1054.40
Mass of Tare, g	155.80
Moisture, %	32.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

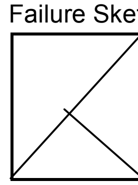
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	895
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	126
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**126**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	06/17/10
		Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-2-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.803
Initial Diameter, in	3.023
Height-to-Diameter Ratio	1.92
Area, in^2	7.18
Volume, in^3	41.65
Mass of Sample, g	1190.10
Wet Density, pcf	108.9
Dry Density, pcf	81.9
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1333.00
Mass of Dry Sample and Tare, g	1039.10
Mass of Tare, g	145.90
Moisture, %	32.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

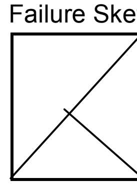
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	916
Specimen Cross-sectional Area, in^2	7.18
Compressive Strength at Failure, psi	128
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**128**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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1874 Forge Street Tucker, GA 30084
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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.538	in	6.45	cm
Diameter	3.009	in	7.64	cm
Area	7.11	in^2	45.88	cm^2
Volume	295.75	cm^3	0.0104	ft^3
Mass	520.10	g	1.15	lb
Specific Gravity	2.500	(Assumed)		
Dry Density	82.6	pcf		

Moisture Content

Mass of wet sample & tare	520.10	g
Mass of dry sample & tare	391.30	g
Mass of tare	0.00	g
% Moisture	32.9	

Test Data

Speed	7	
Board Number	5	
Cell Number	15	
Flow Pump Number	2A	
Flow Pump Rate	1.79E-03	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	58.38	cm
Min Head	57.68	cm
Maximum Gradient	9.04	
Minimum Gradient	8.93	

Final Data (After Test)

Average Height of Sample			2.542	in	6.46	cm
Average Diameter of Sample			3.009	in	7.64	cm
Area	7.11	in^2	45.88	cm^2		
Volume	296.22	cm^3	0.0105	ft^3		
Mass	524.90	g	1.16	lb		

Dry Density	82.5	pcf
Vol. of Voids	139.64	cm^3
Vol. of Solids	156.58	cm^3
Void Ratio	0.89	
Saturation	95.6	%

Moisture Content

Mass of wet sample & tare	628.90	g
Mass of dry sample & tare	495.50	g
Mass of tare	104.20	g
% Moisture	34.1	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/17/10	10	0	-	0.83	58.38	9.04	27.5	-	-	-	
06/17/10	10	10	600	0.82	57.68	8.93	27.5	4.35E-06	0.841	3.65E-06	
06/17/10	10	20	600	0.83	58.38	9.04	27.5	4.35E-06	0.841	3.65E-06	
06/17/10	10	30	600	0.82	57.68	8.93	27.5	4.35E-06	0.841	3.65E-06	*
06/17/10	10	40	600	0.83	58.38	9.04	27.5	4.35E-06	0.841	3.65E-06	*
06/17/10	10	50	600	0.82	57.68	8.93	27.5	4.35E-06	0.841	3.65E-06	*
06/17/10	11	0	600	0.83	58.38	9.04	27.5	4.35E-06	0.841	3.65E-06	*

Reported Average Hydraulic Conductivity* 3.7E-06 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	216
Syringe ID #	245			Pore Pressure Transducer ID #	28

TIMELY ENGINEERING SOIL TESTS, LLC

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Web: www.test-llc.com

Tested By	RI
Date	05/27/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.795
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.93
Area, in^2	7.08
Volume, in^3	41.02
Mass of Sample, g	1186.20
Wet Density, pcf	110.2
Dry Density, pcf	81.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1389.50
Mass of Dry Sample and Tare, g	1084.00
Mass of Tare, g	205.30
Moisture, %	34.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

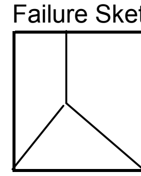
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	633
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	89
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**89**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/27/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.811
Initial Diameter, in	3.006
Height-to-Diameter Ratio	1.93
Area, in^2	7.10
Volume, in^3	41.24
Mass of Sample, g	1191.20
Wet Density, pcf	110.0
Dry Density, pcf	81.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1395.60
Mass of Dry Sample and Tare, g	1088.90
Mass of Tare, g	205.80
Moisture, %	34.7

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

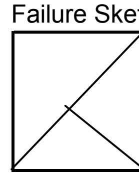
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	643
Specimen Cross-sectional Area, in^2	7.10
Compressive Strength at Failure, psi	91
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**91**

Failure Code 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.827
Initial Diameter, in	2.999
Height-to-Diameter Ratio	1.94
Area, in^2	7.06
Volume, in^3	41.16
Mass of Sample, g	1202.50
Wet Density, pcf	111.3
Dry Density, pcf	83.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1363.50
Mass of Dry Sample and Tare, g	1061.80
Mass of Tare, g	162.40
Moisture, %	33.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

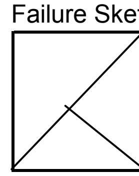
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	857
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	121
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**121**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/03/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.798
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.93
Area, in^2	7.06
Volume, in^3	40.93
Mass of Sample, g	1189.60
Wet Density, pcf	110.7
Dry Density, pcf	82.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1349.20
Mass of Dry Sample and Tare, g	1044.90
Mass of Tare, g	161.60
Moisture, %	34.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

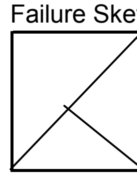
Load Cell ID #	11
Compression Device ID #	10
Balance ID #	1/7
Digital Caliper ID #	16
Readout Device ID #	10
Oven ID #	12/13/14

Maximum Load at Failure, lbf	837
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	119
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**119**

Failure Code 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type:
Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.806
Initial Diameter, in	3.004
Height-to-Diameter Ratio	1.93
Area, in^2	7.09
Volume, in^3	41.15
Mass of Sample, g	1188.40
Wet Density, pcf	110.0
Dry Density, pcf	82.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1337.00
Mass of Dry Sample and Tare, g	1037.00
Mass of Tare, g	151.00
Moisture, %	33.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

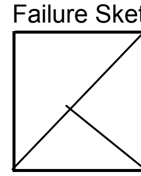
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1127
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	159
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**159**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/17/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012/(Bulk Ash 050610)-3-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.805
Initial Diameter, in	3.007
Height-to-Diameter Ratio	1.93
Area, in^2	7.10
Volume, in^3	41.22
Mass of Sample, g	1188.80
Wet Density, pcf	109.9
Dry Density, pcf	82.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1332.70
Mass of Dry Sample and Tare, g	1035.70
Mass of Tare, g	146.70
Moisture, %	33.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

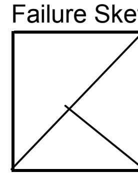
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1139
Specimen Cross-sectional Area, in^2	7.10
Compressive Strength at Failure, psi	160
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**160**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/15/10
Checked By	48

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.968	in	7.54	cm
Diameter	2.973	in	7.55	cm
Area	6.94	in^2	44.79	cm^2
Volume	337.63	cm^3	0.0119	ft^3
Mass	628.50	g	1.39	lb
Specific Gravity	2.650	(Assumed)		
Dry Density	90.4	pcf		

Moisture Content

Mass of wet sample & tare	628.50	g
Mass of dry sample & tare	488.90	g
Mass of tare	0.00	g
% Moisture	28.6	

Test Data

Speed	14	
Board Number	5	
Cell Number	19	
Flow Pump Number	2A	
Flow Pump Rate	1.40E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	116.76	cm
Min Head	116.06	cm
Maximum Gradient	15.48	
Minimum Gradient	15.38	

Final Data (After Test)

Average Height of Sample			2.970	in	7.54	cm
Average Diameter of Sample			2.994	in	7.60	cm
Area	7.04	in^2	45.42	cm^2		
Volume	342.65	cm^3	0.0121	ft^3		
Mass	639.30	g	1.41	lb		

Dry Density	89.0	pcf
Vol. of Voids	158.13	cm^3
Vol. of Solids	184.52	cm^3
Void Ratio	0.86	
Saturation	95.1	%

Moisture Content

Mass of wet sample & tare	738.10	g
Mass of dry sample & tare	587.80	g
Mass of tare	98.90	g
% Moisture	30.7	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/15/10	10	0	-	1.65	116.06	15.38	27.0	-	-	-	
06/15/10	10	10	600	1.66	116.76	15.48	27.0	2.00E-08	0.850	1.70E-08	
06/15/10	10	20	600	1.65	116.06	15.38	27.0	2.00E-08	0.850	1.70E-08	
06/15/10	10	30	600	1.66	116.76	15.48	27.0	2.00E-08	0.850	1.70E-08	*
06/15/10	10	40	600	1.65	116.06	15.38	27.0	2.00E-08	0.850	1.70E-08	*
06/15/10	10	50	600	1.66	116.76	15.48	27.0	2.00E-08	0.850	1.70E-08	*
06/15/10	11	0	600	1.66	116.76	15.48	27.0	1.99E-08	0.850	1.69E-08	*

Reported Average Hydraulic Conductivity* 1.7E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	216
Syringe ID #	245			Pore Pressure Transducer ID #	28

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/25/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.797
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.93
Area, in^2	7.07
Volume, in^3	40.98
Mass of Sample, g	1270.70
Wet Density, pcf	118.1
Dry Density, pcf	91.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1477.20
Mass of Dry Sample and Tare, g	1189.60
Mass of Tare, g	208.40
Moisture, %	29.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

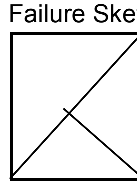
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1045
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	148
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**148**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 05/25/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.756
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.92
Area, in^2	7.09
Volume, in^3	40.82
Mass of Sample, g	1263.10
Wet Density, pcf	117.9
Dry Density, pcf	91.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1451.70
Mass of Dry Sample and Tare, g	1165.30
Mass of Tare, g	190.40
Moisture, %	29.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

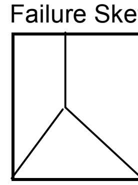
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1091
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	154
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**154**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



DESCRIPTION

Failure Type: Cone and Split

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/01/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.809
Initial Diameter, in	3.004
Height-to-Diameter Ratio	1.93
Area, in^2	7.09
Volume, in^3	41.17
Mass of Sample, g	1273.80
Wet Density, pcf	117.9
Dry Density, pcf	91.5
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1464.50
Mass of Dry Sample and Tare, g	1180.40
Mass of Tare, g	194.40
Moisture, %	28.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

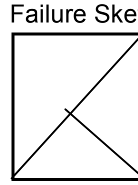
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1326
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	187
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**187**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



DESCRIPTION

Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/01/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.766
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.76
Mass of Sample, g	1260.70
Wet Density, pcf	117.8
Dry Density, pcf	91.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1462.20
Mass of Dry Sample and Tare, g	1181.10
Mass of Tare, g	205.30
Moisture, %	28.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

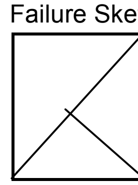
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1250
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	177
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**177**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



DESCRIPTION

Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/15/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.763
Initial Diameter, in	2.999
Height-to-Diameter Ratio	1.92
Area, in^2	7.06
Volume, in^3	40.71
Mass of Sample, g	1265.00
Wet Density, pcf	118.4
Dry Density, pcf	91.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1469.80
Mass of Dry Sample and Tare, g	1186.60
Mass of Tare, g	207.20
Moisture, %	28.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

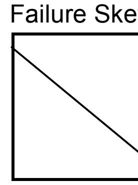
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1490
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	211
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**211**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/15/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-1-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.766
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.76
Mass of Sample, g	1262.70
Wet Density, pcf	118.0
Dry Density, pcf	92.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1448.10
Mass of Dry Sample and Tare, g	1173.80
Mass of Tare, g	194.60
Moisture, %	28.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

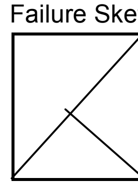
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1589
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	225
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**225**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



DESCRIPTION

Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

T.E.S.T.
TIMELY ENGINEERING SOIL TESTS, LLC
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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/15/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.883	in	7.32	cm
Diameter	2.996	in	7.61	cm
Area	7.05	in^2	45.48	cm^2
Volume	333.06	cm^3	0.0118	ft^3
Mass	636.40	g	1.40	lb
Specific Gravity	2.700	(Assumed)		
Dry Density	93.6	pcf		

Moisture Content

Mass of wet sample & tare	636.40	g
Mass of dry sample & tare	499.80	g
Mass of tare	0.00	g
% Moisture	27.3	

Test Data

Speed	14	
Board Number	6	
Cell Number	15	
Flow Pump Number	2B	
Flow Pump Rate	1.40E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	120.28	cm
Min Head	118.87	cm
Maximum Gradient	16.42	
Minimum Gradient	16.23	

Final Data (After Test)

Average Height of Sample			2.884	in	7.33	cm
Average Diameter of Sample			3.000	in	7.62	cm
Area	7.07	in^2	45.60	cm^2		
Volume	334.06	cm^3	0.0118	ft^3		
Mass	648.40	g	1.43	lb		

Dry Density	93.4	pcf
Vol. of Voids	148.92	cm^3
Vol. of Solids	185.14	cm^3
Void Ratio	0.80	
Saturation	99.7	%

Moisture Content

Mass of wet sample & tare	737.50	g
Mass of dry sample & tare	589.00	g
Mass of tare	89.20	g
% Moisture	29.7	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x (°C)	@ T_x	R_T	@ 20 °C	
06/15/10	10	0	-	1.69	118.87	16.23	27.0	-	-	-	
06/15/10	10	10	600	1.70	119.58	16.32	27.0	1.89E-08	0.850	1.60E-08	
06/15/10	10	20	600	1.69	118.87	16.23	27.0	1.89E-08	0.850	1.60E-08	
06/15/10	10	30	600	1.70	119.58	16.32	27.0	1.89E-08	0.850	1.60E-08	*
06/15/10	10	40	600	1.71	120.28	16.42	27.0	1.88E-08	0.850	1.59E-08	*
06/15/10	10	50	600	1.70	119.58	16.32	27.0	1.88E-08	0.850	1.59E-08	*
06/15/10	11	0	600	1.71	120.28	16.42	27.0	1.88E-08	0.850	1.59E-08	*

Reported Average Hydraulic Conductivity* 1.6E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	263
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	216
Syringe ID #	246			Pore Pressure Transducer ID #	28

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Phone: 770-938-8233
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Web: www.test-llc.com

Tested By	RI
Date	05/25/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.781
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.93
Area, in^2	7.07
Volume, in^3	40.86
Mass of Sample, g	1275.70
Wet Density, pcf	118.9
Dry Density, pcf	92.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1468.60
Mass of Dry Sample and Tare, g	1187.30
Mass of Tare, g	194.30
Moisture, %	28.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

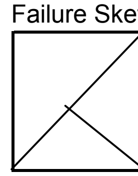
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1672
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	237
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**237**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



DESCRIPTION

Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	05/25/10
		Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.817
Initial Diameter, in	3.001
Height-to-Diameter Ratio	1.94
Area, in^2	7.07
Volume, in^3	41.15
Mass of Sample, g	1284.30
Wet Density, pcf	118.9
Dry Density, pcf	92.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1444.50
Mass of Dry Sample and Tare, g	1162.30
Mass of Tare, g	161.90
Moisture, %	28.2

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

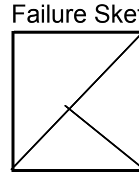
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1598
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	226
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**226**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/01/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.792
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.93
Area, in^2	7.07
Volume, in^3	40.94
Mass of Sample, g	1276.70
Wet Density, pcf	118.8
Dry Density, pcf	92.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1480.60
Mass of Dry Sample and Tare, g	1202.50
Mass of Tare, g	206.60
Moisture, %	27.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

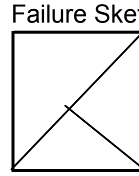
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2058
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	291
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**291**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/01/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.767
Initial Diameter, in	3.001
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.78
Mass of Sample, g	1274.70
Wet Density, pcf	119.1
Dry Density, pcf	93.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1478.60
Mass of Dry Sample and Tare, g	1202.60
Mass of Tare, g	208.40
Moisture, %	27.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

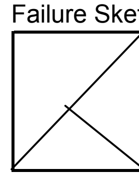
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2135
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	302
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**302**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/15/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.815
Initial Diameter, in	3.004
Height-to-Diameter Ratio	1.94
Area, in^2	7.09
Volume, in^3	41.21
Mass of Sample, g	1281.60
Wet Density, pcf	118.5
Dry Density, pcf	93.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1461.60
Mass of Dry Sample and Tare, g	1190.50
Mass of Tare, g	188.10
Moisture, %	27.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

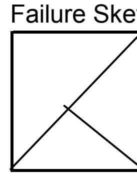
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2554
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	360
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**360**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/15/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-2-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.756
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.92
Area, in^2	7.08
Volume, in^3	40.74
Mass of Sample, g	1268.00
Wet Density, pcf	118.6
Dry Density, pcf	93.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1450.00
Mass of Dry Sample and Tare, g	1181.20
Mass of Tare, g	190.60
Moisture, %	27.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2605
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	368
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**368**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch

DESCRIPTION

Failure Type: Shear

USCS (ASTM D2487: D2488)

REMARKS

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AAP

Tested By	RI
Date	06/15/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.819	in	7.16	cm
Diameter	2.995	in	7.61	cm
Area	7.05	in^2	45.45	cm^2
Volume	325.45	cm^3	0.0115	ft^3
Mass	622.30	g	1.37	lb
Specific Gravity	2.700	(Assumed)		
Dry Density	93.9	pcf		

Moisture Content

Mass of wet sample & tare	622.30	g
Mass of dry sample & tare	489.50	g
Mass of tare	0.00	g
% Moisture	27.1	

Test Data

Speed	14	
Board Number	2	
Cell Number	9	
Flow Pump Number	2A	
Flow Pump Rate	1.40E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	173.74	cm
Min Head	172.33	cm
Maximum Gradient	24.25	
Minimum Gradient	24.05	

Final Data (After Test)

Average Height of Sample			2.821	in	7.17	cm
Average Diameter of Sample			2.998	in	7.61	cm
Area	7.06	in^2	45.54	cm^2		
Volume	326.33	cm^3	0.0115	ft^3		
Mass	635.60	g	1.40	lb		

Dry Density	93.6	pcf
Vol. of Voids	145.01	cm^3
Vol. of Solids	181.32	cm^3
Void Ratio	0.80	
Saturation	100.7	%

Moisture Content

Mass of wet sample & tare	732.00	g
Mass of dry sample & tare	586.00	g
Mass of tare	96.50	g
% Moisture	29.8	

TIME FUNCTION			Δt	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/15/10	11	10	-	2.45	172.33	24.05	27.0	-	-	-	
06/15/10	11	20	600	2.46	173.04	24.15	27.0	1.28E-08	0.850	1.08E-08	
06/15/10	11	30	600	2.45	172.33	24.05	27.0	1.28E-08	0.850	1.08E-08	
06/15/10	11	40	600	2.46	173.04	24.15	27.0	1.28E-08	0.850	1.08E-08	*
06/15/10	11	50	600	2.47	173.74	24.25	27.0	1.27E-08	0.850	1.08E-08	*
06/15/10	12	0	600	2.46	173.04	24.15	27.0	1.27E-08	0.850	1.08E-08	*
06/15/10	12	10	600	2.47	173.74	24.25	27.0	1.27E-08	0.850	1.08E-08	*

Reported Average Hydraulic Conductivity* 1.1E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	64
Syringe ID #	245			Pore Pressure Transducer ID #	26/27

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
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Web: www.test-llc.com

Tested By	RI
Date	05/25/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.768
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.77
Mass of Sample, g	1278.20
Wet Density, pcf	119.4
Dry Density, pcf	93.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1432.80
Mass of Dry Sample and Tare, g	1155.20
Mass of Tare, g	156.60
Moisture, %	27.8

Note 1: Water content was obtained after shear from partial sample.

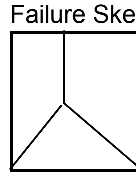
TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2284
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	323
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**323**

Failure Code: 2

Failure Sketch



Failure Type: Cone and Split

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	05/25/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.796
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.93
Area, in^2	7.09
Volume, in^3	41.11
Mass of Sample, g	1283.40
Wet Density, pcf	118.9
Dry Density, pcf	92.9
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1437.20
Mass of Dry Sample and Tare, g	1157.20
Mass of Tare, g	155.70
Moisture, %	28.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

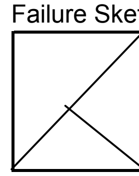
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2269
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	320
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**320**

Failure Code 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/01/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.781
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.92
Area, in^2	7.09
Volume, in^3	41.00
Mass of Sample, g	1281.30
Wet Density, pcf	119.1
Dry Density, pcf	93.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1484.10
Mass of Dry Sample and Tare, g	1209.70
Mass of Tare, g	207.20
Moisture, %	27.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2795
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	394
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**394**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch

Failure Type: Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI		
Date	06/01/10		
Checked By	[signature]		
Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.773
Initial Diameter, in	2.999
Height-to-Diameter Ratio	1.92
Area, in^2	7.06
Volume, in^3	40.78
Mass of Sample, g	1273.90
Wet Density, pcf	119.0
Dry Density, pcf	93.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1474.60
Mass of Dry Sample and Tare, g	1202.40
Mass of Tare, g	205.80
Moisture, %	27.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2648
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	375
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**375**

Failure Code: 4

Failure Sketch

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Type: Shear

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/15/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9013/(Bulk SED-050610-A)-3-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.805
Initial Diameter, in	3.005
Height-to-Diameter Ratio	1.93
Area, in^2	7.09
Volume, in^3	41.17
Mass of Sample, g	1276.80
Wet Density, pcf	118.1
Dry Density, pcf	93.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1463.60
Mass of Dry Sample and Tare, g	1195.50
Mass of Tare, g	194.30
Moisture, %	26.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	3133
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	442
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**442**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch

Failure Type: Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E. S.T.

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/16/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.598	in	6.60	cm
Diameter	3.004	in	7.63	cm
Area	7.09	in^2	45.73	cm^2
Volume	301.74	cm^3	0.0107	ft^3
Mass	574.10	g	1.27	lb
Specific Gravity	2.650	(Assumed)		
Dry Density	95.0	pcf		

Moisture Content

Mass of wet sample & tare	574.10	g
Mass of dry sample & tare	459.50	g
Mass of tare	0.00	g
% Moisture	24.9	

Test Data

Speed	12	
Board Number	7	
Cell Number	7	
Flow Pump Number	2A	
Flow Pump Rate	5.60E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	74.56	cm
Min Head	73.15	cm
Maximum Gradient	11.30	
Minimum Gradient	11.09	

Final Data (After Test)

Average Height of Sample			2.597	in	6.60	cm
Average Diameter of Sample			3.005	in	7.63	cm
Area	7.09	in^2	45.76	cm^2		
Volume	301.82	cm^3	0.0107	ft^3		
Mass	583.80	g	1.29	lb		

Dry Density	95.0	pcf
Vol. of Voids	128.34	cm^3
Vol. of Solids	173.49	cm^3
Void Ratio	0.74	
Saturation	96.7	%

Moisture Content

Mass of wet sample & tare	679.20	g
Mass of dry sample & tare	555.20	g
Mass of tare	95.70	g
% Moisture	27.0	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/16/10	9	10	-	1.04	73.15	11.09	27.1	-	-	-	
06/16/10	9	20	600	1.05	73.86	11.20	27.1	1.10E-07	0.848	9.32E-08	
06/16/10	9	30	600	1.04	73.15	11.09	27.1	1.10E-07	0.848	9.32E-08	
06/16/10	9	40	600	1.05	73.86	11.20	27.1	1.10E-07	0.848	9.32E-08	*
06/16/10	9	50	600	1.06	74.56	11.30	27.1	1.09E-07	0.848	9.23E-08	*
06/16/10	10	0	600	1.05	73.86	11.20	27.1	1.09E-07	0.848	9.23E-08	*
06/16/10	10	10	600	1.06	74.56	11.30	27.1	1.09E-07	0.848	9.23E-08	*

Reported Average Hydraulic Conductivity* 9.3E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	245			Pore Pressure Transducer ID #	28

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Tested By	RI
Date	05/26/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.725
Initial Diameter, in	3.008
Height-to-Diameter Ratio	1.90
Area, in^2	7.11
Volume, in^3	40.68
Mass of Sample, g	1273.80
Wet Density, pcf	119.3
Dry Density, pcf	95.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1482.40
Mass of Dry Sample and Tare, g	1225.60
Mass of Tare, g	210.60
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	813
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	114
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**114**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch

Failure Type: Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	05/26/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.772
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.92
Area, in^2	7.08
Volume, in^3	40.85
Mass of Sample, g	1286.10
Wet Density, pcf	119.9
Dry Density, pcf	95.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1491.70
Mass of Dry Sample and Tare, g	1232.70
Mass of Tare, g	207.20
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

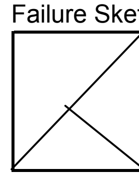
Maximum Load at Failure, lbf	852
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	120
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**120**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Sketch



Failure Type: Cone and Shear

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/02/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.814
Initial Diameter, in	3.001
Height-to-Diameter Ratio	1.94
Area, in^2	7.07
Volume, in^3	41.12
Mass of Sample, g	1295.80
Wet Density, pcf	120.0
Dry Density, pcf	95.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1462.30
Mass of Dry Sample and Tare, g	1200.70
Mass of Tare, g	167.80
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

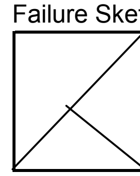
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1003
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	142
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**142**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/02/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.802
Initial Diameter, in	3.007
Height-to-Diameter Ratio	1.93
Area, in^2	7.10
Volume, in^3	41.20
Mass of Sample, g	1288.50
Wet Density, pcf	119.1
Dry Density, pcf	95.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1443.00
Mass of Dry Sample and Tare, g	1182.70
Mass of Tare, g	155.80
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

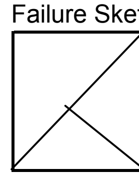
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	970
Specimen Cross-sectional Area, in^2	7.10
Compressive Strength at Failure, psi	137
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**137**

Failure Code 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Web: www.test-llc.com

Tested By	RI
Date	06/16/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.793
Initial Diameter, in	3.008
Height-to-Diameter Ratio	1.93
Area, in^2	7.11
Volume, in^3	41.17
Mass of Sample, g	1283.70
Wet Density, pcf	118.8
Dry Density, pcf	95.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1486.70
Mass of Dry Sample and Tare, g	1234.50
Mass of Tare, g	208.30
Moisture, %	24.6

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

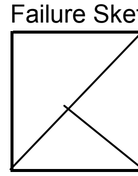
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1055
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	148
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**148**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Tested By	RI
Date	06/16/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-1-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.778
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.92
Area, in^2	7.08
Volume, in^3	40.90
Mass of Sample, g	1287.70
Wet Density, pcf	119.9
Dry Density, pcf	96.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1472.10
Mass of Dry Sample and Tare, g	1216.90
Mass of Tare, g	190.40
Moisture, %	24.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

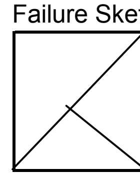
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1106
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	156
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**156**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E. S.T.

Timely Engineering Soil Tests, LLC

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Web: www.test-llc.com

Tested By	RI
Date	06/16/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.595	in	6.59	cm
Diameter	3.006	in	7.64	cm
Area	7.10	in^2	45.79	cm^2
Volume	301.79	cm^3	0.0107	ft^3
Mass	577.30	g	1.27	lb
Specific Gravity	2.700	(Assumed)		
Dry Density	95.4	pcf		

Moisture Content

Mass of wet sample & tare	577.30	g
Mass of dry sample & tare	461.30	g
Mass of tare	0.00	g
% Moisture	25.1	

Test Data

Speed	12	
Board Number	8	
Cell Number	15	
Flow Pump Number	2B	
Flow Pump Rate	5.60E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	81.59	cm
Min Head	80.19	cm
Maximum Gradient	12.39	
Minimum Gradient	12.18	

Final Data (After Test)

Average Height of Sample			2.593	in	6.59	cm
Average Diameter of Sample			3.004	in	7.63	cm
Area	7.09	in^2	45.73	cm^2		
Volume	301.16	cm^3	0.0106	ft^3		
Mass	587.20	g	1.29	lb		

Dry Density	95.6	pcf
Vol. of Voids	130.28	cm^3
Vol. of Solids	170.88	cm^3
Void Ratio	0.76	
Saturation	96.6	%

Moisture Content

Mass of wet sample & tare	680.10	g
Mass of dry sample & tare	554.30	g
Mass of tare	93.00	g
% Moisture	27.3	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/16/10	9	10	-	1.14	80.19	12.18	27.1	-	-	-	
06/16/10	9	20	600	1.15	80.89	12.28	27.1	1.00E-07	0.848	8.50E-08	
06/16/10	9	30	600	1.14	80.19	12.18	27.1	1.00E-07	0.848	8.50E-08	
06/16/10	9	40	600	1.15	80.89	12.28	27.1	1.00E-07	0.848	8.50E-08	*
06/16/10	9	50	600	1.16	81.59	12.39	27.1	9.93E-08	0.848	8.42E-08	*
06/16/10	10	0	600	1.15	80.89	12.28	27.1	9.93E-08	0.848	8.42E-08	*
06/16/10	10	10	600	1.16	81.59	12.39	27.1	9.93E-08	0.848	8.42E-08	*

Reported Average Hydraulic Conductivity* 8.4E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	263
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	246			Pore Pressure Transducer ID #	28

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Web: www.test-llc.com

Tested By	RI
Date	05/26/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.794
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.93
Area, in^2	7.06
Volume, in^3	40.90
Mass of Sample, g	1288.20
Wet Density, pcf	120.0
Dry Density, pcf	95.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1490.30
Mass of Dry Sample and Tare, g	1223.90
Mass of Tare, g	203.70
Moisture, %	26.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11
Compression Device ID #	10
Balance ID #	1/7
Digital Caliper ID #	16
Readout Device ID #	10
Oven ID #	12/13/14

Maximum Load at Failure, lbf	1044
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	148
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**148**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Sketch

Failure Type: Shear

USCS (ASTM D2487: D2488)

REMARKS

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Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.750
Initial Diameter, in	3.014
Height-to-Diameter Ratio	1.91
Area, in^2	7.13
Volume, in^3	41.02
Mass of Sample, g	1277.80
Wet Density, pcf	118.7
Dry Density, pcf	94.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1481.20
Mass of Dry Sample and Tare, g	1216.90
Mass of Tare, g	206.70
Moisture, %	26.2

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

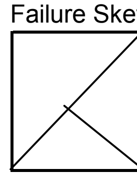
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1029
Specimen Cross-sectional Area, in^2	7.13
Compressive Strength at Failure, psi	144
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**144**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E. S.T.

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Web: www.test-llc.com

Tested By	RI
Date	06/02/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.791
Initial Diameter, in	3.002
Height-to-Diameter Ratio	1.93
Area, in^2	7.08
Volume, in^3	40.99
Mass of Sample, g	1283.20
Wet Density, pcf	119.3
Dry Density, pcf	94.5
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1439.70
Mass of Dry Sample and Tare, g	1174.30
Mass of Tare, g	157.70
Moisture, %	26.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

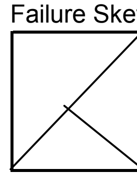
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1196
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	169
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**169**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/02/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.794
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.93
Area, in^2	7.07
Volume, in^3	40.96
Mass of Sample, g	1289.50
Wet Density, pcf	119.9
Dry Density, pcf	95.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1449.90
Mass of Dry Sample and Tare, g	1183.10
Mass of Tare, g	161.80
Moisture, %	26.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

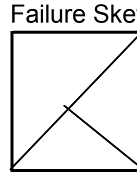
Load Cell ID #	11
Compression Device ID #	10
Balance ID #	1/7
Digital Caliper ID #	16
Readout Device ID #	10
Oven ID #	12/13/14

Maximum Load at Failure, lbf	1218
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	172
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**172**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 06/16/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.761
Initial Diameter, in	3.004
Height-to-Diameter Ratio	1.92
Area, in^2	7.09
Volume, in^3	40.83
Mass of Sample, g	1278.30
Wet Density, pcf	119.3
Dry Density, pcf	94.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1863.70
Mass of Dry Sample and Tare, g	1603.10
Mass of Tare, g	590.50
Moisture, %	25.7

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1389
Specimen Cross-sectional Area, in^2	7.09
Compressive Strength at Failure, psi	196
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**196**

Failure Code: 1

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch

Failure Type: Cone

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/16/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-2-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.753
Initial Diameter, in	3.009
Height-to-Diameter Ratio	1.91
Area, in^2	7.11
Volume, in^3	40.91
Mass of Sample, g	1278.20
Wet Density, pcf	119.0
Dry Density, pcf	94.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1883.20
Mass of Dry Sample and Tare, g	1624.80
Mass of Tare, g	611.80
Moisture, %	25.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

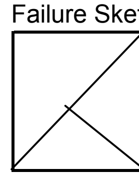
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1378
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	194
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**194**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/16/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.636	in	6.70	cm
Diameter	3.002	in	7.63	cm
Area	7.08	in^2	45.66	cm^2
Volume	305.74	cm^3	0.0108	ft^3
Mass	584.00	g	1.29	lb
Specific Gravity	2.700	(Assumed)		
Dry Density	95.5	pcf		

Moisture Content

Mass of wet sample & tare	584.00	g
Mass of dry sample & tare	468.00	g
Mass of tare	0.00	g
% Moisture	24.8	

Test Data

Speed	12	
Board Number	5	
Cell Number	2	
Flow Pump Number	2B	
Flow Pump Rate	5.60E-05	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	90.74	cm
Min Head	89.33	cm
Maximum Gradient	13.55	
Minimum Gradient	13.34	

Final Data (After Test)

Average Height of Sample	2.636	in	6.70	cm
Average Diameter of Sample	3.004	in	7.63	cm

Area	7.09	in^2	45.73	cm^2
Volume	306.15	cm^3	0.0108	ft^3
Mass	596.50	g	1.32	lb

Dry Density	95.4	pcf
Vol. of Voids	132.76	cm^3
Vol. of Solids	173.39	cm^3
Void Ratio	0.77	
Saturation	96.7	%

Moisture Content

Mass of wet sample & tare	696.30	g
Mass of dry sample & tare	568.00	g
Mass of tare	100.00	g
% Moisture	27.4	

TIME FUNCTION			Δt	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/16/10	10	20	-	1.27	89.33	13.34	27.1	-	-	-	
06/16/10	10	30	600	1.28	90.04	13.45	27.1	9.14E-08	0.848	7.76E-08	
06/16/10	10	40	600	1.27	89.33	13.34	27.1	9.14E-08	0.848	7.76E-08	
06/16/10	10	50	600	1.28	90.04	13.45	27.1	9.14E-08	0.848	7.76E-08	*
06/16/10	11	0	600	1.29	90.74	13.55	27.1	9.07E-08	0.848	7.70E-08	*
06/16/10	11	10	600	1.28	90.04	13.45	27.1	9.07E-08	0.848	7.70E-08	*
06/16/10	11	20	600	1.29	90.74	13.55	27.1	9.07E-08	0.848	7.70E-08	*

Reported Average Hydraulic Conductivity* 7.7E-08 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	263
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	216
Syringe ID #	246			Pore Pressure Transducer ID #	28

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/26/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.766
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.76
Mass of Sample, g	1283.20
Wet Density, pcf	119.9
Dry Density, pcf	95.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1475.00
Mass of Dry Sample and Tare, g	1211.10
Mass of Tare, g	194.60
Moisture, %	26.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

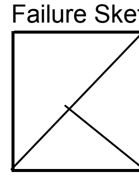
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1403
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	198
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**198**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E.S.T. TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	05/26/10
		Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.767
Initial Diameter, in	3.003
Height-to-Diameter Ratio	1.92
Area, in^2	7.08
Volume, in^3	40.85
Mass of Sample, g	1281.30
Wet Density, pcf	119.5
Dry Density, pcf	94.9
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1469.90
Mass of Dry Sample and Tare, g	1207.05
Mass of Tare, g	190.60
Moisture, %	25.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

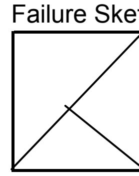
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1315
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	186
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**186**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com		
		Tested By	RI/KI
		Date	06/02/10
		Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD | **B**

SAMPLE DATA

Initial Height, in	5.796
Initial Diameter, in	3.009
Height-to-Diameter Ratio	1.93
Area, in^2	7.11
Volume, in^3	41.22
Mass of Sample, g	1289.70
Wet Density, pcf	119.2
Dry Density, pcf	94.5
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1447.40
Mass of Dry Sample and Tare, g	1180.70
Mass of Tare, g	158.80
Moisture, %	26.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

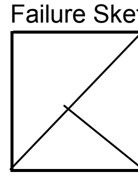
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1588
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	223
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**223**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 06/02/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD | **B**

SAMPLE DATA

Initial Height, in	5.793
Initial Diameter, in	3.003
Height-to-Diameter Ratio	1.93
Area, in^2	7.08
Volume, in^3	41.03
Mass of Sample, g	1287.70
Wet Density, pcf	119.6
Dry Density, pcf	94.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1433.20
Mass of Dry Sample and Tare, g	1167.70
Mass of Tare, g	146.60
Moisture, %	26.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

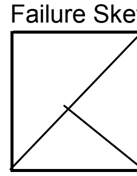
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1552
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	219
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**219**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 06/16/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.758
Initial Diameter, in	3.003
Height-to-Diameter Ratio	1.92
Area, in^2	7.08
Volume, in^3	40.78
Mass of Sample, g	1282.80
Wet Density, pcf	119.8
Dry Density, pcf	95.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1482.30
Mass of Dry Sample and Tare, g	1224.40
Mass of Tare, g	205.80
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

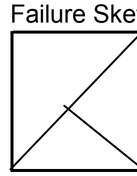
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1852
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	261
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**261**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

AASHTO R18

Tested By	RI
Date	06/16/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9014/(Bulk SED-050610-B)-3-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.758
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.92
Area, in^2	7.06
Volume, in^3	40.65
Mass of Sample, g	1283.10
Wet Density, pcf	120.3
Dry Density, pcf	95.9
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1486.70
Mass of Dry Sample and Tare, g	1229.10
Mass of Tare, g	210.60
Moisture, %	25.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

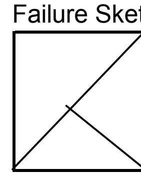
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1980
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	280
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**280**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.503	in	6.36	cm
Diameter	3.001	in	7.62	cm
Area	7.07	in^2	45.63	cm^2
Volume	290.12	cm^3	0.0102	ft^3
Mass	542.50	g	1.20	lb
Specific Gravity	2.600	(Assumed)		
Dry Density	91.4	pcf		

Moisture Content

Mass of wet sample & tare	542.50	g
Mass of dry sample & tare	425.00	g
Mass of tare	0.00	g
% Moisture	27.6	

Test Data

Speed	10	
Board Number	7	
Cell Number	11	
Flow Pump Number	2A	
Flow Pump Rate	2.24E-04	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	52.76	cm
Min Head	51.35	cm
Maximum Gradient	8.30	
Minimum Gradient	8.08	

Final Data (After Test)

Average Height of Sample	2.502	in	6.36	cm
Average Diameter of Sample	3.002	in	7.63	cm

Area	7.08	in^2	45.66	cm^2
Volume	290.20	cm^3	0.0102	ft^3
Mass	548.60	g	1.21	lb

Dry Density	91.4	pcf
Vol. of Voids	126.65	cm^3
Vol. of Solids	163.55	cm^3
Void Ratio	0.77	
Saturation	97.4	%

Moisture Content

Mass of wet sample & tare	639.30	g
Mass of dry sample & tare	516.00	g
Mass of tare	91.00	g
% Moisture	29.0	

TIME FUNCTION			Δ t	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/18/10	8	30	-	0.74	52.05	8.19	27.5	-	-	-	
06/18/10	8	40	600	0.73	51.35	8.08	27.5	6.03E-07	0.840	5.07E-07	
06/18/10	8	50	600	0.74	52.05	8.19	27.5	6.03E-07	0.840	5.07E-07	
06/18/10	9	0	600	0.73	51.35	8.08	27.5	6.03E-07	0.840	5.07E-07	*
06/18/10	9	10	600	0.74	52.05	8.19	27.5	6.03E-07	0.840	5.07E-07	*
06/18/10	9	20	600	0.75	52.76	8.30	27.5	5.95E-07	0.840	5.00E-07	*
06/18/10	9	30	600	0.75	52.76	8.30	27.5	5.91E-07	0.840	4.97E-07	*

Reported Average Hydraulic Conductivity* 5.0E-07 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION

NA

USCS (ASTM D2487;2488)

NA

REMARKS

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	245			Pore Pressure Transducer ID #	28

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1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/28/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.777
Initial Diameter, in	2.992
Height-to-Diameter Ratio	1.93
Area, in^2	7.03
Volume, in^3	40.62
Mass of Sample, g	1253.90
Wet Density, pcf	117.6
Dry Density, pcf	91.5
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1408.40
Mass of Dry Sample and Tare, g	1131.20
Mass of Tare, g	156.70
Moisture, %	28.4

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

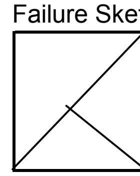
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	661
Specimen Cross-sectional Area, in^2	7.03
Compressive Strength at Failure, psi	94
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**94**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/28/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.796
Initial Diameter, in	3.012
Height-to-Diameter Ratio	1.92
Area, in^2	7.13
Volume, in^3	41.30
Mass of Sample, g	1256.60
Wet Density, pcf	115.9
Dry Density, pcf	90.2
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1422.60
Mass of Dry Sample and Tare, g	1144.50
Mass of Tare, g	167.80
Moisture, %	28.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

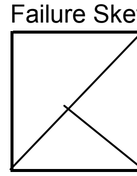
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	641
Specimen Cross-sectional Area, in^2	7.13
Compressive Strength at Failure, psi	90
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**90**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/04/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.761
Initial Diameter, in	3.013
Height-to-Diameter Ratio	1.91
Area, in^2	7.13
Volume, in^3	41.08
Mass of Sample, g	1251.10
Wet Density, pcf	116.0
Dry Density, pcf	90.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1454.80
Mass of Dry Sample and Tare, g	1178.90
Mass of Tare, g	205.30
Moisture, %	28.3

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

Load Cell ID #	11
Compression Device ID #	10
Balance ID #	1/7
Digital Caliper ID #	16
Readout Device ID #	10
Oven ID #	12/13/14

Maximum Load at Failure, lbf	840
Specimen Cross-sectional Area, in^2	7.13
Compressive Strength at Failure, psi	118
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**118**

Failure Code: 4

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

DESCRIPTION

Failure Sketch

Failure Type: Shear

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/04/10
Checked By	*(initials)*

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD | **B**

SAMPLE DATA

Initial Height, in	5.741
Initial Diameter, in	3.008
Height-to-Diameter Ratio	1.91
Area, in^2	7.11
Volume, in^3	40.80
Mass of Sample, g	1244.10
Wet Density, pcf	116.2
Dry Density, pcf	90.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1447.90
Mass of Dry Sample and Tare, g	1172.70
Mass of Tare, g	205.70
Moisture, %	28.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

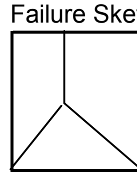
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	837
Specimen Cross-sectional Area, in^2	7.11
Compressive Strength at Failure, psi	118
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**118**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E.S.T. TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 06/18/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.805
Initial Diameter, in	3.007
Height-to-Diameter Ratio	1.93
Area, in^2	7.10
Volume, in^3	41.22
Mass of Sample, g	1255.20
Wet Density, pcf	116.0
Dry Density, pcf	90.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1406.70
Mass of Dry Sample and Tare, g	1135.00
Mass of Tare, g	154.80
Moisture, %	27.7

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

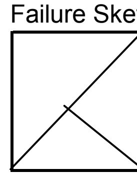
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1328
Specimen Cross-sectional Area, in^2	7.10
Compressive Strength at Failure, psi	187
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**187**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.760
Initial Diameter, in	3.010
Height-to-Diameter Ratio	1.91
Area, in^2	7.12
Volume, in^3	40.99
Mass of Sample, g	1245.00
Wet Density, pcf	115.7
Dry Density, pcf	90.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1401.20
Mass of Dry Sample and Tare, g	1133.60
Mass of Tare, g	158.90
Moisture, %	27.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

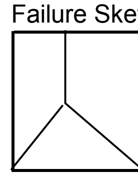
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1438
Specimen Cross-sectional Area, in^2	7.12
Compressive Strength at Failure, psi	202
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**202**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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1874 Forge Street Tucker, GA 30084
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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.482	in	6.30	cm
Diameter	3.003	in	7.63	cm
Area	7.08	in^2	45.69	cm^2
Volume	288.07	cm^3	0.0102	ft^3
Mass	535.20	g	1.18	lb
Specific Gravity	2.600	(Assumed)		
Dry Density	90.5	pcf		

Moisture Content

Mass of wet sample & tare	535.20	g
Mass of dry sample & tare	418.00	g
Mass of tare	0.00	g
% Moisture	28.0	

Test Data

Speed	10	
Board Number	7	
Cell Number	2	
Flow Pump Number	2A	
Flow Pump Rate	2.24E-04	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	80.19	cm
Min Head	78.78	cm
Maximum Gradient	12.75	
Minimum Gradient	12.52	

Final Data (After Test)

Average Height of Sample	2.477	in	6.29	cm
Average Diameter of Sample	3.004	in	7.63	cm
Area	7.09 in^2	45.73	cm^2	
Volume	287.68 cm^3	0.0102	ft^3	
Mass	542.20 g	1.20	lb	

Dry Density	90.7	pcf
Vol. of Voids	126.92	cm^3
Vol. of Solids	160.77	cm^3
Void Ratio	0.79	
Saturation	97.9	%

Moisture Content

Mass of wet sample & tare	632.40	g
Mass of dry sample & tare	508.20	g
Mass of tare	90.20	g
% Moisture	29.7	

TIME FUNCTION			Δt	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x(°C)	@ T_x	R_T	@ 20 °C	
06/18/10	9	40	-	1.12	78.78	12.52	27.5	-	-	-	
06/18/10	9	50	600	1.13	79.48	12.63	27.5	3.89E-07	0.841	3.27E-07	
06/18/10	10	0	600	1.12	78.78	12.52	27.5	3.89E-07	0.841	3.27E-07	
06/18/10	10	10	600	1.13	79.48	12.63	27.5	3.89E-07	0.841	3.27E-07	*
06/18/10	10	20	600	1.14	80.19	12.75	27.5	3.86E-07	0.841	3.25E-07	*
06/18/10	10	30	600	1.13	79.48	12.63	27.5	3.86E-07	0.841	3.25E-07	*
06/18/10	10	40	600	1.14	80.19	12.75	27.5	3.86E-07	0.841	3.25E-07	*

Reported Average Hydraulic Conductivity* 3.3E-07 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION: NA

USCS (ASTM D2487;2488): NA

REMARKS:

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	262
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	245			Pore Pressure Transducer ID #	28

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/28/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.766
Initial Diameter, in	2.988
Height-to-Diameter Ratio	1.93
Area, in^2	7.01
Volume, in^3	40.43
Mass of Sample, g	1249.30
Wet Density, pcf	117.7
Dry Density, pcf	91.4
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1409.10
Mass of Dry Sample and Tare, g	1130.60
Mass of Tare, g	161.90
Moisture, %	28.7

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

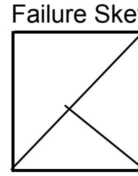
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	925
Specimen Cross-sectional Area, in^2	7.01
Compressive Strength at Failure, psi	132
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**132**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/28/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.721
Initial Diameter, in	2.995
Height-to-Diameter Ratio	1.91
Area, in^2	7.05
Volume, in^3	40.30
Mass of Sample, g	1237.70
Wet Density, pcf	117.0
Dry Density, pcf	90.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1393.90
Mass of Dry Sample and Tare, g	1116.50
Mass of Tare, g	157.70
Moisture, %	28.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

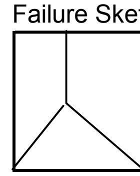
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	930
Specimen Cross-sectional Area, in^2	7.05
Compressive Strength at Failure, psi	132
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**132**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/04/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.787
Initial Diameter, in	2.998
Height-to-Diameter Ratio	1.93
Area, in^2	7.06
Volume, in^3	40.85
Mass of Sample, g	1254.80
Wet Density, pcf	117.0
Dry Density, pcf	91.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.86

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1460.20
Mass of Dry Sample and Tare, g	1182.30
Mass of Tare, g	207.20
Moisture, %	28.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

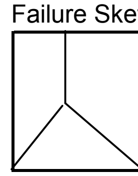
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1174
Specimen Cross-sectional Area, in^2	7.06
Compressive Strength at Failure, psi	166
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**166**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/04/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.764
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.74
Mass of Sample, g	1249.00
Wet Density, pcf	116.8
Dry Density, pcf	90.8
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1455.30
Mass of Dry Sample and Tare, g	1178.10
Mass of Tare, g	208.30
Moisture, %	28.6

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

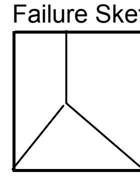
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1231
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	174
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**174**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.754
Initial Diameter, in	3.007
Height-to-Diameter Ratio	1.91
Area, in^2	7.10
Volume, in^3	40.86
Mass of Sample, g	1242.20
Wet Density, pcf	115.8
Dry Density, pcf	90.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1434.20
Mass of Dry Sample and Tare, g	1164.80
Mass of Tare, g	194.60
Moisture, %	27.8

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

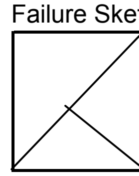
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1961
Specimen Cross-sectional Area, in^2	7.10
Compressive Strength at Failure, psi	276
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**276**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.719
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.91
Area, in^2	7.07
Volume, in^3	40.43
Mass of Sample, g	1233.60
Wet Density, pcf	116.2
Dry Density, pcf	90.9
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1421.40
Mass of Dry Sample and Tare, g	1153.00
Mass of Tare, g	190.60
Moisture, %	27.9

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

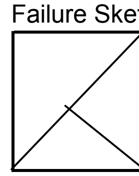
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1951
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	276
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**276**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/18/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	7	Add. Info	Curing Age: 28 Days

ASTM D 5084; Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (Method D, Constant Rate of Flow)

Initial Sample Data (Before Test)

Height	2.514	in	6.39	cm
Diameter	3.003	in	7.63	cm
Area	7.08	in^2	45.69	cm^2
Volume	291.79	cm^3	0.0103	ft^3
Mass	541.80	g	1.19	lb
Specific Gravity	2.600	(Assumed)		
Dry Density	90.1	pcf		

Moisture Content

Mass of wet sample & tare	541.80	g
Mass of dry sample & tare	421.30	g
Mass of tare	0.00	g
% Moisture	28.6	

Test Data

Speed	10	
Board Number	8	
Cell Number	19	
Flow Pump Number	2B	
Flow Pump Rate	2.24E-04	cm^3/sec
B - Value	0.95	
Cell Pressure	110.0	psi
Back Pressure	100.0	psi
Confining (Effective) Pressure	10.0	psi
Max Head	111.84	cm
Min Head	111.14	cm
Maximum Gradient	17.54	
Minimum Gradient	17.43	

Final Data (After Test)

Average Height of Sample	2.511	in	6.38	cm
Average Diameter of Sample	3.002	in	7.63	cm

Area	7.08	in^2	45.66	cm^2
Volume	291.25	cm^3	0.0103	ft^3
Mass	549.00	g	1.21	lb

Dry Density	90.3	pcf
Vol. of Voids	129.21	cm^3
Vol. of Solids	162.04	cm^3
Void Ratio	0.80	
Saturation	98.8	%

Moisture Content

Mass of wet sample & tare	639.60	g
Mass of dry sample & tare	511.90	g
Mass of tare	90.60	g
% Moisture	30.3	

TIME FUNCTION			Δt	READING	Head	Gradient	Temp.	PERMEABILITY (cm/sec)			
DATE	HOUR	MIN	(sec)	(psi)	(cm)		T_x (°C)	@ T_x	R_T	@ 20 °C	
06/18/10	9	40	-	1.58	111.14	17.43	27.5	-	-	-	
06/18/10	9	50	600	1.58	111.14	17.43	27.5	2.82E-07	0.841	2.37E-07	
06/18/10	10	0	600	1.59	111.84	17.54	27.5	2.81E-07	0.841	2.36E-07	
06/18/10	10	10	600	1.58	111.14	17.43	27.5	2.81E-07	0.841	2.36E-07	*
06/18/10	10	20	600	1.59	111.84	17.54	27.5	2.81E-07	0.841	2.36E-07	*
06/18/10	10	30	600	1.59	111.84	17.54	27.5	2.80E-07	0.841	2.35E-07	*
06/18/10	10	40	600	1.59	111.84	17.54	27.5	2.80E-07	0.841	2.35E-07	*

Reported Average Hydraulic Conductivity* 2.4E-07 cm/sec

Note: Deaired Water Used for Permeability Test.

DESCRIPTION: NA

USCS (ASTM D2487;2488): NA

REMARKS:

Flow pump ID #	244	Balance ID #	1/6/7	Differential Pressure Transducer ID #	263
Thermometer ID #	377	Oven ID #	14/15	Board Pressure Transducer ID #	215
Syringe ID #	246			Pore Pressure Transducer ID #	28

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 05/28/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	1	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD **B**

SAMPLE DATA

Initial Height, in	5.746
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.92
Area, in^2	7.07
Volume, in^3	40.60
Mass of Sample, g	1243.20
Wet Density, pcf	116.6
Dry Density, pcf	90.1
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1448.90
Mass of Dry Sample and Tare, g	1166.50
Mass of Tare, g	208.30
Moisture, %	29.5

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

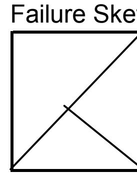
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1096
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	155
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**155**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/28/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	2	Add. Info	Curing Age: 7 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.769
Initial Diameter, in	2.997
Height-to-Diameter Ratio	1.92
Area, in^2	7.05
Volume, in^3	40.70
Mass of Sample, g	1245.80
Wet Density, pcf	116.6
Dry Density, pcf	90.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1438.40
Mass of Dry Sample and Tare, g	1154.40
Mass of Tare, g	194.30
Moisture, %	29.6

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

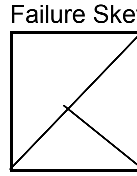
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1048
Specimen Cross-sectional Area, in^2	7.05
Compressive Strength at Failure, psi	149
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**149**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	06/04/10
		Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	3	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.719
Initial Diameter, in	3.003
Height-to-Diameter Ratio	1.90
Area, in^2	7.08
Volume, in^3	40.51
Mass of Sample, g	1235.50
Wet Density, pcf	116.2
Dry Density, pcf	90.0
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1440.70
Mass of Dry Sample and Tare, g	1163.20
Mass of Tare, g	206.70
Moisture, %	29.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

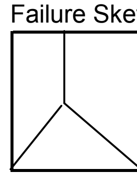
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1519
Specimen Cross-sectional Area, in^2	7.08
Compressive Strength at Failure, psi	214
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**214**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	06/04/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	4	Add. Info	Curing Age: 14 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.716
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.91
Area, in^2	7.07
Volume, in^3	40.40
Mass of Sample, g	1236.90
Wet Density, pcf	116.6
Dry Density, pcf	90.3
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1429.60
Mass of Dry Sample and Tare, g	1151.70
Mass of Tare, g	194.30
Moisture, %	29.0

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

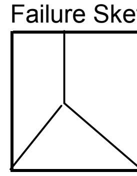
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	1463
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	207
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**207**

Failure Code: 2

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Split

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

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		Tested By: RI Date: 06/18/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	5	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.730
Initial Diameter, in	3.010
Height-to-Diameter Ratio	1.90
Area, in^2	7.12
Volume, in^3	40.77
Mass of Sample, g	1230.90
Wet Density, pcf	115.0
Dry Density, pcf	89.7
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1831.80
Mass of Dry Sample and Tare, g	1562.40
Mass of Tare, g	603.70
Moisture, %	28.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

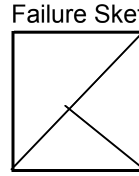
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2372
Specimen Cross-sectional Area, in^2	7.12
Compressive Strength at Failure, psi	333
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**333**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

T.E.S.T.
TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	KI
Date	06/18/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Mold
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1	Depth/Elev.	-
Subsample	6	Add. Info	Curing Age: 28 Days

ASTM D 1633: Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders

METHOD B

SAMPLE DATA

Initial Height, in	5.719
Initial Diameter, in	3.000
Height-to-Diameter Ratio	1.91
Area, in^2	7.07
Volume, in^3	40.43
Mass of Sample, g	1232.00
Wet Density, pcf	116.1
Dry Density, pcf	90.6
Machine Speed, in/min	0.050
Strain rate, % / min	0.87

WATER CONTENT DETERMINATION

Mass of Wet Sample and Tare, g	1821.80
Mass of Dry Sample and Tare, g	1551.60
Mass of Tare, g	590.50
Moisture, %	28.1

Note 1: Water content was obtained after shear from partial sample.

TEST DATA

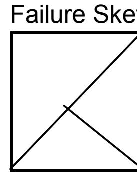
Load Cell ID #	11	Digital Caliper ID #	16
Compression Device ID #	10	Readout Device ID #	10
Balance ID #	1/7	Oven ID #	12/13/14

Maximum Load at Failure, lbf	2423
Specimen Cross-sectional Area, in^2	7.07
Compressive Strength at Failure, psi	343
Conversion Factor for Height to Diameter Ratio	1.00
Reported Compressive Strength at Failure, psi	**343**

Failure Code: 3

*Note 2: * - A conversion factor based on H/D=1.15 (C.F.-.908 as 100% and add. correction per ASTM C42)*

Failure Sketch



Failure Type: Cone and Shear

DESCRIPTION

USCS (ASTM D2487: D2488)

REMARKS

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/14/10
Checked By	lB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012/KIF-Bulk Ash 050610	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

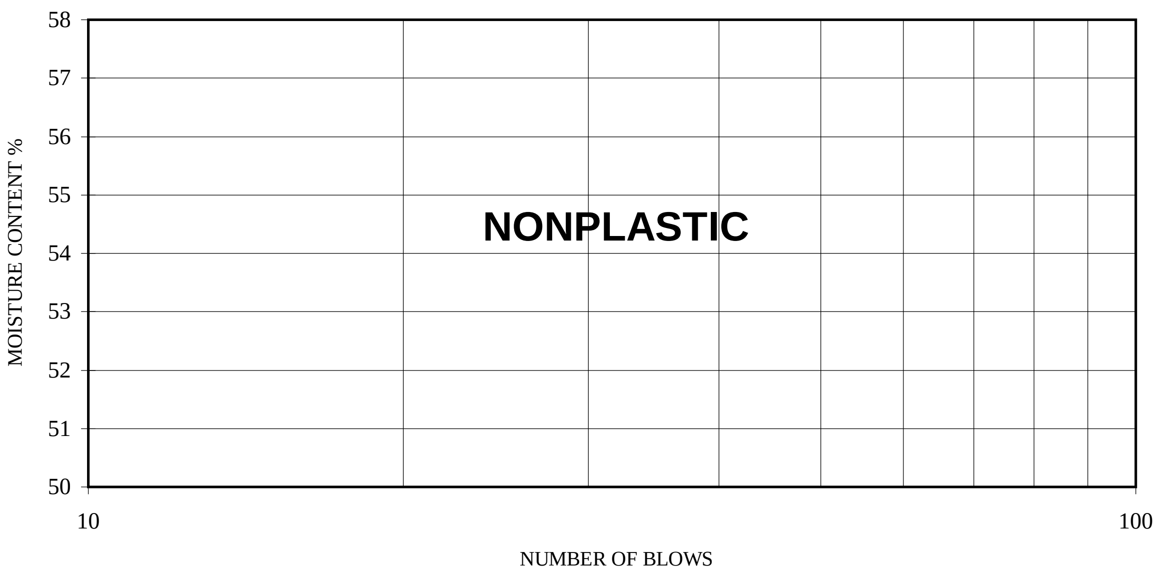
ASTM D 4318

Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT		
Number of Blows	8	8
Weight of Wet Sample & Tare, g	34.43	33.43
Weight of Dry Soil & Tare, g	32.68	31.74
Weight of Tare, g	25.55	24.90
Moisture Content, %	24.54	24.71

Liquid Limit Device ID # 56

NOTES: 1. Material appears to be Nonplastic. (Liquid Limit or Plastic Limit test could not be performed.)
2. Material passing No. 40 sieve was used for test.



PLASTIC LIMIT		
Weight of Wet Soil & Tare, g	28.60	29.18
Weight of Dry Soil & Tare, g	27.60	27.92
Weight of Tare, g	23.53	22.79
Moisture Content, %	24.57	24.56

PREPARATION PROCEDURE	DRY
Oven ID Number	12/13/14/15
Balance ID Number	2

NATURAL MOISTURE	
Weight of Wet Soil & Tare, g	1392.00
Weight of Dry Soil & Tare, g	1075.00
Weight of Tare, g	156.50
Moisture Content, %	34.51

LIQUID LIMIT (LL)	NP
PLASTIC LIMIT (PL)	NP
PLASTICITY INDEX (PI)	NP
LIQUIDITY INDEX (LI)	-

DESCRIPTION: Gray Silt With Sand

USCS (ASTM D2487;2488): ML

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/13/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012/KIF-Bulk Ash 050610	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	1392.00
Mass of Dry Sample & Tare, g	1075.00
Mass of Tare, g	156.50
Moisture Content, %	34.5

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	368.17
Mass of Dry Sample & Tare, g	354.26
Mass of Tare, g	90.94
Moisture Content, %	5.3

Mass of Total Sample before separation on #4 sieve & Tare, g	1392.10
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	1322.25

Mass of Sample used for hydrometer analysis, g	101.10
Dry Mass, g	96.03
% of Total Sample passing #4 sieve	98.8

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"			0.0	100.0
2"			0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"			0.0	100.0
.375"		0.00	0.0	100.0
#4	COARSE SAND	15.38	1.2	98.8

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	2.08	96.7
#20		4.18	94.5
#40	FINE SAND	6.04	92.6
#60		8.38	90.2
#100		13.71	84.7
#200	FINES	24.79	73.3

Remarks

Material passing 3/8" sieve was used for test 2.1% of total received material was retained on 3/8" sieve

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	12:10

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	4.1
% COARSE GRAVEL	0.0	% FINE SAND	19.3
% FINE GRAVEL	1.2	% FINES	73.3
% COARSE SAND	2.1	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	12.2	% CLAY(<0.002mm)	4.4

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/14/10	12:12	2	52.0	25.6	0.01253	6.0	46.0	8.7	0.99	0.0262	46.9
05/14/10	12:15	5	45.5	25.6	0.01253	6.0	39.5	9.8	0.99	0.0176	40.2
05/14/10	12:25	15	35.0	25.6	0.01253	6.0	29.0	11.6	0.99	0.0110	29.5
05/14/10	12:40	30	27.0	25.6	0.01253	6.0	21.0	12.9	0.99	0.0082	21.4
05/14/10	13:10	60	21.0	25.6	0.01253	6.0	15.0	13.9	0.99	0.0060	15.3
05/14/10	16:20	250	12.5	25.6	0.01253	6.0	6.5	15.3	0.99	0.0031	6.6
05/15/10	12:10	1440	9.0	25.6	0.01253	6.0	3.0	15.9	0.99	0.0013	3.1

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

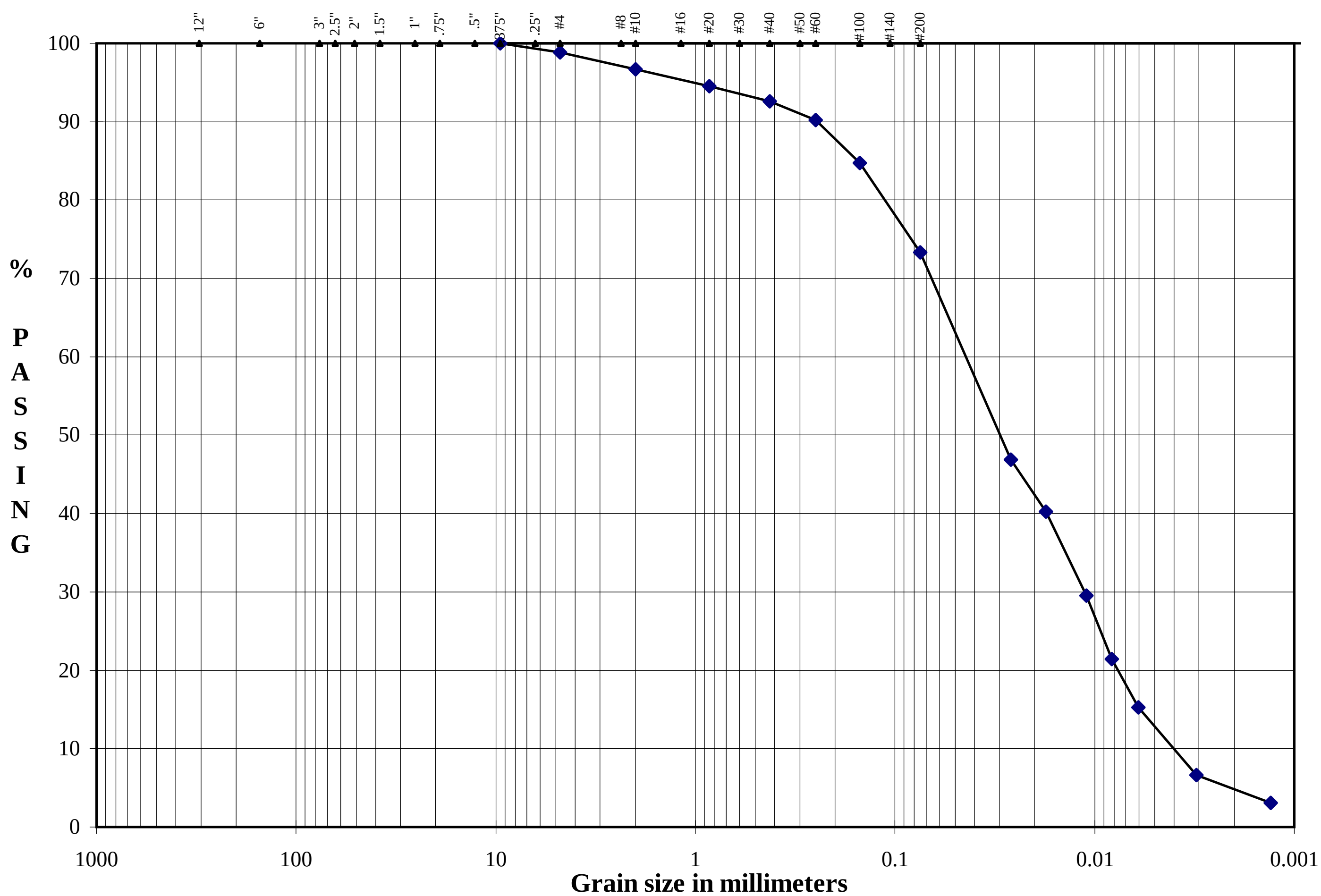
TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	05/13/10
		Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012/KIF-Bulk Ash 050610	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay Fines

DESCRIPTION: Gray Silt With Sand

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

USCS (ASTM D2487; D2488): ML

T.E. S.T.	TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By: RI Date: 05/14/10 Checked By: LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9013/KIF-Bulk SED-050610-A	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

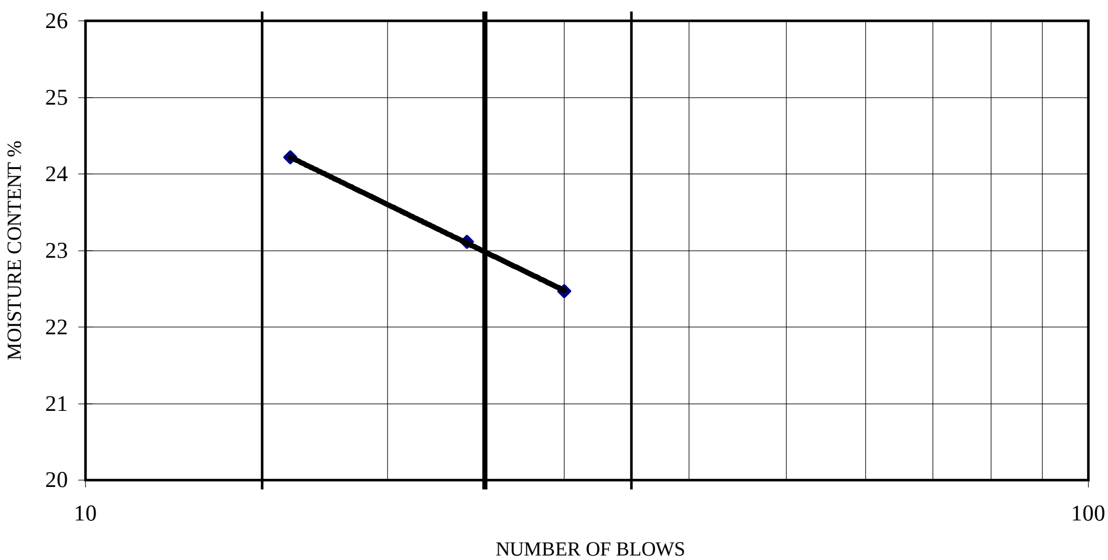
ASTM D 4318/AASHTO T 88, T 89

Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	30	24	16
Mass of Wet Sample & Tare, g	34.90	33.22	35.34
Mass of Dry Sample & Tare, g	33.08	31.55	33.57
Mass of Tare, g	24.98	24.34	26.26
Moisture Content, %	22.47	23.11	24.21

Oven ID #	12/13/14/15
Balance ID #	2
Liquid Limit Device ID #	56



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	31.16	30.68
Mass of Dry Sample & Tare, g	29.83	29.32
Mass of Tare, g	21.78	21.07
Moisture Content, %	16.52	16.48

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	1133.00
Mass of Dry Sample & Tare, g	967.50
Mass of Tare, g	162.00
Moisture Content, %	20.55

LIQUID LIMIT (LL)	23
PLASTIC LIMIT (PL)	17
PLASTICITY INDEX (PI)	6
LIQUIDITY INDEX (LI)	0.59

DESCRIPTION: Reddish Yellow Sandy Silty Clay

USCS (ASTM D2487; D2488): CL-ML

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/12/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9013/KIF-Bulk SED-050610-A	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	1133.00
Mass of Dry Sample & Tare, g	967.50
Mass of Tare, g	162.00
Moisture Content, %	20.5

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	428.52
Mass of Dry Sample & Tare, g	393.59
Mass of Tare, g	97.27
Moisture Content, %	11.8

Mass of Total Sample before separation on #4 sieve & Tare, g	1069.00
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	956.27

Mass of Sample used for hydrometer analysis, g	90.19
Dry Mass, g	80.68
% of Total Sample passing #4 sieve	99.9

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"			0.0	100.0
2"			0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"			0.0	100.0
.375"		0.00	0.0	100.0
#4	COARSE SAND	1.21	0.1	99.9

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	0.04	99.8
#20		0.29	99.5
#40	FINE SAND	1.88	97.5
#60		8.70	89.1
#100		19.11	76.2
#200	FINES	34.94	56.6

Remarks

Material passing 3/8" sieve was used for test 1.8% of total received material was retained on 3/8" sieve

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	12:12

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	2.3
% COARSE GRAVEL	0.0	% FINE SAND	40.9
% FINE GRAVEL	0.1	% FINES	56.6
% COARSE SAND	0.0	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	18.4	% CLAY(<0.002mm)	13.8

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/14/10	12:14	2	33.5	25.6	0.01253	6.0	27.5	11.8	0.99	0.0305	33.7
05/14/10	12:17	5	30.5	25.6	0.01253	6.0	24.5	12.3	0.99	0.0197	30.0
05/14/10	12:27	15	27.0	25.6	0.01253	6.0	21.0	12.9	0.99	0.0116	25.7
05/14/10	12:42	30	24.5	25.6	0.01253	6.0	18.5	13.3	0.99	0.0083	22.7
05/14/10	13:12	60	22.0	25.6	0.01253	6.0	16.0	13.7	0.99	0.0060	19.6
05/14/10	16:22	250	19.0	25.6	0.01253	6.0	13.0	14.2	0.99	0.0030	15.9
05/15/10	12:12	1440	16.0	25.6	0.01253	6.0	10.0	14.7	0.99	0.0013	12.3

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

TIMELY ENGINEERING SOIL TESTS, LLC

1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

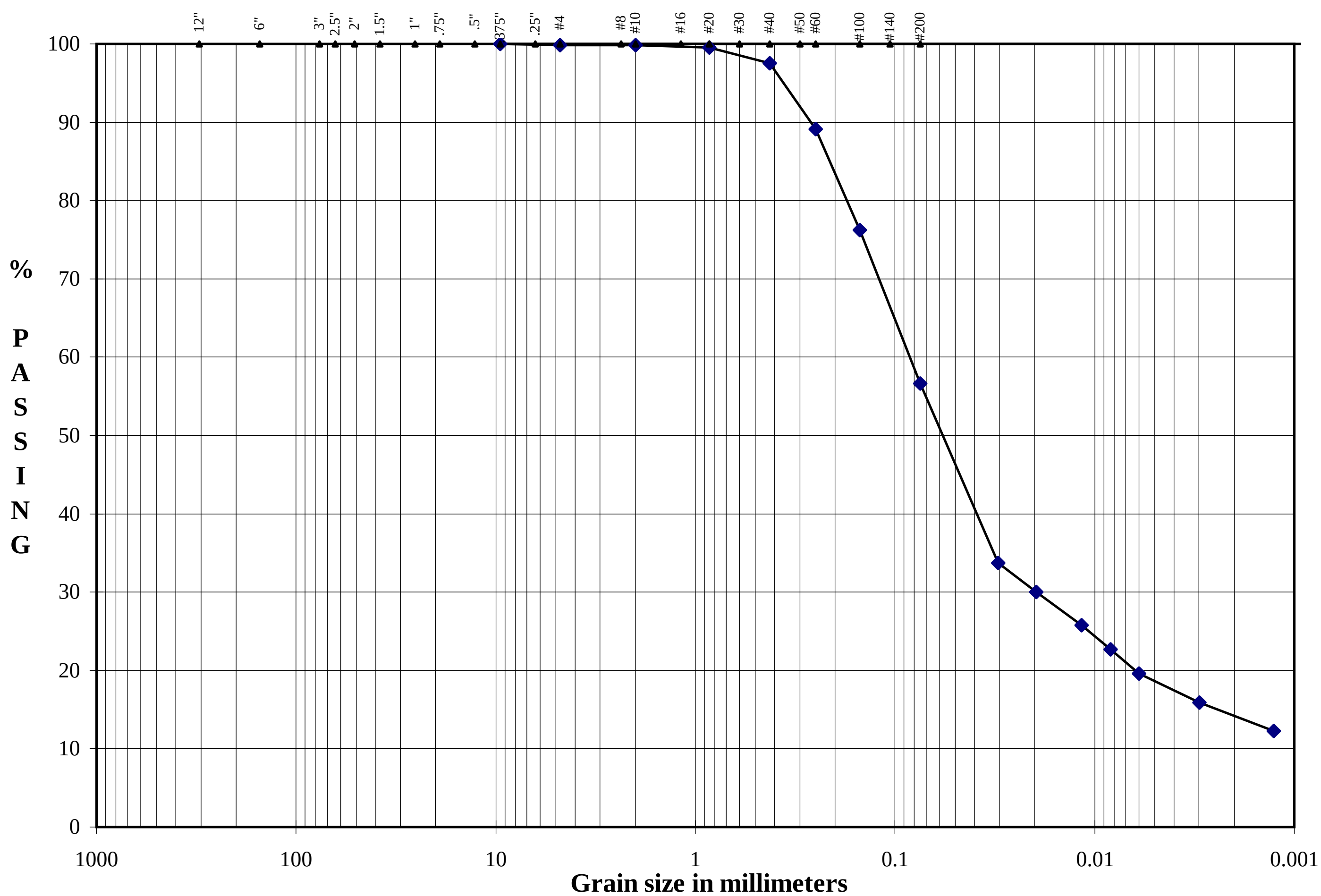
Tested By	RI
Date	05/12/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9013/KIF-Bulk SED-050610-A	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Reddish Yellow Sandy Silty Clay

USCS (ASTM D2487; D2488): CL-ML

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/12/10
Checked By	[illegible]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9013/KIF-Bulk SED-050610-A	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 698
Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3))

DETERMINATION OF TEST PROCEDURE

	wet	dry
Mass of Soil before sieving, g		#DIV/0!
Mass of Mat. Retained on No. 4 sieve, g	0.0	0.0
Mass of Mat. Retained on 3/8" sieve, g	0.0	0.0
Mass of Mat. Retained on 3/4" sieve, g	0.0	0.0

MOISTURE CONTENT

	Coarse + Fine Fraction	Coarse Fraction
Mass of Wet Sample & Tare, g		
Mass of Dry Sample & Tare, g		
Mass of Tare, g		
Moisture Content, %	#DIV/0!	

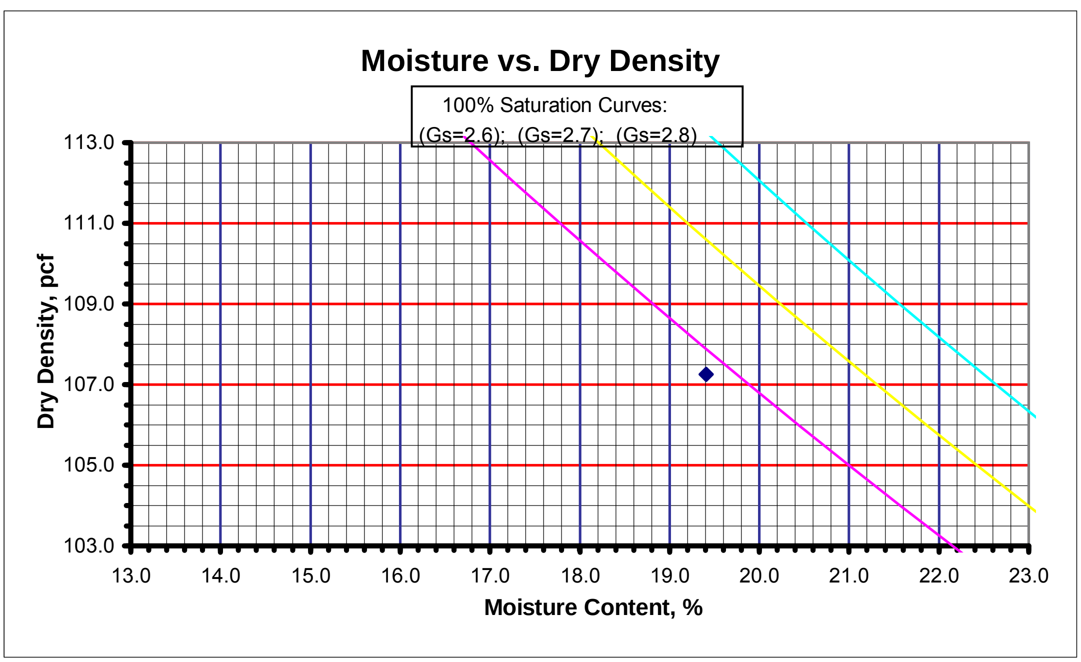
Material Retained on No. 4 Sieve, %	#DIV/0!
Material Retained on 3/8" Sieve, %	#DIV/0!
Material Retained on 3/4" Sieve, %	#DIV/0!
Total, % (oversized)	

Procedure: B

TEST DATA

Points	1	2	3	4	5
Mass of Mold and Soil, g	6185.0				
Mass of Wet Sample & Tare, g	517.5				
Mass of Dry Sample & Tare, g	448.5				
Mass of Tare, g	93.0				
Moisture Content, %	19.4				
Wet Density, pcf	128.1				
Dry Density, pcf	107.3				

Mold ID Number	321B
Mass of Mold, g	4250.5
Volume of Mold, ft^3	0.0333
Hammer ID Number	318
Number of Blows per layer	25
Number of Layers	3



Method A: Material retained on No. 4 ≤ 20%
Method B: Material retained on No. 4 > 20% and material retained on 3/8" ≤ 20%
Method C: Material retained on 3/8" > 20% and material retained on 3/4" < 30%

REMARKS

DESCRIPTION

Reddish Yellow Sandy Silty Clay

USCS (ASTM D2487; D2488)

CL-ML

Maximum Dry Density, pcf		**Corrected Maximum Dry Density, pcf**	**NA**
Optimum Moisture Content, %		**Corrected Optimum Moisture Content, %**	**NA**

TIMELY ENGINEERING SOIL TESTS, LLC

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Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/14/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9014/KIF-Bulk SED-050610-B	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

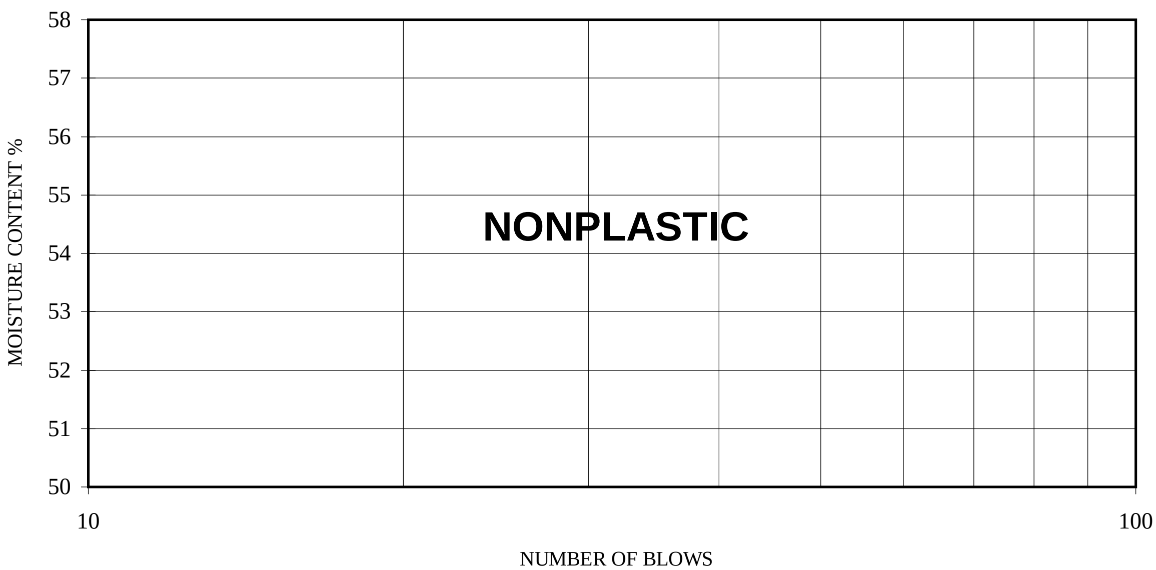
ASTM D 4318

Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT		
Number of Blows	10	10
Weight of Wet Sample & Tare, g	34.11	36.84
Weight of Dry Soil & Tare, g	32.82	35.34
Weight of Tare, g	25.82	27.18
Moisture Content, %	18.43	18.38

Liquid Limit Device ID # 56

NOTES: 1. Material appears to be Nonplastic. (Liquid Limit or Plastic Limit test could not be performed.)
2. Material passing No. 40 sieve was used for test.



PLASTIC LIMIT		
Weight of Wet Soil & Tare, g	30.30	25.04
Weight of Dry Soil & Tare, g	29.15	23.67
Weight of Tare, g	22.89	16.18
Moisture Content, %	18.37	18.30

PREPARATION PROCEDURE	DRY
Oven ID Number	12/13/14/15
Balance ID Number	2

NATURAL MOISTURE	
Weight of Wet Soil & Tare, g	1188.00
Weight of Dry Soil & Tare, g	1000.30
Weight of Tare, g	158.50
Moisture Content, %	22.30

LIQUID LIMIT (LL)	NP
PLASTIC LIMIT (PL)	NP
PLASTICITY INDEX (PI)	NP
LIQUIDITY INDEX (LI)	-

DESCRIPTION: Yellow Silty Sand

USCS (ASTM D2487;2488): SM

AASHTO (M 145): NA

TIMELY ENGINEERING SOIL TESTS, LLC
1874 Forge Street Tucker, GA 30084
Phone: 770-938-8233
Fax: 770-923-8973
Web: www.test-llc.com

Tested By	RI
Date	05/12/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9014/KIF-Bulk SED-050610-B	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content		*Moisture Content of Material Used for Hydrometer Analysis*	
Mass of Wet Sample & Tare, g	1188.00	Mass of Wet Sample & Tare, g	366.38
Mass of Dry Sample & Tare, g	1000.30	Mass of Dry Sample & Tare, g	359.82
Mass of Tare, g	158.50	Mass of Tare, g	83.71
Moisture Content, %	22.3	Moisture Content, %	2.4

Mass of Total Sample before separation on #4 sieve & Tare, g	1257.80	Mass of Sample used for hydrometer analysis, g	101.82
Mass of Tare, g	0.00	Dry Mass, g	99.46
Total Mass of Dry Sample, g	1228.61	% of Total Sample passing #4 sieve	100.0

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"			0.0	100.0
2"			0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"			0.0	100.0
.375"			0.0	100.0
#4	COARSE SAND	0.00	0.0	100.0

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	0.14	99.9
#20		0.20	99.8
#40	FINE SAND	0.41	99.6
#60		8.65	91.3
#100		43.71	56.1
#200	FINES	73.57	26.0

Remarks
Material passing 3/8" sieve was used for test 0.4% of total received material was retained on 3/8" sieve

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	12:14

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	0.3
% COARSE GRAVEL	0.0	% FINE SAND	73.6
% FINE GRAVEL	0.0	% FINES	26.0
% COARSE SAND	0.1	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	10.3	% CLAY(<0.002mm)	7.6

Date	Time	Testing time (min)	Reading	Temp (°C)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/14/10	12:16	2	24.0	25.6	0.01253	6.0	18.0	13.4	0.99	0.0324	17.9
05/14/10	12:19	5	22.0	25.6	0.01253	6.0	16.0	13.7	0.99	0.0208	15.9
05/14/10	12:29	15	20.0	25.6	0.01253	6.0	14.0	14.1	0.99	0.0121	13.9
05/14/10	12:44	30	19.0	25.6	0.01253	6.0	13.0	14.2	0.99	0.0086	12.9
05/14/10	13:14	60	17.5	25.6	0.01253	6.0	11.5	14.5	0.99	0.0062	11.4
05/14/10	16:24	250	14.5	25.6	0.01253	6.0	8.5	15.0	0.99	0.0031	8.5
05/15/10	12:14	1440	13.0	25.6	0.01253	6.0	7.0	15.2	0.99	0.0013	7.0

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

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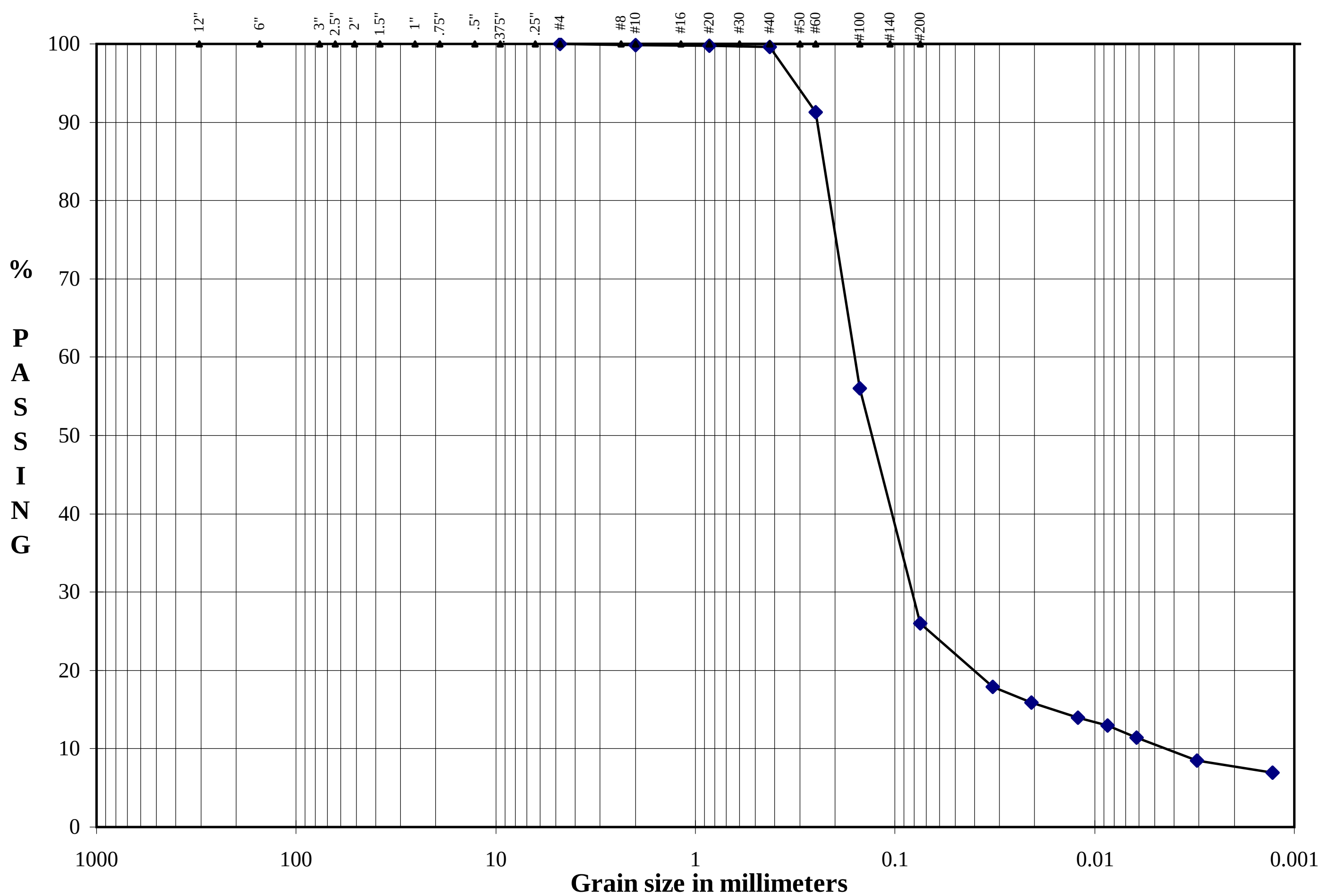
Fax: 770-923-8973
Web: www.test-llc.com

		Tested By	RI
		Date	05/12/10
		Checked By	
Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9014/KIF-Bulk SED-050610-B	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

DESCRIPTION: Yellow Silty Sand

USCS (ASTM D2487; D2488): SM

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Tested By	RI
Date	05/12/10
Checked By	[signature]

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9014/KIF-Bulk SED-050610-B	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 698
Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m^3))

DETERMINATION OF TEST PROCEDURE

	wet	dry
Mass of Soil before sieving, g		#DIV/0!
Mass of Mat. Retained on No. 4 sieve, g	0.0	0.0
Mass of Mat. Retained on 3/8" sieve, g	0.0	0.0
Mass of Mat. Retained on 3/4" sieve, g	0.0	0.0

MOISTURE CONTENT

	Coarse + Fine Fraction	Coarse Fraction
Mass of Wet Sample & Tare, g		
Mass of Dry Sample & Tare, g		
Mass of Tare, g		
Moisture Content, %	#DIV/0!	

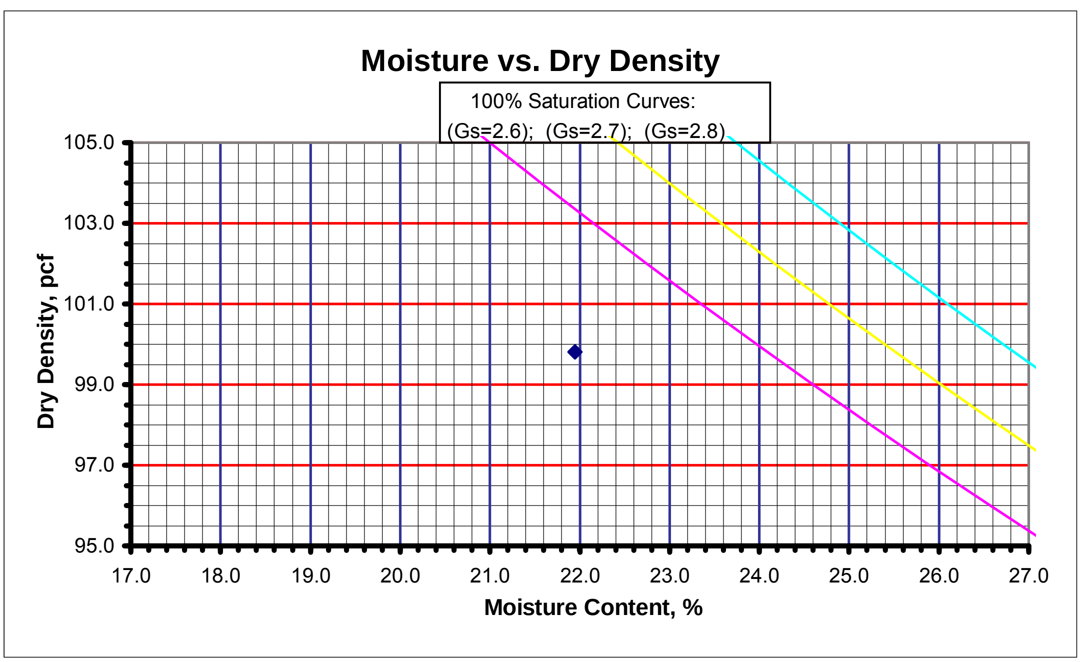
Material Retained on No. 4 Sieve, %	#DIV/0!
Material Retained on 3/8" Sieve, %	#DIV/0!
Material Retained on 3/4" Sieve, %	#DIV/0!
Total, % (oversized)	

Procedure: B

TEST DATA

Points	1	2	3	4	5
Mass of Mold and Soil, g	6089.0				
Mass of Wet Sample & Tare, g	505.0				
Mass of Dry Sample & Tare, g	432.3				
Mass of Tare, g	101.0				
Moisture Content, %	21.9				
Wet Density, pcf	121.7				
Dry Density, pcf	99.8				

Mold ID Number	321B
Mass of Mold, g	4250.5
Volume of Mold, ft^3	0.0333
Hammer ID Number	318
Number of Blows per layer	25
Number of Layers	3



Method A: Material retained on No. 4 ≤ 20%
Method B: Material retained on No. 4 > 20% and material retained on 3/8" ≤ 20%
Method C: Material retained on 3/8" > 20% and material retained on 3/4" < 30%

REMARKS

DESCRIPTION
Yellow Silty Sand

USCS (ASTM D2487; D2488)
SM

Maximum Dry Density, pcf		**Corrected Maximum Dry Density, pcf**	**NA**
Optimum Moisture Content, %		**Corrected Optimum Moisture Content, %**	**NA**

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Tested By	RI
Date	05/22/10
Checked By	LB

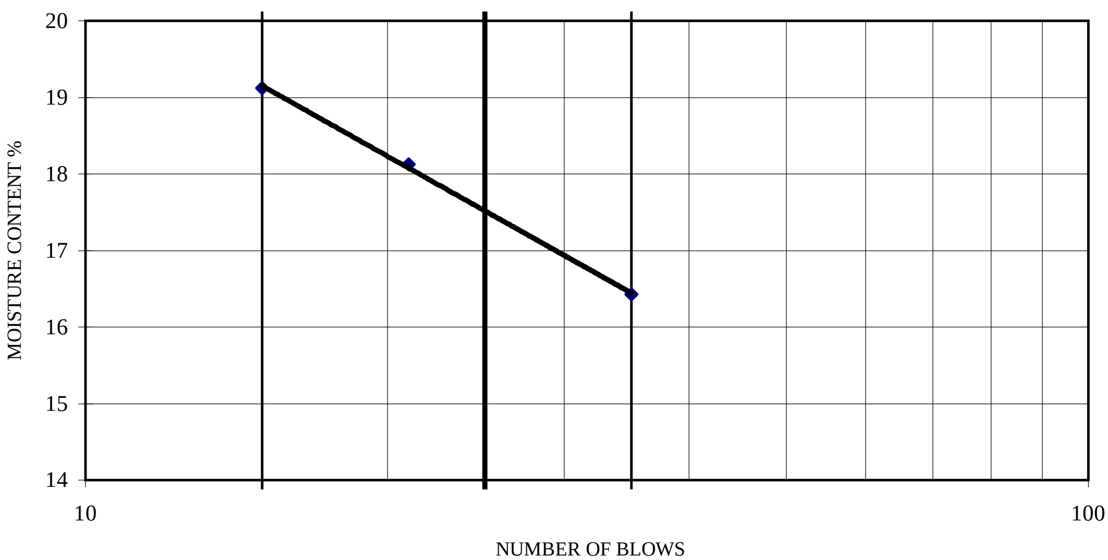
Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 4318/AASHTO T 88, T 89
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

LIQUID LIMIT

Number of Blows	35	21	15
Mass of Wet Sample & Tare, g	34.43	34.65	36.27
Mass of Dry Sample & Tare, g	33.06	33.19	34.70
Mass of Tare, g	24.72	25.16	26.49
Moisture Content, %	16.43	18.12	19.12

Oven ID #	12/13/14/15
Balance ID #	2
Liquid Limit Device ID #	56



PLASTIC LIMIT

Mass of Wet Sample & Tare, g	29.82	28.51
Mass of Dry Sample & Tare, g	28.58	27.24
Mass of Tare, g	20.45	18.90
Moisture Content, %	15.25	15.23

PREPARATION PROCEDURE: DRY

NOTE: MATERIAL PASSING NO. 40 SIEVE WAS USED FOR TEST

NATURAL MOISTURE

Mass of Wet Sample & Tare, g	855.50
Mass of Dry Sample & Tare, g	766.40
Mass of Tare, g	442.50
Moisture Content, %	27.51

LIQUID LIMIT (LL)	18
PLASTIC LIMIT (PL)	15
PLASTICITY INDEX (PI)	3
LIQUIDITY INDEX (LI)	4.17

DESCRIPTION: Brownish Gray Sandy Silt

USCS (ASTM D2487; D2488): ML

AASHTO (M 145): NA

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Tested By	RI
Date	05/10/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88
Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

As-Received Moisture Content

Mass of Wet Sample & Tare, g	855.50
Mass of Dry Sample & Tare, g	766.40
Mass of Tare, g	442.50
Moisture Content, %	27.5

Moisture Content of Material Used for Hydrometer Analysis

Mass of Wet Sample & Tare, g	352.42
Mass of Dry Sample & Tare, g	337.80
Mass of Tare, g	89.28
Moisture Content, %	5.9

Mass of Total Sample before separation on #4 sieve & Tare, g	971.80
Mass of Tare, g	0.00
Total Mass of Dry Sample, g	917.81

Mass of Sample used for hydrometer analysis, g	100.48
Dry Mass, g	94.90
% of Total Sample passing #4 sieve	99.1

SIEVE ANALYSIS

PORTION OF SAMPLE RETAINED ON #4 SIEVE

Mass of Tare, g: 0.00

Sieve Size		Sample & Tare, g	% RETAINED	%PASSING
12"	COBBLES		0.0	100.0
3"	COARSE GRAVEL		0.0	100.0
2.5"			0.0	100.0
2"			0.0	100.0
1.5"			0.0	100.0
1"			0.0	100.0
.75"	FINE GRAVEL		0.0	100.0
.5"			0.0	100.0
.375"		0.00	0.0	100.0
#4	COARSE SAND	7.90	0.9	99.1

PORTION OF SAMPLE PASSING #4 SIEVE (Hydrometer Backsieve)

Sieve Size		Cumulative Mass retained, g	% PASSING
#10	MEDIUM SAND	1.58	97.5
#20		2.81	96.2
#40	FINE SAND	4.19	94.8
#60		9.60	89.1
#100		25.70	72.3
#200	FINES	43.75	53.4

Remarks

HYDROMETER ANALYSIS

Length of Dispersion Period	1 Minute
Mechanical Dispersion Device ID #	61
Amount of Dispersing Agent (ml)	125.0
Specific Gravity (assumed)	2.700
Specific Gravity (tested)	
Starting time	11:26

PARTICLE-SIZE ANALYSIS

% COBBLES	0.0	% MEDIUM SAND	2.7
% COARSE GRAVEL	0.0	% FINE SAND	41.3
% FINE GRAVEL	0.9	% FINES	53.4
% COARSE SAND	1.7	% TOTAL SAMPLE	100.0
% CLAY(<0.005mm)	15.2	% CLAY(<0.002mm)	8.2

Date	Time	Testing time (min)	Reading	Temp (^oC)	K	Composite Correction	Actual Reading	Effective Depth (cm)	a	Particle Diam. (mm)	Percent Passing
05/21/10	11:28	2	42.0	25.7	0.01253	6.0	36.0	10.4	0.99	0.0286	37.2
05/21/10	11:31	5	38.0	25.7	0.01253	6.0	32.0	11.1	0.99	0.0186	33.1
05/21/10	11:41	15	31.0	25.7	0.01253	6.0	25.0	12.2	0.99	0.0113	25.9
05/21/10	11:56	30	26.5	25.7	0.01253	6.0	20.5	13.0	0.99	0.0082	21.2
05/21/10	12:26	60	23.0	25.7	0.01253	6.0	17.0	13.6	0.99	0.0060	17.6
05/21/10	15:36	250	16.0	25.7	0.01253	6.0	10.0	14.7	0.99	0.0030	10.3
05/22/10	11:26	1440	12.5	25.7	0.01253	6.0	6.5	15.3	0.99	0.0013	6.7

Hydrometer 152H ID #	451190	Oven ID #	12/13/14/15
Sieve Shaker ID #	54/130	Balance ID#	1/6/7

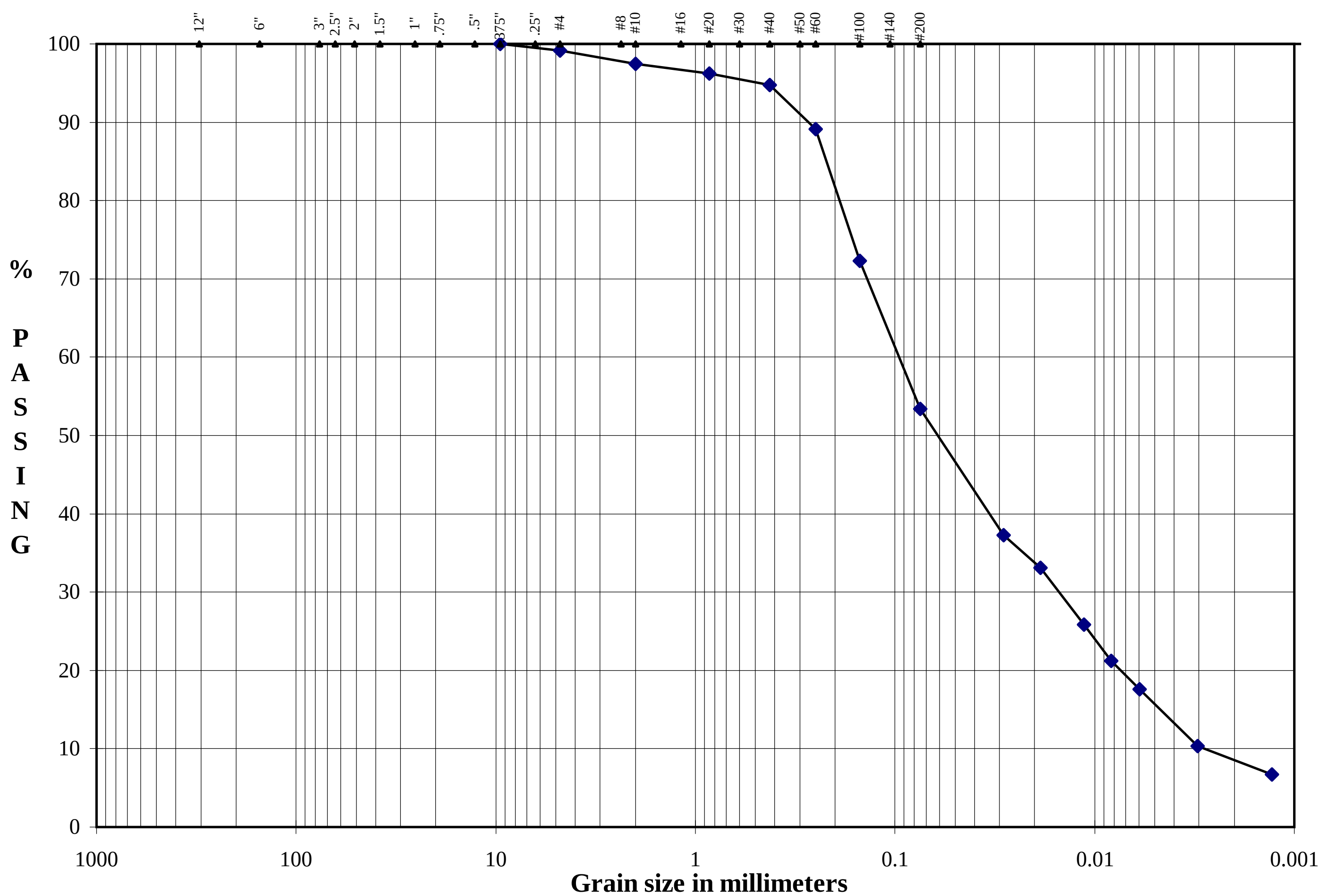
TIMELY ENGINEERING SOIL TESTS, LLC	1874 Forge Street Tucker, GA 30084 Phone: 770-938-8233 Fax: 770-923-8973 Web: www.test-llc.com	Tested By	RI
		Date	05/10/10
		Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012+9013+9014/(Ash+Sed.A+Sed.B)	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 422/AASHTO T 88

Standard Test Method for Particle-Size Analysis of Soils (with Hydrometer Analysis)

Particle-Size Analysis



Boulders	Cobbles	Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

DESCRIPTION: Brownish Gray Sandy Silt

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	NA	mm
Cu	NA	
Cc	NA	

USCS (ASTM D2487; D2488): ML

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Tested By	KI
Date	05/20/10
Checked By	

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	S. Type	Bulk
Sample ID	9012/KIF-Bulk Ash 050610	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

WET (BULK*) DENSITY DETERMINATION (ASTM D2937 Mod./D4531/D883)

Sample ID	Moisture Content,%	Mass of Container, g	Mass of Wet Sample & Container, g	Volume of Container, ml	Volume of Container, ft^3	Wet Density, pcf	Dry Density, pcf	Comments
9012/KIF-Bulk Ash 050610	35.1	68.4	1283.2	690.0	0.024	109.9	81.4	
(9012+9013+9014)/Ash+Sed.A+Sed.B	27.5	68.4	1381.9	690.0	0.024	118.8	93.2	

Comments

*Bulk Density - the mass per unit volume of material, including voids inherent in the material as tested. Mass and volume determined in as-received condition of material.

Balance ID Number	12/13/14/15
Oven ID Number	1/6/7
Caliper ID Number	16

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Tested By	RI
Date	05/20/10
Checked By	LB

Client Pr. #	-	Lab. PR. #	1003-03-1
Pr. Name	Kingston Fossil Plant	Sample Type	Bulk
Sample ID	Various (See below)	Depth/Elev.	-
Location	Swan Pond Embay	Add. Info	-

ASTM D 2216; MOISTURE CONTENT DETERMINATION

Date	Tech	Sample ID	Mass of Wet Sample & Tare (g)	Mass of Dry Sample & Tare (g)	Mass of Tare (g)	Moisture Content (%)	Comments
5/13/2010	KI	9012/KIF-Bulk Ash-050610	1306.00	1006.30	153.00	35.1	
5/12/2010	RI	9013/KIF-Bulk Sed.-050610-A	1422.00	1261.60	449.00	19.7	
5/12/2010	RI	9014/KIF-Bulk Sed.-050610-B	1464.00	1279.40	439.50	22.0	
5/20/2010	RI	9012+9013+9014 /Ash+Sed.A+Sed.B	855.50	766.40	442.50	27.5	

REMARKS

Balance ID Number	1/6/7
Oven ID Number	12/13/14/15

T.E. S.T.
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Batch Worksheet

BATCH-SAMPLE ID	9012/(Bulk Ash 050610)-1-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/20/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**35.1**
Type of Cement Used	I/II
Mass of Dry Soil, g	**8142.2**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012	**Soil (wet)**	100.0	**11000.1**
9044	Cement	7.5	**610.7**
	Water, mL	489	

Remarks

Sample ID	Required Test	Nominal Mold Size: Diam., in.	Nominal Mold Size: Height, in.	Tamping Tech	End Preparation: Removal Tech	End Preparation: Trim Tech	End Preparation: Method	Comments
9012-1-1-1	UCS	3	7					7 days
9012-1-1-2	UCS	3	7					7 days
9012-1-1-3	UCS	3	7					14 days
9012-1-1-4	UCS	3	7					14 days
9012-1-1-5	UCS	3	7					28 days
9012-1-1-6	UCS	3	7					28 days
9012-1-1-7	Perm	3	4					28 days
9012-1-1-8	extra	3	4					
9012-1-1-9	extra	3	7					

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Batch Worksheet

BATCH-SAMPLE ID	9012/(Bulk Ash 050610)-2-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/20/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**35.1**
Type of Cement Used	I/II
Mass of Dry Soil, g	**8142.2**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012	**Soil (wet)**	100.0	**11000.1**
9044	Cement	10.0	**814.2**
	Water, mL	651	

Remarks

Sample ID	Required Test	Nominal Mold Size: Diam., in.	Nominal Mold Size: Height, in.	Tamping Tech	End Preparation: Removal Tech	Trim Tech	Method	Comments
9012-2-1-1	UCS	3	7					7 days
9012-2-1-2	UCS	3	7					7 days
9012-2-1-3	UCS	3	7					14 days
9012-2-1-4	UCS	3	7					14 days
9012-2-1-5	UCS	3	7					28 days
9012-2-1-6	UCS	3	7					28 days
9012-2-1-7	Perm	3	4					28 days
9012-2-1-8	extra	3	4					
9012-2-1-9	extra	3	7					
9012-1-1-10	extra	3	4					

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Batch Worksheet

BATCH-SAMPLE ID	9012/(Bulk Ash 050610)-3-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/20/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**35.1**
Type of Cement Used	I/II
Mass of Dry Soil, g	**8142.2**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012	**Soil (wet)**	100.0	**11000.1**
9044	Cement	12.5	**1017.8**
	Water, mL	814	

Remarks

Sample ID	Required Test	Nominal Mold Size: Diam., in.	Nominal Mold Size: Height, in.	Tamping Tech	End Preparation: Removal Tech	Trim Tech	Method	Comments
9012-3-1-1	UCS	3	7					7 days
9012-3-1-2	UCS	3	7					7 days
9012-3-1-3	UCS	3	7					14 days
9012-3-1-4	UCS	3	7					14 days
9012-3-1-5	UCS	3	7					28 days
9012-3-1-6	UCS	3	7					28 days
9012-3-1-7	Perm	3	4					28 days
9012-3-1-8	extra	3	4					
9012-3-1-9	extra	3	7					
9012-3-1-10	extra	3	4					

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Batch Worksheet

BATCH-SAMPLE ID	9013/(Bulk Sed. 050610A)-1-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/18/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**19.7**
Type of Cement Used	I/II
Mass of Dry Soil, g	**10000.0**
Water/Cem. Mat. Ratio	**2.0**

Mix Constituents:

Component ID	**Component Name**	**Amount, % (based on soil dry mass)**	**Amount, g**
9013	**Soil (wet)**	100.0	**11970.0**
9044	Cement	7.5	**750.0**
	Water, mL	1500	

Remarks

Original grout was prepared with water/cement ratio of 1.0 and after adding to soil additional amount of water was added to mix in order to make soil-grout material moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	**Required Test**	**Nominal Mold Size Diam., in.**	**Nominal Mold Size Height, in.**	**Tamping Tech**	**End Preparation Removal Tech**	**End Preparation Trim Tech**	**End Preparation Method**	**Comments**
9013-1-1-1	UCS	3	6					7 days
9013-1-1-2	UCS	3	6					7 days
9013-1-1-3	UCS	3	6					14 days
9013-1-1-4	UCS	3	6					14 days
9013-1-1-5	UCS	3	6					28 days
9013-1-1-6	UCS	3	6					28 days
9013-1-1-7	Perm	3	3					28 days
9013-1-1-8	extra	3	3					
9013-1-1-9	extra	3	6					
9013-1-1-10	extra	3	6					
9013-1-1-11	extra	3	6					

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Batch Worksheet

	BATCH-SAMPLE ID	9013/(Bulk Sed. 050610A)-2-1		BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/18/2010

Time Batch Mixing Started				
Total Time Batch was Mixed, min			**Soil Moisture Content, %**	**19.7**
Time Batch Completely in Molds			Type of Cement Used	I/II
			Mass of Dry Soil, g	**9190.0**
			Water/Cem. Mat. Ratio	**1.5**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9013	**Soil (wet)**	100.0	**11000.4**
9044	Cement	10.0	**919.0**
	Water, mL	1379	

Remarks

Original grout was prepared with water/cement ratio of 1.0 and after adding to soil additional amount of water was added to mix in order to make soil-grout material moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	Required Test	Nominal Mold Size Diam., in.	Nominal Mold Size Height, in.	Tamping Tech	End Preparation Removal Tech	End Preparation Trim Tech	End Preparation Method	Comments
9013-2-1-1	UCS	3	6					7 days
9013-2-1-2	UCS	3	6					7 days
9013-2-1-3	UCS	3	6					14 days
9013-2-1-4	UCS	3	6					14 days
9013-2-1-5	UCS	3	6					28 days
9013-2-1-6	UCS	3	6					28 days
9013-2-1-7	Perm	3	3					28 days
9013-2-1-8	extra	3	3					
9013-2-1-9	extra	3	6					
9013-2-1-10	extra	3	6					
9013-2-1-11	extra	3	6					partial

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Batch Worksheet

BATCH-SAMPLE ID	9013/(Bulk Sed. 050610A)-3-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/18/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**19.7**
Type of Cement Used	I/II
Mass of Dry Soil, g	**9190.0**
Water/Cem. Mat. Ratio	**1.261**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9013	**Soil (wet)**	100.0	**11000.4**
9044	Cement	12.5	**1148.8**
	Water, mL	1449	

Remarks

Original grout was prepared with water/cement ratio of 1.0 and after adding to soil additional amount of water was added to mix in order to make soil-grout material moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	Required Test	Nominal Mold Size Diam., in.	Nominal Mold Size Height, in.	Tamping Tech	End Preparation Removal Tech	End Preparation Trim Tech	End Preparation Method	Comments
9013-3-1-1	UCS	3	6					7 days
9013-3-1-2	UCS	3	6					7 days
9013-3-1-3	UCS	3	6					14 days
9013-3-1-4	UCS	3	6					14 days
9013-3-1-5	UCS	3	6					28 days
9013-3-1-6	UCS	3	6					28 days
9013-3-1-7	Perm	3	3					28 days
9013-3-1-8	extra	3	3					
9013-3-1-9	extra	3	6					
9013-3-1-10	extra	3	6					
9013-3-1-11	extra	3	6					

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Batch Worksheet

BATCH-SAMPLE ID	9014/(Bulk Sed. 050610-B)-1-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/19/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**22.0**
Type of Cement Used	I/II
Mass of Dry Soil, g	**9016.5**
Water/Cem. Mat. Ratio	**1.0**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9014	**Soil (wet)**	100.0	**11000.1**
9044	Cement	7.5	**676.2**
	Water, mL	676	

Remarks

Original grout was prepared with water/cement ratio of 1.0 and after adding to soil additional amount of water was not needed, material was moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	Required Test	Nominal Mold Size: Diam., in.	Nominal Mold Size: Height, in.	Tamping Tech	End Preparation: Removal Tech	End Preparation: Trim Tech	End Preparation: Method	End Preparation: Comments
9014-1-1-1	UCS	3	6					7 days
9014-1-1-2	UCS	3	6					7 days
9014-1-1-3	UCS	3	6					14 days
9014-1-1-4	UCS	3	6					14 days
9014-1-1-5	UCS	3	6					28 days
9014-1-1-6	UCS	3	6					28 days
9014-1-1-7	Perm	3	3					28 days
9014-1-1-8	extra	3	3					
9014-1-1-9	extra	3	6					
9014-1-1-10	extra	3	6					

T.E.S.T.

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Batch Worksheet

BATCH-SAMPLE ID	9014/(Bulk Sed. 050610-B)-2-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/19/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**22.0**
Type of Cement Used	I/II
Mass of Dry Soil, g	**9016.5**
Water/Cem. Mat. Ratio	**1.0**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9014	**Soil (wet)**	100.0	**11000.1**
9044	Cement	10.0	**901.7**
	Water, mL	902	

Remarks

Original grout was prepared with water/cement ratio of 1.0 and after adding to soil additional amount of water was not needed, material was moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	Required Test	Nominal Mold Size: Diam., in.	Nominal Mold Size: Height, in.	Tamping Tech	End Preparation: Removal Tech	End Preparation: Trim Tech	End Preparation: Method	End Preparation: Comments
9014-2-1-1	UCS	3	6					7 days
9014-2-1-2	UCS	3	6					7 days
9014-2-1-3	UCS	3	6					14 days
9014-2-1-4	UCS	3	6					14 days
9014-2-1-5	UCS	3	6					28 days
9014-2-1-6	UCS	3	6					28 days
9014-2-1-7	Perm	3	3					28 days
9014-2-1-8	extra	3	3					
9014-2-1-9	extra	3	6					
9014-2-1-10	extra	3	6					
9014-2-1-11	extra	3	6					partial

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BATCH-SAMPLE ID	9014/(Bulk Sed. 050610-B)-3-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/19/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**22.0**
Type of Cement Used	I/II
Mass of Dry Soil, g	**9016.5**
Water/Cem. Mat. Ratio	**0.9**

Mix Constituents:

Component ID	**Component Name**	**Amount, % (based on soil dry mass)**	**Amount, g**
9014	**Soil (wet)**	100.0	**11000.1**
9044	Cement	12.5	**1127.1**
	Water, mL	1014	

Remarks

Original grout was prepared with water/cement ratio of 0.9 and after adding to soil additional amount of water was not needed, material was moldable consistency.

Reported above water/cament ratio is based on total amount of water used during mix preparation

Sample ID	**Required Test**	**Nominal Mold Size: Diam., in.**	**Nominal Mold Size: Height, in.**	**Tamping Tech**	**End Preparation: Removal Tech**	**End Preparation: Trim Tech**	**End Preparation: Method**	**End Preparation: Comments**
9014-3-1-1	UCS	3	6					7 days
9014-3-1-2	UCS	3	6					7 days
9014-3-1-3	UCS	3	6					14 days
9014-3-1-4	UCS	3	6					14 days
9014-3-1-5	UCS	3	6					28 days
9014-3-1-6	UCS	3	6					28 days
9014-3-1-7	Perm	3	3					28 days
9014-3-1-8	extra	3	3					
9014-3-1-9	extra	3	6					
9014-3-1-10	extra	3	6					
9014-3-1-11	extra	3	6					partial

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Batch Worksheet

BATCH-SAMPLE ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-1-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/21/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**27.5**
Type of Cement Used	I/II
Mass of Dry Soil, g	**7059.0**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012+9013+9014	**Soil (wet)**	100.0	**9000.2**
9044	Cement	7.5	**529.4**
	Water, mL	424	

Remarks

Soil was composited based on provided depth of layers and wet density

Sample ID	Required Test	Nominal Mold Size Diam., in.	Nominal Mold Size Height, in.	Tamping Tech	End Preparation Removal Tech	End Preparation Trim Tech	End Preparation Method	Comments
(9012+9013+9014)-1-1-1	UCS	3	6					7 days
(9012+9013+9014)-1-1-2	UCS	3	6					7 days
(9012+9013+9014)-1-1-3	UCS	3	6					14 days
(9012+9013+9014)-1-1-4	UCS	3	6					14 days
(9012+9013+9014)-1-1-5	UCS	3	6					28 days
(9012+9013+9014)-1-1-6	UCS	3	6					28 days
(9012+9013+9014)-1-1-7	Perm	3	3					28 days
(9012+9013+9014)-1-1-8	extra	3	3					
(9012+9013+9014)-1-1-9	extra	2	4					

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Batch Worksheet

	BATCH-SAMPLE ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-2-1		BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/21/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**27.5**
Type of Cement Used	I/II
Mass of Dry Soil, g	**7059.0**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012+9013+9014	**Soil (wet)**	100.0	**9000.2**
9044	Cement	10.0	**705.9**
	Water, mL	565	

Remarks

Soil was composited based on provided depth of layers and wet density

Sample ID	Required Test	Nominal Mold Size Diam., in.	Nominal Mold Size Height, in.	Tamping Tech	End Preparation Removal Tech	End Preparation Trim Tech	End Preparation Method	End Preparation Comments
(9012+9013+9014)-2-1-1	UCS	3	6					7 days
(9012+9013+9014)-2-1-2	UCS	3	6					7 days
(9012+9013+9014)-2-1-3	UCS	3	6					14 days
(9012+9013+9014)-2-1-4	UCS	3	6					14 days
(9012+9013+9014)-2-1-5	UCS	3	6					28 days
(9012+9013+9014)-2-1-6	UCS	3	6					28 days
(9012+9013+9014)-2-1-7	Perm	3	3					28 days
(9012+9013+9014)-2-1-8	extra	3	3					
(9012+9013+9014)-2-1-9	extra	2	4					
(9012+9013+9014)-2-1-10	extra	2	4					

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Batch Worksheet

BATCH-SAMPLE ID	9012+9013+9014/(Ash+Sed.A+Sed.B)-3-1			BATCH #	1
PR. NUMBER	1003-03-1	PROJECT LOCATION	Swan Pond Embay	MIXING TECH	KI/RI
PR. NAME	Kingston Fossil Plant	SAMPLE TYPE	Mold	BATCH DATE	5/21/2010

Time Batch Mixing Started	
Total Time Batch was Mixed, min	
Time Batch Completely in Molds	

Soil Moisture Content, %	**27.5**
Type of Cement Used	I/II
Mass of Dry Soil, g	**7059.0**
Water/Cem. Mat. Ratio	**0.8**

Mix Constituents:

Component ID	Component Name	Amount, % (based on soil dry mass)	Amount, g
9012+9013+9014	**Soil (wet)**	100.0	**9000.2**
9044	Cement	12.5	**882.4**
	Water, mL	706	

Remarks

Soil was composited based on provided depth of layers and wet density

Sample ID	Required Test	Nominal Mold Size Diam., in.	Nominal Mold Size Height, in.	Tamping Tech	End Preparation Removal Tech	End Preparation Trim Tech	End Preparation Method	Comments
(9012+9013+9014)-3-1-1	UCS	3	6					7 days
(9012+9013+9014)-3-1-2	UCS	3	6					7 days
(9012+9013+9014)-3-1-3	UCS	3	6					14 days
(9012+9013+9014)-3-1-4	UCS	3	6					14 days
(9012+9013+9014)-3-1-5	UCS	3	6					28 days
(9012+9013+9014)-3-1-6	UCS	3	6					28 days
(9012+9013+9014)-3-1-7	Perm	3	3					28 days
(9012+9013+9014)-3-1-8	extra	3	3					
(9012+9013+9014)-3-1-9	extra	3	6					

APPENDIX G

Geosyntec (2011) – Natural Attenuation of Chromium, Mercury, Selenium and Thorium-228

Final White Paper

Kingston Ash Recovery Project

Natural Attenuation of Chromium, Mercury, Selenium and Thorium-228

June 07, 2011

1. INTRODUCTION

1.1 Background and Purpose

Contiguous ash deposits within the former Dredge Cell, the active Ash Pond, and the Lateral Expansion Area at Kingston Fossil Plant (KIF) will be closed under the Comprehensive Environment Response, Compensation, and Liability Act as a single ash landfill. Groundwater flow patterns at the KIF site indicate that groundwater in contact with ash in the closed landfill could be transported with shallow groundwater to the Emory River and Swan Pond Embayment. In addition, groundwater in contact with other ash deposits beneath the Stilling Pond and the Ash Processing Area ("Ball Field") is expected to ultimately discharge to the Emory River and/or the Intake Channel.

The goal of groundwater flow and transport modeling is to quantify ash-related constituent concentrations and mass loadings entering the Emory River and Swan Pond Creek via groundwater seepage from ash source areas. These predictions will subsequently be used in evaluating potential long-term risks to human and aquatic receptors. The *Kingston Ash Recovery Project, Non-Time-Critical Removal, Action Sampling and Analysis Plan (SAP)* (Jacobs, 2010a) identifies constituents of concern (COCs) selected for transport modeling purposes. The selected COCs include arsenic (As), mercury (Hg), chromium (Cr), selenium (Se), radium-226 (Ra-226), and thorium-228 (Th-228). Table 1-1 provides risk-based screening levels for COCs as prescribed in Jacobs (2010a).

1.2 Objectives

The purpose of this paper is to show that Hg, Cr, Se, and Th-228 are subject to natural attenuation at the site or occur at negligible concentrations such that transport modeling is unwarranted. These constituents are subject to natural attenuation by adsorption, ion-exchange, and chemical precipitation or exist at concentrations less than applicable risk-based screening levels. Laboratory testing and analyses of ash, native soils/sediments, porewater, and groundwater have been performed in accordance with the SAP. Results presented herein support monitored natural attenuation (MNA) of these constituents.

1.3 Report Organization

Unique report sections follow for COCs considered herein. Hg is discussed in Section 2, Cr follows in Section 3, Section 4 relates to Th-228, and Se is discussed in Section 5.

2. MERCURY

2.1 Mercury Chemistry

Mercury has an atomic number of 80 and under typical environmental conditions it exists in water as Hg(I) or Hg(II). Mercury has very limited solubility and under aerobic conditions tends to precipitate as the mineral montroydite (HgO). Under reducing conditions it exists in the elemental form (Hg(l)) while under sulfidogenic conditions precipitates as the sulfide, cinnabar.

2.2 Mercury Occurrence

Combustion releases coal-bound mercury into the flue gas in elemental, oxidized, and particulate forms. Gaseous elemental and oxidized mercury may condense on fly ash particles or be adsorbed on carbon in the flue gas; these particles are subsequently removed by particulate control devices such as electrostatic precipitators (ESPs) and fabric filters. Mercury concentrations in Coal Combustion Products (CCPs) depend on the type of coal burned. During combustion, eastern bituminous coals release mostly oxidized mercury, while subbituminous and lignite coals release mostly elemental mercury. Mercury concentrations in CCPs also depend on the combustion and emission control processes used at individual power plants.

According to EPRI (2005), mercury concentrations in CCPs are generally less than 1 mg/kg. In field leachates from a variety of management facilities and sampling locations, dissolved total mercury usually measures less than 50 ng/L. Dissolved organic mercury is almost always less than 1 ng/L or non-detectable. These data suggest that mercury leaching from ash is unlikely to significantly impact groundwater quality at disposal facilities. Field data suggest that net methylation in conventional CCP ponds and landfills is low. Dissolved organic mercury (the more-toxic methyl and dimethyl forms) is almost always less than 1 ng/L or non-detectable in nearly all field leachate samples.

Milligan and Ruane (1980) describe the first comprehensive ash and leachate sampling study performed at KIF (Plant J). Figure 2-1 shows the locations of eight boring/wells installed for this study. During boring, samples were collected across the vertical profile of each borehole. Results for ash and natural media solids indicated mercury concentrations ranging from < 0.1 to 1.2 ug/g in 20 of 56 ash, soil, and shale samples. Table 2-1 summarizes analytical results by media type. During the collection of soil samples, twenty samples were selected for extraction and analysis of porewater. Mercury was less than method detection levels (MDLs; < 10 or 20 ug/L) in all samples analyzed. With the exception of two samples (wells 3 and 4; 2.9 and 0.60 ug/L), results from initial groundwater sampling at the eight wells indicated mercury concentrations less than MDL (< 0.2 ug/L). A second groundwater sampling event for this study indicated mercury below the MDL (< 0.2 ug/L) at all locations. A leachate attenuation experiment (column experiment) was also performed by Milligan and Ruane (1980) using ash pond leachate. Mercury was never detected in column effluent above the MDL (< 0.8 ug/L).

Mercury was not included as an analyte for ash solids analyses (Table 2-2) during recent leaching studies (column and batch testing) involving KIF fly ash (Jacobs, 2010b). However, Toxicity Characteristic Leaching Procedure (TCLP) testing of ash samples by TVA in 1995 and 2002 (Table 2-3) was performed for samples from the KIF hopper and pre-failure dredge cell. As shown in Table 2-3, mercury concentrations on the four ash samples were below MDLs (< 0.2 and 2.0 ug/L). More recent sampling of ash (2009 - 2010) has been conducted prior to ash loading and offsite shipment by rail. A summary of these results (Table 2-4) shows that TCLP and total ash concentrations for mercury were below respective MDLs in all samples.

Table 2-5 summarizes results of historical groundwater sampling at KIF compliance monitoring wells. Wells locations are identified in Figure 2-2. As indicated in Table 2-5, mercury was not observed at a total (131 samples) or dissolved (43 samples) concentration in excess of the MDLs (< 0.1 to 0.2 ug/L). To support groundwater transport model development, porewater sampling was performed during September and October 2010 in accordance with the SAP (Jacobs, 2010a). Figure 2-3 depicts sampling locations and Table 2-6 summarizes sampling results by media type. As shown in Table 2-6, mercury (dissolved) was not observed at any location in excess of the MDLs (< 0.15 to 0.2 ug/L).

The Geochemists Workbench (GWB) Act2 module has been applied to model geochemical reactions between mercury in ash leachate, transport media (i.e., ash, alluvial clay, alluvial sand, residuum, and bedrock), minerals, and reactants. The model utilized KIF-specific ash data, groundwater composition data, mineralogy, and hydraulic parameters. Figure 2-4 shows a resulting stability diagram for mercury at a concentration of 0.01 ug/L, along with symbols at Eh and pH values corresponding to groundwater in contact with different solid media. The diagram shows the most stable form of an element under different pH and redox conditions. The diagram depicts conditions where a solid mineral phase is the most stable form of an element as tan-colored areas and conditions where a dissolved species is the most stable form as light blue areas. From Figure 2-4 it can be seen that the mineral montroydite (HgO) is in the most stable form of mercury under oxidized conditions, with elemental mercury the most stable form at less oxidized conditions and the mineral cinnabar (HgS) the most stable form under sulfidogenic conditions. The symbols representing various saturated media at the KIF facility all reside within zones where dissolved forms of mercury would be favored to precipitate and where dissolution or leaching of mercury of solids would not occur. Conditions beneath the KIF facility are not conducive to leaching of mercury from ash or migration of mercury in groundwater.

2.3 Mercury Summary

Mercury has never been detected in aqueous samples (porewater or groundwater) at KIF. Results of historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, porewater, and groundwater illustrate that mercury almost always occurs at concentrations less than analytic detection levels. In recent sampling and analyses associated with the SAP, mercury concentrations were always less than analytic detection levels. Geochemical modeling indicates that conditions within ash are not favorable for dissolution and leaching of minute concentrations of mercury that might exist on ash. Furthermore, geochemical conditions of groundwater in the natural media underlying ash are not conducive to the dissolution and migration of mercury.

3. CHROMIUM

3.1 Chromium Chemistry

Chromium has an atomic number of 24 and under typical environmental conditions it exhibits only two oxidation states, Cr(III) and Cr(VI). Cr(VI) is the common oxidation state under aerobic conditions and it exists in water as soluble oxyanions such as CrO_4^{2-} and $Cr_2O_7^{2-}$ (dominant above pH > 6). Cr(VI) is generally the more soluble form, while the reduced form (Cr(III)) has its solubility limited by precipitation of the oxide (CrO_3) under moderately reducing conditions and the sulfide (brezinaite) under sulfidogenic conditions.

3.2 Chromium Occurrence

From Milligan and Ruane (1980), results for ash and natural media solids indicated chromium concentrations ranging from 6 to 47 ug/g in 46 of 52 ash, soil, and shale samples. Table 2-1 summarizes analytical results by media type. During the collection of soil samples, 23 samples were selected for extraction and analysis of porewater. Chromium ranged from less than MDL (< 10 ug/L) to 90 ug/L in all samples analyzed except for one outlier sand sample (700 ug/L). With the exception of three samples (wells 4, 6 and 7; 10, 6 and 12 ug/L), results from groundwater sampling at the eight wells indicated chromium concentrations less than MDL (< 2 ug/L). A second groundwater sampling event for this study indicated chromium below the MDL (< 2 ug/L) at all locations. A leachate attenuation experiment (column experiment) was also performed by Milligan and Ruane (1980) using ash pond leachate. Chromium was never detected in column effluent above the MDL (< 5 ug/L).

A second comprehensive groundwater assessment at KIF was performed by Velasco and Bohac (1991). MINTEQ modeling described in the report predicted that the chromium would be immobile due to precipitation and adsorption mechanisms.

Chromium was included as an analyte for ash solids analyses (Table 2-2) during recent leaching studies (column and batch testing) involving KIF fly ash (Jacobs, 2010b). As indicated in Table 2-2, chromium was observed at a concentration of 66.4 mg/kg. TCLP testing of ash samples by TVA in 1995 and 2002 (Table 2-3) was performed for samples from the KIF hopper and pre-failure dredge cell. As shown in Table 2-3, chromium concentrations on the four ash samples ranged from 12 to 800 ug/L. More recent sampling of ash (2009 - 2010) has been conducted prior to ash loading and offsite shipment by rail. A summary of these results (Table 2-4) shows that the TCLP chromium concentrations were less than the MDL (< 50 ug/L) in all but one (69 ug/L) of 109 samples. Total ash concentrations for chromium (Table 2-4) were 25.2 and 39.3 ug/L for the two samples collected.

Table 2-5 summarizes results of historical groundwater sampling at KIF compliance monitoring wells. Wells locations are identified in Figure 2-2. As indicated in Table 2-5, dissolved chromium concentrations were observed in 13 of 96 groundwater samples at concentrations ranging from 0.33 to 14 ug/L during the period 1990 through 2010. The mean concentration of dissolved chromium (when detected) was 2.96 ug/L. To support groundwater transport model development, porewater sampling was performed during September and October 2010 in accordance with the SAP (Jacobs, 2010a). Figure 2-3 depicts sampling locations and Table 2-6 summarizes sampling results by media type. As shown in Table 2-6, chromium (dissolved) was observed to range from the MDL (< 0.33 ug/L) to 0.51 ug/l in ash samples. Dissolved chromium was not detected in underlying alluvial clay or sand; however, bedrock concentrations ranged from the MDL (< 0.33 ug/L) to 1.54 ug/L. Chromium within the Conasauga shale at the site is believed to be naturally occurring (see Table 2-1).

Chromium was observed on fly ash solids at a concentration of 66.4 mg/kg (Table 2-2) during recent leaching studies (column and batch testing) involving KIF fly ash (Jacobs, 2010b). Results of the column leaching test for chromium are shown in Figure 3-1. Boron is included for comparison since it is considered a conservative constituent (i.e., does not readily attenuate). Chromium concentrations in leachate from ash show a rapid increase to 273 μg/L for a cumulative liquid:solid (LS) ratio of 0.4 (pore volume of 0.8). Thereafter, chromium concentration decreases to less than the risk-based screening level of 100 ug/L (Table 1-1) after 14 days (~ 1.4 pore volumes). It is important to note that pH values observed during the column leaching test ranged from 7.0 to 10.91. Excluding data from a single sample, the pH of recent ash porewater sampling ranged from 6.2 to 7.5 and averaged 6.9. Because these data represent actual conditions within the ash, this circumneutral pH is expected to be most representative of field conditions within the ash fill. The report from Jacobs (2010b) describing column leaching tests does not indicate that measures were taken to simulate field conditions (e.g., redox potential) and it is possible that conditions were aerobic during testing. This would result in significant overestimates of Cr solubility and mobility from column leaching tests.

The GWB Act2 module has been applied to model geochemical reactions between chromium in ash leachate, transport media (i.e., ash, alluvial clay, alluvial sand, residuum, and bedrock), minerals, and reactants. The model utilized KIF-specific ash data, groundwater composition data, mineralogy, and hydraulic parameters. Figure 3-2 shows a stability diagram for chromium at a concentration of 100 ug/L, along with symbols at Eh and pH values corresponding to groundwater in the different solid media at KIF. The diagram shows large areas where a solid mineral phase is the most stable form of chromium at lower oxidation-reduction potentials, or more reduced conditions. Under moderately reducing conditions, precipitation of the mineral chromite (Cr_2O_3) can limit chromium solubility, while under sulfidogenic conditions, precipitation of the sulfide brezinaite can limit it. Geochemical model predictions indicate that groundwater conditions beneath the KIF facility are not conducive to leaching of chromium from ash or migration of chromium in groundwater.

3.3 Chromium Summary

Results of historical sampling and analyses of ash, underlying soils and bedrock, ash leachate, porewater, and groundwater illustrate that chromium groundwater concentrations almost always occur at less than the risk-based human health screening level (100 ug/L; Table 1-1). In recent porewater sampling and analyses associated with the SAP, dissolved chromium concentrations were always less than the risk-based screening level and not detected (< 0.33 ug/L) in underlying alluvium and residuum. Geochemical modeling indicates that conditions within ash are not favorable for dissolution and leaching of small concentrations of chromium that might exist on ash. Furthermore, geochemical conditions of natural media underlying ash are not conducive to the dissolution and migration of chromium.

4. THORIUM-228

4.1 Thorium Chemistry

Thorium has an atomic number of 90 and under typical environmental conditions it has an oxidation number of +4. The thorium cation (Th^{+4}) is a Type A acceptor and, because of its high charge density it tends to be precipitated as the (hydr)oxide at normal pH. The aqueous solubility of thorium under normal environmental conditions can be limited by the precipitation of thorianite (ThO_2). For a Th^{+4} concentration equal to the risk-based human health screening level (approximately $8x10^{-15}$ molar), a pH below approximately 5 is required to avoid thorianite precipitation. Under sulfidogenic conditions, the solubility of thorium is limited by precipitation of the sulfide ThS_2. Thorium-228 is a member of the uranium (4n) decay series, and can occur naturally.

4.2 Thorium Occurrence

Thorium was not included as an analyte for ash solids analyses (Table 2-2) during recent leaching studies (column and batch testing) involving KIF fly ash (Jacobs, 2010b). More recent sampling of ash (2009 - 2010) has been conducted prior to ash loading and offsite shipment by rail. A summary of these results (Table 2-4) identifies a single sample analysis for Th-228 (0.884 pCi/g).

To support groundwater transport model development, porewater sampling was performed during September and October 2010 in accordance with the SAP (Jacobs, 2010a). Figure 2-3 depicts sampling locations and Table 2-6 summarizes sampling results by media type. As shown in Table 2-6, Th-228 was not detected at concentrations exceeding MDLs. The MDL concentrations for Th-228 were all less than the risk-based human health screening level of 0.159 pCi/L.

Figure 4-1 shows a stability diagram for thorium at a concentration of 15 pCi/L (8×10^{-15} mol/L), along with symbols at Eh and pH values corresponding to the different media potentially in contact with groundwater at KIF. The diagram shows large areas where dissolved thorium is the most stable form of thorium, with the solubility limited by precipitation of the sulfide (approximately 32 mg/L sulfur present) under sulfidogenic conditions.

4.3 Thorium Summary

Although ash samples from the failed dredge cell and the ash flow area contained Th-228, porewater samples did not exhibit Th-228 above the risk-based human health screening level of 0.159 pCi/L. The low solubility and mobility of Th-228 at Site pH and non-detection in ash porewater show that the Th-228 can be expected to attenuate in groundwater.

5. SELENIUM

5.1 Selenium Chemistry

Selenium has an atomic number of 34 and occurs just beneath sulfur in the periodic table, so that it has similar chemical properties. Similar to sulfur, selenium forms acidic oxides (SeO_2 andSeO_3). When hydrated, these oxides form selenous acid (H_2SeO_3)and selenic acid (H_2SeO_4), and at normal pH the oxyanions from these are quite water-soluble. Reduced forms of selenium include elemental selenium, and water-soluble H_2Se (present as HSe^- in the normal pH range). Analogous to iron sulfide, selenium forms iron selenides (FeSe and $FeSe_2$) under the reduced conditions where sulfide is stable.

Analogous to sulfur, the more oxidized forms of selenium are more water-soluble and the reduced forms are less soluble. Because of that, selenium is deposited under reducing conditions (e.g., wetlands and swamps). Selenium has been observed in groundwater from ancient wetlands below the static water table when the water table was lowered due to agricultural pumping. Contact with the oxygen in the air oxidized the selenides to soluble forms of selenium in the groundwater.

5.2 Selenium Occurrence

From Milligan and Ruane (1980), results for ash and natural media solids indicated selenium concentrations of only 2 and 22 ug/g in 2 of 19 ash, soil, and shale samples. Table 2-1 summarizes analytical results by media type. During the collection of soil samples, 11 samples were selected for extraction and analysis of porewater. Selenium was less than MDLs (< 20 or 50 ug/L) in all samples analyzed. With the exception of two samples (wells 3 and 4; 1 and 5 ug/L), results from groundwater sampling at the eight wells indicated selenium concentrations less than MDL (< 1 ug/L). A second groundwater sampling event for this study indicated selenium below the MDL (< 1 ug/L) at all locations. A leachate attenuation experiment (column experiment) was also performed by Milligan and Ruane (1980) using ash pond leachate. Selenium was never detected in column effluent above the MDL (< 4 ug/L).

TCLP testing of ash samples by TVA in 1995 and 2002 (Table 2-3) was performed for samples from the KIF hopper and pre-failure dredge cell. As shown in Table 2-3, selenium concentrations on the four ash samples ranged from < 1.0 to 67 ug/L. More recent sampling of ash (2009 - 2010) has been conducted prior to ash loading and offsite shipment by rail. A summary of these results (Table 2-4) shows that the TCLP selenium concentrations were less than the MDL (< 50 ug/L) in all but seven of 109 samples. Total ash concentrations for selenium (Table 2-4) were 3.6 and 6.6 ug/L for the two samples collected.

Table 2-5 summarizes results of historical groundwater sampling at KIF compliance monitoring wells. Wells locations are identified in Figure 2-2. As indicated in Table 2-5, dissolved selenium concentrations were observed in 2 of 59 groundwater samples at a concentration of 2 ug/L during the period 1990 through 2010. The concentration of total selenium (when detected) ranged from 0.3 to 4.1 ug/L. To support groundwater transport model development, porewater sampling was performed during September and October 2010 in accordance with the SAP (Jacobs, 2010a). Figure 2-3 depicts sampling locations and Table 2-6 summarizes sampling results by media type. As shown in Table 2-6, selenium (dissolved) was observed to range from the MDL (< 0.33 ug/L) to 19.6 ug/l in ash samples. However, the two highest selenium concentrations, 16.5 and 19.6 ug/L at GP13 and GP18, respectively, are anomalous as described in later paragraphs. Dissolved selenium was not detected in underlying alluvial clay, sand or bedrock.

Selenium was included as an analyte for ash solids analyses (Table 2-2) during recent leaching studies (column and batch testing) involving KIF fly ash (Jacobs, 2010b). As indicated in Table 2-2, selenium was less than the MDL of 6.69 mg/kg. Results of the column leaching test for selenium are shown in Figure 5-1. Boron is included for comparison since it is considered a conservative constituent (i.e., does not readily attenuate). Leaching of selenium from ash showed an initial high concentration of 778 μg/L that decreased to 40 μg/L by a cumulative LS ratio of 1.0 (~ two pore volumes). Concentrations continued to decrease slightly to a concentration of 33 μg/L. As previously indicated, pH values observed during the column leaching test ranged from 7.0 to 10.91. Excluding data from a single sample, the pH of recent ash porewater sampling ranged from 6.2 to 7.5 and averaged 6.9. This neutral pH is expected to be most representative of field conditions within the ash fill. Because the data represent actual conditions within the ash, this circumneutral pH is expected to be most representative of field conditions within the ash fill. The report from Jacobs (2010b) describing column leaching tests does not indicate that measures were taken to simulate field conditions (e.g., redox potential) and it is possible that conditions were aerobic during testing. This would result in significant overestimates of Se solubility and mobility from column leaching tests.

Figure 5.2 shows the stability (Eh-pH) diagram for selenium at an aqueous concentration of 5 ug/L based on KIF-specific groundwater conditions. The diagram was prepared using the GWB geochemical modeling software and the Lawrence Livermore thermochemical dataset. Light blue areas represent conditions where the dominant species is a soluble dissolved selenium species, while the tan areas represent conditions where the dominant Se species is a mineral. In the tan areas, selenium is not soluble at the concentration (5 ug/L) used to construct the diagram. That is, dissolved selenium is predicted to precipitate and selenium minerals in contact with groundwater would not dissolve to increase aqueous selenium concentrations. It can be noted that the tan areas represent reduced selenium species. Under the most reduced conditions, the soluble species HSe^- is shown to dominate. The Eh values for the dominance of this species are below those that would be consistent with production of methane, and well below KIF aquifer conditions.

Average Eh and pH values for alluvial sand, alluvial clay, residuum, and bedrock aquifers are plotted on Figure 5-2. As indicated, all results fall within a range where precipitation of selenium is predicted. Eh – pH diagrams do not consider changes in the speciation of various constituents as conditions change. Geochemical modeling was performed using GWB with input including KIF-specific ash data, groundwater composition data, mineralogy, and hydraulic parameters. GWB was used to simulate equilibrium geochemical reactions (including precipitation) for each aquifer at a selenium concentration of 5 ug/L. For all of groundwater in contact with natural media, selenium was predicted to be precipitated as elemental selenium.

Although porewater samples collected from ash in September and October 2010 exhibited selenium concentrations less than 1 ug/L, samples from GP13 and GP18 showed selenium concentrations of 19.6 ug/L and 16.5 ug/L, respectively. These two results are considered anomalous.

The GP18 sample also displayed a high pH (11.5) and an oxidation-reduction potential (ORP) of 129 mV. The mean pH and ORP for ash porewater samples was 6.9 177 mV, respectively. This elevated pH without a corresponding oxidation-reduction potential change is consistent with the localized presence of an alkaline material other than ash. The groundwater temperature for the GP-18 sample was 23.3 degrees C, while the average for the other ash GP samples was 18.7 degrees C. This locally elevated temperature is consistent with a localized exothermic reaction, such as hydration of lime. It appears that lime (or other alkaline material) was admixed with ash in the immediate vicinity of GP18. Other data are consistent with this hypothesis. The calcium/magnesium ratio for the GP18 sample was > 896, compared to a range of 3.8 to 11 for the other ash samples, and the calcium/sodium ratio was > 211, compared to the range of 11 to 70 for the other ash samples.

For the GP13 sample, field data were not obtained due to low well productivity during sampling. However, the reported calcium concentration for the GP13 sample was 92.5 mg/L, compared to the average of 308 mg/L, the magnesium concentration was 23 mg/L compared to the average of 33 mg/L, and the reported sodium concentration was 1.7 mg/L, compared to the average of 10.4 mg/L. Based on these values and their deviations in the same directions as for the GP18 sample, this sample does not seem representative of the ash porewater.

The presence of such localized high-pH zones in the ash should be considered. If such zones were present to a degree to affect the general characteristics of the ash porewater at a large scale, effects would be evident at downgradient monitoring wells. However (for instance), no selenium detections downgradient of GP13 and GP18 have been observed. Hence, these zones seem to represent a very small fraction of the total ash volume and do not alter the average geochemical properties of the material.

5.3 Selenium Summary

Although selenium has been measured on ash solids at KIF, historical groundwater concentrations at compliance wells have always been less than the risk-based screening level of 5 ug/L (Table 1-1). Dissolved selenium was not detected in the porewater of underlying alluvial clay, sand or bedrock. Selenium concentrations in ash porewater suggest concentrations well below the risk-based screening level of 5 ug/L. Although two anomalous selenium concentrations were observed (GP13 and GP18), results suggest influences from an alkaline additive such as lime. Geochemical modeling of selenium at the site predicted selenium to be precipitated as elemental selenium with site geochemical conditions favoring natural attenuation.

6. REFERENCES

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TABLES

Table 1-1. Risk-Based Screening Levels

Analyte	Units	Human Health Screening Level[1]	Ecological Screening Level[2]
Arsenic	ug/L	0.018	150
Chromium	ug/L	100	NA[3]
Mercury	ug/L	0.05	0.012
Selenium	ug/L	18	5
Ra-226	pCi/L	0.000816	NA
Th-228	pCi/L	0.159	NA

[1] *chronic values; mix of risk-based screening levels and regulatory standards/criteria.*

[2] *regulatory criteria or recommended ecological toxicity screening values.*

[3] *NA = not applicable*

Table 2-1. Summary of Solids Concentrations for Ash and Natural Media from Milligan and Ruane (1980)

Analyte	Units	Media	MDL[1]	Results Range
Chromium	ug/g	ash	5	6 - 47
		clay-silt		6 - 37
		sand		< 5 - 26
		shale		30 - 46
Mercury	ug/g	ash	0.1	< 0.1 - 1.2
		clay-silt		< 0.1 - 0.93
		sand		< 0.1 - 0.55
		shale		< 0.1 - 1.1
Selenium	ug/g	ash	2	< 2 - 2.0
		clay-silt	1	< 1 - 22
		sand	2	ND[1]
		shale	2	ND

[1] *ND = Not Detected*

Table 2-2. Summary of Ash Solids Concentrations - Batch and Column Tests (Total Metals, Method SW846 610B)

Analyte	Units	MDL[1]	Results
Chromium	mg/kg dry	2.68	66.4
Mercury	Not Analyzed		
Selenium	mg/kg dry	6.69	ND[2]
Thorium-228	Not Analyzed		

[1] *Method Detection Limit*

[2] *Not Detected*

Table 2-3. Summary of TCLP Analyses for Fly Ash (1995 and 2002)

Analyte	Units	Results	Location	Date (yr)
Chromium	ug/L	800.0	Hopper	2002
Chromium	ug/L	< 50	Dredge Cell	2002
Chromium	ug/L	22.0	Dredge Cell (Cell 1)	1995
Chromium	ug/L	12.0	Dredge Cell (Cell 3)	1995
Mercury	ug/L	< 2.0	Hopper	2002
Mercury	ug/L	< 2.0	Dredge Cell	2002
Mercury	ug/L	< 0.2	Dredge Cell (Cell 1)	1995
Mercury	ug/L	< 0.2	Dredge Cell (Cell 3)	1995
Selenium	ug/L	< 1.0	Hopper	2002
Selenium	ug/L	21.9	Dredge Cell	2002
Selenium	ug/L	67.0	Dredge Cell (Cell 1)	1995
Selenium	ug/L	18.0	Dredge Cell (Cell 3)	1995

Table 2-4. Summary of Analytical Results for Ash from Rail Car Loading

Analyte	Units	Detection Limit	Minimum	Maximum	Number of Detections / Samples	Mean of Detections
TCLP Metals						
Chromium	ug/L	50.0	ND[1]	69.0	1 / 109	69.0
Mercury	ug/L	10.0	ND	ND	0 / 109	ND
Selenium	ug/L	100.0	ND	141.0	7 / 109	110.0
Total Metals						
Chromium	mg/kg	1.2 - 1.25	25.2	39.3	2 / 2	35.1
Mercury	mg/kg	0.119 -0.124	ND	ND	0 / 2	ND
Selenium	mg/kg	2.4 - 2.5	3.6	6.57	2 / 2	5.6
Radionuclides						
Thorium-228 (Alpha)	pCi/g	0.1106	0.884	0.884	1 / 1	0.884

[1] *Not Detected*

Table 2-5. Summary of Historical Groundwater Sampling Results at Compliance Monitoring Wells

Analyte	Units	Detection Limit	Minimum	Maximum	Number of Detections / Samples	Mean of Detections	Date Range
Chromium, Total	ug/L	0.33 to 1.0	0.10	53.0	123 / 275	5.05	03/08/90 to 12/17/10
Chromium, Dissolved	ug/L	0.33 to 1.0	0.33	14.0	13 / 96	2.96	03/07/90 to 12/17/10
Mercury, Total	ug/L	0.10 to 0.20	ND[1]	ND	0 / 131	ND	12/14/00 to 12/17/10
Mercury, Dissolved	ug/L	0.10 to 0.15	ND	ND	0 / 43	ND	09/14/09 to 12/17/10
Selenium, Total	ug/L	0.20 to 1.0	0.30	4.10	20 / 193	1.89	03/06/90 to 12/17/10
Selenium, Dissolved	ug/L	0.33 to 1.0	2.00	2.00	2 / 59	2.00	03/07/90 to 12/17/10

[1] *Not Detected*

Table 2-6. Summary of Analytical Results (Dissolved Concentrations) from Porewater Sampling

Location	Media	Chromium (ug/L)	Mercury (ug/L)	Selenium (ug/L)	Thorium-228 (pCi/L)
GP07	Ash	0.38	ND(0.15)	ND(0.33)	ND(0.062)
GP08	Ash	ND[1](0.33)	ND(0.15)	0.35	ND(0.102)
GP09	Ash	0.41	ND(0.15)	ND(0.33)	ND(0.108)
GP10	Ash	0.45	ND(0.15)	ND(0.33)	ND(0.123)
GP11	Ash	0.37	ND(0.15)	0.53	ND(0.066)
GP12	Ash	ND(0.33)	ND(0.15)	0.97	ND(0.043)
GP13	Ash	0.51	NAn[2]	16.50	NAn
GP14	Ash	0.34	ND(0.15)	ND(0.33)	ND(0.092)
GP15	Ash	0.38	ND(0.15)	0.40	ND(0.110)
GP16	Ash	ND(0.33)	ND(0.15)	0.92	ND (0.095)
GP18	Ash	ND(0.33)	ND(0.15)	19.60	ND(0.128)
	MDL[3]	0.33	0.15	0.33	0.043 to 0.128
	Minimum	ND(0.33)	NA[4]	ND(0.33)	NA
	Maximum	0.51	NA	19.60	NA
	Mean	0.38	NA	3.69	NA
22	Alluvium	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.049)
6AR	Alluvium	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.081)
TWP04	Alluvium	ND(0.33)	ND(0.20)	ND(0.33)	ND(0.094)
TWP05	Alluvium	ND(0.33)	ND(0.20)	ND(0.33)	ND(0.088)
TWP06	Alluvium	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.087)
	MDL	0.33	0.15 to 0.2	0.33	0.049 to 0.094
	Minimum	NA	NA	NA	NA
	Maximum	NA	NA	NA	NA
	Mean	NA	NA	NA	NA
AD1	Residuum	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.063)
AD2	Residuum	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.114)
AD3	Residuum	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.108)
GW02	Residuum	0.51	ND(0.15)	ND(0.33)	ND(0.032)
	MDL	0.33	0.15	0.33	0.032 to 0.114
	Minimum	ND(0.33)	NA	NA	NA
	Maximum	0.51	NA	NA	NA
	Mean	0.38	NA	NA	NA
GW01	Bedrock	1.54	ND(0.15)	ND(0.33)	ND(0.138)
GW03	Bedrock	0.42	ND(0.15)	ND(0.33)	ND(0.034)
TWP24	Bedrock	ND(0.33)	ND(0.20)	ND(0.33)	ND(0.084)
TWP25	Bedrock	0.64	ND(0.20)	ND(0.33)	ND(0.081)
TWP26	Bedrock	ND(0.33)	ND(0.15)	ND(0.33)	ND(0.085)
	MDL	0.33	0.15 to 0.2	0.33	0.034 to 0.138
	Minimum	ND(0.33)	NA	NA	NA
	Maximum	1.54	NA	NA	NA
	Mean	0.65	NA	NA	NA

[1] *ND = Not Detected*
[2] *NAn = Not Analyzed*
[3] *MDL = Method Detection Limit*
[4] *NA = Not Applicable*

Figures

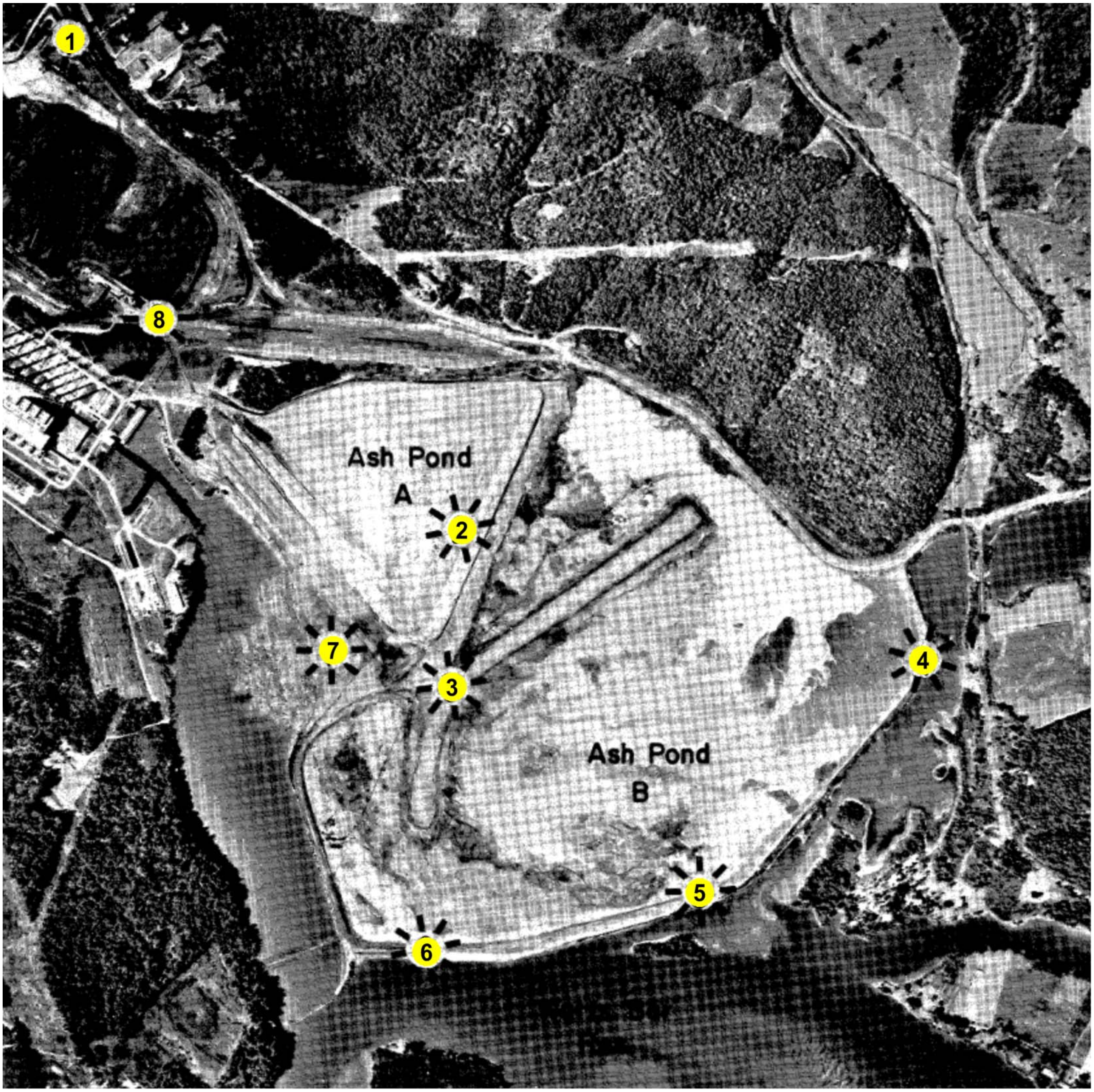

Figure 2-1. Location Map of Wells from Milligan and Ruane (1980) Groundwater Study.

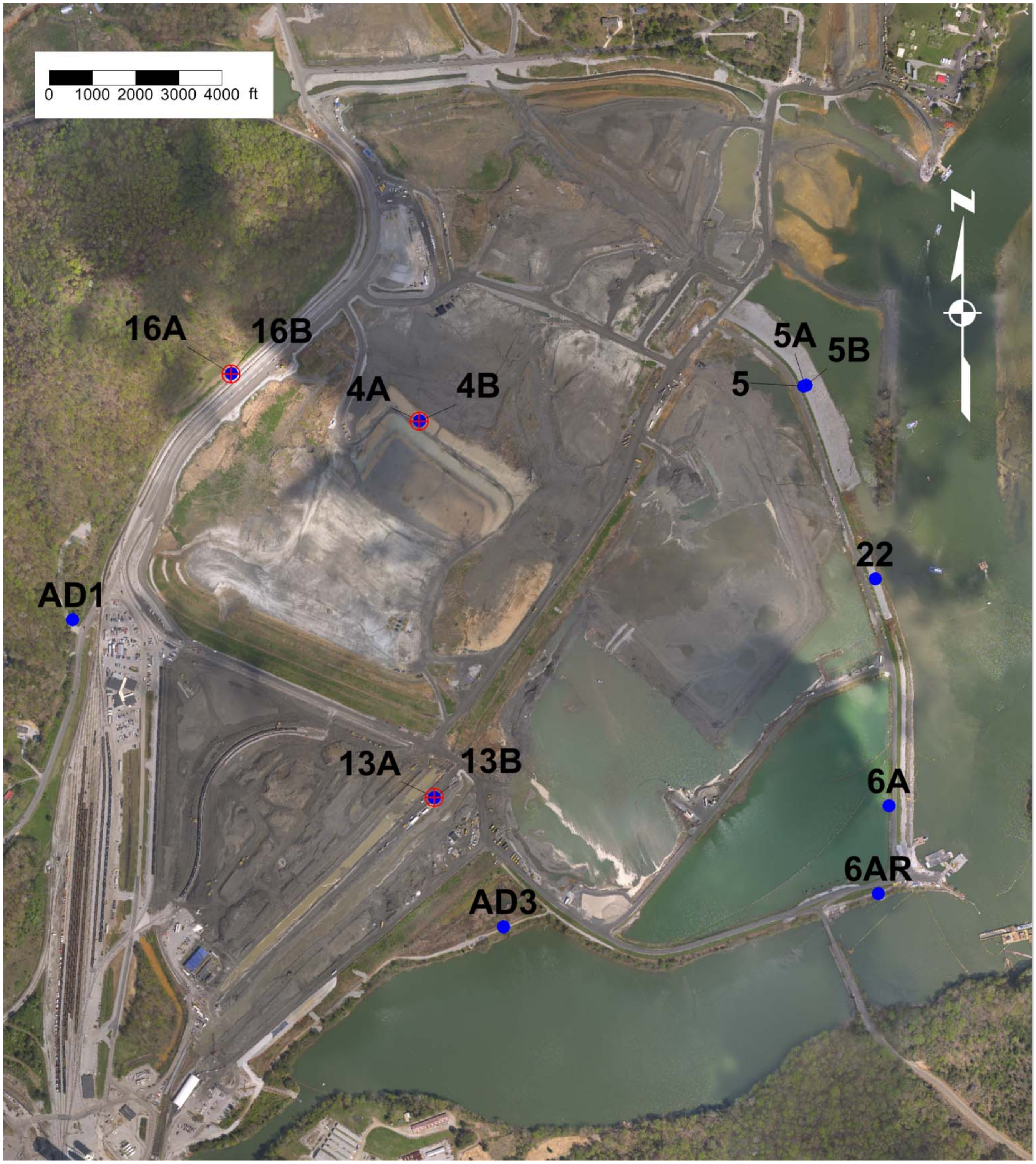

Figure 2-2. Location Map of Historical Wells.

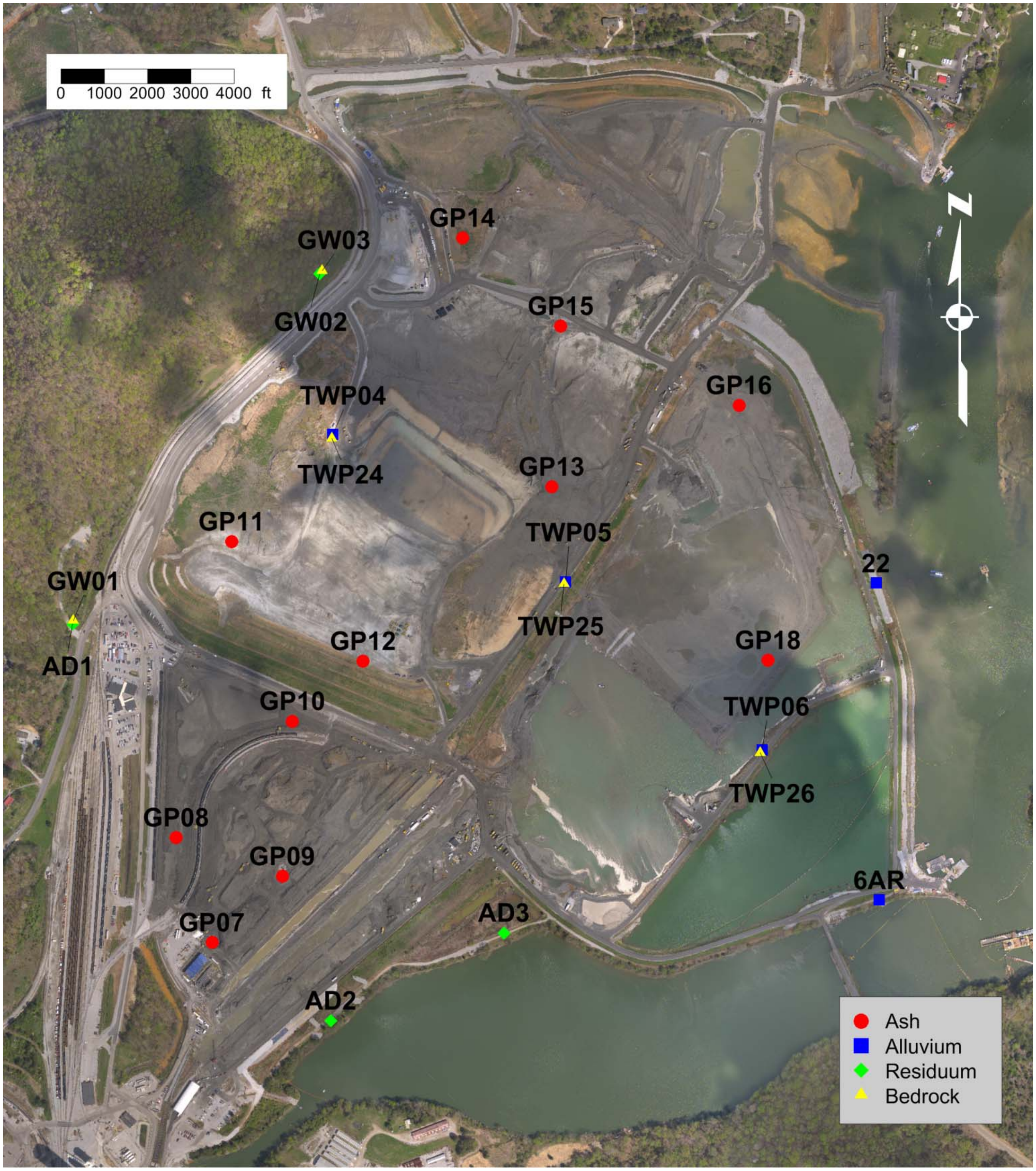

Figure 2-3. Location Map of Porewater Samples.

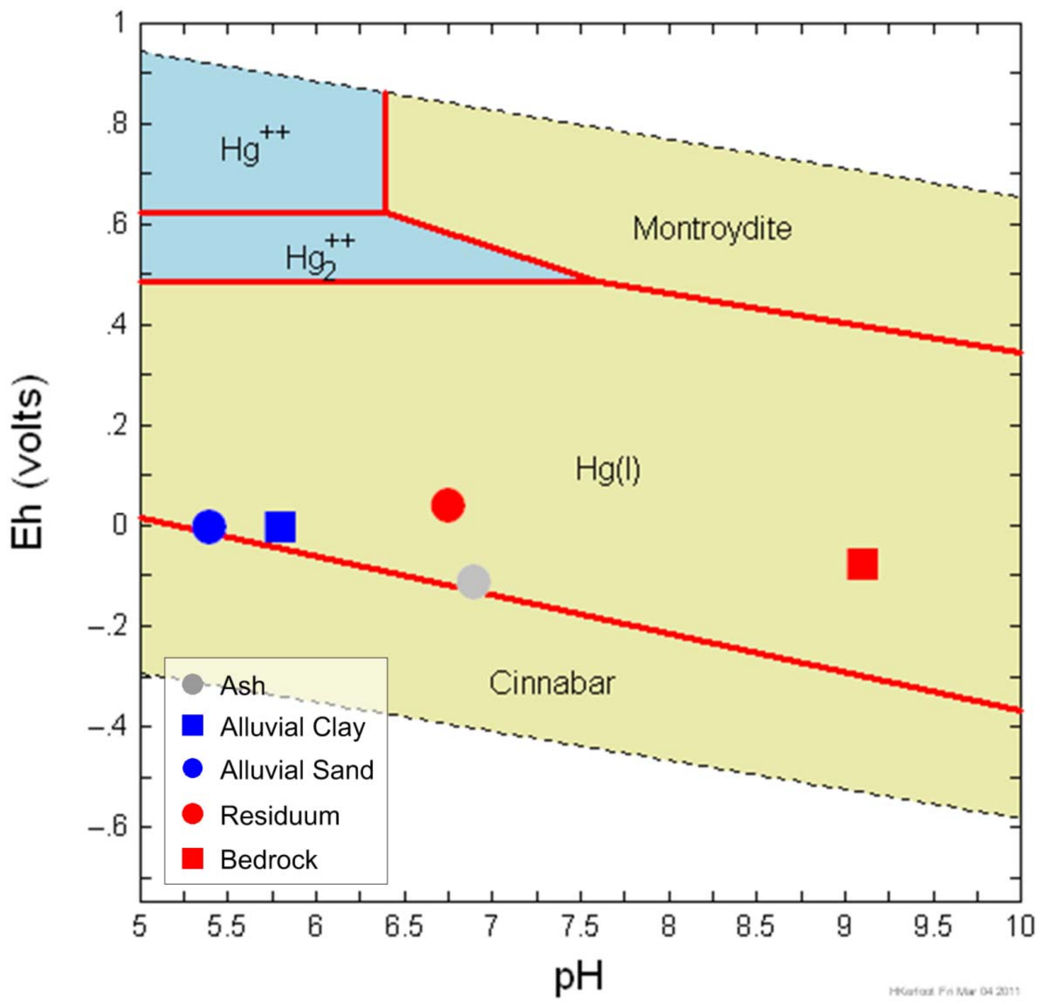

Figure 2-4. Stability Diagram for Mercury (0.01 ug/L).

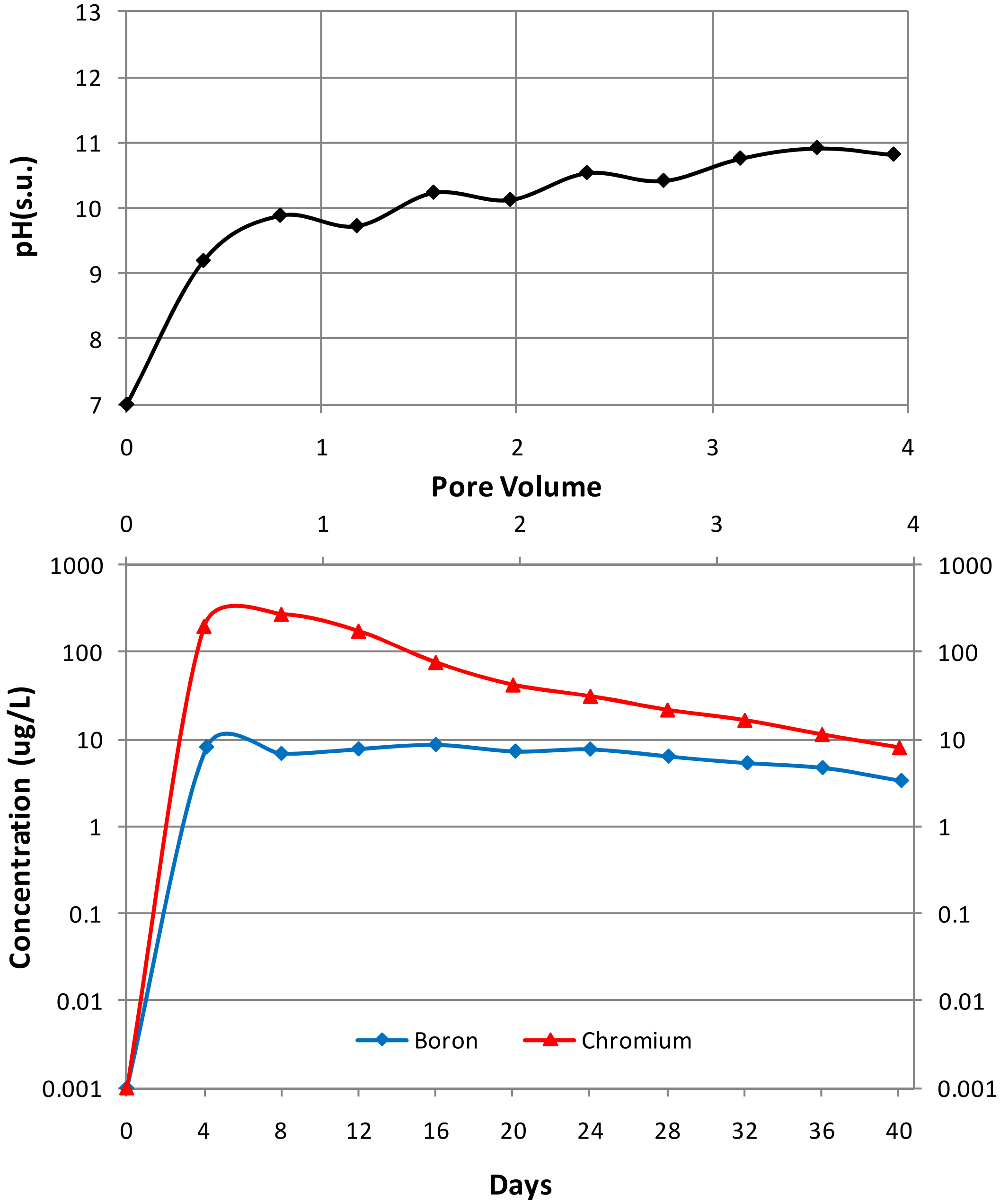

Figure 3-1. Results of Column Leaching Test for Chromium.

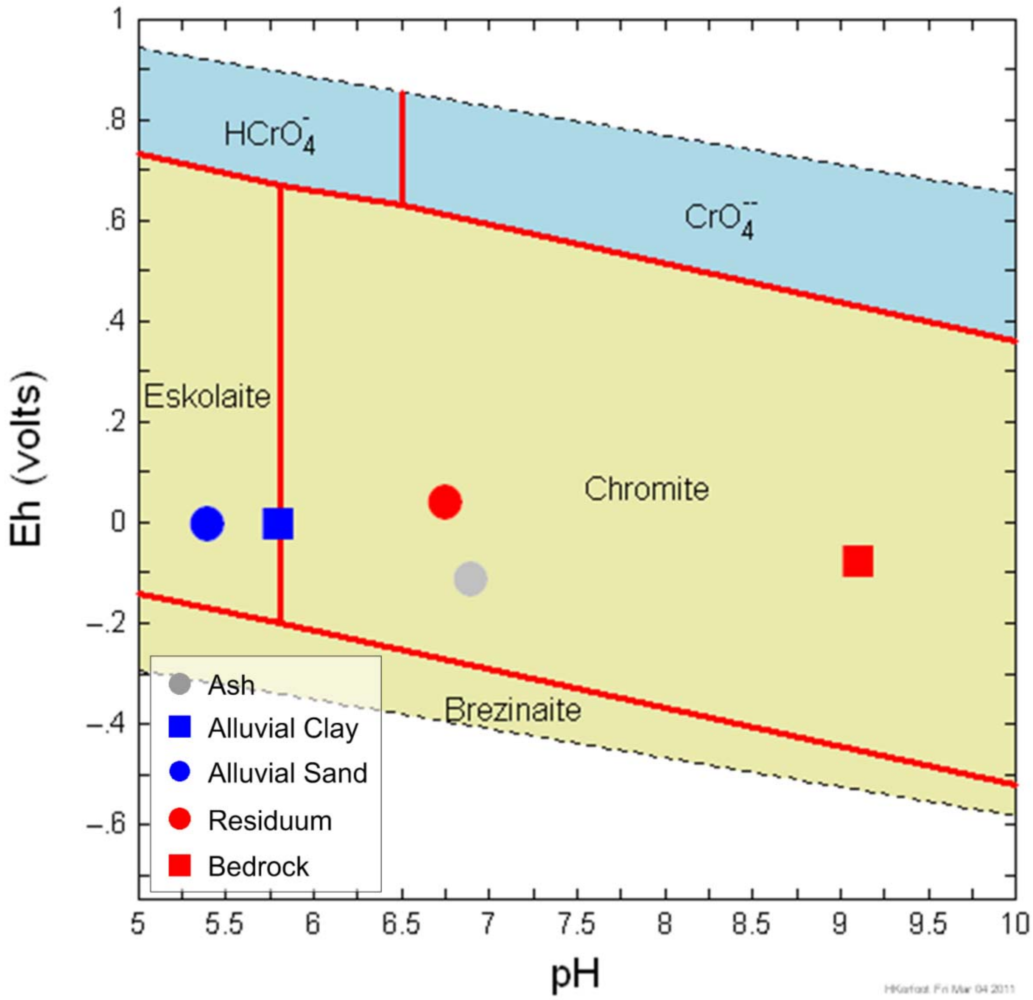

Figure 3-2. Stability Diagram for Chromium (100 ug/L).

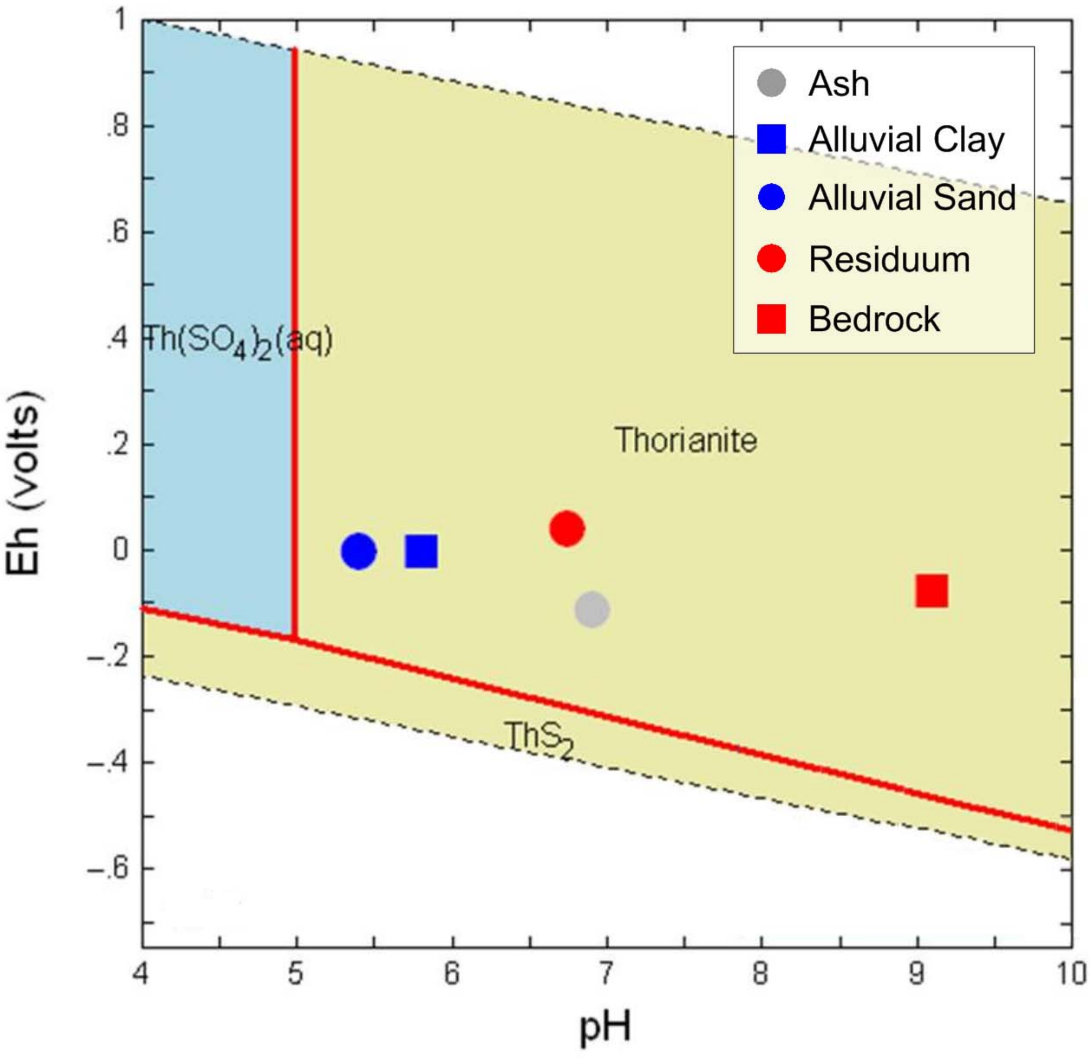

Figure 4-1. Stability Diagram for Thorium (15 pCi/L; 8 x 10^{-15} mol/L).

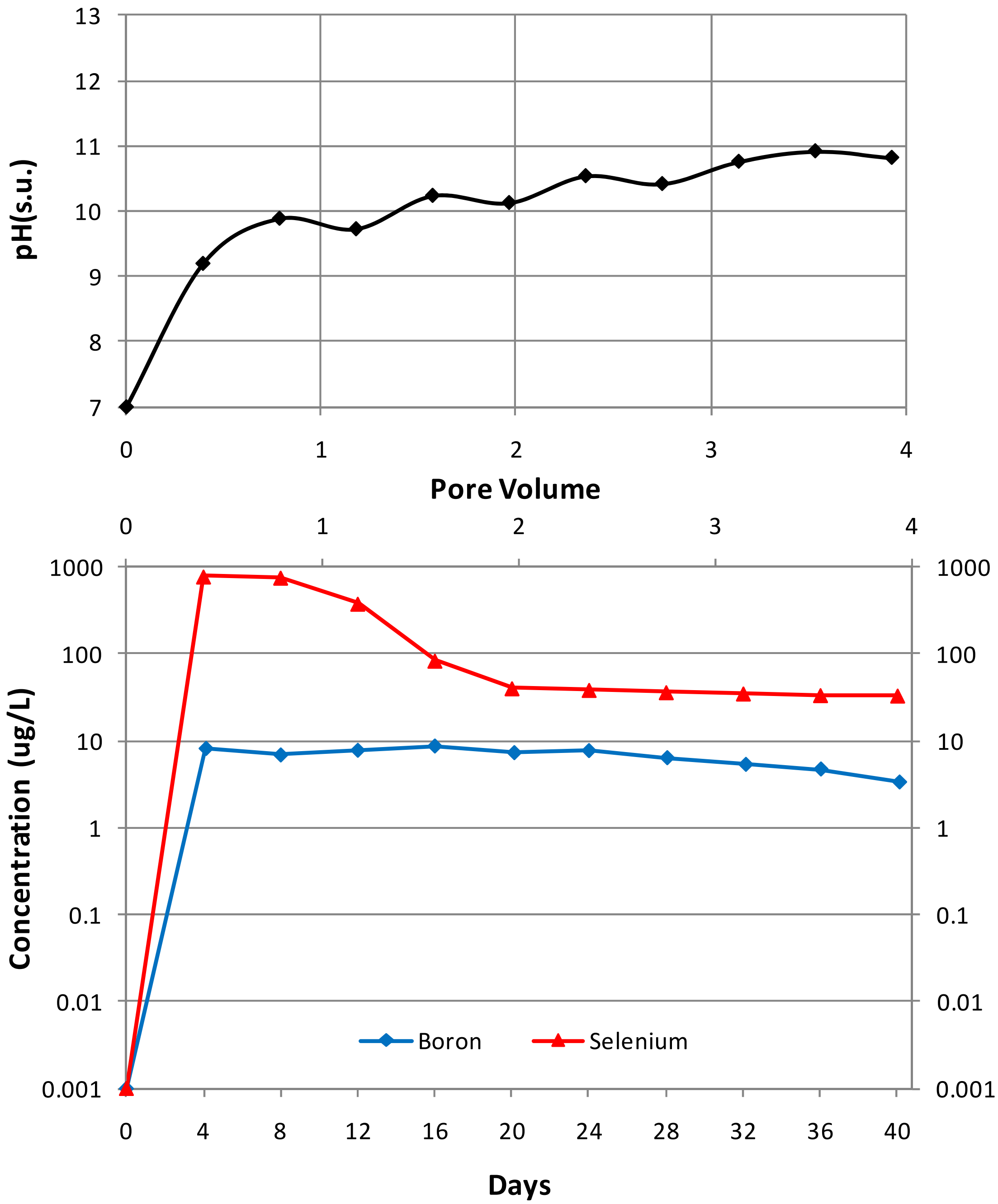

Figure 5-1. Results of Column Leaching Test for Selenium.

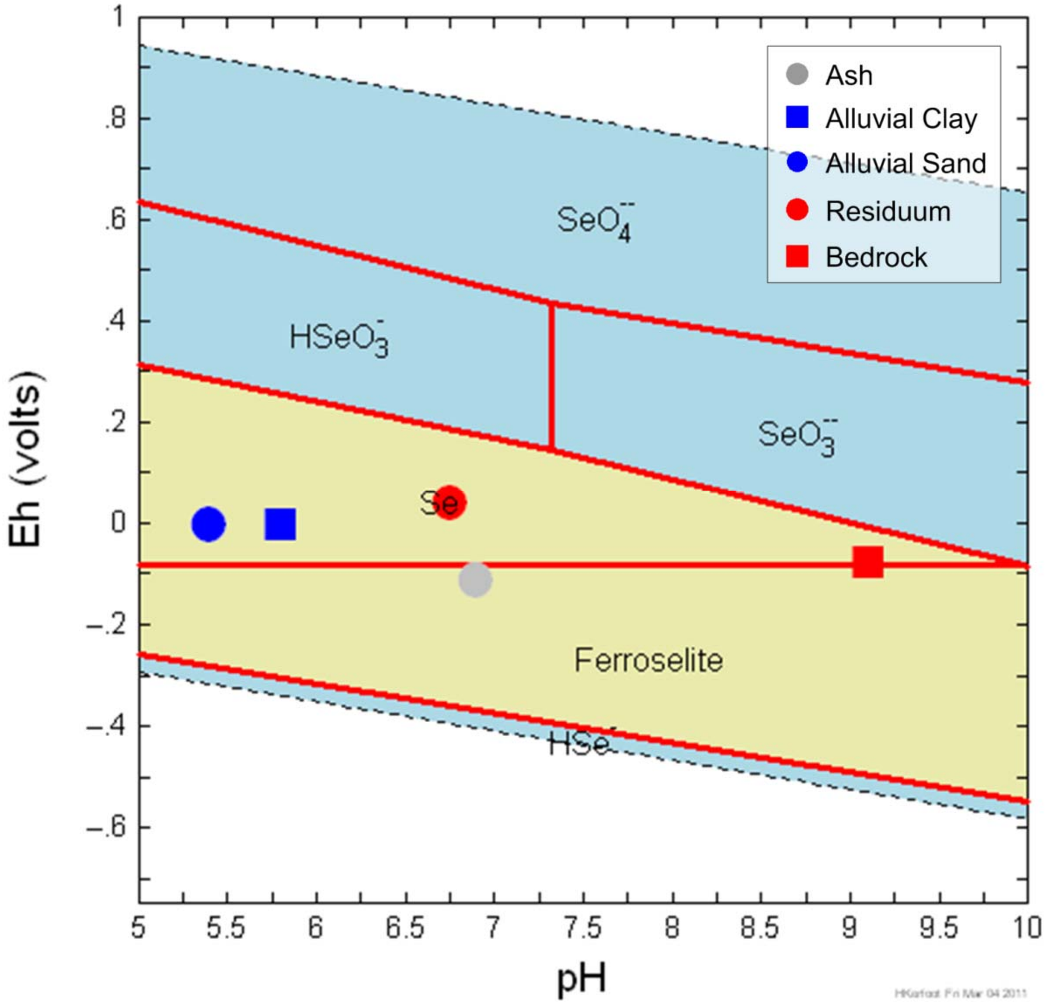

Figure 5-2. Stability Diagram for Selenium (5 ug/L).

APPENDIX H

Geochemical Modeling – Arsenic Distribution Coefficients (Kd)

APPENDIX H – Geochemical Modeling – Arsenic Distribution Coefficients (Kd)

Tables I-1 through I-5 list the simulation results for the total arsenic present (moles), the fraction sorbed (fsorbed; %), concentration sorbed (C_s, moles/kg), dissolved concentration (C_w, moles/L), and the Kd value (L/kg, computed as C_s/ C_w) for alluvial clay, alluvial sand, residuum, bedrock and ash. Individual model output are presented following Table I-1 to I-5.

Table I-1 Simulation Results for Alluvial Sand

Total Moles Arsenic	*f*sorbed (%)	C_s (Mol/kg)	C_w (mole/L)	Kd (L/kg)
1.51E-08	98.70	3.37E-09	2.00E-10	16.9
1.51E-07	98.70	3.37E-08	2.00E-09	16.9
7.56E-10	98.70	1.69E-10	9.98E-12	16.9
7.56E-09	98.70	1.69E-09	9.98E-11	16.9
7.56E-08	98.70	1.69E-08	9.98E-10	16.9
3.76E-05	98.70	8.38E-06	4.96E-07	16.9
1.12E-04	98.70	2.49E-05	1.50E-06	16.6
9.72E-04	98.50	2.16E-04	1.50E-05	14.4
2.00E-03	98.10	4.43E-04	3.72E-05	11.9
2.43E-03	98.00	5.37E-04	4.98E-05	10.8
4.27E-03	96.50	9.31E-04	1.49E-04	6.3
6.05E-03	91.70	1.25E-03	4.99E-04	2.5

Table I-2 Simultation Results for Alluvial Clay

Total Moles Arsenic	*f*sorbed (%)	C_s (Mol/kg)	C_w (mole/L)	Kd (L/kg)
6.57E-08	98.50	1.43E-08	9.99E-10	14.3
1.31E-08	98.50	2.87E-09	2.00E-10	14.3
6.50E-06	98.50	1.42E-06	9.88E-08	14.3
6.59E-07	98.50	1.44E-07	1.00E-08	14.3
3.26E-05	98.50	7.11E-06	4.99E-07	14.3
9.64E-05	98.40	2.10E-05	1.50E-06	14.0
3.06E-04	98.40	6.66E-05	5.02E-06	13.3
8.07E-04	98.10	1.75E-04	1.50E-05	11.7
1.59E-03	97.60	3.43E-04	3.75E-05	9.2

Table I-3 Simulation Results for Residuum

Total Moles Arsenic	*f*sorbed (%)	C_s (Mol/kg)	C_w (mole/L)	Kd (L/kg)
1.50E-08	100.00	3.38E-09	7.48E-12	451.5
2.66E-05	100.00	6.00E-06	1.33E-08	451.5
8.17E-06	100.00	1.84E-06	4.08E-09	451.5
1.50E-08	100.00	3.38E-09	7.48E-12	451.5
1.66E-06	100.00	3.74E-07	8.29E-10	451.5
1.50E-07	100.00	3.38E-08	7.48E-11	451.5
1.50E-08	100.00	3.38E-09	7.48E-12	451.5
2.67E-05	99.90	6.02E-06	2.13E-08	282.1
1.60E-04	99.90	3.61E-05	1.44E-07	250.7
1.90E-04	99.90	4.27E-05	2.27E-07	188.0
1.26E-03	99.40	2.83E-04	7.56E-06	37.4
2.27E-03	99.10	5.07E-04	2.15E-05	23.5

Table I-4 Simulation Results for Bedrock

Total Moles Arsenic	*f*sorbed (%)	C_s (Mol/kg)	C_w (mole/L)	Kd (L/kg)
4.61E-06	99.99	1.04E-06	3.46E-02	2258
5.25E-05	99.98	1.18E-05	1.05E-08	1129.0
2.31E-04	99.96	5.21E-05	9.24E-08	564.4
2.91E-04	99.94	7.33E-05	1.75E-07	419.2
4.03E-04	99.89	9.09E-05	4.43E-07	205.1
6.29E-04	99.59	1.42E-04	2.58E-06	54.9
7.39E-04	99.14	1.65E-04	6.36E-06	26.0
8.03E-04	98.67	1.79E-04	1.07E-05	16.8
8.71E-04	97.99	1.93E-04	1.75E-05	11.0
1.00E-03	95.33	2.16E-04	4.68E-05	4.6

Table I-5 Simulation results for Ash

Total Moles Arsenic	*f*sorbed (%)	C_s (Mol/kg)	C_W (mole/L)	Kd (L/kg)
1.18E-05	99.88	2.66E-06	1.42E-08	188.0
1.18E-06	99.88	2.67E-07	1.42E-09	188.0
1.18E-07	99.88	2.67E-08	1.42E-10	188.0
1.18E-08	99.88	2.67E-09	1.42E-11	188.0
1.17E-04	99.88	2.64E-05	1.41E-07	188.0
1.08E-03	99.87	2.42E-04	1.40E-06	173.5
2.38E-03	99.85	5.36E-04	3.56E-06	150.3
3.95E-03	99.82	8.90E-04	7.10E-06	125.2
5.93E-03	99.75	1.34E-03	1.48E-05	90.1

ALLUVIAL SAND – MODEL OUTPUT

0.004273 total moles Arsenic

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012729
Activity of water   =    0.999736
Solvent mass        =    0.990015 kg
Solution mass       =    0.990797 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007577 molal
Dissolved solids    =         789 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        5.36 uC/cm2
  Surface potential =        53.6 mV
  Surface area      =   1.63e+007 cm2
```

```
 Nernst redox couples                                Eh (volts)     pe
---------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                     -0.0030   -0.0519
  e-  + Fe+++  = Fe++                                   0.0684    1.1847
```

```
                        moles        moles          grams          cm3
 Reactants            remaining     reacted        reacted        reacted
---------------------------------------------------------------------------
  H2O                   0.05551        0.0000         0.0000
```

```
 Minerals in system     moles      log moles      grams        volume (cm3)
---------------------------------------------------------------------------
  Hematite              0.01697     -1.770          2.710          0.5127
                                                ____________   ____________
       (total)                                   2.710          0.5137
```

```
 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
--------------------------------------------------------------------------
  Cl-                  0.007533         266.9       0.8900       -2.1736
  Na+                  0.004815         110.6       0.8934       -2.3663
  CO2(aq)              0.003505         154.1       1.0000       -2.4553
```

Ca++	0.001290	51.68	0.6530	-3.0744
SO4--	0.001058	101.6	0.6353	-3.1724
Mg++	0.0005094	12.37	0.6691	-3.4675
HCO3-	0.0003750	22.86	0.8950	-3.4741
Fe++	0.0001613	9.004	0.6530	-3.9774
As(OH)3	0.0001515	19.06	1.0000	-3.8196
K+	0.0001170	4.570	0.8900	-3.9825
Mn++	0.0001146	6.293	0.6530	-4.1258
CaSO4	0.0001145	15.57	1.0000	-3.9413
MgSO4	3.724e-005	4.479	1.0000	-4.4290
CaCl+	3.685e-005	2.781	0.8934	-4.4825
NaSO4-	1.538e-005	1.830	0.8934	-4.8620
FeSO4	1.119e-005	1.698	1.0000	-4.9512
HSe-	9.878e-006	0.7893	0.8934	-5.0543
MnSO4	8.602e-006	1.298	1.0000	-5.0654
CaHCO3+	4.897e-006	0.4947	0.8972	-5.3572
H+	4.386e-006	0.004418	0.9076	-5.4000
MgCl+	4.021e-006	0.2401	0.8934	-5.4446
NaHCO3	2.242e-006	0.1882	1.0000	-5.6494
FeCl+	1.412e-006	0.1288	0.8934	-5.8992
MgHCO3+	1.279e-006	0.1091	0.8934	-5.9420
FeHCO3+	9.425e-007	0.1101	0.8934	-6.0747
NaCl	6.194e-007	0.03617	1.0000	-6.2081
KSO4-	5.447e-007	0.07357	0.8934	-6.3128
MnHCO3+	5.088e-007	0.05895	0.8934	-6.3424
MnCl+	3.562e-007	0.03217	0.8934	-6.4973
HSO4-	2.388e-007	0.02316	0.8934	-6.6709
H2Se	2.231e-007	0.01805	1.0000	-6.6515
H2PO4-	5.056e-008	0.004900	0.8934	-7.3451
As(OH)4-	1.911e-008	0.002729	0.8934	-7.7678
KCl	1.627e-008	0.001212	1.0000	-7.7886

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.004165	0.004123	1.0000	-2.3804
>(w)FeOCO2H	0.001287	0.001274	1.0000	-2.8903
>(w)FeOH2+	0.001029	0.001018	8.0692	-2.9878
>(s)FeOH2+	0.0001394	0.0001380	8.0692	-3.8558
>(w)FeSO4-	0.0001392	0.0001378	0.12393	-3.8564
>(w)FeOH	0.0001069	0.0001059	1.0000	-3.9709

```
 >(w)FeOCO2-         6.707e-005   6.640e-005      0.12393     -4.1735
 >(w)FeOHSO4--       2.886e-005   2.857e-005     0.015358     -4.5397
 >(w)FeHPO4-         2.343e-005   2.320e-005      0.12393     -4.6302
 >(s)FeOHCa++        1.750e-005   1.732e-005       65.112     -4.7570
 >(s)FeOH            1.449e-005   1.435e-005       1.0000     -4.8389
 >(w)FeH2PO4         9.182e-006   9.091e-006       1.0000     -5.0370
 >(w)FePO4--         1.015e-006   1.005e-006     0.015358     -5.9934
 >(w)FeO-            2.546e-007   2.521e-007      0.12393     -6.5941
 >(s)FeO-            3.451e-008   3.416e-008      0.12393     -7.4621
 >(w)FeHAsO4-        1.670e-008   1.654e-008      0.12393     -7.7772
 >(w)FeOHAsO4---     8.060e-009   7.980e-009    0.0019033     -8.0937
 >(w)FeH2AsO4        5.200e-009   5.148e-009       1.0000     -8.2840
 >(w)FeOCa+          3.961e-009   3.922e-009       8.0692     -8.4022
 >(w)FeSeO3-         3.644e-017   3.608e-017      0.12393    -16.4384
 >(w)FeOHSeO3--      2.230e-018   2.208e-018     0.015358    -17.6517
 >(w)FeSeO4-         3.982e-041   3.942e-041      0.12393    -40.3999
 >(w)FeOHSeO4--      9.479e-042   9.385e-042     0.015358    -41.0232
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
 FeSe2             13.4113s/sat   Siderite          -1.9607
 Se(black)          8.1917s/sat   Rhodochrosite     -2.0399
 Hematite           0.0000 sat    Anhydrite         -2.0416
 FeSe              -0.2226        Bassanite         -2.6724
 MnHPO4(c)         -0.3538        CaSO4^1/2H2O(bet  -2.8498
 Goethite          -0.4676        Calcite           -2.9594
 Gypsum            -1.7951
  (only minerals with log Q/K > -3 listed)

Gases                 fugacity      log fug.
-----------------------------------------------
 CO2(g)                 0.07996      -1.097
 Steam                  0.02023      -1.694
 H2(g)               1.375e-011     -10.862
 H2S(g)              2.043e-015     -14.690
 CH4(g)              2.730e-021     -20.564
 S2(g)               1.027e-034     -33.988
 O2(g)               1.491e-064     -63.827
```

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00427	0.000150	21.6	0.00412	595.	
Ca++	0.00145	0.00143	57.9	1.73e-005	0.701	
Cl-	0.00750	0.00750	268.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00673	6.85	
H2O	55.5	55.5	1.01e+006	-0.00976	-177.	
HCO3-	0.00519	0.00385	237.	0.00134	82.6	
HPO4--	3.33e-005	5.50e-008	0.00533	3.33e-005	3.23	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	1.48e-008	0.000479	
SO4--	0.00140	0.00123	120.	0.000166	16.1	
SeO3--	1.00e-005	1.00e-005	1.28	3.83e-017	4.91e-012	

Sorbed	fraction	log fraction
As(OH)4-	0.9649	-0.016
Ca++	0.01195	-1.922
HCO3-	0.2582	-0.588
HPO4--	0.9984	-0.001
SO4--	0.1188	-0.925
SeO3--	3.829e-012	-11.417

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
Arsenic	0.004273	0.0001500	11.34	0.004123	311.8
Calcium	0.001449	0.001432	57.93	1.733e-005	0.7009
Carbon	0.005192	0.003851	46.69	0.001341	16.25
Chlorine	0.007501	0.007501	268.4		
Hydrogen	109.9	109.9	1.118e+005	0.005083	5.171
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		

Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01156	186.6
Phosphorus	3.335e-005	5.500e-008	0.001719	3.329e-005	1.041
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	3.829e-017	3.051e-012
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001400	0.001234	39.92	0.0001664	5.384

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.408              log fO2 =  -65.710
Eh =  -0.0307 volts      pe =  -0.5310
Ionic strength      =    0.012726
Activity of water   =    0.999736
Solvent mass        =    0.990015 kg
Solution mass       =    0.990796 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007577 molal
Dissolved solids    =         788 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       19.09 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        5.35 uC/cm2
  Surface potential =        53.5 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0307	-0.5310
e- + Fe+++ = Fe++	0.0670	1.1603

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137

Realgar	2.216e-006	-5.654	0.0002371	6.603e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007533	266.9	0.8900	-2.1736
Na+	0.004815	110.6	0.8934	-2.3663
CO2(aq)	0.003493	153.6	1.0000	-2.4569
Ca++	0.001290	51.66	0.6530	-3.0745
SO4--	0.001059	101.6	0.6353	-3.1723
Mg++	0.0005093	12.37	0.6691	-3.4675
HCO3-	0.0003807	23.21	0.8950	-3.4675
Fe++	0.0001613	9.003	0.6530	-3.9774
As(OH)3	0.0001502	18.91	1.0000	-3.8232
K+	0.0001170	4.570	0.8900	-3.9825
Mn++	0.0001146	6.292	0.6530	-4.1258
CaSO4	0.0001145	15.57	1.0000	-3.9413
MgSO4	3.725e-005	4.480	1.0000	-4.4289
CaCl+	3.684e-005	2.780	0.8934	-4.4826
NaSO4-	1.538e-005	1.830	0.8934	-4.8619
FeSO4	1.119e-005	1.698	1.0000	-4.9512
MnSO4	8.604e-006	1.298	1.0000	-5.0653
CaHCO3+	4.970e-006	0.5020	0.8972	-5.3508
H+	4.305e-006	0.004335	0.9076	-5.4081
MgCl+	4.021e-006	0.2401	0.8934	-5.4446
NaHCO3	2.276e-006	0.1910	1.0000	-5.6428
FeCl+	1.412e-006	0.1288	0.8934	-5.8992
MgHCO3+	1.299e-006	0.1107	0.8934	-5.9354
FeHCO3+	9.568e-007	0.1117	0.8934	-6.0681
NaCl	6.194e-007	0.03617	1.0000	-6.2080
KSO4-	5.449e-007	0.07358	0.8934	-6.3127
MnHCO3+	5.165e-007	0.05984	0.8934	-6.3359
MnCl+	3.561e-007	0.03217	0.8934	-6.4973
HSO4-	2.344e-007	0.02274	0.8934	-6.6789
H2PO4-	5.063e-008	0.004906	0.8934	-7.3446
As(OH)4-	1.930e-008	0.002757	0.8934	-7.7633
KCl	1.627e-008	0.001212	1.0000	-7.7886

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.004164	0.004122	1.0000	-2.3805
>(w)FeOCO2H	0.001293	0.001280	1.0000	-2.8884
>(w)FeOH2+	0.001024	0.001014	8.0180	-2.9896
>(s)FeOH2+	0.0001389	0.0001375	8.0180	-3.8573
>(w)FeSO4-	0.0001369	0.0001355	0.12472	-3.8637
>(w)FeOH	0.0001078	0.0001067	1.0000	-3.9674
>(w)FeOCO2-	6.821e-005	6.753e-005	0.12472	-4.1661
>(w)FeOHSO4--	2.874e-005	2.845e-005	0.015555	-4.5416
>(w)FeHPO4-	2.350e-005	2.327e-005	0.12472	-4.6289
>(s)FeOHCa++	1.787e-005	1.769e-005	64.289	-4.7478
>(s)FeOH	1.462e-005	1.447e-005	1.0000	-4.8351
>(w)FeH2PO4	9.096e-006	9.006e-006	1.0000	-5.0411
>(w)FePO4--	1.031e-006	1.021e-006	0.015555	-5.9867
>(w)FeO-	2.599e-007	2.573e-007	0.12472	-6.5852
>(s)FeO-	3.524e-008	3.489e-008	0.12472	-7.4529
>(w)FeOCa+	4.094e-009	4.053e-009	8.0180	-8.3879
>(w)FeHAsO4-	1.933e-009	1.914e-009	0.12472	-8.7138
>(w)FeOHAsO4---	9.561e-010	9.466e-010	0.0019400	-9.0195
>(w)FeH2AsO4	5.943e-010	5.883e-010	1.0000	-9.2260
>(w)FeSeO3-	3.126e-027	3.095e-027	0.12472	-26.5050
>(w)FeOHSeO3--	1.937e-028	1.917e-028	0.015555	-27.7129
>(w)FeSeO4-	3.904e-052	3.865e-052	0.12472	-51.4085
>(w)FeOHSeO4--	9.411e-053	9.317e-053	0.015555	-52.0264

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Se(black)	0.0000	sat	Siderite	-1.9460
Realgar	0.0000	sat	FeSe2	-2.0131
Hematite	0.0000	sat	Rhodochrosite	-2.0252
MnHPO4(c)	-0.3451		Anhydrite	-2.0416
Goethite	-0.4676		Bassanite	-2.6725
Gypsum	-1.7952		CaSO4^1/2H2O(bet	-2.8498
Orpiment	-1.8849		Calcite	-2.9449

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.07967	-1.099
Steam	0.02023	-1.694
H2(g)	1.202e-010	-9.920
H2S(g)	1.153e-011	-10.938
CH4(g)	1.593e-017	-16.798
S2(g)	4.272e-029	-28.369
O2(g)	1.948e-066	-65.710

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00427	0.000149	21.5	0.00412	595.	
Ca++	0.00145	0.00143	57.9	1.77e-005	0.716	
Cl-	0.00750	0.00750	268.			
Fe++	0.000173	0.000173	9.76	1.07e-068	6.05e-064	
Fe+++	0.0339	9.95e-012	5.61e-007			
H+	-0.0915	0.00361	3.67	0.00673	6.85	
H2O	55.0	55.0	9.99e+005	-0.00976	-177.	
HCO3-	0.00519	0.00384	237.	0.00135	83.0	
HPO4--	3.33e-005	5.51e-008	0.00534	3.33e-005	3.23	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	7.29e-012	2.35e-007	1.72e-009	5.57e-005	
SO4--	0.00140	0.00123	120.	0.000164	15.9	
SeO3--	1.00e-005	5.73e-013	7.34e-008	3.29e-027	4.21e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9652	-0.015
Ca++	0.01221	-1.913
HCO3-	0.2596	-0.586
HPO4--	0.9983	-0.001
SO4--	0.1173	-0.931
SeO3--	5.736e-015	-14.241

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg

---

Arsenic	0.004273	0.0001488	11.25	0.004122	311.7
Calcium	0.001449	0.001432	57.92	1.770e-005	0.7160
Carbon	0.005192	0.003845	46.61	0.001348	16.34
Chlorine	0.007501	0.007501	268.4		
Hydrogen	109.9	109.9	1.118e+005	0.005078	5.166
Iron	0.03411	0.0001732	9.760	1.073e-068	6.047e-064
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01156	186.7
Phosphorus	3.335e-005	5.510e-008	0.001723	3.329e-005	1.041
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	5.730e-013	4.566e-008	3.286e-027	2.619e-022
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001400	0.001234	39.92	0.0001640	5.305

```
Step #   100             Xi = 1.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.408              log fO2 =  -65.711
Eh =  -0.0307 volts      pe =  -0.5313
Ionic strength      =    0.012714
Activity of water   =    0.999736
Solvent mass        =    0.991015 kg
Solution mass       =    0.991796 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007569 molal
Dissolved solids    =         787 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       19.08 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        5.35 uC/cm2
  Surface potential =        53.5 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0307	-0.5313
e- + Fe+++ = Fe++	0.0670	1.1602

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.216e-006	-5.654	0.0002371	6.603e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007526	266.6	0.8901	-2.1740
Na+	0.004810	110.5	0.8935	-2.3668
CO2(aq)	0.003489	153.4	1.0000	-2.4573
Ca++	0.001289	51.61	0.6531	-3.0749
SO4--	0.001058	101.5	0.6354	-3.1726
Mg++	0.0005088	12.36	0.6692	-3.4679
HCO3-	0.0003805	23.20	0.8951	-3.4678
Fe++	0.0001612	8.994	0.6531	-3.9777
As(OH)3	0.0001501	18.89	1.0000	-3.8236
K+	0.0001169	4.566	0.8901	-3.9829
Mn++	0.0001145	6.286	0.6531	-4.1262
CaSO4	0.0001143	15.55	1.0000	-3.9419
MgSO4	3.719e-005	4.473	1.0000	-4.4296
CaCl+	3.677e-005	2.775	0.8935	-4.4834
NaSO4-	1.536e-005	1.827	0.8935	-4.8626
FeSO4	1.117e-005	1.696	1.0000	-4.9518
MnSO4	8.591e-006	1.296	1.0000	-5.0660
CaHCO3+	4.963e-006	0.5013	0.8972	-5.3514
H+	4.303e-006	0.004334	0.9076	-5.4083
MgCl+	4.014e-006	0.2397	0.8935	-5.4454
NaHCO3	2.272e-006	0.1907	1.0000	-5.6435
FeCl+	1.409e-006	0.1286	0.8935	-5.8999
MgHCO3+	1.297e-006	0.1106	0.8935	-5.9360
FeHCO3+	9.554e-007	0.1116	0.8935	-6.0687
NaCl	6.182e-007	0.03610	1.0000	-6.2089
KSO4-	5.439e-007	0.07346	0.8935	-6.3134

MnHCO3+	5.158e-007	0.05976	0.8935	-6.3365
MnCl+	3.555e-007	0.03211	0.8935	-6.4981
HSO4-	2.342e-007	0.02271	0.8935	-6.6794
H2PO4-	5.058e-008	0.004902	0.8935	-7.3450
As(OH)4-	1.930e-008	0.002756	0.8935	-7.7635
KCl	1.624e-008	0.001210	1.0000	-7.7894

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.004159	0.004122	1.0000	-2.3810
>(w)FeOCO2H	0.001292	0.001280	1.0000	-2.8889
>(w)FeOH2+	0.001023	0.001014	8.0199	-2.9900
>(s)FeOH2+	0.0001387	0.0001375	8.0199	-3.8578
>(w)FeSO4-	0.0001367	0.0001355	0.12469	-3.8641
>(w)FeOH	0.0001078	0.0001068	1.0000	-3.9675
>(w)FeOCO2-	6.817e-005	6.756e-005	0.12469	-4.1664
>(w)FeOHSO4--	2.872e-005	2.846e-005	0.015548	-4.5418
>(w)FeHPO4-	2.348e-005	2.327e-005	0.12469	-4.6293
>(s)FeOHCa++	1.784e-005	1.768e-005	64.319	-4.7485
>(s)FeOH	1.461e-005	1.448e-005	1.0000	-4.8353
>(w)FeH2PO4	9.083e-006	9.001e-006	1.0000	-5.0418
>(w)FePO4--	1.031e-006	1.022e-006	0.015548	-5.9868
>(w)FeO-	2.600e-007	2.577e-007	0.12469	-6.5850
>(s)FeO-	3.525e-008	3.494e-008	0.12469	-7.4528
>(w)FeOCa+	4.090e-009	4.054e-009	8.0199	-8.3882
>(w)FeHAsO4-	1.931e-009	1.914e-009	0.12469	-8.7142
>(w)FeOHAsO4---	9.564e-010	9.478e-010	0.0019386	-9.0194
>(w)FeH2AsO4	5.934e-010	5.880e-010	1.0000	-9.2267
>(w)FeSeO3-	3.124e-027	3.096e-027	0.12469	-26.5053
>(w)FeOHSeO3--	1.937e-028	1.919e-028	0.015548	-27.7129
>(w)FeSeO4-	3.900e-052	3.865e-052	0.12469	-51.4089
>(w)FeOHSeO4--	9.406e-053	9.322e-053	0.015548	-52.0266

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Se(black)	0.0000	sat	Siderite	-1.9464
Realgar	0.0000	sat	FeSe2	-2.0129
Hematite	0.0000	sat	Rhodochrosite	-2.0256

MnHPO4(c)	-0.3457	Anhydrite	-2.0423
Goethite	-0.4676	Bassanite	-2.6731
Gypsum	-1.7958	CaSO4^1/2H2O(bet	-2.8505
Orpiment	-1.8848	Calcite	-2.9453

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07959	-1.099
Steam	0.02023	-1.694
H2(g)	1.203e-010	-9.920
H2S(g)	1.153e-011	-10.938
CH4(g)	1.595e-017	-16.797
S2(g)	4.272e-029	-28.369
O2(g)	1.946e-066	-65.711

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00427	0.000149	21.4	0.00412	594.	
Ca++	0.00145	0.00143	57.9	1.77e-005	0.715	
Cl-	0.00750	0.00750	268.			
Fe++	0.000173	0.000173	9.75	1.07e-068	6.04e-064	
Fe+++	0.0339	9.95e-012	5.60e-007			
H+	-0.0915	0.00361	3.67	0.00673	6.84	
H2O	55.0	55.0	9.99e+005	-0.00976	-177.	
HCO3-	0.00519	0.00384	237.	0.00135	82.9	
HPO4--	3.33e-005	5.51e-008	0.00533	3.33e-005	3.22	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	7.28e-012	2.35e-007	1.72e-009	5.56e-005	
SO4--	0.00140	0.00123	119.	0.000164	15.9	
SeO3--	1.00e-005	5.74e-013	7.35e-008	3.29e-027	4.21e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9652	-0.015

Ca++	0.01220	-1.914
HCO3-	0.2595	-0.586
HPO4--	0.9983	-0.001
SO4--	0.1173	-0.931
SeO3--	5.728e-015	-14.242

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.004273	0.0001488	11.24	0.004122	311.4
Calcium	0.001449	0.001432	57.86	1.769e-005	0.7148
Carbon	0.005192	0.003845	46.56	0.001348	16.32
Chlorine	0.007501	0.007501	268.1		
Hydrogen	110.0	110.0	1.118e+005	0.005078	5.161
Iron	0.03411	0.0001732	9.750	1.073e-068	6.040e-064
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.09	55.02	8.876e+005	0.01156	186.5
Phosphorus	3.335e-005	5.511e-008	0.001721	3.329e-005	1.040
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	5.740e-013	4.570e-008	3.288e-027	2.618e-022
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001400	0.001234	39.88	0.0001640	5.300

0.006045 total moles arsenic

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012641
Activity of water   =    0.999742
Solvent mass        =    0.990021 kg
Solution mass       =    0.990841 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007400 molal
Dissolved solids    =         827 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.80 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        4.33 uC/cm2
  Surface potential =        43.3 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0684	1.1842

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007358	260.6	0.8904	-2.1837
Na+	0.004815	110.6	0.8937	-2.3662
CO2(aq)	0.003505	154.1	1.0000	-2.4553

Ca++	0.001291	51.69	0.6537	-3.0737
SO4--	0.001058	101.5	0.6361	-3.1720
Mg++	0.0005094	12.37	0.6698	-3.4670
As(OH)3	0.0005050	63.55	1.0000	-3.2967
HCO3-	0.0003749	22.86	0.8953	-3.4741
Fe++	0.0001613	9.003	0.6537	-3.9768
K+	0.0001170	4.570	0.8904	-3.9823
CaSO4	0.0001148	15.61	1.0000	-3.9401
Mn++	0.0001146	6.292	0.6537	-4.1253
MgSO4	3.732e-005	4.488	1.0000	-4.4281
CaCl+	3.605e-005	2.721	0.8937	-4.4919
NaSO4-	1.540e-005	1.831	0.8937	-4.8614
FeSO4	1.121e-005	1.702	1.0000	-4.9503
HSe-	9.878e-006	0.7892	0.8937	-5.0542
MnSO4	8.620e-006	1.301	1.0000	-5.0645
CaHCO3+	4.903e-006	0.4953	0.8975	-5.3565
H+	4.385e-006	0.004416	0.9078	-5.4000
MgCl+	3.932e-006	0.2348	0.8937	-5.4542
NaHCO3	2.243e-006	0.1882	1.0000	-5.6492
FeCl+	1.381e-006	0.1260	0.8937	-5.9087
MgHCO3+	1.280e-006	0.1092	0.8937	-5.9415
FeHCO3+	9.434e-007	0.1102	0.8937	-6.0741
NaCl	6.053e-007	0.03535	1.0000	-6.2180
KSO4-	5.453e-007	0.07364	0.8937	-6.3122
MnHCO3+	5.092e-007	0.05900	0.8937	-6.3419
MnCl+	3.482e-007	0.03145	0.8937	-6.5069
HSO4-	2.390e-007	0.02318	0.8937	-6.6705
H2Se	2.232e-007	0.01806	1.0000	-6.6513
As(OH)4-	6.366e-008	0.009093	0.8937	-7.2449
H2PO4-	5.056e-008	0.004900	0.8937	-7.3450
KCl	1.590e-008	0.001185	1.0000	-7.7985

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.005601	0.005545	1.0000	-2.2517
>(w)FeOH2+	0.0006216	0.0006154	5.3871	-3.2065
>(w)FeOCO2H	0.0005194	0.0005142	1.0000	-3.2845
>(s)FeOH2+	0.0001363	0.0001349	5.3871	-3.8656
>(w)FeOH	4.314e-005	4.271e-005	1.0000	-4.3651
>(w)FeSO4-	3.753e-005	3.716e-005	0.18563	-4.4256

>(s)FeOHCa++	2.567e-005	2.541e-005	29.020	-4.5907
>(w)FeOCO2-	1.807e-005	1.789e-005	0.18563	-4.7431
>(s)FeOH	9.457e-006	9.363e-006	1.0000	-5.0242
>(w)FeHPO4-	6.313e-006	6.250e-006	0.18563	-5.1998
>(w)FeOHSO4--	5.195e-006	5.143e-006	0.034459	-5.2844
>(w)FeH2PO4	3.706e-006	3.669e-006	1.0000	-5.4311
>(w)FePO4--	1.826e-007	1.808e-007	0.034459	-6.7384
>(w)FeO-	6.859e-008	6.790e-008	0.18563	-7.1638
>(s)FeO-	1.504e-008	1.489e-008	0.18563	-7.8229
>(w)FeHAsO4-	1.500e-008	1.485e-008	0.18563	-7.8240
>(w)FeH2AsO4	6.993e-009	6.923e-009	1.0000	-8.1553
>(w)FeOHAsO4---	3.226e-009	3.193e-009	0.0063965	-8.4914
>(w)FeOCa+	2.398e-009	2.374e-009	5.3871	-8.6202
>(w)FeSeO3-	9.820e-018	9.722e-018	0.18563	-17.0079
>(w)FeOHSeO3--	4.012e-019	3.972e-019	0.034459	-18.3967
>(w)FeSeO4-	1.073e-041	1.062e-041	0.18563	-40.9694
>(w)FeOHSeO4--	1.705e-042	1.688e-042	0.034459	-41.7682

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4121s/sat	Siderite	-1.9601
Se(black)	8.1919s/sat	Rhodochrosite	-2.0394
Hematite	0.0000 sat	Anhydrite	-2.0405
FeSe	-0.2219	Bassanite	-2.6713
MnHPO4(c)	-0.3532	CaSO4^1/2H2O(bet	-2.8487
Goethite	-0.4676	Calcite	-2.9587
Gypsum	-1.7940		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.045e-015	-14.689
CH4(g)	2.730e-021	-20.564
S2(g)	1.029e-034	-33.988
O2(g)	1.491e-064	-63.827

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00605	0.000500	72.1	0.00555	800.	
Ca++	0.00146	0.00143	57.9	2.54e-005	1.03	
Cl-	0.00733	0.00733	262.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00686	6.98	
H2O	55.5	55.5	1.01e+006	-0.0117	-212.	
HCO3-	0.00438	0.00385	237.	0.000532	32.8	
HPO4--	1.02e-005	5.50e-008	0.00533	1.01e-005	0.978	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	1.25e-008	0.000403	
SO4--	0.00128	0.00123	120.	4.23e-005	4.10	
SeO3--	1.00e-005	1.00e-005	1.28	1.01e-017	1.30e-012	

Sorbed	fraction	log fraction
As(OH)4-	0.9173	-0.037
Ca++	0.01743	-1.759
HCO3-	0.1214	-0.916
HPO4--	0.9946	-0.002
SO4--	0.03315	-1.480
SeO3--	1.012e-012	-11.995

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
Arsenic	0.006045	0.0005000	37.81	0.005545	419.3
Calcium	0.001458	0.001432	57.93	2.541e-005	1.028
Carbon	0.004384	0.003851	46.69	0.0005321	6.451
Chlorine	0.007326	0.007326	262.1		
Hydrogen	109.9	109.9	1.118e+005	0.006244	6.352
Iron	0.03411	0.0001732	9.759		
Magnesium	0.0005464	0.0005464	13.40		

Manganese	0.0001229	0.0001229	6.812		
Oxygen	55.03	54.97	8.876e+005	0.01232	198.9
Phosphorus	1.015e-005	5.500e-008	0.001719	1.010e-005	0.3157
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.012e-017	8.064e-013
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001276	0.001234	39.92	4.230e-005	1.369

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.410              log fO2 =  -65.480
Eh =  -0.0275 volts      pe =  -0.4753
Ionic strength      =    0.012636
Activity of water   =    0.999742
Solvent mass        =    0.990021 kg
Solution mass       =    0.990839 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007400 molal
Dissolved solids    =         826 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       19.18 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        4.31 uC/cm2
  Surface potential =        43.1 Mv
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0275	-0.4753
e- + Fe+++ = Fe++	0.0667	1.1539

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137

Realgar	2.217e-006	-5.654	0.0002372	6.606e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007358	260.6	0.8904	-2.1837
Na+	0.004815	110.6	0.8937	-2.3662
CO2(aq)	0.003494	153.7	1.0000	-2.4566
Ca++	0.001290	51.67	0.6538	-3.0739
SO4--	0.001057	101.4	0.6362	-3.1724
Mg++	0.0005094	12.37	0.6698	-3.4670
As(OH)3	0.0005009	63.03	1.0000	-3.3002
HCO3-	0.0003825	23.32	0.8953	-3.4654
Fe++	0.0001613	9.003	0.6538	-3.9768
K+	0.0001170	4.570	0.8904	-3.9823
CaSO4	0.0001146	15.59	1.0000	-3.9407
Mn++	0.0001146	6.292	0.6538	-4.1253
MgSO4	3.728e-005	4.484	1.0000	-4.4285
CaCl+	3.603e-005	2.720	0.8937	-4.4921
NaSO4-	1.538e-005	1.830	0.8937	-4.8618
FeSO4	1.120e-005	1.700	1.0000	-4.9507
MnSO4	8.612e-006	1.299	1.0000	-5.0649
CaHCO3+	5.001e-006	0.5051	0.8975	-5.3479
H+	4.285e-006	0.004315	0.9078	-5.4101
MgCl+	3.932e-006	0.2348	0.8937	-5.4542
NaHCO3	2.288e-006	0.1921	1.0000	-5.6405
FeCl+	1.381e-006	0.1260	0.8937	-5.9087
MgHCO3+	1.306e-006	0.1114	0.8937	-5.9327
FeHCO3+	9.625e-007	0.1124	0.8937	-6.0654
NaCl	6.054e-007	0.03535	1.0000	-6.2180
KSO4-	5.447e-007	0.07356	0.8937	-6.3126
MnHCO3+	5.195e-007	0.06019	0.8937	-6.3332
MnCl+	3.483e-007	0.03145	0.8937	-6.5069
HSO4-	2.333e-007	0.02262	0.8937	-6.6810
As(OH)4-	6.463e-008	0.009231	0.8937	-7.2384
H2PO4-	5.079e-008	0.004922	0.8937	-7.3430
KCl	1.590e-008	0.001185	1.0000	-7.7985

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.005603	0.005547	1.0000	-2.2516
>(w)FeOH2+	0.0006172	0.0006111	5.3461	-3.2096
>(w)FeOCO2H	0.0005222	0.0005170	1.0000	-3.2822
>(s)FeOH2+	0.0001355	0.0001342	5.3461	-3.8680
>(w)FeOH	4.351e-005	4.307e-005	1.0000	-4.3614
>(w)FeSO4-	3.666e-005	3.630e-005	0.18705	-4.4358
>(s)FeOHCa++	2.631e-005	2.605e-005	28.581	-4.5798
>(w)FeOCO2-	1.845e-005	1.826e-005	0.18705	-4.7341
>(s)FeOH	9.553e-006	9.458e-006	1.0000	-5.0198
>(w)FeHPO4-	6.347e-006	6.284e-006	0.18705	-5.1974
>(w)FeOHSO4--	5.155e-006	5.104e-006	0.034988	-5.2878
>(w)FeH2PO4	3.668e-006	3.631e-006	1.0000	-5.4356
>(w)FePO4--	1.865e-007	1.846e-007	0.034988	-6.7293
>(w)FeO-	7.025e-008	6.955e-008	0.18705	-7.1533
>(s)FeO-	1.543e-008	1.527e-008	0.18705	-7.8117
>(w)FeOCa+	2.493e-009	2.468e-009	5.3461	-8.6033
>(w)FeHAsO4-	2.272e-009	2.249e-009	0.18705	-8.6437
>(w)FeH2AsO4	1.043e-009	1.032e-009	1.0000	-8.9818
>(w)FeOHAsO4---	5.040e-010	4.990e-010	0.0065446	-9.2975
>(w)FeSeO3-	1.437e-027	1.423e-027	0.18705	-26.8425
>(w)FeOHSeO3--	5.963e-029	5.904e-029	0.034988	-28.2245
>(w)FeSeO4-	2.341e-052	2.317e-052	0.18705	-51.6307
>(w)FeOHSeO4--	3.779e-053	3.741e-053	0.034988	-52.4227

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Se(black)	0.0000	sat	Rhodochrosite	-2.0206
Realgar	0.0000	sat	Anhydrite	-2.0411
Hematite	0.0000	sat	FeSe2	-2.1241
MnHPO4(c)	-0.3411		Orpiment	-2.2345
Goethite	-0.4676		Bassanite	-2.6719
Gypsum	-1.7946		CaSO4^1/2H2O(bet	-2.8493
Siderite	-1.9413		Calcite	-2.9401

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.07971	-1.098
Steam	0.02023	-1.694
H2(g)	9.221e-011	-10.035
H2S(g)	3.949e-012	-11.404
CH4(g)	5.510e-018	-17.259
S2(g)	8.528e-030	-29.069
O2(g)	3.313e-066	-65.480

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00605	0.000496	71.6	0.00555	800.	
Ca++	0.00146	0.00143	57.9	2.61e-005	1.05	
Cl-	0.00733	0.00733	262.			
Fe++	0.000173	0.000173	9.76	6.43e-069	3.63e-064	
Fe+++	0.0339	9.90e-012	5.58e-007			
H+	-0.0910	0.00396	4.03	0.00686	6.98	
H2O	55.0	55.0	9.99e+005	-0.0117	-212.	
HCO3-	0.00438	0.00385	237.	0.000535	33.0	
HPO4--	1.02e-005	5.53e-008	0.00536	1.01e-005	0.978	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	4.94e-011	1.60e-006	1.89e-009	6.10e-005	
SO4--	0.00128	0.00123	119.	4.14e-005	4.01	
SeO3--	1.00e-005	4.41e-013	5.65e-008	1.48e-027	1.90e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9179	-0.037
Ca++	0.01788	-1.748
HCO3-	0.1221	-0.913
HPO4--	0.9946	-0.002
SO4--	0.03250	-1.488
SeO3--	3.359e-015	-14.474

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg

Arsenic	0.006045	0.0004960	37.50	0.005547	419.4
Calcium	0.001458	0.001431	57.90	2.605e-005	1.054
Carbon	0.004384	0.003848	46.65	0.0005352	6.488
Chlorine	0.007326	0.007326	262.1		
Hydrogen	109.9	109.9	1.118e+005	0.006241	6.349
Iron	0.03411	0.0001732	9.759	6.432e-069	3.625e-064
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.812		
Oxygen	55.03	54.97	8.876e+005	0.01232	199.0
Phosphorus	1.015e-005	5.529e-008	0.001728	1.010e-005	0.3157
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	4.411e-013	3.515e-008	1.482e-027	1.181e-022
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001276	0.001232	39.87	4.140e-005	1.340

```
       Step #   100             Xi = 1.0000
       Temperature =  18.0 C    Pressure =  1.013 bars
       pH =  5.410              log fO2 =  -65.480
       Eh =  -0.0275 volts      pe =  -0.4756
       Ionic strength      =    0.012624
       Activity of water   =    0.999743
       Solvent mass        =    0.991021 kg
       Solution mass       =    0.991839 kg
       Solution density    =    1.018    g/cm3
       Chlorinity          =    0.007393 molal
       Dissolved solids    =         825 mg/kg sol'n
       Rock mass           =    0.002711 kg
       Carbonate alkalinity=       19.17 mg/kg as CaCO3
       HFO sorbing surface:
         Surface charge    =        4.31 uC/cm2
         Surface potential =        43.1 mV
         Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0275	-0.4756
e- + Fe+++ = Fe++	0.0666	1.1538

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.217e-006	-5.654	0.0002372	6.606e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007350	260.4	0.8904	-2.1841
Na+	0.004810	110.5	0.8938	-2.3666
CO2(aq)	0.003491	153.5	1.0000	-2.4571
Ca++	0.001289	51.62	0.6539	-3.0742
SO4--	0.001056	101.3	0.6363	-3.1727
Mg++	0.0005089	12.36	0.6699	-3.4674
As(OH)3	0.0005005	62.98	1.0000	-3.3006
HCO3-	0.0003823	23.30	0.8954	-3.4656
Fe++	0.0001612	8.994	0.6539	-3.9772
K+	0.0001169	4.566	0.8904	-3.9827
Mn++	0.0001145	6.286	0.6539	-4.1257
CaSO4	0.0001144	15.57	1.0000	-3.9414
MgSO4	3.723e-005	4.477	1.0000	-4.4292
CaCl+	3.597e-005	2.715	0.8938	-4.4928
NaSO4-	1.535e-005	1.826	0.8938	-4.8626
FeSO4	1.118e-005	1.698	1.0000	-4.9514
MnSO4	8.599e-006	1.297	1.0000	-5.0655
CaHCO3+	4.994e-006	0.5044	0.8975	-5.3485
H+	4.283e-006	0.004313	0.9079	-5.4103
MgCl+	3.925e-006	0.2343	0.8938	-5.4550
NaHCO3	2.285e-006	0.1918	1.0000	-5.6412
FeCl+	1.378e-006	0.1257	0.8938	-5.9095
MgHCO3+	1.304e-006	0.1112	0.8938	-5.9333
FeHCO3+	9.611e-007	0.1122	0.8938	-6.0660
NaCl	6.042e-007	0.03528	1.0000	-6.2188
KSO4-	5.438e-007	0.07344	0.8938	-6.3133

```
 MnHCO3+            5.188e-007      0.06011      0.8938       -6.3338
 MnCl+              3.476e-007      0.03140      0.8938       -6.5077
 HSO4-              2.330e-007      0.02260      0.8938       -6.6814
 As(OH)4-           6.460e-008     0.009227      0.8938       -7.2386
 H2PO4-             5.074e-008     0.004917      0.8938       -7.3434
 KCl                1.587e-008     0.001182      1.0000       -7.7993
  (only species > 1e-8 molal listed)

Surface species       molality       moles     Boltzman fct. log molality
---------------------------------------------------------------------------
 >(w)FeH2AsO3         0.005597     0.005547        1.0000     -2.2520
 >(w)FeOH2+          0.0006167    0.0006112        5.3473     -3.2099
 >(w)FeOCO2H         0.0005216    0.0005169        1.0000     -3.2827
 >(s)FeOH2+          0.0001354    0.0001342        5.3473     -3.8684
 >(w)FeOH           4.350e-005   4.311e-005        1.0000     -4.3615
 >(w)FeSO4-         3.662e-005   3.629e-005       0.18701     -4.4362
 >(s)FeOHCa++       2.627e-005   2.604e-005        28.594     -4.5805
 >(w)FeOCO2-        1.844e-005   1.827e-005       0.18701     -4.7343
 >(s)FeOH           9.550e-006   9.464e-006        1.0000     -5.0200
 >(w)FeHPO4-        6.342e-006   6.285e-006       0.18701     -5.1978
 >(w)FeOHSO4--      5.153e-006   5.106e-006      0.034973     -5.2880
 >(w)FeH2PO4        3.663e-006   3.630e-006        1.0000     -5.4362
 >(w)FePO4--        1.865e-007   1.848e-007      0.034973     -6.7294
 >(w)FeO-           7.029e-008   6.966e-008       0.18701     -7.1531
 >(s)FeO-           1.543e-008   1.529e-008       0.18701     -7.8116
 >(w)FeOCa+         2.491e-009   2.469e-009        5.3473     -8.6036
 >(w)FeHAsO4-       2.270e-009   2.249e-009       0.18701     -8.6441
 >(w)FeH2AsO4       1.041e-009   1.032e-009        1.0000     -8.9824
 >(w)FeOHAsO4---    5.042e-010   4.997e-010     0.0065402     -9.2974
 >(w)FeSeO3-        1.436e-027   1.423e-027       0.18701    -26.8428
 >(w)FeOHSeO3--     5.963e-029   5.910e-029      0.034973    -28.2245
 >(w)FeSeO4-        2.338e-052   2.317e-052       0.18701    -51.6312
 >(w)FeOHSeO4--     3.777e-053   3.743e-053      0.034973    -52.4229
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

Mineral saturation states
                   log Q/K                         log Q/K
----------------------------------------------------------------
 Se(black)          0.0000 sat    Rhodochrosite     -2.0210
 Realgar            0.0000 sat    Anhydrite         -2.0417
 Hematite           0.0000 sat    FeSe2             -2.1238
```

MnHPO4(c)	-0.3416	Orpiment	-2.2345
Goethite	-0.4676	Bassanite	-2.6726
Gypsum	-1.7953	CaSO4^1/2H2O(bet	-2.8499
Siderite	-1.9417	Calcite	-2.9405

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07963	-1.099
Steam	0.02023	-1.694
H2(g)	9.226e-011	-10.035
H2S(g)	3.951e-012	-11.403
CH4(g)	5.516e-018	-17.258
S2(g)	8.529e-030	-29.069
O2(g)	3.309e-066	-65.480

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00605	0.000496	71.5	0.00555	799.	
Ca++	0.00146	0.00143	57.8	2.60e-005	1.05	
Cl-	0.00733	0.00733	262.			
Fe++	0.000173	0.000173	9.75	6.43e-069	3.62e-064	
Fe+++	0.0339	9.91e-012	5.58e-007			
H+	-0.0910	0.00396	4.02	0.00686	6.97	
H2O	55.0	55.0	9.99e+005	-0.0117	-212.	
HCO3-	0.00438	0.00385	237.	0.000535	32.9	
HPO4--	1.02e-005	5.53e-008	0.00535	1.01e-005	0.977	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	4.94e-011	1.59e-006	1.89e-009	6.10e-005	
SO4--	0.00128	0.00123	119.	4.14e-005	4.01	
SeO3--	1.00e-005	4.42e-013	5.66e-008	1.48e-027	1.90e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9179	-0.037

Ca++	0.01787	-1.748
HCO3-	0.1221	-0.913
HPO4--	0.9946	-0.002
SO4--	0.03250	-1.488
SeO3--	3.354e-015	-14.474

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.006045	0.0004960	37.47	0.005547	419.0
Calcium	0.001458	0.001432	57.85	2.604e-005	1.052
Carbon	0.004384	0.003848	46.60	0.0005352	6.481
Chlorine	0.007326	0.007326	261.9		
Hydrogen	110.0	110.0	1.118e+005	0.006241	6.342
Iron	0.03411	0.0001732	9.750	6.431e-069	3.621e-064
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.09	55.02	8.876e+005	0.01232	198.8
Phosphorus	1.015e-005	5.530e-008	0.001727	1.010e-005	0.3154
Potassium	0.0001164	0.0001164	4.587		
Selenium	1.000e-005	4.420e-013	3.518e-008	1.482e-027	1.180e-022
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001276	0.001232	39.83	4.140e-005	1.338

0.0009716 total moles arsenic

```
        Step #     0             Xi = 0.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.400              log fO2 =  -63.827
        Eh =  -0.0030 volts      pe =  -0.0519
        Ionic strength      =    0.012789
        Activity of water   =    0.999732
        Solvent mass        =    0.990012 kg
        Solution mass       =    0.990781 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007697 molal
        Dissolved solids    =         776 mg/kg sol'n
        Rock mass           =    0.002710 kg
        Carbonate alkalinity=       18.81 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.07 uC/cm2
          Surface potential =        60.7 mV
          Surface area      =   1.63e+007 cm2

 Nernst redox couples                                Eh (volts)     pe
------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                    -0.0030   -0.0519
  e-  + Fe+++  = Fe++                                  0.0685    1.1851

                        moles        moles         grams          cm3
 Reactants            remaining     reacted       reacted       reacted
-----------------------------------------------------------------------
  H2O                   0.05551       0.0000        0.0000

 Minerals in system   moles    log moles      grams        volume (cm3)
------------------------------------------------------------------------
  Hematite           0.01697     -1.770          2.710          0.5137
                                             _____________  _____________
        (total)                                  2.710          0.5137

 Aqueous species       molality    mg/kg sol'n    act. coef.    log act.

  Cl-                   0.007653         271.1      0.8898       -2.1668
  Na+                   0.004815         110.6      0.8932       -2.3664
```

CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6347	-3.1727
Mg++	0.0005094	12.37	0.6686	-3.4678
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9777
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1261
CaSO4	0.0001143	15.55	1.0000	-3.9420
CaCl+	3.740e-005	2.822	0.8932	-4.4762
MgSO4	3.719e-005	4.473	1.0000	-4.4296
NaSO4-	1.537e-005	1.828	0.8932	-4.8623
As(OH)3	1.515e-005	1.906	1.0000	-4.8196
FeSO4	1.117e-005	1.696	1.0000	-4.9519
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.590e-006	1.296	1.0000	-5.0660
CaHCO3+	4.893e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004418	0.9074	-5.4000
MgCl+	4.082e-006	0.2437	0.8932	-5.4382
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.433e-006	0.1307	0.8932	-5.8928
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.419e-007	0.1100	0.8932	-6.0750
NaCl	6.289e-007	0.03673	1.0000	-6.2014
KSO4-	5.444e-007	0.07352	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05892	0.8932	-6.3427
MnCl+	3.615e-007	0.03265	0.8932	-6.4909
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.652e-008	0.001231	1.0000	-7.7819

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	Log molality
>(w)FeOCO2H	0.002987	0.002957	1.0000	-2.5248
>(w)FeOH2+	0.001811	0.001793	10.631	-2.7420
>(w)FeH2AsO3	0.0009662	0.0009566	1.0000	-3.0149
>(w)FeSO4-	0.0004252	0.0004209	0.094065	-3.3714
>(w)FeOH	0.0002481	0.0002456	1.0000	-3.6054
>(w)FeOCO2-	0.0002050	0.0002030	0.094065	-3.6882

>(s)FeOH2+	0.0001391	0.0001377	10.631	-3.8568
>(w)FeOHSO4--	0.0001162	0.0001150	0.0088482	-3.9350
>(w)FeHPO4-	7.161e-005	7.089e-005	0.094065	-4.1450
>(w)FeH2PO4	2.130e-005	2.109e-005	1.0000	-4.6716
>(s)FeOH	1.905e-005	1.886e-005	1.0000	-4.7202
>(s)FeOHCa++	1.324e-005	1.310e-005	113.02	-4.8782
>(w)FePO4--	4.088e-006	4.047e-006	0.0088482	-5.3885
>(w)FeO-	7.783e-007	7.705e-007	0.094065	-6.1089
>(s)FeO-	5.976e-008	5.916e-008	0.094065	-7.2236
>(w)FeOCa+	6.968e-009	6.899e-009	10.631	-8.1569
>(w)FeHAsO4-	5.106e-009	5.055e-009	0.094065	-8.2919
>(w)FeOHAsO4---	4.276e-009	4.234e-009	0.00083231	-8.3689
>(w)FeH2AsO4	1.206e-009	1.194e-009	1.0000	-8.9185
>(w)FeSeO3-	1.114e-016	1.103e-016	0.094065	-15.9533
>(w)FeOHSeO3--	8.978e-018	8.889e-018	0.0088482	-17.0468
>(w)FeSeO4-	1.217e-040	1.205e-040	0.094065	-39.9148
>(w)FeOHSeO4--	3.816e-041	3.778e-041	0.0088482	-40.4183

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9610
Se(black)	8.1916s/sat	Rhodochrosite	-2.0402
Hematite	0.0000 sat	Anhydrite	-2.0423
FeSe	-0.2230	Bassanite	-2.6732
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8506
Goethite	-0.4676	Calcite	-2.9599
Gypsum	-1.7959		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.042e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

```
                                In fluid            Sorbed       Kd
 Original basis total moles   moles   mg/kg      moles   mg/kg    L/kg
-----------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-        0.000972  1.50e-005      2.16   0.000957      138.
  Ca++             0.00145    0.00143      57.9  1.31e-005     0.530
  Cl-              0.00762    0.00762      273.
  Fe++            0.000173   0.000173      9.76
  Fe+++             0.0339  1.01e-011 5.71e-007
  H+                 -1.21      -1.11-1.13e+003    0.00638      6.49
  H2O                 55.6       55.5 1.01e+006   -0.00559     -102.
  HCO3-            0.00701    0.00385      237.    0.00316      195.
  HPO4--         9.61e-005  5.50e-008   0.00533  9.60e-005      9.30
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)            -0.279     -0.279-9.01e+003  5.24e-009  0.000169
  SO4--            0.00177    0.00123      120.   0.000536      52.0
  SeO3--         1.00e-005  1.00e-005      1.28  1.19e-016 1.53e-011

 Sorbed                fraction    log fraction
------------------------------------------------
  As(OH)4-                0.9846      -0.007
  Ca++                  0.009072      -2.042
  HCO3-                   0.4507      -0.346
  HPO4--                  0.9994      -0.000
  SO4--                   0.3029      -0.519
  SeO3--             1.191e-011     -10.924

 Elemental composition               In fluid                 Sorbed
                total moles     moles       mg/kg        moles       mg/kg
-----------------------------------------------------------------------
  Arsenic       0.0009716   1.500e-005    1.134    0.0009566       72.34
  Calcium       0.001445   0.001432       57.93   1.311e-005      0.5304
  Carbon        0.007011   0.003851       46.69     0.003160       38.31
  Chlorine       0.007620     0.007620       272.7
  Hydrogen       109.9         109.9  1.118e+005     0.002280       2.319
  Iron           0.03411    0.0001732       9.760
  Magnesium      0.0005464    0.0005464       13.40
```

Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01024	165.4
Phosphorus	9.608e-005	5.500e-008	0.001719	9.603e-005	3.002
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.191e-016	9.495e-012
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001770	0.001234	39.92	0.0005359	17.34

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.405              log fO2 =  -66.152
Eh =  -0.0369 volts      pe =  -0.6388
Ionic strength      =    0.012788
Activity of water   =    0.999732
Solvent mass        =    0.990013 kg
Solution mass       =    0.990781 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007697 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.98 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.06 uC/cm2
  Surface potential =        60.6 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0369	-0.6388
e- + Fe+++ = Fe++	0.0675	1.1687

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137

Realgar	2.220e-006	-5.654	0.0002375	6.614e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007653	271.1	0.8898	-2.1668
Na+	0.004815	110.6	0.8932	-2.3664
CO2(aq)	0.003493	153.6	1.0000	-2.4568
Ca++	0.001290	51.65	0.6524	-3.0750
SO4--	0.001060	101.8	0.6347	-3.1720
Mg++	0.0005093	12.37	0.6686	-3.4679
HCO3-	0.0003785	23.08	0.8948	-3.4702
Fe++	0.0001613	9.002	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1262
CaSO4	0.0001144	15.57	1.0000	-3.9414
CaCl+	3.738e-005	2.822	0.8932	-4.4764
MgSO4	3.724e-005	4.479	1.0000	-4.4289
NaSO4-	1.540e-005	1.831	0.8932	-4.8616
As(OH)3	1.503e-005	1.891	1.0000	-4.8231
FeSO4	1.119e-005	1.698	1.0000	-4.9513
MnSO4	8.603e-006	1.298	1.0000	-5.0653
CaHCO3+	4.936e-006	0.4986	0.8970	-5.3539
H+	4.332e-006	0.004363	0.9074	-5.4055
MgCl+	4.081e-006	0.2437	0.8932	-5.4382
NaHCO3	2.262e-006	0.1898	1.0000	-5.6456
FeCl+	1.433e-006	0.1307	0.8932	-5.8928
MgHCO3+	1.290e-006	0.1100	0.8932	-5.9384
FeHCO3+	9.503e-007	0.1110	0.8932	-6.0712
NaCl	6.289e-007	0.03673	1.0000	-6.2014
KSO4-	5.453e-007	0.07364	0.8932	-6.3124
MnHCO3+	5.131e-007	0.05945	0.8932	-6.3389
MnCl+	3.615e-007	0.03265	0.8932	-6.4910
HSO4-	2.361e-007	0.02290	0.8932	-6.6759
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.652e-008	0.001231	1.0000	-7.7819

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	Log molality

```
---------------------------------------------------------------------------
 >(w)FeOCO2H           0.002994      0.002964        1.0000     -2.5238
 >(w)FeOH2+            0.001807      0.001789        10.583     -2.7430
 >(w)FeH2AsO3         0.0009641     0.0009545        1.0000     -3.0159
 >(w)FeSO4-           0.0004211     0.0004169      0.094487     -3.3756
 >(w)FeOH             0.0002495     0.0002470        1.0000     -3.6029
 >(w)FeOCO2-          0.0002072     0.0002051      0.094487     -3.6837
 >(s)FeOH2+           0.0001388     0.0001374        10.583     -3.8577
 >(w)FeOHSO4--        0.0001160     0.0001148     0.0089279     -3.9356
 >(w)FeHPO4-          7.171e-005    7.099e-005     0.094487     -4.1444
 >(w)FeH2PO4          2.116e-005    2.095e-005       1.0000     -4.6745
 >(s)FeOH             1.916e-005    1.897e-005       1.0000     -4.7176
 >(s)FeOHCa++         1.343e-005    1.330e-005       112.01     -4.8719
 >(w)FePO4--          4.128e-006    4.086e-006    0.0089279     -5.3843
 >(w)FeO-             7.893e-007    7.814e-007     0.094487     -6.1028
 >(s)FeO-             6.060e-008    6.000e-008     0.094487     -7.2175
 >(w)FeOCa+           7.128e-009    7.057e-009       10.583     -8.1470
 >(w)FeHAsO4-         3.531e-010    3.495e-010     0.094487     -9.4521
 >(w)FeOHAsO4---      3.006e-010    2.976e-010   0.00084357     -9.5221
 >(w)FeH2AsO4         8.275e-011    8.192e-011       1.0000    -10.0822
 >(w)FeSeO3-          3.433e-027    3.398e-027     0.094487    -26.4644
 >(w)FeOHSeO3--       2.790e-028    2.762e-028    0.0089279    -27.5544
 >(w)FeSeO4-          2.578e-052    2.552e-052     0.094487    -51.5887
 >(w)FeOHSeO4--       8.153e-053    8.071e-053    0.0089279    -52.0887
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
 Realgar            0.0000 sat    FeSe2              -1.7977
 Hematite           0.0000 sat    Siderite           -1.9517
 Se(black)          0.0000 sat    Rhodochrosite      -2.0309
 MnHPO4(c)         -0.3487        Anhydrite          -2.0418
 Goethite          -0.4676        Bassanite          -2.6726
 Orpiment          -1.2170        CaSO4^1/2H2O(bet   -2.8500
 Gypsum            -1.7953        Calcite            -2.9506
  (only minerals with log Q/K > -3 listed)

 Gases               fugacity      log fug.
-----------------------------------------------
 CO2(g)                 0.07967      -1.099
```

Steam	0.02023	-1.694
H2(g)	2.000e-010	-9.699
H2S(g)	8.930e-011	-10.049
CH4(g)	1.218e-016	-15.914
S2(g)	9.274e-028	-27.033
O2(g)	7.043e-067	-66.152

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.000972	1.49e-005	2.15	0.000955	138.	
Ca++	0.00145	0.00143	57.9	1.33e-005	0.538	
Cl-	0.00762	0.00762	273.			
Fe++	0.000173	0.000173	9.76	7.08e-069	3.99e-064	
Fe+++	0.0339	1.00e-011	5.64e-007			
H+	-0.0919	0.00348	3.54	0.00637	6.48	
H2O	55.0	55.0	9.99e+005	-0.00559	-102.	
HCO3-	0.00701	0.00384	237.	0.00317	195.	
HPO4--	9.61e-005	5.50e-008	0.00533	9.60e-005	9.30	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-2.84e-011	-9.16e-007	3.65e-010	1.18e-005	
SO4--	0.00177	0.00124	120.	0.000532	51.6	
SeO3--	1.00e-005	9.47e-013	1.21e-007	3.67e-027	4.71e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.009206	-2.036
HCO3-	0.4520	-0.345
HPO4--	0.9994	-0.000
SO4--	0.3009	-0.522
SeO3--	3.879e-015	-14.411

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg

Arsenic	0.0009716	1.488e-005	1.125	0.0009545	72.18
Calcium	0.001445	0.001432	57.93	1.330e-005	0.5382
Carbon	0.007011	0.003842	46.58	0.003169	38.41
Chlorine	0.007620	0.007620	272.7		
Hydrogen	109.9	109.9	1.118e+005	0.002275	2.314
Iron	0.03411	0.0001732	9.760	7.084e-069	3.993e-064
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01024	165.4
Phosphorus	9.608e-005	5.503e-008	0.001720	9.603e-005	3.002
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	9.473e-013	7.550e-008	3.675e-027	2.928e-022
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001770	0.001236	39.98	0.0005317	17.21

```
Step #   100              Xi = 1.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.406              log fO2 =  -66.153
Eh =  -0.0369 volts      pe =  -0.6391
Ionic strength      =    0.012776
Activity of water   =    0.999732
Solvent mass        =    0.991013 kg
Solution mass       =    0.991781 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007689 molal
Dissolved solids    =         774 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.97 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.06 uC/cm2
  Surface potential =        60.6 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0369	-0.6391
e- + Fe+++ = Fe++	0.0675	1.1686

moles	moles	grams	cm3

Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.220e-006	-5.654	0.0002375	6.614e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007646	270.8	0.8899	-2.1673
Na+	0.004810	110.5	0.8932	-2.3669
CO2(aq)	0.003490	153.5	1.0000	-2.4572
Ca++	0.001288	51.60	0.6525	-3.0753
SO4--	0.001059	101.7	0.6348	-3.1723
Mg++	0.0005088	12.36	0.6687	-3.4682
HCO3-	0.0003783	23.06	0.8949	-3.4704
Fe++	0.0001612	8.993	0.6525	-3.9781
K+	0.0001169	4.566	0.8899	-3.9830
Mn++	0.0001145	6.286	0.6525	-4.1266
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.732e-005	2.817	0.8932	-4.4771
MgSO4	3.719e-005	4.472	1.0000	-4.4296
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
As(OH)3	1.502e-005	1.890	1.0000	-4.8234
FeSO4	1.117e-005	1.696	1.0000	-4.9519
MnSO4	8.590e-006	1.296	1.0000	-5.0660
CaHCO3+	4.929e-006	0.4979	0.8970	-5.3545
H+	4.331e-006	0.004361	0.9075	-5.4056
MgCl+	4.074e-006	0.2433	0.8932	-5.4390
NaHCO3	2.258e-006	0.1896	1.0000	-5.6462
FeCl+	1.430e-006	0.1305	0.8932	-5.8936
MgHCO3+	1.288e-006	0.1098	0.8932	-5.9390
FeHCO3+	9.490e-007	0.1108	0.8932	-6.0718
NaCl	6.277e-007	0.03666	1.0000	-6.2022
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.123e-007	0.05936	0.8932	-6.3395

MnCl+	3.608e-007	0.03259	0.8932	-6.4917
HSO4-	2.359e-007	0.02288	0.8932	-6.6764
H2PO4-	5.052e-008	0.004896	0.8932	-7.3455
KCl	1.649e-008	0.001229	1.0000	-7.7827

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002990	0.002963	1.0000	-2.5243
>(w)FeOH2+	0.001806	0.001789	10.586	-2.7434
>(w)FeH2AsO3	0.0009632	0.0009545	1.0000	-3.0163
>(w)FeSO4-	0.0004207	0.0004169	0.094465	-3.3761
>(w)FeOH	0.0002495	0.0002472	1.0000	-3.6030
>(w)FeOCO2-	0.0002070	0.0002052	0.094465	-3.6840
>(s)FeOH2+	0.0001386	0.0001374	10.586	-3.8582
>(w)FeOHSO4--	0.0001159	0.0001149	0.0089237	-3.9358
>(w)FeHPO4-	7.165e-005	7.100e-005	0.094465	-4.1448
>(w)FeH2PO4	2.113e-005	2.094e-005	1.0000	-4.6752
>(s)FeOH	1.915e-005	1.898e-005	1.0000	-4.7178
>(s)FeOHCa++	1.341e-005	1.329e-005	112.06	-4.8726
>(w)FePO4--	4.126e-006	4.089e-006	0.0089237	-5.3845
>(w)FeO-	7.895e-007	7.824e-007	0.094465	-6.1026
>(s)FeO-	6.061e-008	6.006e-008	0.094465	-7.2175
>(w)FeOCa+	7.121e-009	7.057e-009	10.586	-8.1474
>(w)FeHAsO4-	3.527e-010	3.496e-010	0.094465	-9.4525
>(w)FeOHAsO4---	3.006e-010	2.979e-010	0.00084297	-9.5220
>(w)FeH2AsO4	8.262e-011	8.188e-011	1.0000	-10.0829
>(w)FeSeO3-	3.430e-027	3.400e-027	0.094465	-26.4647
>(w)FeOHSeO3--	2.790e-028	2.765e-028	0.0089237	-27.5544
>(w)FeSeO4-	2.575e-052	2.552e-052	0.094465	-51.5892
>(w)FeOHSeO4--	8.148e-053	8.075e-053	0.0089237	-52.0890

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Realgar	0.0000	sat	FeSe2	-1.7975
Hematite	0.0000	sat	Siderite	-1.9521
Se(black)	0.0000	sat	Rhodochrosite	-2.0313
MnHPO4(c)	-0.3493		Anhydrite	-2.0424
Goethite	-0.4676		Bassanite	-2.6733

Orpiment	-1.2170	CaSO4^1/2H2O(bet	-2.8506
Gypsum	-1.7960	Calcite	-2.9511

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07960	-1.099
Steam	0.02023	-1.694
H2(g)	2.001e-010	-9.699
H2S(g)	8.935e-011	-10.049
CH4(g)	1.219e-016	-15.914
S2(g)	9.275e-028	-27.033
O2(g)	7.037e-067	-66.153

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.000972	1.49e-005	2.15	0.000955	138.	
Ca++	0.00145	0.00143	57.9	1.33e-005	0.537	
Cl-	0.00762	0.00762	272.			
Fe++	0.000173	0.000173	9.75	7.08e-069	3.99e-064	
Fe+++	0.0339	1.00e-011	5.64e-007			
H+	-0.0919	0.00348	3.53	0.00637	6.48	
H2O	55.1	55.0	9.99e+005	-0.00559	-102.	
HCO3-	0.00701	0.00384	236.	0.00317	195.	
HPO4--	9.61e-005	5.50e-008	0.00533	9.60e-005	9.29	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-2.84e-011	-9.16e-007	3.65e-010	1.18e-005	
SO4--	0.00177	0.00124	120.	0.000532	51.5	
SeO3--	1.00e-005	9.49e-013	1.21e-007	3.68e-027	4.71e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9846	-0.007
Ca++	0.009199	-2.036
HCO3-	0.4519	-0.345

HPO4--	0.9994	-0.000
SO4--	0.3009	-0.522
SeO3--	3.874e-015	-14.412

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0009716	1.488e-005	1.124	0.0009545	72.11
Calcium	0.001445	0.001432	57.87	1.330e-005	0.5373
Carbon	0.007011	0.003843	46.54	0.003168	38.37
Chlorine	0.007620	0.007620	272.4		
Hydrogen	110.0	110.0	1.118e+005	0.002275	2.312
Iron	0.03411	0.0001732	9.750	7.083e-069	3.989e-064
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.01024	165.3
Phosphorus	9.608e-005	5.503e-008	0.001719	9.603e-005	2.999
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	9.490e-013	7.555e-008	3.676e-027	2.927e-022
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001770	0.001236	39.94	0.0005318	17.19

7.562e-008 total moles arsenic

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012797
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990780 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.17 uC/cm2
  Surface potential =        61.7 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3665

CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
MnCl+	3.623e-007	0.03272	0.8932	-6.4900
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003495	0.003460	1.0000	-2.4566
>(w)FeOH2+	0.002042	0.002022	11.034	-2.6899
>(w)FeSO4-	0.0005163	0.0005111	0.090630	-3.2871
>(w)FeOH	0.0002903	0.0002874	1.0000	-3.5372
>(w)FeOCO2-	0.0002490	0.0002465	0.090630	-3.6039
>(w)FeOHSO4--	0.0001464	0.0001449	0.0082139	-3.8345
>(s)FeOH2+	0.0001389	0.0001375	11.034	-3.8574

>(w)FeHPO4-	8.696e-005	8.609e-005	0.090630	-4.0607
>(w)FeH2PO4	2.492e-005	2.467e-005	1.0000	-4.6034
>(s)FeOH	1.974e-005	1.954e-005	1.0000	-4.7047
>(s)FeOHCa++	1.273e-005	1.261e-005	121.75	-4.8950
>(w)FePO4--	5.153e-006	5.101e-006	0.0082139	-5.2880
>(w)FeO-	9.452e-007	9.357e-007	0.090630	-6.0245
>(w)FeH2AsO3	7.537e-008	7.462e-008	1.0000	-7.1228
>(s)FeO-	6.428e-008	6.364e-008	0.090630	-7.1919
>(w)FeOCa+	7.854e-009	7.776e-009	11.034	-8.1049
>(w)FeHAsO4-	4.134e-013	4.092e-013	0.090630	-12.3837
>(w)FeOHAsO4---	3.730e-013	3.692e-013	0.00074443	-12.4283
>(w)FeH2AsO4	9.410e-014	9.316e-014	1.0000	-13.0264
>(w)FeSeO3-	1.352e-016	1.339e-016	0.090630	-15.8689
>(w)FeOHSeO3--	1.132e-017	1.120e-017	0.0082139	-16.9463
>(w)FeSeO4-	1.478e-040	1.463e-040	0.090630	-39.8304
>(w)FeOHSeO4--	4.810e-041	4.762e-041	0.0082139	-40.3178

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9611
Se(black)	8.1916s/sat	Rhodochrosite	-2.0403
Hematite	0.0000 sat	Anhydrite	-2.0424
FeSe	-0.2231	Bassanite	-2.6733
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8507
Goethite	-0.4676	Calcite	-2.9600
Gypsum	-1.7960		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.041e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

	In fluid	Sorbed	Kd

Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-008	1.00e-009	0.000144	7.46e-008	0.0108	
Ca++	0.00144	0.00143	57.9	1.26e-005	0.510	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00626	6.37	
H2O	55.6	55.5	1.01e+006	-0.00433	-78.8	
HCO3-	0.00756	0.00385	237.	0.00371	228.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	4.36e-013	1.41e-008	
SO4--	0.00189	0.00123	120.	0.000656	63.6	
SeO3--	1.00e-005	1.00e-005	1.28	1.45e-016	1.86e-011	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008731	-2.059
HCO3-	0.4904	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3472	-0.459
SeO3--	1.451e-011	-10.838

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-008	1.000e-009	7.562e-005	7.462e-008	0.005643
Calcium	0.001445	0.001432	57.93	1.261e-005	0.5103
Carbon	0.007558	0.003851	46.69	0.003706	44.93
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001420	1.445
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		

Oxygen	55.03	54.97	8.876e+005	0.009873	159.4
Phosphorus	0.0001159	5.500e-008	0.001719	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.451e-016	1.156e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001234	39.92	0.0006561	21.23

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.404              log fO2 =  -67.021
Eh =  -0.0494 volts      pe =  -0.8547
Ionic strength      =    0.012792
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         774 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.94 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.16 uC/cm2
  Surface potential =        61.6 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0494	-0.8547
e- + Fe+++ = Fe++	0.0680	1.1764

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Pyrite	1.428e-006	-5.845	0.0001713	3.419e-005

Se(black)	1.000e-005	-5.000	0.0007896	
			_______________	_______________
(total)			2.711	0.5137*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3664
CO2(aq)	0.003496	153.7	1.0000	-2.4565
Ca++	0.001290	51.65	0.6524	-3.0750
SO4--	0.001060	101.7	0.6346	-3.1722
Mg++	0.0005093	12.37	0.6685	-3.4679
HCO3-	0.0003777	23.03	0.8948	-3.4712
Fe++	0.0001600	8.928	0.6524	-3.9814
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1262
CaSO4	0.0001144	15.56	1.0000	-3.9417
CaCl+	3.746e-005	2.828	0.8932	-4.4755
MgSO4	3.722e-005	4.477	1.0000	-4.4292
NaSO4-	1.539e-005	1.830	0.8932	-4.8619
FeSO4	1.109e-005	1.683	1.0000	-4.9551
MnSO4	8.598e-006	1.297	1.0000	-5.0656
CaHCO3+	4.924e-006	0.4975	0.8970	-5.3549
H+	4.346e-006	0.004377	0.9074	-5.4041
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.256e-006	0.1894	1.0000	-5.6466
FeCl+	1.424e-006	0.1299	0.8932	-5.8955
MgHCO3+	1.287e-006	0.1097	0.8932	-5.9394
FeHCO3+	9.403e-007	0.1098	0.8932	-6.0758
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.450e-007	0.07360	0.8932	-6.3127
MnHCO3+	5.119e-007	0.05931	0.8932	-6.3399
MnCl+	3.622e-007	0.03272	0.8932	-6.4900
HSO4-	2.367e-007	0.02296	0.8932	-6.6748
H2PO4-	5.058e-008	0.004902	0.8932	-7.3451
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003500	0.003465	1.0000	-2.4560

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 >(w)FeOH2+           0.002038      0.002018        10.996     -2.6908
 >(w)FeSO4-          0.0005124     0.0005073      0.090943     -3.2904
 >(w)FeOH            0.0002915     0.0002885        1.0000     -3.5354
 >(w)FeOCO2-         0.0002508     0.0002483      0.090943     -3.6006
 >(w)FeOHSO4--       0.0001462     0.0001447     0.0082707     -3.8352
 >(s)FeOH2+          0.0001386     0.0001373        10.996     -3.8581
 >(w)FeHPO4-         8.705e-005    8.618e-005     0.090943     -4.0602
 >(w)FeH2PO4         2.480e-005    2.455e-005       1.0000     -4.6056
 >(s)FeOH            1.983e-005    1.963e-005       1.0000     -4.7027
 >(s)FeOHCa++        1.288e-005    1.275e-005       120.91     -4.8902
 >(w)FePO4--         5.189e-006    5.137e-006    0.0082707     -5.2849
 >(w)FeO-            9.548e-007    9.453e-007     0.090943     -6.0201
 >(w)FeH2AsO3        7.538e-008    7.462e-008       1.0000     -7.1228
 >(s)FeO-            6.495e-008    6.431e-008     0.090943     -7.1874
 >(w)FeOCa+          7.988e-009    7.909e-009       10.996     -8.0975
 >(w)FeHAsO4-        1.051e-014    1.041e-014     0.090943    -13.9782
 >(w)FeOHAsO4---     9.601e-015    9.506e-015   0.00075216    -14.0177
 >(w)FeH2AsO4        2.379e-015    2.355e-015       1.0000    -14.6236
 >(w)FeSeO3-         5.616e-028    5.560e-028     0.090943    -27.2506
 >(w)FeOHSeO3--      4.728e-029    4.681e-029    0.0082707    -28.3253
 >(w)FeSeO4-         1.551e-053    1.536e-053     0.090943    -52.8093
 >(w)FeOHSeO4--      5.080e-054    5.030e-054    0.0082707    -53.2941
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                    log Q/K                          log Q/K
----------------------------------------------------------------
 Pyrite              0.0000 sat    Siderite          -1.9576
 Hematite            0.0000 sat    Rhodochrosite     -2.0332
 Se(black)           0.0000 sat    Anhydrite         -2.0420
 MnHPO4(c)          -0.3500        Realgar           -2.2164
 Goethite           -0.4676        Bassanite         -2.6729
 FeSe2              -1.3691        CaSO4^1/2H2O(bet  -2.8502
 Gypsum             -1.7956        Calcite           -2.9530
  (only minerals with log Q/K > -3 listed)

 Gases                fugacity      log fug.
-----------------------------------------------
 CO2(g)                 0.07974      -1.098
 Steam                  0.02023      -1.694
 H2S(g)              4.910e-009      -8.309
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H2(g)	5.438e-010	-9.265
CH4(g)	6.667e-015	-14.176
S2(g)	3.792e-025	-24.421
O2(g)	9.525e-068	-67.021

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-008	9.96e-010	0.000144	7.46e-008	0.0108	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.516	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000172	9.68	1.18e-030	6.67e-026	
Fe+++	0.0339	1.00e-011	5.66e-007			
H+	-0.0921	0.00347	3.53	0.00626	6.37	
H2O	55.0	55.0	9.99e+005	-0.00434	-78.8	
HCO3-	0.00756	0.00384	237.	0.00371	229.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-1.52e-009	-4.91e-005	1.11e-014	3.60e-010	
SO4--	0.00189	0.00123	120.	0.000652	63.2	
SeO3--	1.00e-005	2.57e-012	3.29e-007	6.03e-028	7.72e-023	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008829	-2.054
HCO3-	0.4913	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-008	9.959e-010	7.531e-005	7.462e-008	0.005643
Calcium	0.001445	0.001432	57.93	1.276e-005	0.5160
Carbon	0.007558	0.003845	46.61	0.003713	45.01

Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001418	1.442
Iron	0.03411	0.0001717	9.679	3.155e-030	1.779e-025
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009874	159.5
Phosphorus	0.0001159	5.501e-008	0.001720	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.568e-012	2.047e-007	6.028e-028	4.804e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001235	39.96	0.0006519	21.10

```
Step #   100             Xi = 1.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.404              log fO2 =  -67.021
Eh =  -0.0494 volts      pe =  -0.8549
Ionic strength      =    0.012780
Activity of water   =    0.999732
Solvent mass        =    0.991012 kg
Solution mass       =    0.991779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007706 molal
Dissolved solids    =         773 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.93 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.16 uC/cm2
  Surface potential =        61.6 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0494	-0.8549
e- + Fe+++ = Fe++	0.0680	1.1763

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Pyrite	1.428e-006	-5.845	0.0001713	3.419e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5137*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007662	271.4	0.8899	-2.1664
Na+	0.004810	110.5	0.8932	-2.3669
CO2(aq)	0.003493	153.6	1.0000	-2.4568
Ca++	0.001288	51.60	0.6525	-3.0753
SO4--	0.001059	101.6	0.6348	-3.1725
Mg++	0.0005088	12.36	0.6686	-3.4683
HCO3-	0.0003774	23.01	0.8948	-3.4714
Fe++	0.0001598	8.920	0.6525	-3.9817
K+	0.0001169	4.566	0.8899	-3.9830
Mn++	0.0001145	6.286	0.6525	-4.1266
CaSO4	0.0001142	15.54	1.0000	-3.9423
CaCl+	3.740e-005	2.823	0.8932	-4.4762
MgSO4	3.717e-005	4.470	1.0000	-4.4299
NaSO4-	1.536e-005	1.827	0.8932	-4.8626
FeSO4	1.107e-005	1.681	1.0000	-4.9558
MnSO4	8.585e-006	1.295	1.0000	-5.0663
CaHCO3+	4.918e-006	0.4968	0.8970	-5.3554
H+	4.344e-006	0.004375	0.9075	-5.4043
MgCl+	4.083e-006	0.2438	0.8932	-5.4381
NaHCO3	2.253e-006	0.1891	1.0000	-5.6472
FeCl+	1.421e-006	0.1297	0.8932	-5.8963
MgHCO3+	1.285e-006	0.1096	0.8932	-5.9400
FeHCO3+	9.390e-007	0.1097	0.8932	-6.0764
NaCl	6.290e-007	0.03673	1.0000	-6.2013
KSO4-	5.440e-007	0.07347	0.8932	-6.3134
MnHCO3+	5.112e-007	0.05923	0.8932	-6.3405
MnCl+	3.616e-007	0.03266	0.8932	-6.4908
HSO4-	2.365e-007	0.02293	0.8932	-6.6753
H2PO4-	5.054e-008	0.004898	0.8932	-7.3454
KCl	1.653e-008	0.001231	1.0000	-7.7818

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003495	0.003464	1.0000	-2.4565
>(w)FeOH2+	0.002036	0.002018	10.998	-2.6911
>(w)FeSO4-	0.0005118	0.0005072	0.090922	-3.2909
>(w)FeOH	0.0002914	0.0002888	1.0000	-3.5356
>(w)FeOCO2-	0.0002507	0.0002484	0.090922	-3.6009
>(w)FeOHSO4--	0.0001461	0.0001448	0.0082668	-3.8354
>(s)FeOH2+	0.0001385	0.0001373	10.998	-3.8585
>(w)FeHPO4-	8.697e-005	8.619e-005	0.090922	-4.0606
>(w)FeH2PO4	2.476e-005	2.454e-005	1.0000	-4.6062
>(s)FeOH	1.982e-005	1.964e-005	1.0000	-4.7029
>(s)FeOHCa++	1.285e-005	1.274e-005	120.97	-4.8909
>(w)FePO4--	5.187e-006	5.141e-006	0.0082668	-5.2850
>(w)FeO-	9.551e-007	9.465e-007	0.090922	-6.0200
>(w)FeH2AsO3	7.530e-008	7.462e-008	1.0000	-7.1232
>(s)FeO-	6.496e-008	6.438e-008	0.090922	-7.1873
>(w)FeOCa+	7.981e-009	7.909e-009	10.998	-8.0980
>(w)FeHAsO4-	1.050e-014	1.041e-014	0.090922	-13.9786
>(w)FeOHAsO4---	9.604e-015	9.518e-015	0.00075163	-14.0175
>(w)FeH2AsO4	2.376e-015	2.354e-015	1.0000	-14.6242
>(w)FeSeO3-	5.613e-028	5.562e-028	0.090922	-27.2508
>(w)FeOHSeO3--	4.728e-029	4.685e-029	0.0082668	-28.3253
>(w)FeSeO4-	1.550e-053	1.536e-053	0.090922	-52.8098
>(w)FeOHSeO4--	5.078e-054	5.033e-054	0.0082668	-53.2943

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Pyrite	0.0000	sat	Siderite	-1.9581
Hematite	0.0000	sat	Rhodochrosite	-2.0336
Se(black)	0.0000	sat	Anhydrite	-2.0427
MnHPO4(c)	-0.3505		Realgar	-2.2165
Goethite	-0.4676		Bassanite	-2.6735
FeSe2	-1.3690		CaSO4^1/2H2O(bet	-2.8509
Gypsum	-1.7962		Calcite	-2.9534

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07967	-1.099
Steam	0.02023	-1.694
H2S(g)	4.912e-009	-8.309
H2(g)	5.440e-010	-9.264
CH4(g)	6.672e-015	-14.176
S2(g)	3.791e-025	-24.421
O2(g)	9.517e-068	-67.021

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-008	9.96e-010	0.000144	7.46e-008	0.0108	
Ca++	0.00144	0.00143	57.9	1.27e-005	0.515	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000172	9.67	1.18e-030	6.66e-026	
Fe+++	0.0339	1.00e-011	5.66e-007			
H+	-0.0921	0.00347	3.52	0.00626	6.36	
H2O	55.1	55.0	9.99e+005	-0.00434	-78.8	
HCO3-	0.00756	0.00385	237.	0.00371	228.	
HPO4--	0.000116	5.50e-008	0.00532	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-1.52e-009	-4.91e-005	1.11e-014	3.59e-010	
SO4--	0.00189	0.00123	120.	0.000652	63.1	
SeO3--	1.00e-005	2.57e-012	3.29e-007	6.03e-028	7.72e-023	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008823	-2.054
HCO3-	0.4912	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition In fluid Sorbed

	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-008	9.962e-010	7.526e-005	7.462e-008	0.005637
Calcium	0.001445	0.001432	57.87	1.275e-005	0.5151
Carbon	0.007558	0.003845	46.57	0.003712	44.96
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001418	1.441
Iron	0.03411	0.0001717	9.670	3.155e-030	1.777e-025
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009873	159.3
Phosphorus	0.0001159	5.502e-008	0.001718	0.0001159	3.618
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.573e-012	2.048e-007	6.031e-028	4.802e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001890	0.001235	39.92	0.0006520	21.08

1.512e-007 total moles arsenic

```
Step #     0              Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012797
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990780 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.17 uC/cm2
  Surface potential =        61.7 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
MnCl+	3.623e-007	0.03272	0.8932	-6.4900
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003495	0.003460	1.0000	-2.4566
>(w)FeOH2+	0.002042	0.002022	11.034	-2.6899
>(w)FeSO4-	0.0005163	0.0005111	0.090631	-3.2871
>(w)FeOH	0.0002903	0.0002874	1.0000	-3.5372
>(w)FeOCO2-	0.0002490	0.0002465	0.090631	-3.6039
>(w)FeOHSO4--	0.0001464	0.0001449	0.0082139	-3.8345
>(s)FeOH2+	0.0001389	0.0001375	11.034	-3.8574
>(w)FeHPO4-	8.696e-005	8.609e-005	0.090631	-4.0607
>(w)FeH2PO4	2.492e-005	2.467e-005	1.0000	-4.6034
>(s)FeOH	1.974e-005	1.954e-005	1.0000	-4.7047
>(s)FeOHCa++	1.273e-005	1.261e-005	121.74	-4.8950
>(w)FePO4--	5.153e-006	5.101e-006	0.0082139	-5.2880
>(w)FeO-	9.451e-007	9.357e-007	0.090631	-6.0245
>(w)FeH2AsO3	1.507e-007	1.492e-007	1.0000	-6.8218
>(s)FeO-	6.428e-008	6.364e-008	0.090631	-7.1919
>(w)FeOCa+	7.854e-009	7.776e-009	11.034	-8.1049
>(w)FeHAsO4-	8.267e-013	8.184e-013	0.090631	-12.0827
>(w)FeOHAsO4---	7.459e-013	7.384e-013	0.00074443	-12.1273
>(w)FeH2AsO4	1.882e-013	1.863e-013	1.0000	-12.7254
>(w)FeSeO3-	1.352e-016	1.339e-016	0.090631	-15.8689
>(w)FeOHSeO3--	1.132e-017	1.120e-017	0.0082139	-16.9463
>(w)FeSeO4-	1.478e-040	1.463e-040	0.090631	-39.8305
>(w)FeOHSeO4--	4.810e-041	4.762e-041	0.0082139	-40.3178

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9611
Se(black)	8.1916s/sat	Rhodochrosite	-2.0403
Hematite	0.0000 sat	Anhydrite	-2.0424
FeSe	-0.2231	Bassanite	-2.6733
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8507
Goethite	-0.4676	Calcite	-2.9600
Gypsum	-1.7960		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.041e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	1.51e-007	2.00e-009	0.000289	1.49e-007	0.0215	
Ca++	0.00144	0.00143	57.9	1.26e-005	0.510	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00626	6.37	
H2O	55.6	55.5	1.01e+006	-0.00433	-78.8	
HCO3-	0.00756	0.00385	237.	0.00371	228.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	8.72e-013	2.81e-008	
SO4--	0.00189	0.00123	120.	0.000656	63.6	

SeO3--	1.00e-005	1.00e-005	1.28	1.45e-016	1.86e-011

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008731	-2.059
HCO3-	0.4904	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3472	-0.459
SeO3--	1.451e-011	-10.838

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-007	2.000e-009	0.0001512	1.492e-007	0.01128
Calcium	0.001445	0.001432	57.93	1.261e-005	0.5103
Carbon	0.007557	0.003851	46.69	0.003706	44.93
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001420	1.445
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009873	159.4
Phosphorus	0.0001159	5.500e-008	0.001719	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.451e-016	1.156e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001234	39.92	0.0006561	21.23

```
        Step #     0              Xi = 0.0000
        Temperature =  18.0 C     Pressure =  1.013 bars
        pH =  5.404               log fO2 =  -67.021
        Eh =  -0.0494 volts       pe =  -0.8547
        Ionic strength      =    0.012792
        Activity of water   =    0.999731
        Solvent mass        =    0.990012 kg
        Solution mass       =    0.990779 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007713 molal
        Dissolved solids    =         774 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       18.94 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.16 uC/cm2
          Surface potential =        61.6 mV
          Surface area      =   1.63e+007 cm2

 Nernst redox couples                              Eh (volts)     pe
-----------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                   -0.0494   -0.8547
  e-  + Fe+++  = Fe++                                 0.0680    1.1764

                          moles        moles          grams          cm3
 Reactants              remaining     reacted        reacted        reacted
-----------------------------------------------------------------------------
  H2O                     0.05551       0.0000        0.0000

 Minerals in system     moles      log moles      grams        volume (cm3)
-----------------------------------------------------------------------------
  Hematite                0.01697     -1.770          2.710          0.5137
  Pyrite               1.428e-006     -5.845      0.0001713      3.419e-005
  Se(black)            1.000e-005     -5.000      0.0007896
                                                 ___________   _____________
        (total)                                       2.711          0.5137*

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
----------------------------------------------------------------------------
  Cl-                    0.007669         271.7       0.8898       -2.1659
  Na+                    0.004815         110.6       0.8932       -2.3664
  CO2(aq)                0.003496         153.7       1.0000       -2.4565
  Ca++                   0.001290         51.65       0.6524       -3.0750
  SO4--                  0.001060         101.7       0.6346       -3.1722
  Mg++                  0.0005093         12.37       0.6685       -3.4679
  HCO3-                 0.0003777         23.03       0.8948       -3.4712
  Fe++                  0.0001600         8.928       0.6524       -3.9814
  K+                    0.0001170         4.570       0.8898       -3.9826
  Mn++                  0.0001146         6.292       0.6524       -4.1262
  CaSO4                 0.0001144         15.56       1.0000       -3.9417
  CaCl+                3.746e-005         2.828       0.8932       -4.4755
  MgSO4                3.722e-005         4.477       1.0000       -4.4292
  NaSO4-               1.539e-005         1.830       0.8932       -4.8619
  FeSO4                1.109e-005         1.683       1.0000       -4.9551
  MnSO4                8.598e-006         1.297       1.0000       -5.0656
  CaHCO3+              4.924e-006        0.4975       0.8970       -5.3549
  H+                   4.346e-006      0.004377       0.9074       -5.4041
  MgCl+                4.090e-006        0.2442       0.8932       -5.4373
  NaHCO3               2.256e-006        0.1894       1.0000       -5.6466
  FeCl+                1.424e-006        0.1299       0.8932       -5.8955
  MgHCO3+              1.287e-006        0.1097       0.8932       -5.9394
  FeHCO3+              9.403e-007        0.1098       0.8932       -6.0758
  NaCl                 6.302e-007       0.03680       1.0000       -6.2005
  KSO4-                5.450e-007       0.07360       0.8932       -6.3127
  MnHCO3+              5.119e-007       0.05931       0.8932       -6.3399
  MnCl+                3.622e-007       0.03272       0.8932       -6.4900
  HSO4-                2.367e-007       0.02296       0.8932       -6.6748
  H2PO4-               5.058e-008      0.004902       0.8932       -7.3451
  KCl                  1.656e-008      0.001233       1.0000       -7.7810
   (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
```

```
---------------------------------------------------------------------------
 >(w)FeOCO2H          0.003500      0.003465        1.0000     -2.4560
 >(w)FeOH2+           0.002038      0.002018        10.996     -2.6908
 >(w)FeSO4-          0.0005124     0.0005072      0.090944     -3.2904
 >(w)FeOH            0.0002915     0.0002885        1.0000     -3.5354
 >(w)FeOCO2-         0.0002508     0.0002483      0.090944     -3.6006
 >(w)FeOHSO4--       0.0001462     0.0001447     0.0082707     -3.8352
 >(s)FeOH2+          0.0001386     0.0001373        10.996     -3.8581
 >(w)FeHPO4-         8.705e-005    8.618e-005     0.090944     -4.0603
 >(w)FeH2PO4         2.480e-005    2.455e-005       1.0000     -4.6056
 >(s)FeOH            1.983e-005    1.963e-005       1.0000     -4.7027
 >(s)FeOHCa++        1.288e-005    1.275e-005       120.91     -4.8902
 >(w)FePO4--         5.189e-006    5.137e-006    0.0082707     -5.2849
 >(w)FeO-            9.548e-007    9.453e-007     0.090944     -6.0201
 >(w)FeH2AsO3        1.507e-007    1.492e-007       1.0000     -6.8217
 >(s)FeO-            6.495e-008    6.431e-008     0.090944     -7.1874
 >(w)FeOCa+          7.988e-009    7.909e-009       10.996     -8.0975
 >(w)FeHAsO4-        2.103e-014    2.082e-014     0.090944    -13.6772
 >(w)FeOHAsO4---     1.920e-014    1.901e-014   0.00075217    -13.7166
 >(w)FeH2AsO4        4.758e-015    4.710e-015       1.0000    -14.3226
 >(w)FeSeO3-         5.616e-028    5.560e-028     0.090944    -27.2506
 >(w)FeOHSeO3--      4.728e-029    4.681e-029    0.0082707    -28.3253
 >(w)FeSeO4-         1.551e-053    1.536e-053     0.090944    -52.8093
 >(w)FeOHSeO4--      5.080e-054    5.030e-054    0.0082707    -53.2941
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
 Se(black)          0.0000 sat    Realgar           -1.9154
 Hematite           0.0000 sat    Siderite          -1.9576
 Pyrite             0.0000 sat    Rhodochrosite     -2.0332
 MnHPO4(c)         -0.3500        Anhydrite         -2.0420
 Goethite          -0.4676        Bassanite         -2.6729
 FeSe2             -1.3691        CaSO4^1/2H2O(bet  -2.8502
 Gypsum            -1.7956        Calcite           -2.9530
  (only minerals with log Q/K > -3 listed)

 Gases                fugacity      log fug.
-----------------------------------------------
 CO2(g)                 0.07974      -1.098
 Steam                  0.02023      -1.694
 H2S(g)              4.910e-009      -8.309
 H2(g)               5.438e-010      -9.265
 CH4(g)              6.667e-015     -14.176
 S2(g)               3.792e-025     -24.421
 O2(g)               9.525e-068     -67.021

                                 In fluid             Sorbed             Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
 >(s)FeOH        0.000170
 >(w)FeOH         0.00679
 As(OH)4-       1.51e-007  1.99e-009  0.000287  1.49e-007    0.0215
 Ca++             0.00144    0.00143      57.9  1.28e-005     0.516
 Cl-              0.00764    0.00764      273.
 Fe++            0.000173   0.000172      9.68 -7.89e-030-4.45e-025
 Fe+++             0.0339  1.00e-011 5.66e-007
 H+               -0.0921    0.00347      3.53    0.00626      6.37
 H2O                 55.0       55.0 9.99e+005   -0.00434     -78.8
 HCO3-            0.00756    0.00384      237.    0.00371      229.
 HPO4--          0.000116  5.50e-008   0.00533   0.000116      11.2
 K+              0.000116   0.000116      4.59
 Mg++            0.000546   0.000546      13.4
 Mn++            0.000123   0.000123      6.81
 Na+              0.00479    0.00479      111.
 O2(aq)        -1.50e-005 -1.52e-009-4.91e-005  2.23e-014 7.19e-010
 SO4--            0.00189    0.00123      120.   0.000652      63.2
 SeO3--         1.00e-005  2.57e-012 3.29e-007  5.80e-028 7.43e-023

 Sorbed               fraction    log fraction
```

As(OH)4-	0.9868	-0.006
Ca++	0.008829	-2.054
HCO3-	0.4913	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-007	1.992e-009	0.0001506	1.492e-007	0.01129
Calcium	0.001445	0.001432	57.93	1.276e-005	0.5160
Carbon	0.007557	0.003845	46.61	0.003713	45.01
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001418	1.442
Iron	0.03411	0.0001717	9.679	-2.367e-030	-1.334e-025
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009874	159.5
Phosphorus	0.0001159	5.501e-008	0.001720	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.568e-012	2.047e-007	5.801e-028	4.623e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001235	39.96	0.0006519	21.10

```
        Step #   100            Xi = 1.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.404              log fO2 =  -67.021
        Eh =  -0.0494 volts      pe =  -0.8549
        Ionic strength      =    0.012780
        Activity of water   =    0.999732
        Solvent mass        =    0.991012 kg
        Solution mass       =    0.991779 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007706 molal
        Dissolved solids    =         773 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       18.93 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.16 uC/cm2
          Surface potential =        61.6 mV
          Surface area      =   1.63e+007 cm2

Nernst redox couples                                Eh (volts)     pe
----------------------------------------------------------------------------
 e-  + .25*O2(aq)  + H+  = .5*H2O                     -0.0494   -0.8549
 e-  + Fe+++  = Fe++                                   0.0680    1.1763

                        moles        moles          grams          cm3
Reactants             remaining     reacted        reacted        reacted
----------------------------------------------------------------------------
 H2O                 6.993e-017       0.05551         1.000

Minerals in system     moles      log moles      grams        volume (cm3)
----------------------------------------------------------------------------
 Hematite               0.01697     -1.770          2.710           0.5137
 Pyrite              1.428e-006     -5.845      0.0001713       3.419e-005
 Se(black)           1.000e-005     -5.000      0.0007896
                                               ___________    _____________
        (total)                                     2.711          0.5137*

Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
---------------------------------------------------------------------------
 Cl-                   0.007662         271.4      0.8899       -2.1664
 Na+                   0.004810         110.5      0.8932       -2.3669
 CO2(aq)               0.003493         153.6      1.0000       -2.4568
 Ca++                  0.001288         51.60      0.6525       -3.0753
 SO4--                 0.001059         101.6      0.6348       -3.1725
 Mg++                 0.0005088         12.36      0.6686       -3.4683
 HCO3-                0.0003774         23.01      0.8948       -3.4714
 Fe++                 0.0001598         8.920      0.6525       -3.9817
 K+                   0.0001169         4.566      0.8899       -3.9830
 Mn++                 0.0001145         6.286      0.6525       -4.1266
 CaSO4                0.0001142         15.54      1.0000       -3.9423
 CaCl+               3.740e-005         2.823      0.8932       -4.4762
 MgSO4               3.717e-005         4.470      1.0000       -4.4299
 NaSO4-              1.536e-005         1.827      0.8932       -4.8626
 FeSO4               1.107e-005         1.681      1.0000       -4.9558
 MnSO4               8.585e-006         1.295      1.0000       -5.0663
 CaHCO3+             4.918e-006        0.4968      0.8970       -5.3554
 H+                  4.344e-006      0.004375      0.9075       -5.4043
 MgCl+               4.083e-006        0.2438      0.8932       -5.4381
 NaHCO3              2.253e-006        0.1891      1.0000       -5.6472
 FeCl+               1.421e-006        0.1297      0.8932       -5.8963
 MgHCO3+             1.285e-006        0.1096      0.8932       -5.9400
 FeHCO3+             9.390e-007        0.1097      0.8932       -6.0764
 NaCl                6.290e-007       0.03673      1.0000       -6.2013
 KSO4-               5.440e-007       0.07347      0.8932       -6.3134
 MnHCO3+             5.112e-007       0.05923      0.8932       -6.3405
 MnCl+               3.616e-007       0.03266      0.8932       -6.4908
 HSO4-               2.365e-007       0.02293      0.8932       -6.6753
 H2PO4-              5.054e-008      0.004898      0.8932       -7.3454
 KCl                 1.653e-008      0.001231      1.0000       -7.7818
  (only species > 1e-8 molal listed)

Surface species       molality       moles     Boltzman fct. log molality
```

```
---------------------------------------------------------------------------
 >(w)FeOCO2H          0.003495      0.003464        1.0000     -2.4565
 >(w)FeOH2+           0.002036      0.002018        10.998     -2.6912
 >(w)FeSO4-          0.0005118     0.0005072      0.090922     -3.2909
 >(w)FeOH            0.0002914     0.0002888        1.0000     -3.5356
 >(w)FeOCO2-         0.0002507     0.0002484      0.090922     -3.6009
 >(w)FeOHSO4--       0.0001461     0.0001448     0.0082668     -3.8354
 >(s)FeOH2+          0.0001385     0.0001373        10.998     -3.8585
 >(w)FeHPO4-        8.697e-005    8.618e-005      0.090922     -4.0607
 >(w)FeH2PO4        2.476e-005    2.454e-005        1.0000     -4.6062
 >(s)FeOH           1.982e-005    1.964e-005        1.0000     -4.7029
 >(s)FeOHCa++       1.285e-005    1.274e-005        120.97     -4.8909
 >(w)FePO4--        5.187e-006    5.141e-006     0.0082668     -5.2851
 >(w)FeO-           9.551e-007    9.465e-007      0.090922     -6.0200
 >(w)FeH2AsO3       1.506e-007    1.492e-007        1.0000     -6.8222
 >(s)FeO-           6.496e-008    6.438e-008      0.090922     -7.1873
 >(w)FeOCa+         7.981e-009    7.909e-009        10.998     -8.0980
 >(w)FeHAsO4-       2.101e-014    2.082e-014      0.090922    -13.6776
 >(w)FeOHAsO4---    1.921e-014    1.903e-014    0.00075164    -13.7165
 >(w)FeH2AsO4       4.751e-015    4.708e-015        1.0000    -14.3232
 >(w)FeSeO3-        5.613e-028    5.562e-028      0.090922    -27.2508
 >(w)FeOHSeO3--     4.728e-029    4.685e-029     0.0082668    -28.3253
 >(w)FeSeO4-        1.550e-053    1.536e-053      0.090922    -52.8098
 >(w)FeOHSeO4--     5.078e-054    5.033e-054     0.0082668    -53.2943
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
 Se(black)          0.0000 sat    Realgar            -1.9155
 Hematite           0.0000 sat    Siderite           -1.9581
 Pyrite             0.0000 sat    Rhodochrosite      -2.0336
 MnHPO4(c)         -0.3505        Anhydrite          -2.0427
 Goethite          -0.4676        Bassanite          -2.6735
 FeSe2             -1.3690        CaSO4^1/2H2O(bet  -2.8509
 Gypsum            -1.7962        Calcite            -2.9534
  (only minerals with log Q/K > -3 listed)

Gases                fugacity      log fug.
-----------------------------------------------
 CO2(g)                0.07967      -1.099
 Steam                 0.02023      -1.694
 H2S(g)             4.912e-009      -8.309
 H2(g)              5.440e-010      -9.264
 CH4(g)             6.672e-015     -14.176
 S2(g)              3.791e-025     -24.421
 O2(g)              9.517e-068     -67.021

                                   In fluid             Sorbed             Kd
Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
 >(s)FeOH        0.000170
 >(w)FeOH         0.00679
 As(OH)4-       1.51e-007  1.99e-009  0.000287  1.49e-007    0.0215
 Ca++             0.00144    0.00143      57.9  1.27e-005     0.515
 Cl-              0.00764    0.00764      273.
 Fe++            0.000173   0.000172      9.67 -7.10e-030-4.00e-025
 Fe+++             0.0339  1.00e-011 5.66e-007
 H+               -0.0921    0.00347      3.52    0.00626      6.36
 H2O                 55.1       55.0 9.99e+005   -0.00434     -78.8
 HCO3-            0.00756    0.00385      237.    0.00371      228.
 HPO4--          0.000116  5.50e-008   0.00532   0.000116      11.2
 K+              0.000116   0.000116      4.59
 Mg++            0.000546   0.000546      13.4
 Mn++            0.000123   0.000123      6.81
 Na+              0.00479    0.00479      111.
 O2(aq)        -1.50e-005 -1.52e-009-4.91e-005  2.23e-014 7.19e-010
 SO4--            0.00189    0.00123      120.   0.000652      63.1
 SeO3--         1.00e-005  2.57e-012 3.29e-007  5.80e-028 7.43e-023

Sorbed                fraction    log fraction
```

As(OH)4-	0.9868	-0.006
Ca++	0.008823	-2.054
HCO3-	0.4912	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-007	1.992e-009	0.0001505	1.492e-007	0.01127
Calcium	0.001445	0.001432	57.87	1.275e-005	0.5151
Carbon	0.007557	0.003845	46.57	0.003712	44.96
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001418	1.441
Iron	0.03411	0.0001717	9.670	-1.578e-030	-8.884e-026
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009873	159.3
Phosphorus	0.0001159	5.502e-008	0.001718	0.0001159	3.618
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.573e-012	2.048e-007	5.804e-028	4.621e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001890	0.001235	39.92	0.0006519	21.07

0.0001116 total moles arsenic

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012796
Activity of water   =    0.999732
Solvent mass        =    0.990012 kg
Solution mass       =    0.990780 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007712 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.16 uC/cm2
  Surface potential =        61.6 mV
  Surface area      =   1.63e+007 cm2

Nernst redox couples                                Eh (volts)     pe
----------------------------------------------------------------------------
 e-  + .25*O2(aq)  + H+  = .5*H2O                     -0.0030   -0.0519
 e-  + Fe+++  = Fe++                                   0.0685    1.1851

                       moles        moles         grams         cm3
Reactants            remaining     reacted       reacted       reacted
----------------------------------------------------------------------------
 H2O                   0.05551       0.0000        0.0000

Minerals in system     moles      log moles      grams        volume (cm3)
----------------------------------------------------------------------------
 Hematite              0.01697     -1.770          2.710          0.5137
                                             _____________  _____________
        (total)                                    2.710          0.5137

Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
---------------------------------------------------------------------------
 Cl-                  0.007668         271.6       0.8898       -2.1660
 Na+                  0.004815         110.6       0.8932       -2.3665
```

CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.746e-005	2.827	0.8932	-4.4755
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004418	0.9074	-5.4000
MgCl+	4.089e-006	0.2442	0.8932	-5.4374
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
As(OH)3	1.515e-006	0.1906	1.0000	-5.8196
FeCl+	1.436e-006	0.1310	0.8932	-5.8920
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.301e-007	0.03680	1.0000	-6.2006
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05892	0.8932	-6.3428
MnCl+	3.622e-007	0.03271	0.8932	-6.4901
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.655e-008	0.001233	1.0000	-7.7811

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003436	0.003402	1.0000	-2.4639
>(w)FeOH2+	0.002016	0.001995	10.992	-2.6956
>(w)FeSO4-	0.0005058	0.0005007	0.090974	-3.2960
>(w)FeOH	0.0002854	0.0002826	1.0000	-3.5445
>(w)FeOCO2-	0.0002439	0.0002414	0.090974	-3.6128
>(w)FeOHSO4--	0.0001429	0.0001414	0.0082762	-3.8451

>(s)FeOH2+	0.0001389	0.0001375	10.992	-3.8573
>(w)FeH2AsO3	0.0001112	0.0001101	1.0000	-3.9540
>(w)FeHPO4-	8.518e-005	8.433e-005	0.090974	-4.0696
>(w)FeH2PO4	2.451e-005	2.426e-005	1.0000	-4.6107
>(s)FeOH	1.967e-005	1.947e-005	1.0000	-4.7062
>(s)FeOHCa++	1.278e-005	1.266e-005	120.83	-4.8933
>(w)FePO4--	5.029e-006	4.978e-006	0.0082762	-5.2986
>(w)FeO-	9.259e-007	9.166e-007	0.090974	-6.0334
>(s)FeO-	6.381e-008	6.317e-008	0.090974	-7.1951
>(w)FeOCa+	7.753e-009	7.675e-009	10.992	-8.1105
>(w)FeHAsO4-	6.074e-010	6.013e-010	0.090974	-9.2165
>(w)FeOHAsO4---	5.439e-010	5.385e-010	0.00075292	-9.2645
>(w)FeH2AsO4	1.388e-010	1.374e-010	1.0000	-9.8576
>(w)FeSeO3-	1.325e-016	1.312e-016	0.090974	-15.8779
>(w)FeOHSeO3--	1.104e-017	1.093e-017	0.0082762	-16.9569
>(w)FeSeO4-	1.447e-040	1.433e-040	0.090974	-39.8394
>(w)FeOHSeO4--	4.694e-041	4.647e-041	0.0082762	-40.3284

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9611
Se(black)	8.1916s/sat	Rhodochrosite	-2.0402
Hematite	0.0000 sat	Anhydrite	-2.0424
FeSe	-0.2231	Bassanite	-2.6733
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8507
Goethite	-0.4676	Calcite	-2.9600
Gypsum	-1.7960		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.041e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.000112	1.50e-006	0.216	0.000110	15.9	
Ca++	0.00144	0.00143	57.9	1.27e-005	0.512	
Cl-	0.00763	0.00763	273.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00628	6.39	
H2O	55.6	55.5	1.01e+006	-0.00448	-81.4	
HCO3-	0.00749	0.00385	237.	0.00364	224.	
HPO4--	0.000114	5.50e-008	0.00533	0.000114	11.0	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	6.39e-010	2.06e-005	
SO4--	0.00188	0.00123	120.	0.000642	62.3	
SeO3--	1.00e-005	1.00e-005	1.28	1.42e-016	1.82e-011	

Sorbed	fraction	log fraction
As(OH)4-	0.9866	-0.006
Ca++	0.008765	-2.057
HCO3-	0.4861	-0.313
HPO4--	0.9995	-0.000
SO4--	0.3423	-0.466
SeO3--	1.421e-011	-10.847

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
Arsenic	0.0001116	1.500e-006	0.1134	0.0001101	8.323
Calcium	0.001445	0.001432	57.93	1.266e-005	0.5123
Carbon	0.007495	0.003851	46.69	0.003643	44.17
Chlorine	0.007635	0.007635	273.2		
Hydrogen	109.9	109.9	1.118e+005	0.001519	1.545
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		

Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009916	160.1
Phosphorus	0.0001136	5.500e-008	0.001719	0.0001136	3.551
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.421e-016	1.132e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001876	0.001234	39.92	0.0006422	20.78

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.405              log fO2 =  -66.600
Eh =  -0.0433 volts      pe =  -0.7502
Ionic strength      =    0.012796
Activity of water   =    0.999732
Solvent mass        =    0.990012 kg
Solution mass       =    0.990779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007712 molal
Dissolved solids    =         774 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.97 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.15 uC/cm2
  Surface potential =        61.5 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0433	-0.7502
e- + Fe+++ = Fe++	0.0676	1.1700

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137

Realgar	2.221e-006	-5.653	0.0002376	6.620e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007668	271.6	0.8898	-2.1660
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003493	153.6	1.0000	-2.4568
Ca++	0.001290	51.65	0.6524	-3.0751
SO4--	0.001061	101.8	0.6346	-3.1719
Mg++	0.0005093	12.37	0.6685	-3.4679
HCO3-	0.0003782	23.06	0.8948	-3.4706
Fe++	0.0001613	9.002	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1263
CaSO4	0.0001144	15.57	1.0000	-3.9414
CaCl+	3.745e-005	2.827	0.8932	-4.4756
MgSO4	3.724e-005	4.479	1.0000	-4.4289
NaSO4-	1.540e-005	1.832	0.8932	-4.8616
FeSO4	1.119e-005	1.698	1.0000	-4.9512
MnSO4	8.603e-006	1.298	1.0000	-5.0653
CaHCO3+	4.931e-006	0.4981	0.8970	-5.3543
H+	4.336e-006	0.004367	0.9074	-5.4051
MgCl+	4.089e-006	0.2441	0.8932	-5.4375
NaHCO3	2.260e-006	0.1897	1.0000	-5.6460
As(OH)3	1.477e-006	0.1858	1.0000	-5.8307
FeCl+	1.435e-006	0.1310	0.8932	-5.8921
MgHCO3+	1.289e-006	0.1099	0.8932	-5.9388
FeHCO3+	9.494e-007	0.1109	0.8932	-6.0716
NaCl	6.301e-007	0.03680	1.0000	-6.2006
KSO4-	5.453e-007	0.07365	0.8932	-6.3124
MnHCO3+	5.126e-007	0.05939	0.8932	-6.3393
MnCl+	3.621e-007	0.03271	0.8932	-6.4902
HSO4-	2.364e-007	0.02293	0.8932	-6.6755
H2PO4-	5.057e-008	0.004900	0.8932	-7.3452
KCl	1.655e-008	0.001233	1.0000	-7.7811

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality

>(w)FeOCO2H	0.003443	0.003409	1.0000	-2.4631
>(w)FeOH2+	0.002012	0.001991	10.946	-2.6965
>(w)FeSO4-	0.0005014	0.0004964	0.091358	-3.2998
>(w)FeOH	0.0002870	0.0002841	1.0000	-3.5421
>(w)FeOCO2-	0.0002462	0.0002437	0.091358	-3.6087
>(w)FeOHSO4--	0.0001427	0.0001413	0.0083462	-3.8456
>(s)FeOH2+	0.0001386	0.0001372	10.946	-3.8582
>(w)FeH2AsO3	0.0001090	0.0001079	1.0000	-3.9627
>(w)FeHPO4-	8.529e-005	8.444e-005	0.091358	-4.0691
>(w)FeH2PO4	2.435e-005	2.411e-005	1.0000	-4.6134
>(s)FeOH	1.978e-005	1.958e-005	1.0000	-4.7039
>(s)FeOHCa++	1.296e-005	1.283e-005	119.82	-4.8874
>(w)FePO4--	5.073e-006	5.022e-006	0.0083462	-5.2948
>(w)FeO-	9.380e-007	9.286e-007	0.091358	-6.0278
>(s)FeO-	6.464e-008	6.399e-008	0.091358	-7.1895
>(w)FeOCa+	7.918e-009	7.839e-009	10.946	-8.1014
>(w)FeHAsO4-	2.464e-011	2.439e-011	0.091358	-10.6084
>(w)FeOHAsO4---	2.239e-011	2.217e-011	0.00076249	-10.6499
>(w)FeH2AsO4	5.588e-012	5.532e-012	1.0000	-11.2528
>(w)FeSeO3-	1.456e-027	1.442e-027	0.091358	-26.8368
>(w)FeOHSeO3--	1.223e-028	1.211e-028	0.0083462	-27.9125
>(w)FeSeO4-	6.535e-053	6.470e-053	0.091358	-52.1847
>(w)FeOHSeO4--	2.135e-053	2.114e-053	0.0083462	-52.6705

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Hematite	0.0000	sat	Gypsum	-1.7953
Se(black)	0.0000	sat	Siderite	-1.9525
Realgar	0.0000	sat	Rhodochrosite	-2.0317
MnHPO4(c)	-0.3492		Anhydrite	-2.0418
Goethite	-0.4676		Bassanite	-2.6726
Orpiment	-0.5456		CaSO4^1/2H2O(bet	-2.8500
Pyrite	-1.4732		Calcite	-2.9515
FeSe2	-1.5747			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.07968	-1.099
Steam	0.02023	-1.694
H2S(g)	7.021e-010	-9.154
H2(g)	3.347e-010	-9.475
CH4(g)	9.560e-016	-15.020
S2(g)	2.046e-026	-25.689
O2(g)	2.514e-067	-66.600

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.000112	1.46e-006	0.211	0.000108	15.6	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.519	
Cl-	0.00763	0.00763	273.			
Fe++	0.000173	0.000173	9.76	1.80e-069	1.01e-064	
Fe+++	0.0339	1.00e-011	5.65e-007			
H+	-0.0921	0.00346	3.52	0.00627	6.38	
H2O	55.0	55.0	9.99e+005	-0.00448	-81.4	
HCO3-	0.00749	0.00384	237.	0.00365	225.	
HPO4--	0.000114	5.50e-008	0.00533	0.000114	11.0	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-2.19e-010	-7.08e-006	2.60e-011	8.41e-007	
SO4--	0.00188	0.00124	120.	0.000638	61.8	
SeO3--	1.00e-005	1.58e-012	2.03e-007	1.56e-027	2.00e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9866	-0.006
Ca++	0.008885	-2.051
HCO3-	0.4873	-0.312
HPO4--	0.9995	-0.000
SO4--	0.3404	-0.468

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg

Arsenic	0.0001116	1.462e-006	0.1106	0.0001079	8.157
Calcium	0.001445	0.001432	57.93	1.284e-005	0.5193
Carbon	0.007495	0.003842	46.58	0.003652	44.28
Chlorine	0.007635	0.007635	273.2		
Hydrogen	109.9	109.9	1.118e+005	0.001514	1.541
Iron	0.03411	0.0001732	9.760	1.796e-069	1.012e-064
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009916	160.1
Phosphorus	0.0001136	5.502e-008	0.001720	0.0001136	3.551
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.584e-012	1.262e-007	1.563e-027	1.245e-022
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001876	0.001236	39.99	0.0006377	20.64

```
Step #   100             Xi = 1.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.405              log fO2 =  -66.600
Eh =  -0.0434 volts      pe =  -0.7505
Ionic strength      =    0.012783
Activity of water   =    0.999732
Solvent mass        =    0.991012 kg
Solution mass       =    0.991779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007704 molal
Dissolved solids    =         773 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.95 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.15 uC/cm2
  Surface potential =        61.5 mV
  Surface area      =   1.63e+007 cm2
```

```
 Nernst redox couples                                Eh (volts)     pe
---------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                      -0.0434   -0.7505
  e-  + Fe+++  = Fe++                                    0.0676    1.1699
```

```
                        moles        moles         grams          cm3
```

Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.221e-006	-5.653	0.0002376	6.620e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007660	271.4	0.8898	-2.1665
Na+	0.004810	110.5	0.8932	-2.3669
CO2(aq)	0.003490	153.5	1.0000	-2.4572
Ca++	0.001288	51.60	0.6525	-3.0754
SO4--	0.001060	101.7	0.6347	-3.1722
Mg++	0.0005088	12.36	0.6686	-3.4683
HCO3-	0.0003780	23.04	0.8948	-3.4708
Fe++	0.0001612	8.993	0.6525	-3.9782
K+	0.0001169	4.566	0.8898	-3.9830
Mn++	0.0001145	6.286	0.6525	-4.1266
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.738e-005	2.822	0.8932	-4.4763
MgSO4	3.719e-005	4.472	1.0000	-4.4296
NaSO4-	1.537e-005	1.828	0.8932	-4.8623
FeSO4	1.117e-005	1.696	1.0000	-4.9519
MnSO4	8.590e-006	1.296	1.0000	-5.0660
CaHCO3+	4.924e-006	0.4974	0.8970	-5.3549
H+	4.335e-006	0.004366	0.9074	-5.4052
MgCl+	4.081e-006	0.2437	0.8932	-5.4382
NaHCO3	2.256e-006	0.1894	1.0000	-5.6466
As(OH)3	1.476e-006	0.1857	1.0000	-5.8310
FeCl+	1.433e-006	0.1307	0.8932	-5.8928
MgHCO3+	1.287e-006	0.1097	0.8932	-5.9394
FeHCO3+	9.481e-007	0.1107	0.8932	-6.0722
NaCl	6.289e-007	0.03672	1.0000	-6.2014
KSO4-	5.444e-007	0.07352	0.8932	-6.3131
MnHCO3+	5.119e-007	0.05931	0.8932	-6.3399

MnCl+	3.615e-007	0.03265	0.8932	-6.4910
HSO4-	2.361e-007	0.02290	0.8932	-6.6759
H2PO4-	5.052e-008	0.004896	0.8932	-7.3456
KCl	1.652e-008	0.001231	1.0000	-7.7819

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003439	0.003408	1.0000	-2.4636
>(w)FeOH2+	0.002010	0.001992	10.949	-2.6968
>(w)FeSO4-	0.0005009	0.0004964	0.091336	-3.3003
>(w)FeOH	0.0002869	0.0002843	1.0000	-3.5423
>(w)FeOCO2-	0.0002460	0.0002438	0.091336	-3.6090
>(w)FeOHSO4--	0.0001426	0.0001413	0.0083423	-3.8458
>(s)FeOH2+	0.0001385	0.0001372	10.949	-3.8586
>(w)FeH2AsO3	0.0001089	0.0001079	1.0000	-3.9632
>(w)FeHPO4-	8.521e-005	8.445e-005	0.091336	-4.0695
>(w)FeH2PO4	2.432e-005	2.410e-005	1.0000	-4.6141
>(s)FeOH	1.977e-005	1.959e-005	1.0000	-4.7041
>(s)FeOHCa++	1.294e-005	1.282e-005	119.87	-4.8882
>(w)FePO4--	5.071e-006	5.025e-006	0.0083423	-5.2949
>(w)FeO-	9.382e-007	9.298e-007	0.091336	-6.0277
>(s)FeO-	6.464e-008	6.406e-008	0.091336	-7.1895
>(w)FeOCa+	7.910e-009	7.839e-009	10.949	-8.1018
>(w)FeHAsO4-	2.461e-011	2.439e-011	0.091336	-10.6088
>(w)FeOHAsO4---	2.240e-011	2.220e-011	0.00076195	-10.6498
>(w)FeH2AsO4	5.579e-012	5.529e-012	1.0000	-11.2534
>(w)FeSeO3-	1.455e-027	1.442e-027	0.091336	-26.8370
>(w)FeOHSeO3--	1.223e-028	1.212e-028	0.0083423	-27.9126
>(w)FeSeO4-	6.528e-053	6.469e-053	0.091336	-52.1852
>(w)FeOHSeO4--	2.134e-053	2.115e-053	0.0083423	-52.6708

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Hematite	0.0000	sat	Gypsum	-1.7960
Se(black)	0.0000	sat	Siderite	-1.9530
Realgar	0.0000	sat	Rhodochrosite	-2.0321
MnHPO4(c)	-0.3498		Anhydrite	-2.0424
Goethite	-0.4676		Bassanite	-2.6733

Orpiment	-0.5456	CaSO4^1/2H2O(bet	-2.8506
Pyrite	-1.4731	Calcite	-2.9519
FeSe2	-1.5745		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07960	-1.099
Steam	0.02023	-1.694
H2S(g)	7.024e-010	-9.153
H2(g)	3.348e-010	-9.475
CH4(g)	9.569e-016	-15.019
S2(g)	2.046e-026	-25.689
O2(g)	2.512e-067	-66.600

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.000112	1.46e-006	0.211	0.000108	15.5	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.518	
Cl-	0.00763	0.00763	273.			
Fe++	0.000173	0.000173	9.75	1.80e-069	1.01e-064	
Fe+++	0.0339	1.00e-011	5.64e-007			
H+	-0.0921	0.00346	3.52	0.00627	6.37	
H2O	55.1	55.0	9.99e+005	-0.00448	-81.3	
HCO3-	0.00749	0.00384	236.	0.00365	225.	
HPO4--	0.000114	5.50e-008	0.00532	0.000114	11.0	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-2.19e-010	-7.08e-006	2.61e-011	8.41e-007	
SO4--	0.00188	0.00124	120.	0.000638	61.8	
SeO3--	1.00e-005	1.59e-012	2.03e-007	1.56e-027	2.00e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9866	-0.006
Ca++	0.008879	-2.052

HCO3-	0.4873	-0.312
HPO4--	0.9995	-0.000
SO4--	0.3404	-0.468

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001116	1.463e-006	0.1105	0.0001079	8.149
Calcium	0.001445	0.001432	57.87	1.283e-005	0.5184
Carbon	0.007495	0.003843	46.54	0.003652	44.23
Chlorine	0.007635	0.007635	272.9		
Hydrogen	110.0	110.0	1.118e+005	0.001515	1.539
Iron	0.03411	0.0001732	9.750	1.796e-069	1.011e-064
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009915	159.9
Phosphorus	0.0001136	5.502e-008	0.001718	0.0001136	3.547
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	1.587e-012	1.263e-007	1.563e-027	1.245e-022
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001876	0.001236	39.95	0.0006377	20.62

0.002429 total moles arsenic

```
          Step #     0              Xi = 0.0000
          Temperature =  18.0 C     Pressure =  1.013 bars
          pH =  5.400               log fO2 =  -63.827
          Eh =  -0.0030 volts       pe =  -0.0519
          Ionic strength      =     0.012771
          Activity of water   =     0.999733
          Solvent mass        =     0.990013 kg
          Solution mass       =     0.990785 kg
          Solution density    =     1.018    g/cm3
          Chlorinity          =     0.007662 molal
          Dissolved solids    =          779 mg/kg sol'n
          Rock mass           =     0.002710 kg
          Carbonate alkalinity=        18.81 mg/kg as CaCO3
          HFO sorbing surface:
            Surface charge    =         5.86 uC/cm2
            Surface potential =         58.6 mV
            Surface area      =    1.63e+007 cm2

 Nernst redox couples                                 Eh (volts)     pe
----------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                      -0.0030   -0.0519
  e-  + Fe+++  = Fe++                                    0.0685    1.1850

                        moles        moles         grams         cm3
 Reactants            remaining     reacted       reacted       reacted
----------------------------------------------------------------------------
  H2O                    0.05551      0.0000        0.0000

 Minerals in system     moles      log moles      grams        volume (cm3)
----------------------------------------------------------------------------
  Hematite               0.01697     -1.770          2.710          0.5137
                                              -------------  -------------
        (total)                                      2.710          0.5137

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
---------------------------------------------------------------------------
  Cl-                   0.007618         269.9       0.8899        -2.1688
  Na+                   0.004815         110.6       0.8933        -2.3664
  CO2(aq)               0.003505         154.1       1.0000        -2.4553
  Ca++                  0.001290         51.67       0.6526        -3.0747
  SO4--                 0.001059         101.6       0.6348        -3.1726
  Mg++                 0.0005094         12.37       0.6687        -3.4677
  HCO3-                0.0003751         22.87       0.8949        -3.4741
  Fe++                 0.0001613         9.003       0.6526        -3.9776
  K+                   0.0001170         4.570       0.8899        -3.9825
  Mn++                 0.0001146         6.293       0.6526        -4.1260
  CaSO4                0.0001143         15.55       1.0000        -3.9418
  As(OH)3              5.050e-005        6.355       1.0000        -4.2967
  CaCl+                3.723e-005        2.810       0.8933        -4.4781
  MgSO4                3.720e-005        4.474       1.0000        -4.4294
  NaSO4-               1.537e-005        1.829       0.8933        -4.8622
  FeSO4                1.118e-005        1.696       1.0000        -4.9517
  HSe-                 9.878e-006       0.7893       0.8933        -5.0544
  MnSO4                8.594e-006        1.297       1.0000        -5.0658
  CaHCO3+              4.894e-006       0.4944       0.8971        -5.3575
  H+                   4.387e-006     0.004418       0.9075        -5.4000
  MgCl+                4.064e-006       0.2427       0.8933        -5.4401
  NaHCO3               2.241e-006       0.1881       1.0000        -5.6495
  FeCl+                1.427e-006       0.1302       0.8933        -5.8946
  MgHCO3+              1.279e-006       0.1090       0.8933        -5.9422
  FeHCO3+              9.421e-007       0.1100       0.8933        -6.0749
  NaCl                 6.261e-007      0.03656       1.0000        -6.2034
  KSO4-                5.445e-007      0.07353       0.8933        -6.3130
  MnHCO3+              5.086e-007      0.05893       0.8933        -6.3426
  MnCl+                3.599e-007      0.03251       0.8933        -6.4928
  HSO4-                2.388e-007      0.02316       0.8933        -6.6711
  H2Se                 2.231e-007      0.01805       1.0000        -6.6515
  H2PO4-               5.057e-008     0.004900       0.8933        -7.3452
  KCl                  1.645e-008     0.001225       1.0000        -7.7839
   (only species > 1e-8 molal listed)
```

```
 Surface species       molality       moles     Boltzman fct. log molality
----------------------------------------------------------------------------
  >(w)FeH2AsO3          0.002403      0.002379        1.0000     -2.6193
  >(w)FeOCO2H           0.002228      0.002206        1.0000     -2.6521
  >(w)FeOH2+            0.001466      0.001451        9.7999     -2.8339
  >(w)FeSO4-           0.0002924     0.0002895       0.10204     -3.5340
  >(w)FeOH             0.0001850     0.0001832        1.0000     -3.7327
  >(w)FeOCO2-          0.0001410     0.0001396       0.10204     -3.8509
  >(s)FeOH2+           0.0001394     0.0001380        9.7999     -3.8558
  >(w)FeOHSO4--       7.364e-005    7.291e-005      0.010412     -4.1329
  >(w)FeHPO4-         4.924e-005    4.875e-005       0.10204     -4.3077
  >(s)FeOH            1.760e-005    1.742e-005        1.0000     -4.7546
  >(w)FeH2PO4         1.589e-005    1.573e-005        1.0000     -4.7989
  >(s)FeOHCa++        1.440e-005    1.425e-005        96.039     -4.8418
  >(w)FePO4--         2.592e-006    2.566e-006      0.010412     -5.5864
  >(w)FeO-            5.352e-007    5.298e-007       0.10204     -6.2715
  >(s)FeO-            5.089e-008    5.038e-008       0.10204     -7.2934
  >(w)FeHAsO4-        1.170e-008    1.159e-008       0.10204     -7.9317
  >(w)FeOHAsO4---     8.329e-009    8.246e-009     0.0010625     -8.0794
  >(w)FeOCa+          5.640e-009    5.584e-009        9.7999     -8.2487
  >(w)FeH2AsO4        3.000e-009    2.970e-009        1.0000     -8.5229
  >(w)FeSeO3-         7.658e-017    7.582e-017       0.10204    -16.1159
  >(w)FeOHSeO3--      5.692e-018    5.635e-018      0.010412    -17.2448
  >(w)FeSeO4-         8.367e-041    8.284e-041       0.10204    -40.0774
  >(w)FeOHSeO4--      2.419e-041    2.395e-041      0.010412    -40.6163
   (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
  FeSe2            13.4109s/sat   Siderite          -1.9609
  Se(black)         8.1917s/sat   Rhodochrosite     -2.0401
  Hematite          0.0000 sat    Anhydrite         -2.0421
  FeSe             -0.2229        Bassanite         -2.6730
  MnHPO4(c)        -0.3540        CaSO4^1/2H2O(bet  -2.8504
  Goethite         -0.4676        Calcite           -2.9598
  Gypsum           -1.7957
   (only minerals with log Q/K > -3 listed)

 Gases                  fugacity      log fug.
-----------------------------------------------
  CO2(g)                 0.07996      -1.097
  Steam                  0.02023      -1.694
  H2(g)               1.375e-011     -10.862
  H2S(g)              2.042e-015     -14.690
  CH4(g)              2.730e-021     -20.564
  S2(g)               1.026e-034     -33.989
  O2(g)               1.491e-064     -63.827

                                  In fluid             Sorbed            Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
--------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-         0.00243  5.00e-005      7.21    0.00238      343.
  Ca++             0.00145    0.00143      57.9  1.43e-005     0.577
  Cl-              0.00759    0.00759      271.
  Fe++            0.000173   0.000173      9.76
  Fe+++             0.0339  1.01e-011 5.71e-007
  H+                 -1.21      -1.11-1.13e+003    0.00654      6.66
  H2O                 55.6       55.5 1.01e+006   -0.00746     -136.
  HCO3-            0.00620    0.00385      237.    0.00235      144.
  HPO4--         6.71e-005  5.50e-008   0.00533  6.70e-005      6.49
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)            -0.279     -0.279-9.01e+003  1.14e-008  0.000368
  SO4--            0.00160    0.00123      120.   0.000362      35.1
  SeO3--         1.00e-005  1.00e-005      1.28  8.15e-017 1.04e-011
```

Sorbed	fraction	log fraction
As(OH)4-	0.9794	-0.009
Ca++	0.009857	-2.006
HCO3-	0.3785	-0.422
HPO4--	0.9992	-0.000
SO4--	0.2271	-0.644
SeO3--	8.145e-012	-11.089

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002429	5.000e-005	3.781	0.002379	179.9
Calcium	0.001446	0.001432	57.93	1.426e-005	0.5767
Carbon	0.006197	0.003851	46.69	0.002345	28.43
Chlorine	0.007585	0.007585	271.4		
Hydrogen	109.9	109.9	1.118e+005	0.003551	3.612
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01081	174.5
Phosphorus	6.710e-005	5.500e-008	0.001719	6.705e-005	2.096
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	8.145e-017	6.491e-012
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001596	0.001234	39.92	0.0003624	11.73

```
        Step #     0             Xi = 0.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.406              log fO2 =  -65.921
        Eh =  -0.0336 volts      pe =  -0.5818
        Ionic strength      =    0.012770
        Activity of water   =    0.999733
        Solvent mass        =    0.990013 kg
        Solution mass       =    0.990784 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007662 molal
        Dissolved solids    =         778 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       19.02 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        5.85 uC/cm2
          Surface potential =        58.5 mV
          Surface area      =   1.63e+007 cm2

 Nernst redox couples                                Eh (volts)     pe
-----------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                     -0.0336   -0.5818
  e-  + Fe+++  = Fe++                                   0.0673    1.1659

                          moles        moles          grams          cm3
 Reactants              remaining     reacted        reacted        reacted
-----------------------------------------------------------------------------
  H2O                     0.05551       0.0000         0.0000

 Minerals in system     moles      log moles      grams         volume (cm3)
-----------------------------------------------------------------------------
  Hematite              0.01697     -1.770          2.710          0.5137
  Realgar             2.217e-006    -5.654      0.0002372      6.607e-005
  Se(black)           1.000e-005    -5.000      0.0007896
                                              _____________  _____________
        (total)                                    2.711          0.5138*

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
----------------------------------------------------------------------------
  Cl-                   0.007618        269.9      0.8899       -2.1688
  Na+                   0.004815        110.6      0.8933       -2.3664
  CO2(aq)               0.003492        153.6      1.0000       -2.4569
  Ca++                  0.001290        51.65      0.6526       -3.0749
  SO4--                 0.001060        101.7      0.6349       -3.1721
  Mg++                 0.0005093        12.37      0.6687       -3.4678
  HCO3-                0.0003792        23.12      0.8949       -3.4693
  Fe++                 0.0001613        9.002      0.6526       -3.9777
  K+                   0.0001170        4.570      0.8899       -3.9825
  Mn++                 0.0001146        6.292      0.6526       -4.1261
  CaSO4                0.0001144        15.57      1.0000       -3.9414
  As(OH)3             5.012e-005        6.308      1.0000       -4.3000
  MgSO4               3.724e-005        4.479      1.0000       -4.4289
  CaCl+               3.722e-005        2.809      0.8933       -4.4782
  NaSO4-              1.539e-005        1.831      0.8933       -4.8617
  FeSO4               1.119e-005        1.698      1.0000       -4.9512
  MnSO4               8.603e-006        1.298      1.0000       -5.0653
  CaHCO3+             4.947e-006       0.4997      0.8971       -5.3529
  H+                  4.323e-006     0.004354      0.9075       -5.4064
  MgCl+               4.064e-006       0.2426      0.8933       -5.4401
  NaHCO3              2.266e-006       0.1902      1.0000       -5.6447
  FeCl+               1.427e-006       0.1302      0.8933       -5.8947
  MgHCO3+             1.293e-006       0.1102      0.8933       -5.9374
  FeHCO3+             9.524e-007       0.1112      0.8933       -6.0702
  NaCl                6.261e-007      0.03656      1.0000       -6.2034
  KSO4-               5.451e-007      0.07362      0.8933       -6.3125
  MnHCO3+             5.142e-007      0.05958      0.8933       -6.3379
  MnCl+               3.599e-007      0.03251      0.8933       -6.4928
  HSO4-               2.355e-007      0.02285      0.8933       -6.6769
  H2PO4-              5.058e-008     0.004902      0.8933       -7.3450
  KCl                 1.645e-008     0.001225      1.0000       -7.7839
   (only species > 1e-8 molal listed)
```

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.002401	0.002377	1.0000	-2.6197
>(w)FeOCO2H	0.002235	0.002212	1.0000	-2.6508
>(w)FeOH2+	0.001461	0.001447	9.7500	-2.8352
>(w)FeSO4-	0.0002890	0.0002861	0.10256	-3.5392
>(w)FeOH	0.0001863	0.0001844	1.0000	-3.7298
>(w)FeOCO2-	0.0001428	0.0001413	0.10256	-3.8454
>(s)FeOH2+	0.0001390	0.0001376	9.7500	-3.8570
>(w)FeOHSO4--	7.347e-005	7.273e-005	0.010519	-4.1339
>(w)FeHPO4-	4.933e-005	4.884e-005	0.10256	-4.3069
>(s)FeOH	1.772e-005	1.754e-005	1.0000	-4.7516
>(w)FeH2PO4	1.577e-005	1.561e-005	1.0000	-4.8022
>(s)FeOHCa++	1.464e-005	1.449e-005	95.062	-4.8345
>(w)FePO4--	2.621e-006	2.595e-006	0.010519	-5.5815
>(w)FeO-	5.440e-007	5.385e-007	0.10256	-6.2644
>(s)FeO-	5.174e-008	5.122e-008	0.10256	-7.2862
>(w)FeOCa+	5.790e-009	5.732e-009	9.7500	-8.2373
>(w)FeHAsO4-	1.060e-009	1.049e-009	0.10256	-8.9749
>(w)FeOHAsO4---	7.688e-010	7.611e-010	0.0010789	-9.1142
>(w)FeH2AsO4	2.690e-010	2.663e-010	1.0000	-9.5702
>(w)FeSeO3-	4.032e-027	3.992e-027	0.10256	-26.3944
>(w)FeOHSeO3--	3.026e-028	2.996e-028	0.010519	-27.5192
>(w)FeSeO4-	3.954e-052	3.915e-052	0.10256	-51.4030
>(w)FeOHSeO4--	1.154e-052	1.143e-052	0.010519	-51.9377

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Realgar	0.0000	sat	FeSe2	-1.9117
Hematite	0.0000	sat	Siderite	-1.9498
Se(black)	0.0000	sat	Rhodochrosite	-2.0290
MnHPO4(c)	-0.3476		Anhydrite	-2.0417
Goethite	-0.4676		Bassanite	-2.6726
Orpiment	-1.5661		CaSO4^1/2H2O(bet	-2.8500
Gypsum	-1.7953		Calcite	-2.9487

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07966	-1.099
Steam	0.02023	-1.694
H2(g)	1.532e-010	-9.815
H2S(g)	3.060e-011	-10.514
CH4(g)	4.193e-017	-16.377
S2(g)	1.856e-028	-27.731
O2(g)	1.201e-066	-65.921

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00243	4.96e-005	7.16	0.00238	343.	
Ca++	0.00145	0.00143	57.9	1.45e-005	0.587	
Cl-	0.00759	0.00759	271.			
Fe++	0.000173	0.000173	9.76	1.09e-068	6.12e-064	
Fe+++	0.0339	9.99e-012	5.63e-007			
H+	-0.0917	0.00351	3.57	0.00654	6.65	
H2O	55.0	55.0	9.99e+005	-0.00746	-136.	
HCO3-	0.00620	0.00384	237.	0.00235	145.	
HPO4--	6.71e-005	5.50e-008	0.00533	6.70e-005	6.49	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-7.53e-012	-2.43e-007	1.04e-009	3.35e-005	
SO4--	0.00160	0.00124	120.	0.000359	34.8	
SeO3--	1.00e-005	7.27e-013	9.32e-008	4.29e-027	5.50e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9795	-0.009
Ca++	0.01002	-1.999
HCO3-	0.3798	-0.420
HPO4--	0.9992	-0.000
SO4--	0.2251	-0.648
SeO3--	5.903e-015	-14.229

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002429	4.963e-005	3.753	0.002377	179.7
Calcium	0.001446	0.001432	57.92	1.450e-005	0.5865
Carbon	0.006197	0.003843	46.59	0.002354	28.53
Chlorine	0.007585	0.007585	271.4		
Hydrogen	109.9	109.9	1.118e+005	0.003546	3.607
Iron	0.03411	0.0001732	9.760	1.087e-068	6.124e-064
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.01081	174.6
Phosphorus	6.710e-005	5.504e-008	0.001721	6.705e-005	2.096
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	7.270e-013	5.794e-008	4.292e-027	3.420e-022
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001596	0.001235	39.96	0.0003588	11.61

```
Step #   100             Xi = 1.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.407              log fO2 =  -65.921
Eh =  -0.0336 volts      pe =  -0.5821
Ionic strength      =    0.012758
Activity of water   =    0.999734
Solvent mass        =    0.991013 kg
Solution mass       =    0.991784 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007654 molal
Dissolved solids    =         778 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       19.01 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        5.85 uC/cm2
  Surface potential =        58.5 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0336	-0.5821
e- + Fe+++ = Fe++	0.0673	1.1658

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.217e-006	-5.654	0.0002372	6.607e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007610	269.6	0.8899	-2.1692
Na+	0.004810	110.5	0.8933	-2.3668
CO2(aq)	0.003489	153.4	1.0000	-2.4573
Ca++	0.001289	51.60	0.6527	-3.0752
SO4--	0.001059	101.6	0.6350	-3.1724
Mg++	0.0005088	12.36	0.6688	-3.4681
HCO3-	0.0003790	23.11	0.8949	-3.4696
Fe++	0.0001612	8.994	0.6527	-3.9780
K+	0.0001169	4.566	0.8899	-3.9829
Mn++	0.0001145	6.286	0.6527	-4.1264
CaSO4	0.0001143	15.54	1.0000	-3.9421
As(OH)3	5.009e-005	6.303	1.0000	-4.3003
MgSO4	3.719e-005	4.472	1.0000	-4.4296
CaCl+	3.716e-005	2.804	0.8933	-4.4789
NaSO4-	1.537e-005	1.828	0.8933	-4.8625
FeSO4	1.117e-005	1.696	1.0000	-4.9519
MnSO4	8.590e-006	1.296	1.0000	-5.0660
CaHCO3+	4.940e-006	0.4990	0.8971	-5.3535
H+	4.321e-006	0.004352	0.9075	-5.4065
MgCl+	4.056e-006	0.2422	0.8933	-5.4409
NaHCO3	2.263e-006	0.1899	1.0000	-5.6454
FeCl+	1.424e-006	0.1299	0.8933	-5.8955
MgHCO3+	1.291e-006	0.1101	0.8933	-5.9380
FeHCO3+	9.510e-007	0.1111	0.8933	-6.0708
NaCl	6.249e-007	0.03649	1.0000	-6.2042
KSO4-	5.442e-007	0.07349	0.8933	-6.3133
MnHCO3+	5.134e-007	0.05949	0.8933	-6.3385
MnCl+	3.593e-007	0.03245	0.8933	-6.4936
HSO4-	2.353e-007	0.02282	0.8933	-6.6774
H2PO4-	5.053e-008	0.004897	0.8933	-7.3454
KCl	1.642e-008	0.001223	1.0000	-7.7847

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.002398	0.002377	1.0000	-2.6201
>(w)FeOCO2H	0.002232	0.002212	1.0000	-2.6513
>(w)FeOH2+	0.001460	0.001447	9.7523	-2.8356
>(w)FeSO4-	0.0002886	0.0002860	0.10254	-3.5397
>(w)FeOH	0.0001862	0.0001846	1.0000	-3.7299
>(w)FeOCO2-	0.0001427	0.0001414	0.10254	-3.8457
>(s)FeOH2+	0.0001389	0.0001376	9.7523	-3.8574
>(w)FeOHSO4--	7.343e-005	7.277e-005	0.010514	-4.1341
>(w)FeHPO4-	4.929e-005	4.885e-005	0.10254	-4.3072
>(s)FeOH	1.771e-005	1.755e-005	1.0000	-4.7518
>(w)FeH2PO4	1.574e-005	1.560e-005	1.0000	-4.8029
>(s)FeOHCa++	1.462e-005	1.448e-005	95.107	-4.8352
>(w)FePO4--	2.621e-006	2.597e-006	0.010514	-5.5816
>(w)FeO-	5.441e-007	5.392e-007	0.10254	-6.2643
>(s)FeO-	5.175e-008	5.128e-008	0.10254	-7.2861
>(w)FeOCa+	5.785e-009	5.733e-009	9.7523	-8.2377
>(w)FeHAsO4-	1.059e-009	1.049e-009	0.10254	-8.9753
>(w)FeOHAsO4---	7.690e-010	7.621e-010	0.0010782	-9.1141
>(w)FeH2AsO4	2.686e-010	2.662e-010	1.0000	-9.5709
>(w)FeSeO3-	4.030e-027	3.994e-027	0.10254	-26.3947
>(w)FeOHSeO3--	3.026e-028	2.998e-028	0.010514	-27.5192
>(w)FeSeO4-	3.950e-052	3.914e-052	0.10254	-51.4034
>(w)FeOHSeO4--	1.154e-052	1.143e-052	0.010514	-51.9379

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Realgar	0.0000 sat		FeSe2	-1.9115
Hematite	0.0000 sat		Siderite	-1.9502
Se(black)	0.0000 sat		Rhodochrosite	-2.0294
MnHPO4(c)	-0.3481		Anhydrite	-2.0424
Goethite	-0.4676		Bassanite	-2.6732
Orpiment	-1.5661		CaSO4^1/2H2O(bet	-2.8506
Gypsum	-1.7959		Calcite	-2.9492

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07959	-1.099
Steam	0.02023	-1.694
H2(g)	1.532e-010	-9.815
H2S(g)	3.062e-011	-10.514
CH4(g)	4.197e-017	-16.377
S2(g)	1.856e-028	-27.731
O2(g)	1.199e-066	-65.921

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	0.00243	4.96e-005	7.16	0.00238	343.	
Ca++	0.00145	0.00143	57.9	1.45e-005	0.586	
Cl-	0.00759	0.00759	271.			
Fe++	0.000173	0.000173	9.75	1.09e-068	6.12e-064	
Fe+++	0.0339	9.99e-012	5.63e-007			
H+	-0.0917	0.00351	3.57	0.00654	6.65	
H2O	55.0	55.0	9.99e+005	-0.00746	-136.	
HCO3-	0.00620	0.00384	236.	0.00235	145.	
HPO4--	6.71e-005	5.50e-008	0.00533	6.70e-005	6.49	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-7.55e-012	-2.43e-007	1.04e-009	3.35e-005	
SO4--	0.00160	0.00124	120.	0.000359	34.8	
SeO3--	1.00e-005	7.28e-013	9.32e-008	4.29e-027	5.50e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9795	-0.009
Ca++	0.01002	-1.999
HCO3-	0.3798	-0.420
HPO4--	0.9992	-0.000
SO4--	0.2251	-0.648
SeO3--	5.895e-015	-14.230

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002429	4.964e-005	3.750	0.002377	179.5
Calcium	0.001446	0.001432	57.87	1.449e-005	0.5856
Carbon	0.006197	0.003843	46.54	0.002353	28.50
Chlorine	0.007585	0.007585	271.1		
Hydrogen	110.0	110.0	1.118e+005	0.003546	3.604
Iron	0.03411	0.0001732	9.750	1.086e-068	6.117e-064
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.01081	174.4
Phosphorus	6.710e-005	5.505e-008	0.001719	6.705e-005	2.094
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	7.283e-013	5.799e-008	4.293e-027	3.418e-022
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001596	0.001235	39.92	0.0003588	11.60

3.760e-005 total moles arsenic

```
Step #      0               Xi = 0.0000
Temperature =  18.0 C     Pressure =  1.013 bars
pH =  5.400               log fO2 =  -63.827
Eh =  -0.0030 volts       pe =  -0.0519
Ionic strength      =    0.012797
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990780 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.17 uC/cm2
  Surface potential =        61.7 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1660
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4374
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
As(OH)3	5.050e-007	0.06355	1.0000	-6.2967
MnCl+	3.622e-007	0.03272	0.8932	-6.4901
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7811

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003475	0.003440	1.0000	-2.4591
>(w)FeOH2+	0.002033	0.002013	11.020	-2.6918
>(w)FeSO4-	0.0005128	0.0005076	0.090745	-3.2901
>(w)FeOH	0.0002886	0.0002857	1.0000	-3.5397
>(w)FeOCO2-	0.0002472	0.0002448	0.090745	-3.6069
>(w)FeOHSO4--	0.0001452	0.0001437	0.0082346	-3.8380
>(s)FeOH2+	0.0001389	0.0001375	11.020	-3.8574
>(w)FeHPO4-	8.636e-005	8.550e-005	0.090745	-4.0637
>(w)FeH2AsO3	3.747e-005	3.710e-005	1.0000	-4.4263
>(w)FeH2PO4	2.478e-005	2.453e-005	1.0000	-4.6059
>(s)FeOH	1.972e-005	1.952e-005	1.0000	-4.7052
>(s)FeOHCa++	1.275e-005	1.262e-005	121.44	-4.8945
>(w)FePO4--	5.111e-006	5.060e-006	0.0082346	-5.2915
>(w)FeO-	9.387e-007	9.293e-007	0.090745	-6.0275
>(s)FeO-	6.412e-008	6.348e-008	0.090745	-7.1930
>(w)FeOCa+	7.820e-009	7.742e-009	11.020	-8.1068
>(w)FeHAsO4-	2.053e-010	2.032e-010	0.090745	-9.6877
>(w)FeOHAsO4---	1.847e-010	1.829e-010	0.00074724	-9.7335
>(w)FeH2AsO4	4.679e-011	4.632e-011	1.0000	-10.3299
>(w)FeSeO3-	1.343e-016	1.330e-016	0.090745	-15.8719
>(w)FeOHSeO3--	1.122e-017	1.111e-017	0.0082346	-16.9498
>(w)FeSeO4-	1.467e-040	1.453e-040	0.090745	-39.8334
>(w)FeOHSeO4--	4.771e-041	4.723e-041	0.0082346	-40.3214

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9611
Se(black)	8.1916s/sat	Rhodochrosite	-2.0403
Hematite	0.0000 sat	Anhydrite	-2.0424
FeSe	-0.2231	Bassanite	-2.6733
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8507
Goethite	-0.4676	Calcite	-2.9600
Gypsum	-1.7960		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.041e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	3.76e-005	5.00e-007	0.0721	3.71e-005	5.35	
Ca++	0.00144	0.00143	57.9	1.26e-005	0.511	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00627	6.38	
H2O	55.6	55.5	1.01e+006	-0.00438	-79.7	
HCO3-	0.00754	0.00385	237.	0.00369	227.	
HPO4--	0.000115	5.50e-008	0.00533	0.000115	11.1	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	2.16e-010	6.98e-006	
SO4--	0.00189	0.00123	120.	0.000651	63.2	

SeO3--	1.00e-005	1.00e-005	1.28	1.44e-016	1.85e-011

Sorbed	fraction	log fraction
As(OH)4-	0.9867	-0.006
Ca++	0.008743	-2.058
HCO3-	0.4890	-0.311
HPO4--	0.9995	-0.000
SO4--	0.3456	-0.461
SeO3--	1.441e-011	-10.841

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.760e-005	5.000e-007	0.03781	3.710e-005	2.805
Calcium	0.001445	0.001432	57.93	1.263e-005	0.5110
Carbon	0.007536	0.003851	46.69	0.003685	44.67
Chlorine	0.007636	0.007636	273.2		
Hydrogen	109.9	109.9	1.118e+005	0.001453	1.479
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009887	159.7
Phosphorus	0.0001151	5.500e-008	0.001719	0.0001151	3.598
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.441e-016	1.148e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001885	0.001234	39.92	0.0006514	21.08

```
Step #     0              Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.405              log fO2 =  -66.819
Eh =  -0.0465 volts      pe =  -0.8052
Ionic strength      =    0.012796
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         774 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.96 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.15 uC/cm2
  Surface potential =        61.5 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0465	-0.8052
e- + Fe+++ = Fe++	0.0676	1.1701

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Realgar	2.221e-006	-5.653	0.0002376	6.620e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5138*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1660
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003493	153.6	1.0000	-2.4568
Ca++	0.001290	51.65	0.6524	-3.0751
SO4--	0.001061	101.8	0.6346	-3.1719
Mg++	0.0005093	12.37	0.6685	-3.4679
HCO3-	0.0003782	23.06	0.8948	-3.4706
Fe++	0.0001613	9.002	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1263
CaSO4	0.0001144	15.57	1.0000	-3.9414
CaCl+	3.746e-005	2.827	0.8932	-4.4755
MgSO4	3.724e-005	4.479	1.0000	-4.4289
NaSO4-	1.540e-005	1.832	0.8932	-4.8616
FeSO4	1.119e-005	1.698	1.0000	-4.9512
MnSO4	8.603e-006	1.298	1.0000	-5.0653
CaHCO3+	4.930e-006	0.4981	0.8970	-5.3543
H+	4.337e-006	0.004367	0.9074	-5.4050
MgCl+	4.089e-006	0.2442	0.8932	-5.4374
NaHCO3	2.259e-006	0.1897	1.0000	-5.6460
FeCl+	1.436e-006	0.1310	0.8932	-5.8920
MgHCO3+	1.289e-006	0.1099	0.8932	-5.9389
FeHCO3+	9.493e-007	0.1109	0.8932	-6.0716
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.453e-007	0.07365	0.8932	-6.3124
MnHCO3+	5.125e-007	0.05939	0.8932	-6.3393
As(OH)3	4.726e-007	0.05947	1.0000	-6.3255
MnCl+	3.622e-007	0.03271	0.8932	-6.4901
HSO4-	2.364e-007	0.02293	0.8932	-6.6754
H2PO4-	5.057e-008	0.004900	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7811

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003482	0.003447	1.0000	-2.4582
>(w)FeOH2+	0.002029	0.002009	10.974	-2.6927
>(w)FeSO4-	0.0005084	0.0005033	0.091126	-3.2938
>(w)FeOH	0.0002902	0.0002873	1.0000	-3.5373
>(w)FeOCO2-	0.0002496	0.0002471	0.091126	-3.6028
>(w)FeOHSO4--	0.0001450	0.0001436	0.0083039	-3.8385
>(s)FeOH2+	0.0001386	0.0001372	10.974	-3.8582
>(w)FeHPO4-	8.647e-005	8.561e-005	0.091126	-4.0631
>(w)FeH2AsO3	3.526e-005	3.491e-005	1.0000	-4.4527
>(w)FeH2PO4	2.463e-005	2.438e-005	1.0000	-4.6085
>(s)FeOH	1.982e-005	1.963e-005	1.0000	-4.7028
>(s)FeOHCa++	1.292e-005	1.279e-005	120.43	-4.8886
>(w)FePO4--	5.155e-006	5.104e-006	0.0083039	-5.2877
>(w)FeO-	9.508e-007	9.413e-007	0.091126	-6.0219
>(s)FeO-	6.495e-008	6.430e-008	0.091126	-7.1874
>(w)FeOCa+	7.986e-009	7.906e-009	10.974	-8.0977
>(w)FeHAsO4-	6.205e-012	6.143e-012	0.091126	-11.2073
>(w)FeOHAsO4---	5.668e-012	5.611e-012	0.00075670	-11.2466
>(w)FeH2AsO4	1.404e-012	1.390e-012	1.0000	-11.8527
>(w)FeSeO3-	8.899e-028	8.810e-028	0.091126	-27.0507
>(w)FeOHSeO3--	7.492e-029	7.417e-029	0.0083039	-28.1254
>(w)FeSeO4-	3.100e-053	3.069e-053	0.091126	-52.5086
>(w)FeOHSeO4--	1.016e-053	1.005e-053	0.0083039	-52.9933

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Se(black)	0.0000	sat	Gypsum	-1.7953
Realgar	0.0000	sat	Siderite	-1.9526
Hematite	0.0000	sat	Rhodochrosite	-2.0317
Orpiment	-0.2160		Anhydrite	-2.0418
MnHPO4(c)	-0.3492		Bassanite	-2.6726
Goethite	-0.4676		CaSO4^1/2H2O(bet	-2.8500
Pyrite	-0.7037		Calcite	-2.9515
FeSe2	-1.4647			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07968	-1.099
Steam	0.02023	-1.694
H2S(g)	1.933e-009	-8.714
H2(g)	4.311e-010	-9.365
CH4(g)	2.631e-015	-14.580
S2(g)	9.347e-026	-25.029
O2(g)	1.516e-067	-66.819

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	3.76e-005	4.68e-007	0.0675	3.49e-005	5.04	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.518	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.76	8.52e-070	4.80e-065	
Fe+++	0.0339	1.00e-011	5.65e-007			
H+	-0.0921	0.00346	3.52	0.00626	6.37	
H2O	55.0	55.0	9.99e+005	-0.00438	-79.7	
HCO3-	0.00754	0.00384	237.	0.00369	227.	
HPO4--	0.000115	5.50e-008	0.00533	0.000115	11.1	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-6.00e-010	-1.94e-005	6.57e-012	2.12e-007	
SO4--	0.00189	0.00124	120.	0.000647	62.7	
SeO3--	1.00e-005	2.04e-012	2.61e-007	9.55e-028	1.22e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008861	-2.052
HCO3-	0.4902	-0.310
HPO4--	0.9995	-0.000
SO4--	0.3436	-0.464

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.760e-005	4.679e-007	0.03538	3.491e-005	2.640
Calcium	0.001445	0.001432	57.93	1.280e-005	0.5179
Carbon	0.007536	0.003842	46.58	0.003694	44.78
Chlorine	0.007636	0.007636	273.2		
Hydrogen	109.9	109.9	1.118e+005	0.001449	1.474
Iron	0.03411	0.0001732	9.760	8.519e-070	4.802e-065
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009888	159.7
Phosphorus	0.0001151	5.502e-008	0.001720	0.0001151	3.598
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.040e-012	1.626e-007	9.552e-028	7.612e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001885	0.001236	39.99	0.0006469	20.93

```
         Step #   100              Xi = 1.0000
         Temperature =  18.0 C     Pressure =  1.013 bars
         pH =  5.405               log fO2 =  -66.820
         Eh =  -0.0465 volts       pe =  -0.8054
         Ionic strength      =    0.012784
         Activity of water   =    0.999732
         Solvent mass        =    0.991012 kg
         Solution mass       =    0.991779 kg
         Solution density    =    1.018    g/cm3
         Chlorinity          =    0.007705 molal
         Dissolved solids    =         773 mg/kg sol'n
         Rock mass           =    0.002711 kg
         Carbonate alkalinity=       18.95 mg/kg as CaCO3
         HFO sorbing surface:
           Surface charge    =        6.16 uC/cm2
           Surface potential =        61.6 mV
           Surface area      =   1.63e+007 cm2

 Nernst redox couples                                  Eh (volts)     pe
---------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                       -0.0465   -0.8054
  e-  + Fe+++  = Fe++                                     0.0676    1.1700

                          moles        moles          grams          cm3
 Reactants              remaining     reacted        reacted        reacted
---------------------------------------------------------------------------
  H2O                  6.993e-017       0.05551         1.000

 Minerals in system     moles      log moles      grams        volume (cm3)
---------------------------------------------------------------------------
  Hematite               0.01697     -1.770          2.710          0.5137
  Realgar              2.221e-006    -5.653      0.0002376      6.620e-005
  Se(black)            1.000e-005    -5.000      0.0007896
                                                 ___________   _____________
        (total)                                      2.711          0.5138*

 Aqueous species       molality   mg/kg sol'n    act. coef.     log act.
--------------------------------------------------------------------------
  Cl-                    0.007661         271.4      0.8898       -2.1664
  Na+                    0.004810         110.5      0.8932       -2.3669
  CO2(aq)                0.003490         153.5      1.0000       -2.4572
  Ca++                   0.001288         51.60      0.6525       -3.0754
  SO4--                  0.001060         101.7      0.6347       -3.1722
  Mg++                  0.0005088         12.36      0.6686       -3.4683
  HCO3-                 0.0003779         23.04      0.8948       -3.4708
  Fe++                  0.0001612         8.993      0.6525       -3.9782
  K+                    0.0001169         4.566      0.8898       -3.9830
  Mn++                  0.0001145         6.286      0.6525       -4.1266
  CaSO4                 0.0001143         15.54      1.0000       -3.9421
  CaCl+                3.739e-005         2.822      0.8932       -4.4763
  MgSO4                3.719e-005         4.472      1.0000       -4.4296
  NaSO4-               1.537e-005         1.828      0.8932       -4.8623
  FeSO4                1.117e-005         1.696      1.0000       -4.9519
  MnSO4                8.590e-006         1.296      1.0000       -5.0660
  CaHCO3+              4.924e-006        0.4974      0.8970       -5.3549
  H+                   4.335e-006      0.004366      0.9074       -5.4052
  MgCl+                4.082e-006        0.2437      0.8932       -5.4382
  NaHCO3               2.256e-006        0.1894      1.0000       -5.6467
  FeCl+                1.433e-006        0.1307      0.8932       -5.8928
  MgHCO3+              1.287e-006        0.1097      0.8932       -5.9395
  FeHCO3+              9.480e-007        0.1107      0.8932       -6.0722
  NaCl                 6.290e-007       0.03673      1.0000       -6.2014
  KSO4-                5.444e-007       0.07352      0.8932       -6.3131
  MnHCO3+              5.118e-007       0.05930      0.8932       -6.3399
  As(OH)3              4.723e-007       0.05943      1.0000       -6.3258
  MnCl+                3.615e-007       0.03265      0.8932       -6.4909
  HSO4-                2.361e-007       0.02290      0.8932       -6.6759
  H2PO4-               5.052e-008      0.004896      0.8932       -7.3456
  KCl                  1.652e-008      0.001231      1.0000       -7.7819
   (only species > 1e-8 molal listed)
```

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003478	0.003446	1.0000	-2.4587
>(w)FeOH2+	0.002027	0.002009	10.976	-2.6931
>(w)FeSO4-	0.0005078	0.0005033	0.091104	-3.2943
>(w)FeOH	0.0002901	0.0002875	1.0000	-3.5374
>(w)FeOCO2-	0.0002494	0.0002472	0.091104	-3.6031
>(w)FeOHSO4--	0.0001450	0.0001437	0.0083000	-3.8387
>(s)FeOH2+	0.0001385	0.0001372	10.976	-3.8587
>(w)FeHPO4-	8.639e-005	8.561e-005	0.091104	-4.0635
>(w)FeH2AsO3	3.523e-005	3.491e-005	1.0000	-4.4531
>(w)FeH2PO4	2.459e-005	2.437e-005	1.0000	-4.6092
>(s)FeOH	1.981e-005	1.964e-005	1.0000	-4.7030
>(s)FeOHCa++	1.290e-005	1.279e-005	120.48	-4.8893
>(w)FePO4--	5.154e-006	5.107e-006	0.0083000	-5.2879
>(w)FeO-	9.511e-007	9.426e-007	0.091104	-6.0218
>(s)FeO-	6.496e-008	6.437e-008	0.091104	-7.1874
>(w)FeOCa+	7.978e-009	7.907e-009	10.976	-8.0981
>(w)FeHAsO4-	6.199e-012	6.144e-012	0.091104	-11.2077
>(w)FeOHAsO4---	5.669e-012	5.618e-012	0.00075616	-11.2465
>(w)FeH2AsO4	1.402e-012	1.389e-012	1.0000	-11.8533
>(w)FeSeO3-	8.893e-028	8.813e-028	0.091104	-27.0510
>(w)FeOHSeO3--	7.492e-029	7.424e-029	0.0083000	-28.1254
>(w)FeSeO4-	3.097e-053	3.069e-053	0.091104	-52.5091
>(w)FeOHSeO4--	1.015e-053	1.006e-053	0.0083000	-52.9935

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7960
Realgar	0.0000 sat	Siderite	-1.9530
Hematite	0.0000 sat	Rhodochrosite	-2.0322
Orpiment	-0.2159	Anhydrite	-2.0424
MnHPO4(c)	-0.3498	Bassanite	-2.6733
Goethite	-0.4676	CaSO4^1/2H2O(bet	-2.8506
Pyrite	-0.7035	Calcite	-2.9520
FeSe2	-1.4646		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07960	-1.099
Steam	0.02023	-1.694
H2S(g)	1.934e-009	-8.714
H2(g)	4.313e-010	-9.365
CH4(g)	2.634e-015	-14.579
S2(g)	9.347e-026	-25.029
O2(g)	1.514e-067	-66.820

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	3.76e-005	4.68e-007	0.0675	3.49e-005	5.03	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.517	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.75	8.52e-070	4.80e-065	
Fe+++	0.0339	1.00e-011	5.64e-007			
H+	-0.0921	0.00346	3.52	0.00626	6.37	
H2O	55.1	55.0	9.99e+005	-0.00438	-79.6	
HCO3-	0.00754	0.00384	236.	0.00369	227.	
HPO4--	0.000115	5.50e-008	0.00532	0.000115	11.1	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-6.01e-010	-1.94e-005	6.58e-012	2.12e-007	
SO4--	0.00189	0.00124	120.	0.000647	62.7	
SeO3--	1.00e-005	2.04e-012	2.62e-007	9.56e-028	1.22e-022	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008855	-2.053
HCO3-	0.4901	-0.310
HPO4--	0.9995	-0.000
SO4--	0.3436	-0.464

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.760e-005	4.681e-007	0.03536	3.491e-005	2.637
Calcium	0.001445	0.001432	57.87	1.279e-005	0.5170
Carbon	0.007536	0.003843	46.54	0.003694	44.73
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001449	1.473
Iron	0.03411	0.0001732	9.750	8.518e-070	4.797e-065
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009887	159.5
Phosphorus	0.0001151	5.502e-008	0.001718	0.0001151	3.594
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.044e-012	1.627e-007	9.555e-028	7.607e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001885	0.001236	39.95	0.0006469	20.91

7.562e-009 total moles arsenic

```
Step #     0              Xi = 0.0000
Temperature =  18.0 C     Pressure =  1.013 bars
pH =  5.400               log fO2 =  -63.827
Eh =  -0.0030 volts       pe =  -0.0519
Ionic strength      =     0.012797
Activity of water   =     0.999731
Solvent mass        =     0.990012 kg
Solution mass       =     0.990780 kg
Solution density    =     1.018    g/cm3
Chlorinity          =     0.007713 molal
Dissolved solids    =          775 mg/kg sol'n
Rock mass           =     0.002710 kg
Carbonate alkalinity=        18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =         6.17 uC/cm2
  Surface potential =         61.7 mV
  Surface area      =    1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
MnCl+	3.623e-007	0.03272	0.8932	-6.4900
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003495	0.003460	1.0000	-2.4566
>(w)FeOH2+	0.002042	0.002022	11.034	-2.6899
>(w)FeSO4-	0.0005163	0.0005111	0.090630	-3.2871
>(w)FeOH	0.0002903	0.0002874	1.0000	-3.5372
>(w)FeOCO2-	0.0002490	0.0002465	0.090630	-3.6039
>(w)FeOHSO4--	0.0001464	0.0001449	0.0082138	-3.8345
>(s)FeOH2+	0.0001389	0.0001375	11.034	-3.8574
>(w)FeHPO4-	8.696e-005	8.609e-005	0.090630	-4.0607
>(w)FeH2PO4	2.492e-005	2.467e-005	1.0000	-4.6034
>(s)FeOH	1.974e-005	1.954e-005	1.0000	-4.7046
>(s)FeOHCa++	1.273e-005	1.261e-005	121.75	-4.8950
>(w)FePO4--	5.153e-006	5.101e-006	0.0082138	-5.2880
>(w)FeO-	9.452e-007	9.357e-007	0.090630	-6.0245
>(s)FeO-	6.428e-008	6.364e-008	0.090630	-7.1919
>(w)FeOCa+	7.854e-009	7.776e-009	11.034	-8.1049
>(w)FeH2AsO3	7.537e-009	7.462e-009	1.0000	-8.1228
>(w)FeHAsO4-	4.134e-014	4.092e-014	0.090630	-13.3837
>(w)FeOHAsO4---	3.730e-014	3.692e-014	0.00074442	-13.4283
>(w)FeH2AsO4	9.410e-015	9.316e-015	1.0000	-14.0264
>(w)FeSeO3-	1.352e-016	1.339e-016	0.090630	-15.8689
>(w)FeOHSeO3--	1.132e-017	1.120e-017	0.0082138	-16.9463
>(w)FeSeO4-	1.478e-040	1.463e-040	0.090630	-39.8304
>(w)FeOHSeO4--	4.810e-041	4.762e-041	0.0082138	-40.3178

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	13.4107s/sat	Siderite	-1.9611
Se(black)	8.1916s/sat	Rhodochrosite	-2.0403
Hematite	0.0000 sat	Anhydrite	-2.0424
FeSe	-0.2231	Bassanite	-2.6733
MnHPO4(c)	-0.3542	CaSO4^1/2H2O(bet	-2.8507
Goethite	-0.4676	Calcite	-2.9600
Gypsum	-1.7960		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07996	-1.097
Steam	0.02023	-1.694
H2(g)	1.375e-011	-10.862
H2S(g)	2.041e-015	-14.690
CH4(g)	2.730e-021	-20.564
S2(g)	1.026e-034	-33.989
O2(g)	1.491e-064	-63.827

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-009	1.00e-010	1.44e-005	7.46e-009	0.00108	
Ca++	0.00144	0.00143	57.9	1.26e-005	0.510	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000173	9.76			
Fe+++	0.0339	1.01e-011	5.71e-007			
H+	-1.21	-1.11	-1.13e+003	0.00626	6.37	
H2O	55.6	55.5	1.01e+006	-0.00433	-78.8	
HCO3-	0.00756	0.00385	237.	0.00371	228.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-0.279	-0.279	-9.01e+003	4.36e-014	1.41e-009	
SO4--	0.00189	0.00123	120.	0.000656	63.6	
SeO3--	1.00e-005	1.00e-005	1.28	1.45e-016	1.86e-011	

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008731	-2.059
HCO3-	0.4904	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3472	-0.459
SeO3--	1.451e-011	-10.838

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-009	1.000e-010	7.562e-006	7.462e-009	0.0005643
Calcium	0.001445	0.001432	57.93	1.261e-005	0.5103
Carbon	0.007558	0.003851	46.69	0.003706	44.93
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001420	1.445
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009873	159.4
Phosphorus	0.0001159	5.500e-008	0.001719	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.451e-016	1.156e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001234	39.92	0.0006561	21.23

```
        Step #     0              Xi = 0.0000
        Temperature =  18.0 C     Pressure =  1.013 bars
        pH =  5.404               log fO2 =  -67.021
        Eh =  -0.0494 volts       pe =  -0.8547
        Ionic strength      =    0.012792
        Activity of water   =    0.999731
        Solvent mass        =    0.990012 kg
        Solution mass       =    0.990779 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007713 molal
        Dissolved solids    =         774 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       18.94 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.16 uC/cm2
          Surface potential =        61.6 mV
          Surface area      =   1.63e+007 cm2

 Nernst redox couples                              Eh (volts)     pe
---------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                    -0.0494   -0.8547
  e-  + Fe+++  = Fe++                                  0.0680    1.1764

                        moles        moles         grams          cm3
 Reactants            remaining     reacted       reacted       reacted
---------------------------------------------------------------------------
  H2O                   0.05551       0.0000        0.0000

 Minerals in system     moles      log moles      grams        volume (cm3)
---------------------------------------------------------------------------
  Hematite              0.01697     -1.770         2.710          0.5137
  Pyrite              1.428e-006    -5.845       0.0001713      3.419e-005
  Se(black)           1.000e-005    -5.000       0.0007896
                                              ____________   _____________
        (total)                                   2.711          0.5137*

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
--------------------------------------------------------------------------
  Cl-                    0.007669         271.7      0.8898       -2.1659
  Na+                    0.004815         110.6      0.8932       -2.3664
  CO2(aq)                0.003496         153.7      1.0000       -2.4565
  Ca++                   0.001290         51.65      0.6524       -3.0750
  SO4--                  0.001060         101.7      0.6346       -3.1722
  Mg++                  0.0005093         12.37      0.6685       -3.4679
  HCO3-                 0.0003777         23.03      0.8948       -3.4712
  Fe++                  0.0001600         8.928      0.6524       -3.9814
  K+                    0.0001170         4.570      0.8898       -3.9826
  Mn++                  0.0001146         6.292      0.6524       -4.1262
  CaSO4                 0.0001144         15.56      1.0000       -3.9417
  CaCl+                3.746e-005         2.828      0.8932       -4.4755
  MgSO4                3.722e-005         4.477      1.0000       -4.4292
  NaSO4-               1.539e-005         1.830      0.8932       -4.8619
  FeSO4                1.109e-005         1.683      1.0000       -4.9551
  MnSO4                8.598e-006         1.297      1.0000       -5.0656
  CaHCO3+              4.924e-006        0.4975      0.8970       -5.3549
  H+                   4.346e-006      0.004377      0.9074       -5.4041
  MgCl+                4.090e-006        0.2442      0.8932       -5.4373
  NaHCO3               2.256e-006        0.1894      1.0000       -5.6466
  FeCl+                1.424e-006        0.1299      0.8932       -5.8955
  MgHCO3+              1.287e-006        0.1097      0.8932       -5.9394
  FeHCO3+              9.403e-007        0.1098      0.8932       -6.0758
  NaCl                 6.302e-007       0.03680      1.0000       -6.2005
  KSO4-                5.450e-007       0.07360      0.8932       -6.3127
  MnHCO3+              5.119e-007       0.05931      0.8932       -6.3399
  MnCl+                3.622e-007       0.03272      0.8932       -6.4900
  HSO4-                2.367e-007       0.02296      0.8932       -6.6748
  H2PO4-               5.058e-008      0.004902      0.8932       -7.3451
  KCl                  1.656e-008      0.001233      1.0000       -7.7810
   (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
```

>(w)FeOCO2H	0.003500	0.003465	1.0000	-2.4560
>(w)FeOH2+	0.002038	0.002018	10.996	-2.6908
>(w)FeSO4-	0.0005124	0.0005073	0.090943	-3.2904
>(w)FeOH	0.0002915	0.0002885	1.0000	-3.5354
>(w)FeOCO2-	0.0002508	0.0002483	0.090943	-3.6006
>(w)FeOHSO4--	0.0001462	0.0001447	0.0082706	-3.8352
>(s)FeOH2+	0.0001386	0.0001373	10.996	-3.8581
>(w)FeHPO4-	8.705e-005	8.618e-005	0.090943	-4.0602
>(w)FeH2PO4	2.480e-005	2.455e-005	1.0000	-4.6056
>(s)FeOH	1.983e-005	1.963e-005	1.0000	-4.7027
>(s)FeOHCa++	1.288e-005	1.275e-005	120.91	-4.8902
>(w)FePO4--	5.189e-006	5.137e-006	0.0082706	-5.2849
>(w)FeO-	9.548e-007	9.453e-007	0.090943	-6.0201
>(s)FeO-	6.495e-008	6.431e-008	0.090943	-7.1874
>(w)FeOCa+	7.989e-009	7.909e-009	10.996	-8.0975
>(w)FeH2AsO3	7.538e-009	7.462e-009	1.0000	-8.1228
>(w)FeHAsO4-	1.051e-015	1.041e-015	0.090943	-14.9782
>(w)FeOHAsO4---	9.602e-016	9.506e-016	0.00075216	-15.0177
>(w)FeH2AsO4	2.379e-016	2.355e-016	1.0000	-15.6236
>(w)FeSeO3-	5.616e-028	5.560e-028	0.090943	-27.2506
>(w)FeOHSeO3--	4.728e-029	4.681e-029	0.0082706	-28.3253
>(w)FeSeO4-	1.551e-053	1.536e-053	0.090943	-52.8093
>(w)FeOHSeO4--	5.081e-054	5.030e-054	0.0082706	-53.2941

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Pyrite	0.0000 sat		Siderite	-1.9576
Hematite	0.0000 sat		Rhodochrosite	-2.0332
Se(black)	0.0000 sat		Anhydrite	-2.0420
MnHPO4(c)	-0.3500		Bassanite	-2.6729
Goethite	-0.4676		CaSO4^1/2H2O(bet	-2.8502
FeSe2	-1.3691		Calcite	-2.9530
Gypsum	-1.7956			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07974	-1.098
Steam	0.02023	-1.694
H2S(g)	4.910e-009	-8.309
H2(g)	5.438e-010	-9.265
CH4(g)	6.667e-015	-14.176
S2(g)	3.792e-025	-24.421
O2(g)	9.525e-068	-67.021

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-009	9.96e-011	1.44e-005	7.46e-009	0.00108	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.516	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000172	9.68	1.48e-031	8.34e-027	
Fe+++	0.0339	1.00e-011	5.66e-007			
H+	-0.0921	0.00347	3.53	0.00626	6.37	
H2O	55.0	55.0	9.99e+005	-0.00434	-78.8	
HCO3-	0.00756	0.00384	237.	0.00371	229.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-1.52e-009	-4.91e-005	1.11e-015	3.60e-011	
SO4--	0.00189	0.00123	120.	0.000652	63.2	
SeO3--	1.00e-005	2.57e-012	3.29e-007	6.03e-028	7.72e-023	

Sorbed fraction log fraction

As(OH)4-	0.9868	-0.006
Ca++	0.008829	-2.054
HCO3-	0.4913	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-009	9.959e-011	7.531e-006	7.462e-009	0.0005643
Calcium	0.001445	0.001432	57.93	1.276e-005	0.5160
Carbon	0.007558	0.003845	46.61	0.003713	45.01
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001418	1.442
Iron	0.03411	0.0001717	9.679	3.451e-031	1.945e-026
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009874	159.5
Phosphorus	0.0001159	5.501e-008	0.001720	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.568e-012	2.047e-007	6.028e-028	4.804e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001235	39.96	0.0006520	21.10

```
         Step #   100             Xi = 1.0000
         Temperature =  18.0 C    Pressure =  1.013 bars
         pH =  5.404              log fO2 =  -67.021
         Eh =  -0.0494 volts      pe =  -0.8549
         Ionic strength      =    0.012780
         Activity of water   =    0.999732
         Solvent mass        =    0.991012 kg
         Solution mass       =    0.991779 kg
         Solution density    =    1.018    g/cm3
         Chlorinity          =    0.007706 molal
         Dissolved solids    =         773 mg/kg sol'n
         Rock mass           =    0.002711 kg
         Carbonate alkalinity=       18.93 mg/kg as CaCO3
         HFO sorbing surface:
           Surface charge    =        6.16 uC/cm2
           Surface potential =        61.6 mV
           Surface area      =   1.63e+007 cm2

 Nernst redox couples                               Eh (volts)     pe
---------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                     -0.0494   -0.8549
  e-  + Fe+++  = Fe++                                   0.0680    1.1763

                         moles        moles          grams          cm3
 Reactants             remaining     reacted        reacted        reacted
---------------------------------------------------------------------------
  H2O                 6.993e-017      0.05551         1.000

 Minerals in system     moles      log moles      grams        volume (cm3)
---------------------------------------------------------------------------
  Hematite              0.01697     -1.770          2.710           0.5137
  Pyrite              1.428e-006    -5.845      0.0001713       3.419e-005
  Se(black)           1.000e-005    -5.000      0.0007896
                                               ___________    _____________
        (total)                                     2.711           0.5137*

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
--------------------------------------------------------------------------
  Cl-                   0.007662         271.4      0.8899       -2.1664
  Na+                   0.004810         110.5      0.8932       -2.3669
  CO2(aq)               0.003493         153.6      1.0000       -2.4568
  Ca++                  0.001288         51.60      0.6525       -3.0753
  SO4--                 0.001059         101.6      0.6348       -3.1725
  Mg++                 0.0005088         12.36      0.6686       -3.4683
  HCO3-                0.0003774         23.01      0.8948       -3.4714
  Fe++                 0.0001598         8.920      0.6525       -3.9817
  K+                   0.0001169         4.566      0.8899       -3.9830
  Mn++                 0.0001145         6.286      0.6525       -4.1266
  CaSO4                0.0001142         15.54      1.0000       -3.9423
  CaCl+               3.740e-005         2.823      0.8932       -4.4762
  MgSO4               3.717e-005         4.470      1.0000       -4.4299
  NaSO4-              1.536e-005         1.827      0.8932       -4.8626
  FeSO4               1.107e-005         1.681      1.0000       -4.9558
  MnSO4               8.585e-006         1.295      1.0000       -5.0663
  CaHCO3+             4.918e-006        0.4968      0.8970       -5.3554
  H+                  4.344e-006      0.004375      0.9075       -5.4043
  MgCl+               4.083e-006        0.2438      0.8932       -5.4381
  NaHCO3              2.253e-006        0.1891      1.0000       -5.6472
  FeCl+               1.421e-006        0.1297      0.8932       -5.8963
  MgHCO3+             1.285e-006        0.1096      0.8932       -5.9400
  FeHCO3+             9.390e-007        0.1097      0.8932       -6.0764
  NaCl                6.290e-007       0.03673      1.0000       -6.2013
  KSO4-               5.440e-007       0.07347      0.8932       -6.3134
  MnHCO3+             5.112e-007       0.05923      0.8932       -6.3405
  MnCl+               3.616e-007       0.03266      0.8932       -6.4908
  HSO4-               2.365e-007       0.02293      0.8932       -6.6753
  H2PO4-              5.054e-008      0.004898      0.8932       -7.3454
  KCl                 1.653e-008      0.001231      1.0000       -7.7818
   (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
```

```
---------------------------------------------------------------------------
  >(w)FeOCO2H          0.003495      0.003464        1.0000     -2.4565
  >(w)FeOH2+           0.002036      0.002018        10.998     -2.6911
  >(w)FeSO4-          0.0005118     0.0005072      0.090922     -3.2909
  >(w)FeOH            0.0002914     0.0002888        1.0000     -3.5355
  >(w)FeOCO2-         0.0002507     0.0002484      0.090922     -3.6009
  >(w)FeOHSO4--       0.0001461     0.0001448     0.0082667     -3.8354
  >(s)FeOH2+          0.0001385     0.0001373        10.998     -3.8585
  >(w)FeHPO4-        8.697e-005    8.619e-005      0.090922     -4.0606
  >(w)FeH2PO4        2.476e-005    2.454e-005        1.0000     -4.6062
  >(s)FeOH           1.982e-005    1.964e-005        1.0000     -4.7029
  >(s)FeOHCa++       1.285e-005    1.274e-005        120.97     -4.8909
  >(w)FePO4--        5.187e-006    5.141e-006     0.0082667     -5.2850
  >(w)FeO-           9.551e-007    9.465e-007      0.090922     -6.0199
  >(s)FeO-           6.496e-008    6.438e-008      0.090922     -7.1873
  >(w)FeOCa+         7.981e-009    7.909e-009        10.998     -8.0980
  >(w)FeH2AsO3       7.530e-009    7.462e-009        1.0000     -8.1232
  >(w)FeHAsO4-       1.050e-015    1.041e-015      0.090922    -14.9786
  >(w)FeOHAsO4---    9.604e-016    9.518e-016    0.00075163    -15.0175
  >(w)FeH2AsO4       2.376e-016    2.354e-016        1.0000    -15.6242
  >(w)FeSeO3-        5.613e-028    5.563e-028      0.090922    -27.2508
  >(w)FeOHSeO3--     4.728e-029    4.685e-029     0.0082667    -28.3253
  >(w)FeSeO4-        1.550e-053    1.536e-053      0.090922    -52.8098
  >(w)FeOHSeO4--     5.078e-054    5.033e-054     0.0082667    -53.2943
   (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
  Pyrite             0.0000 sat    Siderite          -1.9581
  Hematite           0.0000 sat    Rhodochrosite     -2.0336
  Se(black)          0.0000 sat    Anhydrite         -2.0427
  MnHPO4(c)         -0.3505        Bassanite         -2.6735
  Goethite          -0.4676        CaSO4^1/2H2O(bet  -2.8509
  FeSe2             -1.3690        Calcite           -2.9534
  Gypsum            -1.7962
   (only minerals with log Q/K > -3 listed)

 Gases                 fugacity      log fug.
-----------------------------------------------
  CO2(g)                 0.07967      -1.099
  Steam                  0.02023      -1.694
  H2S(g)             4.912e-009       -8.309
  H2(g)              5.440e-010       -9.264
  CH4(g)             6.672e-015      -14.176
  S2(g)              3.791e-025      -24.421
  O2(g)              9.517e-068      -67.021

                                 In fluid             Sorbed            Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-       7.56e-009  9.96e-011 1.44e-005  7.46e-009   0.00108
  Ca++             0.00144    0.00143      57.9  1.27e-005     0.515
  Cl-              0.00764    0.00764      273.
  Fe++            0.000173   0.000172      9.67  1.48e-031 8.33e-027
  Fe+++             0.0339  1.00e-011 5.66e-007
  H+             -0.0921    0.00347      3.52    0.00626      6.36
  H2O               55.1       55.0 9.99e+005   -0.00434     -78.8
  HCO3-            0.00756    0.00385      237.    0.00371      228.
  HPO4--          0.000116  5.50e-008   0.00532   0.000116      11.2
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)        -1.50e-005 -1.52e-009-4.91e-005  1.11e-015 3.59e-011
  SO4--            0.00189    0.00123      120.   0.000652      63.1
  SeO3--         1.00e-005  2.57e-012 3.29e-007  6.03e-028 7.72e-023

 Sorbed                 fraction    log fraction
```

As(OH)4-	0.9868	-0.006
Ca++	0.008823	-2.054
HCO3-	0.4912	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-009	9.962e-011	7.526e-006	7.462e-009	0.0005637
Calcium	0.001445	0.001432	57.87	1.275e-005	0.5151
Carbon	0.007558	0.003845	46.57	0.003712	44.96
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001418	1.441
Iron	0.03411	0.0001717	9.670	3.451e-031	1.943e-026
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009873	159.3
Phosphorus	0.0001159	5.502e-008	0.001718	0.0001159	3.619
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.573e-012	2.048e-007	6.031e-028	4.802e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001890	0.001235	39.92	0.0006520	21.08

7.562e-010 total moles arsenic

```
        Step #     0             Xi = 0.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.400              log fO2 =  -63.827
        Eh =  -0.0030 volts      pe =  -0.0519
        Ionic strength      =    0.012797
        Activity of water   =    0.999731
        Solvent mass        =    0.990012 kg
        Solution mass       =    0.990780 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007713 molal
        Dissolved solids    =         775 mg/kg sol'n
        Rock mass           =    0.002710 kg
        Carbonate alkalinity=       18.81 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.17 uC/cm2
          Surface potential =        61.7 mV
          Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
MnCl+	3.623e-007	0.03272	0.8932	-6.4900
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7810

```
  (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
---------------------------------------------------------------------------
  >(w)FeOCO2H           0.003495      0.003460        1.0000     -2.4566
  >(w)FeOH2+            0.002042      0.002022        11.034     -2.6899
  >(w)FeSO4-           0.0005163     0.0005111      0.090630     -3.2871
  >(w)FeOH             0.0002903     0.0002874        1.0000     -3.5372
  >(w)FeOCO2-          0.0002490     0.0002465      0.090630     -3.6039
  >(w)FeOHSO4--        0.0001464     0.0001449     0.0082138     -3.8345
  >(s)FeOH2+           0.0001389     0.0001375        11.034     -3.8574
  >(w)FeHPO4-         8.696e-005    8.609e-005      0.090630     -4.0607
  >(w)FeH2PO4         2.492e-005    2.467e-005        1.0000     -4.6034
  >(s)FeOH            1.974e-005    1.954e-005        1.0000     -4.7046
  >(s)FeOHCa++        1.273e-005    1.261e-005        121.75     -4.8950
  >(w)FePO4--         5.153e-006    5.101e-006     0.0082138     -5.2880
  >(w)FeO-            9.452e-007    9.357e-007      0.090630     -6.0245
  >(s)FeO-            6.428e-008    6.364e-008      0.090630     -7.1919
  >(w)FeOCa+          7.854e-009    7.776e-009        11.034     -8.1049
  >(w)FeH2AsO3        7.537e-010    7.462e-010        1.0000     -9.1228
  >(w)FeHAsO4-        4.134e-015    4.092e-015      0.090630    -14.3837
  >(w)FeOHAsO4---     3.730e-015    3.692e-015    0.00074442    -14.4283
  >(w)FeH2AsO4        9.410e-016    9.316e-016        1.0000    -15.0264
  >(w)FeSeO3-         1.352e-016    1.339e-016      0.090630    -15.8689
  >(w)FeOHSeO3--      1.132e-017    1.120e-017     0.0082138    -16.9463
  >(w)FeSeO4-         1.478e-040    1.463e-040      0.090630    -39.8304
  >(w)FeOHSeO4--      4.810e-041    4.762e-041     0.0082138    -40.3178
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                    log Q/K                           log Q/K
----------------------------------------------------------------
  FeSe2             13.4107s/sat   Siderite           -1.9611
  Se(black)          8.1916s/sat   Rhodochrosite      -2.0403
  Hematite           0.0000 sat    Anhydrite          -2.0424
  FeSe              -0.2231        Bassanite          -2.6733
  MnHPO4(c)         -0.3542        CaSO4^1/2H2O(bet  -2.8507
  Goethite          -0.4676        Calcite            -2.9600
  Gypsum            -1.7960
  (only minerals with log Q/K > -3 listed)

 Gases                fugacity      log fug.
-----------------------------------------------
  CO2(g)                0.07996      -1.097
  Steam                 0.02023      -1.694
  H2(g)               1.375e-011    -10.862
  H2S(g)              2.041e-015    -14.690
  CH4(g)              2.730e-021    -20.564
  S2(g)               1.026e-034    -33.989
  O2(g)               1.491e-064    -63.827

                                 In fluid              Sorbed            Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-       7.56e-010  1.00e-011 1.44e-006  7.46e-010  0.000108
  Ca++             0.00144    0.00143      57.9  1.26e-005     0.510
  Cl-              0.00764    0.00764      273.
  Fe++            0.000173   0.000173      9.76
  Fe+++             0.0339  1.01e-011 5.71e-007
  H+                 -1.21      -1.11-1.13e+003    0.00626      6.37
  H2O                 55.6       55.5 1.01e+006   -0.00433     -78.8
  HCO3-            0.00756    0.00385      237.    0.00371      228.
  HPO4--          0.000116  5.50e-008   0.00533   0.000116      11.2
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)            -0.279     -0.279-9.01e+003  4.36e-015 1.41e-010
  SO4--            0.00189    0.00123      120.   0.000656      63.6
```

SeO3--	1.00e-005	1.00e-005	1.28	1.45e-016	1.86e-011

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008731	-2.059
HCO3-	0.4904	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3472	-0.459
SeO3--	1.451e-011	-10.838

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-010	1.000e-011	7.562e-007	7.462e-010	5.643e-005
Calcium	0.001445	0.001432	57.93	1.261e-005	0.5103
Carbon	0.007558	0.003851	46.69	0.003706	44.93
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001420	1.445
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009873	159.4
Phosphorus	0.0001159	5.500e-008	0.001719	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.451e-016	1.156e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001234	39.92	0.0006561	21.23

7.562e-009 total moles arsenic

```
Step #     0              Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.404              log fO2 =  -67.021
Eh =  -0.0494 volts      pe =  -0.8547
Ionic strength      =    0.012792
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990779 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         774 mg/kg sol'n
Rock mass           =    0.002711 kg
Carbonate alkalinity=       18.94 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.16 uC/cm2
  Surface potential =        61.6 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0494	-0.8547
e- + Fe+++ = Fe++	0.0680	1.1764

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Pyrite	1.428e-006	-5.845	0.0001713	3.419e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5137*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3664
CO2(aq)	0.003496	153.7	1.0000	-2.4565
Ca++	0.001290	51.65	0.6524	-3.0750
SO4--	0.001060	101.7	0.6346	-3.1722
Mg++	0.0005093	12.37	0.6685	-3.4679
HCO3-	0.0003777	23.03	0.8948	-3.4712
Fe++	0.0001600	8.928	0.6524	-3.9814
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1262
CaSO4	0.0001144	15.56	1.0000	-3.9417
CaCl+	3.746e-005	2.828	0.8932	-4.4755
MgSO4	3.722e-005	4.477	1.0000	-4.4292
NaSO4-	1.539e-005	1.830	0.8932	-4.8619
FeSO4	1.109e-005	1.683	1.0000	-4.9551
MnSO4	8.598e-006	1.297	1.0000	-5.0656
CaHCO3+	4.924e-006	0.4975	0.8970	-5.3549
H+	4.346e-006	0.004377	0.9074	-5.4041
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.256e-006	0.1894	1.0000	-5.6466
FeCl+	1.424e-006	0.1299	0.8932	-5.8955
MgHCO3+	1.287e-006	0.1097	0.8932	-5.9394
FeHCO3+	9.403e-007	0.1098	0.8932	-6.0758
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.450e-007	0.07360	0.8932	-6.3127
MnHCO3+	5.119e-007	0.05931	0.8932	-6.3399
MnCl+	3.622e-007	0.03272	0.8932	-6.4900
HSO4-	2.367e-007	0.02296	0.8932	-6.6748
H2PO4-	5.058e-008	0.004902	0.8932	-7.3451
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003500	0.003465	1.0000	-2.4560
>(w)FeOH2+	0.002038	0.002018	10.996	-2.6908
>(w)FeSO4-	0.0005124	0.0005073	0.090943	-3.2904
>(w)FeOH	0.0002915	0.0002885	1.0000	-3.5354
>(w)FeOCO2-	0.0002508	0.0002483	0.090943	-3.6006
>(w)FeOHSO4--	0.0001462	0.0001447	0.0082706	-3.8352
>(s)FeOH2+	0.0001386	0.0001373	10.996	-3.8581
>(w)FeHPO4-	8.705e-005	8.618e-005	0.090943	-4.0602
>(w)FeH2PO4	2.480e-005	2.455e-005	1.0000	-4.6056
>(s)FeOH	1.983e-005	1.963e-005	1.0000	-4.7027
>(s)FeOHCa++	1.288e-005	1.275e-005	120.91	-4.8902
>(w)FePO4--	5.189e-006	5.137e-006	0.0082706	-5.2849
>(w)FeO-	9.548e-007	9.453e-007	0.090943	-6.0201
>(s)FeO-	6.495e-008	6.431e-008	0.090943	-7.1874
>(w)FeOCa+	7.989e-009	7.909e-009	10.996	-8.0975
>(w)FeH2AsO3	7.538e-010	7.462e-010	1.0000	-9.1228
>(w)FeHAsO4-	1.051e-016	1.041e-016	0.090943	-15.9782
>(w)FeOHAsO4---	9.602e-017	9.506e-017	0.00075216	-16.0177
>(w)FeH2AsO4	2.379e-017	2.355e-017	1.0000	-16.6236
>(w)FeSeO3-	5.616e-028	5.560e-028	0.090943	-27.2506
>(w)FeOHSeO3--	4.728e-029	4.681e-029	0.0082706	-28.3253
>(w)FeSeO4-	1.551e-053	1.536e-053	0.090943	-52.8093
>(w)FeOHSeO4--	5.081e-054	5.030e-054	0.0082706	-53.2941

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Pyrite	0.0000 sat		Siderite	-1.9576
Hematite	0.0000 sat		Rhodochrosite	-2.0332
Se(black)	0.0000 sat		Anhydrite	-2.0420
MnHPO4(c)	-0.3500		Bassanite	-2.6729
Goethite	-0.4676		CaSO4^1/2H2O(bet	-2.8502
FeSe2	-1.3691		Calcite	-2.9530
Gypsum	-1.7956			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07974	-1.098
Steam	0.02023	-1.694
H2S(g)	4.910e-009	-8.309
H2(g)	5.438e-010	-9.265
CH4(g)	6.667e-015	-14.176
S2(g)	3.792e-025	-24.421
O2(g)	9.525e-068	-67.021

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	7.56e-010	9.96e-012	1.44e-006	7.46e-010	0.000108	
Ca++	0.00144	0.00143	57.9	1.28e-005	0.516	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000172	9.68	1.23e-032	6.95e-028	
Fe+++	0.0339	1.00e-011	5.66e-007			
H+	-0.0921	0.00347	3.53	0.00626	6.37	
H2O	55.0	55.0	9.99e+005	-0.00434	-78.8	
HCO3-	0.00756	0.00384	237.	0.00371	229.	
HPO4--	0.000116	5.50e-008	0.00533	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-1.52e-009	-4.91e-005	1.11e-016	3.60e-012	
SO4--	0.00189	0.00123	120.	0.000652	63.2	

SeO3--	1.00e-005	2.57e-012	3.29e-007	6.03e-028	7.72e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008829	-2.054
HCO3-	0.4913	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-010	9.959e-012	7.531e-007	7.462e-010	5.643e-005
Calcium	0.001445	0.001432	57.93	1.276e-005	0.5160
Carbon	0.007558	0.003845	46.61	0.003713	45.01
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001418	1.442
Iron	0.03411	0.0001717	9.679	3.081e-032	1.737e-027
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009874	159.5
Phosphorus	0.0001159	5.501e-008	0.001720	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.568e-012	2.047e-007	6.028e-028	4.804e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001235	39.96	0.0006520	21.10

```
         Step #   100             Xi = 1.0000
         Temperature =  18.0 C    Pressure =  1.013 bars
         pH =  5.404              log fO2 =  -67.021
         Eh =  -0.0494 volts      pe =  -0.8549
         Ionic strength      =    0.012780
         Activity of water   =    0.999732
         Solvent mass        =    0.991012 kg
         Solution mass       =    0.991779 kg
         Solution density    =    1.018    g/cm3
         Chlorinity          =    0.007706 molal
         Dissolved solids    =         773 mg/kg sol'n
         Rock mass           =    0.002711 kg
         Carbonate alkalinity=       18.93 mg/kg as CaCO3
         HFO sorbing surface:
           Surface charge    =        6.16 uC/cm2
           Surface potential =        61.6 mV
           Surface area      =   1.63e+007 cm2

 Nernst redox couples                                Eh (volts)     pe
----------------------------------------------------------------------------
  e-  + .25*O2(aq)  + H+  = .5*H2O                      -0.0494   -0.8549
  e-  + Fe+++  = Fe++                                    0.0680    1.1763

                          moles        moles         grams          cm3
 Reactants              remaining     reacted       reacted       reacted
----------------------------------------------------------------------------
  H2O                  6.993e-017       0.05551         1.000

 Minerals in system     moles      log moles      grams         volume (cm3)
----------------------------------------------------------------------------
  Hematite               0.01697     -1.770          2.710           0.5137
  Pyrite               1.428e-006     -5.845      0.0001713       3.419e-005
  Se(black)            1.000e-005     -5.000      0.0007896
                                                ___________   _____________
        (total)                                       2.711           0.5137*

 Aqueous species       molality    mg/kg sol'n    act. coef.     log act.
---------------------------------------------------------------------------
  Cl-                    0.007662         271.4      0.8899       -2.1664
  Na+                    0.004810         110.5      0.8932       -2.3669
  CO2(aq)                0.003493         153.6      1.0000       -2.4568
  Ca++                   0.001288         51.60      0.6525       -3.0753
  SO4--                  0.001059         101.6      0.6348       -3.1725
  Mg++                  0.0005088         12.36      0.6686       -3.4683
  HCO3-                 0.0003774         23.01      0.8948       -3.4714
  Fe++                  0.0001598         8.920      0.6525       -3.9817
  K+                    0.0001169         4.566      0.8899       -3.9830
  Mn++                  0.0001145         6.286      0.6525       -4.1266
  CaSO4                 0.0001142         15.54      1.0000       -3.9423
  CaCl+                3.740e-005         2.823      0.8932       -4.4762
  MgSO4                3.717e-005         4.470      1.0000       -4.4299
  NaSO4-               1.536e-005         1.827      0.8932       -4.8626
  FeSO4                1.107e-005         1.681      1.0000       -4.9558
  MnSO4                8.585e-006         1.295      1.0000       -5.0663
  CaHCO3+              4.918e-006        0.4968      0.8970       -5.3554
  H+                   4.344e-006      0.004375      0.9075       -5.4043
  MgCl+                4.083e-006        0.2438      0.8932       -5.4381
  NaHCO3               2.253e-006        0.1891      1.0000       -5.6472
  FeCl+                1.421e-006        0.1297      0.8932       -5.8963
  MgHCO3+              1.285e-006        0.1096      0.8932       -5.9400
  FeHCO3+              9.390e-007        0.1097      0.8932       -6.0764
  NaCl                 6.290e-007       0.03673      1.0000       -6.2013
  KSO4-                5.440e-007       0.07347      0.8932       -6.3134
  MnHCO3+              5.112e-007       0.05923      0.8932       -6.3405
  MnCl+                3.616e-007       0.03266      0.8932       -6.4908
  HSO4-                2.365e-007       0.02293      0.8932       -6.6753
  H2PO4-               5.054e-008      0.004898      0.8932       -7.3454
  KCl                  1.653e-008      0.001231      1.0000       -7.7818
   (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
```

```
---------------------------------------------------------------------------
  >(w)FeOCO2H           0.003495      0.003464        1.0000     -2.4565
  >(w)FeOH2+            0.002036      0.002018        10.998     -2.6911
  >(w)FeSO4-           0.0005118     0.0005072      0.090922     -3.2909
  >(w)FeOH             0.0002914     0.0002888        1.0000     -3.5355
  >(w)FeOCO2-          0.0002507     0.0002484      0.090922     -3.6009
  >(w)FeOHSO4--        0.0001461     0.0001448     0.0082667     -3.8354
  >(s)FeOH2+           0.0001385     0.0001373        10.998     -3.8585
  >(w)FeHPO4-         8.697e-005    8.619e-005      0.090922     -4.0606
  >(w)FeH2PO4         2.476e-005    2.454e-005        1.0000     -4.6062
  >(s)FeOH            1.982e-005    1.964e-005        1.0000     -4.7029
  >(s)FeOHCa++        1.285e-005    1.274e-005        120.97     -4.8909
  >(w)FePO4--         5.187e-006    5.141e-006     0.0082667     -5.2850
  >(w)FeO-            9.551e-007    9.465e-007      0.090922     -6.0199
  >(s)FeO-            6.496e-008    6.438e-008      0.090922     -7.1873
  >(w)FeOCa+          7.981e-009    7.909e-009        10.998     -8.0980
  >(w)FeH2AsO3        7.530e-010    7.462e-010        1.0000     -9.1232
  >(w)FeHAsO4-        1.050e-016    1.041e-016      0.090922    -15.9786
  >(w)FeOHAsO4---     9.604e-017    9.518e-017    0.00075162    -16.0175
  >(w)FeH2AsO4        2.376e-017    2.354e-017        1.0000    -16.6242
  >(w)FeSeO3-         5.613e-028    5.563e-028      0.090922    -27.2508
  >(w)FeOHSeO3--      4.728e-029    4.685e-029     0.0082667    -28.3253
  >(w)FeSeO4-         1.550e-053    1.536e-053      0.090922    -52.8098
  >(w)FeOHSeO4--      5.078e-054    5.033e-054     0.0082667    -53.2943
   (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                    log Q/K                          log Q/K
----------------------------------------------------------------
  Pyrite             0.0000 sat    Siderite          -1.9581
  Hematite           0.0000 sat    Rhodochrosite     -2.0336
  Se(black)          0.0000 sat    Anhydrite         -2.0427
  MnHPO4(c)         -0.3505        Bassanite         -2.6735
  Goethite          -0.4676        CaSO4^1/2H2O(bet  -2.8509
  FeSe2             -1.3690        Calcite           -2.9534
  Gypsum            -1.7962
   (only minerals with log Q/K > -3 listed)

 Gases                 fugacity      log fug.
-----------------------------------------------
  CO2(g)                 0.07967      -1.099
  Steam                  0.02023      -1.694
  H2S(g)              4.912e-009      -8.309
  H2(g)               5.440e-010      -9.264
  CH4(g)              6.672e-015     -14.176
  S2(g)               3.791e-025     -24.421
  O2(g)               9.517e-068     -67.021

                                 In fluid             Sorbed             Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-       7.56e-010  9.96e-012 1.44e-006  7.46e-010  0.000108
  Ca++             0.00144    0.00143      57.9  1.27e-005     0.515
  Cl-              0.00764    0.00764      273.
  Fe++            0.000173   0.000172      9.67  1.85e-032 1.04e-027
  Fe+++             0.0339  1.00e-011 5.66e-007
  H+               -0.0921    0.00347      3.52    0.00626      6.36
  H2O                 55.1       55.0 9.99e+005   -0.00434     -78.8
  HCO3-            0.00756    0.00385      237.    0.00371      228.
  HPO4--          0.000116  5.50e-008   0.00532   0.000116      11.2
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)        -1.50e-005 -1.52e-009-4.91e-005  1.11e-016 3.59e-012
  SO4--            0.00189    0.00123      120.   0.000652      63.1
  SeO3--         1.00e-005  2.57e-012 3.29e-007  6.03e-028 7.72e-023

 Sorbed                 fraction    log fraction
```

As(OH)4-	0.9868	-0.006
Ca++	0.008823	-2.054
HCO3-	0.4912	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	7.562e-010	9.962e-012	7.526e-007	7.462e-010	5.637e-005
Calcium	0.001445	0.001432	57.87	1.275e-005	0.5151
Carbon	0.007558	0.003845	46.57	0.003712	44.96
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001418	1.441
Iron	0.03411	0.0001717	9.670	3.698e-032	2.082e-027
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009873	159.3
Phosphorus	0.0001159	5.502e-008	0.001718	0.0001159	3.619
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.573e-012	2.048e-007	6.031e-028	4.802e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001890	0.001235	39.92	0.0006520	21.08

1.512e-008 total moles arsenic

```
Step #     0             Xi = 0.0000
Temperature =  18.0 C    Pressure =  1.013 bars
pH =  5.400              log fO2 =  -63.827
Eh =  -0.0030 volts      pe =  -0.0519
Ionic strength      =    0.012797
Activity of water   =    0.999731
Solvent mass        =    0.990012 kg
Solution mass       =    0.990780 kg
Solution density    =    1.018    g/cm3
Chlorinity          =    0.007713 molal
Dissolved solids    =         775 mg/kg sol'n
Rock mass           =    0.002710 kg
Carbonate alkalinity=       18.81 mg/kg as CaCO3
HFO sorbing surface:
  Surface charge    =        6.17 uC/cm2
  Surface potential =        61.7 mV
  Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0030	-0.0519
e- + Fe+++ = Fe++	0.0685	1.1851

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
(total)			2.710	0.5137

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3665
CO2(aq)	0.003505	154.1	1.0000	-2.4553
Ca++	0.001290	51.66	0.6524	-3.0749
SO4--	0.001059	101.6	0.6346	-3.1727
Mg++	0.0005094	12.37	0.6685	-3.4679
HCO3-	0.0003751	22.87	0.8948	-3.4741
Fe++	0.0001613	9.003	0.6524	-3.9778
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.293	0.6524	-4.1262
CaSO4	0.0001143	15.54	1.0000	-3.9421
CaCl+	3.747e-005	2.828	0.8932	-4.4754
MgSO4	3.718e-005	4.472	1.0000	-4.4297
NaSO4-	1.537e-005	1.828	0.8932	-4.8624
FeSO4	1.117e-005	1.695	1.0000	-4.9520
HSe-	9.878e-006	0.7893	0.8932	-5.0544
MnSO4	8.589e-006	1.296	1.0000	-5.0661
CaHCO3+	4.892e-006	0.4942	0.8970	-5.3577
H+	4.387e-006	0.004419	0.9074	-5.4000
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.241e-006	0.1881	1.0000	-5.6495
FeCl+	1.436e-006	0.1310	0.8932	-5.8919
MgHCO3+	1.279e-006	0.1090	0.8932	-5.9423
FeHCO3+	9.418e-007	0.1100	0.8932	-6.0751
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.443e-007	0.07351	0.8932	-6.3132
MnHCO3+	5.085e-007	0.05891	0.8932	-6.3428
MnCl+	3.623e-007	0.03272	0.8932	-6.4900
HSO4-	2.387e-007	0.02315	0.8932	-6.6712
H2Se	2.231e-007	0.01805	1.0000	-6.6516
H2PO4-	5.057e-008	0.004901	0.8932	-7.3452
KCl	1.656e-008	0.001233	1.0000	-7.7810

```
  (only species > 1e-8 molal listed)

 Surface species       molality       moles     Boltzman fct. log molality
----------------------------------------------------------------------------
  >(w)FeOCO2H          0.003495      0.003460        1.0000     -2.4566
  >(w)FeOH2+           0.002042      0.002022        11.034     -2.6899
  >(w)FeSO4-          0.0005163     0.0005111      0.090630     -3.2871
  >(w)FeOH            0.0002903     0.0002874        1.0000     -3.5372
  >(w)FeOCO2-         0.0002490     0.0002465      0.090630     -3.6039
  >(w)FeOHSO4--       0.0001464     0.0001449     0.0082138     -3.8345
  >(s)FeOH2+          0.0001389     0.0001375        11.034     -3.8574
  >(w)FeHPO4-        8.696e-005    8.609e-005      0.090630     -4.0607
  >(w)FeH2PO4        2.492e-005    2.467e-005        1.0000     -4.6034
  >(s)FeOH           1.974e-005    1.954e-005        1.0000     -4.7046
  >(s)FeOHCa++       1.273e-005    1.261e-005        121.75     -4.8950
  >(w)FePO4--        5.153e-006    5.101e-006     0.0082138     -5.2880
  >(w)FeO-           9.452e-007    9.357e-007      0.090630     -6.0245
  >(s)FeO-           6.428e-008    6.364e-008      0.090630     -7.1919
  >(w)FeH2AsO3       1.507e-008    1.492e-008        1.0000     -7.8218
  >(w)FeOCa+         7.854e-009    7.776e-009        11.034     -8.1049
  >(w)FeHAsO4-       8.267e-014    8.185e-014      0.090630    -13.0826
  >(w)FeOHAsO4---    7.459e-014    7.385e-014    0.00074442    -13.1273
  >(w)FeH2AsO4       1.882e-014    1.863e-014        1.0000    -13.7254
  >(w)FeSeO3-        1.352e-016    1.339e-016      0.090630    -15.8689
  >(w)FeOHSeO3--     1.132e-017    1.120e-017     0.0082138    -16.9463
  >(w)FeSeO4-        1.478e-040    1.463e-040      0.090630    -39.8304
  >(w)FeOHSeO4--     4.810e-041    4.762e-041     0.0082138    -40.3178
   (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                    log Q/K                            log Q/K
----------------------------------------------------------------
  FeSe2             13.4107s/sat   Siderite            -1.9611
  Se(black)          8.1916s/sat   Rhodochrosite       -2.0403
  Hematite           0.0000 sat    Anhydrite           -2.0424
  FeSe              -0.2231        Bassanite           -2.6733
  MnHPO4(c)         -0.3542        CaSO4^1/2H2O(bet    -2.8507
  Goethite          -0.4676        Calcite             -2.9600
  Gypsum            -1.7960
   (only minerals with log Q/K > -3 listed)

 Gases                 fugacity      log fug.
-----------------------------------------------
  CO2(g)                0.07996      -1.097
  Steam                 0.02023      -1.694
  H2(g)              1.375e-011     -10.862
  H2S(g)             2.041e-015     -14.690
  CH4(g)             2.730e-021     -20.564
  S2(g)              1.026e-034     -33.989
  O2(g)              1.491e-064     -63.827

                                In fluid             Sorbed            Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
--------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-       1.51e-008  2.00e-010 2.89e-005  1.49e-008   0.00215
  Ca++             0.00144    0.00143      57.9  1.26e-005     0.510
  Cl-              0.00764    0.00764      273.
  Fe++            0.000173   0.000173      9.76
  Fe+++             0.0339  1.01e-011 5.71e-007
  H+                 -1.21      -1.11-1.13e+003    0.00626      6.37
  H2O                 55.6       55.5 1.01e+006   -0.00433     -78.8
  HCO3-            0.00756    0.00385      237.    0.00371      228.
  HPO4--          0.000116  5.50e-008   0.00533   0.000116      11.2
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)            -0.279     -0.279-9.01e+003  8.72e-014 2.82e-009
  SO4--            0.00189    0.00123      120.   0.000656      63.6
```

SeO3--	1.00e-005	1.00e-005	1.28	1.45e-016	1.86e-011

Sorbed	fraction	log fraction
As(OH)4-	0.9868	-0.006
Ca++	0.008731	-2.059
HCO3-	0.4904	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3472	-0.459
SeO3--	1.451e-011	-10.838

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-008	2.000e-010	1.512e-005	1.492e-008	0.001129
Calcium	0.001445	0.001432	57.93	1.261e-005	0.5103
Carbon	0.007558	0.003851	46.69	0.003706	44.93
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001420	1.445
Iron	0.03411	0.0001732	9.760		
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009873	159.4
Phosphorus	0.0001159	5.500e-008	0.001719	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	1.000e-005	0.7969	1.451e-016	1.156e-011
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001234	39.92	0.0006561	21.23

```
        Step #     0             Xi = 0.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.404              log fO2 =  -67.021
        Eh =  -0.0494 volts      pe =  -0.8547
        Ionic strength      =    0.012792
        Activity of water   =    0.999731
        Solvent mass        =    0.990012 kg
        Solution mass       =    0.990779 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007713 molal
        Dissolved solids    =         774 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       18.94 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.16 uC/cm2
          Surface potential =        61.6 mV
          Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0494	-0.8547
e- + Fe+++ = Fe++	0.0680	1.1764

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Pyrite	1.428e-006	-5.845	0.0001713	3.419e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5137*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007669	271.7	0.8898	-2.1659
Na+	0.004815	110.6	0.8932	-2.3664
CO2(aq)	0.003496	153.7	1.0000	-2.4565
Ca++	0.001290	51.65	0.6524	-3.0750
SO4--	0.001060	101.7	0.6346	-3.1722
Mg++	0.0005093	12.37	0.6685	-3.4679
HCO3-	0.0003777	23.03	0.8948	-3.4712
Fe++	0.0001600	8.928	0.6524	-3.9814
K+	0.0001170	4.570	0.8898	-3.9826
Mn++	0.0001146	6.292	0.6524	-4.1262
CaSO4	0.0001144	15.56	1.0000	-3.9417
CaCl+	3.746e-005	2.828	0.8932	-4.4755
MgSO4	3.722e-005	4.477	1.0000	-4.4292
NaSO4-	1.539e-005	1.830	0.8932	-4.8619
FeSO4	1.109e-005	1.683	1.0000	-4.9551
MnSO4	8.598e-006	1.297	1.0000	-5.0656
CaHCO3+	4.924e-006	0.4975	0.8970	-5.3549
H+	4.346e-006	0.004377	0.9074	-5.4041
MgCl+	4.090e-006	0.2442	0.8932	-5.4373
NaHCO3	2.256e-006	0.1894	1.0000	-5.6466
FeCl+	1.424e-006	0.1299	0.8932	-5.8955
MgHCO3+	1.287e-006	0.1097	0.8932	-5.9394
FeHCO3+	9.403e-007	0.1098	0.8932	-6.0758
NaCl	6.302e-007	0.03680	1.0000	-6.2005
KSO4-	5.450e-007	0.07360	0.8932	-6.3127
MnHCO3+	5.119e-007	0.05931	0.8932	-6.3399
MnCl+	3.622e-007	0.03272	0.8932	-6.4900
HSO4-	2.367e-007	0.02296	0.8932	-6.6748
H2PO4-	5.058e-008	0.004902	0.8932	-7.3451
KCl	1.656e-008	0.001233	1.0000	-7.7810

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality

```
---------------------------------------------------------------------------
  >(w)FeOCO2H          0.003500      0.003465        1.0000     -2.4560
  >(w)FeOH2+           0.002038      0.002018        10.996     -2.6908
  >(w)FeSO4-          0.0005124     0.0005073      0.090943     -3.2904
  >(w)FeOH            0.0002915     0.0002885        1.0000     -3.5354
  >(w)FeOCO2-         0.0002508     0.0002483      0.090943     -3.6006
  >(w)FeOHSO4--       0.0001462     0.0001447     0.0082707     -3.8352
  >(s)FeOH2+          0.0001386     0.0001373        10.996     -3.8581
  >(w)FeHPO4-        8.705e-005    8.618e-005      0.090943     -4.0602
  >(w)FeH2PO4        2.480e-005    2.455e-005        1.0000     -4.6056
  >(s)FeOH           1.983e-005    1.963e-005        1.0000     -4.7027
  >(s)FeOHCa++       1.288e-005    1.275e-005        120.91     -4.8902
  >(w)FePO4--        5.189e-006    5.137e-006     0.0082707     -5.2849
  >(w)FeO-           9.548e-007    9.453e-007      0.090943     -6.0201
  >(s)FeO-           6.495e-008    6.431e-008      0.090943     -7.1874
  >(w)FeH2AsO3       1.508e-008    1.492e-008        1.0000     -7.8217
  >(w)FeOCa+         7.988e-009    7.909e-009        10.996     -8.0975
  >(w)FeHAsO4-       2.103e-015    2.082e-015      0.090943    -14.6772
  >(w)FeOHAsO4---    1.920e-015    1.901e-015    0.00075216    -14.7166
  >(w)FeH2AsO4       4.758e-016    4.711e-016        1.0000    -15.3226
  >(w)FeSeO3-        5.616e-028    5.560e-028      0.090943    -27.2506
  >(w)FeOHSeO3--     4.728e-029    4.681e-029     0.0082707    -28.3253
  >(w)FeSeO4-        1.551e-053    1.536e-053      0.090943    -52.8093
  >(w)FeOHSeO4--     5.081e-054    5.030e-054     0.0082707    -53.2941
   (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)

 Mineral saturation states
                   log Q/K                          log Q/K
----------------------------------------------------------------
  Se(black)          0.0000 sat    Siderite          -1.9576
  Hematite           0.0000 sat    Rhodochrosite     -2.0332
  Pyrite             0.0000 sat    Anhydrite         -2.0420
  MnHPO4(c)         -0.3500        Bassanite         -2.6729
  Goethite          -0.4676        CaSO4^1/2H2O(bet  -2.8502
  FeSe2             -1.3691        Realgar           -2.9154
  Gypsum            -1.7956        Calcite           -2.9530
   (only minerals with log Q/K > -3 listed)

 Gases                fugacity      log fug.
-----------------------------------------------
  CO2(g)                0.07974      -1.098
  Steam                 0.02023      -1.694
  H2S(g)             4.910e-009      -8.309
  H2(g)              5.438e-010      -9.265
  CH4(g)             6.667e-015     -14.176
  S2(g)              3.792e-025     -24.421
  O2(g)              9.525e-068     -67.021

                               In fluid             Sorbed            Kd
 Original basis total moles   moles     mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
  >(s)FeOH        0.000170
  >(w)FeOH         0.00679
  As(OH)4-       1.51e-008  1.99e-010 2.87e-005  1.49e-008   0.00215
  Ca++             0.00144    0.00143      57.9  1.28e-005     0.516
  Cl-              0.00764    0.00764      273.
  Fe++            0.000173   0.000172      9.68  2.96e-031 1.67e-026
  Fe+++             0.0339  1.00e-011 5.66e-007
  H+               -0.0921    0.00347      3.53    0.00626      6.37
  H2O                 55.0       55.0 9.99e+005   -0.00434     -78.8
  HCO3-            0.00756    0.00384      237.    0.00371      229.
  HPO4--          0.000116  5.50e-008   0.00533   0.000116      11.2
  K+              0.000116   0.000116      4.59
  Mg++            0.000546   0.000546      13.4
  Mn++            0.000123   0.000123      6.81
  Na+              0.00479    0.00479      111.
  O2(aq)        -1.50e-005 -1.52e-009-4.91e-005  2.23e-015 7.19e-011
  SO4--            0.00189    0.00123      120.   0.000652      63.2
  SeO3--         1.00e-005  2.57e-012 3.29e-007  6.03e-028 7.72e-023

 Sorbed                 fraction    log fraction
```

As(OH)4-	0.9868	-0.006
Ca++	0.008829	-2.054
HCO3-	0.4913	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-008	1.992e-010	1.506e-005	1.492e-008	0.001129
Calcium	0.001445	0.001432	57.93	1.276e-005	0.5160
Carbon	0.007558	0.003845	46.61	0.003713	45.01
Chlorine	0.007636	0.007636	273.3		
Hydrogen	109.9	109.9	1.118e+005	0.001418	1.442
Iron	0.03411	0.0001717	9.679	6.903e-031	3.891e-026
Magnesium	0.0005464	0.0005464	13.40		
Manganese	0.0001229	0.0001229	6.813		
Oxygen	55.03	54.97	8.876e+005	0.009874	159.5
Phosphorus	0.0001159	5.501e-008	0.001720	0.0001159	3.622
Potassium	0.0001164	0.0001164	4.592		
Selenium	1.000e-005	2.568e-012	2.047e-007	6.028e-028	4.804e-023
Sodium	0.004785	0.004785	111.0		
Sulfur	0.001890	0.001235	39.96	0.0006520	21.10

```
        Step #   100             Xi = 1.0000
        Temperature =  18.0 C    Pressure =  1.013 bars
        pH =  5.404              log fO2 =  -67.021
        Eh =  -0.0494 volts      pe =  -0.8549
        Ionic strength      =    0.012780
        Activity of water   =    0.999732
        Solvent mass        =    0.991012 kg
        Solution mass       =    0.991779 kg
        Solution density    =    1.018    g/cm3
        Chlorinity          =    0.007706 molal
        Dissolved solids    =         773 mg/kg sol'n
        Rock mass           =    0.002711 kg
        Carbonate alkalinity=       18.93 mg/kg as CaCO3
        HFO sorbing surface:
          Surface charge    =        6.16 uC/cm2
          Surface potential =        61.6 mV
          Surface area      =   1.63e+007 cm2
```

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0494	-0.8549
e- + Fe+++ = Fe++	0.0680	1.1763

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01697	-1.770	2.710	0.5137
Pyrite	1.428e-006	-5.845	0.0001713	3.419e-005
Se(black)	1.000e-005	-5.000	0.0007896	
(total)			2.711	0.5137*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007662	271.4	0.8899	-2.1664
Na+	0.004810	110.5	0.8932	-2.3669
CO2(aq)	0.003493	153.6	1.0000	-2.4568
Ca++	0.001288	51.60	0.6525	-3.0753
SO4--	0.001059	101.6	0.6348	-3.1725
Mg++	0.0005088	12.36	0.6686	-3.4683
HCO3-	0.0003774	23.01	0.8948	-3.4714
Fe++	0.0001598	8.920	0.6525	-3.9817
K+	0.0001169	4.566	0.8899	-3.9830
Mn++	0.0001145	6.286	0.6525	-4.1266
CaSO4	0.0001142	15.54	1.0000	-3.9423
CaCl+	3.740e-005	2.823	0.8932	-4.4762
MgSO4	3.717e-005	4.470	1.0000	-4.4299
NaSO4-	1.536e-005	1.827	0.8932	-4.8626
FeSO4	1.107e-005	1.681	1.0000	-4.9558
MnSO4	8.585e-006	1.295	1.0000	-5.0663
CaHCO3+	4.918e-006	0.4968	0.8970	-5.3554
H+	4.344e-006	0.004375	0.9075	-5.4043
MgCl+	4.083e-006	0.2438	0.8932	-5.4381
NaHCO3	2.253e-006	0.1891	1.0000	-5.6472
FeCl+	1.421e-006	0.1297	0.8932	-5.8963
MgHCO3+	1.285e-006	0.1096	0.8932	-5.9400
FeHCO3+	9.390e-007	0.1097	0.8932	-6.0764
NaCl	6.290e-007	0.03673	1.0000	-6.2013
KSO4-	5.440e-007	0.07347	0.8932	-6.3134
MnHCO3+	5.112e-007	0.05923	0.8932	-6.3405
MnCl+	3.616e-007	0.03266	0.8932	-6.4908
HSO4-	2.365e-007	0.02293	0.8932	-6.6753
H2PO4-	5.054e-008	0.004898	0.8932	-7.3454
KCl	1.653e-008	0.001231	1.0000	-7.7818

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality

>(w)FeOCO2H	0.003495	0.003464	1.0000	-2.4565
>(w)FeOH2+	0.002036	0.002018	10.998	-2.6911
>(w)FeSO4-	0.0005118	0.0005072	0.090922	-3.2909
>(w)FeOH	0.0002914	0.0002888	1.0000	-3.5355
>(w)FeOCO2-	0.0002507	0.0002484	0.090922	-3.6009
>(w)FeOHSO4--	0.0001461	0.0001448	0.0082667	-3.8354
>(s)FeOH2+	0.0001385	0.0001373	10.998	-3.8585
>(w)FeHPO4-	8.697e-005	8.619e-005	0.090922	-4.0606
>(w)FeH2PO4	2.476e-005	2.454e-005	1.0000	-4.6062
>(s)FeOH	1.982e-005	1.964e-005	1.0000	-4.7029
>(s)FeOHCa++	1.285e-005	1.274e-005	120.97	-4.8909
>(w)FePO4--	5.187e-006	5.141e-006	0.0082667	-5.2850
>(w)FeO-	9.551e-007	9.465e-007	0.090922	-6.0199
>(s)FeO-	6.496e-008	6.438e-008	0.090922	-7.1873
>(w)FeH2AsO3	1.506e-008	1.492e-008	1.0000	-7.8222
>(w)FeOCa+	7.981e-009	7.909e-009	10.998	-8.0980
>(w)FeHAsO4-	2.101e-015	2.082e-015	0.090922	-14.6776
>(w)FeOHAsO4---	1.921e-015	1.904e-015	0.00075163	-14.7165
>(w)FeH2AsO4	4.751e-016	4.709e-016	1.0000	-15.3232
>(w)FeSeO3-	5.613e-028	5.563e-028	0.090922	-27.2508
>(w)FeOHSeO3--	4.728e-029	4.685e-029	0.0082667	-28.3253
>(w)FeSeO4-	1.550e-053	1.536e-053	0.090922	-52.8098
>(w)FeOHSeO4--	5.078e-054	5.033e-054	0.0082667	-53.2943

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Siderite	-1.9581
Hematite	0.0000 sat	Rhodochrosite	-2.0336
Pyrite	0.0000 sat	Anhydrite	-2.0427
MnHPO4(c)	-0.3505	Bassanite	-2.6735
Goethite	-0.4676	CaSO4^1/2H2O(bet	-2.8509
FeSe2	-1.3690	Realgar	-2.9155
Gypsum	-1.7962	Calcite	-2.9534

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.07967	-1.099
Steam	0.02023	-1.694
H2S(g)	4.912e-009	-8.309
H2(g)	5.440e-010	-9.264
CH4(g)	6.672e-015	-14.176
S2(g)	3.791e-025	-24.421
O2(g)	9.517e-068	-67.021

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000170					
>(w)FeOH	0.00679					
As(OH)4-	1.51e-008	1.99e-010	2.87e-005	1.49e-008	0.00215	
Ca++	0.00144	0.00143	57.9	1.27e-005	0.515	
Cl-	0.00764	0.00764	273.			
Fe++	0.000173	0.000172	9.67	2.96e-031	1.67e-026	
Fe+++	0.0339	1.00e-011	5.66e-007			
H+	-0.0921	0.00347	3.52	0.00626	6.36	
H2O	55.1	55.0	9.99e+005	-0.00434	-78.8	
HCO3-	0.00756	0.00385	237.	0.00371	228.	
HPO4--	0.000116	5.50e-008	0.00532	0.000116	11.2	
K+	0.000116	0.000116	4.59			
Mg++	0.000546	0.000546	13.4			
Mn++	0.000123	0.000123	6.81			
Na+	0.00479	0.00479	111.			
O2(aq)	-1.50e-005	-1.52e-009	-4.91e-005	2.23e-015	7.19e-011	
SO4--	0.00189	0.00123	120.	0.000652	63.1	
SeO3--	1.00e-005	2.57e-012	3.29e-007	6.03e-028	7.72e-023	

Sorbed	fraction	log fraction

As(OH)4-	0.9868	-0.006
Ca++	0.008823	-2.054
HCO3-	0.4912	-0.309
HPO4--	0.9995	-0.000
SO4--	0.3455	-0.462

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.512e-008	1.992e-010	1.505e-005	1.492e-008	0.001127
Calcium	0.001445	0.001432	57.87	1.275e-005	0.5151
Carbon	0.007558	0.003845	46.57	0.003712	44.96
Chlorine	0.007636	0.007636	273.0		
Hydrogen	110.0	110.0	1.118e+005	0.001418	1.441
Iron	0.03411	0.0001717	9.670	6.903e-031	3.887e-026
Magnesium	0.0005464	0.0005464	13.39		
Manganese	0.0001229	0.0001229	6.806		
Oxygen	55.08	55.02	8.876e+005	0.009873	159.3
Phosphorus	0.0001159	5.502e-008	0.001718	0.0001159	3.619
Potassium	0.0001164	0.0001164	4.588		
Selenium	1.000e-005	2.573e-012	2.048e-007	6.031e-028	4.802e-023
Sodium	0.004785	0.004785	110.9		
Sulfur	0.001890	0.001235	39.92	0.0006520	21.08

1.512e-008 total moles arsenic

ALLUVIAL CLAY – MODEL OUTPUT

6.570e-008 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012440

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			———	———
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.255e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4985
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.465e-007	0.03191	1.0000	-6.2624
KSO4-	5.384e-007	0.07271	0.8944	-6.3174

MnCl+	3.135e-007	0.02832	0.8944	-6.5522
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6426	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002597	0.002593	1.0000	-2.5855
>(w)FeOH2+	0.001047	0.001045	7.3778	-2.9800
>(w)FeOCO2-	0.0003108	0.0003102	0.13554	-3.5076
>(w)FeOH	0.0002500	0.0002496	1.0000	-3.6021
>(w)FeSO4-	0.0001180	0.0001179	0.13554	-3.9279
>(s)FeOH2+	7.013e-005	7.002e-005	7.3778	-4.1541
>(w)FeOHSO4--	5.622e-005	5.613e-005	0.018372	-4.2501
>(w)FeHPO4-	4.726e-005	4.718e-005	0.13554	-4.3255
>(s)FeOHCa++	2.405e-005	2.401e-005	54.432	-4.6189
>(s)FeOH	1.674e-005	1.672e-005	1.0000	-4.7761
>(w)FeH2PO4	8.064e-006	8.050e-006	1.0000	-5.0935
>(w)FePO4--	4.703e-006	4.695e-006	0.018372	-5.3276
>(w)FeO-	1.367e-006	1.365e-006	0.13554	-5.8641
>(s)FeO-	9.157e-008	9.143e-008	0.13554	-7.0382
>(w)FeH2AsO3	6.431e-008	6.420e-008	1.0000	-7.1917
>(w)FeOCa+	2.530e-008	2.526e-008	7.3778	-7.5969
>(w)FeOHAsO4---	3.438e-010	3.433e-010	0.0024901	-9.4637
>(w)FeHAsO4-	1.351e-010	1.349e-010	0.13554	-9.8694
>(w)FeH2AsO4	1.831e-011	1.828e-011	1.0000	-10.7373

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
MnHPO4(c)	0.0170s/sat		Anhydrite	-2.0456
Hematite	0.0000 sat		Calcite	-2.2260
Goethite	-0.4676		Aragonite	-2.3915
Siderite	-1.2291		Bassanite	-2.6764
Rhodochrosite	-1.3078		CaSO4^1/2H2O(bet	-2.8538
Gypsum	-1.7991			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	6.57e-008	1.00e-009	0.000143	6.47e-008	0.00926	
Ca++	0.00146	0.00143	57.5	2.40e-005	0.964	
Cl-	0.00672	0.00672	238.			
Fe++	0.000173	0.000173	9.68			
Fe+++	0.0222	4.40e-012	2.46e-007			
H+	-0.247	-0.184	-186.	0.00389	3.92	

H2O	55.5	55.5	1.00e+006	-0.00308	-55.6
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.50e-008	0.00528	5.99e-005	5.76
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	2.48e-010	7.95e-006
SO4--	0.00141	0.00123	119.	0.000174	16.7

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01651	-1.782
HCO3-	0.4298	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1236	-0.908

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.570e-008	1.000e-009	7.499e-005	6.470e-008	0.004852
Calcium	0.001456	0.001432	57.45	2.404e-005	0.9642
Carbon	0.006754	0.003851	46.30	0.002903	34.90
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006893	0.6954
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006564	105.1
Phosphorus	5.998e-005	5.500e-008	0.001705	5.992e-005	1.858
Potassium	0.0001164	0.0001164	4.554		

Sodium	0.004785	0.004785	110.1		
Sulfur	0.001408	0.001234	39.59	0.0001740	5.583

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7277

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.78 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7277
e- + Fe+++ = Fe++	-0.0005	-0.0090

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.436e-006	-5.843	0.0002167	

(total)	1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003025	133.0	1.0000	-2.5193
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008108	49.43	0.8960	-3.1388
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.880	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001118	6.139	0.6556	-4.1348
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.255e-005	2.457	0.8944	-4.5359
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.104e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0243
MnSO4	8.395e-006	1.267	1.0000	-5.0760
NaHCO3	4.814e-006	0.4041	1.0000	-5.3175
MgCl+	3.548e-006	0.2118	0.8944	-5.4985
MgHCO3+	2.747e-006	0.2342	0.8944	-5.6096
FeHCO3+	2.017e-006	0.2356	0.8944	-5.7437
H+	1.748e-006	0.001760	0.9083	-5.7993
FeCl+	1.242e-006	0.1133	0.8944	-5.9544
MnHCO3+	1.077e-006	0.1248	0.8944	-6.0161
NaCl	5.465e-007	0.03192	1.0000	-6.2624
KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573

HSO4-	9.476e-008	0.009191	0.8944	-7.0718
H2PO4-	4.643e-008	0.004499	0.8944	-7.3817
CO3--	2.736e-008	0.001641	0.6427	-7.7548
CaCO3	2.176e-008	0.002177	1.0000	-7.6623
KCl	1.437e-008	0.001070	1.0000	-7.8426
FeCO3	1.388e-008	0.001607	1.0000	-7.8577

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002598	0.002594	1.0000	-2.5854
>(w)FeOH2+	0.001047	0.001046	7.3901	-2.9800
>(w)FeOCO2-	0.0003109	0.0003104	0.13532	-3.5074
>(w)FeOH	0.0002500	0.0002496	1.0000	-3.6020
>(w)FeSO4-	0.0001184	0.0001182	0.13532	-3.9266
>(s)FeOH2+	7.018e-005	7.006e-005	7.3901	-4.1538
>(w)FeOHSO4--	5.640e-005	5.631e-005	0.018310	-4.2487
>(w)FeHPO4-	4.612e-005	4.605e-005	0.13532	-4.3361
>(s)FeOHCa++	2.399e-005	2.395e-005	54.614	-4.6199
>(s)FeOH	1.676e-005	1.673e-005	1.0000	-4.7758
>(w)FeH2PO4	7.870e-006	7.857e-006	1.0000	-5.1040
>(w)FePO4--	4.591e-006	4.584e-006	0.018310	-5.3381
>(w)FeO-	1.368e-006	1.365e-006	0.13532	-5.8640
>(s)FeO-	9.166e-008	9.151e-008	0.13532	-7.0378
>(w)FeH2AsO3	6.431e-008	6.420e-008	1.0000	-7.1917
>(w)FeOCa+	2.523e-008	2.519e-008	7.3901	-7.5981
>(w)FeOHAsO4---	3.439e-010	3.433e-010	0.0024777	-9.4636
>(w)FeHAsO4-	1.351e-010	1.348e-010	0.13532	-9.8695
>(w)FeH2AsO4	1.830e-011	1.827e-011	1.0000	-10.7375

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0457
Hematite	0.0000 sat	Calcite	-2.2272
Goethite	-0.4676	Aragonite	-2.3928
Siderite	-1.2303	Bassanite	-2.6765
Rhodochrosite	-1.3142	CaSO4^1/2H2O(bet	-2.8539
Gypsum	-1.7992		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06900	-1.161
Steam	0.02023	-1.694
H2(g)	6.030e-014	-13.220
H2S(g)	1.198e-025	-24.922
CH4(g)	8.722e-031	-30.059
S2(g)	1.835e-050	-49.736
O2(g)	7.747e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	6.57e-008	1.00e-009	0.000143	6.47e-008	0.00926	
Ca++	0.00146	0.00143	57.5	2.40e-005	0.962	
Cl-	0.00672	0.00672	238.			
Fe++	0.000173	0.000173	9.68			
Fe+++	0.0222	4.41e-012	2.46e-007			
H+	-0.0596	0.00302	3.05	0.00389	3.92	
H2O	55.4	55.4	9.99e+005	-0.00308	-55.5	

HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	2.49e-010	4.19e-013	1.34e-008	2.48e-010	7.95e-006
SO4--	0.00141	0.00123	119.	0.000175	16.8

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01647	-1.783
HCO3-	0.4299	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1240	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.570e-008	9.999e-010	7.498e-005	6.470e-008	0.004852
Calcium	0.001456	0.001432	57.45	2.398e-005	0.9619
Carbon	0.006754	0.003851	46.29	0.002904	34.91
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006888	0.6949
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.677		
Oxygen	55.47	55.43	8.877e+005	0.006563	105.1
Phosphorus	5.998e-005	5.357e-008	0.001661	5.849e-005	1.813
Potassium	0.0001164	0.0001164	4.554		
Sodium	0.004785	0.004785	110.1		

Sulfur	0.001408	0.001233	39.57	0.0001745	5.600

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -59.112

Eh = 0.0420 volts pe = 0.7273

Ionic strength = 0.012425

Activity of water = 0.999766

Solvent mass = 0.999368 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006723 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.75 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7273
e- + Fe+++ = Fe++	-0.0005	-0.0090

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.379e-006	-5.860	0.0002082	

(total)	1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006684	236.8	0.8912	-2.2250
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5197
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008102	49.40	0.8960	-3.1391
Mg++	0.0005037	12.23	0.6715	-3.4708
Fe++	0.0001590	8.871	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001132	15.41	1.0000	-3.9460
Mn++	0.0001118	6.136	0.6557	-4.1349
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5366
NaSO4-	1.516e-005	1.803	0.8945	-4.8677
FeSO4	1.102e-005	1.673	1.0000	-4.9578
CaHCO3+	1.051e-005	1.062	0.8982	-5.0249
MnSO4	8.386e-006	1.265	1.0000	-5.0765
NaHCO3	4.806e-006	0.4035	1.0000	-5.3182
MgCl+	3.541e-006	0.2115	0.8945	-5.4993
MgHCO3+	2.743e-006	0.2339	0.8945	-5.6102
FeHCO3+	2.014e-006	0.2352	0.8945	-5.7443
H+	1.747e-006	0.001760	0.9084	-5.7994
FeCl+	1.240e-006	0.1131	0.8945	-5.9552
MnHCO3+	1.076e-006	0.1247	0.8945	-6.0165
NaCl	5.455e-007	0.03185	1.0000	-6.2632
KSO4-	5.373e-007	0.07256	0.8945	-6.3183
MnCl+	3.095e-007	0.02795	0.8945	-6.5578

HSO4-	9.466e-008	0.009182	0.8945	-7.0723
H2PO4-	4.643e-008	0.004499	0.8945	-7.3817
CO3--	2.735e-008	0.001640	0.6428	-7.7550
CaCO3	2.174e-008	0.002174	1.0000	-7.6628
KCl	1.434e-008	0.001068	1.0000	-7.8435
FeCO3	1.386e-008	0.001605	1.0000	-7.8582

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002595	0.002593	1.0000	-2.5859
>(w)FeOH2+	0.001046	0.001046	7.3916	-2.9803
>(w)FeOCO2-	0.0003106	0.0003104	0.13529	-3.5077
>(w)FeOH	0.0002500	0.0002498	1.0000	-3.6021
>(w)FeSO4-	0.0001183	0.0001182	0.13529	-3.9271
>(s)FeOH2+	7.012e-005	7.007e-005	7.3916	-4.1542
>(w)FeOHSO4--	5.636e-005	5.633e-005	0.018303	-4.2490
>(w)FeHPO4-	4.612e-005	4.609e-005	0.13529	-4.3361
>(s)FeOHCa++	2.395e-005	2.394e-005	54.636	-4.6206
>(s)FeOH	1.675e-005	1.674e-005	1.0000	-4.7760
>(w)FeH2PO4	7.866e-006	7.861e-006	1.0000	-5.1042
>(w)FePO4--	4.593e-006	4.590e-006	0.018303	-5.3379
>(w)FeO-	1.368e-006	1.367e-006	0.13529	-5.8639
>(s)FeO-	9.166e-008	9.160e-008	0.13529	-7.0378
>(w)FeH2AsO3	6.424e-008	6.420e-008	1.0000	-7.1922
>(w)FeOCa+	2.520e-008	2.519e-008	7.3916	-7.5986
>(w)FeOHAsO4---	3.436e-010	3.434e-010	0.0024762	-9.4639
>(w)FeHAsO4-	1.348e-010	1.348e-010	0.13529	-9.8702
>(w)FeH2AsO4	1.827e-011	1.825e-011	1.0000	-10.7384

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0463
Hematite	0.0000 sat	Calcite	-2.2277
Goethite	-0.4676	Aragonite	-2.3933
Siderite	-1.2308	Bassanite	-2.6771
Rhodochrosite	-1.3145	CaSO4^1/2H2O(bet	-2.8545
Gypsum	-1.7998		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06893	-1.162
Steam	0.02023	-1.694
H2(g)	6.036e-014	-13.219
H2S(g)	1.201e-025	-24.920
CH4(g)	8.751e-031	-30.058
S2(g)	1.842e-050	-49.735
O2(g)	7.730e-060	-59.112

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	6.57e-008	1.00e-009	0.000143	6.47e-008	0.00925	
Ca++	0.00146	0.00143	57.4	2.40e-005	0.960	
Cl-	0.00672	0.00672	238.			
Fe++	0.000173	0.000173	9.67			
Fe+++	0.0222	4.41e-012	2.46e-007			
H+	-0.0596	0.00302	3.05	0.00389	3.92	
H2O	55.5	55.5	9.99e+005	-0.00308	-55.5	

HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	2.49e-010	4.19e-013	1.34e-008	2.48e-010	7.94e-006
SO4--	0.00141	0.00123	118.	0.000175	16.8

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01646	-1.784
HCO3-	0.4299	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1240	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.570e-008	1.000e-009	7.492e-005	6.470e-008	0.004847
Calcium	0.001456	0.001432	57.40	2.396e-005	0.9603
Carbon	0.006754	0.003851	46.25	0.002903	34.87
Chlorine	0.006718	0.006718	238.2		
Hydrogen	110.9	110.9	1.118e+005	0.0006890	0.6944
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.673		
Oxygen	55.53	55.49	8.877e+005	0.006563	105.0
Phosphorus	5.998e-005	5.363e-008	0.001661	5.855e-005	1.813
Potassium	0.0001164	0.0001164	4.549		
Sodium	0.004785	0.004785	110.0		

Sulfur	0.001408	0.001233	39.53	0.0001745	5.595

1.314e-008 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012440

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.255e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.465e-007	0.03191	1.0000	-6.2624
KSO4-	5.384e-007	0.07271	0.8944	-6.3174

MnCl+	3.135e-007	0.02832	0.8944	-6.5522
HSe-	1.173e-007	0.009372	0.8944	-6.9792
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6426	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002597	0.002593	1.0000	-2.5855
>(w)FeOH2+	0.001047	0.001045	7.3778	-2.9800
>(w)FeOCO2-	0.0003108	0.0003102	0.13554	-3.5076
>(w)FeOH	0.0002500	0.0002496	1.0000	-3.6020
>(w)FeSO4-	0.0001181	0.0001179	0.13554	-3.9279
>(s)FeOH2+	7.013e-005	7.002e-005	7.3778	-4.1541
>(w)FeOHSO4--	5.622e-005	5.613e-005	0.018372	-4.2501
>(w)FeHPO4-	4.726e-005	4.718e-005	0.13554	-4.3255
>(s)FeOHCa++	2.405e-005	2.401e-005	54.432	-4.6189
>(s)FeOH	1.674e-005	1.672e-005	1.0000	-4.7761
>(w)FeH2PO4	8.064e-006	8.051e-006	1.0000	-5.0935
>(w)FePO4--	4.703e-006	4.695e-006	0.018372	-5.3276
>(w)FeO-	1.367e-006	1.365e-006	0.13554	-5.8641
>(s)FeO-	9.158e-008	9.143e-008	0.13554	-7.0382
>(w)FeOCa+	2.530e-008	2.526e-008	7.3778	-7.5969
>(w)FeH2AsO3	1.286e-008	1.284e-008	1.0000	-7.8907
>(w)FeOHAsO4---	6.877e-011	6.865e-011	0.0024901	-10.1626
>(w)FeHAsO4-	2.702e-011	2.697e-011	0.13554	-10.5684
>(w)FeSeO3-	1.098e-011	1.096e-011	0.13554	-10.9593
>(w)FeH2AsO4	3.662e-012	3.656e-012	1.0000	-11.4363

>(w)FeOHSeO3--	1.543e-012	1.541e-012	0.018372	-11.8115
>(w)FeSeO4-	2.736e-033	2.732e-033	0.13554	-32.5629
>(w)FeOHSeO4--	1.496e-033	1.494e-033	0.018372	-32.8250

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	11.9128s/sat	FeSe	-1.7518
Se(black)	8.2248s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0170s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2291	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					

As(OH)4-	1.31e-008	2.00e-010	2.86e-005	1.29e-008	0.00185
Ca++	0.00146	0.00143	57.5	2.40e-005	0.964
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00389	3.92
H2O	55.5	55.5	1.00e+006	-0.00308	-55.6
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.50e-008	0.00528	5.99e-005	5.76
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	4.96e-011	1.59e-006
SO4--	0.00141	0.00123	119.	0.000174	16.7
SeO3--	1.18e-007	1.18e-007	0.0150	1.25e-011	1.59e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01651	-1.782
HCO3-	0.4298	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1236	-0.908
SeO3--	0.0001058	-3.975

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.314e-008	2.000e-010	1.500e-005	1.294e-008	0.0009703
Calcium	0.001456	0.001432	57.45	2.404e-005	0.9642
Carbon	0.006755	0.003851	46.30	0.002903	34.90

Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006893	0.6953
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006564	105.1
Phosphorus	5.998e-005	5.500e-008	0.001705	5.993e-005	1.858
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.182e-007	1.181e-007	0.009337	1.250e-011	9.882e-007
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001408	0.001234	39.59	0.0001740	5.583

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3067

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.78 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3067
e- + Fe+++ = Fe++	-0.0005	-0.0091

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.441e-006	-5.841	0.0002175	

Pyrite	1.665e-008	-7.778	1.998e-006	3.987e-007
Se(black)	1.182e-007	-6.928	9.329e-006	
			______________	______________
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003025	133.0	1.0000	-2.5193
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008108	49.44	0.8960	-3.1388
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001118	6.139	0.6556	-4.1348
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.255e-005	2.457	0.8944	-4.5359
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.103e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0243
MnSO4	8.394e-006	1.267	1.0000	-5.0760
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.548e-006	0.2118	0.8944	-5.4985
MgHCO3+	2.747e-006	0.2342	0.8944	-5.6095
FeHCO3+	2.017e-006	0.2356	0.8944	-5.7437
H+	1.747e-006	0.001760	0.9083	-5.7994
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.077e-006	0.1248	0.8944	-6.0160
NaCl	5.465e-007	0.03191	1.0000	-6.2624

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
HSO4-	9.475e-008	0.009190	0.8944	-7.0719
H2PO4-	4.642e-008	0.004499	0.8944	-7.3817
CO3--	2.737e-008	0.001641	0.6427	-7.7548
CaCO3	2.177e-008	0.002177	1.0000	-7.6622
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.388e-008	0.001607	1.0000	-7.8576

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002598	0.002594	1.0000	-2.5854
>(w)FeOH2+	0.001047	0.001045	7.3897	-2.9800
>(w)FeOCO2-	0.0003109	0.0003104	0.13532	-3.5074
>(w)FeOH	0.0002501	0.0002496	1.0000	-3.6020
>(w)FeSO4-	0.0001184	0.0001182	0.13532	-3.9267
>(s)FeOH2+	7.018e-005	7.006e-005	7.3897	-4.1538
>(w)FeOHSO4--	5.639e-005	5.630e-005	0.018312	-4.2488
>(w)FeHPO4-	4.612e-005	4.605e-005	0.13532	-4.3361
>(s)FeOHCa++	2.399e-005	2.396e-005	54.608	-4.6199
>(s)FeOH	1.676e-005	1.673e-005	1.0000	-4.7758
>(w)FeH2PO4	7.868e-006	7.856e-006	1.0000	-5.1041
>(w)FePO4--	4.591e-006	4.584e-006	0.018312	-5.3381
>(w)FeO-	1.368e-006	1.366e-006	0.13532	-5.8640
>(s)FeO-	9.167e-008	9.152e-008	0.13532	-7.0378
>(w)FeOCa+	2.523e-008	2.519e-008	7.3897	-7.5980
>(w)FeH2AsO3	1.296e-008	1.294e-008	1.0000	-7.8874
>(w)FeOHAsO4---	5.918e-015	5.908e-015	0.0024781	-14.2278
>(w)FeHAsO4-	2.324e-015	2.320e-015	0.13532	-14.6337
>(w)FeH2AsO4	3.150e-016	3.144e-016	1.0000	-15.5017
>(w)FeSeO3-	4.770e-028	4.763e-028	0.13532	-27.3215

>(w)FeOHSeO3--	6.706e-029	6.695e-029	0.018312	-28.1735
>(w)FeSeO4-	1.015e-053	1.013e-053	0.13532	-52.9937
>(w)FeOHSeO4--	5.549e-054	5.540e-054	0.018312	-53.2558

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
MnHPO4(c)	0.0000 sat	Rhodochrosite	-1.3141
Pyrite	0.0000 sat	Gypsum	-1.7992
Hematite	0.0000 sat	Anhydrite	-2.0457
Se(black)	0.0000 sat	Calcite	-2.2271
FeSe2	-0.4653	Aragonite	-2.3927
Goethite	-0.4676	Bassanite	-2.6765
Siderite	-1.2302	CaSO4^1/2H2O(bet	-2.8539

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2S(g)	2.253e-009	-8.647
H2(g)	7.062e-010	-9.151
CH4(g)	1.641e-014	-13.785
S2(g)	4.733e-026	-25.325
O2(g)	5.648e-068	-67.248

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH 0.000111					
>(w)FeOH 0.00443					

As(OH)4-	1.31e-008	2.01e-010	2.88e-005	1.29e-008	0.00185
Ca++	0.00146	0.00143	57.5	2.40e-005	0.962
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68	3.94e-031	2.20e-026
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.4	55.4	9.99e+005	-0.00308	-55.5
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	-1.77e-007	-7.34e-010	-2.35e-005	4.27e-015	1.37e-010
SO4--	0.00141	0.00123	119.	0.000175	16.8
SeO3--	1.18e-007	8.24e-012	1.05e-006	5.43e-028	6.90e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01647	-1.783
HCO3-	0.4299	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1240	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.314e-008	2.013e-010	1.510e-005	1.294e-008	0.0009702
Calcium	0.001456	0.001432	57.45	2.398e-005	0.9620
Carbon	0.006755	0.003851	46.29	0.002904	34.91
Chlorine	0.006718	0.006718	238.4		

Hydrogen	110.8	110.8	1.118e+005	0.0006888	0.6948
Iron	0.02234	0.0001731	9.678	1.183e-030	6.614e-026
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.677		
Oxygen	55.47	55.43	8.877e+005	0.006563	105.1
Phosphorus	5.998e-005	5.357e-008	0.001661	5.849e-005	1.813
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.182e-007	8.237e-012	6.509e-007	5.432e-028	4.293e-023
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001408	0.001233	39.57	0.0001745	5.600

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3069

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999368 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006722 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.75 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3069
e- + Fe+++ = Fe++	-0.0005	-0.0091

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.385e-006	-5.858	0.0002090	

Pyrite	1.665e-008	-7.779	1.998e-006	3.987e-007
Se(black)	1.182e-007	-6.928	9.329e-006	
			___________	___________
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006684	236.8	0.8912	-2.2250
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5197
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008103	49.40	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001589	8.870	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001132	15.41	1.0000	-3.9460
Mn++	0.0001118	6.136	0.6557	-4.1349
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5367
NaSO4-	1.516e-005	1.803	0.8945	-4.8677
FeSO4	1.102e-005	1.672	1.0000	-4.9579
CaHCO3+	1.051e-005	1.062	0.8982	-5.0249
MnSO4	8.385e-006	1.265	1.0000	-5.0765
NaHCO3	4.807e-006	0.4035	1.0000	-5.3181
MgCl+	3.541e-006	0.2115	0.8945	-5.4993
MgHCO3+	2.743e-006	0.2339	0.8945	-5.6102
FeHCO3+	2.014e-006	0.2352	0.8945	-5.7443
H+	1.747e-006	0.001759	0.9084	-5.7995
FeCl+	1.239e-006	0.1131	0.8945	-5.9552
MnHCO3+	1.076e-006	0.1247	0.8945	-6.0165
NaCl	5.454e-007	0.03185	1.0000	-6.2632

KSO4-	5.373e-007	0.07256	0.8945	-6.3183
MnCl+	3.095e-007	0.02795	0.8945	-6.5578
HSO4-	9.465e-008	0.009180	0.8945	-7.0723
H2PO4-	4.642e-008	0.004499	0.8945	-7.3817
CO3--	2.735e-008	0.001640	0.6428	-7.7549
CaCO3	2.174e-008	0.002175	1.0000	-7.6627
KCl	1.434e-008	0.001068	1.0000	-7.8435
FeCO3	1.386e-008	0.001605	1.0000	-7.8582

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002595	0.002593	1.0000	-2.5859
>(w)FeOH2+	0.001046	0.001046	7.3912	-2.9803
>(w)FeOCO2-	0.0003107	0.0003105	0.13530	-3.5077
>(w)FeOH	0.0002500	0.0002498	1.0000	-3.6021
>(w)FeSO4-	0.0001183	0.0001182	0.13530	-3.9271
>(s)FeOH2+	7.011e-005	7.007e-005	7.3912	-4.1542
>(w)FeOHSO4--	5.636e-005	5.632e-005	0.018305	-4.2490
>(w)FeHPO4-	4.612e-005	4.609e-005	0.13530	-4.3361
>(s)FeOHCa++	2.396e-005	2.394e-005	54.630	-4.6206
>(s)FeOH	1.675e-005	1.674e-005	1.0000	-4.7760
>(w)FeH2PO4	7.865e-006	7.860e-006	1.0000	-5.1043
>(w)FePO4--	4.593e-006	4.590e-006	0.018305	-5.3379
>(w)FeO-	1.368e-006	1.367e-006	0.13530	-5.8639
>(s)FeO-	9.167e-008	9.161e-008	0.13530	-7.0378
>(w)FeOCa+	2.521e-008	2.519e-008	7.3912	-7.5985
>(w)FeH2AsO3	1.295e-008	1.294e-008	1.0000	-7.8878
>(w)FeOHAsO4---	5.918e-015	5.914e-015	0.0024766	-14.2278
>(w)FeHAsO4-	2.322e-015	2.321e-015	0.13530	-14.6341
>(w)FeH2AsO4	3.145e-016	3.143e-016	1.0000	-15.5023
>(w)FeSeO3-	4.767e-028	4.764e-028	0.13530	-27.3217

>(w)FeOHSeO3--	6.705e-029	6.700e-029	0.018305	-28.1736
>(w)FeSeO4-	1.014e-053	1.013e-053	0.13530	-52.9942
>(w)FeOHSeO4--	5.545e-054	5.542e-054	0.018305	-53.2561

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
MnHPO4(c)	0.0000 sat	Rhodochrosite	-1.3144
Pyrite	0.0000 sat	Gypsum	-1.7998
Hematite	0.0000 sat	Anhydrite	-2.0463
Se(black)	0.0000 sat	Calcite	-2.2276
FeSe2	-0.4652	Aragonite	-2.3932
Goethite	-0.4676	Bassanite	-2.6771
Siderite	-1.2308	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06893	-1.162
Steam	0.02023	-1.694
H2S(g)	2.254e-009	-8.647
H2(g)	7.065e-010	-9.151
CH4(g)	1.642e-014	-13.785
S2(g)	4.733e-026	-25.325
O2(g)	5.643e-068	-67.248

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH 0.000111					
>(w)FeOH 0.00443					

As(OH)4-	1.31e-008	2.01e-010	2.88e-005	1.29e-008	0.00185
Ca++	0.00146	0.00143	57.4	2.40e-005	0.960
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67	1.97e-031	1.10e-026
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.5	55.5	9.99e+005	-0.00308	-55.5
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	-1.77e-007	-7.35e-010	-2.35e-005	4.27e-015	1.37e-010
SO4--	0.00141	0.00123	118.	0.000175	16.8
SeO3--	1.18e-007	8.25e-012	1.05e-006	5.43e-028	6.90e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01646	-1.784
HCO3-	0.4299	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1240	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.314e-008	2.014e-010	1.509e-005	1.294e-008	0.0009693
Calcium	0.001456	0.001432	57.40	2.397e-005	0.9604
Carbon	0.006755	0.003851	46.25	0.002904	34.87
Chlorine	0.006718	0.006718	238.2		

Hydrogen	110.9	110.9	1.118e+005	0.0006889	0.6943
Iron	0.02234	0.0001731	9.668	9.861e-031	5.506e-026
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.673		
Oxygen	55.53	55.49	8.877e+005	0.006563	105.0
Phosphorus	5.998e-005	5.362e-008	0.001661	5.854e-005	1.813
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.182e-007	8.250e-012	6.513e-007	5.434e-028	4.290e-023
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001408	0.001233	39.53	0.0001745	5.594

6.560e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012440

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			______________	______________
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.254e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.465e-007	0.03191	1.0000	-6.2624
KSO4-	5.384e-007	0.07271	0.8944	-6.3174

MnCl+	3.135e-007	0.02832	0.8944	-6.5522
HSe-	1.877e-007	0.01500	0.8944	-6.7751
As(OH)3	1.000e-007	0.01259	1.0000	-6.9998
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6426	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002593	0.002589	1.0000	-2.5862
>(w)FeOH2+	0.001046	0.001044	7.3750	-2.9805
>(w)FeOCO2-	0.0003102	0.0003097	0.13559	-3.5084
>(w)FeOH	0.0002496	0.0002492	1.0000	-3.6027
>(w)FeSO4-	0.0001178	0.0001176	0.13559	-3.9287
>(s)FeOH2+	7.013e-005	7.002e-005	7.3750	-4.1541
>(w)FeOHSO4--	5.609e-005	5.600e-005	0.018385	-4.2511
>(w)FeHPO4-	4.717e-005	4.709e-005	0.13559	-4.3264
>(s)FeOHCa++	2.406e-005	2.402e-005	54.391	-4.6187
>(s)FeOH	1.674e-005	1.671e-005	1.0000	-4.7763
>(w)FeH2PO4	8.052e-006	8.039e-006	1.0000	-5.0941
>(w)FeH2AsO3	6.421e-006	6.411e-006	1.0000	-5.1924
>(w)FePO4--	4.693e-006	4.685e-006	0.018385	-5.3286
>(w)FeO-	1.365e-006	1.363e-006	0.13559	-5.8649
>(s)FeO-	9.150e-008	9.136e-008	0.13559	-7.0386
>(w)FeOHAsO4---	3.429e-008	3.424e-008	0.0024929	-7.4648
>(w)FeOCa+	2.527e-008	2.523e-008	7.3750	-7.5973
>(w)FeHAsO4-	1.348e-008	1.346e-008	0.13559	-7.8702
>(w)FeH2AsO4	1.828e-009	1.825e-009	1.0000	-8.7380

>(w)FeSeO3-	1.754e-011	1.751e-011	0.13559	-10.7560
>(w)FeOHSeO3--	2.464e-012	2.460e-012	0.018385	-11.6084
>(w)FeSeO4-	4.370e-033	4.363e-033	0.13559	-32.3595
>(w)FeOHSeO4--	2.388e-033	2.385e-033	0.018385	-32.6219

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0170s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2291	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH 0.000111					

>(w)FeOH	0.00443				
As(OH)4-	6.56e-006	1.00e-007	0.0143	6.46e-006	0.924
Ca++	0.00146	0.00143	57.5	2.40e-005	0.965
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00389	3.92
H2O	55.5	55.5	1.00e+006	-0.00309	-55.7
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	5.99e-005	5.50e-008	0.00528	5.98e-005	5.75
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	2.48e-008	0.000793
SO4--	0.00141	0.00123	119.	0.000174	16.7
SeO3--	1.89e-007	1.89e-007	0.0240	2.00e-011	2.54e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01651	-1.782
HCO3-	0.4294	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1234	-0.909
SeO3--	0.0001056	-3.976

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.560e-006	1.000e-007	0.007499	6.460e-006	0.4844
Calcium	0.001456	0.001432	57.45	2.404e-005	0.9646

Carbon	0.006750	0.003851	46.30	0.002899	34.85
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006953	0.7014
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006567	105.2
Phosphorus	5.987e-005	5.500e-008	0.001705	5.981e-005	1.854
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.997e-011	1.578e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001407	0.001234	39.59	0.0001736	5.572

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3067

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3067
e- + Fe+++ = Fe++	-0.0005	-0.0093

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.442e-006	-5.841	0.0002177	

Pyrite	1.971e-008	-7.705	2.364e-006	4.718e-007
Se(black)	1.891e-007	-6.723	1.493e-005	
			____________	____________
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003025	133.0	1.0000	-2.5193
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008109	49.44	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001118	6.139	0.6556	-4.1348
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.255e-005	2.457	0.8944	-4.5359
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.103e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.394e-006	1.267	1.0000	-5.0760
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.548e-006	0.2118	0.8944	-5.4985
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6095
FeHCO3+	2.018e-006	0.2356	0.8944	-5.7436
H+	1.747e-006	0.001760	0.9083	-5.7994
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.078e-006	0.1249	0.8944	-6.0160
NaCl	5.465e-007	0.03191	1.0000	-6.2624

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
As(OH)3	1.008e-007	0.01268	1.0000	-6.9966
HSO4-	9.473e-008	0.009189	0.8944	-7.0720
H2PO4-	4.642e-008	0.004498	0.8944	-7.3818
CO3--	2.737e-008	0.001641	0.6427	-7.7547
CaCO3	2.177e-008	0.002178	1.0000	-7.6621
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.388e-008	0.001607	1.0000	-7.8576

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002594	0.002590	1.0000	-2.5860
>(w)FeOH2+	0.001046	0.001044	7.3870	-2.9805
>(w)FeOCO2-	0.0003104	0.0003099	0.13537	-3.5081
>(w)FeOH	0.0002497	0.0002493	1.0000	-3.6026
>(w)FeSO4-	0.0001182	0.0001180	0.13537	-3.9275
>(s)FeOH2+	7.017e-005	7.006e-005	7.3870	-4.1538
>(w)FeOHSO4--	5.627e-005	5.618e-005	0.018326	-4.2497
>(w)FeHPO4-	4.603e-005	4.596e-005	0.13537	-4.3369
>(s)FeOHCa++	2.400e-005	2.397e-005	54.567	-4.6197
>(s)FeOH	1.675e-005	1.672e-005	1.0000	-4.7759
>(w)FeH2PO4	7.855e-006	7.843e-006	1.0000	-5.1048
>(w)FeH2AsO3	6.470e-006	6.460e-006	1.0000	-5.1891
>(w)FePO4--	4.581e-006	4.574e-006	0.018326	-5.3390
>(w)FeO-	1.366e-006	1.363e-006	0.13537	-5.8647
>(s)FeO-	9.161e-008	9.146e-008	0.13537	-7.0380
>(w)FeOCa+	2.521e-008	2.517e-008	7.3870	-7.5984
>(w)FeOHAsO4---	2.952e-012	2.947e-012	0.0024809	-11.5298
>(w)FeHAsO4-	1.160e-012	1.158e-012	0.13537	-11.9355
>(w)FeH2AsO4	1.572e-013	1.570e-013	1.0000	-12.8034

>(w)FeSeO3-	4.762e-028	4.754e-028	0.13537	-27.3222
>(w)FeOHSeO3--	6.692e-029	6.681e-029	0.018326	-28.1744
>(w)FeSeO4-	1.013e-053	1.011e-053	0.13537	-52.9945
>(w)FeOHSeO4--	5.537e-054	5.528e-054	0.018326	-53.2567

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Pyrite	0.0000 sat	Rhodochrosite	-1.3140
MnHPO4(c)	0.0000 sat	Orpiment	-1.3585
Hematite	0.0000 sat	Gypsum	-1.7992
Se(black)	0.0000 sat	Anhydrite	-2.0457
FeSe2	-0.4652	Calcite	-2.2270
Goethite	-0.4676	Aragonite	-2.3926
Realgar	-0.4971	Bassanite	-2.6765
Siderite	-1.2302	CaSO4^1/2H2O(bet	-2.8539

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2S(g)	2.253e-009	-8.647
H2(g)	7.062e-010	-9.151
CH4(g)	1.641e-014	-13.785
S2(g)	4.732e-026	-25.325
O2(g)	5.647e-068	-67.248

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

```
 >(s)FeOH       0.000111
 >(w)FeOH        0.00443
 As(OH)4-      6.56e-006  1.01e-007    0.0144  6.46e-006     0.924
 Ca++            0.00146    0.00143      57.5  2.40e-005     0.962
 Cl-             0.00672    0.00672      238.
 Fe++           0.000173   0.000173      9.68  1.01e-028 5.64e-024
 Fe+++            0.0222  4.40e-012 2.46e-007
 H+              -0.0596    0.00302      3.05    0.00389      3.92
 H2O                55.4       55.4 9.99e+005   -0.00309     -55.7
 HCO3-           0.00675    0.00385      235.    0.00290      177.
 HPO4--        5.99e-005  5.36e-008   0.00515  5.84e-005      5.61
 K+             0.000116   0.000116      4.55
 Mg++           0.000546   0.000546      13.3
 Mn++           0.000123   0.000121      6.68
 Na+             0.00479    0.00479      110.
 O2(aq)       -2.59e-007 -7.33e-010-2.35e-005  2.13e-012 6.83e-008
 SO4--           0.00141    0.00123      119.   0.000174      16.7
 SeO3--        1.89e-007  8.24e-012 1.05e-006 -6.41e-028-8.14e-023

Sorbed               fraction    log fraction
------------------------------------------------
 As(OH)4-             0.9847      -0.007
 Ca++                0.01648      -1.783
 HCO3-                0.4296      -0.367
 HPO4--               0.9991      -0.000
 SO4--                0.1238      -0.907

Elemental composition          In fluid              Sorbed
              total moles    moles      mg/kg       moles      mg/kg
-------------------------------------------------------------------------------
 Arsenic       6.560e-006   1.007e-007   0.007548   6.460e-006     0.4844
 Calcium         0.001456     0.001432      57.45   2.399e-005     0.9624
```

Carbon	0.006750	0.003850	46.29	0.002900	34.86
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006947	0.7008
Iron	0.02234	0.0001731	9.678	5.049e-028	2.822e-023
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.677		
Oxygen	55.47	55.43	8.877e+005	0.006566	105.1
Phosphorus	5.987e-005	5.356e-008	0.001661	5.837e-005	1.810
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	8.238e-012	6.510e-007	-6.409e-028	-5.065e-023
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001407	0.001233	39.57	0.0001742	5.588

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3069

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999368 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006722 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3069
e- + Fe+++ = Fe++	-0.0005	-0.0092

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.386e-006	-5.858	0.0002092	

Pyrite	1.971e-008	-7.705	2.364e-006	4.718e-007
Se(black)	1.891e-007	-6.723	1.493e-005	
			____________	____________
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006684	236.8	0.8912	-2.2250
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5197
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008103	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001589	8.870	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001132	15.41	1.0000	-3.9460
Mn++	0.0001118	6.136	0.6557	-4.1350
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5367
NaSO4-	1.516e-005	1.803	0.8945	-4.8677
FeSO4	1.102e-005	1.672	1.0000	-4.9579
CaHCO3+	1.051e-005	1.062	0.8982	-5.0249
MnSO4	8.385e-006	1.265	1.0000	-5.0765
NaHCO3	4.807e-006	0.4035	1.0000	-5.3181
MgCl+	3.541e-006	0.2115	0.8945	-5.4993
MgHCO3+	2.743e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7443
H+	1.747e-006	0.001759	0.9084	-5.7995
FeCl+	1.239e-006	0.1131	0.8945	-5.9552
MnHCO3+	1.076e-006	0.1247	0.8945	-6.0164
NaCl	5.454e-007	0.03185	1.0000	-6.2633

KSO4-	5.373e-007	0.07256	0.8945	-6.3183
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
As(OH)3	1.007e-007	0.01267	1.0000	-6.9969
HSO4-	9.464e-008	0.009179	0.8945	-7.0724
H2PO4-	4.642e-008	0.004499	0.8945	-7.3818
CO3--	2.736e-008	0.001640	0.6428	-7.7549
CaCO3	2.175e-008	0.002175	1.0000	-7.6626
KCl	1.434e-008	0.001068	1.0000	-7.8435
FeCO3	1.386e-008	0.001605	1.0000	-7.8581

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002591	0.002589	1.0000	-2.5866
>(w)FeOH2+	0.001045	0.001044	7.3885	-2.9808
>(w)FeOCO2-	0.0003101	0.0003099	0.13535	-3.5085
>(w)FeOH	0.0002496	0.0002495	1.0000	-3.6027
>(w)FeSO4-	0.0001180	0.0001180	0.13535	-3.9280
>(s)FeOH2+	7.011e-005	7.006e-005	7.3885	-4.1542
>(w)FeOHSO4--	5.624e-005	5.620e-005	0.018318	-4.2500
>(w)FeHPO4-	4.603e-005	4.600e-005	0.13535	-4.3369
>(s)FeOHCa++	2.397e-005	2.395e-005	54.590	-4.6204
>(s)FeOH	1.674e-005	1.673e-005	1.0000	-4.7761
>(w)FeH2PO4	7.852e-006	7.847e-006	1.0000	-5.1050
>(w)FeH2AsO3	6.464e-006	6.459e-006	1.0000	-5.1895
>(w)FePO4--	4.583e-006	4.580e-006	0.018318	-5.3388
>(w)FeO-	1.366e-006	1.365e-006	0.13535	-5.8646
>(s)FeO-	9.161e-008	9.156e-008	0.13535	-7.0380
>(w)FeOCa+	2.518e-008	2.517e-008	7.3885	-7.5989
>(w)FeOHAsO4---	2.952e-012	2.950e-012	0.0024793	-11.5299
>(w)FeHAsO4-	1.159e-012	1.158e-012	0.13535	-11.9359
>(w)FeH2AsO4	1.570e-013	1.569e-013	1.0000	-12.8040

>(w)FeSeO3-	4.759e-028	4.756e-028	0.13535	-27.3225
>(w)FeOHSeO3--	6.691e-029	6.687e-029	0.018318	-28.1745
>(w)FeSeO4-	1.012e-053	1.011e-053	0.13535	-52.9949
>(w)FeOHSeO4--	5.534e-054	5.531e-054	0.018318	-53.2570

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Pyrite	0.0000 sat	Rhodochrosite	-1.3144
MnHPO4(c)	0.0000 sat	Orpiment	-1.3586
Hematite	0.0000 sat	Gypsum	-1.7998
Se(black)	0.0000 sat	Anhydrite	-2.0463
FeSe2	-0.4651	Calcite	-2.2276
Goethite	-0.4676	Aragonite	-2.3931
Realgar	-0.4972	Bassanite	-2.6771
Siderite	-1.2307	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06893	-1.162
Steam	0.02023	-1.694
H2S(g)	2.254e-009	-8.647
H2(g)	7.065e-010	-9.151
CH4(g)	1.642e-014	-13.785
S2(g)	4.732e-026	-25.325
O2(g)	5.643e-068	-67.248

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000111				
>(w)FeOH	0.00443				
As(OH)4-	6.56e-006	1.01e-007	0.0144	6.46e-006	0.923
Ca++	0.00146	0.00143	57.4	2.40e-005	0.961
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67	1.01e-028	5.64e-024
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.5	55.5	9.99e+005	-0.00309	-55.6
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	5.99e-005	5.36e-008	0.00515	5.84e-005	5.61
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	-2.59e-007	-7.34e-010	-2.35e-005	2.13e-012	6.82e-008
SO4--	0.00141	0.00123	118.	0.000174	16.7
SeO3--	1.89e-007	8.25e-012	1.05e-006	-6.41e-028	-8.14e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01646	-1.783
HCO3-	0.4295	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1238	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.560e-006	1.007e-007	0.007543	6.459e-006	0.4839
Calcium	0.001456	0.001432	57.40	2.398e-005	0.9608

Carbon	0.006750	0.003851	46.25	0.002899	34.82
Chlorine	0.006718	0.006718	238.1		
Hydrogen	110.9	110.9	1.118e+005	0.0006949	0.7003
Iron	0.02234	0.0001731	9.668	5.049e-028	2.819e-023
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.673		
Oxygen	55.53	55.49	8.877e+005	0.006565	105.0
Phosphorus	5.987e-005	5.362e-008	0.001661	5.843e-005	1.810
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	8.251e-012	6.514e-007	-6.414e-028	-5.064e-023
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001407	0.001233	39.53	0.0001742	5.583

6.569e-007 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012440

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.255e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.465e-007	0.03191	1.0000	-6.2624
KSO4-	5.384e-007	0.07271	0.8944	-6.3174

MnCl+	3.135e-007	0.02832	0.8944	-6.5522
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6426	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.392e-008	0.001611	1.0000	-7.8564
As(OH)3	1.000e-008	0.001259	1.0000	-7.9998

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002597	0.002593	1.0000	-2.5856
>(w)FeOH2+	0.001047	0.001045	7.3775	-2.9800
>(w)FeOCO2-	0.0003107	0.0003102	0.13555	-3.5077
>(w)FeOH	0.0002500	0.0002496	1.0000	-3.6021
>(w)FeSO4-	0.0001180	0.0001178	0.13555	-3.9280
>(s)FeOH2+	7.013e-005	7.002e-005	7.3775	-4.1541
>(w)FeOHSO4--	5.621e-005	5.612e-005	0.018373	-4.2502
>(w)FeHPO4-	4.725e-005	4.717e-005	0.13555	-4.3256
>(s)FeOHCa++	2.405e-005	2.401e-005	54.428	-4.6189
>(s)FeOH	1.674e-005	1.672e-005	1.0000	-4.7762
>(w)FeH2PO4	8.062e-006	8.049e-006	1.0000	-5.0935
>(w)FePO4--	4.702e-006	4.694e-006	0.018373	-5.3277
>(w)FeO-	1.367e-006	1.365e-006	0.13555	-5.8642
>(w)FeH2AsO3	6.430e-007	6.419e-007	1.0000	-6.1918
>(s)FeO-	9.157e-008	9.142e-008	0.13555	-7.0383
>(w)FeOCa+	2.530e-008	2.526e-008	7.3775	-7.5969
>(w)FeOHAsO4---	3.437e-009	3.432e-009	0.0024904	-8.4638
>(w)FeHAsO4-	1.351e-009	1.348e-009	0.13555	-8.8695
>(w)FeH2AsO4	1.831e-010	1.828e-010	1.0000	-9.7374

>(w)FeSeO3-	1.757e-011	1.754e-011	0.13555	-10.7553
>(w)FeOHSeO3--	2.469e-012	2.465e-012	0.018373	-11.6075
>(w)FeSeO4-	4.377e-033	4.370e-033	0.13555	-32.3588
>(w)FeOHSeO4--	2.393e-033	2.389e-033	0.018373	-32.6210

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0170s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2291	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					

>(w)FeOH	0.00443				
As(OH)4-	6.57e-007	1.00e-008	0.00143	6.47e-007	0.0926
Ca++	0.00146	0.00143	57.5	2.40e-005	0.964
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00389	3.92
H2O	55.5	55.5	1.00e+006	-0.00308	-55.6
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.50e-008	0.00528	5.99e-005	5.76
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	2.48e-009	7.95e-005
SO4--	0.00141	0.00123	119.	0.000174	16.7
SeO3--	1.89e-007	1.89e-007	0.0240	2.00e-011	2.54e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9848	-0.007
Ca++	0.01651	-1.782
HCO3-	0.4298	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1236	-0.908
SeO3--	0.0001058	-3.975

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.569e-007	1.000e-008	0.0007499	6.469e-007	0.04851
Calcium	0.001456	0.001432	57.45	2.404e-005	0.9643

Carbon	0.006754	0.003851	46.30	0.002903	34.90
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006899	0.6959
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006564	105.1
Phosphorus	5.997e-005	5.500e-008	0.001705	5.991e-005	1.857
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	2.000e-011	1.581e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001408	0.001234	39.59	0.0001740	5.582

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3067

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3067
e- + Fe+++ = Fe++	-0.0005	-0.0092

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.445e-006	-5.840	0.0002180	

Pyrite	2.608e-008	-7.584	3.129e-006	6.244e-007
Se(black)	1.891e-007	-6.723	1.493e-005	
			――――――	――――――
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006691	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003025	133.0	1.0000	-2.5193
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1741
HCO3-	0.0008109	49.44	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.878	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001118	6.139	0.6556	-4.1348
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.255e-005	2.457	0.8944	-4.5359
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.103e-005	1.675	1.0000	-4.9573
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.394e-006	1.267	1.0000	-5.0760
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.548e-006	0.2118	0.8944	-5.4985
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6095
FeHCO3+	2.017e-006	0.2356	0.8944	-5.7437
H+	1.747e-006	0.001760	0.9083	-5.7994
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.078e-006	0.1249	0.8944	-6.0160
NaCl	5.465e-007	0.03191	1.0000	-6.2624

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
HSO4-	9.474e-008	0.009189	0.8944	-7.0719
H2PO4-	4.642e-008	0.004499	0.8944	-7.3818
CO3--	2.737e-008	0.001641	0.6427	-7.7547
CaCO3	2.177e-008	0.002177	1.0000	-7.6621
KCl	1.437e-008	0.001070	1.0000	-7.8427
FeCO3	1.388e-008	0.001607	1.0000	-7.8576
As(OH)3	1.008e-008	0.001268	1.0000	-7.9966

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002597	0.002593	1.0000	-2.5854
>(w)FeOH2+	0.001047	0.001045	7.3892	-2.9800
>(w)FeOCO2-	0.0003109	0.0003104	0.13533	-3.5074
>(w)FeOH	0.0002500	0.0002496	1.0000	-3.6020
>(w)FeSO4-	0.0001184	0.0001182	0.13533	-3.9268
>(s)FeOH2+	7.017e-005	7.006e-005	7.3892	-4.1538
>(w)FeOHSO4--	5.638e-005	5.629e-005	0.018315	-4.2489
>(w)FeHPO4-	4.611e-005	4.603e-005	0.13533	-4.3362
>(s)FeOHCa++	2.400e-005	2.396e-005	54.600	-4.6198
>(s)FeOH	1.676e-005	1.673e-005	1.0000	-4.7758
>(w)FeH2PO4	7.867e-006	7.854e-006	1.0000	-5.1042
>(w)FePO4--	4.590e-006	4.583e-006	0.018315	-5.3382
>(w)FeO-	1.368e-006	1.365e-006	0.13533	-5.8640
>(w)FeH2AsO3	6.479e-007	6.468e-007	1.0000	-6.1885
>(s)FeO-	9.166e-008	9.152e-008	0.13533	-7.0378
>(w)FeOCa+	2.523e-008	2.519e-008	7.3892	-7.5980
>(w)FeOHAsO4---	2.959e-013	2.954e-013	0.0024786	-12.5289
>(w)FeHAsO4-	1.162e-013	1.160e-013	0.13533	-12.9348
>(w)FeH2AsO4	1.575e-014	1.572e-014	1.0000	-13.8028

>(w)FeSeO3-	4.770e-028	4.762e-028	0.13533	-27.3215
>(w)FeOHSeO3--	6.705e-029	6.694e-029	0.018315	-28.1736
>(w)FeSeO4-	1.014e-053	1.013e-053	0.13533	-52.9938
>(w)FeOHSeO4--	5.548e-054	5.539e-054	0.018315	-53.2559

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Pyrite	0.0000 sat	Realgar	-1.4971
MnHPO4(c)	0.0000 sat	Gypsum	-1.7992
Hematite	0.0000 sat	Anhydrite	-2.0457
Se(black)	0.0000 sat	Calcite	-2.2271
FeSe2	-0.4652	Aragonite	-2.3926
Goethite	-0.4676	Bassanite	-2.6765
Siderite	-1.2302	CaSO4^1/2H2O(bet	-2.8539
Rhodochrosite	-1.3141		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2S(g)	2.253e-009	-8.647
H2(g)	7.062e-010	-9.151
CH4(g)	1.641e-014	-13.785
S2(g)	4.733e-026	-25.325
O2(g)	5.647e-068	-67.248

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000111				
>(w)FeOH	0.00443				
As(OH)4-	6.57e-007	1.01e-008	0.00144	6.47e-007	0.0925
Ca++	0.00146	0.00143	57.5	2.40e-005	0.962
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68	2.52e-029	1.41e-024
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.4	55.4	9.99e+005	-0.00308	-55.6
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	-2.81e-007	-7.33e-010	-2.35e-005	2.14e-013	6.84e-009
SO4--	0.00141	0.00123	119.	0.000174	16.8
SeO3--	1.89e-007	8.24e-012	1.05e-006	5.43e-028	6.90e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01647	-1.783
HCO3-	0.4299	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1239	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.569e-007	1.007e-008	0.0007548	6.468e-007	0.04850
Calcium	0.001456	0.001432	57.45	2.398e-005	0.9621

Carbon	0.006754	0.003850	46.29	0.002904	34.91
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0006893	0.6954
Iron	0.02234	0.0001731	9.677	6.311e-029	3.528e-024
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.677		
Oxygen	55.47	55.43	8.877e+005	0.006564	105.1
Phosphorus	5.997e-005	5.357e-008	0.001661	5.847e-005	1.813
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	8.238e-012	6.510e-007	5.431e-028	4.292e-023
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001408	0.001233	39.57	0.0001745	5.598

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -67.248

Eh = -0.0755 volts pe = -1.3069

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999368 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006722 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.14 uC/cm2

Surface potential = 51.4 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0755	-1.3069
e- + Fe+++ = Fe++	-0.0005	-0.0092

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.388e-006	-5.857	0.0002095	

Pyrite	2.608e-008	-7.584	3.129e-006	6.244e-007
Se(black)	1.891e-007	-6.723	1.493e-005	
			______________	______________
(total)			1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006684	236.8	0.8912	-2.2250
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5197
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008103	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001589	8.870	0.6557	-3.9821
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001132	15.41	1.0000	-3.9460
Mn++	0.0001118	6.136	0.6557	-4.1350
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5367
NaSO4-	1.516e-005	1.803	0.8945	-4.8677
FeSO4	1.102e-005	1.672	1.0000	-4.9579
CaHCO3+	1.051e-005	1.062	0.8982	-5.0249
MnSO4	8.385e-006	1.265	1.0000	-5.0765
NaHCO3	4.807e-006	0.4035	1.0000	-5.3181
MgCl+	3.541e-006	0.2115	0.8945	-5.4993
MgHCO3+	2.743e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.014e-006	0.2352	0.8945	-5.7443
H+	1.747e-006	0.001759	0.9084	-5.7995
FeCl+	1.239e-006	0.1131	0.8945	-5.9553
MnHCO3+	1.076e-006	0.1247	0.8945	-6.0165
NaCl	5.454e-007	0.03185	1.0000	-6.2633

KSO4-	5.373e-007	0.07256	0.8945	-6.3183
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
HSO4-	9.464e-008	0.009179	0.8945	-7.0724
H2PO4-	4.642e-008	0.004499	0.8945	-7.3817
CO3--	2.736e-008	0.001640	0.6428	-7.7549
CaCO3	2.175e-008	0.002175	1.0000	-7.6626
KCl	1.434e-008	0.001068	1.0000	-7.8435
FeCO3	1.386e-008	0.001605	1.0000	-7.8581
As(OH)3	1.007e-008	0.001268	1.0000	-7.9969

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002594	0.002593	1.0000	-2.5860
>(w)FeOH2+	0.001046	0.001046	7.3907	-2.9804
>(w)FeOCO2-	0.0003106	0.0003104	0.13530	-3.5078
>(w)FeOH	0.0002499	0.0002498	1.0000	-3.6021
>(w)FeSO4-	0.0001182	0.0001182	0.13530	-3.9273
>(s)FeOH2+	7.011e-005	7.006e-005	7.3907	-4.1542
>(w)FeOHSO4--	5.634e-005	5.631e-005	0.018307	-4.2491
>(w)FeHPO4-	4.611e-005	4.608e-005	0.13530	-4.3362
>(s)FeOHCa++	2.396e-005	2.394e-005	54.623	-4.6205
>(s)FeOH	1.675e-005	1.674e-005	1.0000	-4.7760
>(w)FeH2PO4	7.863e-006	7.858e-006	1.0000	-5.1044
>(w)FePO4--	4.592e-006	4.589e-006	0.018307	-5.3380
>(w)FeO-	1.368e-006	1.367e-006	0.13530	-5.8639
>(w)FeH2AsO3	6.472e-007	6.468e-007	1.0000	-6.1889
>(s)FeO-	9.166e-008	9.161e-008	0.13530	-7.0378
>(w)FeOCa+	2.521e-008	2.519e-008	7.3907	-7.5985
>(w)FeOHAsO4---	2.959e-013	2.957e-013	0.0024771	-12.5289
>(w)FeHAsO4-	1.161e-013	1.160e-013	0.13530	-12.9352
>(w)FeH2AsO4	1.572e-014	1.571e-014	1.0000	-13.8035

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 >(w)FeSeO3-        4.766e-028    4.763e-028      0.13530    -27.3218
 >(w)FeOHSeO3--     6.704e-029    6.699e-029      0.018307    -28.1737
 >(w)FeSeO4-        1.013e-053    1.013e-053      0.13530    -52.9943
 >(w)FeOHSeO4--     5.544e-054    5.541e-054      0.018307    -53.2561
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)


 Mineral saturation states
                 log Q/K                      log Q/K
----------------------------------------------------------------
 Pyrite            0.0000 sat    Realgar          -1.4972
 MnHPO4(c)         0.0000 sat    Gypsum           -1.7998
 Hematite          0.0000 sat    Anhydrite        -2.0463
 Se(black)         0.0000 sat    Calcite          -2.2276
 FeSe2            -0.4652        Aragonite        -2.3931
 Goethite         -0.4676        Bassanite        -2.6772
 Siderite         -1.2307        CaSO4^1/2H2O(bet  -2.8545
 Rhodochrosite    -1.3144
  (only minerals with log Q/K > -3 listed)


 Gases              fugacity      log fug.
-----------------------------------------------
 CO2(g)               0.06893      -1.162
 Steam                0.02023      -1.694
 H2S(g)             2.254e-009      -8.647
 H2(g)              7.065e-010      -9.151
 CH4(g)             1.642e-014     -13.785
 S2(g)              4.732e-026     -25.325
 O2(g)              5.643e-068     -67.248


                            In fluid           Sorbed          Kd
 Original basis total moles   moles     mg/kg      moles    mg/kg      L/kg
-------------------------------------------------------------------------------
```

>(s)FeOH	0.000111				
>(w)FeOH	0.00443				
As(OH)4-	6.57e-007	1.01e-008	0.00144	6.47e-007	0.0925
Ca++	0.00146	0.00143	57.4	2.40e-005	0.961
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67	2.52e-029	1.41e-024
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.5	55.5	9.99e+005	-0.00308	-55.5
HCO3-	0.00675	0.00385	235.	0.00290	177.
HPO4--	6.00e-005	5.36e-008	0.00515	5.85e-005	5.62
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	-2.81e-007	-7.34e-010	-2.35e-005	2.14e-013	6.84e-009
SO4--	0.00141	0.00123	118.	0.000174	16.8
SeO3--	1.89e-007	8.25e-012	1.05e-006	5.43e-028	6.90e-023

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01646	-1.784
HCO3-	0.4298	-0.367
HPO4--	0.9991	-0.000
SO4--	0.1240	-0.907

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	6.569e-007	1.007e-008	0.0007543	6.468e-007	0.04846
Calcium	0.001456	0.001432	57.40	2.397e-005	0.9605

Carbon	0.006754	0.003851	46.25	0.002903	34.87
Chlorine	0.006718	0.006718	238.1		
Hydrogen	110.9	110.9	1.118e+005	0.0006895	0.6949
Iron	0.02234	0.0001731	9.667	6.311e-029	3.524e-024
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.673		
Oxygen	55.53	55.49	8.877e+005	0.006563	105.0
Phosphorus	5.997e-005	5.362e-008	0.001661	5.853e-005	1.813
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	8.251e-012	6.514e-007	5.433e-028	4.290e-023
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001408	0.001233	39.53	0.0001745	5.593

3.261e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012440

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			____________	____________
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006690	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.254e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.464e-007	0.03191	1.0000	-6.2625
KSO4-	5.384e-007	0.07271	0.8944	-6.3174

As(OH)3	5.002e-007	0.06295	1.0000	-6.3008
MnCl+	3.135e-007	0.02832	0.8944	-6.5522
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6426	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.436e-008	0.001070	1.0000	-7.8427
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002578	0.002574	1.0000	-2.5887
>(w)FeOH2+	0.001041	0.001040	7.3640	-2.9824
>(w)FeOCO2-	0.0003079	0.0003074	0.13580	-3.5116
>(w)FeOH	0.0002481	0.0002477	1.0000	-3.6053
>(w)FeSO4-	0.0001170	0.0001168	0.13580	-3.9320
>(s)FeOH2+	7.013e-005	7.001e-005	7.3640	-4.1541
>(w)FeOHSO4--	5.559e-005	5.550e-005	0.018441	-4.2550
>(w)FeHPO4-	4.682e-005	4.674e-005	0.13580	-4.3296
>(w)FeH2AsO3	3.191e-005	3.186e-005	1.0000	-4.4960
>(s)FeOHCa++	2.409e-005	2.405e-005	54.228	-4.6181
>(s)FeOH	1.671e-005	1.668e-005	1.0000	-4.7770
>(w)FeH2PO4	8.004e-006	7.991e-006	1.0000	-5.0967
>(w)FePO4--	4.651e-006	4.643e-006	0.018441	-5.3325
>(w)FeO-	1.355e-006	1.352e-006	0.13580	-5.8682
>(w)FeOHAsO4---	1.697e-007	1.694e-007	0.0025042	-6.7704
>(s)FeO-	9.122e-008	9.107e-008	0.13580	-7.0399
>(w)FeHAsO4-	6.691e-008	6.680e-008	0.13580	-7.1745
>(w)FeOCa+	2.516e-008	2.512e-008	7.3640	-7.5993
>(w)FeH2AsO4	9.087e-009	9.072e-009	1.0000	-8.0416

>(w)FeSeO3-	1.741e-011	1.738e-011	0.13580	-10.7593
>(w)FeOHSeO3--	2.442e-012	2.438e-012	0.018441	-11.6123
>(w)FeSeO4-	4.337e-033	4.330e-033	0.13580	-32.3628
>(w)FeOHSeO4--	2.367e-033	2.363e-033	0.018441	-32.6258

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0170s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					

>(w)FeOH	0.00443				
As(OH)4-	3.26e-005	5.00e-007	0.0715	3.21e-005	4.59
Ca++	0.00146	0.00143	57.5	2.41e-005	0.966
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00389	3.93
H2O	55.5	55.5	1.00e+006	-0.00312	-56.3
HCO3-	0.00673	0.00385	235.	0.00288	176.
HPO4--	5.94e-005	5.50e-008	0.00528	5.94e-005	5.70
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	1.23e-007	0.00393
SO4--	0.00141	0.00123	119.	0.000172	16.6
SeO3--	1.89e-007	1.89e-007	0.0240	1.98e-011	2.52e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9847	-0.007
Ca++	0.01653	-1.782
HCO3-	0.4279	-0.369
HPO4--	0.9991	-0.000
SO4--	0.1225	-0.912
SeO3--	0.0001048	-3.980

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.261e-005	5.000e-007	0.03749	3.211e-005	2.408
Calcium	0.001456	0.001432	57.45	2.408e-005	0.9659

Carbon	0.006732	0.003851	46.30	0.002881	34.63
Chlorine	0.006718	0.006718	238.4		
Hydrogen	110.8	110.8	1.118e+005	0.0007193	0.7256
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006577	105.3
Phosphorus	5.943e-005	5.500e-008	0.001705	5.937e-005	1.841
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.982e-011	1.566e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001406	0.001234	39.59	0.0001723	5.528

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -60.390

Eh = 0.0235 volts pe = 0.4076

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998368 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006729 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0235	0.4076
e- + Fe+++ = Fe++	-0.0005	-0.0095

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.433e-006	-5.844	0.0002163	

Se(black)	1.891e-007	-6.723	1.493e-005
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006690	237.0	0.8911	-2.2246
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008110	49.45	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.880	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001118	6.140	0.6556	-4.1348
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.255e-005	2.457	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.104e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.395e-006	1.267	1.0000	-5.0760
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6095
FeHCO3+	2.018e-006	0.2356	0.8944	-5.7436
H+	1.747e-006	0.001759	0.9083	-5.7995
FeCl+	1.242e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.078e-006	0.1249	0.8944	-6.0160
NaCl	5.464e-007	0.03191	1.0000	-6.2625
KSO4-	5.382e-007	0.07269	0.8944	-6.3175

As(OH)3	5.030e-007	0.06330	1.0000	-6.2984
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
HSO4-	9.472e-008	0.009188	0.8944	-7.0720
H2PO4-	4.641e-008	0.004498	0.8944	-7.3819
CO3--	2.738e-008	0.001642	0.6427	-7.7546
CaCO3	2.178e-008	0.002178	1.0000	-7.6620
KCl	1.436e-008	0.001070	1.0000	-7.8427
FeCO3	1.389e-008	0.001608	1.0000	-7.8574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002579	0.002574	1.0000	-2.5886
>(w)FeOH2+	0.001041	0.001039	7.3767	-2.9825
>(w)FeOCO2-	0.0003081	0.0003076	0.13556	-3.5113
>(w)FeOH	0.0002482	0.0002478	1.0000	-3.6051
>(w)FeSO4-	0.0001173	0.0001171	0.13556	-3.9307
>(s)FeOH2+	7.016e-005	7.005e-005	7.3767	-4.1539
>(w)FeOHSO4--	5.579e-005	5.570e-005	0.018377	-4.2535
>(w)FeHPO4-	4.569e-005	4.562e-005	0.13556	-4.3402
>(w)FeH2AsO3	3.210e-005	3.205e-005	1.0000	-4.4935
>(s)FeOHCa++	2.404e-005	2.400e-005	54.416	-4.6191
>(s)FeOH	1.673e-005	1.670e-005	1.0000	-4.7766
>(w)FeH2PO4	7.807e-006	7.794e-006	1.0000	-5.1075
>(w)FePO4--	4.541e-006	4.534e-006	0.018377	-5.3428
>(w)FeO-	1.356e-006	1.354e-006	0.13556	-5.8678
>(s)FeO-	9.137e-008	9.122e-008	0.13556	-7.0392
>(w)FeOHAsO4---	3.917e-008	3.911e-008	0.0024912	-7.4070
>(w)FeOCa+	2.510e-008	2.506e-008	7.3767	-7.6003
>(w)FeHAsO4-	1.543e-008	1.540e-008	0.13556	-7.8116
>(w)FeH2AsO4	2.094e-009	2.091e-009	1.0000	-8.6790
>(w)FeSeO3-	3.407e-021	3.401e-021	0.13556	-20.4676

>(w)FeOHSeO3--	4.782e-022	4.774e-022	0.018377	-21.3204
>(w)FeSeO4-	1.945e-043	1.942e-043	0.13556	-42.7111
>(w)FeOHSeO4--	1.062e-043	1.060e-043	0.018377	-42.9738

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7992
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0457
Hematite	0.0000 sat	Calcite	-2.2270
Goethite	-0.4676	Aragonite	-2.3925
Siderite	-1.2300	Bassanite	-2.6765
Rhodochrosite	-1.3139	CaSO4^1/2H2O(bet	-2.8539

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	2.631e-013	-12.580
H2S(g)	4.337e-023	-22.363
CH4(g)	3.160e-028	-27.500
S2(g)	1.264e-046	-45.898
O2(g)	4.069e-061	-60.390

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	3.26e-005	5.02e-007	0.0719	3.21e-005		4.59

Ca++	0.00146	0.00143	57.5	2.40e-005	0.964
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.93
H2O	55.4	55.4	9.99e+005	-0.00312	-56.3
HCO3-	0.00673	0.00385	235.	0.00288	176.
HPO4--	5.94e-005	5.36e-008	0.00514	5.79e-005	5.57
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	-1.61e-007	4.83e-011	1.55e-006	2.83e-008	0.000906
SO4--	0.00141	0.00123	119.	0.000173	16.6
SeO3--	1.89e-007	3.07e-015	3.90e-010	3.88e-021	4.93e-016

Sorbed	fraction	log fraction
As(OH)4-	0.9846	-0.007
Ca++	0.01650	-1.783
HCO3-	0.4281	-0.368
HPO4--	0.9991	-0.000
SO4--	0.1229	-0.910
SeO3--	1.264e-006	-5.898

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.261e-005	5.024e-007	0.03768	3.211e-005	2.408
Calcium	0.001456	0.001432	57.45	2.402e-005	0.9637
Carbon	0.006732	0.003850	46.29	0.002882	34.65
Chlorine	0.006718	0.006718	238.4		

Hydrogen	110.8	110.8	1.118e+005	0.0007186	0.7249
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.677		
Oxygen	55.47	55.43	8.877e+005	0.006576	105.3
Phosphorus	5.943e-005	5.355e-008	0.001660	5.794e-005	1.796
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	3.069e-015	2.426e-010	3.879e-021	3.065e-016
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001406	0.001233	39.57	0.0001728	5.545

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -60.391

Eh = 0.0235 volts pe = 0.4073

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999368 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006722 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0235	0.4073
e- + Fe+++ = Fe++	-0.0005	-0.0094

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.377e-006	-5.861	0.0002079	

Se(black)	1.891e-007	-6.723	1.493e-005
		______________	______________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006684	236.8	0.8912	-2.2250
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008104	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001132	15.41	1.0000	-3.9460
Mn++	0.0001118	6.137	0.6557	-4.1349
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5367
NaSO4-	1.516e-005	1.803	0.8945	-4.8677
FeSO4	1.102e-005	1.673	1.0000	-4.9578
CaHCO3+	1.052e-005	1.062	0.8982	-5.0248
MnSO4	8.386e-006	1.265	1.0000	-5.0764
NaHCO3	4.808e-006	0.4036	1.0000	-5.3181
MgCl+	3.541e-006	0.2114	0.8945	-5.4993
MgHCO3+	2.744e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7442
H+	1.746e-006	0.001759	0.9084	-5.7996
FeCl+	1.239e-006	0.1131	0.8945	-5.9552
MnHCO3+	1.077e-006	0.1247	0.8945	-6.0164
NaCl	5.454e-007	0.03185	1.0000	-6.2633
KSO4-	5.373e-007	0.07256	0.8945	-6.3183

As(OH)3	5.026e-007	0.06326	1.0000	-6.2987
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
HSO4-	9.463e-008	0.009178	0.8945	-7.0724
H2PO4-	4.641e-008	0.004498	0.8945	-7.3818
CO3--	2.736e-008	0.001641	0.6428	-7.7548
CaCO3	2.175e-008	0.002175	1.0000	-7.6625
KCl	1.434e-008	0.001068	1.0000	-7.8435
FeCO3	1.387e-008	0.001606	1.0000	-7.8580

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002575	0.002574	1.0000	-2.5891
>(w)FeOH2+	0.001040	0.001040	7.3782	-2.9828
>(w)FeOCO2-	0.0003079	0.0003077	0.13553	-3.5116
>(w)FeOH	0.0002482	0.0002480	1.0000	-3.6053
>(w)FeSO4-	0.0001172	0.0001171	0.13553	-3.9312
>(s)FeOH2+	7.010e-005	7.005e-005	7.3782	-4.1543
>(w)FeOHSO4--	5.575e-005	5.572e-005	0.018369	-4.2537
>(w)FeHPO4-	4.569e-005	4.566e-005	0.13553	-4.3402
>(w)FeH2AsO3	3.207e-005	3.205e-005	1.0000	-4.4939
>(s)FeOHCa++	2.400e-005	2.398e-005	54.438	-4.6198
>(s)FeOH	1.672e-005	1.671e-005	1.0000	-4.7768
>(w)FeH2PO4	7.803e-006	7.798e-006	1.0000	-5.1077
>(w)FePO4--	4.543e-006	4.540e-006	0.018369	-5.3426
>(w)FeO-	1.356e-006	1.355e-006	0.13553	-5.8677
>(s)FeO-	9.137e-008	9.131e-008	0.13553	-7.0392
>(w)FeOHAsO4---	3.914e-008	3.912e-008	0.0024897	-7.4073
>(w)FeOCa+	2.507e-008	2.506e-008	7.3782	-7.6008
>(w)FeHAsO4-	1.541e-008	1.540e-008	0.13553	-7.8123
>(w)FeH2AsO4	2.090e-009	2.089e-009	1.0000	-8.6799
>(w)FeSeO3-	3.400e-021	3.398e-021	0.13553	-20.4685

>(w)FeOHSeO3--	4.775e-022	4.772e-022	0.018369	-21.3210
>(w)FeSeO4-	1.939e-043	1.938e-043	0.13553	-42.7124
>(w)FeOHSeO4--	1.059e-043	1.059e-043	0.018369	-42.9749

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7998
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0463
Hematite	0.0000 sat	Calcite	-2.2275
Goethite	-0.4676	Aragonite	-2.3930
Siderite	-1.2306	Bassanite	-2.6771
Rhodochrosite	-1.3143	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02023	-1.694
H2(g)	2.634e-013	-12.579
H2S(g)	4.351e-023	-22.361
CH4(g)	3.171e-028	-27.499
S2(g)	1.269e-046	-45.897
O2(g)	4.061e-061	-60.391

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	3.26e-005	5.03e-007	0.0718	3.21e-005		4.59

Ca++	0.00146	0.00143	57.4	2.40e-005	0.962
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00389	3.92
H2O	55.5	55.5	9.99e+005	-0.00312	-56.2
HCO3-	0.00673	0.00385	235.	0.00288	176.
HPO4--	5.94e-005	5.36e-008	0.00514	5.80e-005	5.57
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	-1.61e-007	4.83e-011	1.54e-006	2.83e-008	0.000906
SO4--	0.00141	0.00123	118.	0.000173	16.6
SeO3--	1.89e-007	3.08e-015	3.90e-010	3.88e-021	4.92e-016

Sorbed	fraction	log fraction
As(OH)4-	0.9846	-0.007
Ca++	0.01649	-1.783
HCO3-	0.4280	-0.369
HPO4--	0.9991	-0.000
SO4--	0.1229	-0.910
SeO3--	1.260e-006	-5.900

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	3.261e-005	5.026e-007	0.03765	3.211e-005	2.405
Calcium	0.001456	0.001432	57.40	2.401e-005	0.9622
Carbon	0.006732	0.003851	46.25	0.002882	34.61
Chlorine	0.006718	0.006718	238.1		

Hydrogen	110.9	110.9	1.118e+005	0.0007188	0.7244
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.674		
Oxygen	55.53	55.49	8.877e+005	0.006576	105.2
Phosphorus	5.943e-005	5.361e-008	0.001660	5.800e-005	1.796
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	3.076e-015	2.429e-010	3.875e-021	3.060e-016
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001406	0.001233	39.53	0.0001728	5.540

3.261e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012439

Activity of water = 0.999765

Solvent mass = 0.998369 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006727 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.12 uC/cm2

Surface potential = 51.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006689	237.0	0.8911	-2.2247
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4334
CaCl+	3.254e-005	2.456	0.8944	-4.5361
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4987
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
As(OH)3	1.501e-006	0.1889	1.0000	-5.8237
FeCl+	1.241e-006	0.1132	0.8944	-5.9546
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.463e-007	0.03191	1.0000	-6.2625

KSO4-	5.384e-007	0.07271	0.8944	-6.3174
MnCl+	3.134e-007	0.02831	0.8944	-6.5523
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6427	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.436e-008	0.001070	1.0000	-7.8428
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002540	0.002536	1.0000	-2.5952
>(w)FeOH2+	0.001030	0.001028	7.3365	-2.9872
>(w)FeOCO2-	0.0003022	0.0003017	0.13630	-3.5197
>(w)FeOH	0.0002445	0.0002441	1.0000	-3.6117
>(w)FeSO4-	0.0001148	0.0001146	0.13630	-3.9400
>(w)FeH2AsO3	9.434e-005	9.419e-005	1.0000	-4.0253
>(s)FeOH2+	7.011e-005	6.999e-005	7.3365	-4.1542
>(w)FeOHSO4--	5.437e-005	5.428e-005	0.018579	-4.2646
>(w)FeHPO4-	4.596e-005	4.588e-005	0.13630	-4.3376
>(s)FeOHCa++	2.418e-005	2.414e-005	53.825	-4.6166
>(s)FeOH	1.664e-005	1.662e-005	1.0000	-4.7787
>(w)FeH2PO4	7.887e-006	7.874e-006	1.0000	-5.1031
>(w)FePO4--	4.548e-006	4.541e-006	0.018579	-5.3421
>(w)FeO-	1.330e-006	1.328e-006	0.13630	-5.8762
>(w)FeOHAsO4---	4.960e-007	4.952e-007	0.0025324	-6.3045
>(w)FeHAsO4-	1.971e-007	1.967e-007	0.13630	-6.7054
>(s)FeO-	9.052e-008	9.037e-008	0.13630	-7.0433
>(w)FeH2AsO4	2.686e-008	2.682e-008	1.0000	-7.5709
>(w)FeOCa+	2.489e-008	2.484e-008	7.3365	-7.6041

>(w)FeSeO3-	1.709e-011	1.706e-011	0.13630	-10.7673
>(w)FeOHSeO3--	2.388e-012	2.384e-012	0.018579	-11.6219
>(w)FeSeO4-	4.258e-033	4.251e-033	0.13630	-32.3708
>(w)FeOHSeO4--	2.315e-033	2.311e-033	0.018579	-32.6354

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0171s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH 0.000111					

>(w)FeOH	0.00443				
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005	13.6
Ca++	0.00146	0.00143	57.5	2.42e-005	0.969
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00390	3.94
H2O	55.5	55.5	1.00e+006	-0.00320	-57.7
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.50e-008	0.00528	5.83e-005	5.60
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	3.59e-007	0.0115
SO4--	0.00140	0.00123	119.	0.000169	16.2
SeO3--	1.89e-007	1.89e-007	0.0240	1.94e-011	2.47e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01659	-1.780
HCO3-	0.4242	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1204	-0.919
SeO3--	0.0001029	-3.988

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.500e-006	0.1125	9.491e-005	7.117
Calcium	0.001456	0.001432	57.45	2.416e-005	0.9693

Carbon	0.006689	0.003851	46.30	0.002838	34.11
Chlorine	0.006716	0.006716	238.3		
Hydrogen	110.8	110.8	1.118e+005	0.0007780	0.7849
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006602	105.7
Phosphorus	5.835e-005	5.500e-008	0.001705	5.830e-005	1.807
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.945e-011	1.537e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001403	0.001234	39.59	0.0001689	5.420

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -59.378

Eh = 0.0382 volts pe = 0.6607

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998369 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006727 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.12 uC/cm2

Surface potential = 51.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0382	0.6607
e- + Fe+++ = Fe++	-0.0005	-0.0095

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.416e-006	-5.849	0.0002137	

Se(black)	1.891e-007	-6.723	1.493e-005
		___	___
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006689	237.0	0.8911	-2.2247
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008110	49.45	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.880	0.6556	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001119	6.140	0.6556	-4.1347
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.254e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.104e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.396e-006	1.267	1.0000	-5.0759
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6095
FeHCO3+	2.018e-006	0.2357	0.8944	-5.7435
H+	1.747e-006	0.001759	0.9083	-5.7995
As(OH)3	1.503e-006	0.1892	1.0000	-5.8230
FeCl+	1.241e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.078e-006	0.1249	0.8944	-6.0159
NaCl	5.464e-007	0.03191	1.0000	-6.2625

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
HSO4-	9.472e-008	0.009188	0.8944	-7.0720
H2PO4-	4.640e-008	0.004497	0.8944	-7.3819
CO3--	2.738e-008	0.001642	0.6427	-7.7546
CaCO3	2.178e-008	0.002178	1.0000	-7.6620
KCl	1.436e-008	0.001070	1.0000	-7.8428
FeCO3	1.389e-008	0.001608	1.0000	-7.8574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002541	0.002537	1.0000	-2.5950
>(w)FeOH2+	0.001030	0.001028	7.3492	-2.9873
>(w)FeOCO2-	0.0003025	0.0003020	0.13607	-3.5193
>(w)FeOH	0.0002446	0.0002442	1.0000	-3.6116
>(w)FeSO4-	0.0001151	0.0001150	0.13607	-3.9387
>(w)FeH2AsO3	9.453e-005	9.437e-005	1.0000	-4.0244
>(s)FeOH2+	7.014e-005	7.003e-005	7.3492	-4.1540
>(w)FeOHSO4--	5.456e-005	5.447e-005	0.018515	-4.2631
>(w)FeHPO4-	4.485e-005	4.477e-005	0.13607	-4.3483
>(s)FeOHCa++	2.412e-005	2.408e-005	54.010	-4.6176
>(s)FeOH	1.666e-005	1.663e-005	1.0000	-4.7783
>(w)FeH2PO4	7.691e-006	7.679e-006	1.0000	-5.1140
>(w)FePO4--	4.441e-006	4.433e-006	0.018515	-5.3525
>(w)FeO-	1.331e-006	1.329e-006	0.13607	-5.8758
>(w)FeOHAsO4---	3.659e-007	3.653e-007	0.0025193	-6.4366
>(w)FeHAsO4-	1.452e-007	1.450e-007	0.13607	-6.8380
>(s)FeO-	9.067e-008	9.052e-008	0.13607	-7.0425
>(w)FeOCa+	2.482e-008	2.478e-008	7.3492	-7.6051
>(w)FeH2AsO4	1.978e-008	1.975e-008	1.0000	-7.7037
>(w)FeSeO3-	3.442e-020	3.437e-020	0.13607	-19.4632

>(w)FeOHSeO3--	4.814e-021	4.806e-021	0.018515	-20.3175
>(w)FeSeO4-	6.305e-042	6.294e-042	0.13607	-41.2003
>(w)FeOHSeO4--	3.430e-042	3.424e-042	0.018515	-41.4647

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7992
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2270
Goethite	-0.4676	Aragonite	-2.3925
Siderite	-1.2300	Bassanite	-2.6765
Rhodochrosite	-1.3139	CaSO4^1/2H2O(bet	-2.8539

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	8.201e-014	-13.086
H2S(g)	4.095e-025	-24.388
CH4(g)	2.983e-030	-29.525
S2(g)	1.159e-049	-48.936
O2(g)	4.188e-060	-59.378

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005	13.6	

Ca++	0.00146	0.00143	57.5	2.41e-005	0.967
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00390	3.94
H2O	55.4	55.4	9.99e+005	-0.00320	-57.7
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.35e-008	0.00514	5.69e-005	5.46
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	7.64e-008	4.63e-010	1.48e-005	2.65e-007	0.00849
SO4--	0.00140	0.00123	119.	0.000169	16.3
SeO3--	1.89e-007	9.57e-016	1.22e-010	3.92e-020	4.98e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01655	-1.781
HCO3-	0.4244	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1208	-0.918
SeO3--	4.094e-005	-4.388

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.502e-006	0.1126	9.490e-005	7.117
Calcium	0.001456	0.001432	57.45	2.411e-005	0.9671
Carbon	0.006689	0.003850	46.29	0.002839	34.13
Chlorine	0.006716	0.006716	238.3		

Hydrogen	110.8	110.8	1.118e+005	0.0007773	0.7841
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.678		
Oxygen	55.47	55.43	8.877e+005	0.006602	105.7
Phosphorus	5.835e-005	5.355e-008	0.001660	5.688e-005	1.764
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	9.567e-016	7.561e-011	3.917e-020	3.096e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001403	0.001233	39.57	0.0001694	5.437

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.379

Eh = 0.0381 volts pe = 0.6604

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999369 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006721 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0381	0.6604
e- + Fe+++ = Fe++	-0.0005	-0.0095

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.361e-006	-5.866	0.0002054	

Se(black)	1.891e-007	-6.723	1.493e-005
		____________	____________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006683	236.7	0.8912	-2.2251
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008104	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.41	1.0000	-3.9460
Mn++	0.0001118	6.137	0.6557	-4.1349
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5368
NaSO4-	1.516e-005	1.804	0.8945	-4.8677
FeSO4	1.102e-005	1.673	1.0000	-4.9578
CaHCO3+	1.052e-005	1.062	0.8982	-5.0248
MnSO4	8.387e-006	1.265	1.0000	-5.0764
NaHCO3	4.808e-006	0.4036	1.0000	-5.3181
MgCl+	3.540e-006	0.2114	0.8945	-5.4994
MgHCO3+	2.744e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7442
H+	1.746e-006	0.001759	0.9084	-5.7996
As(OH)3	1.502e-006	0.1890	1.0000	-5.8233
FeCl+	1.239e-006	0.1131	0.8945	-5.9553
MnHCO3+	1.077e-006	0.1248	0.8945	-6.0163
NaCl	5.453e-007	0.03185	1.0000	-6.2634

KSO4-	5.373e-007	0.07256	0.8945	-6.3182
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
HSO4-	9.463e-008	0.009178	0.8945	-7.0724
H2PO4-	4.640e-008	0.004497	0.8945	-7.3819
CO3--	2.736e-008	0.001641	0.6428	-7.7548
CaCO3	2.175e-008	0.002176	1.0000	-7.6625
KCl	1.434e-008	0.001068	1.0000	-7.8436
FeCO3	1.387e-008	0.001606	1.0000	-7.8579

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002538	0.002536	1.0000	-2.5955
>(w)FeOH2+	0.001029	0.001028	7.3507	-2.9876
>(w)FeOCO2-	0.0003023	0.0003021	0.13604	-3.5196
>(w)FeOH	0.0002445	0.0002444	1.0000	-3.6117
>(w)FeSO4-	0.0001150	0.0001150	0.13604	-3.9392
>(w)FeH2AsO3	9.443e-005	9.437e-005	1.0000	-4.0249
>(s)FeOH2+	7.008e-005	7.004e-005	7.3507	-4.1544
>(w)FeOHSO4--	5.453e-005	5.449e-005	0.018507	-4.2634
>(w)FeHPO4-	4.485e-005	4.482e-005	0.13604	-4.3483
>(s)FeOHCa++	2.408e-005	2.407e-005	54.033	-4.6183
>(s)FeOH	1.665e-005	1.664e-005	1.0000	-4.7785
>(w)FeH2PO4	7.688e-006	7.683e-006	1.0000	-5.1142
>(w)FePO4--	4.443e-006	4.440e-006	0.018507	-5.3524
>(w)FeO-	1.331e-006	1.330e-006	0.13604	-5.8758
>(w)FeOHAsO4---	3.657e-007	3.654e-007	0.0025178	-6.4369
>(w)FeHAsO4-	1.450e-007	1.449e-007	0.13604	-6.8387
>(s)FeO-	9.067e-008	9.061e-008	0.13604	-7.0425
>(w)FeOCa+	2.480e-008	2.478e-008	7.3507	-7.6056
>(w)FeH2AsO4	1.974e-008	1.973e-008	1.0000	-7.7046
>(w)FeSeO3-	3.435e-020	3.433e-020	0.13604	-19.4640

>(w)FeOHSeO3--	4.806e-021	4.803e-021	0.018507	-20.3182
>(w)FeSeO4-	6.285e-042	6.281e-042	0.13604	-41.2017
>(w)FeOHSeO4--	3.421e-042	3.419e-042	0.018507	-41.4658

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7998
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0463
Hematite	0.0000 sat	Calcite	-2.2275
Goethite	-0.4676	Aragonite	-2.3930
Siderite	-1.2306	Bassanite	-2.6771
Rhodochrosite	-1.3142	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02023	-1.694
H2(g)	8.209e-014	-13.086
H2S(g)	4.107e-025	-24.386
CH4(g)	2.993e-030	-29.524
S2(g)	1.164e-049	-48.934
O2(g)	4.179e-060	-59.379

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005		13.6

Ca++	0.00146	0.00143	57.4	2.41e-005	0.966
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00390	3.93
H2O	55.5	55.5	9.99e+005	-0.00320	-57.6
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.36e-008	0.00514	5.69e-005	5.46
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	7.64e-008	4.63e-010	1.48e-005	2.65e-007	0.00848
SO4--	0.00140	0.00123	118.	0.000169	16.3
SeO3--	1.89e-007	9.59e-016	1.22e-010	3.91e-020	4.97e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01654	-1.781
HCO3-	0.4243	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1208	-0.918
SeO3--	4.081e-005	-4.389

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.503e-006	0.1126	9.490e-005	7.110
Calcium	0.001456	0.001432	57.40	2.409e-005	0.9655
Carbon	0.006689	0.003851	46.25	0.002838	34.09
Chlorine	0.006716	0.006716	238.1		

Hydrogen	110.9	110.9	1.118e+005	0.0007775	0.7835
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.674		
Oxygen	55.53	55.49	8.877e+005	0.006601	105.6
Phosphorus	5.835e-005	5.360e-008	0.001660	5.694e-005	1.763
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	9.589e-016	7.570e-011	3.914e-020	3.090e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001403	0.001233	39.53	0.0001694	5.432

9.461e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012439

Activity of water = 0.999765

Solvent mass = 0.998369 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006727 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.12 uC/cm2

Surface potential = 51.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			-------------	-------------
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006689	237.0	0.8911	-2.2247
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6381	-3.1739
HCO3-	0.0008119	49.51	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4334
CaCl+	3.254e-005	2.456	0.8944	-4.5361
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.547e-006	0.2118	0.8944	-5.4987
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
As(OH)3	1.501e-006	0.1889	1.0000	-5.8237
FeCl+	1.241e-006	0.1132	0.8944	-5.9546
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.463e-007	0.03191	1.0000	-6.2625

KSO4-	5.384e-007	0.07271	0.8944	-6.3174
MnCl+	3.134e-007	0.02831	0.8944	-6.5523
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.464e-008	0.009180	0.8944	-7.0724
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.745e-008	0.001646	0.6427	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.436e-008	0.001070	1.0000	-7.8428
FeCO3	1.392e-008	0.001611	1.0000	-7.8564

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002540	0.002536	1.0000	-2.5952
>(w)FeOH2+	0.001030	0.001028	7.3365	-2.9872
>(w)FeOCO2-	0.0003022	0.0003017	0.13630	-3.5197
>(w)FeOH	0.0002445	0.0002441	1.0000	-3.6117
>(w)FeSO4-	0.0001148	0.0001146	0.13630	-3.9400
>(w)FeH2AsO3	9.434e-005	9.419e-005	1.0000	-4.0253
>(s)FeOH2+	7.011e-005	6.999e-005	7.3365	-4.1542
>(w)FeOHSO4--	5.437e-005	5.428e-005	0.018579	-4.2646
>(w)FeHPO4-	4.596e-005	4.588e-005	0.13630	-4.3376
>(s)FeOHCa++	2.418e-005	2.414e-005	53.825	-4.6166
>(s)FeOH	1.664e-005	1.662e-005	1.0000	-4.7787
>(w)FeH2PO4	7.887e-006	7.874e-006	1.0000	-5.1031
>(w)FePO4--	4.548e-006	4.541e-006	0.018579	-5.3421
>(w)FeO-	1.330e-006	1.328e-006	0.13630	-5.8762
>(w)FeOHAsO4---	4.960e-007	4.952e-007	0.0025324	-6.3045
>(w)FeHAsO4-	1.971e-007	1.967e-007	0.13630	-6.7054
>(s)FeO-	9.052e-008	9.037e-008	0.13630	-7.0433
>(w)FeH2AsO4	2.686e-008	2.682e-008	1.0000	-7.5709
>(w)FeOCa+	2.489e-008	2.484e-008	7.3365	-7.6041

>(w)FeSeO3-	1.709e-011	1.706e-011	0.13630	-10.7673
>(w)FeOHSeO3--	2.388e-012	2.384e-012	0.018579	-11.6219
>(w)FeSeO4-	4.258e-033	4.251e-033	0.13630	-32.3708
>(w)FeOHSeO4--	2.315e-033	2.311e-033	0.018579	-32.6354

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0171s/sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH 0.000111					

>(w)FeOH	0.00443				
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005	13.6
Ca++	0.00146	0.00143	57.5	2.42e-005	0.969
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00390	3.94
H2O	55.5	55.5	1.00e+006	-0.00320	-57.7
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.50e-008	0.00528	5.83e-005	5.60
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	3.59e-007	0.0115
SO4--	0.00140	0.00123	119.	0.000169	16.2
SeO3--	1.89e-007	1.89e-007	0.0240	1.94e-011	2.47e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01659	-1.780
HCO3-	0.4242	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1204	-0.919
SeO3--	0.0001029	-3.988

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.500e-006	0.1125	9.491e-005	7.117
Calcium	0.001456	0.001432	57.45	2.416e-005	0.9693

Carbon	0.006689	0.003851	46.30	0.002838	34.11
Chlorine	0.006716	0.006716	238.3		
Hydrogen	110.8	110.8	1.118e+005	0.0007780	0.7849
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006602	105.7
Phosphorus	5.835e-005	5.500e-008	0.001705	5.830e-005	1.807
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.945e-011	1.537e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001403	0.001234	39.59	0.0001689	5.420

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.799 log fO2 = -59.378

Eh = 0.0382 volts pe = 0.6607

Ionic strength = 0.012436

Activity of water = 0.999765

Solvent mass = 0.998369 kg

Solution mass = 0.999110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006727 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.12 uC/cm2

Surface potential = 51.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0382	0.6607
e- + Fe+++ = Fe++	-0.0005	-0.0095

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.416e-006	-5.849	0.0002137	

Se(black)	1.891e-007	-6.723	1.493e-005
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006689	237.0	0.8911	-2.2247
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008110	49.45	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.880	0.6556	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001119	6.140	0.6556	-4.1347
MgSO4	3.685e-005	4.432	1.0000	-4.4336
CaCl+	3.254e-005	2.456	0.8944	-4.5360
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.104e-005	1.675	1.0000	-4.9572
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.396e-006	1.267	1.0000	-5.0759
NaHCO3	4.815e-006	0.4042	1.0000	-5.3174
MgCl+	3.547e-006	0.2118	0.8944	-5.4986
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6095
FeHCO3+	2.018e-006	0.2357	0.8944	-5.7435
H+	1.747e-006	0.001759	0.9083	-5.7995
As(OH)3	1.503e-006	0.1892	1.0000	-5.8230
FeCl+	1.241e-006	0.1133	0.8944	-5.9545
MnHCO3+	1.078e-006	0.1249	0.8944	-6.0159
NaCl	5.464e-007	0.03191	1.0000	-6.2625

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.099e-007	0.02799	0.8944	-6.5573
HSO4-	9.472e-008	0.009188	0.8944	-7.0720
H2PO4-	4.640e-008	0.004497	0.8944	-7.3819
CO3--	2.738e-008	0.001642	0.6427	-7.7546
CaCO3	2.178e-008	0.002178	1.0000	-7.6620
KCl	1.436e-008	0.001070	1.0000	-7.8428
FeCO3	1.389e-008	0.001608	1.0000	-7.8574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002541	0.002537	1.0000	-2.5950
>(w)FeOH2+	0.001030	0.001028	7.3492	-2.9873
>(w)FeOCO2-	0.0003025	0.0003020	0.13607	-3.5193
>(w)FeOH	0.0002446	0.0002442	1.0000	-3.6116
>(w)FeSO4-	0.0001151	0.0001150	0.13607	-3.9387
>(w)FeH2AsO3	9.453e-005	9.437e-005	1.0000	-4.0244
>(s)FeOH2+	7.014e-005	7.003e-005	7.3492	-4.1540
>(w)FeOHSO4--	5.456e-005	5.447e-005	0.018515	-4.2631
>(w)FeHPO4-	4.485e-005	4.477e-005	0.13607	-4.3483
>(s)FeOHCa++	2.412e-005	2.408e-005	54.010	-4.6176
>(s)FeOH	1.666e-005	1.663e-005	1.0000	-4.7783
>(w)FeH2PO4	7.691e-006	7.679e-006	1.0000	-5.1140
>(w)FePO4--	4.441e-006	4.433e-006	0.018515	-5.3525
>(w)FeO-	1.331e-006	1.329e-006	0.13607	-5.8758
>(w)FeOHAsO4---	3.659e-007	3.653e-007	0.0025193	-6.4366
>(w)FeHAsO4-	1.452e-007	1.450e-007	0.13607	-6.8380
>(s)FeO-	9.067e-008	9.052e-008	0.13607	-7.0425
>(w)FeOCa+	2.482e-008	2.478e-008	7.3492	-7.6051
>(w)FeH2AsO4	1.978e-008	1.975e-008	1.0000	-7.7037
>(w)FeSeO3-	3.442e-020	3.437e-020	0.13607	-19.4632

>(w)FeOHSeO3--	4.814e-021	4.806e-021	0.018515	-20.3175
>(w)FeSeO4-	6.305e-042	6.294e-042	0.13607	-41.2003
>(w)FeOHSeO4--	3.430e-042	3.424e-042	0.018515	-41.4647

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7992
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2270
Goethite	-0.4676	Aragonite	-2.3925
Siderite	-1.2300	Bassanite	-2.6765
Rhodochrosite	-1.3139	CaSO4^1/2H2O(bet	-2.8539

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	8.201e-014	-13.086
H2S(g)	4.095e-025	-24.388
CH4(g)	2.983e-030	-29.525
S2(g)	1.159e-049	-48.936
O2(g)	4.188e-060	-59.378

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005		13.6

Ca++	0.00146	0.00143	57.5	2.41e-005	0.967
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00390	3.94
H2O	55.4	55.4	9.99e+005	-0.00320	-57.7
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.35e-008	0.00514	5.69e-005	5.46
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000121	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	7.64e-008	4.63e-010	1.48e-005	2.65e-007	0.00849
SO4--	0.00140	0.00123	119.	0.000169	16.3
SeO3--	1.89e-007	9.57e-016	1.22e-010	3.92e-020	4.98e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01655	-1.781
HCO3-	0.4244	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1208	-0.918
SeO3--	4.094e-005	-4.388

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.502e-006	0.1126	9.490e-005	7.117
Calcium	0.001456	0.001432	57.45	2.411e-005	0.9671
Carbon	0.006689	0.003850	46.29	0.002839	34.13
Chlorine	0.006716	0.006716	238.3		

Hydrogen	110.8	110.8	1.118e+005	0.0007773	0.7841
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001214	6.678		
Oxygen	55.47	55.43	8.877e+005	0.006602	105.7
Phosphorus	5.835e-005	5.355e-008	0.001660	5.688e-005	1.764
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	9.567e-016	7.561e-011	3.917e-020	3.096e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001403	0.001233	39.57	0.0001694	5.437

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.379

Eh = 0.0381 volts pe = 0.6604

Ionic strength = 0.012424

Activity of water = 0.999766

Solvent mass = 0.999369 kg

Solution mass = 1.000110 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006721 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.13 uC/cm2

Surface potential = 51.3 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0381	0.6604
e- + Fe+++ = Fe++	-0.0005	-0.0095

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.361e-006	-5.866	0.0002054	

Se(black)	1.891e-007	-6.723	1.493e-005
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006683	236.7	0.8912	-2.2251
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6557	-3.0772
SO4--	0.001049	100.7	0.6383	-3.1744
HCO3-	0.0008104	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.41	1.0000	-3.9460
Mn++	0.0001118	6.137	0.6557	-4.1349
MgSO4	3.679e-005	4.425	1.0000	-4.4342
CaCl+	3.249e-005	2.452	0.8945	-4.5368
NaSO4-	1.516e-005	1.804	0.8945	-4.8677
FeSO4	1.102e-005	1.673	1.0000	-4.9578
CaHCO3+	1.052e-005	1.062	0.8982	-5.0248
MnSO4	8.387e-006	1.265	1.0000	-5.0764
NaHCO3	4.808e-006	0.4036	1.0000	-5.3181
MgCl+	3.540e-006	0.2114	0.8945	-5.4994
MgHCO3+	2.744e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7442
H+	1.746e-006	0.001759	0.9084	-5.7996
As(OH)3	1.502e-006	0.1890	1.0000	-5.8233
FeCl+	1.239e-006	0.1131	0.8945	-5.9553
MnHCO3+	1.077e-006	0.1248	0.8945	-6.0163
NaCl	5.453e-007	0.03185	1.0000	-6.2634

KSO4-	5.373e-007	0.07256	0.8945	-6.3182
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
HSO4-	9.463e-008	0.009178	0.8945	-7.0724
H2PO4-	4.640e-008	0.004497	0.8945	-7.3819
CO3--	2.736e-008	0.001641	0.6428	-7.7548
CaCO3	2.175e-008	0.002176	1.0000	-7.6625
KCl	1.434e-008	0.001068	1.0000	-7.8436
FeCO3	1.387e-008	0.001606	1.0000	-7.8579

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002538	0.002536	1.0000	-2.5955
>(w)FeOH2+	0.001029	0.001028	7.3507	-2.9876
>(w)FeOCO2-	0.0003023	0.0003021	0.13604	-3.5196
>(w)FeOH	0.0002445	0.0002444	1.0000	-3.6117
>(w)FeSO4-	0.0001150	0.0001150	0.13604	-3.9392
>(w)FeH2AsO3	9.443e-005	9.437e-005	1.0000	-4.0249
>(s)FeOH2+	7.008e-005	7.004e-005	7.3507	-4.1544
>(w)FeOHSO4--	5.453e-005	5.449e-005	0.018507	-4.2634
>(w)FeHPO4-	4.485e-005	4.482e-005	0.13604	-4.3483
>(s)FeOHCa++	2.408e-005	2.407e-005	54.033	-4.6183
>(s)FeOH	1.665e-005	1.664e-005	1.0000	-4.7785
>(w)FeH2PO4	7.688e-006	7.683e-006	1.0000	-5.1142
>(w)FePO4--	4.443e-006	4.440e-006	0.018507	-5.3524
>(w)FeO-	1.331e-006	1.330e-006	0.13604	-5.8758
>(w)FeOHAsO4---	3.657e-007	3.654e-007	0.0025178	-6.4369
>(w)FeHAsO4-	1.450e-007	1.449e-007	0.13604	-6.8387
>(s)FeO-	9.067e-008	9.061e-008	0.13604	-7.0425
>(w)FeOCa+	2.480e-008	2.478e-008	7.3507	-7.6056
>(w)FeH2AsO4	1.974e-008	1.973e-008	1.0000	-7.7046
>(w)FeSeO3-	3.435e-020	3.433e-020	0.13604	-19.4640

>(w)FeOHSeO3--	4.806e-021	4.803e-021	0.018507	-20.3182
>(w)FeSeO4-	6.285e-042	6.281e-042	0.13604	-41.2017
>(w)FeOHSeO4--	3.421e-042	3.419e-042	0.018507	-41.4658

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7998
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0463
Hematite	0.0000 sat	Calcite	-2.2275
Goethite	-0.4676	Aragonite	-2.3930
Siderite	-1.2306	Bassanite	-2.6771
Rhodochrosite	-1.3142	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02023	-1.694
H2(g)	8.209e-014	-13.086
H2S(g)	4.107e-025	-24.386
CH4(g)	2.993e-030	-29.524
S2(g)	1.164e-049	-48.934
O2(g)	4.179e-060	-59.379

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	9.64e-005	1.50e-006	0.215	9.49e-005		13.6

Ca++	0.00146	0.00143	57.4	2.41e-005	0.966
Cl-	0.00672	0.00672	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0596	0.00302	3.05	0.00390	3.93
H2O	55.5	55.5	9.99e+005	-0.00320	-57.6
HCO3-	0.00669	0.00385	235.	0.00284	173.
HPO4--	5.84e-005	5.36e-008	0.00514	5.69e-005	5.46
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.67		
Na+	0.00479	0.00479	110.		
O2(aq)	7.64e-008	4.63e-010	1.48e-005	2.65e-007	0.00848
SO4--	0.00140	0.00123	118.	0.000169	16.3
SeO3--	1.89e-007	9.59e-016	1.22e-010	3.91e-020	4.97e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9844	-0.007
Ca++	0.01654	-1.781
HCO3-	0.4243	-0.372
HPO4--	0.9991	-0.000
SO4--	0.1208	-0.918
SeO3--	4.081e-005	-4.389

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	9.641e-005	1.503e-006	0.1126	9.490e-005	7.110
Calcium	0.001456	0.001432	57.40	2.409e-005	0.9655
Carbon	0.006689	0.003851	46.25	0.002838	34.09
Chlorine	0.006716	0.006716	238.1		

Hydrogen	110.9	110.9	1.118e+005	0.0007775	0.7835
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001215	6.674		
Oxygen	55.53	55.49	8.877e+005	0.006601	105.6
Phosphorus	5.835e-005	5.360e-008	0.001660	5.694e-005	1.763
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	9.589e-016	7.570e-011	3.914e-020	3.090e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001403	0.001233	39.53	0.0001694	5.432

0.0003059 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012438

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006724 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.09 uC/cm2

Surface potential = 50.9 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006686	236.8	0.8911	-2.2249
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0769
SO4--	0.001050	100.8	0.6382	-3.1739
HCO3-	0.0008119	49.50	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6714	-3.4705
Fe++	0.0001591	8.879	0.6556	-3.9817
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.686e-005	4.433	1.0000	-4.4334
CaCl+	3.252e-005	2.455	0.8944	-4.5363
NaSO4-	1.519e-005	1.807	0.8944	-4.8668
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.496e-006	1.282	1.0000	-5.0708
As(OH)3	5.002e-006	0.6295	1.0000	-5.3008
NaHCO3	4.821e-006	0.4047	1.0000	-5.3169
MgCl+	3.545e-006	0.2117	0.8944	-5.4989
MgHCO3+	2.751e-006	0.2345	0.8944	-5.6090
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7431
H+	1.745e-006	0.001757	0.9083	-5.8000
FeCl+	1.241e-006	0.1132	0.8944	-5.9548
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0104
NaCl	5.460e-007	0.03189	1.0000	-6.2628

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KSO4-           5.384e-007     0.07271     0.8944     -6.3174
MnCl+           3.133e-007     0.02830     0.8944     -6.5525
HSe-            1.877e-007     0.01500     0.8944     -6.7751
HSO4-           9.465e-008     0.009180    0.8944     -7.0724
H2PO4-          4.765e-008     0.004618    0.8944     -7.3704
CO3--           2.744e-008     0.001646    0.6427     -7.7536
CaCO3           2.183e-008     0.002183    1.0000     -7.6610
KCl             1.435e-008     0.001069    1.0000     -7.8430
FeCO3           1.392e-008     0.001611    1.0000     -7.8564
 (only species > 1e-8 molal listed)


Surface species      molality      moles     Boltzman fct. log molality
--------------------------------------------------------------------------
 >(w)FeOCO2H          0.002416      0.002412        1.0000     -2.6169
 >(w)FeOH2+           0.0009924     0.0009908       7.2429     -3.0033
 >(w)FeH2AsO3         0.0002991     0.0002987       1.0000     -3.5241
 >(w)FeOCO2-          0.0002838     0.0002834       0.13807    -3.5470
 >(w)FeOH             0.0002326     0.0002322       1.0000     -3.6334
 >(w)FeSO4-           0.0001078     0.0001076       0.13807    -3.9673
 >(s)FeOH2+           7.005e-005    6.993e-005      7.2429     -4.1546
 >(w)FeOHSO4--        5.041e-005    5.033e-005      0.019062   -4.2975
 >(w)FeHPO4-          4.316e-005    4.309e-005      0.13807    -4.3649
 >(s)FeOHCa++         2.447e-005    2.443e-005      52.459     -4.6114
 >(s)FeOH             1.642e-005    1.639e-005      1.0000     -4.7847
 >(w)FeH2PO4          7.502e-006    7.490e-006      1.0000     -5.1248
 >(w)FePO4--          4.217e-006    4.210e-006      0.019062   -5.3750
 >(w)FeOHAsO4---      1.513e-006    1.511e-006      0.0026319  -5.8201
 >(w)FeO-             1.249e-006    1.247e-006      0.13807    -5.9035
 >(w)FeHAsO4-         6.169e-007    6.159e-007      0.13807    -6.2098
 >(s)FeO-             8.815e-008    8.800e-008      0.13807    -7.0548
 >(w)FeH2AsO4         8.517e-008    8.503e-008      1.0000     -7.0697
 >(w)FeOCa+           2.398e-008    2.394e-008      7.2429     -7.6202
```

>(w)FeSeO3-	1.605e-011	1.602e-011	0.13807	-10.7946
>(w)FeOHSeO3--	2.214e-012	2.211e-012	0.019062	-11.6548
>(w)FeSeO4-	3.998e-033	3.992e-033	0.13807	-32.3981
>(w)FeOHSeO4--	2.146e-033	2.143e-033	0.019062	-32.6683

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3210s/sat	FeSe	-1.5477
Se(black)	8.4289s/sat	Gypsum	-1.7991
MnHPO4(c)	0.0171s/sat	Anhydrite	-2.0455
Hematite	0.0000 sat	Calcite	-2.2260
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6764
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					

>(w)FeOH	0.00443				
As(OH)4-	0.000306	5.00e-006	0.715	0.000301	43.0
Ca++	0.00146	0.00143	57.5	2.45e-005	0.981
Cl-	0.00671	0.00671	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00393	3.97
H2O	55.5	55.5	1.00e+006	-0.00346	-62.4
HCO3-	0.00655	0.00385	235.	0.00270	165.
HPO4--	5.48e-005	5.50e-008	0.00528	5.48e-005	5.26
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	1.11e-006	0.0354
SO4--	0.00139	0.00123	119.	0.000158	15.2
SeO3--	1.89e-007	1.89e-007	0.0240	1.82e-011	2.32e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9837	-0.007
Ca++	0.01679	-1.775
HCO3-	0.4117	-0.385
HPO4--	0.9990	-0.000
SO4--	0.1135	-0.945
SeO3--	9.644e-005	-4.016

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0003059	5.000e-006	0.3749	0.0003009	22.56
Calcium	0.001457	0.001432	57.45	2.445e-005	0.9809

Carbon	0.006547	0.003851	46.30	0.002696	32.41
Chlorine	0.006713	0.006713	238.2		
Hydrogen	110.8	110.8	1.118e+005	0.0009704	0.9789
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006685	107.1
Phosphorus	5.485e-005	5.500e-008	0.001705	5.479e-005	1.699
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.823e-011	1.441e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001392	0.001234	39.59	0.0001580	5.069

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.190

Eh = 0.0409 volts pe = 0.7078

Ionic strength = 0.012434

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006724 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.09 uC/cm2

Surface potential = 50.9 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0409	0.7078
e- + Fe+++ = Fe++	-0.0006	-0.0096

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.360e-006	-5.866	0.0002052	

Se(black)	1.891e-007	-6.723	1.493e-005
		______________	______________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006686	236.8	0.8911	-2.2249
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.19	0.6556	-3.0768
SO4--	0.001050	100.7	0.6382	-3.1740
HCO3-	0.0008110	49.45	0.8960	-3.1387
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.880	0.6556	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9453
Mn++	0.0001119	6.143	0.6556	-4.1345
MgSO4	3.685e-005	4.432	1.0000	-4.4335
CaCl+	3.253e-005	2.455	0.8944	-4.5362
NaSO4-	1.519e-005	1.807	0.8944	-4.8670
FeSO4	1.104e-005	1.675	1.0000	-4.9571
CaHCO3+	1.053e-005	1.064	0.8981	-5.0242
MnSO4	8.401e-006	1.268	1.0000	-5.0757
As(OH)3	5.004e-006	0.6297	1.0000	-5.3007
NaHCO3	4.816e-006	0.4042	1.0000	-5.3173
MgCl+	3.545e-006	0.2117	0.8944	-5.4988
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6094
FeHCO3+	2.018e-006	0.2357	0.8944	-5.7435
H+	1.747e-006	0.001759	0.9083	-5.7995
FeCl+	1.241e-006	0.1132	0.8944	-5.9548
MnHCO3+	1.078e-006	0.1250	0.8944	-6.0157
NaCl	5.461e-007	0.03189	1.0000	-6.2628

KSO4-	5.382e-007	0.07269	0.8944	-6.3175
MnCl+	3.098e-007	0.02799	0.8944	-6.5573
HSO4-	9.472e-008	0.009188	0.8944	-7.0720
H2PO4-	4.637e-008	0.004494	0.8944	-7.3822
CO3--	2.738e-008	0.001642	0.6427	-7.7545
CaCO3	2.178e-008	0.002178	1.0000	-7.6619
KCl	1.436e-008	0.001069	1.0000	-7.8430
FeCO3	1.389e-008	0.001608	1.0000	-7.8574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002417	0.002413	1.0000	-2.6167
>(w)FeOH2+	0.0009922	0.0009905	7.2552	-3.0034
>(w)FeH2AsO3	0.0002993	0.0002988	1.0000	-3.5239
>(w)FeOCO2-	0.0002841	0.0002836	0.13783	-3.5466
>(w)FeOH	0.0002327	0.0002323	1.0000	-3.6333
>(w)FeSO4-	0.0001081	0.0001080	0.13783	-3.9660
>(s)FeOH2+	7.008e-005	6.997e-005	7.2552	-4.1544
>(w)FeOHSO4--	5.059e-005	5.050e-005	0.018998	-4.2960
>(w)FeHPO4-	4.209e-005	4.202e-005	0.13783	-4.3758
>(s)FeOHCa++	2.441e-005	2.438e-005	52.638	-4.6123
>(s)FeOH	1.643e-005	1.641e-005	1.0000	-4.7842
>(w)FeH2PO4	7.312e-006	7.300e-006	1.0000	-5.1360
>(w)FePO4--	4.115e-006	4.108e-006	0.018998	-5.3856
>(w)FeOHAsO4---	1.385e-006	1.382e-006	0.0026185	-5.8586
>(w)FeO-	1.250e-006	1.248e-006	0.13783	-5.9031
>(w)FeHAsO4-	5.638e-007	5.629e-007	0.13783	-6.2489
>(s)FeO-	8.829e-008	8.815e-008	0.13783	-7.0541
>(w)FeH2AsO4	7.780e-008	7.767e-008	1.0000	-7.1090
>(w)FeOCa+	2.392e-008	2.388e-008	7.2552	-7.6212
>(w)FeSeO3-	4.986e-020	4.978e-020	0.13783	-19.3023

>(w)FeOHSeO3--	6.883e-021	6.872e-021	0.018998	-20.1622
>(w)FeSeO4-	1.134e-041	1.132e-041	0.13783	-40.9454
>(w)FeOHSeO4--	6.091e-042	6.081e-042	0.018998	-41.2153

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7991
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0456
Hematite	0.0000 sat	Calcite	-2.2269
Goethite	-0.4676	Aragonite	-2.3924
Siderite	-1.2300	Bassanite	-2.6765
Rhodochrosite	-1.3136	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.603e-014	-13.180
H2S(g)	1.721e-025	-24.764
CH4(g)	1.254e-030	-29.902
S2(g)	3.160e-050	-49.500
O2(g)	6.460e-060	-59.190

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	0.000306	5.00e-006	0.716	0.000301		43.0

Ca++	0.00146	0.00143	57.5	2.44e-005	0.979
Cl-	0.00671	0.00671	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0595	0.00303	3.05	0.00393	3.97
H2O	55.4	55.4	9.99e+005	-0.00346	-62.4
HCO3-	0.00655	0.00385	235.	0.00270	165.
HPO4--	5.48e-005	5.35e-008	0.00514	5.34e-005	5.13
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	8.24e-007	1.91e-009	6.13e-005	1.01e-006	0.0324
SO4--	0.00139	0.00123	119.	0.000158	15.2
SeO3--	1.89e-007	7.70e-016	9.79e-011	5.66e-020	7.20e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9836	-0.007
Ca++	0.01675	-1.776
HCO3-	0.4119	-0.385
HPO4--	0.9990	-0.000
SO4--	0.1139	-0.944
SeO3--	7.353e-005	-4.134

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0003059	5.001e-006	0.3750	0.0003009	22.56
Calcium	0.001457	0.001432	57.45	2.440e-005	0.9788
Carbon	0.006547	0.003850	46.29	0.002697	32.42
Chlorine	0.006713	0.006713	238.2		

Hydrogen	110.8	110.8	1.118e+005	0.0009697	0.9782
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001215	6.681		
Oxygen	55.47	55.43	8.877e+005	0.006685	107.0
Phosphorus	5.485e-005	5.352e-008	0.001659	5.343e-005	1.656
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	7.704e-016	6.088e-011	5.665e-020	4.477e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001392	0.001233	39.57	0.0001585	5.085

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.191

Eh = 0.0409 volts pe = 0.7074

Ionic strength = 0.012422

Activity of water = 0.999766

Solvent mass = 0.999369 kg

Solution mass = 1.000111 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006717 molal

Dissolved solids = 742 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.09 uC/cm2

Surface potential = 50.9 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0409	0.7074
e- + Fe+++ = Fe++	-0.0006	-0.0095

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.307e-006	-5.884	0.0001972	

Se(black)	1.891e-007	-6.723	1.493e-005
		______________	______________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006679	236.6	0.8912	-2.2253
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6557	-3.0771
SO4--	0.001049	100.7	0.6383	-3.1743
HCO3-	0.0008104	49.41	0.8960	-3.1390
Mg++	0.0005037	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6557	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.41	1.0000	-3.9459
Mn++	0.0001118	6.140	0.6557	-4.1347
MgSO4	3.680e-005	4.426	1.0000	-4.4342
CaCl+	3.247e-005	2.451	0.8945	-4.5370
NaSO4-	1.516e-005	1.804	0.8945	-4.8677
FeSO4	1.102e-005	1.673	1.0000	-4.9578
CaHCO3+	1.052e-005	1.062	0.8982	-5.0248
MnSO4	8.391e-006	1.266	1.0000	-5.0762
As(OH)3	5.000e-006	0.6293	1.0000	-5.3010
NaHCO3	4.808e-006	0.4036	1.0000	-5.3181
MgCl+	3.539e-006	0.2113	0.8945	-5.4996
MgHCO3+	2.744e-006	0.2339	0.8945	-5.6101
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7442
H+	1.746e-006	0.001759	0.9084	-5.7996
FeCl+	1.239e-006	0.1130	0.8945	-5.9555
MnHCO3+	1.077e-006	0.1248	0.8945	-6.0161
NaCl	5.450e-007	0.03183	1.0000	-6.2636

KSO4-	5.373e-007	0.07257	0.8945	-6.3182
MnCl+	3.094e-007	0.02795	0.8945	-6.5579
HSO4-	9.463e-008	0.009178	0.8945	-7.0724
H2PO4-	4.638e-008	0.004495	0.8945	-7.3821
CO3--	2.736e-008	0.001641	0.6428	-7.7547
CaCO3	2.175e-008	0.002176	1.0000	-7.6625
KCl	1.433e-008	0.001067	1.0000	-7.8438
FeCO3	1.387e-008	0.001606	1.0000	-7.8579

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002414	0.002413	1.0000	-2.6173
>(w)FeOH2+	0.0009914	0.0009908	7.2567	-3.0037
>(w)FeH2AsO3	0.0002990	0.0002988	1.0000	-3.5243
>(w)FeOCO2-	0.0002839	0.0002837	0.13780	-3.5469
>(w)FeOH	0.0002326	0.0002325	1.0000	-3.6334
>(w)FeSO4-	0.0001080	0.0001079	0.13780	-3.9665
>(s)FeOH2+	7.002e-005	6.997e-005	7.2567	-4.1548
>(w)FeOHSO4--	5.055e-005	5.052e-005	0.018990	-4.2962
>(w)FeHPO4-	4.209e-005	4.207e-005	0.13780	-4.3758
>(s)FeOHCa++	2.438e-005	2.436e-005	52.660	-4.6131
>(s)FeOH	1.643e-005	1.642e-005	1.0000	-4.7844
>(w)FeH2PO4	7.309e-006	7.304e-006	1.0000	-5.1362
>(w)FePO4--	4.117e-006	4.114e-006	0.018990	-5.3854
>(w)FeOHAsO4---	1.384e-006	1.383e-006	0.0026168	-5.8589
>(w)FeO-	1.250e-006	1.249e-006	0.13780	-5.9030
>(w)FeHAsO4-	5.629e-007	5.626e-007	0.13780	-6.2496
>(s)FeO-	8.829e-008	8.824e-008	0.13780	-7.0541
>(w)FeH2AsO4	7.764e-008	7.759e-008	1.0000	-7.1099
>(w)FeOCa+	2.390e-008	2.388e-008	7.2567	-7.6216
>(w)FeSeO3-	4.976e-020	4.973e-020	0.13780	-19.3031

>(w)FeOHSeO3-- 6.873e-021 6.869e-021 0.018990 -20.1629

>(w)FeSeO4- 1.131e-041 1.130e-041 0.13780 -40.9467

>(w)FeOHSeO4-- 6.075e-042 6.072e-042 0.018990 -41.2164

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7998
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0463
Hematite	0.0000 sat	Calcite	-2.2274
Goethite	-0.4676	Aragonite	-2.3929
Siderite	-1.2305	Bassanite	-2.6771
Rhodochrosite	-1.3139	CaSO4^1/2H2O(bet	-2.8545

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02023	-1.694
H2(g)	6.610e-014	-13.180
H2S(g)	1.727e-025	-24.763
CH4(g)	1.258e-030	-29.900
S2(g)	3.173e-050	-49.499
O2(g)	6.446e-060	-59.191

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	0.000306	5.00e-006	0.715	0.000301	43.0	

Ca++	0.00146	0.00143	57.4	2.44e-005	0.977
Cl-	0.00671	0.00671	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0595	0.00303	3.05	0.00393	3.96
H2O	55.5	55.5	9.99e+005	-0.00346	-62.3
HCO3-	0.00655	0.00385	235.	0.00270	164.
HPO4--	5.48e-005	5.36e-008	0.00514	5.35e-005	5.13
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	8.24e-007	1.91e-009	6.12e-005	1.01e-006	0.0324
SO4--	0.00139	0.00123	118.	0.000158	15.2
SeO3--	1.89e-007	7.72e-016	9.80e-011	5.66e-020	7.18e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9836	-0.007
Ca++	0.01674	-1.776
HCO3-	0.4118	-0.385
HPO4--	0.9990	-0.000
SO4--	0.1139	-0.944
SeO3--	7.329e-005	-4.135

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0003059	5.003e-006	0.3748	0.0003009	22.54
Calcium	0.001457	0.001432	57.40	2.438e-005	0.9772
Carbon	0.006547	0.003851	46.25	0.002696	32.38
Chlorine	0.006713	0.006713	238.0		

Hydrogen	110.9	110.9	1.118e+005	0.0009699	0.9774
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001216	6.677		
Oxygen	55.53	55.49	8.877e+005	0.006684	106.9
Phosphorus	5.485e-005	5.357e-008	0.001659	5.348e-005	1.656
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	7.721e-016	6.096e-011	5.660e-020	4.468e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001392	0.001233	39.53	0.0001585	5.080

0.0008067 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012433

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006714 molal

Dissolved solids = 744 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006676	236.5	0.8911	-2.2256
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.8	0.6382	-3.1739
HCO3-	0.0008119	49.50	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6556	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001135	15.44	1.0000	-3.9451
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.687e-005	4.434	1.0000	-4.4334
CaCl+	3.248e-005	2.451	0.8944	-4.5369
NaSO4-	1.519e-005	1.807	0.8944	-4.8668
As(OH)3	1.501e-005	1.889	1.0000	-4.8237
FeSO4	1.104e-005	1.676	1.0000	-4.9570
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.497e-006	1.282	1.0000	-5.0707
NaHCO3	4.821e-006	0.4047	1.0000	-5.3168
MgCl+	3.540e-006	0.2114	0.8944	-5.4995
MgHCO3+	2.751e-006	0.2346	0.8944	-5.6089
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7430
H+	1.745e-006	0.001757	0.9084	-5.8000
FeCl+	1.239e-006	0.1130	0.8944	-5.9554
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0103
NaCl	5.453e-007	0.03184	1.0000	-6.2634

KSO4-	5.384e-007	0.07272	0.8944	-6.3173
MnCl+	3.128e-007	0.02826	0.8944	-6.5531
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.465e-008	0.009180	0.8944	-7.0723
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.744e-008	0.001646	0.6427	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.433e-008	0.001068	1.0000	-7.8436
FeCO3	1.392e-008	0.001611	1.0000	-7.8564
H2AsO4-	1.099e-008	0.001547	0.8944	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002121	0.002117	1.0000	-2.6735
>(w)FeOH2+	0.0009020	0.0009005	6.9943	-3.0448
>(w)FeH2AsO3	0.0007877	0.0007864	1.0000	-3.1037
>(w)FeOCO2-	0.0002406	0.0002402	0.14297	-3.6188
>(w)FeOH	0.0002041	0.0002038	1.0000	-3.6901
>(w)FeSO4-	9.139e-005	9.124e-005	0.14297	-4.0391
>(s)FeOH2+	6.986e-005	6.974e-005	6.9943	-4.1558
>(w)FeOHSO4--	4.126e-005	4.119e-005	0.020441	-4.3844
>(w)FeHPO4-	3.658e-005	3.652e-005	0.14297	-4.4367
>(s)FeOHCa++	2.527e-005	2.523e-005	48.920	-4.5974
>(s)FeOH	1.581e-005	1.578e-005	1.0000	-4.8011
>(w)FeH2PO4	6.585e-006	6.574e-006	1.0000	-5.1815
>(w)FeOHAsO4---	3.588e-006	3.582e-006	0.0029226	-5.4451
>(w)FePO4--	3.452e-006	3.446e-006	0.020441	-5.4620
>(w)FeHAsO4-	1.569e-006	1.566e-006	0.14297	-5.8045
>(w)FeO-	1.058e-006	1.057e-006	0.14297	-5.9753
>(w)FeH2AsO4	2.243e-007	2.239e-007	1.0000	-6.6493
>(s)FeO-	8.198e-008	8.184e-008	0.14297	-7.0863

>(w)FeOCa+	2.180e-008	2.176e-008	6.9943	-7.6616
>(w)FeSeO3-	1.360e-011	1.358e-011	0.14297	-10.8664
>(w)FeOHSeO3--	1.812e-012	1.809e-012	0.020441	-11.7418
>(w)FeSeO4-	3.389e-033	3.384e-033	0.14297	-32.4699
>(w)FeOHSeO4--	1.757e-033	1.754e-033	0.020441	-32.7553

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3211s/sat	FeSe	-1.5476
Se(black)	8.4289s/sat	Gypsum	-1.7990
MnHPO4(c)	0.0171s/sat	Anhydrite	-2.0455
Hematite	0.0000 sat	Calcite	-2.2259
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6763
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8537

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

```
>(s)FeOH        0.000111
>(w)FeOH         0.00443
As(OH)4-        0.000807  1.50e-005      2.15   0.000792      113.
Ca++             0.00146    0.00143      57.5  2.53e-005      1.01
Cl-              0.00670    0.00670      238.
Fe++            0.000173   0.000173      9.68
Fe+++             0.0222  4.40e-012 2.46e-007
H+                -0.247     -0.184     -186.    0.00401      4.04
H2O                 55.5       55.5 1.00e+006   -0.00408     -73.5
HCO3-            0.00621    0.00385      235.    0.00236      144.
HPO4--         4.66e-005  5.50e-008   0.00528  4.65e-005      4.47
K+              0.000116   0.000116      4.55
Mg++            0.000546   0.000546      13.3
Mn++            0.000123   0.000123      6.76
Na+              0.00479    0.00479      110.
O2(aq)           -0.0468    -0.0468-1.50e+003  2.69e-006    0.0860
SO4--            0.00137    0.00123      119.   0.000132      12.7
SeO3--         1.89e-007  1.89e-007    0.0240  1.54e-011 1.96e-006

Sorbed              fraction    log fraction
-----------------------------------------------
As(OH)4-              0.9814      -0.008
Ca++                 0.01733      -1.761
HCO3-                 0.3797      -0.421
HPO4--                0.9988      -0.001
SO4--                0.09695      -1.013
SeO3--             8.140e-005      -4.089

Elemental composition          In fluid              Sorbed
             total moles    moles      mg/kg       moles      mg/kg
-----------------------------------------------------------------------------
Arsenic          0.0008067   1.500e-005       1.125    0.0007917       59.37
```

Calcium	0.001457	0.001432	57.45	2.525e-005	1.013
Carbon	0.006209	0.003851	46.30	0.002357	28.34
Chlorine	0.006703	0.006703	237.9		
Hydrogen	110.8	110.8	1.118e+005	0.001427	1.440
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006885	110.3
Phosphorus	4.660e-005	5.500e-008	0.001705	4.654e-005	1.443
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.539e-011	1.216e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001366	0.001234	39.59	0.0001324	4.250

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.143

Eh = 0.0416 volts pe = 0.7194

Ionic strength = 0.012429

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006714 molal

Dissolved solids = 744 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0416	0.7194
e- + Fe+++ = Fe++	-0.0006	-0.0097

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.218e-006	-5.914	0.0001838	

Se(black)	1.891e-007	-6.723	1.493e-005
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006676	236.5	0.8911	-2.2256
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.19	0.6557	-3.0768
SO4--	0.001050	100.8	0.6382	-3.1740
HCO3-	0.0008111	49.45	0.8960	-3.1386
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6557	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001120	6.150	0.6557	-4.1340
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.248e-005	2.451	0.8944	-4.5368
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
As(OH)3	1.501e-005	1.888	1.0000	-4.8238
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.053e-005	1.064	0.8981	-5.0241
MnSO4	8.412e-006	1.269	1.0000	-5.0751
NaHCO3	4.816e-006	0.4043	1.0000	-5.3173
MgCl+	3.540e-006	0.2114	0.8944	-5.4995
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6094
FeHCO3+	2.018e-006	0.2357	0.8944	-5.7434
H+	1.747e-006	0.001759	0.9084	-5.7996
FeCl+	1.239e-006	0.1130	0.8944	-5.9554
MnHCO3+	1.080e-006	0.1251	0.8944	-6.0151
NaCl	5.453e-007	0.03184	1.0000	-6.2634

KSO4-	5.383e-007	0.07270	0.8944	-6.3174
MnCl+	3.098e-007	0.02798	0.8944	-6.5574
HSO4-	9.472e-008	0.009187	0.8944	-7.0720
H2PO4-	4.631e-008	0.004488	0.8944	-7.3828
CO3--	2.739e-008	0.001642	0.6427	-7.7544
CaCO3	2.179e-008	0.002179	1.0000	-7.6618
KCl	1.433e-008	0.001068	1.0000	-7.8436
FeCO3	1.389e-008	0.001608	1.0000	-7.8572
H2AsO4-	1.057e-008	0.001488	0.8944	-8.0244

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002121	0.002118	1.0000	-2.6734
>(w)FeOH2+	0.0009017	0.0009003	7.0058	-3.0449
>(w)FeH2AsO3	0.0007878	0.0007866	1.0000	-3.1036
>(w)FeOCO2-	0.0002408	0.0002404	0.14274	-3.6183
>(w)FeOH	0.0002042	0.0002039	1.0000	-3.6899
>(w)FeSO4-	9.165e-005	9.150e-005	0.14274	-4.0379
>(s)FeOH2+	6.989e-005	6.978e-005	7.0058	-4.1556
>(w)FeOHSO4--	4.140e-005	4.134e-005	0.020374	-4.3829
>(w)FeHPO4-	3.563e-005	3.557e-005	0.14274	-4.4482
>(s)FeOHCa++	2.522e-005	2.518e-005	49.082	-4.5983
>(s)FeOH	1.583e-005	1.580e-005	1.0000	-4.8006
>(w)FeH2PO4	6.409e-006	6.398e-006	1.0000	-5.1932
>(w)FeOHAsO4---	3.464e-006	3.458e-006	0.0029082	-5.4604
>(w)FePO4--	3.364e-006	3.358e-006	0.020374	-5.4732
>(w)FeHAsO4-	1.512e-006	1.510e-006	0.14274	-5.8204
>(w)FeO-	1.060e-006	1.058e-006	0.14274	-5.9749
>(w)FeH2AsO4	2.161e-007	2.157e-007	1.0000	-6.6654
>(s)FeO-	8.212e-008	8.199e-008	0.14274	-7.0855
>(w)FeOCa+	2.175e-008	2.171e-008	7.0058	-7.6626

>(w)FeSeO3-	4.705e-020	4.698e-020	0.14274	-19.3274
>(w)FeOHSeO3--	6.273e-021	6.263e-021	0.020374	-20.2025
>(w)FeSeO4-	1.129e-041	1.127e-041	0.14274	-40.9472
>(w)FeOHSeO4--	5.858e-042	5.848e-042	0.020374	-41.2323

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7991
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0455
Hematite	0.0000 sat	Calcite	-2.2268
Goethite	-0.4676	Aragonite	-2.3923
Siderite	-1.2299	Bassanite	-2.6764
Rhodochrosite	-1.3130	CaSO4^1/2H2O(bet	-2.8538

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.258e-014	-13.204
H2S(g)	1.389e-025	-24.857
CH4(g)	1.012e-030	-29.995
S2(g)	2.290e-050	-49.640
O2(g)	7.192e-060	-59.143

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					

As(OH)4-	0.000807	1.50e-005	2.15	0.000792	113.
Ca++	0.00146	0.00143	57.5	2.52e-005	1.01
Cl-	0.00670	0.00670	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0595	0.00304	3.06	0.00401	4.04
H2O	55.4	55.4	9.99e+005	-0.00408	-73.5
HCO3-	0.00621	0.00385	235.	0.00236	144.
HPO4--	4.66e-005	5.34e-008	0.00513	4.53e-005	4.35
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.69		
Na+	0.00479	0.00479	110.		
O2(aq)	2.41e-006	6.06e-009	0.000194	2.59e-006	0.0830
SO4--	0.00137	0.00123	119.	0.000133	12.8
SeO3--	1.89e-007	7.30e-016	9.28e-011	5.32e-020	6.77e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9814	-0.008
Ca++	0.01729	-1.762
HCO3-	0.3798	-0.420
HPO4--	0.9988	-0.001
SO4--	0.09724	-1.012
SeO3--	7.290e-005	-4.137

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0008067	1.500e-005	1.125	0.0007917	59.37
Calcium	0.001457	0.001432	57.45	2.520e-005	1.011
Carbon	0.006209	0.003850	46.29	0.002358	28.35

Chlorine	0.006703	0.006703	237.9		
Hydrogen	110.8	110.8	1.118e+005	0.001427	1.439
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001216	6.689		
Oxygen	55.47	55.43	8.877e+005	0.006885	110.2
Phosphorus	4.660e-005	5.345e-008	0.001657	4.533e-005	1.405
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	7.302e-016	5.771e-011	5.324e-020	4.207e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001366	0.001233	39.57	0.0001328	4.263

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.144

Eh = 0.0415 volts pe = 0.7190

Ionic strength = 0.012418

Activity of water = 0.999766

Solvent mass = 0.999369 kg

Solution mass = 1.000112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006707 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7190
e- + Fe+++ = Fe++	-0.0006	-0.0097

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.171e-006	-5.932	0.0001767	

Se(black)	1.891e-007	-6.723	1.493e-005
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006669	236.3	0.8912	-2.2260
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6558	-3.0771
SO4--	0.001049	100.7	0.6384	-3.1743
HCO3-	0.0008105	49.42	0.8961	-3.1389
Mg++	0.0005036	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6558	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.41	1.0000	-3.9458
Mn++	0.0001120	6.147	0.6558	-4.1341
MgSO4	3.680e-005	4.426	1.0000	-4.4341
CaCl+	3.242e-005	2.447	0.8945	-4.5376
NaSO4-	1.516e-005	1.804	0.8945	-4.8676
As(OH)3	1.499e-005	1.887	1.0000	-4.8241
FeSO4	1.102e-005	1.673	1.0000	-4.9577
CaHCO3+	1.052e-005	1.063	0.8982	-5.0247
MnSO4	8.402e-006	1.268	1.0000	-5.0756
NaHCO3	4.808e-006	0.4036	1.0000	-5.3180
MgCl+	3.534e-006	0.2110	0.8945	-5.5002
MgHCO3+	2.744e-006	0.2340	0.8945	-5.6100
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7441
H+	1.746e-006	0.001759	0.9084	-5.7997
FeCl+	1.237e-006	0.1128	0.8945	-5.9561
MnHCO3+	1.079e-006	0.1250	0.8945	-6.0156
NaCl	5.442e-007	0.03178	1.0000	-6.2642

KSO4-	5.374e-007	0.07257	0.8945	-6.3182
MnCl+	3.093e-007	0.02794	0.8945	-6.5580
HSO4-	9.462e-008	0.009178	0.8945	-7.0724
H2PO4-	4.632e-008	0.004489	0.8945	-7.3827
CO3--	2.737e-008	0.001641	0.6429	-7.7546
CaCO3	2.176e-008	0.002176	1.0000	-7.6623
KCl	1.431e-008	0.001066	1.0000	-7.8444
FeCO3	1.387e-008	0.001606	1.0000	-7.8578
H2AsO4-	1.055e-008	0.001486	0.8945	-8.0251

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002119	0.002118	1.0000	-2.6739
>(w)FeOH2+	0.0009011	0.0009005	7.0073	-3.0452
>(w)FeH2AsO3	0.0007871	0.0007866	1.0000	-3.1040
>(w)FeOCO2-	0.0002406	0.0002405	0.14271	-3.6187
>(w)FeOH	0.0002042	0.0002040	1.0000	-3.6900
>(w)FeSO4-	9.155e-005	9.149e-005	0.14271	-4.0383
>(s)FeOH2+	6.983e-005	6.978e-005	7.0073	-4.1560
>(w)FeOHSO4--	4.138e-005	4.135e-005	0.020365	-4.3832
>(w)FeHPO4-	3.563e-005	3.561e-005	0.14271	-4.4482
>(s)FeOHCa++	2.518e-005	2.516e-005	49.103	-4.5990
>(s)FeOH	1.582e-005	1.581e-005	1.0000	-4.8008
>(w)FeH2PO4	6.406e-006	6.402e-006	1.0000	-5.1934
>(w)FeOHAsO4---	3.461e-006	3.459e-006	0.0029063	-5.4607
>(w)FePO4--	3.365e-006	3.363e-006	0.020365	-5.4730
>(w)FeHAsO4-	1.510e-006	1.509e-006	0.14271	-5.8211
>(w)FeO-	1.060e-006	1.059e-006	0.14271	-5.9748
>(w)FeH2AsO4	2.156e-007	2.155e-007	1.0000	-6.6663
>(s)FeO-	8.212e-008	8.207e-008	0.14271	-7.0855
>(w)FeOCa+	2.173e-008	2.171e-008	7.0073	-7.6630

>(w)FeSeO3-	4.696e-020	4.693e-020	0.14271	-19.3283
>(w)FeOHSeO3--	6.264e-021	6.260e-021	0.020365	-20.2031
>(w)FeSeO4-	1.126e-041	1.125e-041	0.14271	-40.9485
>(w)FeOHSeO4--	5.843e-042	5.839e-042	0.020365	-41.2334

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7997
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0462
Hematite	0.0000 sat	Calcite	-2.2273
Goethite	-0.4676	Aragonite	-2.3928
Siderite	-1.2304	Bassanite	-2.6770
Rhodochrosite	-1.3133	CaSO4^1/2H2O(bet	-2.8544

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02024	-1.694
H2(g)	6.265e-014	-13.203
H2S(g)	1.393e-025	-24.856
CH4(g)	1.015e-030	-29.993
S2(g)	2.298e-050	-49.639
O2(g)	7.177e-060	-59.144

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					

As(OH)4-	0.000807	1.50e-005	2.14	0.000792	113.
Ca++	0.00146	0.00143	57.4	2.52e-005	1.01
Cl-	0.00670	0.00670	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0595	0.00304	3.06	0.00401	4.04
H2O	55.5	55.5	9.99e+005	-0.00407	-73.4
HCO3-	0.00621	0.00385	235.	0.00236	144.
HPO4--	4.66e-005	5.35e-008	0.00513	4.54e-005	4.35
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	2.41e-006	6.05e-009	0.000194	2.59e-006	0.0829
SO4--	0.00137	0.00123	118.	0.000133	12.8
SeO3--	1.89e-007	7.32e-016	9.29e-011	5.32e-020	6.75e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9814	-0.008
Ca++	0.01728	-1.762
HCO3-	0.3798	-0.420
HPO4--	0.9988	-0.001
SO4--	0.09725	-1.012
SeO3--	7.268e-005	-4.139

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0008067	1.500e-005	1.124	0.0007917	59.31
Calcium	0.001457	0.001432	57.40	2.518e-005	1.009
Carbon	0.006209	0.003851	46.25	0.002358	28.32

Chlorine	0.006703	0.006703	237.6		
Hydrogen	110.9	110.9	1.118e+005	0.001427	1.438
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001217	6.685		
Oxygen	55.53	55.49	8.877e+005	0.006884	110.1
Phosphorus	4.660e-005	5.350e-008	0.001657	4.537e-005	1.405
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	7.318e-016	5.778e-011	5.319e-020	4.200e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001366	0.001233	39.53	0.0001328	4.259

0.0003059 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012433

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006714 molal

Dissolved solids = 744 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0110

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			————	————
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006676	236.5	0.8911	-2.2256
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6556	-3.0768
SO4--	0.001050	100.8	0.6382	-3.1739
HCO3-	0.0008119	49.50	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6556	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001135	15.44	1.0000	-3.9451
Mn++	0.0001132	6.212	0.6556	-4.1297
MgSO4	3.687e-005	4.434	1.0000	-4.4334
CaCl+	3.248e-005	2.451	0.8944	-4.5369
NaSO4-	1.519e-005	1.807	0.8944	-4.8668
As(OH)3	1.501e-005	1.889	1.0000	-4.8237
FeSO4	1.104e-005	1.676	1.0000	-4.9570
CaHCO3+	1.054e-005	1.065	0.8981	-5.0237
MnSO4	8.497e-006	1.282	1.0000	-5.0707
NaHCO3	4.821e-006	0.4047	1.0000	-5.3168
MgCl+	3.540e-006	0.2114	0.8944	-5.4995
MgHCO3+	2.751e-006	0.2346	0.8944	-5.6089
FeHCO3+	2.020e-006	0.2359	0.8944	-5.7430
H+	1.745e-006	0.001757	0.9084	-5.8000
FeCl+	1.239e-006	0.1130	0.8944	-5.9554
MnHCO3+	1.092e-006	0.1265	0.8944	-6.0103
NaCl	5.453e-007	0.03184	1.0000	-6.2634

KSO4-	5.384e-007	0.07272	0.8944	-6.3173
MnCl+	3.128e-007	0.02826	0.8944	-6.5531
HSe-	1.877e-007	0.01500	0.8944	-6.7751
HSO4-	9.465e-008	0.009180	0.8944	-7.0723
H2PO4-	4.765e-008	0.004618	0.8944	-7.3704
CO3--	2.744e-008	0.001646	0.6427	-7.7536
CaCO3	2.183e-008	0.002183	1.0000	-7.6610
KCl	1.433e-008	0.001068	1.0000	-7.8436
FeCO3	1.392e-008	0.001611	1.0000	-7.8564
H2AsO4-	1.099e-008	0.001547	0.8944	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002121	0.002117	1.0000	-2.6735
>(w)FeOH2+	0.0009020	0.0009005	6.9943	-3.0448
>(w)FeH2AsO3	0.0007877	0.0007864	1.0000	-3.1037
>(w)FeOCO2-	0.0002406	0.0002402	0.14297	-3.6188
>(w)FeOH	0.0002041	0.0002038	1.0000	-3.6901
>(w)FeSO4-	9.139e-005	9.124e-005	0.14297	-4.0391
>(s)FeOH2+	6.986e-005	6.974e-005	6.9943	-4.1558
>(w)FeOHSO4--	4.126e-005	4.119e-005	0.020441	-4.3844
>(w)FeHPO4-	3.658e-005	3.652e-005	0.14297	-4.4367
>(s)FeOHCa++	2.527e-005	2.523e-005	48.920	-4.5974
>(s)FeOH	1.581e-005	1.578e-005	1.0000	-4.8011
>(w)FeH2PO4	6.585e-006	6.574e-006	1.0000	-5.1815
>(w)FeOHAsO4---	3.588e-006	3.582e-006	0.0029226	-5.4451
>(w)FePO4--	3.452e-006	3.446e-006	0.020441	-5.4620
>(w)FeHAsO4-	1.569e-006	1.566e-006	0.14297	-5.8045
>(w)FeO-	1.058e-006	1.057e-006	0.14297	-5.9753
>(w)FeH2AsO4	2.243e-007	2.239e-007	1.0000	-6.6493
>(s)FeO-	8.198e-008	8.184e-008	0.14297	-7.0863

>(w)FeOCa+	2.180e-008	2.176e-008	6.9943	-7.6616
>(w)FeSeO3-	1.360e-011	1.358e-011	0.14297	-10.8664
>(w)FeOHSeO3--	1.812e-012	1.809e-012	0.020441	-11.7418
>(w)FeSeO4-	3.389e-033	3.384e-033	0.14297	-32.4699
>(w)FeOHSeO4--	1.757e-033	1.754e-033	0.020441	-32.7553

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3211s/sat	FeSe	-1.5476
Se(black)	8.4289s/sat	Gypsum	-1.7990
MnHPO4(c)	0.0171s/sat	Anhydrite	-2.0455
Hematite	0.0000 sat	Calcite	-2.2259
Goethite	-0.4676	Aragonite	-2.3915
Siderite	-1.2290	Bassanite	-2.6763
Rhodochrosite	-1.3078	CaSO4^1/2H2O(bet	-2.8537

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02023	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.822e-050	-49.739
O2(g)	7.751e-060	-59.111

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000111				
>(w)FeOH	0.00443				
As(OH)4-	0.000807	1.50e-005	2.15	0.000792	113.
Ca++	0.00146	0.00143	57.5	2.53e-005	1.01
Cl-	0.00670	0.00670	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.247	-0.184	-186.	0.00401	4.04
H2O	55.5	55.5	1.00e+006	-0.00408	-73.5
HCO3-	0.00621	0.00385	235.	0.00236	144.
HPO4--	4.66e-005	5.50e-008	0.00528	4.65e-005	4.47
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000123	6.76		
Na+	0.00479	0.00479	110.		
O2(aq)	-0.0468	-0.0468	-1.50e+003	2.69e-006	0.0860
SO4--	0.00137	0.00123	119.	0.000132	12.7
SeO3--	1.89e-007	1.89e-007	0.0240	1.54e-011	1.96e-006

Sorbed	fraction	log fraction
As(OH)4-	0.9814	-0.008
Ca++	0.01733	-1.761
HCO3-	0.3797	-0.421
HPO4--	0.9988	-0.001
SO4--	0.09695	-1.013
SeO3--	8.140e-005	-4.089

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0008067	1.500e-005	1.125	0.0007917	59.37

Calcium	0.001457	0.001432	57.45	2.525e-005	1.013
Carbon	0.006209	0.003851	46.30	0.002357	28.34
Chlorine	0.006703	0.006703	237.9		
Hydrogen	110.8	110.8	1.118e+005	0.001427	1.440
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.006885	110.3
Phosphorus	4.660e-005	5.500e-008	0.001705	4.654e-005	1.443
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	1.890e-007	0.01494	1.539e-011	1.216e-006
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001366	0.001234	39.59	0.0001324	4.250

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.143

Eh = 0.0416 volts pe = 0.7194

Ionic strength = 0.012429

Activity of water = 0.999766

Solvent mass = 0.998369 kg

Solution mass = 0.999112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006714 molal

Dissolved solids = 744 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.79 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0416	0.7194
e- + Fe+++ = Fe++	-0.0006	-0.0097

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.218e-006	-5.914	0.0001838	

Se(black)	1.891e-007	-6.723	1.493e-005	
		_____________	_____________	
(total)		1.770	0.3355*	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006676	236.5	0.8911	-2.2256
Na+	0.004772	109.6	0.8944	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.19	0.6557	-3.0768
SO4--	0.001050	100.8	0.6382	-3.1740
HCO3-	0.0008111	49.45	0.8960	-3.1386
Mg++	0.0005041	12.24	0.6715	-3.4704
Fe++	0.0001591	8.879	0.6557	-3.9816
K+	0.0001160	4.532	0.8911	-3.9856
CaSO4	0.0001134	15.43	1.0000	-3.9452
Mn++	0.0001120	6.150	0.6557	-4.1340
MgSO4	3.686e-005	4.433	1.0000	-4.4335
CaCl+	3.248e-005	2.451	0.8944	-4.5368
NaSO4-	1.519e-005	1.807	0.8944	-4.8669
As(OH)3	1.501e-005	1.888	1.0000	-4.8238
FeSO4	1.104e-005	1.676	1.0000	-4.9571
CaHCO3+	1.053e-005	1.064	0.8981	-5.0241
MnSO4	8.412e-006	1.269	1.0000	-5.0751
NaHCO3	4.816e-006	0.4043	1.0000	-5.3173
MgCl+	3.540e-006	0.2114	0.8944	-5.4995
MgHCO3+	2.748e-006	0.2343	0.8944	-5.6094
FeHCO3+	2.018e-006	0.2357	0.8944	-5.7434
H+	1.747e-006	0.001759	0.9084	-5.7996
FeCl+	1.239e-006	0.1130	0.8944	-5.9554
MnHCO3+	1.080e-006	0.1251	0.8944	-6.0151
NaCl	5.453e-007	0.03184	1.0000	-6.2634

KSO4-	5.383e-007	0.07270	0.8944	-6.3174
MnCl+	3.098e-007	0.02798	0.8944	-6.5574
HSO4-	9.472e-008	0.009187	0.8944	-7.0720
H2PO4-	4.631e-008	0.004488	0.8944	-7.3828
CO3--	2.739e-008	0.001642	0.6427	-7.7544
CaCO3	2.179e-008	0.002179	1.0000	-7.6618
KCl	1.433e-008	0.001068	1.0000	-7.8436
FeCO3	1.389e-008	0.001608	1.0000	-7.8572
H2AsO4-	1.057e-008	0.001488	0.8944	-8.0244

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002121	0.002118	1.0000	-2.6734
>(w)FeOH2+	0.0009017	0.0009003	7.0058	-3.0449
>(w)FeH2AsO3	0.0007878	0.0007866	1.0000	-3.1036
>(w)FeOCO2-	0.0002408	0.0002404	0.14274	-3.6183
>(w)FeOH	0.0002042	0.0002039	1.0000	-3.6899
>(w)FeSO4-	9.165e-005	9.150e-005	0.14274	-4.0379
>(s)FeOH2+	6.989e-005	6.978e-005	7.0058	-4.1556
>(w)FeOHSO4--	4.140e-005	4.134e-005	0.020374	-4.3829
>(w)FeHPO4-	3.563e-005	3.557e-005	0.14274	-4.4482
>(s)FeOHCa++	2.522e-005	2.518e-005	49.082	-4.5983
>(s)FeOH	1.583e-005	1.580e-005	1.0000	-4.8006
>(w)FeH2PO4	6.409e-006	6.398e-006	1.0000	-5.1932
>(w)FeOHAsO4---	3.464e-006	3.458e-006	0.0029082	-5.4604
>(w)FePO4--	3.364e-006	3.358e-006	0.020374	-5.4732
>(w)FeHAsO4-	1.512e-006	1.510e-006	0.14274	-5.8204
>(w)FeO-	1.060e-006	1.058e-006	0.14274	-5.9749
>(w)FeH2AsO4	2.161e-007	2.157e-007	1.0000	-6.6654
>(s)FeO-	8.212e-008	8.199e-008	0.14274	-7.0855
>(w)FeOCa+	2.175e-008	2.171e-008	7.0058	-7.6626

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 >(w)FeSeO3-        4.705e-020   4.698e-020      0.14274    -19.3274
 >(w)FeOHSeO3--     6.273e-021   6.263e-021      0.020374   -20.2025
 >(w)FeSeO4-        1.129e-041   1.127e-041      0.14274    -40.9472
 >(w)FeOHSeO4--     5.858e-042   5.848e-042      0.020374   -41.2323
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)


 Mineral saturation states
                 log Q/K                      log Q/K
----------------------------------------------------------------
 Se(black)         0.0000 sat    Gypsum           -1.7991
 MnHPO4(c)         0.0000 sat    Anhydrite        -2.0455
 Hematite          0.0000 sat    Calcite          -2.2268
 Goethite         -0.4676        Aragonite        -2.3923
 Siderite         -1.2299        Bassanite        -2.6764
 Rhodochrosite    -1.3130        CaSO4^1/2H2O(bet  -2.8538
  (only minerals with log Q/K > -3 listed)


 Gases              fugacity     log fug.
-----------------------------------------------
 CO2(g)               0.06899     -1.161
 Steam                0.02023     -1.694
 H2(g)              6.258e-014    -13.204
 H2S(g)             1.389e-025    -24.857
 CH4(g)             1.012e-030    -29.995
 S2(g)              2.290e-050    -49.640
 O2(g)              7.192e-060    -59.143


                            In fluid           Sorbed          Kd
 Original basis total moles   moles    mg/kg     moles    mg/kg     L/kg
-------------------------------------------------------------------------------
 >(s)FeOH       0.000111
 >(w)FeOH         0.00443
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As(OH)4-	0.000807	1.50e-005	2.15	0.000792	113.
Ca++	0.00146	0.00143	57.5	2.52e-005	1.01
Cl-	0.00670	0.00670	238.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0595	0.00304	3.06	0.00401	4.04
H2O	55.4	55.4	9.99e+005	-0.00408	-73.5
HCO3-	0.00621	0.00385	235.	0.00236	144.
HPO4--	4.66e-005	5.34e-008	0.00513	4.53e-005	4.35
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.69		
Na+	0.00479	0.00479	110.		
O2(aq)	2.41e-006	6.06e-009	0.000194	2.59e-006	0.0830
SO4--	0.00137	0.00123	119.	0.000133	12.8
SeO3--	1.89e-007	7.30e-016	9.28e-011	5.32e-020	6.77e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9814	-0.008
Ca++	0.01729	-1.762
HCO3-	0.3798	-0.420
HPO4--	0.9988	-0.001
SO4--	0.09724	-1.012
SeO3--	7.290e-005	-4.137

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0008067	1.500e-005	1.125	0.0007917	59.37
Calcium	0.001457	0.001432	57.45	2.520e-005	1.011
Carbon	0.006209	0.003850	46.29	0.002358	28.35

Chlorine	0.006703	0.006703	237.9		
Hydrogen	110.8	110.8	1.118e+005	0.001427	1.439
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001216	6.689		
Oxygen	55.47	55.43	8.877e+005	0.006885	110.2
Phosphorus	4.660e-005	5.345e-008	0.001657	4.533e-005	1.405
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.891e-007	7.302e-016	5.771e-011	5.324e-020	4.207e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001366	0.001233	39.57	0.0001328	4.263

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.144

Eh = 0.0415 volts pe = 0.7190

Ionic strength = 0.012418

Activity of water = 0.999766

Solvent mass = 0.999369 kg

Solution mass = 1.000112 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006707 molal

Dissolved solids = 743 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 5.00 uC/cm2

Surface potential = 50.0 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7190
e- + Fe+++ = Fe++	-0.0006	-0.0097

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	1.171e-006	-5.932	0.0001767	

Se(black)	1.891e-007	-6.723	1.493e-005
		______________	______________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006669	236.3	0.8912	-2.2260
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003022	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6558	-3.0771
SO4--	0.001049	100.7	0.6384	-3.1743
HCO3-	0.0008105	49.42	0.8961	-3.1389
Mg++	0.0005036	12.23	0.6716	-3.4708
Fe++	0.0001590	8.871	0.6558	-3.9820
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.41	1.0000	-3.9458
Mn++	0.0001120	6.147	0.6558	-4.1341
MgSO4	3.680e-005	4.426	1.0000	-4.4341
CaCl+	3.242e-005	2.447	0.8945	-4.5376
NaSO4-	1.516e-005	1.804	0.8945	-4.8676
As(OH)3	1.499e-005	1.887	1.0000	-4.8241
FeSO4	1.102e-005	1.673	1.0000	-4.9577
CaHCO3+	1.052e-005	1.063	0.8982	-5.0247
MnSO4	8.402e-006	1.268	1.0000	-5.0756
NaHCO3	4.808e-006	0.4036	1.0000	-5.3180
MgCl+	3.534e-006	0.2110	0.8945	-5.5002
MgHCO3+	2.744e-006	0.2340	0.8945	-5.6100
FeHCO3+	2.015e-006	0.2353	0.8945	-5.7441
H+	1.746e-006	0.001759	0.9084	-5.7997
FeCl+	1.237e-006	0.1128	0.8945	-5.9561
MnHCO3+	1.079e-006	0.1250	0.8945	-6.0156
NaCl	5.442e-007	0.03178	1.0000	-6.2642

KSO4-	5.374e-007	0.07257	0.8945	-6.3182
MnCl+	3.093e-007	0.02794	0.8945	-6.5580
HSO4-	9.462e-008	0.009178	0.8945	-7.0724
H2PO4-	4.632e-008	0.004489	0.8945	-7.3827
CO3--	2.737e-008	0.001641	0.6429	-7.7546
CaCO3	2.176e-008	0.002176	1.0000	-7.6623
KCl	1.431e-008	0.001066	1.0000	-7.8444
FeCO3	1.387e-008	0.001606	1.0000	-7.8578
H2AsO4-	1.055e-008	0.001486	0.8945	-8.0251

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002119	0.002118	1.0000	-2.6739
>(w)FeOH2+	0.0009011	0.0009005	7.0073	-3.0452
>(w)FeH2AsO3	0.0007871	0.0007866	1.0000	-3.1040
>(w)FeOCO2-	0.0002406	0.0002405	0.14271	-3.6187
>(w)FeOH	0.0002042	0.0002040	1.0000	-3.6900
>(w)FeSO4-	9.155e-005	9.149e-005	0.14271	-4.0383
>(s)FeOH2+	6.983e-005	6.978e-005	7.0073	-4.1560
>(w)FeOHSO4--	4.138e-005	4.135e-005	0.020365	-4.3832
>(w)FeHPO4-	3.563e-005	3.561e-005	0.14271	-4.4482
>(s)FeOHCa++	2.518e-005	2.516e-005	49.103	-4.5990
>(s)FeOH	1.582e-005	1.581e-005	1.0000	-4.8008
>(w)FeH2PO4	6.406e-006	6.402e-006	1.0000	-5.1934
>(w)FeOHAsO4---	3.461e-006	3.459e-006	0.0029063	-5.4607
>(w)FePO4--	3.365e-006	3.363e-006	0.020365	-5.4730
>(w)FeHAsO4-	1.510e-006	1.509e-006	0.14271	-5.8211
>(w)FeO-	1.060e-006	1.059e-006	0.14271	-5.9748
>(w)FeH2AsO4	2.156e-007	2.155e-007	1.0000	-6.6663
>(s)FeO-	8.212e-008	8.207e-008	0.14271	-7.0855
>(w)FeOCa+	2.173e-008	2.171e-008	7.0073	-7.6630

>(w)FeSeO3-	4.696e-020	4.693e-020	0.14271	-19.3283
>(w)FeOHSeO3--	6.264e-021	6.260e-021	0.020365	-20.2031
>(w)FeSeO4-	1.126e-041	1.125e-041	0.14271	-40.9485
>(w)FeOHSeO4--	5.843e-042	5.839e-042	0.020365	-41.2334

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7997
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0462
Hematite	0.0000 sat	Calcite	-2.2273
Goethite	-0.4676	Aragonite	-2.3928
Siderite	-1.2304	Bassanite	-2.6770
Rhodochrosite	-1.3133	CaSO4^1/2H2O(bet	-2.8544

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02024	-1.694
H2(g)	6.265e-014	-13.203
H2S(g)	1.393e-025	-24.856
CH4(g)	1.015e-030	-29.993
S2(g)	2.298e-050	-49.639
O2(g)	7.177e-060	-59.144

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					

As(OH)4-	0.000807	1.50e-005	2.14	0.000792	113.
Ca++	0.00146	0.00143	57.4	2.52e-005	1.01
Cl-	0.00670	0.00670	238.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0595	0.00304	3.06	0.00401	4.04
H2O	55.5	55.5	9.99e+005	-0.00407	-73.4
HCO3-	0.00621	0.00385	235.	0.00236	144.
HPO4--	4.66e-005	5.35e-008	0.00513	4.54e-005	4.35
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.68		
Na+	0.00479	0.00479	110.		
O2(aq)	2.41e-006	6.05e-009	0.000194	2.59e-006	0.0829
SO4--	0.00137	0.00123	118.	0.000133	12.8
SeO3--	1.89e-007	7.32e-016	9.29e-011	5.32e-020	6.75e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9814	-0.008
Ca++	0.01728	-1.762
HCO3-	0.3798	-0.420
HPO4--	0.9988	-0.001
SO4--	0.09725	-1.012
SeO3--	7.268e-005	-4.139

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0008067	1.500e-005	1.124	0.0007917	59.31
Calcium	0.001457	0.001432	57.40	2.518e-005	1.009
Carbon	0.006209	0.003851	46.25	0.002358	28.32

Chlorine	0.006703	0.006703	237.6		
Hydrogen	110.9	110.9	1.118e+005	0.001427	1.438
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001217	6.685		
Oxygen	55.53	55.49	8.877e+005	0.006884	110.1
Phosphorus	4.660e-005	5.350e-008	0.001657	4.537e-005	1.405
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.891e-007	7.318e-016	5.778e-011	5.319e-020	4.200e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001366	0.001233	39.53	0.0001328	4.259

0.0008067 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.111

Eh = 0.0420 volts pe = 0.7271

Ionic strength = 0.012423

Activity of water = 0.999767

Solvent mass = 0.998369 kg

Solution mass = 0.999115 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006694 molal

Dissolved solids = 746 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.84 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 4.82 uC/cm2

Surface potential = 48.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0420	0.7271
e- + Fe+++ = Fe++	-0.0006	-0.0111

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01108	-1.955	1.770	0.3355
			———	———
(total)			1.770	0.3355

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006656	235.8	0.8912	-2.2268
Na+	0.004772	109.6	0.8945	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.18	0.6557	-3.0767
SO4--	0.001050	100.8	0.6383	-3.1738
HCO3-	0.0008119	49.50	0.8960	-3.1382
Mg++	0.0005041	12.24	0.6716	-3.4704
Fe++	0.0001591	8.879	0.6557	-3.9816
K+	0.0001160	4.532	0.8912	-3.9855
CaSO4	0.0001135	15.44	1.0000	-3.9450
Mn++	0.0001132	6.212	0.6557	-4.1296
As(OH)3	3.752e-005	4.722	1.0000	-4.4258
MgSO4	3.687e-005	4.435	1.0000	-4.4333
CaCl+	3.239e-005	2.444	0.8945	-4.5381
NaSO4-	1.519e-005	1.808	0.8945	-4.8668
FeSO4	1.104e-005	1.676	1.0000	-4.9569
CaHCO3+	1.054e-005	1.065	0.8982	-5.0236
MnSO4	8.499e-006	1.282	1.0000	-5.0706
NaHCO3	4.821e-006	0.4047	1.0000	-5.3168
MgCl+	3.530e-006	0.2108	0.8945	-5.5007
MgHCO3+	2.751e-006	0.2346	0.8945	-5.6089
FeHCO3+	2.021e-006	0.2360	0.8945	-5.7430
H+	1.745e-006	0.001757	0.9084	-5.8000
FeCl+	1.235e-006	0.1127	0.8945	-5.9566
MnHCO3+	1.092e-006	0.1265	0.8945	-6.0103
NaCl	5.437e-007	0.03175	1.0000	-6.2646

KSO4-	5.385e-007	0.07272	0.8945	-6.3173
MnCl+	3.120e-007	0.02818	0.8945	-6.5544
HSe-	1.877e-007	0.01500	0.8945	-6.7751
HSO4-	9.466e-008	0.009181	0.8945	-7.0723
H2PO4-	4.765e-008	0.004618	0.8945	-7.3704
H2AsO4-	2.746e-008	0.003867	0.8945	-7.6097
CO3--	2.744e-008	0.001645	0.6428	-7.7536
CaCO3	2.183e-008	0.002184	1.0000	-7.6609
KCl	1.429e-008	0.001065	1.0000	-7.8449
FeCO3	1.392e-008	0.001612	1.0000	-7.8563
As(OH)4-	1.187e-008	0.001696	0.8945	-7.9739

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.001663	0.001660	1.0000	-2.7791
>(w)FeH2AsO3	0.001544	0.001542	1.0000	-2.8113
>(w)FeOH2+	0.0007588	0.0007576	6.5191	-3.1198
>(w)FeOCO2-	0.0001758	0.0001755	0.15340	-3.7549
>(w)FeOH	0.0001601	0.0001598	1.0000	-3.7957
>(s)FeOH2+	6.938e-005	6.927e-005	6.5191	-4.1588
>(w)FeSO4-	6.680e-005	6.669e-005	0.15340	-4.1752
>(w)FeOHSO4--	2.811e-005	2.807e-005	0.023530	-4.5511
>(s)FeOHCa++	2.693e-005	2.689e-005	42.498	-4.5697
>(w)FeHPO4-	2.674e-005	2.669e-005	0.15340	-4.5729
>(s)FeOH	1.464e-005	1.461e-005	1.0000	-4.8346
>(w)FeOHAsO4---	5.696e-006	5.686e-006	0.0036095	-5.2445
>(w)FeH2PO4	5.163e-006	5.155e-006	1.0000	-5.2871
>(w)FeHAsO4-	2.866e-006	2.861e-006	0.15340	-5.5427
>(w)FePO4--	2.351e-006	2.347e-006	0.023530	-5.6287
>(w)FeO-	7.736e-007	7.723e-007	0.15340	-6.1115
>(w)FeH2AsO4	4.396e-007	4.389e-007	1.0000	-6.3569

>(s)FeO-	7.073e-008	7.061e-008	0.15340	-7.1504
>(w)FeOCa+	1.834e-008	1.831e-008	6.5191	-7.7366
>(w)FeSeO3-	9.942e-012	9.925e-012	0.15340	-11.0025
>(w)FeOHSeO3--	1.235e-012	1.233e-012	0.023530	-11.9085
>(w)FeSeO4-	2.477e-033	2.473e-033	0.15340	-32.6061
>(w)FeOHSeO4--	1.197e-033	1.195e-033	0.023530	-32.9220

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	12.3212s/sat	Gypsum	-1.7989
Se(black)	8.4290s/sat	Anhydrite	-2.0454
MnHPO4(c)	0.0172s/sat	Calcite	-2.2258
Hematite	0.0000 sat	Aragonite	-2.3914
Goethite	-0.4676	Bassanite	-2.6762
Siderite	-1.2289	CaSO4^1/2H2O(bet	-2.8536
Rhodochrosite	-1.3077	Magnetite	-3.0000
FeSe	-1.5476		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02024	-1.694
H2(g)	6.028e-014	-13.220
H2S(g)	1.193e-025	-24.923
CH4(g)	8.711e-031	-30.060
S2(g)	1.823e-050	-49.739
O2(g)	7.751e-060	-59.111

In fluid Sorbed Kd

Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					
>(w)FeOH	0.00443					
As(OH)4-	0.00159	3.75e-005	5.37	0.00155	222.	
Ca++	0.00146	0.00143	57.5	2.69e-005	1.08	
Cl-	0.00668	0.00668	237.			
Fe++	0.000173	0.000173	9.68			
Fe+++	0.0222	4.40e-012	2.46e-007			
H+	-0.246	-0.184	-186.	0.00412	4.16	
H2O	55.5	55.5	1.00e+006	-0.00503	-90.7	
HCO3-	0.00569	0.00385	235.	0.00184	112.	
HPO4--	3.43e-005	5.50e-008	0.00528	3.42e-005	3.29	
K+	0.000116	0.000116	4.55			
Mg++	0.000546	0.000546	13.3			
Mn++	0.000123	0.000123	6.76			
Na+	0.00479	0.00479	110.			
O2(aq)	-0.0468	-0.0468	-1.50e+003	4.49e-006	0.144	
SO4--	0.00133	0.00123	119.	9.48e-005	9.11	
SeO3--	1.89e-007	1.89e-007	0.0240	1.12e-011	1.42e-006	

Sorbed	fraction	log fraction
As(OH)4-	0.9764	-0.010
Ca++	0.01844	-1.734
HCO3-	0.3228	-0.491
HPO4--	0.9984	-0.001
SO4--	0.07133	-1.147
SeO3--	5.902e-005	-4.229

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg

Arsenic	0.001588	3.750e-005	2.812	0.001551	116.3
Calcium	0.001459	0.001432	57.45	2.691e-005	1.079
Carbon	0.005687	0.003851	46.30	0.001836	22.07
Chlorine	0.006683	0.006683	237.1		
Hydrogen	110.8	110.8	1.118e+005	0.002129	2.147
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001229	6.756		
Oxygen	55.47	55.43	8.877e+005	0.007202	115.3
Phosphorus	3.425e-005	5.500e-008	0.001705	3.420e-005	1.060
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.890e-007	1.890e-007	0.01494	1.116e-011	8.818e-007
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001328	0.001234	39.59	9.476e-005	3.041

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.131

Eh = 0.0417 volts pe = 0.7224

Ionic strength = 0.012420

Activity of water = 0.999767

Solvent mass = 0.998369 kg

Solution mass = 0.999115 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006694 molal

Dissolved solids = 746 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.80 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 4.82 uC/cm2

Surface potential = 48.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0417	0.7224
e- + Fe+++ = Fe++	-0.0006	-0.0101

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	9.763e-007	-6.010	0.0001473	

Se(black)	1.890e-007	-6.723	1.493e-005
		______	______
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006656	235.8	0.8912	-2.2268
Na+	0.004772	109.6	0.8945	-2.3697
CO2(aq)	0.003024	133.0	1.0000	-2.5194
Ca++	0.001278	51.19	0.6557	-3.0767
SO4--	0.001050	100.8	0.6383	-3.1739
HCO3-	0.0008112	49.46	0.8960	-3.1385
Mg++	0.0005041	12.24	0.6716	-3.4704
Fe++	0.0001591	8.879	0.6557	-3.9816
K+	0.0001160	4.532	0.8912	-3.9855
CaSO4	0.0001135	15.44	1.0000	-3.9450
Mn++	0.0001123	6.162	0.6557	-4.1331
As(OH)3	3.751e-005	4.720	1.0000	-4.4259
MgSO4	3.687e-005	4.435	1.0000	-4.4333
CaCl+	3.239e-005	2.445	0.8945	-4.5380
NaSO4-	1.519e-005	1.807	0.8945	-4.8668
FeSO4	1.104e-005	1.676	1.0000	-4.9569
CaHCO3+	1.054e-005	1.064	0.8982	-5.0239
MnSO4	8.431e-006	1.272	1.0000	-5.0741
NaHCO3	4.817e-006	0.4044	1.0000	-5.3172
MgCl+	3.530e-006	0.2108	0.8945	-5.5007
MgHCO3+	2.749e-006	0.2344	0.8945	-5.6092
FeHCO3+	2.019e-006	0.2358	0.8945	-5.7433
H+	1.746e-006	0.001759	0.9084	-5.7997
FeCl+	1.236e-006	0.1127	0.8945	-5.9566
MnHCO3+	1.082e-006	0.1254	0.8945	-6.0141
NaCl	5.437e-007	0.03175	1.0000	-6.2646

KSO4-	5.384e-007	0.07271	0.8945	-6.3173
MnCl+	3.095e-007	0.02795	0.8945	-6.5578
HSO4-	9.471e-008	0.009187	0.8945	-7.0720
H2PO4-	4.620e-008	0.004478	0.8945	-7.3838
CO3--	2.739e-008	0.001643	0.6428	-7.7542
H2AsO4-	2.681e-008	0.003775	0.8945	-7.6202
CaCO3	2.180e-008	0.002180	1.0000	-7.6615
KCl	1.429e-008	0.001065	1.0000	-7.8449
FeCO3	1.390e-008	0.001609	1.0000	-7.8570
As(OH)4-	1.186e-008	0.001694	0.8945	-7.9744

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.001664	0.001661	1.0000	-2.7789
>(w)FeH2AsO3	0.001544	0.001542	1.0000	-2.8113
>(w)FeOH2+	0.0007586	0.0007574	6.5290	-3.1200
>(w)FeOCO2-	0.0001760	0.0001757	0.15316	-3.7544
>(w)FeOH	0.0001602	0.0001599	1.0000	-3.7955
>(s)FeOH2+	6.941e-005	6.930e-005	6.5290	-4.1586
>(w)FeSO4-	6.698e-005	6.687e-005	0.15316	-4.1741
>(w)FeOHSO4--	2.821e-005	2.816e-005	0.023459	-4.5497
>(s)FeOHCa++	2.689e-005	2.684e-005	42.628	-4.5705
>(w)FeHPO4-	2.598e-005	2.593e-005	0.15316	-4.5854
>(s)FeOH	1.465e-005	1.463e-005	1.0000	-4.8341
>(w)FeOHAsO4---	5.580e-006	5.570e-006	0.0035930	-5.2534
>(w)FeH2PO4	5.013e-006	5.005e-006	1.0000	-5.2999
>(w)FeHAsO4-	2.803e-006	2.799e-006	0.15316	-5.5523
>(w)FePO4--	2.286e-006	2.282e-006	0.023459	-5.6409
>(w)FeO-	7.745e-007	7.733e-007	0.15316	-6.1110
>(w)FeH2AsO4	4.297e-007	4.290e-007	1.0000	-6.3668
>(s)FeO-	7.087e-008	7.075e-008	0.15316	-7.1496

>(w)FeOCa+	1.831e-008	1.828e-008	6.5290	-7.7374
>(w)FeSeO3-	3.541e-020	3.535e-020	0.15316	-19.4509
>(w)FeOHSeO3--	4.400e-021	4.393e-021	0.023459	-20.3565
>(w)FeSeO4-	8.621e-042	8.607e-042	0.15316	-41.0644
>(w)FeOHSeO4--	4.168e-042	4.162e-042	0.023459	-41.3800

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7989
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0454
Hematite	0.0000 sat	Calcite	-2.2265
Goethite	-0.4676	Aragonite	-2.3920
Siderite	-1.2296	Bassanite	-2.6762
Rhodochrosite	-1.3119	CaSO4^1/2H2O(bet	-2.8536

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06899	-1.161
Steam	0.02024	-1.694
H2(g)	6.168e-014	-13.210
H2S(g)	1.310e-025	-24.883
CH4(g)	9.550e-031	-30.020
S2(g)	2.098e-050	-49.678
O2(g)	7.403e-060	-59.131

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					

>(w)FeOH	0.00443				
As(OH)4-	0.00159	3.75e-005	5.36	0.00155	222.
Ca++	0.00146	0.00143	57.5	2.69e-005	1.08
Cl-	0.00668	0.00668	237.		
Fe++	0.000173	0.000173	9.68		
Fe+++	0.0222	4.40e-012	2.46e-007		
H+	-0.0593	0.00306	3.09	0.00412	4.16
H2O	55.4	55.4	9.99e+005	-0.00503	-90.7
HCO3-	0.00569	0.00385	235.	0.00184	112.
HPO4--	3.43e-005	5.33e-008	0.00512	3.32e-005	3.19
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.70		
Na+	0.00479	0.00479	110.		
O2(aq)	4.23e-006	1.54e-008	0.000492	4.40e-006	0.141
SO4--	0.00133	0.00123	119.	9.50e-005	9.14
SeO3--	1.89e-007	7.20e-016	9.15e-011	3.97e-020	5.05e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9764	-0.010
Ca++	0.01841	-1.735
HCO3-	0.3229	-0.491
HPO4--	0.9984	-0.001
SO4--	0.07154	-1.145
SeO3--	5.520e-005	-4.258

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001588	3.749e-005	2.811	0.001551	116.3
Calcium	0.001459	0.001432	57.45	2.686e-005	1.078

Carbon	0.005687	0.003851	46.29	0.001837	22.08
Chlorine	0.006683	0.006683	237.1		
Hydrogen	110.8	110.8	1.118e+005	0.002128	2.147
Iron	0.02234	0.0001732	9.679		
Magnesium	0.0005464	0.0005464	13.29		
Manganese	0.0001229	0.0001219	6.702		
Oxygen	55.47	55.43	8.877e+005	0.007202	115.3
Phosphorus	3.425e-005	5.332e-008	0.001653	3.322e-005	1.030
Potassium	0.0001164	0.0001164	4.554		
Selenium	1.890e-007	7.199e-016	5.689e-011	3.974e-020	3.141e-015
Sodium	0.004785	0.004785	110.1		
Sulfur	0.001328	0.001233	39.58	9.503e-005	3.049

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 5.800 log fO2 = -59.131

Eh = 0.0417 volts pe = 0.7221

Ionic strength = 0.012408

Activity of water = 0.999767

Solvent mass = 0.999369 kg

Solution mass = 1.000115 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.006687 molal

Dissolved solids = 745 mg/kg sol'n

Rock mass = 0.001770 kg

Carbonate alkalinity= 40.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 4.82 uC/cm2

Surface potential = 48.2 mV

Surface area = 1.06e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0417	0.7221
e- + Fe+++ = Fe++	-0.0006	-0.0101

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01108	-1.955	1.770	0.3355
MnHPO4(c)	9.385e-007	-6.028	0.0001416	

Se(black)	1.890e-007	-6.723	1.493e-005
		______________	______________
(total)		1.770	0.3355*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006649	235.6	0.8912	-2.2272
Na+	0.004768	109.5	0.8945	-2.3701
CO2(aq)	0.003021	132.9	1.0000	-2.5198
Ca++	0.001277	51.14	0.6558	-3.0770
SO4--	0.001049	100.7	0.6384	-3.1742
HCO3-	0.0008106	49.42	0.8961	-3.1388
Mg++	0.0005036	12.23	0.6717	-3.4707
Fe++	0.0001590	8.871	0.6558	-3.9819
K+	0.0001159	4.528	0.8912	-3.9860
CaSO4	0.0001133	15.42	1.0000	-3.9457
Mn++	0.0001122	6.158	0.6558	-4.1333
As(OH)3	3.748e-005	4.717	1.0000	-4.4262
MgSO4	3.681e-005	4.428	1.0000	-4.4340
CaCl+	3.233e-005	2.440	0.8945	-4.5388
NaSO4-	1.517e-005	1.804	0.8945	-4.8675
FeSO4	1.103e-005	1.674	1.0000	-4.9576
CaHCO3+	1.052e-005	1.063	0.8982	-5.0246
MnSO4	8.421e-006	1.271	1.0000	-5.0746
NaHCO3	4.810e-006	0.4037	1.0000	-5.3179
MgCl+	3.523e-006	0.2104	0.8945	-5.5014
MgHCO3+	2.745e-006	0.2340	0.8945	-5.6099
FeHCO3+	2.016e-006	0.2354	0.8945	-5.7439
H+	1.746e-006	0.001758	0.9084	-5.7998
FeCl+	1.233e-006	0.1125	0.8945	-5.9573
MnHCO3+	1.081e-006	0.1253	0.8945	-6.0146
NaCl	5.427e-007	0.03169	1.0000	-6.2655

KSO4-	5.375e-007	0.07259	0.8945	-6.3181
MnCl+	3.090e-007	0.02791	0.8945	-6.5584
HSO4-	9.462e-008	0.009177	0.8945	-7.0724
H2PO4-	4.621e-008	0.004479	0.8945	-7.3837
CO3--	2.738e-008	0.001642	0.6430	-7.7544
H2AsO4-	2.677e-008	0.003770	0.8945	-7.6208
CaCO3	2.177e-008	0.002178	1.0000	-7.6621
KCl	1.427e-008	0.001063	1.0000	-7.8457
FeCO3	1.388e-008	0.001607	1.0000	-7.8575
As(OH)4-	1.185e-008	0.001693	0.8945	-7.9746

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.001662	0.001661	1.0000	-2.7795
>(w)FeH2AsO3	0.001543	0.001542	1.0000	-2.8117
>(w)FeOH2+	0.0007580	0.0007576	6.5305	-3.1203
>(w)FeOCO2-	0.0001759	0.0001758	0.15313	-3.7548
>(w)FeOH	0.0001601	0.0001600	1.0000	-3.7956
>(s)FeOH2+	6.935e-005	6.930e-005	6.5305	-4.1590
>(w)FeSO4-	6.691e-005	6.687e-005	0.15313	-4.1745
>(w)FeOHSO4--	2.819e-005	2.817e-005	0.023448	-4.5499
>(s)FeOHCa++	2.684e-005	2.683e-005	42.647	-4.5712
>(w)FeHPO4-	2.598e-005	2.597e-005	0.15313	-4.5853
>(s)FeOH	1.465e-005	1.464e-005	1.0000	-4.8343
>(w)FeOHAsO4---	5.576e-006	5.572e-006	0.0035906	-5.2537
>(w)FeH2PO4	5.011e-006	5.008e-006	1.0000	-5.3000
>(w)FeHAsO4-	2.799e-006	2.797e-006	0.15313	-5.5530
>(w)FePO4--	2.288e-006	2.286e-006	0.023448	-5.6406
>(w)FeO-	7.747e-007	7.742e-007	0.15313	-6.1109
>(w)FeH2AsO4	4.288e-007	4.286e-007	1.0000	-6.3677
>(s)FeO-	7.087e-008	7.083e-008	0.15313	-7.1495

>(w)FeOCa+	1.829e-008	1.828e-008	6.5305	-7.7378
>(w)FeSeO3-	3.534e-020	3.532e-020	0.15313	-19.4517
>(w)FeOHSeO3--	4.394e-021	4.391e-021	0.023448	-20.3571
>(w)FeSeO4-	8.596e-042	8.591e-042	0.15313	-41.0657
>(w)FeOHSeO4--	4.158e-042	4.156e-042	0.023448	-41.3811

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Se(black)	0.0000 sat	Gypsum	-1.7996
MnHPO4(c)	0.0000 sat	Anhydrite	-2.0460
Hematite	0.0000 sat	Calcite	-2.2270
Goethite	-0.4676	Aragonite	-2.3926
Siderite	-1.2301	Bassanite	-2.6769
Rhodochrosite	-1.3123	CaSO4^1/2H2O(bet	-2.8542

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.06892	-1.162
Steam	0.02024	-1.694
H2(g)	6.175e-014	-13.209
H2S(g)	1.314e-025	-24.881
CH4(g)	9.579e-031	-30.019
S2(g)	2.106e-050	-49.677
O2(g)	7.388e-060	-59.131

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000111					

>(w)FeOH	0.00443				
As(OH)4-	0.00159	3.75e-005	5.36	0.00155	222.
Ca++	0.00146	0.00143	57.4	2.68e-005	1.08
Cl-	0.00668	0.00668	237.		
Fe++	0.000173	0.000173	9.67		
Fe+++	0.0222	4.41e-012	2.46e-007		
H+	-0.0593	0.00306	3.08	0.00412	4.15
H2O	55.5	55.5	9.99e+005	-0.00503	-90.6
HCO3-	0.00569	0.00385	235.	0.00184	112.
HPO4--	3.43e-005	5.34e-008	0.00512	3.33e-005	3.19
K+	0.000116	0.000116	4.55		
Mg++	0.000546	0.000546	13.3		
Mn++	0.000123	0.000122	6.70		
Na+	0.00479	0.00479	110.		
O2(aq)	4.23e-006	1.54e-008	0.000491	4.40e-006	0.141
SO4--	0.00133	0.00123	118.	9.50e-005	9.13
SeO3--	1.89e-007	7.21e-016	9.16e-011	3.97e-020	5.04e-015

Sorbed	fraction	log fraction
As(OH)4-	0.9764	-0.010
Ca++	0.01840	-1.735
HCO3-	0.3229	-0.491
HPO4--	0.9984	-0.001
SO4--	0.07154	-1.145
SeO3--	5.504e-005	-4.259

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001588	3.750e-005	2.809	0.001551	116.2
Calcium	0.001459	0.001432	57.40	2.684e-005	1.076

Carbon	0.005687	0.003851	46.25	0.001836	22.05
Chlorine	0.006683	0.006683	236.9		
Hydrogen	111.0	110.9	1.118e+005	0.002128	2.145
Iron	0.02234	0.0001732	9.669		
Magnesium	0.0005464	0.0005464	13.28		
Manganese	0.0001229	0.0001219	6.698		
Oxygen	55.53	55.49	8.877e+005	0.007201	115.2
Phosphorus	3.425e-005	5.338e-008	0.001653	3.326e-005	1.030
Potassium	0.0001164	0.0001164	4.549		
Selenium	1.890e-007	7.214e-016	5.696e-011	3.971e-020	3.135e-015
Sodium	0.004785	0.004785	110.0		
Sulfur	0.001328	0.001233	39.54	9.504e-005	3.047

RESIDUUM– MODEL OUTPUT

0.0001602 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008250

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998784 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 469 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.16 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.72 uC/cm2

Surface potential = 17.2 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3676

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
			______	______
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9123	-2.6275
Ca++	0.001390	55.69	0.7010	-3.0112
SO4--	0.001281	123.0	0.6879	-3.0550
Na+	0.001215	27.91	0.9111	-2.9560
CO2(aq)	0.001122	49.36	1.0000	-2.9500
Mg++	0.0003975	9.656	0.7131	-3.5475
CaSO4	0.0001716	23.36	1.0000	-3.7654
Cl-	0.0001395	4.945	0.9088	-3.8968
K+	9.295e-005	3.632	0.9088	-4.0733
MgSO4	4.018e-005	4.834	1.0000	-4.3960
CaHCO3+	3.882e-005	3.923	0.9138	-4.4501
Mn++	2.695e-005	1.480	0.7010	-4.7238
MgHCO3+	7.286e-006	0.6214	0.9111	-5.1779
Fe++	5.793e-006	0.3234	0.7010	-5.3913
HSe-	5.738e-006	0.4587	0.9111	-5.2816
NaSO4-	5.045e-006	0.6003	0.9111	-5.3376
NaHCO3	4.175e-006	0.3505	1.0000	-5.3794
MnSO4	2.766e-006	0.4174	1.0000	-5.5582
MnHCO3+	8.786e-007	0.1018	0.9111	-6.0966
CaCl+	8.178e-007	0.06174	0.9111	-6.1278
CO3--	7.139e-007	0.04282	0.6913	-6.3067
CaCO3	6.944e-007	0.06947	1.0000	-6.1584
KSO4-	5.654e-007	0.07639	0.9111	-6.2880
FeSO4	5.638e-007	0.08561	1.0000	-6.2489
HSeO3-	4.174e-007	0.05338	0.9111	-6.4199
FeHCO3+	2.606e-007	0.03044	0.9111	-6.6245

H+	1.930e-007	0.0001945	0.9212	-6.7500
SeO3--	1.504e-007	0.01908	0.6580	-7.0046
As(OH)3	1.232e-007	0.01550	1.0000	-6.9095
MgCO3	9.592e-008	0.008083	1.0000	-7.0181
MgCl+	6.360e-008	0.003799	0.9111	-7.2369
HAsO4--	6.338e-008	0.008865	0.6879	-7.3605
H2AsO4-	5.139e-008	0.007239	0.9111	-7.3296
MnCO3	3.743e-008	0.004300	1.0000	-7.4268
OH-	3.167e-008	0.0005384	0.9100	-7.5403
FeCO3	1.665e-008	0.001928	1.0000	-7.7785
HSO4-	1.315e-008	0.001276	0.9111	-7.9215

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003276	0.003270	1.0000	-2.4847
>(w)FeOH2+	0.001591	0.001588	1.9517	-2.7984
>(w)FeOCO2-	0.0009241	0.0009225	0.51237	-3.0343
>(w)FeOH	0.0008954	0.0008939	1.0000	-3.0480
>(s)FeOHCa++	0.0001589	0.0001587	3.8092	-3.7988
>(w)FeSeO3-	0.0001506	0.0001503	0.51237	-3.8222
>(w)FeOHAsO4---	0.0001228	0.0001226	0.13451	-3.9109
>(w)FeOHSeO3--	4.991e-005	4.983e-005	0.26252	-4.3018
>(w)FeH2AsO3	2.834e-005	2.830e-005	1.0000	-4.5475
>(w)FeOHSO4--	1.853e-005	1.850e-005	0.26252	-4.7321
>(w)FeSO4-	1.650e-005	1.647e-005	0.51237	-4.7825
>(s)FeOH2+	1.183e-005	1.181e-005	1.9517	-4.9271
>(w)FeO-	1.155e-005	1.153e-005	0.51237	-4.9376
>(w)FeHAsO4-	8.674e-006	8.660e-006	0.51237	-5.0618
>(s)FeOH	6.657e-006	6.646e-006	1.0000	-5.1767
>(w)FeOCa+	3.551e-006	3.545e-006	1.9517	-5.4496
>(w)FeHPO4-	3.003e-006	2.997e-006	0.51237	-5.5225

>(w)FePO4--	7.045e-007	7.034e-007	0.26252	-6.1521
>(w)FeH2AsO4	4.987e-007	4.978e-007	1.0000	-6.3022
>(w)FeH2PO4	2.173e-007	2.169e-007	1.0000	-6.6629
>(s)FeO-	8.585e-008	8.570e-008	0.51237	-7.0663
>(w)FeOHSeO4--	2.659e-024	2.655e-024	0.26252	-23.5753
>(w)FeSeO4-	2.062e-024	2.059e-024	0.51237	-23.6857

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	15.8694s/sat	Dolomite-ord	-1.1273
Se(black)	10.9165s/sat	Siderite	-1.2074
Hematite	0.0000 sat	Gypsum	-1.6129
Rhodochrosite	-0.4598	Monohydrocalcite	-1.6987
Goethite	-0.4651	Anhydrite	-1.8751
FeSe	-0.5208	Magnesite	-2.0879
Calcite	-0.7220	Bassanite	-2.5063
MnHPO4(c)	-0.7859	Magnetite	-2.5924
Aragonite	-0.8877	CaSO4^1/2H2O(bet	-2.6856
Dolomite	-1.1273	Dolomite-dis	-2.7358

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02457	-1.610
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.790e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.922e-065	-64.534

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	0.000160	2.38e-007	0.0340	0.000160	22.9	
Ca++	0.00176	0.00160	64.2	0.000162	6.51	
Cl-	0.000140	0.000140	4.98			
Fe++	6.63e-006	6.63e-006	0.370			
Fe+++	0.0354	9.90e-013	5.54e-008			
H+	-0.290	-0.188	-190.	0.00481	4.85	
H2O	55.6	55.5	1.00e+006	-0.00456	-82.3	
HCO3-	0.00795	0.00375	229.	0.00419	256.	
HPO4--	3.92e-006	5.50e-009	0.000529	3.92e-006	0.376	
K+	9.34e-005	9.34e-005	3.65			
Mg++	0.000444	0.000444	10.8			
Mn++	3.06e-005	3.06e-005	1.68			
Na+	0.00122	0.00122	28.1			
O2(aq)	-0.0473	-0.0473	-1.52e+003	6.59e-005	2.11	
SO4--	0.00153	0.00150	144.	3.50e-005	3.36	
SeO3--	0.000206	6.30e-006	0.801	0.000200	25.4	

Sorbed	fraction	log fraction
As(OH)4-	0.9985	-0.001
Ca++	0.09209	-1.036
HCO3-	0.5277	-0.278
HPO4--	0.9986	-0.001
SO4--	0.02280	-1.642
SeO3--	0.9695	-0.013

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001602	2.378e-007	0.01784	0.0001600	12.00
Calcium	0.001762	0.001599	64.18	0.0001622	6.510
Carbon	0.007946	0.003753	45.13	0.004193	50.42
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0005236	0.5284
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.879e+005	0.009545	152.9
Phosphorus	3.923e-006	5.500e-009	0.0001706	3.918e-006	0.1215
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	0.0002065	6.301e-006	0.4982	0.0002002	15.82
Sodium	0.001222	0.001222	28.12		
Sulfur	0.001534	0.001499	48.12	3.497e-005	1.123

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.746 log fO2 = -44.910

Eh = 0.1982 volts pe = 3.4499

Ionic strength = 0.008246

Activity of water = 0.999995

Solvent mass = 0.998315 kg

Solution mass = 0.998783 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 469 mg/kg sol'n

Rock mass = 0.002832 kg

Carbonate alkalinity= 131.02 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.68 uC/cm2

Surface potential = 16.8 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1982	3.4499
e- + Fe+++ = Fe++	-0.0778	-1.3546

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	2.281e-005	-4.642	0.001801	

(total)	2.832	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002582	157.4	0.9123	-2.6280
Ca++	0.001390	55.68	0.7011	-3.0113
SO4--	0.001282	123.0	0.6880	-3.0547
Na+	0.001215	27.91	0.9111	-2.9560
CO2(aq)	0.001132	49.81	1.0000	-2.9461
Mg++	0.0003975	9.656	0.7132	-3.5475
CaSO4	0.0001717	23.37	1.0000	-3.7652
Cl-	0.0001395	4.945	0.9088	-3.8968
K+	9.295e-005	3.632	0.9088	-4.0733
MgSO4	4.020e-005	4.837	1.0000	-4.3958
CaHCO3+	3.877e-005	3.918	0.9138	-4.4506
Mn++	2.695e-005	1.480	0.7011	-4.7237
MgHCO3+	7.279e-006	0.6207	0.9111	-5.1784
Fe++	5.793e-006	0.3234	0.7011	-5.3913
NaSO4-	5.048e-006	0.6006	0.9111	-5.3373
NaHCO3	4.171e-006	0.3502	1.0000	-5.3798
MnSO4	2.768e-006	0.4177	1.0000	-5.5579
MnHCO3+	8.777e-007	0.1017	0.9111	-6.0970
CaCl+	8.177e-007	0.06173	0.9111	-6.1278
CO3--	7.060e-007	0.04235	0.6914	-6.3115
CaCO3	6.867e-007	0.06870	1.0000	-6.1632
KSO4-	5.658e-007	0.07643	0.9111	-6.2878
FeSO4	5.642e-007	0.08566	1.0000	-6.2486
HSeO3-	3.918e-007	0.05011	0.9111	-6.4474
FeHCO3+	2.603e-007	0.03041	0.9111	-6.6249
H+	1.950e-007	0.0001964	0.9212	-6.7457
SeO3--	1.397e-007	0.01773	0.6580	-7.0364

MgCO3	9.487e-008	0.007995	1.0000	-7.0229
HAsO4--	8.138e-008	0.01138	0.6880	-7.2519
H2AsO4-	6.664e-008	0.009388	0.9111	-7.2166
MgCl+	6.361e-008	0.003799	0.9111	-7.2369
MnCO3	3.702e-008	0.004254	1.0000	-7.4315
OH-	3.136e-008	0.0005331	0.9100	-7.5446
FeCO3	1.647e-008	0.001908	1.0000	-7.7832
HSO4-	1.329e-008	0.001289	0.9111	-7.9169

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003287	0.003282	1.0000	-2.4832
>(w)FeOH2+	0.001621	0.001618	1.9239	-2.7902
>(w)FeOCO2-	0.0009051	0.0009036	0.51978	-3.0433
>(w)FeOH	0.0008905	0.0008890	1.0000	-3.0504
>(s)FeOHCa++	0.0001592	0.0001589	3.7014	-3.7982
>(w)FeOHAsO4---	0.0001487	0.0001484	0.14043	-3.8277
>(w)FeSeO3-	0.0001386	0.0001384	0.51978	-3.8582
>(w)FeOHSeO3--	4.483e-005	4.476e-005	0.27017	-4.3484
>(w)FeOHSO4--	1.792e-005	1.789e-005	0.27017	-4.7467
>(w)FeSO4-	1.635e-005	1.632e-005	0.51978	-4.7865
>(s)FeOH2+	1.179e-005	1.177e-005	1.9239	-4.9284
>(w)FeO-	1.121e-005	1.119e-005	0.51978	-4.9505
>(w)FeHAsO4-	1.103e-005	1.101e-005	0.51978	-4.9574
>(s)FeOH	6.479e-006	6.468e-006	1.0000	-5.1885
>(w)FeOCa+	3.547e-006	3.541e-006	1.9239	-5.4501
>(w)FeHPO4-	3.011e-006	3.006e-006	0.51978	-5.5212
>(w)FePO4--	6.896e-007	6.885e-007	0.27017	-6.1614
>(w)FeH2AsO4	6.497e-007	6.486e-007	1.0000	-6.1873
>(w)FeH2PO4	2.233e-007	2.229e-007	1.0000	-6.6511
>(s)FeO-	8.153e-008	8.140e-008	0.51978	-7.0887

>(w)FeH2AsO3	1.320e-010	1.318e-010	1.0000	-9.8793
>(w)FeOHSeO4--	6.681e-019	6.669e-019	0.27017	-18.1752
>(w)FeSeO4-	5.308e-019	5.299e-019	0.51978	-18.2750

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2121
Se(black)	0.0000 sat	Gypsum	-1.6127
Rhodochrosite	-0.4646	Monohydrocalcite	-1.7035
Goethite	-0.4651	Anhydrite	-1.8749
Calcite	-0.7268	Magnesite	-2.0926
MnHPO4(c)	-0.7803	Bassanite	-2.5061
Aragonite	-0.8925	Magnetite	-2.6010
Dolomite	-1.1368	CaSO4^1/2H2O(bet	-2.6854
Dolomite-ord	-1.1368	Dolomite-dis	-2.7454

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02479	-1.606
Steam	0.01836	-1.736
H2(g)	2.547e-021	-20.594
O2(g)	1.231e-045	-44.910
H2S(g)	1.132e-056	-55.946
CH4(g)	1.743e-060	-59.759
S2(g)	6.359e-098	-97.197

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000177				
>(w)FeOH	0.00709				
As(OH)4-	0.000160	1.48e-007	0.0212	0.000160	22.9
Ca++	0.00176	0.00160	64.2	0.000162	6.52
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.94e-013	5.56e-008		
H+	-0.100	0.00113	1.14	0.00476	4.80
H2O	55.5	55.4	1.00e+006	-0.00452	-81.4
HCO3-	0.00795	0.00376	230.	0.00419	256.
HPO4--	3.92e-006	5.60e-009	0.000539	3.92e-006	0.376
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00122	0.00122	28.1		
O2(aq)	5.73e-005	7.39e-008	0.00237	8.00e-005	2.56
SO4--	0.00153	0.00150	144.	3.42e-005	3.29
SeO3--	0.000206	5.31e-007	0.0675	0.000183	23.3

Sorbed	fraction	log fraction
As(OH)4-	0.9991	-0.000
Ca++	0.09221	-1.035
HCO3-	0.5267	-0.278
HPO4--	0.9986	-0.001
SO4--	0.02230	-1.652
SeO3--	0.9971	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001602	1.478e-007	0.01109	0.0001601	12.01

Calcium	0.001762	0.001599	64.17	0.0001624	6.518
Carbon	0.007946	0.003760	45.22	0.004185	50.33
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0005572	0.5623
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.879e+005	0.009543	152.9
Phosphorus	3.923e-006	5.604e-009	0.0001738	3.918e-006	0.1215
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	0.0002065	5.307e-007	0.04195	0.0001831	14.48
Sodium	0.001222	0.001222	28.12		
Sulfur	0.001534	0.001500	48.14	3.421e-005	1.098

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.746 log fO2 = -44.910

Eh = 0.1982 volts pe = 3.4499

Ionic strength = 0.008239

Activity of water = 0.999995

Solvent mass = 0.999315 kg

Solution mass = 0.999783 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 468 mg/kg sol'n

Rock mass = 0.002832 kg

Carbonate alkalinity= 130.91 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.68 uC/cm2

Surface potential = 16.8 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1982	3.4499
e- + Fe+++ = Fe++	-0.0778	-1.3540

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	2.281e-005	-4.642	0.001801	

(total)		2.832	0.5364*	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002579	157.3	0.9123	-2.6283
Ca++	0.001389	55.63	0.7012	-3.0116
SO4--	0.001280	122.9	0.6881	-3.0550
Na+	0.001213	27.88	0.9112	-2.9564
CO2(aq)	0.001132	49.77	1.0000	-2.9463
Mg++	0.0003971	9.647	0.7132	-3.5479
CaSO4	0.0001715	23.33	1.0000	-3.7659
Cl-	0.0001394	4.940	0.9089	-3.8973
K+	9.285e-005	3.629	0.9089	-4.0737
MgSO4	4.014e-005	4.829	1.0000	-4.3964
CaHCO3+	3.871e-005	3.912	0.9138	-4.4513
Mn++	2.692e-005	1.478	0.7012	-4.7241
MgHCO3+	7.266e-006	0.6197	0.9112	-5.1791
Fe++	5.788e-006	0.3231	0.7012	-5.3916
NaSO4-	5.039e-006	0.5996	0.9112	-5.3381
NaHCO3	4.163e-006	0.3496	1.0000	-5.3806
MnSO4	2.763e-006	0.4171	1.0000	-5.5586
MnHCO3+	8.763e-007	0.1016	0.9112	-6.0978
CaCl+	8.163e-007	0.06163	0.9112	-6.1286
CO3--	7.052e-007	0.04230	0.6915	-6.3119
CaCO3	6.855e-007	0.06858	1.0000	-6.1640
KSO4-	5.648e-007	0.07630	0.9112	-6.2885
FeSO4	5.633e-007	0.08553	1.0000	-6.2492
HSeO3-	3.914e-007	0.05007	0.9112	-6.4477
FeHCO3+	2.599e-007	0.03036	0.9112	-6.6256
H+	1.950e-007	0.0001965	0.9212	-6.7456
SeO3--	1.396e-007	0.01771	0.6582	-7.0369

MgCO3	9.470e-008	0.007980	1.0000	-7.0237
HAsO4--	8.125e-008	0.01136	0.6881	-7.2525
H2AsO4-	6.656e-008	0.009376	0.9112	-7.2172
MgCl+	6.349e-008	0.003792	0.9112	-7.2377
MnCO3	3.695e-008	0.004246	1.0000	-7.4323
OH-	3.135e-008	0.0005329	0.9100	-7.5447
FeCO3	1.644e-008	0.001904	1.0000	-7.7840
HSO4-	1.328e-008	0.001289	0.9112	-7.9171

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003283	0.003281	1.0000	-2.4837
>(w)FeOH2+	0.001620	0.001619	1.9248	-2.7906
>(w)FeOCO2-	0.0009042	0.0009036	0.51955	-3.0437
>(w)FeOH	0.0008900	0.0008894	1.0000	-3.0506
>(s)FeOHCa++	0.0001590	0.0001589	3.7047	-3.7987
>(w)FeOHAsO4---	0.0001485	0.0001484	0.14024	-3.8281
>(w)FeSeO3-	0.0001384	0.0001384	0.51955	-3.8587
>(w)FeOHSeO3--	4.480e-005	4.477e-005	0.26993	-4.3488
>(w)FeOHSO4--	1.791e-005	1.790e-005	0.26993	-4.7469
>(w)FeSO4-	1.634e-005	1.632e-005	0.51955	-4.7869
>(s)FeOH2+	1.180e-005	1.179e-005	1.9248	-4.9283
>(w)FeO-	1.120e-005	1.120e-005	0.51955	-4.9507
>(w)FeHAsO4-	1.101e-005	1.101e-005	0.51955	-4.9581
>(s)FeOH	6.482e-006	6.477e-006	1.0000	-5.1883
>(w)FeOCa+	3.540e-006	3.537e-006	1.9248	-5.4510
>(w)FeHPO4-	3.008e-006	3.006e-006	0.51955	-5.5217
>(w)FePO4--	6.891e-007	6.886e-007	0.26993	-6.1617
>(w)FeH2AsO4	6.486e-007	6.482e-007	1.0000	-6.1880
>(w)FeH2PO4	2.230e-007	2.229e-007	1.0000	-6.6516
>(s)FeO-	8.159e-008	8.154e-008	0.51955	-7.0884

>(w)FeH2AsO3 1.319e-010 1.318e-010 1.0000 -9.8799

>(w)FeOHSeO4-- 6.673e-019 6.668e-019 0.26993 -18.1757

>(w)FeSeO4- 5.301e-019 5.297e-019 0.51955 -18.2757

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2129
Se(black)	0.0000 sat	Gypsum	-1.6134
Goethite	-0.4651	Monohydrocalcite	-1.7043
Rhodochrosite	-0.4654	Anhydrite	-1.8755
Calcite	-0.7276	Magnesite	-2.0934
MnHPO4(c)	-0.7811	Bassanite	-2.5067
Aragonite	-0.8933	Magnetite	-2.6015
Dolomite	-1.1384	CaSO4^1/2H2O(bet	-2.6861
Dolomite-ord	-1.1384	Dolomite-dis	-2.7470

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02478	-1.606
Steam	0.01836	-1.736
H2(g)	2.548e-021	-20.594
O2(g)	1.230e-045	-44.910
H2S(g)	1.134e-056	-55.946
CH4(g)	1.744e-060	-59.758
S2(g)	6.368e-098	-97.196

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000177				
>(w)FeOH	0.00709				
As(OH)4-	0.000160	1.48e-007	0.0211	0.000160	22.9
Ca++	0.00176	0.00160	64.1	0.000162	6.51
Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.95e-013	5.56e-008		
H+	-0.100	0.00113	1.14	0.00476	4.80
H2O	55.5	55.5	1.00e+006	-0.00451	-81.4
HCO3-	0.00795	0.00376	230.	0.00418	255.
HPO4--	3.92e-006	5.60e-009	0.000538	3.92e-006	0.376
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00122	0.00122	28.1		
O2(aq)	5.73e-005	7.39e-008	0.00236	8.00e-005	2.56
SO4--	0.00153	0.00150	144.	3.42e-005	3.29
SeO3--	0.000206	5.31e-007	0.0674	0.000183	23.3

Sorbed	fraction	log fraction
As(OH)4-	0.9991	-0.000
Ca++	0.09220	-1.035
HCO3-	0.5266	-0.278
HPO4--	0.9986	-0.001
SO4--	0.02231	-1.652
SeO3--	0.9971	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001602	1.477e-007	0.01107	0.0001601	12.00

Calcium	0.001762	0.001599	64.11	0.0001624	6.511
Carbon	0.007946	0.003761	45.18	0.004185	50.27
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0005575	0.5620
Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.879e+005	0.009541	152.7
Phosphorus	3.923e-006	5.603e-009	0.0001736	3.918e-006	0.1214
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	0.0002065	5.306e-007	0.04191	0.0001831	14.46
Sodium	0.001222	0.001222	28.09		
Sulfur	0.001534	0.001500	48.10	3.422e-005	1.097

8.170e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008201

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.19 uC/cm2

Surface potential = 21.9 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6886	-3.0545
Na+	0.001126	25.87	0.9114	-2.9888
CO2(aq)	0.001122	49.37	1.0000	-2.9498
Mg++	0.0003974	9.654	0.7137	-3.5473
CaSO4	0.0001719	23.39	1.0000	-3.7647
Cl-	0.0001395	4.945	0.9090	-3.8967
K+	9.295e-005	3.632	0.9090	-4.0732
MgSO4	4.024e-005	4.842	1.0000	-4.3953
CaHCO3+	3.884e-005	3.925	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7235
MgHCO3+	7.290e-006	0.6217	0.9114	-5.1776
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.682e-006	0.5571	0.9114	-5.3699
NaHCO3	3.872e-006	0.3251	1.0000	-5.4120
MnSO4	2.771e-006	0.4181	1.0000	-5.5574
MnHCO3+	8.792e-007	0.1019	0.9114	-6.0962
CaCl+	8.183e-007	0.06178	0.9114	-6.1274
CO3--	7.134e-007	0.04279	0.6920	-6.3066
CaCO3	6.950e-007	0.06953	1.0000	-6.1580
KSO4-	5.660e-007	0.07646	0.9114	-6.2875
FeSO4	5.648e-007	0.08575	1.0000	-6.2481
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6241
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.600e-008	0.008090	1.0000	-7.0177

MgCl+	6.364e-008	0.003802	0.9114	-7.2366
HSe-	5.738e-008	0.004587	0.9114	-7.2815
MnCO3	3.746e-008	0.004304	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210
As(OH)3	1.232e-008	0.001551	1.0000	-7.9094

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003471	0.003465	1.0000	-2.4595
>(w)FeOH2+	0.001405	0.001402	2.3414	-2.8524
>(w)FeOCO2-	0.001175	0.001173	0.42710	-2.9301
>(w)FeOH	0.0009486	0.0009470	1.0000	-3.0229
>(s)FeOHCa++	0.0001543	0.0001541	5.4819	-3.8116
>(w)FeOHSO4--	2.828e-005	2.823e-005	0.18242	-4.5485
>(w)FeOHAsO4---	2.246e-005	2.242e-005	0.077911	-4.6486
>(w)FeSO4-	2.099e-005	2.095e-005	0.42710	-4.6780
>(w)FeO-	1.467e-005	1.465e-005	0.42710	-4.8335
>(s)FeOH2+	1.377e-005	1.374e-005	2.3414	-4.8612
>(s)FeOH	9.295e-006	9.280e-006	1.0000	-5.0317
>(w)FeHPO4-	3.818e-006	3.811e-006	0.42710	-5.4182
>(w)FeOCa+	3.138e-006	3.133e-006	2.3414	-5.5033
>(w)FeH2AsO3	3.004e-006	2.999e-006	1.0000	-5.5223
>(w)FeSeO3-	1.914e-006	1.911e-006	0.42710	-5.7180
>(w)FeHAsO4-	1.103e-006	1.101e-006	0.42710	-5.9575
>(w)FePO4--	1.075e-006	1.073e-006	0.18242	-5.9687
>(w)FeOHSeO3--	7.612e-007	7.599e-007	0.18242	-6.1185
>(w)FeH2PO4	2.303e-007	2.299e-007	1.0000	-6.6377
>(s)FeO-	1.438e-007	1.435e-007	0.42710	-6.8423
>(w)FeH2AsO4	5.285e-008	5.276e-008	1.0000	-7.2770

>(w)FeOHSeO4-- 4.055e-026 4.048e-026 0.18242 -25.3920

>(w)FeSeO4- 2.621e-026 2.617e-026 0.42710 -25.5815

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	11.8699s/sat	Siderite	-1.2070
Se(black)	8.9166s/sat	Gypsum	-1.6122
Hematite	0.0000 sat	Monohydrocalcite	-1.6983
Rhodochrosite	-0.4594	Anhydrite	-1.8744
Goethite	-0.4651	Magnesite	-2.0875
Calcite	-0.7216	Bassanite	-2.5055
MnHPO4(c)	-0.7854	FeSe	-2.5204
Aragonite	-0.8873	Magnetite	-2.5921
Dolomite	-1.1265	CaSO4^1/2H2O(bet	-2.6849
Dolomite-ord	-1.1265	Dolomite-dis	-2.7350

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.797e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.928e-065	-64.533

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000177				
>(w)FeOH	0.00709				
As(OH)4-	2.66e-005	2.38e-008	0.00340	2.66e-005	3.80
Ca++	0.00176	0.00160	64.2	0.000157	6.31
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.290	-0.188	-190.	0.00485	4.89
H2O	55.6	55.5	1.00e+006	-0.00470	-84.7
HCO3-	0.00839	0.00375	229.	0.00464	283.
HPO4--	5.12e-006	5.50e-009	0.000529	5.11e-006	0.491
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	26.1		
O2(aq)	-0.0473	-0.0473	-1.52e+003	1.18e-005	0.378
SO4--	0.00155	0.00150	144.	4.92e-005	4.73
SeO3--	2.73e-006	6.30e-008	0.00801	2.67e-006	0.340

Sorbed	fraction	log fraction
As(OH)4-	0.9991	-0.000
Ca++	0.08949	-1.048
HCO3-	0.5527	-0.257
HPO4--	0.9989	-0.000
SO4--	0.03177	-1.498
SeO3--	0.9770	-0.010

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	2.660e-005	2.378e-008	0.001784	2.657e-005	1.993

Calcium	0.001756	0.001599	64.18	0.0001572	6.308
Carbon	0.008391	0.003753	45.13	0.004638	55.77
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0002048	0.2067
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009572	153.3
Phosphorus	5.120e-006	5.500e-009	0.0001706	5.114e-006	0.1586
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	2.734e-006	6.301e-008	0.004982	2.671e-006	0.2112
Sodium	0.001133	0.001133	26.07		
Sulfur	0.001548	0.001499	48.12	4.919e-005	1.579

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.749 log fO2 = -47.254

Eh = 0.1643 volts pe = 2.8602

Ionic strength = 0.008201

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.11 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.18 uC/cm2

Surface potential = 21.8 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1643	2.8602
e- + Fe+++ = Fe++	-0.0785	-1.3658

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.591e-006	-5.798	0.0001257	

(total)	2.830	0.5364*	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6276
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6886	-3.0545
Na+	0.001126	25.87	0.9114	-2.9888
CO2(aq)	0.001124	49.44	1.0000	-2.9493
Mg++	0.0003974	9.654	0.7137	-3.5473
CaSO4	0.0001719	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9090	-3.8967
K+	9.295e-005	3.632	0.9090	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3953
CaHCO3+	3.883e-005	3.924	0.9140	-4.4499
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.288e-006	0.6216	0.9114	-5.1777
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.682e-006	0.5571	0.9114	-5.3699
NaHCO3	3.871e-006	0.3250	1.0000	-5.4122
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.789e-007	0.1019	0.9114	-6.0963
CaCl+	8.183e-007	0.06178	0.9114	-6.1274
CO3--	7.120e-007	0.04271	0.6920	-6.3074
CaCO3	6.937e-007	0.06940	1.0000	-6.1588
KSO4-	5.661e-007	0.07647	0.9114	-6.2875
FeSO4	5.648e-007	0.08576	1.0000	-6.2481
FeHCO3+	2.607e-007	0.03045	0.9114	-6.6242
H+	1.933e-007	0.0001948	0.9214	-6.7493
MgCO3	9.582e-008	0.008075	1.0000	-7.0186
MgCl+	6.364e-008	0.003802	0.9114	-7.2365

MnCO3	3.739e-008	0.004296	1.0000	-7.4272
OH-	3.161e-008	0.0005374	0.9102	-7.5410
FeCO3	1.664e-008	0.001927	1.0000	-7.7789
HSO4-	1.318e-008	0.001279	0.9114	-7.9203

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003473	0.003467	1.0000	-2.4593
>(w)FeOH2+	0.001408	0.001405	2.3383	-2.8514
>(w)FeOCO2-	0.001172	0.001170	0.42767	-2.9311
>(w)FeOH	0.0009479	0.0009463	1.0000	-3.0233
>(s)FeOHCa++	0.0001543	0.0001541	5.4674	-3.8116
>(w)FeOHSO4--	2.819e-005	2.814e-005	0.18290	-4.5500
>(w)FeOHAsO4---	2.532e-005	2.528e-005	0.078222	-4.5965
>(w)FeSO4-	2.098e-005	2.095e-005	0.42767	-4.6782
>(w)FeO-	1.462e-005	1.459e-005	0.42767	-4.8351
>(s)FeOH2+	1.377e-005	1.375e-005	2.3383	-4.8610
>(s)FeOH	9.272e-006	9.256e-006	1.0000	-5.0328
>(w)FeHPO4-	3.820e-006	3.813e-006	0.42767	-5.4180
>(w)FeOCa+	3.135e-006	3.130e-006	2.3383	-5.5038
>(w)FeHAsO4-	1.250e-006	1.248e-006	0.42767	-5.9029
>(w)FePO4--	1.072e-006	1.070e-006	0.18290	-5.9698
>(w)FeSeO3-	8.178e-007	8.165e-007	0.42767	-6.0873
>(w)FeOHSeO3--	3.242e-007	3.237e-007	0.18290	-6.4891
>(w)FeH2PO4	2.311e-007	2.307e-007	1.0000	-6.6362
>(s)FeO-	1.430e-007	1.428e-007	0.42767	-6.8446
>(w)FeH2AsO4	6.010e-008	6.000e-008	1.0000	-7.2211
>(w)FeH2AsO3	1.816e-010	1.813e-010	1.0000	-9.7409
>(w)FeOHSeO4--	3.249e-022	3.244e-022	0.18290	-21.4882
>(w)FeSeO4-	2.107e-022	2.103e-022	0.42767	-21.6764

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2078
Se(black)	0.0000 sat	Gypsum	-1.6122
Rhodochrosite	-0.4602	Monohydrocalcite	-1.6991
Goethite	-0.4651	Anhydrite	-1.8743
Calcite	-0.7224	Magnesite	-2.0883
MnHPO4(c)	-0.7850	Bassanite	-2.5055
Aragonite	-0.8881	Magnetite	-2.5935
Dolomite	-1.1282	CaSO4^1/2H2O(bet	-2.6849
Dolomite-ord	-1.1282	Dolomite-dis	-2.7367

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02461	-1.609
Steam	0.01836	-1.736
H2(g)	3.787e-020	-19.422
O2(g)	5.567e-048	-47.254
H2S(g)	5.444e-052	-51.264
CH4(g)	8.453e-056	-55.073
S2(g)	6.650e-091	-90.177

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	2.66e-005	1.30e-008	0.00186	2.66e-005		3.81
Ca++	0.00176	0.00160	64.2	0.000157		6.31

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.91e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00484	4.89
H2O	55.5	55.4	1.00e+006	-0.00469	-84.6
HCO3-	0.00839	0.00375	229.	0.00464	283.
HPO4--	5.12e-006	5.51e-009	0.000530	5.11e-006	0.491
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	26.1		
O2(aq)	1.17e-005	6.50e-009	0.000208	1.33e-005	0.426
SO4--	0.00155	0.00150	144.	4.91e-005	4.72
SeO3--	2.73e-006	2.42e-009	0.000308	1.14e-006	0.145

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08950	-1.048
HCO3-	0.5526	-0.258
HPO4--	0.9989	-0.000
SO4--	0.03170	-1.499
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	2.660e-005	1.300e-008	0.0009755	2.659e-005	1.994
Calcium	0.001756	0.001599	64.18	0.0001572	6.308
Carbon	0.008391	0.003754	45.14	0.004637	55.77
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0002088	0.2107

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009573	153.3
Phosphorus	5.120e-006	5.510e-009	0.0001709	5.114e-006	0.1586
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	2.734e-006	2.425e-009	0.0001917	1.140e-006	0.09014
Sodium	0.001133	0.001133	26.07		
Sulfur	0.001548	0.001499	48.12	4.909e-005	1.576

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.749 log fO2 = -47.255

Eh = 0.1643 volts pe = 2.8602

Ionic strength = 0.008193

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.00 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.18 uC/cm2

Surface potential = 21.8 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1643	2.8602
e- + Fe+++ = Fe++	-0.0784	-1.3651

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.591e-006	-5.798	0.0001257	

(total)	2.830	0.5364*	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002581	157.4	0.9125	-2.6279
Ca++	0.001388	55.62	0.7018	-3.0113
SO4--	0.001280	122.9	0.6887	-3.0548
Na+	0.001125	25.85	0.9114	-2.9892
CO2(aq)	0.001123	49.41	1.0000	-2.9495
Mg++	0.0003970	9.645	0.7138	-3.5476
CaSO4	0.0001717	23.36	1.0000	-3.7653
Cl-	0.0001394	4.940	0.9091	-3.8971
K+	9.285e-005	3.629	0.9091	-4.0736
MgSO4	4.018e-005	4.834	1.0000	-4.3960
CaHCO3+	3.877e-005	3.918	0.9140	-4.4506
Mn++	2.692e-005	1.478	0.7018	-4.7238
MgHCO3+	7.276e-006	0.6205	0.9114	-5.1784
Fe++	5.787e-006	0.3230	0.7018	-5.3914
NaSO4-	4.674e-006	0.5561	0.9114	-5.3706
NaHCO3	3.864e-006	0.3245	1.0000	-5.4130
MnSO4	2.766e-006	0.4175	1.0000	-5.5581
MnHCO3+	8.775e-007	0.1017	0.9114	-6.0971
CaCl+	8.169e-007	0.06168	0.9114	-6.1281
CO3--	7.111e-007	0.04266	0.6921	-6.3079
CaCO3	6.924e-007	0.06927	1.0000	-6.1596
KSO4-	5.651e-007	0.07634	0.9114	-6.2882
FeSO4	5.639e-007	0.08563	1.0000	-6.2488
FeHCO3+	2.603e-007	0.03040	0.9114	-6.6249
H+	1.934e-007	0.0001948	0.9214	-6.7492
MgCO3	9.564e-008	0.008060	1.0000	-7.0194
MgCl+	6.353e-008	0.003795	0.9114	-7.2373

MnCO3	3.732e-008	0.004288	1.0000	-7.4280
OH-	3.161e-008	0.0005373	0.9103	-7.5411
FeCO3	1.661e-008	0.001923	1.0000	-7.7797
HSO4-	1.317e-008	0.001278	0.9114	-7.9206

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003469	0.003467	1.0000	-2.4598
>(w)FeOH2+	0.001407	0.001406	2.3392	-2.8518
>(w)FeOCO2-	0.001171	0.001170	0.42749	-2.9315
>(w)FeOH	0.0009473	0.0009467	1.0000	-3.0235
>(s)FeOHCa++	0.0001541	0.0001540	5.4720	-3.8121
>(w)FeOHSO4--	2.817e-005	2.815e-005	0.18275	-4.5502
>(w)FeOHAsO4---	2.529e-005	2.528e-005	0.078123	-4.5970
>(w)FeSO4-	2.097e-005	2.095e-005	0.42749	-4.6785
>(w)FeO-	1.461e-005	1.460e-005	0.42749	-4.8352
>(s)FeOH2+	1.377e-005	1.376e-005	2.3392	-4.8609
>(s)FeOH	9.276e-006	9.269e-006	1.0000	-5.0327
>(w)FeHPO4-	3.816e-006	3.813e-006	0.42749	-5.4184
>(w)FeOCa+	3.129e-006	3.126e-006	2.3392	-5.5046
>(w)FeHAsO4-	1.249e-006	1.248e-006	0.42749	-5.9035
>(w)FePO4--	1.071e-006	1.070e-006	0.18275	-5.9702
>(w)FeSeO3-	8.170e-007	8.164e-007	0.42749	-6.0878
>(w)FeOHSeO3--	3.240e-007	3.237e-007	0.18275	-6.4895
>(w)FeH2PO4	2.308e-007	2.307e-007	1.0000	-6.6367
>(s)FeO-	1.431e-007	1.430e-007	0.42749	-6.8444
>(w)FeH2AsO4	6.000e-008	5.996e-008	1.0000	-7.2218
>(w)FeH2AsO3	1.814e-010	1.812e-010	1.0000	-9.7415
>(w)FeOHSeO4--	3.246e-022	3.243e-022	0.18275	-21.4887
>(w)FeSeO4-	2.104e-022	2.102e-022	0.42749	-21.6770

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2086
Se(black)	0.0000 sat	Gypsum	-1.6128
Rhodochrosite	-0.4610	Monohydrocalcite	-1.6999
Goethite	-0.4651	Anhydrite	-1.8750
Calcite	-0.7232	Magnesite	-2.0891
MnHPO4(c)	-0.7858	Bassanite	-2.5062
Aragonite	-0.8889	Magnetite	-2.5940
Dolomite	-1.1297	CaSO4^1/2H2O(bet	-2.6855
Dolomite-ord	-1.1298	Dolomite-dis	-2.7383

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02459	-1.609
Steam	0.01836	-1.736
H2(g)	3.788e-020	-19.422
O2(g)	5.563e-048	-47.255
H2S(g)	5.450e-052	-51.264
CH4(g)	8.459e-056	-55.073
S2(g)	6.659e-091	-90.177

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	2.66e-005	1.30e-008	0.00186	2.66e-005		3.80
Ca++	0.00176	0.00160	64.1	0.000157		6.30

Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.92e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00484	4.88
H2O	55.5	55.5	1.00e+006	-0.00469	-84.5
HCO3-	0.00839	0.00375	229.	0.00464	283.
HPO4--	5.12e-006	5.51e-009	0.000529	5.11e-006	0.491
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	26.0		
O2(aq)	1.17e-005	6.50e-009	0.000208	1.33e-005	0.425
SO4--	0.00155	0.00150	144.	4.91e-005	4.72
SeO3--	2.73e-006	2.42e-009	0.000308	1.14e-006	0.145

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08948	-1.048
HCO3-	0.5526	-0.258
HPO4--	0.9989	-0.000
SO4--	0.03172	-1.499
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	2.660e-005	1.300e-008	0.0009740	2.659e-005	1.992
Calcium	0.001756	0.001599	64.11	0.0001572	6.301
Carbon	0.008391	0.003754	45.10	0.004637	55.70
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0002091	0.2108

Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.880e+005	0.009572	153.2
Phosphorus	5.120e-006	5.510e-009	0.0001707	5.114e-006	0.1584
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	2.734e-006	2.425e-009	0.0001915	1.140e-006	0.09005
Sodium	0.001133	0.001133	26.05		
Sulfur	0.001548	0.001499	48.07	4.910e-005	1.575

8.17e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008197

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.23 uC/cm2

Surface potential = 22.3 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
			______________	______________
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.37	1.0000	-2.9498
Na+	0.001119	25.71	0.9114	-2.9915
Mg++	0.0003974	9.654	0.7137	-3.5472
CaSO4	0.0001719	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3953
CaHCO3+	3.885e-005	3.925	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.652e-006	0.5536	0.9114	-5.3726
NaHCO3	3.848e-006	0.3231	1.0000	-5.4148
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.792e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04279	0.6920	-6.3066
CaCO3	6.950e-007	0.06953	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.648e-007	0.08576	1.0000	-6.2481
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177

MgCl+	6.365e-008	0.003802	0.9114	-7.2365
MnCO3	3.747e-008	0.004305	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003482	0.003476	1.0000	-2.4582
>(w)FeOH2+	0.001387	0.001385	2.3781	-2.8578
>(w)FeOCO2-	0.001197	0.001195	0.42050	-2.9219
>(w)FeOH	0.0009516	0.0009500	1.0000	-3.0216
>(s)FeOHCa++	0.0001539	0.0001536	5.6554	-3.8129
>(w)FeOHSO4--	2.927e-005	2.922e-005	0.17682	-4.5336
>(w)FeSO4-	2.139e-005	2.135e-005	0.42050	-4.6698
>(w)FeO-	1.495e-005	1.493e-005	0.42050	-4.8253
>(s)FeOH2+	1.394e-005	1.392e-005	2.3781	-4.8557
>(s)FeOH	9.561e-006	9.545e-006	1.0000	-5.0195
>(w)FeOHAsO4---	6.944e-006	6.932e-006	0.074354	-5.1584
>(w)FeHPO4-	3.890e-006	3.883e-006	0.42050	-5.4100
>(w)FeOCa+	3.099e-006	3.094e-006	2.3781	-5.5087
>(w)FePO4--	1.112e-006	1.110e-006	0.17682	-5.9538
>(w)FeH2AsO3	8.863e-007	8.848e-007	1.0000	-6.0524
>(w)FeHAsO4-	3.305e-007	3.299e-007	0.42050	-6.4809
>(w)FeSeO3-	3.096e-007	3.090e-007	0.42050	-6.5093
>(w)FeH2PO4	2.311e-007	2.307e-007	1.0000	-6.6363
>(s)FeO-	1.502e-007	1.500e-007	0.42050	-6.8233
>(w)FeOHSeO3--	1.250e-007	1.248e-007	0.17682	-6.9030
>(w)FeH2AsO4	1.559e-008	1.557e-008	1.0000	-7.8071
>(w)FeOHSeO4--	6.660e-027	6.649e-027	0.17682	-26.1765
>(w)FeSeO4-	4.239e-027	4.232e-027	0.42050	-26.3728

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	10.2711s/sat	Siderite	-1.2070
Se(black)	8.1172s/sat	Gypsum	-1.6121
Hematite	0.0000 sat	Monohydrocalcite	-1.6983
Rhodochrosite	-0.4594	Anhydrite	-1.8743
Goethite	-0.4651	Magnesite	-2.0875
Calcite	-0.7215	Bassanite	-2.5055
MnHPO4(c)	-0.7853	Magnetite	-2.5920
Aragonite	-0.8873	CaSO4^1/2H2O(bet	-2.6848
Dolomite	-1.1264	Dolomite-dis	-2.7350
Dolomite-ord	-1.1265		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.797e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.929e-065	-64.533

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					

As(OH)4-	8.17e-006	7.00e-009	0.00100	8.16e-006	1.17
Ca++	0.00176	0.00160	64.2	0.000157	6.29
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.290	-0.188	-190.	0.00487	4.91
H2O	55.6	55.5	1.00e+006	-0.00471	-84.9
HCO3-	0.00842	0.00375	229.	0.00467	285.
HPO4--	5.23e-006	5.50e-009	0.000529	5.22e-006	0.502
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	25.9		
O2(aq)	-0.0473	-0.0473	-1.52e+003	3.64e-006	0.117
SO4--	0.00155	0.00150	144.	5.06e-005	4.86
SeO3--	4.44e-007	1.00e-008	0.00127	4.34e-007	0.0551

Sorbed	fraction	log fraction
As(OH)4-	0.9991	-0.000
Ca++	0.08924	-1.049
HCO3-	0.5545	-0.256
HPO4--	0.9989	-0.000
SO4--	0.03263	-1.486
SeO3--	0.9775	-0.010

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	8.170e-006	6.995e-009	0.0005247	8.163e-006	0.6123
Calcium	0.001756	0.001599	64.18	0.0001567	6.288
Carbon	0.008424	0.003753	45.13	0.004671	56.17

Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001642	0.1657
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009571	153.3
Phosphorus	5.230e-006	5.500e-009	0.0001706	5.224e-006	0.1620
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.438e-007	1.000e-008	0.0007906	4.338e-007	0.03430
Sodium	0.001126	0.001126	25.91		
Sulfur	0.001550	0.001499	48.12	5.057e-005	1.623

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -52.702

Eh = 0.0861 volts pe = 1.4977

Ionic strength = 0.008197

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.14 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.22 uC/cm2

Surface potential = 22.2 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0861	1.4977
e- + Fe+++ = Fe++	-0.0786	-1.3673

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	4.438e-007	-6.353	3.504e-005	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6275
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001123	49.39	1.0000	-2.9497
Na+	0.001119	25.71	0.9114	-2.9915
Mg++	0.0003974	9.654	0.7137	-3.5472
CaSO4	0.0001719	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.884e-005	3.925	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.290e-006	0.6217	0.9114	-5.1776
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.653e-006	0.5536	0.9114	-5.3726
NaHCO3	3.848e-006	0.3231	1.0000	-5.4148
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.792e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.129e-007	0.04276	0.6920	-6.3068
CaCO3	6.947e-007	0.06950	1.0000	-6.1582
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2481
FeHCO3+	2.607e-007	0.03046	0.9114	-6.6241
H+	1.931e-007	0.0001945	0.9214	-6.7498
MgCO3	9.595e-008	0.008086	1.0000	-7.0179
MgCl+	6.365e-008	0.003802	0.9114	-7.2365

MnCO3	3.744e-008	0.004302	1.0000	-7.4266
OH-	3.165e-008	0.0005380	0.9102	-7.5405
FeCO3	1.666e-008	0.001929	1.0000	-7.7783
HSO4-	1.317e-008	0.001278	0.9114	-7.9208

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003483	0.003477	1.0000	-2.4581
>(w)FeOH2+	0.001388	0.001386	2.3772	-2.8575
>(w)FeOCO2-	0.001196	0.001194	0.42066	-2.9222
>(w)FeOH	0.0009514	0.0009498	1.0000	-3.0217
>(s)FeOHCa++	0.0001539	0.0001536	5.6512	-3.8129
>(w)FeOHSO4--	2.924e-005	2.919e-005	0.17695	-4.5340
>(w)FeSO4-	2.139e-005	2.135e-005	0.42066	-4.6699
>(w)FeO-	1.494e-005	1.491e-005	0.42066	-4.8258
>(s)FeOH2+	1.394e-005	1.392e-005	2.3772	-4.8557
>(s)FeOH	9.554e-006	9.538e-006	1.0000	-5.0198
>(w)FeOHAsO4---	7.764e-006	7.751e-006	0.074438	-5.1099
>(w)FeHPO4-	3.891e-006	3.884e-006	0.42066	-5.4100
>(w)FeOCa+	3.099e-006	3.093e-006	2.3772	-5.5088
>(w)FePO4--	1.111e-006	1.110e-006	0.17695	-5.9541
>(w)FeHAsO4-	3.701e-007	3.695e-007	0.42066	-6.4317
>(w)FeH2PO4	2.313e-007	2.309e-007	1.0000	-6.6359
>(s)FeO-	1.500e-007	1.497e-007	0.42066	-6.8239
>(w)FeH2AsO3	2.797e-008	2.792e-008	1.0000	-7.5533
>(w)FeH2AsO4	1.748e-008	1.745e-008	1.0000	-7.7575
>(w)FeSeO3-	2.978e-012	2.973e-012	0.42066	-11.5261
>(w)FeOHSeO3--	1.202e-012	1.200e-012	0.17695	-11.9202
>(w)FeOHSeO4--	2.274e-030	2.270e-030	0.17695	-29.6433
>(w)FeSeO4-	1.448e-030	1.446e-030	0.42066	-29.8391

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2072
Se(black)	0.0000 sat	Gypsum	-1.6121
Rhodochrosite	-0.4596	Monohydrocalcite	-1.6985
Goethite	-0.4651	Anhydrite	-1.8743
Calcite	-0.7218	Magnesite	-2.0877
MnHPO4(c)	-0.7852	Bassanite	-2.5055
Aragonite	-0.8875	Magnetite	-2.5924
Dolomite	-1.1269	CaSO4^1/2H2O(bet	-2.6848
Dolomite-ord	-1.1269	Dolomite-dis	-2.7355

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02459	-1.609
Steam	0.01836	-1.736
H2(g)	2.006e-017	-16.698
H2S(g)	4.276e-041	-40.369
CH4(g)	6.647e-045	-44.177
O2(g)	1.984e-053	-52.702
S2(g)	1.462e-074	-73.835

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	8.17e-006	3.89e-009	0.000557	8.17e-006		1.17
Ca++	0.00176	0.00160	64.2	0.000157		6.29

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00487	4.91
H2O	55.5	55.4	1.00e+006	-0.00471	-84.9
HCO3-	0.00842	0.00375	229.	0.00467	285.
HPO4--	5.23e-006	5.50e-009	0.000529	5.22e-006	0.502
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	25.9		
O2(aq)	3.63e-006	1.89e-009	6.05e-005	4.07e-006	0.130
SO4--	0.00155	0.00150	144.	5.05e-005	4.86
SeO3--	4.44e-007	8.66e-015	1.10e-009	4.17e-012	5.30e-007

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08924	-1.049
HCO3-	0.5545	-0.256
HPO4--	0.9989	-0.000
SO4--	0.03261	-1.487
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	8.170e-006	3.888e-009	0.0002917	8.166e-006	0.6125
Calcium	0.001756	0.001599	64.18	0.0001567	6.288
Carbon	0.008424	0.003753	45.14	0.004671	56.17
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001654	0.1669

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009571	153.3
Phosphorus	5.230e-006	5.503e-009	0.0001707	5.224e-006	0.1620
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.438e-007	8.657e-015	6.844e-010	4.173e-012	3.299e-007
Sodium	0.001126	0.001126	25.91		
Sulfur	0.001550	0.001499	48.12	5.054e-005	1.622

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -52.703

Eh = 0.0861 volts pe = 1.4976

Ionic strength = 0.008190

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.03 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.23 uC/cm2

Surface potential = 22.3 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0861	1.4976
e- + Fe+++ = Fe++	-0.0785	-1.3667

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	4.438e-007	-6.353	3.504e-005	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002582	157.5	0.9125	-2.6278
Ca++	0.001388	55.62	0.7018	-3.0112
SO4--	0.001280	122.9	0.6888	-3.0548
CO2(aq)	0.001122	49.36	1.0000	-2.9499
Na+	0.001118	25.69	0.9114	-2.9919
Mg++	0.0003970	9.645	0.7138	-3.5476
CaSO4	0.0001717	23.36	1.0000	-3.7653
Cl-	0.0001394	4.940	0.9091	-3.8971
K+	9.285e-005	3.629	0.9091	-4.0736
MgSO4	4.019e-005	4.835	1.0000	-4.3959
CaHCO3+	3.878e-005	3.919	0.9140	-4.4504
Mn++	2.692e-005	1.478	0.7018	-4.7238
MgHCO3+	7.278e-006	0.6207	0.9114	-5.1783
Fe++	5.787e-006	0.3230	0.7018	-5.3913
NaSO4-	4.644e-006	0.5526	0.9114	-5.3734
NaHCO3	3.841e-006	0.3225	1.0000	-5.4156
MnSO4	2.767e-006	0.4176	1.0000	-5.5580
MnHCO3+	8.777e-007	0.1017	0.9114	-6.0969
CaCl+	8.170e-007	0.06168	0.9114	-6.1281
CO3--	7.121e-007	0.04271	0.6921	-6.3073
CaCO3	6.934e-007	0.06937	1.0000	-6.1590
KSO4-	5.651e-007	0.07634	0.9114	-6.2882
FeSO4	5.640e-007	0.08563	1.0000	-6.2487
FeHCO3+	2.603e-007	0.03041	0.9114	-6.6248
H+	1.931e-007	0.0001946	0.9214	-6.7497
MgCO3	9.578e-008	0.008071	1.0000	-7.0187
MgCl+	6.353e-008	0.003795	0.9114	-7.2373

MnCO3	3.738e-008	0.004294	1.0000	-7.4274
OH-	3.164e-008	0.0005379	0.9103	-7.5406
FeCO3	1.663e-008	0.001926	1.0000	-7.7791
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003479	0.003476	1.0000	-2.4586
>(w)FeOH2+	0.001387	0.001386	2.3782	-2.8579
>(w)FeOCO2-	0.001195	0.001194	0.42048	-2.9226
>(w)FeOH	0.0009508	0.0009502	1.0000	-3.0219
>(s)FeOHCa++	0.0001537	0.0001536	5.6559	-3.8134
>(w)FeOHSO4--	2.923e-005	2.921e-005	0.17681	-4.5342
>(w)FeSO4-	2.137e-005	2.136e-005	0.42048	-4.6702
>(w)FeO-	1.493e-005	1.492e-005	0.42048	-4.8260
>(s)FeOH2+	1.395e-005	1.394e-005	2.3782	-4.8556
>(s)FeOH	9.558e-006	9.552e-006	1.0000	-5.0196
>(w)FeOHAsO4---	7.756e-006	7.751e-006	0.074344	-5.1104
>(w)FeHPO4-	3.887e-006	3.884e-006	0.42048	-5.4104
>(w)FeOCa+	3.092e-006	3.090e-006	2.3782	-5.5097
>(w)FePO4--	1.111e-006	1.110e-006	0.17681	-5.9545
>(w)FeHAsO4-	3.696e-007	3.694e-007	0.42048	-6.4323
>(w)FeH2PO4	2.310e-007	2.308e-007	1.0000	-6.6364
>(s)FeO-	1.501e-007	1.500e-007	0.42048	-6.8237
>(w)FeH2AsO3	2.794e-008	2.792e-008	1.0000	-7.5537
>(w)FeH2AsO4	1.745e-008	1.744e-008	1.0000	-7.7582
>(w)FeSeO3-	2.973e-012	2.971e-012	0.42048	-11.5268
>(w)FeOHSeO3--	1.200e-012	1.199e-012	0.17681	-11.9208
>(w)FeOHSeO4--	2.269e-030	2.268e-030	0.17681	-29.6441
>(w)FeSeO4-	1.445e-030	1.444e-030	0.42048	-29.8401

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2080
Se(black)	0.0000 sat	Gypsum	-1.6128
Rhodochrosite	-0.4604	Monohydrocalcite	-1.6993
Goethite	-0.4651	Anhydrite	-1.8750
Calcite	-0.7226	Magnesite	-2.0885
MnHPO4(c)	-0.7860	Bassanite	-2.5061
Aragonite	-0.8883	Magnetite	-2.5930
Dolomite	-1.1285	CaSO4^1/2H2O(bet	-2.6855
Dolomite-ord	-1.1285	Dolomite-dis	-2.7370

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02457	-1.610
Steam	0.01836	-1.736
H2(g)	2.007e-017	-16.697
H2S(g)	4.285e-041	-40.368
CH4(g)	6.660e-045	-44.177
O2(g)	1.982e-053	-52.703
S2(g)	1.466e-074	-73.834

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	8.17e-006	3.89e-009	0.000556	8.17e-006		1.17
Ca++	0.00176	0.00160	64.1	0.000157		6.28

Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.91e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00487	4.91
H2O	55.5	55.5	1.00e+006	-0.00471	-84.8
HCO3-	0.00842	0.00375	229.	0.00467	285.
HPO4--	5.23e-006	5.50e-009	0.000528	5.22e-006	0.502
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00113	0.00113	25.9		
O2(aq)	3.63e-006	1.89e-009	6.04e-005	4.07e-006	0.130
SO4--	0.00155	0.00150	144.	5.06e-005	4.86
SeO3--	4.44e-007	8.65-015	1.10e-009	4.17e-012	5.30e-007

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08922	-1.050
HCO3-	0.5544	-0.256
HPO4--	0.9989	-0.000
SO4--	0.03263	-1.486
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	8.170e-006	3.887e-009	0.0002913	8.166e-006	0.6119
Calcium	0.001756	0.001599	64.12	0.0001567	6.281
Carbon	0.008424	0.003754	45.10	0.004670	56.11
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0001657	0.1670

Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.880e+005	0.009569	153.1
Phosphorus	5.230e-006	5.502e-009	0.0001705	5.224e-006	0.1619
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	4.438e-007	8.652e-015	6.833e-010	4.170e-012	3.294e-007
Sodium	0.001126	0.001126	25.88		
Sulfur	0.001550	0.001499	48.07	5.056e-005	1.621

1.658e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
			______________	______________
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.38	1.0000	-2.9498
Na+	0.001117	25.66	0.9114	-2.9924
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001719	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.926	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.643e-006	0.5525	0.9114	-5.3735
NaHCO3	3.840e-006	0.3224	1.0000	-5.4157
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.793e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04278	0.6920	-6.3066
CaCO3	6.951e-007	0.06954	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2481
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177

MgCl+	6.365e-008	0.003802	0.9114	-7.2365
MnCO3	3.747e-008	0.004305	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003480	1.0000	-2.4577
>(w)FeOH2+	0.001382	0.001379	2.3905	-2.8596
>(w)FeOCO2-	0.001204	0.001202	0.41832	-2.9192
>(w)FeOH	0.0009525	0.0009509	1.0000	-3.0211
>(s)FeOHCa++	0.0001537	0.0001535	5.7146	-3.8133
>(w)FeOHSO4--	2.961e-005	2.956e-005	0.17499	-4.5286
>(w)FeSO4-	2.152e-005	2.149e-005	0.41832	-4.6671
>(w)FeO-	1.504e-005	1.502e-005	0.41832	-4.8226
>(s)FeOH2+	1.400e-005	1.398e-005	2.3905	-4.8539
>(s)FeOH	9.652e-006	9.635e-006	1.0000	-5.0154
>(w)FeHPO4-	3.914e-006	3.908e-006	0.41832	-5.4074
>(w)FeOCa+	3.086e-006	3.081e-006	2.3905	-5.5105
>(w)FeOHAsO4---	1.412e-006	1.410e-006	0.073201	-5.8502
>(w)FePO4--	1.125e-006	1.123e-006	0.17499	-5.9489
>(w)FeSeO3-	3.115e-007	3.109e-007	0.41832	-6.5066
>(w)FeH2PO4	2.313e-007	2.309e-007	1.0000	-6.6359
>(w)FeH2AsO3	1.774e-007	1.771e-007	1.0000	-6.7510
>(s)FeO-	1.524e-007	1.522e-007	0.41832	-6.8169
>(w)FeOHSeO3--	1.264e-007	1.262e-007	0.17499	-6.8981
>(w)FeHAsO4-	6.651e-008	6.639e-008	0.41832	-7.1771
>(w)FeH2AsO4	3.122e-009	3.116e-009	1.0000	-8.5056
>(w)FeOHSeO4--	6.736e-027	6.725e-027	0.17499	-26.1716
>(w)FeSeO4-	4.265e-027	4.258e-027	0.41832	-26.3701

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	10.2711s/sat	Siderite	-1.2070
Se(black)	8.1172s/sat	Gypsum	-1.6121
Hematite	0.0000 sat	Monohydrocalcite	-1.6982
Rhodochrosite	-0.4594	Anhydrite	-1.8743
Goethite	-0.4651	Magnesite	-2.0875
Calcite	-0.7215	Bassanite	-2.5055
MnHPO4(c)	-0.7853	Magnetite	-2.5920
Aragonite	-0.8873	CaSO4^1/2H2O(bet	-2.6848
Dolomite	-1.1264	Dolomite-dis	-2.7350
Dolomite-ord	-1.1264		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.797e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.929e-065	-64.533

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					

As(OH)4-	1.66e-006	1.40e-009	0.000200	1.66e-006	0.237
Ca++	0.00176	0.00160	64.2	0.000157	6.28
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.290	-0.188	-190.	0.00488	4.92
H2O	55.6	55.5	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.27e-006	5.50e-009	0.000529	5.26e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.9		
O2(aq)	-0.0473	-0.0473	-1.52e+003	7.40e-007	0.0237
SO4--	0.00155	0.00150	144.	5.10e-005	4.91
SeO3--	4.47e-007	1.00e-008	0.00127	4.37e-007	0.0556

Sorbed	fraction	log fraction
As(OH)4-	0.9992	-0.000
Ca++	0.08915	-1.050
HCO3-	0.5551	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03293	-1.482
SeO3--	0.9776	-0.010

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.658e-006	1.399e-009	0.0001049	1.656e-006	0.1242
Calcium	0.001756	0.001599	64.18	0.0001565	6.282
Carbon	0.008435	0.003753	45.13	0.004682	56.30

Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001501	0.1515
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.267e-006	5.500e-009	0.0001706	5.262e-006	0.1632
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.472e-007	1.000e-008	0.0007906	4.372e-007	0.03456
Sodium	0.001123	0.001123	25.85		
Sulfur	0.001550	0.001499	48.12	5.104e-005	1.638

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.790

Eh = 0.1566 volts pe = 2.7256

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1566	2.7256
e- + Fe+++ = Fe++	-0.0786	-1.3678

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.026e-007	-6.989	8.099e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001123	49.38	1.0000	-2.9498
Na+	0.001117	25.66	0.9114	-2.9924
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001719	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.925	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.643e-006	0.5525	0.9114	-5.3735
NaHCO3	3.840e-006	0.3224	1.0000	-5.4157
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.792e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.132e-007	0.04278	0.6920	-6.3066
CaCO3	6.950e-007	0.06953	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2480
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001945	0.9214	-6.7500
MgCO3	9.600e-008	0.008090	1.0000	-7.0177
MgCl+	6.365e-008	0.003802	0.9114	-7.2365

MnCO3	3.746e-008	0.004304	1.0000	-7.4264
OH-	3.166e-008	0.0005382	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003480	1.0000	-2.4577
>(w)FeOH2+	0.001382	0.001379	2.3903	-2.8596
>(w)FeOCO2-	0.001204	0.001202	0.41835	-2.9193
>(w)FeOH	0.0009525	0.0009508	1.0000	-3.0212
>(s)FeOHCa++	0.0001537	0.0001535	5.7137	-3.8133
>(w)FeOHSO4--	2.960e-005	2.955e-005	0.17502	-4.5287
>(w)FeSO4-	2.152e-005	2.148e-005	0.41835	-4.6671
>(w)FeO-	1.504e-005	1.502e-005	0.41835	-4.8227
>(s)FeOH2+	1.400e-005	1.398e-005	2.3903	-4.8539
>(s)FeOH	9.650e-006	9.634e-006	1.0000	-5.0155
>(w)FeHPO4-	3.914e-006	3.908e-006	0.41835	-5.4073
>(w)FeOCa+	3.086e-006	3.081e-006	2.3903	-5.5106
>(w)FeOHAsO4---	1.582e-006	1.579e-006	0.073219	-5.8009
>(w)FePO4--	1.125e-006	1.123e-006	0.17502	-5.9489
>(w)FeSeO3-	2.450e-007	2.446e-007	0.41835	-6.6108
>(w)FeH2PO4	2.313e-007	2.309e-007	1.0000	-6.6358
>(s)FeO-	1.524e-007	1.521e-007	0.41835	-6.8170
>(w)FeOHSeO3--	9.946e-008	9.929e-008	0.17502	-7.0024
>(w)FeHAsO4-	7.452e-008	7.440e-008	0.41835	-7.1277
>(w)FeH2AsO4	3.498e-009	3.493e-009	1.0000	-8.4561
>(w)FeH2AsO3	1.959e-011	1.955e-011	1.0000	-10.7080
>(w)FeOHSeO4--	5.379e-023	5.370e-023	0.17502	-22.2693
>(w)FeSeO4-	3.406e-023	3.401e-023	0.41835	-22.4677

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2070
Se(black)	0.0000 sat	Gypsum	-1.6121
Rhodochrosite	-0.4594	Monohydrocalcite	-1.6983
Goethite	-0.4651	Anhydrite	-1.8743
Calcite	-0.7216	Magnesite	-2.0875
MnHPO4(c)	-0.7853	Bassanite	-2.5055
Aragonite	-0.8873	Magnetite	-2.5921
Dolomite	-1.1265	CaSO4^1/2H2O(bet	-2.6848
Dolomite-ord	-1.1265	Dolomite-dis	-2.7351

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.017e-020	-19.154
O2(g)	1.621e-048	-47.790
H2S(g)	6.400e-051	-50.194
CH4(g)	9.955e-055	-54.002
S2(g)	2.676e-089	-88.572

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.66e-006	7.55e-010	0.000108	1.66e-006	0.237	
Ca++	0.00176	0.00160	64.2	0.000157	6.28	

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.4	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.27e-006	5.50e-009	0.000529	5.26e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.9		
O2(aq)	7.26e-007	3.77e-010	1.21e-005	8.28e-007	0.0265
SO4--	0.00155	0.00150	144.	5.10e-005	4.91
SeO3--	4.47e-007	7.07e-010	8.99e-005	3.44e-007	0.0437

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08915	-1.050
HCO3-	0.5551	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03292	-1.483
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.658e-006	7.551e-010	5.664e-005	1.657e-006	0.1243
Calcium	0.001756	0.001599	64.18	0.0001565	6.282
Carbon	0.008435	0.003753	45.13	0.004682	56.30
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001503	0.1517

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.267e-006	5.501e-009	0.0001706	5.262e-006	0.1632
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.472e-007	7.075e-010	5.593e-005	3.439e-007	0.02719
Sodium	0.001123	0.001123	25.85		
Sulfur	0.001550	0.001499	48.12	5.103e-005	1.638

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.790

Eh = 0.1566 volts pe = 2.7256

Ionic strength = 0.008189

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 465 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.03 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1566	2.7256
e- + Fe+++ = Fe++	-0.0786	-1.3672

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.026e-007	-6.989	8.099e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002582	157.5	0.9125	-2.6278
Ca++	0.001388	55.62	0.7018	-3.0112
SO4--	0.001280	122.9	0.6888	-3.0548
CO2(aq)	0.001122	49.35	1.0000	-2.9501
Na+	0.001115	25.63	0.9114	-2.9928
Mg++	0.0003970	9.645	0.7138	-3.5476
CaSO4	0.0001717	23.36	1.0000	-3.7653
Cl-	0.0001394	4.940	0.9091	-3.8971
K+	9.285e-005	3.629	0.9091	-4.0736
MgSO4	4.019e-005	4.835	1.0000	-4.3959
CaHCO3+	3.878e-005	3.919	0.9140	-4.4504
Mn++	2.692e-005	1.478	0.7018	-4.7238
MgHCO3+	7.279e-006	0.6207	0.9114	-5.1782
Fe++	5.787e-006	0.3230	0.7018	-5.3913
NaSO4-	4.635e-006	0.5515	0.9114	-5.3743
NaHCO3	3.833e-006	0.3218	1.0000	-5.4165
MnSO4	2.767e-006	0.4176	1.0000	-5.5580
MnHCO3+	8.778e-007	0.1017	0.9114	-6.0969
CaCl+	8.170e-007	0.06168	0.9114	-6.1281
CO3--	7.124e-007	0.04273	0.6921	-6.3071
CaCO3	6.937e-007	0.06940	1.0000	-6.1588
KSO4-	5.651e-007	0.07634	0.9114	-6.2882
FeSO4	5.640e-007	0.08563	1.0000	-6.2487
FeHCO3+	2.603e-007	0.03041	0.9114	-6.6247
H+	1.931e-007	0.0001945	0.9214	-6.7499
MgCO3	9.582e-008	0.008075	1.0000	-7.0185
MgCl+	6.353e-008	0.003795	0.9114	-7.2373

MnCO3	3.739e-008	0.004296	1.0000	-7.4272
OH-	3.165e-008	0.0005381	0.9103	-7.5404
FeCO3	1.664e-008	0.001927	1.0000	-7.7789
HSO4-	1.315e-008	0.001276	0.9114	-7.9212

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003481	0.003479	1.0000	-2.4582
>(w)FeOH2+	0.001381	0.001380	2.3913	-2.8599
>(w)FeOCO2-	0.001203	0.001202	0.41818	-2.9197
>(w)FeOH	0.0009519	0.0009512	1.0000	-3.0214
>(s)FeOHCa++	0.0001535	0.0001534	5.7185	-3.8138
>(w)FeOHSO4--	2.958e-005	2.956e-005	0.17487	-4.5289
>(w)FeSO4-	2.151e-005	2.149e-005	0.41818	-4.6675
>(w)FeO-	1.503e-005	1.502e-005	0.41818	-4.8229
>(s)FeOH2+	1.400e-005	1.399e-005	2.3913	-4.8538
>(s)FeOH	9.654e-006	9.647e-006	1.0000	-5.0153
>(w)FeHPO4-	3.910e-006	3.908e-006	0.41818	-5.4078
>(w)FeOCa+	3.080e-006	3.078e-006	2.3913	-5.5114
>(w)FeOHAsO4---	1.580e-006	1.579e-006	0.073127	-5.8013
>(w)FePO4--	1.124e-006	1.123e-006	0.17487	-5.9493
>(w)FeSeO3-	2.448e-007	2.446e-007	0.41818	-6.6112
>(w)FeH2PO4	2.310e-007	2.309e-007	1.0000	-6.6363
>(s)FeO-	1.525e-007	1.524e-007	0.41818	-6.8168
>(w)FeOHSeO3--	9.937e-008	9.931e-008	0.17487	-7.0027
>(w)FeHAsO4-	7.442e-008	7.437e-008	0.41818	-7.1283
>(w)FeH2AsO4	3.493e-009	3.490e-009	1.0000	-8.4568
>(w)FeH2AsO3	1.956e-011	1.955e-011	1.0000	-10.7086
>(w)FeOHSeO4--	5.373e-023	5.369e-023	0.17487	-22.2698
>(w)FeSeO4-	3.402e-023	3.399e-023	0.41818	-22.4683

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Hematite	0.0000	sat	Siderite	-1.2078
Se(black)	0.0000	sat	Gypsum	-1.6128
Rhodochrosite	-0.4602		Monohydrocalcite	-1.6991
Goethite	-0.4651		Anhydrite	-1.8750
Calcite	-0.7224		Magnesite	-2.0883
MnHPO4(c)	-0.7861		Bassanite	-2.5061
Aragonite	-0.8881		Magnetite	-2.5926
Dolomite	-1.1281		CaSO4^1/2H2O(bet	-2.6855
Dolomite-ord	-1.1281		Dolomite-dis	-2.7366

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02456	-1.610
Steam	0.01836	-1.736
H2(g)	7.020e-020	-19.154
O2(g)	1.620e-048	-47.790
H2S(g)	6.407e-051	-50.193
CH4(g)	9.962e-055	-54.002
S2(g)	2.680e-089	-88.572

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.66e-006	7.55e-010	0.000108	1.66e-006	0.237	
Ca++	0.00176	0.00160	64.1	0.000157	6.27	

Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.91e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.5	1.00e+006	-0.00471	-84.9
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.27e-006	5.50e-009	0.000528	5.26e-006	0.505
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	7.26e-007	3.77e-010	1.21e-005	8.28e-007	0.0265
SO4--	0.00155	0.00150	144.	5.11e-005	4.91
SeO3--	4.47e-007	7.07e-010	8.98e-005	3.44e-007	0.0437

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08913	-1.050
HCO3-	0.5550	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03294	-1.482
SeO3--	0.9979	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.658e-006	7.547e-010	5.656e-005	1.657e-006	0.1242
Calcium	0.001756	0.001599	64.12	0.0001565	6.274
Carbon	0.008435	0.003754	45.10	0.004681	56.24
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0001506	0.1518

Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.880e+005	0.009568	153.1
Phosphorus	5.267e-006	5.500e-009	0.0001704	5.262e-006	0.1630
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	4.472e-007	7.075e-010	5.587e-005	3.439e-007	0.02716
Sodium	0.001123	0.001123	25.83		
Sulfur	0.001550	0.001499	48.07	5.105e-005	1.637

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
			____________	____________

(total)		2.830	0.5364	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.38	1.0000	-2.9498
Na+	0.001116	25.65	0.9114	-2.9926
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001720	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.926	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.641e-006	0.5522	0.9114	-5.3737
NaHCO3	3.838e-006	0.3223	1.0000	-5.4159
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.793e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04278	0.6920	-6.3066
CaCO3	6.951e-007	0.06954	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2480
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177
MgCl+	6.365e-008	0.003802	0.9114	-7.2365
MnCO3	3.747e-008	0.004305	1.0000	-7.4264

OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003480	1.0000	-2.4576
>(w)FeOH2+	0.001380	0.001378	2.3934	-2.8601
>(w)FeOCO2-	0.001206	0.001204	0.41781	-2.9186
>(w)FeOH	0.0009527	0.0009511	1.0000	-3.0210
>(s)FeOHCa++	0.0001537	0.0001534	5.7284	-3.8134
>(w)FeOHSO4--	2.968e-005	2.963e-005	0.17457	-4.5275
>(w)FeSO4-	2.155e-005	2.152e-005	0.41781	-4.6665
>(w)FeO-	1.507e-005	1.504e-005	0.41781	-4.8220
>(s)FeOH2+	1.401e-005	1.399e-005	2.3934	-4.8535
>(s)FeOH	9.673e-006	9.656e-006	1.0000	-5.0144
>(w)FeHPO4-	3.920e-006	3.913e-006	0.41781	-5.4067
>(w)FeOCa+	3.083e-006	3.078e-006	2.3934	-5.5110
>(w)FePO4--	1.128e-006	1.126e-006	0.17457	-5.9477
>(w)FeSeO3-	3.119e-007	3.114e-007	0.41781	-6.5060
>(w)FeH2PO4	2.313e-007	2.309e-007	1.0000	-6.6358
>(s)FeO-	1.530e-007	1.527e-007	0.41781	-6.8154
>(w)FeOHAsO4---	1.276e-007	1.274e-007	0.072937	-6.8942
>(w)FeOHSeO3--	1.268e-007	1.266e-007	0.17457	-6.8969
>(w)FeH2AsO3	1.597e-008	1.595e-008	1.0000	-7.7966
>(w)FeHAsO4-	5.994e-009	5.984e-009	0.41781	-8.2223
>(w)FeH2AsO4	2.810e-010	2.805e-010	1.0000	-9.5513
>(w)FeOHSeO4--	6.754e-027	6.743e-027	0.17457	-26.1704
>(w)FeSeO4-	4.271e-027	4.264e-027	0.41781	-26.3694

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	10.2711s/sat	Siderite	-1.2070
Se(black)	8.1172s/sat	Gypsum	-1.6121
Hematite	0.0000 sat	Monohydrocalcite	-1.6982
Rhodochrosite	-0.4594	Anhydrite	-1.8743
Goethite	-0.4651	Magnesite	-2.0875
Calcite	-0.7215	Bassanite	-2.5055
MnHPO4(c)	-0.7853	Magnetite	-2.5920
Aragonite	-0.8873	CaSO4^1/2H2O(bet	-2.6848
Dolomite	-1.1264	Dolomite-dis	-2.7350
Dolomite-ord	-1.1264		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.797e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.929e-065	-64.533

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.50e-007	1.26e-010	1.80e-005	1.50e-007	0.0214	
Ca++	0.00176	0.00160	64.2	0.000156	6.28	

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.290	-0.188	-190.	0.00488	4.92
H2O	55.6	55.5	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000529	5.27e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	-0.0473	-0.0473	-1.52e+003	6.68e-008	0.00214
SO4--	0.00155	0.00150	144.	5.11e-005	4.92
SeO3--	4.48e-007	1.00e-008	0.00127	4.38e-007	0.0557

Sorbed	fraction	log fraction
As(OH)4-	0.9992	-0.000
Ca++	0.08913	-1.050
HCO3-	0.5552	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03299	-1.482
SeO3--	0.9777	-0.010

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-007	1.259e-010	9.445e-006	1.496e-007	0.01122
Calcium	0.001756	0.001599	64.18	0.0001565	6.280
Carbon	0.008438	0.003753	45.13	0.004685	56.33
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001468	0.1481

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.276e-006	5.500e-009	0.0001706	5.270e-006	0.1634
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.480e-007	1.000e-008	0.0007906	4.380e-007	0.03462
Sodium	0.001123	0.001123	25.84		
Sulfur	0.001550	0.001499	48.12	5.115e-005	1.642

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.699

Eh = 0.1579 volts pe = 2.7484

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1579	2.7484
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	2.166e-008	-7.664	1.710e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.38	1.0000	-2.9498
Na+	0.001116	25.65	0.9114	-2.9926
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001720	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.926	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.641e-006	0.5522	0.9114	-5.3737
NaHCO3	3.838e-006	0.3223	1.0000	-5.4159
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.793e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04278	0.6920	-6.3066
CaCO3	6.951e-007	0.06954	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2480
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177
MgCl+	6.365e-008	0.003802	0.9114	-7.2365

MnCO3	3.747e-008	0.004305	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003480	1.0000	-2.4576
>(w)FeOH2+	0.001380	0.001378	2.3934	-2.8601
>(w)FeOCO2-	0.001206	0.001204	0.41782	-2.9186
>(w)FeOH	0.0009527	0.0009511	1.0000	-3.0210
>(s)FeOHCa++	0.0001537	0.0001534	5.7283	-3.8134
>(w)FeOHSO4--	2.968e-005	2.963e-005	0.17457	-4.5275
>(w)FeSO4-	2.155e-005	2.152e-005	0.41782	-4.6665
>(w)FeO-	1.507e-005	1.504e-005	0.41782	-4.8220
>(s)FeOH2+	1.401e-005	1.399e-005	2.3934	-4.8535
>(s)FeOH	9.673e-006	9.656e-006	1.0000	-5.0145
>(w)FeHPO4-	3.920e-006	3.913e-006	0.41782	-5.4067
>(w)FeOCa+	3.083e-006	3.078e-006	2.3934	-5.5110
>(w)FePO4--	1.128e-006	1.126e-006	0.17457	-5.9477
>(w)FeSeO3-	3.030e-007	3.025e-007	0.41782	-6.5186
>(w)FeH2PO4	2.313e-007	2.310e-007	1.0000	-6.6357
>(s)FeO-	1.530e-007	1.527e-007	0.41782	-6.8154
>(w)FeOHAsO4---	1.429e-007	1.426e-007	0.072939	-6.8451
>(w)FeOHSeO3--	1.232e-007	1.229e-007	0.17457	-6.9095
>(w)FeHAsO4-	6.712e-009	6.701e-009	0.41782	-8.1731
>(w)FeH2AsO4	3.147e-010	3.141e-010	1.0000	-9.5022
>(w)FeH2AsO3	1.586e-012	1.583e-012	1.0000	-11.7998
>(w)FeOHSeO4--	7.401e-023	7.388e-023	0.17457	-22.1307
>(w)FeSeO4-	4.680e-023	4.672e-023	0.41782	-22.3297

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2070
Se(black)	0.0000 sat	Gypsum	-1.6121
Rhodochrosite	-0.4594	Monohydrocalcite	-1.6982
Goethite	-0.4651	Anhydrite	-1.8743
Calcite	-0.7215	Magnesite	-2.0874
MnHPO4(c)	-0.7853	Bassanite	-2.5055
Aragonite	-0.8873	Magnetite	-2.5920
Dolomite	-1.1264	CaSO4^1/2H2O(bet	-2.6848
Dolomite-ord	-1.1264	Dolomite-dis	-2.7350

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	6.316e-020	-19.200
O2(g)	2.002e-048	-47.699
H2S(g)	4.199e-051	-50.377
CH4(g)	6.531e-055	-54.185
S2(g)	1.422e-089	-88.847

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.50e-007	6.79e-011	9.72e-006	1.50e-007	0.0214	
Ca++	0.00176	0.00160	64.2	0.000156	6.28	

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.4	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000529	5.27e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	5.32e-008	3.39e-011	1.09e-006	7.48e-008	0.00240
SO4--	0.00155	0.00150	144.	5.11e-005	4.92
SeO3--	4.48e-007	8.74e-010	0.000111	4.25e-007	0.0541

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08913	-1.050
HCO3-	0.5552	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03299	-1.482
SeO3--	0.9980	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-007	6.790e-011	5.094e-006	1.496e-007	0.01122
Calcium	0.001756	0.001599	64.18	0.0001565	6.280
Carbon	0.008438	0.003753	45.13	0.004685	56.33
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001468	0.1482

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.276e-006	5.500e-009	0.0001706	5.270e-006	0.1634
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.480e-007	8.735e-010	6.906e-005	4.254e-007	0.03363
Sodium	0.001123	0.001123	25.84		
Sulfur	0.001550	0.001499	48.12	5.115e-005	1.642

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.699

Eh = 0.1579 volts pe = 2.7484

Ionic strength = 0.008189

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 465 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.04 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1579	2.7484
e- + Fe+++ = Fe++	-0.0786	-1.3673

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	2.166e-008	-7.664	1.710e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002582	157.5	0.9125	-2.6278
Ca++	0.001388	55.62	0.7018	-3.0112
SO4--	0.001280	122.9	0.6888	-3.0548
CO2(aq)	0.001122	49.34	1.0000	-2.9501
Na+	0.001115	25.62	0.9114	-2.9930
Mg++	0.0003970	9.645	0.7138	-3.5476
CaSO4	0.0001717	23.36	1.0000	-3.7653
Cl-	0.0001394	4.940	0.9091	-3.8971
K+	9.285e-005	3.629	0.9091	-4.0736
MgSO4	4.019e-005	4.835	1.0000	-4.3959
CaHCO3+	3.878e-005	3.919	0.9140	-4.4504
Mn++	2.692e-005	1.478	0.7018	-4.7238
MgHCO3+	7.279e-006	0.6207	0.9114	-5.1782
Fe++	5.787e-006	0.3230	0.7018	-5.3913
NaSO4-	4.632e-006	0.5512	0.9114	-5.3745
NaHCO3	3.831e-006	0.3217	1.0000	-5.4167
MnSO4	2.767e-006	0.4176	1.0000	-5.5580
MnHCO3+	8.778e-007	0.1017	0.9114	-6.0969
CaCl+	8.170e-007	0.06168	0.9114	-6.1281
CO3--	7.125e-007	0.04273	0.6922	-6.3070
CaCO3	6.938e-007	0.06941	1.0000	-6.1588
KSO4-	5.651e-007	0.07634	0.9114	-6.2882
FeSO4	5.640e-007	0.08563	1.0000	-6.2487
FeHCO3+	2.603e-007	0.03041	0.9114	-6.6247
H+	1.930e-007	0.0001945	0.9214	-6.7499
MgCO3	9.583e-008	0.008076	1.0000	-7.0185
MgCl+	6.353e-008	0.003795	0.9114	-7.2373

MnCO3	3.740e-008	0.004297	1.0000	-7.4271
OH-	3.166e-008	0.0005381	0.9103	-7.5404
FeCO3	1.664e-008	0.001927	1.0000	-7.7788
HSO4-	1.315e-008	0.001276	0.9114	-7.9212

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003482	0.003480	1.0000	-2.4582
>(w)FeOH2+	0.001379	0.001378	2.3944	-2.8604
>(w)FeOCO2-	0.001205	0.001204	0.41764	-2.9190
>(w)FeOH	0.0009522	0.0009515	1.0000	-3.0213
>(s)FeOHCa++	0.0001535	0.0001534	5.7331	-3.8139
>(w)FeOHSO4--	2.967e-005	2.965e-005	0.17442	-4.5277
>(w)FeSO4-	2.154e-005	2.152e-005	0.41764	-4.6668
>(w)FeO-	1.506e-005	1.505e-005	0.41764	-4.8222
>(s)FeOH2+	1.402e-005	1.401e-005	2.3944	-4.8534
>(s)FeOH	9.676e-006	9.670e-006	1.0000	-5.0143
>(w)FeHPO4-	3.916e-006	3.913e-006	0.41764	-5.4072
>(w)FeOCa+	3.077e-006	3.075e-006	2.3944	-5.5118
>(w)FePO4--	1.127e-006	1.126e-006	0.17442	-5.9481
>(w)FeSeO3-	3.027e-007	3.025e-007	0.41764	-6.5190
>(w)FeH2PO4	2.311e-007	2.309e-007	1.0000	-6.6363
>(s)FeO-	1.530e-007	1.529e-007	0.41764	-6.8152
>(w)FeOHAsO4---	1.427e-007	1.426e-007	0.072847	-6.8455
>(w)FeOHSeO3--	1.230e-007	1.230e-007	0.17442	-6.9099
>(w)FeHAsO4-	6.703e-009	6.698e-009	0.41764	-8.1738
>(w)FeH2AsO4	3.142e-010	3.139e-010	1.0000	-9.5029
>(w)FeH2AsO3	1.584e-012	1.582e-012	1.0000	-11.8004
>(w)FeOHSeO4--	7.392e-023	7.387e-023	0.17442	-22.1313
>(w)FeSeO4-	4.674e-023	4.670e-023	0.41764	-22.3304

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2077
Se(black)	0.0000 sat	Gypsum	-1.6128
Rhodochrosite	-0.4602	Monohydrocalcite	-1.6990
Goethite	-0.4651	Anhydrite	-1.8750
Calcite	-0.7223	Magnesite	-2.0883
MnHPO4(c)	-0.7861	Bassanite	-2.5061
Aragonite	-0.8880	Magnetite	-2.5926
Dolomite	-1.1280	CaSO4^1/2H2O(bet	-2.6855
Dolomite-ord	-1.1280	Dolomite-dis	-2.7365

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02456	-1.610
Steam	0.01836	-1.736
H2(g)	6.318e-020	-19.199
O2(g)	2.000e-048	-47.699
H2S(g)	4.203e-051	-50.376
CH4(g)	6.536e-055	-54.185
S2(g)	1.424e-089	-88.847

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.50e-007	6.79e-011	9.70e-006	1.50e-007	0.0214	
Ca++	0.00176	0.00160	64.1	0.000156	6.27	

Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.91e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.5	1.00e+006	-0.00471	-84.9
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000528	5.27e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	5.32e-008	3.39e-011	1.09e-006	7.48e-008	0.00239
SO4--	0.00155	0.00150	144.	5.12e-005	4.92
SeO3--	4.48e-007	8.74e-010	0.000111	4.25e-007	0.0540

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08911	-1.050
HCO3-	0.5551	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03301	-1.481
SeO3--	0.9980	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-007	6.787e-011	5.086e-006	1.496e-007	0.01121
Calcium	0.001756	0.001599	64.12	0.0001565	6.272
Carbon	0.008438	0.003754	45.10	0.004684	56.27
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0001471	0.1483

Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.880e+005	0.009568	153.1
Phosphorus	5.276e-006	5.499e-009	0.0001704	5.270e-006	0.1633
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	4.480e-007	8.735e-010	6.899e-005	4.254e-007	0.03360
Sodium	0.001123	0.001123	25.81		
Sulfur	0.001550	0.001499	48.07	5.117e-005	1.641

1.497e-007 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.38	1.0000	-2.9498
Na+	0.001116	25.64	0.9114	-2.9926
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001720	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.926	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.640e-006	0.5522	0.9114	-5.3738
NaHCO3	3.838e-006	0.3223	1.0000	-5.4159
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.793e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04278	0.6920	-6.3066
CaCO3	6.951e-007	0.06954	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2480
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177

MgCl+	6.365e-008	0.003802	0.9114	-7.2365
MnCO3	3.747e-008	0.004305	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003481	1.0000	-2.4576
>(w)FeOH2+	0.001380	0.001378	2.3937	-2.8601
>(w)FeOCO2-	0.001206	0.001204	0.41777	-2.9186
>(w)FeOH	0.0009527	0.0009511	1.0000	-3.0210
>(s)FeOHCa++	0.0001537	0.0001534	5.7297	-3.8134
>(w)FeOHSO4--	2.969e-005	2.964e-005	0.17453	-4.5274
>(w)FeSO4-	2.156e-005	2.152e-005	0.41777	-4.6664
>(w)FeO-	1.507e-005	1.504e-005	0.41777	-4.8220
>(s)FeOH2+	1.401e-005	1.399e-005	2.3937	-4.8534
>(s)FeOH	9.675e-006	9.658e-006	1.0000	-5.0144
>(w)FeHPO4-	3.920e-006	3.914e-006	0.41777	-5.4067
>(w)FeOCa+	3.083e-006	3.078e-006	2.3937	-5.5110
>(w)FePO4--	1.128e-006	1.126e-006	0.17453	-5.9476
>(w)FeSeO3-	3.120e-007	3.114e-007	0.41777	-6.5059
>(w)FeH2PO4	2.313e-007	2.310e-007	1.0000	-6.6357
>(s)FeO-	1.530e-007	1.527e-007	0.41777	-6.8153
>(w)FeOHSeO3--	1.268e-007	1.266e-007	0.17453	-6.8968
>(w)FeOHAsO4---	1.276e-008	1.274e-008	0.072913	-7.8941
>(w)FeH2AsO3	1.597e-009	1.595e-009	1.0000	-8.7966
>(w)FeHAsO4-	5.995e-010	5.985e-010	0.41777	-9.2222
>(w)FeH2AsO4	2.810e-011	2.805e-011	1.0000	-10.5513
>(w)FeOHSeO4--	6.756e-027	6.744e-027	0.17453	-26.1703
>(w)FeSeO4-	4.272e-027	4.265e-027	0.41777	-26.3694

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	10.2711s/sat	Siderite	-1.2070
Se(black)	8.1172s/sat	Gypsum	-1.6121
Hematite	0.0000 sat	Monohydrocalcite	-1.6982
Rhodochrosite	-0.4594	Anhydrite	-1.8743
Goethite	-0.4651	Magnesite	-2.0874
Calcite	-0.7215	Bassanite	-2.5055
MnHPO4(c)	-0.7853	Magnetite	-2.5920
Aragonite	-0.8873	CaSO4^1/2H2O(bet	-2.6848
Dolomite	-1.1264	Dolomite-dis	-2.7350
Dolomite-ord	-1.1264		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	7.124e-016	-15.147
H2S(g)	6.797e-035	-34.168
CH4(g)	1.057e-038	-37.976
O2(g)	1.573e-056	-55.803
S2(g)	2.929e-065	-64.533

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					

As(OH)4-	1.50e-008	1.26e-011	1.80e-006	1.50e-008	0.00214
Ca++	0.00176	0.00160	64.2	0.000156	6.28
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.290	-0.188	-190.	0.00488	4.92
H2O	55.6	55.5	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000529	5.27e-006	0.507
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	-0.0473	-0.0473	-1.52e+003	6.68e-009	0.000214
SO4--	0.00155	0.00150	144.	5.12e-005	4.92
SeO3--	4.48e-007	1.00e-008	0.00127	4.38e-007	0.0557

Sorbed	fraction	log fraction
As(OH)4-	0.9992	-0.000
Ca++	0.08913	-1.050
HCO3-	0.5552	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03300	-1.481
SeO3--	0.9777	-0.010

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-008	1.259e-011	9.445e-007	1.496e-008	0.001122
Calcium	0.001756	0.001599	64.18	0.0001565	6.280
Carbon	0.008438	0.003753	45.13	0.004685	56.34

Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001465	0.1478
Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.276e-006	5.500e-009	0.0001706	5.271e-006	0.1635
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.480e-007	1.000e-008	0.0007906	4.380e-007	0.03463
Sodium	0.001123	0.001123	25.84		
Sulfur	0.001550	0.001499	48.12	5.116e-005	1.642

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.691

Eh = 0.1580 volts pe = 2.7502

Ionic strength = 0.008196

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 466 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.15 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1580	2.7502
e- + Fe+++ = Fe++	-0.0786	-1.3679

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.445e-008	-7.840	1.141e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9125	-2.6274
Ca++	0.001390	55.67	0.7017	-3.0109
SO4--	0.001281	123.0	0.6887	-3.0545
CO2(aq)	0.001122	49.37	1.0000	-2.9498
Na+	0.001116	25.64	0.9114	-2.9926
Mg++	0.0003974	9.654	0.7138	-3.5472
CaSO4	0.0001720	23.40	1.0000	-3.7646
Cl-	0.0001395	4.945	0.9091	-3.8967
K+	9.295e-005	3.632	0.9091	-4.0732
MgSO4	4.025e-005	4.842	1.0000	-4.3952
CaHCO3+	3.885e-005	3.926	0.9140	-4.4497
Mn++	2.694e-005	1.479	0.7017	-4.7234
MgHCO3+	7.291e-006	0.6218	0.9114	-5.1775
Fe++	5.792e-006	0.3233	0.7017	-5.3910
NaSO4-	4.640e-006	0.5522	0.9114	-5.3738
NaHCO3	3.838e-006	0.3223	1.0000	-5.4159
MnSO4	2.771e-006	0.4182	1.0000	-5.5574
MnHCO3+	8.793e-007	0.1019	0.9114	-6.0962
CaCl+	8.184e-007	0.06179	0.9114	-6.1273
CO3--	7.133e-007	0.04279	0.6920	-6.3066
CaCO3	6.951e-007	0.06954	1.0000	-6.1580
KSO4-	5.661e-007	0.07647	0.9114	-6.2874
FeSO4	5.649e-007	0.08577	1.0000	-6.2480
FeHCO3+	2.608e-007	0.03046	0.9114	-6.6240
H+	1.930e-007	0.0001944	0.9214	-6.7500
MgCO3	9.601e-008	0.008091	1.0000	-7.0177
MgCl+	6.365e-008	0.003802	0.9114	-7.2365

MnCO3	3.747e-008	0.004305	1.0000	-7.4264
OH-	3.166e-008	0.0005383	0.9102	-7.5403
FeCO3	1.667e-008	0.001930	1.0000	-7.7781
HSO4-	1.316e-008	0.001277	0.9114	-7.9210

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003486	0.003481	1.0000	-2.4576
>(w)FeOH2+	0.001380	0.001378	2.3937	-2.8601
>(w)FeOCO2-	0.001206	0.001204	0.41777	-2.9186
>(w)FeOH	0.0009527	0.0009511	1.0000	-3.0210
>(s)FeOHCa++	0.0001537	0.0001534	5.7296	-3.8134
>(w)FeOHSO4--	2.969e-005	2.964e-005	0.17453	-4.5274
>(w)FeSO4-	2.156e-005	2.152e-005	0.41777	-4.6664
>(w)FeO-	1.507e-005	1.504e-005	0.41777	-4.8220
>(s)FeOH2+	1.401e-005	1.399e-005	2.3937	-4.8534
>(s)FeOH	9.675e-006	9.658e-006	1.0000	-5.0144
>(w)FeHPO4-	3.920e-006	3.914e-006	0.41777	-5.4067
>(w)FeOCa+	3.083e-006	3.078e-006	2.3937	-5.5110
>(w)FePO4--	1.128e-006	1.126e-006	0.17453	-5.9476
>(w)FeSeO3-	3.082e-007	3.076e-007	0.41777	-6.5112
>(w)FeH2PO4	2.313e-007	2.310e-007	1.0000	-6.6357
>(s)FeO-	1.530e-007	1.527e-007	0.41777	-6.8153
>(w)FeOHSeO3--	1.253e-007	1.251e-007	0.17453	-6.9022
>(w)FeOHAsO4---	1.429e-008	1.427e-008	0.072914	-7.8450
>(w)FeHAsO4-	6.713e-010	6.701e-010	0.41777	-9.1731
>(w)FeH2AsO4	3.146e-011	3.141e-011	1.0000	-10.5022
>(w)FeH2AsO3	1.572e-013	1.570e-013	1.0000	-12.8035
>(w)FeOHSeO4--	7.591e-023	7.578e-023	0.17453	-22.1197
>(w)FeSeO4-	4.800e-023	4.792e-023	0.41777	-22.3188

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2070
Se(black)	0.0000 sat	Gypsum	-1.6121
Rhodochrosite	-0.4594	Monohydrocalcite	-1.6982
Goethite	-0.4651	Anhydrite	-1.8743
Calcite	-0.7215	Magnesite	-2.0874
MnHPO4(c)	-0.7853	Bassanite	-2.5055
Aragonite	-0.8873	Magnetite	-2.5920
Dolomite	-1.1264	CaSO4^1/2H2O(bet	-2.6848
Dolomite-ord	-1.1264	Dolomite-dis	-2.7350

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02458	-1.609
Steam	0.01836	-1.736
H2(g)	6.263e-020	-19.203
O2(g)	2.035e-048	-47.691
H2S(g)	4.060e-051	-50.391
CH4(g)	6.316e-055	-54.200
S2(g)	1.352e-089	-88.869

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.50e-008	6.79e-012	9.72e-007	1.50e-008	0.00214	
Ca++	0.00176	0.00160	64.2	0.000156	6.28	

Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.90e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.4	1.00e+006	-0.00471	-85.0
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000529	5.27e-006	0.507
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	-6.96e-009	3.39e-012	1.09e-007	7.48e-009	0.000240
SO4--	0.00155	0.00150	144.	5.12e-005	4.92
SeO3--	4.48e-007	8.88e-010	0.000113	4.33e-007	0.0550

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08913	-1.050
HCO3-	0.5552	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03300	-1.481
SeO3--	0.9980	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-008	6.790e-012	5.093e-007	1.497e-008	0.001123
Calcium	0.001756	0.001599	64.18	0.0001565	6.280
Carbon	0.008438	0.003753	45.13	0.004685	56.34
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.0001465	0.1478

Iron	0.03545	6.625e-006	0.3705		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.880e+005	0.009570	153.3
Phosphorus	5.276e-006	5.500e-009	0.0001706	5.271e-006	0.1635
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	4.480e-007	8.883e-010	7.022e-005	4.327e-007	0.03421
Sodium	0.001123	0.001123	25.84		
Sulfur	0.001550	0.001499	48.12	5.116e-005	1.642

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -47.692

Eh = 0.1580 volts pe = 2.7502

Ionic strength = 0.008188

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999781 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 465 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.04 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 2.24 uC/cm2

Surface potential = 22.4 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.1580	2.7502
e- + Fe+++ = Fe++	-0.0786	-1.3673

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	1.445e-008	-7.840	1.141e-006	

(total)	2.830	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002582	157.5	0.9125	-2.6278
Ca++	0.001388	55.62	0.7018	-3.0112
SO4--	0.001280	122.9	0.6888	-3.0548
CO2(aq)	0.001122	49.34	1.0000	-2.9501
Na+	0.001115	25.62	0.9114	-2.9931
Mg++	0.0003970	9.645	0.7138	-3.5476
CaSO4	0.0001717	23.36	1.0000	-3.7653
Cl-	0.0001394	4.940	0.9091	-3.8971
K+	9.285e-005	3.629	0.9091	-4.0736
MgSO4	4.019e-005	4.835	1.0000	-4.3959
CaHCO3+	3.878e-005	3.919	0.9140	-4.4504
Mn++	2.692e-005	1.478	0.7018	-4.7238
MgHCO3+	7.279e-006	0.6207	0.9114	-5.1782
Fe++	5.787e-006	0.3230	0.7018	-5.3913
NaSO4-	4.632e-006	0.5512	0.9114	-5.3745
NaHCO3	3.831e-006	0.3217	1.0000	-5.4167
MnSO4	2.767e-006	0.4176	1.0000	-5.5580
MnHCO3+	8.778e-007	0.1017	0.9114	-6.0969
CaCl+	8.170e-007	0.06168	0.9114	-6.1281
CO3--	7.125e-007	0.04273	0.6922	-6.3070
CaCO3	6.938e-007	0.06941	1.0000	-6.1587
KSO4-	5.651e-007	0.07634	0.9114	-6.2882
FeSO4	5.640e-007	0.08563	1.0000	-6.2487
FeHCO3+	2.603e-007	0.03041	0.9114	-6.6247
H+	1.930e-007	0.0001945	0.9214	-6.7499
MgCO3	9.583e-008	0.008076	1.0000	-7.0185
MgCl+	6.353e-008	0.003795	0.9114	-7.2373

MnCO3	3.740e-008	0.004297	1.0000	-7.4271
OH-	3.166e-008	0.0005381	0.9103	-7.5404
FeCO3	1.664e-008	0.001927	1.0000	-7.7788
HSO4-	1.315e-008	0.001276	0.9114	-7.9212

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.003482	0.003480	1.0000	-2.4581
>(w)FeOH2+	0.001379	0.001378	2.3947	-2.8604
>(w)FeOCO2-	0.001205	0.001204	0.41759	-2.9190
>(w)FeOH	0.0009522	0.0009515	1.0000	-3.0213
>(s)FeOHCa++	0.0001535	0.0001534	5.7344	-3.8139
>(w)FeOHSO4--	2.968e-005	2.965e-005	0.17439	-4.5276
>(w)FeSO4-	2.154e-005	2.152e-005	0.41759	-4.6668
>(w)FeO-	1.506e-005	1.505e-005	0.41759	-4.8221
>(s)FeOH2+	1.402e-005	1.401e-005	2.3947	-4.8534
>(s)FeOH	9.678e-006	9.672e-006	1.0000	-5.0142
>(w)FeHPO4-	3.916e-006	3.914e-006	0.41759	-5.4071
>(w)FeOCa+	3.077e-006	3.075e-006	2.3947	-5.5119
>(w)FePO4--	1.127e-006	1.126e-006	0.17439	-5.9480
>(w)FeSeO3-	3.078e-007	3.076e-007	0.41759	-6.5117
>(w)FeH2PO4	2.311e-007	2.309e-007	1.0000	-6.6363
>(s)FeO-	1.531e-007	1.530e-007	0.41759	-6.8150
>(w)FeOHSeO3--	1.252e-007	1.251e-007	0.17439	-6.9025
>(w)FeOHAsO4---	1.428e-008	1.427e-008	0.072822	-7.8454
>(w)FeHAsO4-	6.703e-010	6.699e-010	0.41759	-9.1737
>(w)FeH2AsO4	3.141e-011	3.139e-011	1.0000	-10.5029
>(w)FeH2AsO3	1.570e-013	1.569e-013	1.0000	-12.8040
>(w)FeOHSeO4--	7.582e-023	7.577e-023	0.17439	-22.1202
>(w)FeSeO4-	4.793e-023	4.790e-023	0.41759	-22.3194

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2077
Se(black)	0.0000 sat	Gypsum	-1.6128
Rhodochrosite	-0.4602	Monohydrocalcite	-1.6990
Goethite	-0.4651	Anhydrite	-1.8750
Calcite	-0.7223	Magnesite	-2.0882
MnHPO4(c)	-0.7861	Bassanite	-2.5061
Aragonite	-0.8880	Magnetite	-2.5925
Dolomite	-1.1280	CaSO4^1/2H2O(bet	-2.6855
Dolomite-ord	-1.1280	Dolomite-dis	-2.7365

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02456	-1.610
Steam	0.01836	-1.736
H2(g)	6.265e-020	-19.203
O2(g)	2.034e-048	-47.692
H2S(g)	4.065e-051	-50.391
CH4(g)	6.321e-055	-54.199
S2(g)	1.354e-089	-88.868

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	1.50e-008	6.79e-012	9.70e-007	1.50e-008	0.00214	
Ca++	0.00176	0.00160	64.1	0.000156	6.27	

Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	9.91e-013	5.54e-008		
H+	-0.100	0.00112	1.13	0.00488	4.92
H2O	55.5	55.5	1.00e+006	-0.00471	-84.9
HCO3-	0.00844	0.00375	229.	0.00468	286.
HPO4--	5.28e-006	5.50e-009	0.000528	5.27e-006	0.506
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00112	0.00112	25.8		
O2(aq)	-6.96e-009	3.39e-012	1.09e-007	7.48e-009	0.000240
SO4--	0.00155	0.00150	144.	5.12e-005	4.92
SeO3--	4.48e-007	8.88e-010	0.000113	4.33e-007	0.0549

Sorbed	fraction	log fraction
As(OH)4-	0.9995	-0.000
Ca++	0.08911	-1.050
HCO3-	0.5551	-0.256
HPO4--	0.9990	-0.000
SO4--	0.03301	-1.481
SeO3--	0.9980	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.497e-008	6.787e-012	5.086e-007	1.497e-008	0.001122
Calcium	0.001756	0.001599	64.12	0.0001565	6.272
Carbon	0.008438	0.003754	45.10	0.004684	56.27
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.0001468	0.1480

Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.880e+005	0.009568	153.1
Phosphorus	5.276e-006	5.499e-009	0.0001704	5.271e-006	0.1633
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	4.480e-007	8.883e-010	7.015e-005	4.327e-007	0.03417
Sodium	0.001123	0.001123	25.81		
Sulfur	0.001550	0.001499	48.07	5.118e-005	1.641

1.497e-007 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008443

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998795 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 480 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.20 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = -0.221 uC/cm2

Surface potential = -2.21 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0785	-1.3664

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9114	-2.6280
Na+	0.001569	36.06	0.9103	-2.8451
Ca++	0.001391	55.73	0.6986	-3.0124
SO4--	0.001281	123.0	0.6853	-3.0567
CO2(aq)	0.001121	49.31	1.0000	-2.9504
Mg++	0.0003978	9.663	0.7109	-3.5486
CaSO4	0.0001705	23.20	1.0000	-3.7682
Cl-	0.0001395	4.945	0.9079	-3.8973
K+	9.295e-005	3.632	0.9079	-4.0737
MgSO4	3.992e-005	4.803	1.0000	-4.3988
CaHCO3+	3.872e-005	3.912	0.9129	-4.4517
Mn++	2.697e-005	1.481	0.6986	-4.7249
As(OH)3	1.013e-005	1.275	1.0000	-4.9944
MgHCO3+	7.268e-006	0.6198	0.9103	-5.1794
NaSO4-	6.493e-006	0.7726	0.9103	-5.2284
Fe++	5.798e-006	0.3236	0.6986	-5.3925
HSe-	5.738e-006	0.4586	0.9103	-5.2821
NaHCO3	5.384e-006	0.4521	1.0000	-5.2689
HAsO4--	5.233e-006	0.7319	0.6853	-5.4454
H2AsO4-	4.231e-006	0.5959	0.9103	-5.4144
MnSO4	2.748e-006	0.4147	1.0000	-5.5611
MnHCO3+	8.762e-007	0.1016	0.9103	-6.0982
CaCl+	8.156e-007	0.06158	0.9103	-6.1293
CO3--	7.159e-007	0.04294	0.6887	-6.3071
CaCO3	6.919e-007	0.06922	1.0000	-6.1600
KSO4-	5.632e-007	0.07609	0.9103	-6.2902

FeSO4	5.601e-007	0.08504	1.0000	-6.2517
HSeO3-	4.173e-007	0.05338	0.9103	-6.4204
FeHCO3+	2.599e-007	0.03036	0.9103	-6.6261
H+	1.932e-007	0.0001946	0.9205	-6.7500
SeO3--	1.509e-007	0.01915	0.6548	-7.0051
MgCO3	9.559e-008	0.008056	1.0000	-7.0196
MgCl+	6.344e-008	0.003789	0.9103	-7.2384
MnCO3	3.729e-008	0.004284	1.0000	-7.4284
OH-	3.170e-008	0.0005389	0.9091	-7.5403
As(OH)4-	2.638e-008	0.003769	0.9103	-7.6195
FeCO3	1.659e-008	0.001921	1.0000	-7.7801
HSO4-	1.311e-008	0.001272	0.9103	-7.9232

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOH2+	0.002027	0.002024	0.91759	-2.6931
>(w)FeOCO2H	0.001961	0.001958	1.0000	-2.7076
>(w)FeH2AsO3	0.001397	0.001394	1.0000	-2.8549
>(w)FeOHAsO4---	0.0006287	0.0006277	1.2943	-3.2015
>(w)FeOH	0.0005365	0.0005356	1.0000	-3.2704
>(w)FeOCO2-	0.0002601	0.0002596	1.0898	-3.5849
>(w)FeHAsO4-	0.0002010	0.0002006	1.0898	-3.6968
>(s)FeOHCa++	0.0001700	0.0001697	0.84198	-3.7696
>(w)FeSeO3-	4.238e-005	4.230e-005	1.0898	-4.3729
>(w)FeH2AsO4	2.458e-005	2.453e-005	1.0000	-4.6095
>(w)FeOHSeO3--	6.603e-006	6.592e-006	1.1877	-5.1802
>(s)FeOH2+	5.962e-006	5.952e-006	0.91759	-5.2246
>(w)FeSO4-	4.630e-006	4.622e-006	1.0898	-5.3345
>(w)FeOCa+	4.514e-006	4.506e-006	0.91759	-5.3455
>(w)FeO-	3.252e-006	3.247e-006	1.0898	-5.4878
>(w)FeOHSO4--	2.445e-006	2.440e-006	1.1877	-5.6118

```
 >(s)FeOH           1.578e-006    1.575e-006       1.0000     -5.8020
 >(w)FeHPO4-         8.443e-007    8.428e-007       1.0898     -6.0735
 >(w)FeH2PO4         1.300e-007    1.297e-007       1.0000     -6.8862
 >(w)FePO4--         9.314e-008    9.298e-008       1.1877     -7.0309
 >(s)FeO-            9.565e-009    9.549e-009       1.0898     -8.0193
 >(w)FeSeO4-         5.803e-025    5.793e-025       1.0898    -24.2364
 >(w)FeOHSeO4--      3.518e-025    3.512e-025       1.1877    -24.4537
  (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)


 Mineral saturation states
                 log Q/K                    log Q/K
----------------------------------------------------------------
 FeSe2            15.8673s/sat   Dolomite-ord      -1.1303
 Se(black)        10.9161s/sat   Siderite          -1.2090
 Hematite          0.0000 sat    Gypsum            -1.6158
 Rhodochrosite     -0.4614       Monohydrocalcite  -1.7002
 Goethite          -0.4651       Anhydrite         -1.8779
 FeSe              -0.5224       Magnesite         -2.0894
 Calcite           -0.7235       Bassanite         -2.5091
 MnHPO4(c)         -0.7878       Magnetite         -2.5936
 Aragonite         -0.8892       CaSO4^1/2H2O(bet  -2.6885
 Dolomite          -1.1303       Dolomite-dis      -2.7388
  (only minerals with log Q/K > -3 listed)


 Gases             fugacity      log fug.
-----------------------------------------------
 CO2(g)              0.02455      -1.610
 Steam               0.01836      -1.736
 H2(g)             7.124e-016    -15.147
 H2S(g)            6.763e-035    -34.170
 CH4(g)            1.056e-038    -37.976
 O2(g)             1.573e-056    -55.803
```

S2(g) 2.900e-065 -64.538

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	0.00227	1.96e-005	2.80	0.00225	322.	
Ca++	0.00177	0.00160	64.2	0.000174	6.99	
Cl-	0.000140	0.000140	4.98			
Fe++	6.63e-006	6.63e-006	0.370			
Fe+++	0.0354	9.90e-013	5.54e-008			
H+	-0.290	-0.188	-190.	0.00419	4.23	
H2O	55.6	55.5	1.00e+006	-0.00613	-111.	
HCO3-	0.00597	0.00375	229.	0.00222	135.	
HPO4--	1.07e-006	5.50e-009	0.000529	1.07e-006	0.102	
K+	9.34e-005	9.34e-005	3.65			
Mg++	0.000444	0.000444	10.8			
Mn++	3.06e-005	3.06e-005	1.68			
Na+	0.00158	0.00158	36.3			
O2(aq)	-0.0469	-0.0473	-1.52e+003	0.000426	13.7	
SO4--	0.00151	0.00150	144.	7.06e-006	0.679	
SeO3--	5.52e-005	6.30e-006	0.801	4.89e-005	6.22	

Sorbed	fraction	log fraction
As(OH)4-	0.9914	-0.004
Ca++	0.09822	-1.008
HCO3-	0.3714	-0.430
HPO4--	0.9949	-0.002
SO4--	0.004689	-2.329
SeO3--	0.8858	-0.053

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002267	1.959e-005	1.469	0.002247	168.6
Calcium	0.001773	0.001599	64.18	0.0001742	6.990
Carbon	0.005970	0.003753	45.13	0.002217	26.66
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.003135	3.163
Iron	0.03545	6.625e-006	0.3704		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.50	55.43	8.879e+005	0.01054	168.8
Phosphorus	1.071e-006	5.500e-009	0.0001706	1.066e-006	0.03304
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	5.520e-005	6.301e-006	0.4981	4.890e-005	3.866
Sodium	0.001579	0.001579	36.34		
Sulfur	0.001506	0.001499	48.12	7.062e-006	0.2267

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.737 log fO2 = -55.523

Eh = 0.0463 volts pe = 0.8051

Ionic strength = 0.008437

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998795 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 480 mg/kg sol'n

Rock mass = 0.002834 kg

Carbonate alkalinity= 130.53 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = -0.307 uC/cm2

Surface potential = -3.07 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0463	0.8051
e- + Fe+++ = Fe++	-0.0763	-1.3278

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	5.520e-005	-4.258	0.004358	

(total)	2.834	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002571	156.8	0.9114	-2.6301
Na+	0.001569	36.06	0.9103	-2.8451
Ca++	0.001391	55.74	0.6987	-3.0123
SO4--	0.001281	123.0	0.6853	-3.0565
CO2(aq)	0.001149	50.55	1.0000	-2.9396
Mg++	0.0003978	9.663	0.7109	-3.5485
CaSO4	0.0001706	23.21	1.0000	-3.7680
Cl-	0.0001395	4.945	0.9079	-3.8973
K+	9.295e-005	3.632	0.9079	-4.0737
MgSO4	3.994e-005	4.805	1.0000	-4.3986
CaHCO3+	3.853e-005	3.894	0.9130	-4.4537
Mn++	2.697e-005	1.481	0.6987	-4.7248
As(OH)3	9.690e-006	1.220	1.0000	-5.0137
MgHCO3+	7.233e-006	0.6169	0.9103	-5.1815
HAsO4--	6.509e-006	0.9104	0.6853	-5.3506
NaSO4-	6.495e-006	0.7728	0.9103	-5.2282
Fe++	5.799e-006	0.3237	0.6987	-5.3924
H2AsO4-	5.421e-006	0.7636	0.9103	-5.3067
NaHCO3	5.358e-006	0.4499	1.0000	-5.2710
MnSO4	2.749e-006	0.4149	1.0000	-5.5608
MnHCO3+	8.721e-007	0.1011	0.9103	-6.1002
CaCl+	8.158e-007	0.06159	0.9103	-6.1293
CO3--	6.915e-007	0.04147	0.6888	-6.3221
CaCO3	6.685e-007	0.06688	1.0000	-6.1749
KSO4-	5.634e-007	0.07611	0.9103	-6.2900
FeSO4	5.605e-007	0.08510	1.0000	-6.2515
FeHCO3+	2.587e-007	0.03022	0.9103	-6.6281

H+	1.990e-007	0.0002005	0.9205	-6.7371
MgCO3	9.235e-008	0.007783	1.0000	-7.0346
MgCl+	6.345e-008	0.003790	0.9103	-7.2384
MnCO3	3.603e-008	0.004140	1.0000	-7.4433
OH-	3.077e-008	0.0005231	0.9091	-7.5532
As(OH)4-	2.450e-008	0.003500	0.9103	-7.6517
FeCO3	1.603e-008	0.001857	1.0000	-7.7950
HSO4-	1.351e-008	0.001311	0.9103	-7.9101

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOH2+	0.002107	0.002103	0.88753	-2.6763
>(w)FeOCO2H	0.001962	0.001958	1.0000	-2.7074
>(w)FeH2AsO3	0.001304	0.001302	1.0000	-2.8847
>(w)FeOHAsO4---	0.0006704	0.0006693	1.4304	-3.1737
>(w)FeOH	0.0005235	0.0005226	1.0000	-3.2811
>(w)FeOCO2-	0.0002443	0.0002439	1.1267	-3.6121
>(w)FeHAsO4-	0.0002431	0.0002427	1.1267	-3.6142
>(s)FeOHCa++	0.0001701	0.0001698	0.78771	-3.7693
>(w)FeH2AsO4	3.166e-005	3.160e-005	1.0000	-4.4995
>(s)FeOH2+	5.943e-006	5.933e-006	0.88753	-5.2260
>(w)FeSO4-	4.503e-006	4.495e-006	1.1267	-5.3465
>(w)FeOCa+	4.422e-006	4.414e-006	0.88753	-5.3544
>(w)FeO-	2.980e-006	2.975e-006	1.1267	-5.5258
>(w)FeOHSO4--	2.232e-006	2.229e-006	1.2695	-5.6512
>(s)FeOH	1.477e-006	1.474e-006	1.0000	-5.8307
>(w)FeHPO4-	8.419e-007	8.405e-007	1.1267	-6.0747
>(w)FeH2PO4	1.380e-007	1.378e-007	1.0000	-6.8600
>(w)FePO4--	8.721e-008	8.706e-008	1.2695	-7.0595
>(s)FeO-	8.406e-009	8.392e-009	1.1267	-8.0754
>(w)FeSeO3-	8.971e-016	8.956e-016	1.1267	-15.0472

>(w)FeOHSeO3--	1.313e-016	1.310e-016	1.2695	-15.8819
>(w)FeSeO4-	1.695e-035	1.692e-035	1.1267	-34.7708
>(w)FeOHSeO4--	9.650e-036	9.633e-036	1.2695	-35.0155

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2239
Se(black)	0.0000 sat	Gypsum	-1.6155
Goethite	-0.4651	Monohydrocalcite	-1.7152
Rhodochrosite	-0.4763	Anhydrite	-1.8777
Calcite	-0.7385	Magnesite	-2.1043
MnHPO4(c)	-0.7768	Bassanite	-2.5089
Aragonite	-0.9042	Magnetite	-2.6192
Dolomite	-1.1602	CaSO4^1/2H2O(bet	-2.6882
Dolomite-ord	-1.1602	Dolomite-dis	-2.7688

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02516	-1.599
Steam	0.01836	-1.736
H2(g)	5.162e-016	-15.287
H2S(g)	1.980e-035	-34.703
CH4(g)	2.985e-039	-38.525
O2(g)	2.996e-056	-55.523
S2(g)	4.731e-066	-65.325

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000177				
>(w)FeOH	0.00709				
As(OH)4-	0.00227	2.16e-005	3.09	0.00225	321.
Ca++	0.00177	0.00160	64.2	0.000174	6.99
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	1.00e-012	5.61e-008		
H+	-0.101	0.00115	1.16	0.00406	4.10
H2O	55.5	55.4	9.99e+005	-0.00603	-109.
HCO3-	0.00597	0.00377	230.	0.00220	135.
HPO4--	1.07e-006	5.74e-009	0.000552	1.07e-006	0.102
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00158	0.00158	36.3		
O2(aq)	0.000423	5.96e-006	0.191	0.000472	15.1
SO4--	0.00151	0.00150	144.	6.72e-006	0.647
SeO3--	5.52e-005	6.16e-017	7.83e-012	1.03e-015	1.31e-010

Sorbed	fraction	log fraction
As(OH)4-	0.9905	-0.004
Ca++	0.09823	-1.008
HCO3-	0.3688	-0.433
HPO4--	0.9946	-0.002
SO4--	0.004464	-2.350
SeO3--	0.9434	-0.025

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002267	2.161e-005	1.621	0.002245	168.4

Calcium	0.001773	0.001599	64.18	0.0001742	6.991
Carbon	0.005970	0.003768	45.31	0.002202	26.48
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.003187	3.216
Iron	0.03545	6.625e-006	0.3704		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.50	55.43	8.879e+005	0.01053	168.7
Phosphorus	1.071e-006	5.743e-009	0.0001781	1.065e-006	0.03304
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	5.520e-005	6.156e-017	4.867e-012	1.027e-015	8.117e-011
Sodium	0.001579	0.001579	36.34		
Sulfur	0.001506	0.001499	48.13	6.724e-006	0.2158

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.737 log fO2 = -55.524

Eh = 0.0463 volts pe = 0.8051

Ionic strength = 0.008429

Activity of water = 0.999995

Solvent mass = 0.999316 kg

Solution mass = 0.999795 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 479 mg/kg sol'n

Rock mass = 0.002834 kg

Carbonate alkalinity= 130.41 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = -0.306 uC/cm2

Surface potential = -3.06 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0463	0.8051
e- + Fe+++ = Fe++	-0.0763	-1.3273

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	5.520e-005	-4.258	0.004358	

(total)	2.834	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002569	156.7	0.9115	-2.6305
Na+	0.001568	36.03	0.9103	-2.8455
Ca++	0.001390	55.69	0.6988	-3.0126
SO4--	0.001280	122.9	0.6855	-3.0569
CO2(aq)	0.001148	50.52	1.0000	-2.9399
Mg++	0.0003974	9.654	0.7110	-3.5489
CaSO4	0.0001703	23.18	1.0000	-3.7687
Cl-	0.0001394	4.940	0.9080	-3.8977
K+	9.286e-005	3.629	0.9080	-4.0741
MgSO4	3.988e-005	4.797	1.0000	-4.3993
CaHCO3+	3.847e-005	3.887	0.9130	-4.4544
Mn++	2.695e-005	1.480	0.6988	-4.7252
As(OH)3	9.686e-006	1.219	1.0000	-5.0139
MgHCO3+	7.221e-006	0.6158	0.9103	-5.1822
HAsO4--	6.500e-006	0.9091	0.6855	-5.3511
NaSO4-	6.484e-006	0.7715	0.9103	-5.2290
Fe++	5.794e-006	0.3234	0.6988	-5.3927
H2AsO4-	5.415e-006	0.7628	0.9103	-5.3072
NaHCO3	5.348e-006	0.4491	1.0000	-5.2718
MnSO4	2.745e-006	0.4143	1.0000	-5.5615
MnHCO3+	8.706e-007	0.1009	0.9103	-6.1010
CaCl+	8.143e-007	0.06148	0.9103	-6.1300
CO3--	6.906e-007	0.04142	0.6889	-6.3226
CaCO3	6.673e-007	0.06675	1.0000	-6.1757
KSO4-	5.624e-007	0.07598	0.9103	-6.2908
FeSO4	5.596e-007	0.08496	1.0000	-6.2521
FeHCO3+	2.582e-007	0.03017	0.9103	-6.6288

H+	1.990e-007	0.0002005	0.9206	-6.7370
MgCO3	9.218e-008	0.007768	1.0000	-7.0354
MgCl+	6.334e-008	0.003783	0.9103	-7.2391
MnCO3	3.597e-008	0.004132	1.0000	-7.4441
OH-	3.077e-008	0.0005230	0.9092	-7.5533
As(OH)4-	2.448e-008	0.003498	0.9103	-7.6520
FeCO3	1.600e-008	0.001853	1.0000	-7.7958
HSO4-	1.350e-008	0.001310	0.9103	-7.9104

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOH2+	0.002105	0.002104	0.88788	-2.6767
>(w)FeOCO2H	0.001959	0.001958	1.0000	-2.7080
>(w)FeH2AsO3	0.001303	0.001302	1.0000	-2.8852
>(w)FeOHAsO4---	0.0006698	0.0006694	1.4287	-3.1740
>(w)FeOH	0.0005232	0.0005229	1.0000	-3.2813
>(w)FeOCO2-	0.0002440	0.0002438	1.1263	-3.6126
>(w)FeHAsO4-	0.0002428	0.0002426	1.1263	-3.6148
>(s)FeOHCa++	0.0001699	0.0001698	0.78833	-3.7698
>(w)FeH2AsO4	3.161e-005	3.159e-005	1.0000	-4.5002
>(s)FeOH2+	5.945e-006	5.941e-006	0.88788	-5.2258
>(w)FeSO4-	4.499e-006	4.496e-006	1.1263	-5.3468
>(w)FeOCa+	4.413e-006	4.410e-006	0.88788	-5.3553
>(w)FeO-	2.979e-006	2.977e-006	1.1263	-5.5259
>(w)FeOHSO4--	2.231e-006	2.230e-006	1.2685	-5.6515
>(s)FeOH	1.478e-006	1.477e-006	1.0000	-5.8305
>(w)FeHPO4-	8.411e-007	8.405e-007	1.1263	-6.0752
>(w)FeH2PO4	1.379e-007	1.378e-007	1.0000	-6.8605
>(w)FePO4--	8.714e-008	8.708e-008	1.2685	-7.0598
>(s)FeO-	8.412e-009	8.407e-009	1.1263	-8.0751
>(w)FeSeO3-	8.958e-016	8.952e-016	1.1263	-15.0478

>(w)FeOHSeO3--	1.311e-016	1.310e-016	1.2685	-15.8824
>(w)FeSeO4-	1.692e-035	1.691e-035	1.1263	-34.7716
>(w)FeOHSeO4--	9.633e-036	9.627e-036	1.2685	-35.0162

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2247
Se(black)	0.0000 sat	Gypsum	-1.6162
Goethite	-0.4651	Monohydrocalcite	-1.7160
Rhodochrosite	-0.4771	Anhydrite	-1.8784
Calcite	-0.7392	Magnesite	-2.1051
MnHPO4(c)	-0.7775	Bassanite	-2.5096
Aragonite	-0.9050	Magnetite	-2.6197
Dolomite	-1.1618	CaSO4^1/2H2O(bet	-2.6889
Dolomite-ord	-1.1618	Dolomite-dis	-2.7704

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02515	-1.600
Steam	0.01836	-1.736
H2(g)	5.165e-016	-15.287
H2S(g)	1.983e-035	-34.703
CH4(g)	2.989e-039	-38.525
O2(g)	2.993e-056	-55.524
S2(g)	4.741e-066	-65.324

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

>(s)FeOH	0.000177				
>(w)FeOH	0.00709				
As(OH)4-	0.00227	2.16e-005	3.09	0.00225	321.
Ca++	0.00177	0.00160	64.1	0.000174	6.98
Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	1.00e-012	5.61e-008		
H+	-0.101	0.00115	1.16	0.00406	4.09
H2O	55.5	55.5	9.99e+005	-0.00603	-109.
HCO3-	0.00597	0.00377	230.	0.00220	134.
HPO4--	1.07e-006	5.74e-009	0.000551	1.07e-006	0.102
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00158	0.00158	36.3		
O2(aq)	0.000423	5.95e-006	0.191	0.000472	15.1
SO4--	0.00151	0.00150	144.	6.73e-006	0.646
SeO3--	5.52e-005	6.16e-017	7.82e-012	1.03e-015	1.30e-010

Sorbed	fraction	log fraction
As(OH)4-	0.9905	-0.004
Ca++	0.09822	-1.008
HCO3-	0.3687	-0.433
HPO4--	0.9946	-0.002
SO4--	0.004466	-2.350
SeO3--	0.9434	-0.025

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002267	2.161e-005	1.619	0.002245	168.3

Calcium	0.001773	0.001599	64.11	0.0001742	6.983
Carbon	0.005970	0.003769	45.28	0.002202	26.45
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.003187	3.213
Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.879e+005	0.01053	168.5
Phosphorus	1.071e-006	5.742e-009	0.0001779	1.065e-006	0.03300
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	5.520e-005	6.162e-017	4.866e-012	1.026e-015	8.105e-011
Sodium	0.001579	0.001579	36.30		
Sulfur	0.001506	0.001499	48.08	6.726e-006	0.2157

0.001260 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.750 log fO2 = -55.803

Eh = 0.0415 volts pe = 0.7223

Ionic strength = 0.008372

Activity of water = 0.999995

Solvent mass = 0.998316 kg

Solution mass = 0.998790 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 475 mg/kg sol'n

Rock mass = 0.002830 kg

Carbonate alkalinity= 131.19 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.418 uC/cm2

Surface potential = 4.18 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0415	0.7223
e- + Fe+++ = Fe++	-0.0785	-1.3668

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.01772	-1.751	2.830	0.5364
			______	______
(total)			2.830	0.5364

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002584	157.6	0.9117	-2.6278
Na+	0.001447	33.26	0.9106	-2.8801
Ca++	0.001391	55.72	0.6995	-3.0119
SO4--	0.001281	123.0	0.6862	-3.0560
CO2(aq)	0.001121	49.33	1.0000	-2.9502
Mg++	0.0003977	9.660	0.7117	-3.5482
CaSO4	0.0001709	23.26	1.0000	-3.7672
Cl-	0.0001395	4.945	0.9082	-3.8971
K+	9.295e-005	3.632	0.9082	-4.0736
MgSO4	4.001e-005	4.814	1.0000	-4.3978
CaHCO3+	3.875e-005	3.916	0.9132	-4.4511
Mn++	2.696e-005	1.480	0.6995	-4.7245
MgHCO3+	7.274e-006	0.6204	0.9106	-5.1789
NaSO4-	5.996e-006	0.7135	0.9106	-5.2628
Fe++	5.796e-006	0.3236	0.6995	-5.3921
HSe-	5.738e-006	0.4586	0.9106	-5.2819
NaHCO3	4.968e-006	0.4172	1.0000	-5.3038
As(OH)3	3.257e-006	0.4101	1.0000	-5.4871
MnSO4	2.754e-006	0.4157	1.0000	-5.5600
HAsO4--	1.681e-006	0.2350	0.6862	-5.9381
H2AsO4-	1.360e-006	0.1916	0.9106	-5.9072
MnHCO3+	8.771e-007	0.1017	0.9106	-6.0976
CaCl+	8.164e-007	0.06164	0.9106	-6.1288
CO3--	7.152e-007	0.04290	0.6897	-6.3070
CaCO3	6.928e-007	0.06931	1.0000	-6.1594
KSO4-	5.640e-007	0.07619	0.9106	-6.2894

FeSO4	5.614e-007	0.08524	1.0000	-6.2507
HSeO3-	4.173e-007	0.05338	0.9106	-6.4202
FeHCO3+	2.601e-007	0.03039	0.9106	-6.6255
H+	1.931e-007	0.0001946	0.9208	-6.7500
SeO3--	1.507e-007	0.01913	0.6560	-7.0049
MgCO3	9.571e-008	0.008066	1.0000	-7.0191
MgCl+	6.350e-008	0.003793	0.9106	-7.2379
MnCO3	3.734e-008	0.004290	1.0000	-7.4278
OH-	3.169e-008	0.0005387	0.9094	-7.5403
FeCO3	1.661e-008	0.001924	1.0000	-7.7795
HSO4-	1.313e-008	0.001273	0.9106	-7.9226

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002549	0.002545	1.0000	-2.5936
>(w)FeOH2+	0.002055	0.002051	1.1767	-2.6872
>(w)FeOH	0.0006973	0.0006961	1.0000	-3.1566
>(w)FeH2AsO3	0.0005838	0.0005829	1.0000	-3.2337
>(w)FeOHAsO4---	0.0005541	0.0005532	0.61382	-3.2564
>(w)FeOCO2-	0.0004336	0.0004329	0.84986	-3.3629
>(s)FeOHCa++	0.0001674	0.0001671	1.3845	-3.7762
>(w)FeHAsO4-	0.0001077	0.0001075	0.84986	-3.9677
>(w)FeSeO3-	7.066e-005	7.054e-005	0.84986	-4.1509
>(w)FeOHSeO3--	1.412e-005	1.410e-005	0.72226	-4.8502
>(w)FeH2AsO4	1.027e-005	1.025e-005	1.0000	-4.9884
>(w)FeSO4-	7.727e-006	7.714e-006	0.84986	-5.1120
>(s)FeOH2+	7.523e-006	7.511e-006	1.1767	-5.1236
>(w)FeO-	5.421e-006	5.412e-006	0.84986	-5.2659
>(w)FeOHSO4--	5.232e-006	5.223e-006	0.72226	-5.2813
>(w)FeOCa+	4.579e-006	4.572e-006	1.1767	-5.3392
>(s)FeOH	2.553e-006	2.549e-006	1.0000	-5.5929

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>(w)FeHPO4-        1.408e-006    1.406e-006      0.84986     -5.8514
>(w)FePO4--        1.992e-007    1.989e-007      0.72226     -6.7007
>(w)FeH2PO4        1.690e-007    1.688e-007       1.0000     -6.7720
>(s)FeO-           1.985e-008    1.981e-008      0.84986     -7.7023
>(w)FeSeO4-        9.675e-025    9.659e-025      0.84986    -24.0143
>(w)FeOHSeO4--     7.522e-025    7.509e-025      0.72226    -24.1237
 (Boltzman factor = exp(zF PSI/RT),  where PSI is surface potential)


Mineral saturation states
                log Q/K                      log Q/K
----------------------------------------------------------------
FeSe2          15.8680s/sat   Dolomite-ord      -1.1292
Se(black)      10.9162s/sat   Siderite          -1.2084
Hematite        0.0000 sat    Gypsum            -1.6147
Rhodochrosite  -0.4608        Monohydrocalcite  -1.6997
Goethite       -0.4651        Anhydrite         -1.8769
FeSe           -0.5218        Magnesite         -2.0888
Calcite        -0.7229        Bassanite         -2.5081
MnHPO4(c)      -0.7871        Magnetite         -2.5931
Aragonite      -0.8887        CaSO4^1/2H2O(bet  -2.6874
Dolomite       -1.1292        Dolomite-dis      -2.7377
 (only minerals with log Q/K > -3 listed)


Gases            fugacity     log fug.
----------------------------------------------
CO2(g)            0.02456     -1.610
Steam             0.01836     -1.736
H2(g)          7.124e-016    -15.147
H2S(g)         6.773e-035    -34.169
CH4(g)         1.056e-038    -37.976
O2(g)          1.573e-056    -55.803
S2(g)          2.908e-065    -64.536
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Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000177					
>(w)FeOH	0.00709					
As(OH)4-	0.00126	6.30e-006	0.901	0.00125	179.	
Ca++	0.00177	0.00160	64.2	0.000172	6.89	
Cl-	0.000140	0.000140	4.98			
Fe++	6.63e-006	6.63e-006	0.370			
Fe+++	0.0354	9.90e-013	5.54e-008			
H+	-0.290	-0.188	-190.	0.00416	4.20	
H2O	55.6	55.5	1.00e+006	-0.00501	-90.4	
HCO3-	0.00673	0.00375	229.	0.00298	182.	
HPO4--	1.78e-006	5.50e-009	0.000529	1.77e-006	0.170	
K+	9.34e-005	9.34e-005	3.65			
Mg++	0.000444	0.000444	10.8			
Mn++	3.06e-005	3.06e-005	1.68			
Na+	0.00146	0.00146	33.5			
O2(aq)	-0.0470	-0.0473	-1.52e+003	0.000335	10.7	
SO4--	0.00151	0.00150	144.	1.29e-005	1.24	
SeO3--	9.09e-005	6.30e-006	0.801	8.46e-005	10.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9950	-0.002
Ca++	0.09696	-1.013
HCO3-	0.4424	-0.354
HPO4--	0.9969	-0.001
SO4--	0.008556	-2.068
SeO3--	0.9307	-0.031

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001260	6.296e-006	0.4723	0.001254	94.05
Calcium	0.001771	0.001599	64.18	0.0001717	6.890
Carbon	0.006731	0.003753	45.13	0.002978	35.81
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.002131	2.150
Iron	0.03545	6.625e-006	0.3704		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.879e+005	0.009921	158.9
Phosphorus	1.779e-006	5.500e-009	0.0001706	1.773e-006	0.05499
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	9.093e-005	6.301e-006	0.4982	8.463e-005	6.691
Sodium	0.001456	0.001456	33.51		
Sulfur	0.001512	0.001499	48.12	1.294e-005	0.4153

Step # 0 Xi = 0.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.720 log fO2 = -55.029

Eh = 0.0544 volts pe = 0.9463

Ionic strength = 0.008360

Activity of water = 0.999995

Solvent mass = 0.998315 kg

Solution mass = 0.998790 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 476 mg/kg sol'n

Rock mass = 0.002837 kg

Carbonate alkalinity= 129.78 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.255 uC/cm2

Surface potential = 2.55 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0544	0.9463
e- + Fe+++ = Fe++	-0.0733	-1.2761

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	9.093e-005	-4.041	0.007180	

(total)	2.837	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002557	156.0	0.9118	-2.6323
Na+	0.001447	33.26	0.9106	-2.8801
Ca++	0.001391	55.73	0.6996	-3.0118
SO4--	0.001282	123.1	0.6864	-3.0556
CO2(aq)	0.001190	52.35	1.0000	-2.9244
Mg++	0.0003977	9.661	0.7118	-3.5481
CaSO4	0.0001712	23.29	1.0000	-3.7666
Cl-	0.0001395	4.945	0.9083	-3.8971
K+	9.295e-005	3.632	0.9083	-4.0735
MgSO4	4.006e-005	4.820	1.0000	-4.3972
CaHCO3+	3.836e-005	3.877	0.9133	-4.4555
Mn++	2.697e-005	1.481	0.6996	-4.7243
MgHCO3+	7.201e-006	0.6141	0.9106	-5.1833
NaSO4-	6.002e-006	0.7142	0.9106	-5.2623
Fe++	5.799e-006	0.3237	0.6996	-5.3918
NaHCO3	4.918e-006	0.4129	1.0000	-5.3083
MnSO4	2.758e-006	0.4163	1.0000	-5.5594
HAsO4--	2.707e-006	0.3786	0.6864	-5.7309
As(OH)3	2.474e-006	0.3115	1.0000	-5.6066
H2AsO4-	2.350e-006	0.3310	0.9106	-5.6696
MnHCO3+	8.684e-007	0.1006	0.9106	-6.1019
CaCl+	8.167e-007	0.06166	0.9106	-6.1286
CO3--	6.598e-007	0.03958	0.6898	-6.3418
CaCO3	6.396e-007	0.06399	1.0000	-6.1941
KSO4-	5.646e-007	0.07627	0.9106	-6.2889
FeSO4	5.624e-007	0.08539	1.0000	-6.2500
FeHCO3+	2.576e-007	0.03009	0.9106	-6.6297

H+	2.071e-007	0.0002086	0.9208	-6.7197
MgCO3	8.835e-008	0.007446	1.0000	-7.0538
MgCl+	6.352e-008	0.003794	0.9106	-7.2377
MnCO3	3.448e-008	0.003961	1.0000	-7.4625
OH-	2.955e-008	0.0005024	0.9095	-7.5706
FeCO3	1.534e-008	0.001777	1.0000	-7.8141
HSO4-	1.409e-008	0.001367	0.9106	-7.8918

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002561	0.002556	1.0000	-2.5916
>(w)FeOH2+	0.002222	0.002218	1.1045	-2.6533
>(w)FeOH	0.0006599	0.0006588	1.0000	-3.1805
>(w)FeOHAsO4---	0.0006517	0.0006506	0.74225	-3.1860
>(w)FeH2AsO3	0.0004197	0.0004190	1.0000	-3.3771
>(w)FeOCO2-	0.0003812	0.0003806	0.90542	-3.4188
>(s)FeOHCa++	0.0001677	0.0001674	1.2198	-3.7756
>(w)FeHAsO4-	0.0001654	0.0001651	0.90542	-3.7816
>(w)FeH2AsO4	1.801e-005	1.798e-005	1.0000	-4.7444
>(s)FeOH2+	7.581e-006	7.568e-006	1.1045	-5.1203
>(w)FeSO4-	7.368e-006	7.356e-006	0.90542	-5.1326
>(w)FeO-	4.491e-006	4.483e-006	0.90542	-5.3477
>(w)FeOHSO4--	4.367e-006	4.360e-006	0.81979	-5.3598
>(w)FeOCa+	4.308e-006	4.300e-006	1.1045	-5.3658
>(s)FeOH	2.252e-006	2.248e-006	1.0000	-5.6475
>(w)FeHPO4-	1.408e-006	1.406e-006	0.90542	-5.8513
>(w)FeH2PO4	1.931e-007	1.928e-007	1.0000	-6.7141
>(w)FePO4--	1.744e-007	1.741e-007	0.81979	-6.7585
>(s)FeO-	1.532e-008	1.530e-008	0.90542	-7.8147
>(w)FeSeO3-	4.225e-015	4.218e-015	0.90542	-14.3742
>(w)FeOHSeO3--	7.390e-016	7.377e-016	0.81979	-15.1314

>(w)FeSeO4-	1.411e-034	1.409e-034	0.90542	-33.8504
>(w)FeOHSeO4--	9.604e-035	9.588e-035	0.81979	-34.0175

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2430
Se(black)	0.0000 sat	Gypsum	-1.6141
Goethite	-0.4651	Monohydrocalcite	-1.7343
Rhodochrosite	-0.4955	Anhydrite	-1.8763
Calcite	-0.7576	Magnesite	-2.1235
MnHPO4(c)	-0.7658	Bassanite	-2.5075
Aragonite	-0.9234	Magnetite	-2.6535
Dolomite	-1.1986	CaSO4^1/2H2O(bet	-2.6868
Dolomite-ord	-1.1986	Dolomite-dis	-2.8072

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02606	-1.584
Steam	0.01836	-1.736
H2(g)	2.920e-016	-15.535
H2S(g)	2.201e-036	-35.657
CH4(g)	3.165e-040	-39.500
O2(g)	9.363e-056	-55.029
S2(g)	1.827e-067	-66.738

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					

>(w)FeOH	0.00709				
As(OH)4-	0.00126	7.52e-006	1.08	0.00125	179.
Ca++	0.00177	0.00160	64.2	0.000172	6.89
Cl-	0.000140	0.000140	4.98		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	1.02e-012	5.70e-008		
H+	-0.101	0.00119	1.20	0.00392	3.95
H2O	55.5	55.4	1.00e+006	-0.00480	-86.6
HCO3-	0.00673	0.00379	232.	0.00294	179.
HPO4--	1.78e-006	6.03e-009	0.000579	1.77e-006	0.170
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00146	0.00146	33.5		
O2(aq)	0.000328	2.52e-006	0.0809	0.000417	13.4
SO4--	0.00151	0.00150	144.	1.17e-005	1.13
SeO3--	9.09e-005	6.41e-017	8.14e-012	4.96e-015	6.30e-010

Sorbed	fraction	log fraction
As(OH)4-	0.9940	-0.003
Ca++	0.09694	-1.013
HCO3-	0.4363	-0.360
HPO4--	0.9966	-0.001
SO4--	0.007748	-2.111
SeO3--	0.9872	-0.006

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001260	7.525e-006	0.5644	0.001253	93.96
Calcium	0.001771	0.001599	64.18	0.0001717	6.889

Carbon	0.006731	0.003794	45.63	0.002937	35.32
Chlorine	0.0001402	0.0001402	4.976		
Hydrogen	110.8	110.8	1.118e+005	0.002266	2.286
Iron	0.03545	6.625e-006	0.3704		
Magnesium	0.0004444	0.0004444	10.81		
Manganese	3.058e-005	3.058e-005	1.682		
Oxygen	55.49	55.43	8.879e+005	0.009908	158.7
Phosphorus	1.779e-006	6.025e-009	0.0001868	1.773e-006	0.05498
Potassium	9.335e-005	9.335e-005	3.654		
Selenium	9.093e-005	6.407e-017	5.065e-012	4.956e-015	3.918e-010
Sodium	0.001456	0.001456	33.51		
Sulfur	0.001512	0.001500	48.16	1.172e-005	0.3761

Step # 100 Xi = 1.0000

Temperature = 16.4 C Pressure = 1.013 bars

pH = 6.720 log fO2 = -55.029

Eh = 0.0544 volts pe = 0.9462

Ionic strength = 0.008352

Activity of water = 0.999995

Solvent mass = 0.999315 kg

Solution mass = 0.999790 kg

Solution density = 1.019 g/cm3

Chlorinity = 0.000140 molal

Dissolved solids = 476 mg/kg sol'n

Rock mass = 0.002837 kg

Carbonate alkalinity= 129.66 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.256 uC/cm2

Surface potential = 2.56 mV

Surface area = 1.70e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0544	0.9462
e- + Fe+++ = Fe++	-0.0733	-1.2755

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.01772	-1.751	2.830	0.5364
Se(black)	9.093e-005	-4.041	0.007180	

(total)	2.837	0.5364*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HCO3-	0.002555	155.8	0.9118	-2.6327
Na+	0.001446	33.22	0.9107	-2.8805
Ca++	0.001390	55.68	0.6997	-3.0121
SO4--	0.001281	122.9	0.6865	-3.0560
CO2(aq)	0.001189	52.32	1.0000	-2.9247
Mg++	0.0003973	9.652	0.7119	-3.5484
CaSO4	0.0001709	23.25	1.0000	-3.7673
Cl-	0.0001394	4.940	0.9083	-3.8975
K+	9.285e-005	3.629	0.9083	-4.0740
MgSO4	4.000e-005	4.812	1.0000	-4.3979
CaHCO3+	3.830e-005	3.870	0.9133	-4.4562
Mn++	2.694e-005	1.479	0.6997	-4.7246
MgHCO3+	7.189e-006	0.6131	0.9107	-5.1840
NaSO4-	5.992e-006	0.7130	0.9107	-5.2631
Fe++	5.794e-006	0.3234	0.6997	-5.3921
NaHCO3	4.909e-006	0.4122	1.0000	-5.3090
MnSO4	2.754e-006	0.4156	1.0000	-5.5600
HAsO4--	2.703e-006	0.3781	0.6865	-5.7315
As(OH)3	2.473e-006	0.3113	1.0000	-5.6068
H2AsO4-	2.347e-006	0.3306	0.9107	-5.6702
MnHCO3+	8.669e-007	0.1005	0.9107	-6.1027
CaCl+	8.153e-007	0.06155	0.9107	-6.1293
CO3--	6.591e-007	0.03953	0.6899	-6.3423
CaCO3	6.385e-007	0.06387	1.0000	-6.1949
KSO4-	5.636e-007	0.07613	0.9107	-6.2897
FeSO4	5.615e-007	0.08526	1.0000	-6.2506
FeHCO3+	2.572e-007	0.03004	0.9107	-6.6304

H+	2.071e-007	0.0002087	0.9208	-6.7196
MgCO3	8.819e-008	0.007432	1.0000	-7.0546
MgCl+	6.341e-008	0.003787	0.9107	-7.2385
MnCO3	3.442e-008	0.003954	1.0000	-7.4632
OH-	2.954e-008	0.0005022	0.9095	-7.5707
FeCO3	1.532e-008	0.001774	1.0000	-7.8149
HSO4-	1.408e-008	0.001366	0.9107	-7.8920

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.002557	0.002556	1.0000	-2.5922
>(w)FeOH2+	0.002220	0.002218	1.1049	-2.6537
>(w)FeOH	0.0006595	0.0006591	1.0000	-3.1808
>(w)FeOHAsO4---	0.0006511	0.0006506	0.74129	-3.1864
>(w)FeH2AsO3	0.0004193	0.0004190	1.0000	-3.3775
>(w)FeOCO2-	0.0003808	0.0003806	0.90503	-3.4193
>(s)FeOHCa++	0.0001675	0.0001674	1.2209	-3.7760
>(w)FeHAsO4-	0.0001651	0.0001650	0.90503	-3.7822
>(w)FeH2AsO4	1.798e-005	1.797e-005	1.0000	-4.7451
>(s)FeOH2+	7.583e-006	7.578e-006	1.1049	-5.1201
>(w)FeSO4-	7.363e-006	7.358e-006	0.90503	-5.1329
>(w)FeO-	4.489e-006	4.486e-006	0.90503	-5.3478
>(w)FeOHSO4--	4.365e-006	4.362e-006	0.81908	-5.3600
>(w)FeOCa+	4.299e-006	4.296e-006	1.1049	-5.3666
>(s)FeOH	2.253e-006	2.251e-006	1.0000	-5.6472
>(w)FeHPO4-	1.407e-006	1.406e-006	0.90503	-5.8517
>(w)FeH2PO4	1.929e-007	1.928e-007	1.0000	-6.7147
>(w)FePO4--	1.742e-007	1.741e-007	0.81908	-6.7588
>(s)FeO-	1.533e-008	1.532e-008	0.90503	-7.8143
>(w)FeSeO3-	4.218e-015	4.215e-015	0.90503	-14.3749
>(w)FeOHSeO3--	7.380e-016	7.375e-016	0.81908	-15.1319

>(w)FeSeO4-	1.408e-034	1.407e-034	0.90503	-33.8513
>(w)FeOHSeO4--	9.586e-035	9.579e-035	0.81908	-34.0184

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Siderite	-1.2438
Se(black)	0.0000 sat	Gypsum	-1.6148
Goethite	-0.4651	Monohydrocalcite	-1.7351
Rhodochrosite	-0.4963	Anhydrite	-1.8770
Calcite	-0.7584	Magnesite	-2.1244
MnHPO4(c)	-0.7666	Bassanite	-2.5081
Aragonite	-0.9242	Magnetite	-2.6540
Dolomite	-1.2002	CaSO4^1/2H2O(bet	-2.6875
Dolomite-ord	-1.2002	Dolomite-dis	-2.8088

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.02604	-1.584
Steam	0.01836	-1.736
H2(g)	2.922e-016	-15.534
H2S(g)	2.205e-036	-35.657
CH4(g)	3.170e-040	-39.499
O2(g)	9.352e-056	-55.029
S2(g)	1.833e-067	-66.737

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000177					

>(w)FeOH	0.00709				
As(OH)4-	0.00126	7.52e-006	1.08	0.00125	179.
Ca++	0.00177	0.00160	64.1	0.000172	6.88
Cl-	0.000140	0.000140	4.97		
Fe++	6.63e-006	6.63e-006	0.370		
Fe+++	0.0354	1.02e-012	5.70e-008		
H+	-0.101	0.00119	1.20	0.00392	3.95
H2O	55.5	55.5	1.00e+006	-0.00480	-86.5
HCO3-	0.00673	0.00379	232.	0.00294	179.
HPO4--	1.78e-006	6.02e-009	0.000578	1.77e-006	0.170
K+	9.34e-005	9.34e-005	3.65		
Mg++	0.000444	0.000444	10.8		
Mn++	3.06e-005	3.06e-005	1.68		
Na+	0.00146	0.00146	33.5		
O2(aq)	0.000328	2.52e-006	0.0808	0.000417	13.3
SO4--	0.00151	0.00150	144.	1.17e-005	1.13
SeO3--	9.09e-005	6.41e-017	8.14e-012	4.95e-015	6.29e-010

Sorbed	fraction	log fraction
As(OH)4-	0.9940	-0.003
Ca++	0.09693	-1.014
HCO3-	0.4362	-0.360
HPO4--	0.9966	-0.001
SO4--	0.007751	-2.111
SeO3--	0.9872	-0.006

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001260	7.524e-006	0.5638	0.001253	93.87
Calcium	0.001771	0.001599	64.12	0.0001717	6.882

Carbon	0.006731	0.003795	45.59	0.002936	35.28
Chlorine	0.0001402	0.0001402	4.971		
Hydrogen	110.9	110.9	1.118e+005	0.002266	2.285
Iron	0.03545	6.625e-006	0.3701		
Magnesium	0.0004444	0.0004444	10.80		
Manganese	3.058e-005	3.058e-005	1.680		
Oxygen	55.55	55.49	8.879e+005	0.009907	158.5
Phosphorus	1.779e-006	6.025e-009	0.0001866	1.773e-006	0.05492
Potassium	9.335e-005	9.335e-005	3.651		
Selenium	9.093e-005	6.409e-017	5.061e-012	4.953e-015	3.912e-010
Sodium	0.001456	0.001456	33.48		
Sulfur	0.001512	0.001500	48.11	1.172e-005	0.3758

BEDROCK – MODEL OUTPUT

0.003020 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.009625

Activity of water = 0.999784

Solvent mass = 0.999835 kg

Solution mass = 1.000565 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.006167 molal

Dissolved solids = 729 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.31 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.18 uC/cm2

Surface potential = 11.8 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1020	-1.7529

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006145	217.7	0.9021	-2.2562
HCO3-	0.004376	266.8	0.9061	-2.4018
Na+	0.002985	68.56	0.9048	-2.5686
CO2(aq)	0.001608	70.71	1.0000	-2.7938
K+	0.001212	47.35	0.9021	-2.9613
Ca++	0.0009032	36.17	0.6833	-3.2096
Mg++	0.0001024	2.486	0.6968	-4.1468
SO4--	9.674e-005	9.285	0.6686	-4.1892
CaHCO3+	4.226e-005	4.270	0.9078	-4.4160
CaCl+	2.112e-005	1.594	0.9048	-4.7188
NaHCO3	1.599e-005	1.343	1.0000	-4.7960
CaSO4	8.189e-006	1.114	1.0000	-5.0868
Fe++	6.586e-006	0.3675	0.6833	-5.3468
Mn++	5.115e-006	0.2808	0.6833	-5.4566
MgHCO3+	3.148e-006	0.2684	0.9048	-5.5454
CO3--	1.487e-006	0.08915	0.6724	-6.0001
CaCO3	9.390e-007	0.09392	1.0000	-6.0273
NaSO4-	9.267e-007	0.1102	0.9048	-6.0765
MgSO4	7.602e-007	0.09143	1.0000	-6.1191
MgCl+	6.661e-007	0.03978	0.9048	-6.2199
KSO4-	5.467e-007	0.07384	0.9048	-6.3057
FeHCO3+	4.463e-007	0.05211	0.9048	-6.3939
NaCl	3.363e-007	0.01964	1.0000	-6.4733
MnHCO3+	2.796e-007	0.03239	0.9048	-6.5970
H+	1.730e-007	0.0001742	0.9162	-6.8000
KCl	1.455e-007	0.01084	1.0000	-6.8370

HAsO4--	1.398e-007	0.01955	0.6686	-7.0293
H2AsO4-	9.668e-008	0.01362	0.9048	-7.0581
FeCl+	5.362e-008	0.004892	0.9048	-7.3141
MgCO3	5.269e-008	0.004440	1.0000	-7.2782
OH-	4.772e-008	0.0008111	0.9035	-7.3654
FeSO4	4.615e-008	0.007006	1.0000	-7.3358
MnSO4	4.009e-008	0.006050	1.0000	-7.3969
FeCO3	3.020e-008	0.003496	1.0000	-7.5200
MnCl+	1.358e-008	0.001226	0.9048	-7.9107
MnCO3	1.307e-008	0.001501	1.0000	-7.8838
NaCO3-	1.093e-008	0.0009067	0.9048	-8.0048

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08365	0.08363	1.0000	-1.0776
>(w)FeOH2+	0.02769	0.02768	1.5857	-1.5578
>(w)FeOCO2-	0.02151	0.02151	0.63064	-1.6673
>(w)FeOH	0.01421	0.01420	1.0000	-1.8475
>(s)FeOHCa++	0.003328	0.003327	2.5144	-2.4778
>(w)FeOHAsO4---	0.002765	0.002765	0.25082	-2.5583
>(s)FeOH2+	0.0002831	0.0002831	1.5857	-3.5480
>(w)FeHAsO4-	0.0002352	0.0002351	0.63064	-3.6286
>(w)FeO-	0.0001670	0.0001670	0.63064	-3.7773
>(s)FeOH	0.0001453	0.0001452	1.0000	-3.8378
>(w)FeOCa+	4.928e-005	4.927e-005	1.5857	-4.3073
>(w)FeH2AsO4	1.483e-005	1.483e-005	1.0000	-4.8288
>(w)FeOHSO4--	1.425e-005	1.424e-005	0.39771	-4.8463
>(w)FeSO4-	1.392e-005	1.391e-005	0.63064	-4.8564
>(w)FeH2AsO3	5.121e-006	5.120e-006	1.0000	-5.2906
>(s)FeO-	1.708e-006	1.707e-006	0.63064	-5.7676

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2494
Goethite	-0.4707	Monohydrocalcite	-1.5771
Calcite	-0.5936	Magnetite	-2.2596
Aragonite	-0.7588	Magnesite	-2.3161
Siderite	-0.8199	Dolomite-dis	-2.8313
Rhodochrosite	-0.8743	Gypsum	-2.9482
Dolomite	-1.2494		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03862	-1.413
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.586e-044	-43.587
CH4(g)	1.104e-046	-45.957
O2(g)	1.803e-051	-50.744
S2(g)	6.361e-080	-79.196

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00302	2.38e-007	0.0340	0.00302	431.	
Ca++	0.00435	0.000976	39.1	0.00338	135.	
Cl-	0.00617	0.00617	218.			
Fe++	7.16e-006	7.16e-006	0.400			

Fe+++	0.751	1.11e-012	6.20e-008		
H+	-2.15	0.00160	1.62	0.106	107.
H2O	56.5	55.5	9.99e+005	-0.108	-1.95e+003
HCO3-	0.111	0.00605	369.	0.105	6.41e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	0.00151	1.18e-007	0.00378	0.00151	48.2
SO4--	0.000135	0.000107	10.3	2.82e-005	2.70

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7758	-0.110
HCO3-	0.9456	-0.024
SO4--	0.2080	-0.682

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003020	2.378e-007	0.01781	0.003020	226.1
Calcium	0.004352	0.0009755	39.08	0.003376	135.3
Carbon	0.1112	0.006047	72.60	0.1051	1262.
Chlorine	0.006166	0.006166	218.5		
Hydrogen	111.0	111.0	1.118e+005	0.006244	6.290
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.599		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2222	3553.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		

Sulfur	0.0001354	0.0001072	3.436	2.816e-005	0.9022

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.009617

Activity of water = 0.999785

Solvent mass = 1.000835 kg

Solution mass = 1.001565 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.006161 molal

Dissolved solids = 729 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.22 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.19 uC/cm2

Surface potential = 11.9 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1019	-1.7523

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006139	217.5	0.9021	-2.2566
HCO3-	0.004374	266.7	0.9061	-2.4019
Na+	0.002982	68.50	0.9048	-2.5690
CO2(aq)	0.001608	70.70	1.0000	-2.7938
K+	0.001211	47.30	0.9021	-2.9617
Ca++	0.0009027	36.15	0.6834	-3.2098
Mg++	0.0001023	2.484	0.6969	-4.1471
SO4--	9.665e-005	9.277	0.6687	-4.1896
CaHCO3+	4.223e-005	4.266	0.9078	-4.4164
CaCl+	2.109e-005	1.592	0.9048	-4.7194
NaHCO3	1.597e-005	1.341	1.0000	-4.7966
CaSO4	8.179e-006	1.113	1.0000	-5.0873
Fe++	6.579e-006	0.3672	0.6834	-5.3471
Mn++	5.110e-006	0.2805	0.6834	-5.4569
MgHCO3+	3.144e-006	0.2681	0.9048	-5.5459
CO3--	1.486e-006	0.08910	0.6725	-6.0003
CaCO3	9.381e-007	0.09382	1.0000	-6.0278
NaSO4-	9.251e-007	0.1100	0.9048	-6.0773
MgSO4	7.590e-007	0.09128	1.0000	-6.1198
MgCl+	6.649e-007	0.03970	0.9048	-6.2207
KSO4-	5.458e-007	0.07371	0.9048	-6.3064
FeHCO3+	4.457e-007	0.05205	0.9048	-6.3944
NaCl	3.356e-007	0.01960	1.0000	-6.4741
MnHCO3+	2.792e-007	0.03235	0.9048	-6.5975
H+	1.730e-007	0.0001742	0.9162	-6.7999
KCl	1.453e-007	0.01082	1.0000	-6.8378
HAsO4--	1.397e-007	0.01953	0.6687	-7.0296
H2AsO4-	9.664e-008	0.01361	0.9048	-7.0583

FeCl+	5.352e-008	0.004883	0.9048	-7.3149
MgCO3	5.262e-008	0.004433	1.0000	-7.2788
OH-	4.771e-008	0.0008109	0.9035	-7.3654
FeSO4	4.608e-008	0.006994	1.0000	-7.3365
MnSO4	4.003e-008	0.006040	1.0000	-7.3976
FeCO3	3.016e-008	0.003491	1.0000	-7.5206
MnCl+	1.355e-008	0.001224	0.9048	-7.9115
MnCO3	1.305e-008	0.001499	1.0000	-7.8844
NaCO3-	1.092e-008	0.0009053	0.9048	-8.0054

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08356	0.08363	1.0000	-1.0780
>(w)FeOH2+	0.02766	0.02768	1.5860	-1.5581
>(w)FeOCO2-	0.02149	0.02151	0.63051	-1.6678
>(w)FeOH	0.01419	0.01421	1.0000	-1.8479
>(s)FeOHCa++	0.003324	0.003327	2.5154	-2.4783
>(w)FeOHAsO4---	0.002762	0.002765	0.25066	-2.5587
>(s)FeOH2+	0.0002830	0.0002833	1.5860	-3.5482
>(w)FeHAsO4-	0.0002349	0.0002351	0.63051	-3.6291
>(w)FeO-	0.0001668	0.0001670	0.63051	-3.7777
>(s)FeOH	0.0001452	0.0001454	1.0000	-3.8379
>(w)FeOCa+	4.919e-005	4.923e-005	1.5860	-4.3081
>(w)FeH2AsO4	1.481e-005	1.483e-005	1.0000	-4.8293
>(w)FeOHSO4--	1.423e-005	1.424e-005	0.39755	-4.8469
>(w)FeSO4-	1.390e-005	1.391e-005	0.63051	-4.8570
>(w)FeH2AsO3	5.116e-006	5.120e-006	1.0000	-5.2911
>(s)FeO-	1.707e-006	1.709e-006	0.63051	-5.7677

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2505
Goethite	-0.4707	Monohydrocalcite	-1.5775
Calcite	-0.5940	Magnetite	-2.2601
Aragonite	-0.7593	Magnesite	-2.3167
Siderite	-0.8205	Dolomite-dis	-2.8323
Rhodochrosite	-0.8749	Gypsum	-2.9487
Dolomite	-1.2504		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03862	-1.413
Steam	0.02292	-1.640
H2(g)	8.837e-018	-17.054
H2S(g)	2.586e-044	-43.587
CH4(g)	1.105e-046	-45.957
O2(g)	1.802e-051	-50.744
S2(g)	6.360e-080	-79.197

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00302	2.38e-007	0.0340	0.00302	431.	
Ca++	0.00435	0.000976	39.1	0.00338	135.	
Cl-	0.00617	0.00617	218.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.20e-008			
H+	-2.15	0.00161	1.62	0.106	107.	

H2O	56.6	55.6	9.99e+005	-0.108	-1.95e+003
HCO3-	0.111	0.00605	369.	0.105	6.41e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	0.00151	1.18e-007	0.00378	0.00151	48.2
SO4--	0.000135	0.000107	10.3	2.82e-005	2.70

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7758	-0.110
HCO3-	0.9456	-0.024
SO4--	0.2079	-0.682

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003020	2.379e-007	0.01780	0.003020	225.9
Calcium	0.004352	0.0009759	39.05	0.003376	135.1
Carbon	0.1112	0.006052	72.57	0.1051	1261.
Chlorine	0.006166	0.006166	218.3		
Hydrogen	111.1	111.1	1.118e+005	0.006247	6.287
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2222	3549.
Potassium	0.001212	0.001212	47.33		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001354	0.0001072	3.433	2.815e-005	0.9011

0.001154 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010045

Activity of water = 0.999755

Solvent mass = 0.999835 kg

Solution mass = 1.000595 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007015 molal

Dissolved solids = 759 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.41 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.41 uC/cm2

Surface potential = 14.1 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1018	-1.7497

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006989	247.6	0.9003	-2.2012
HCO3-	0.004378	267.0	0.9044	-2.4023
Na+	0.002985	68.56	0.9031	-2.5694
CO2(aq)	0.001606	70.62	1.0000	-2.7943
K+	0.001212	47.34	0.9003	-2.9622
Ca++	0.0009010	36.09	0.6787	-3.2136
Mg++	0.0001023	2.485	0.6925	-4.1497
SO4--	9.688e-005	9.299	0.6635	-4.1919
CaHCO3+	4.189e-005	4.232	0.9062	-4.4206
CaCl+	2.380e-005	1.796	0.9031	-4.6677
NaHCO3	1.594e-005	1.338	1.0000	-4.7974
CaSO4	8.064e-006	1.097	1.0000	-5.0935
Fe++	6.583e-006	0.3673	0.6787	-5.3500
Mn++	5.115e-006	0.2808	0.6787	-5.4595
MgHCO3+	3.129e-006	0.2668	0.9031	-5.5488
CO3--	1.496e-006	0.08970	0.6674	-6.0007
CaCO3	9.292e-007	0.09293	1.0000	-6.0319
NaSO4-	9.210e-007	0.1096	0.9031	-6.0800
MgCl+	7.525e-007	0.04493	0.9031	-6.1678
MgSO4	7.505e-007	0.09026	1.0000	-6.1247
KSO4-	5.433e-007	0.07338	0.9031	-6.3092
FeHCO3+	4.433e-007	0.05176	0.9031	-6.3976
NaCl	3.810e-007	0.02225	1.0000	-6.4191
MnHCO3+	2.778e-007	0.03219	0.9031	-6.6005
H+	1.732e-007	0.0001745	0.9149	-6.8000
KCl	1.649e-007	0.01228	1.0000	-6.7828

FeCl+	6.054e-008	0.005523	0.9031	-7.2622
MgCO3	5.227e-008	0.004404	1.0000	-7.2817
OH-	4.782e-008	0.0008126	0.9017	-7.3654
FeSO4	4.553e-008	0.006911	1.0000	-7.3417
HAsO4--	4.121e-008	0.005762	0.6635	-7.5631
MnSO4	3.958e-008	0.005972	1.0000	-7.4025
FeCO3	2.994e-008	0.003466	1.0000	-7.5237
H2AsO4-	2.834e-008	0.003991	0.9031	-7.5919
MnCl+	1.534e-008	0.001385	0.9031	-7.8586
MnCO3	1.296e-008	0.001489	1.0000	-7.8873
NaCO3-	1.092e-008	0.0009055	0.9031	-8.0061

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08487	0.08486	1.0000	-1.0712
>(w)FeOH2+	0.02574	0.02574	1.7325	-1.5893
>(w)FeOCO2-	0.02385	0.02384	0.57719	-1.6225
>(w)FeOH	0.01443	0.01443	1.0000	-1.8407
>(s)FeOHCa++	0.003276	0.003275	3.0017	-2.4847
>(w)FeOHAsO4---	0.001072	0.001072	0.19229	-2.9698
>(s)FeOH2+	0.0003073	0.0003073	1.7325	-3.5124
>(w)FeO-	0.0001854	0.0001853	0.57719	-3.7320
>(s)FeOH	0.0001723	0.0001723	1.0000	-3.7637
>(w)FeHAsO4-	7.638e-005	7.637e-005	0.57719	-4.1170
>(w)FeOCa+	4.540e-005	4.539e-005	1.7325	-4.3430
>(w)FeOHSO4--	1.717e-005	1.717e-005	0.33315	-4.7652
>(w)FeSO4-	1.535e-005	1.535e-005	0.57719	-4.8138
>(w)FeH2AsO4	4.408e-006	4.408e-006	1.0000	-5.3557
>(s)FeO-	2.213e-006	2.213e-006	0.57719	-5.6550
>(w)FeH2AsO3	1.522e-006	1.522e-006	1.0000	-5.8175

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2575
Goethite	-0.4707	Monohydrocalcite	-1.5817
Calcite	-0.5982	Magnetite	-2.2628
Aragonite	-0.7634	Magnesite	-2.3196
Siderite	-0.8237	Dolomite-dis	-2.8393
Rhodochrosite	-0.8778	Gypsum	-2.9549
Dolomite	-1.2575		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03858	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.570e-044	-43.590
CH4(g)	1.103e-046	-45.957
O2(g)	1.803e-051	-50.744
S2(g)	6.285e-080	-79.202

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00115	7.00e-008	0.00999	0.00115	165.	
Ca++	0.00430	0.000976	39.1	0.00332	133.	
Cl-	0.00701	0.00701	248.			
Fe++	7.16e-006	7.16e-006	0.400			

Fe+++	0.751	1.11e-012	6.20e-008		
H+	-2.14	0.00160	1.61	0.109	109.
H2O	56.5	55.5	9.99e+005	-0.110	-1.98e+003
HCO3-	0.115	0.00605	369.	0.109	6.63e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	0.000576	3.48e-008	0.00111	0.000576	18.4
SO4--	0.000140	0.000107	10.3	3.25e-005	3.12

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7729	-0.112
HCO3-	0.9473	-0.024
SO4--	0.2327	-0.633

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001154	6.995e-008	0.005238	0.001154	86.42
Calcium	0.004296	0.0009755	39.08	0.003321	133.0
Carbon	0.1148	0.006047	72.59	0.1087	1305.
Chlorine	0.007013	0.007013	248.5		
Hydrogen	111.0	111.0	1.118e+005	0.001959	1.973
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2221	3551.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		

Sulfur	0.0001397	0.0001072	3.436	3.252e-005	1.042

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010037

Activity of water = 0.999755

Solvent mass = 1.000835 kg

Solution mass = 1.001595 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007008 molal

Dissolved solids = 758 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.33 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.41 uC/cm2

Surface potential = 14.1 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1017	-1.7491

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.006982	247.4	0.9003	-2.2016
HCO3-	0.004377	266.9	0.9044	-2.4025
Na+	0.002982	68.49	0.9031	-2.5698
CO2(aq)	0.001606	70.61	1.0000	-2.7944
K+	0.001211	47.30	0.9003	-2.9626
Ca++	0.0009005	36.07	0.6787	-3.2138
Mg++	0.0001022	2.482	0.6926	-4.1501
SO4--	9.679e-005	9.291	0.6636	-4.1922
CaHCO3+	4.186e-005	4.229	0.9062	-4.4210
CaCl+	2.376e-005	1.794	0.9031	-4.6683
NaHCO3	1.592e-005	1.337	1.0000	-4.7980
CaSO4	8.054e-006	1.096	1.0000	-5.0940
Fe++	6.576e-006	0.3670	0.6787	-5.3503
Mn++	5.110e-006	0.2805	0.6787	-5.4599
MgHCO3+	3.125e-006	0.2665	0.9031	-5.5494
CO3--	1.495e-006	0.08964	0.6675	-6.0009
CaCO3	9.283e-007	0.09284	1.0000	-6.0323
NaSO4-	9.194e-007	0.1094	0.9031	-6.0808
MgCl+	7.511e-007	0.04485	0.9031	-6.1686
MgSO4	7.493e-007	0.09011	1.0000	-6.1254
KSO4-	5.424e-007	0.07325	0.9031	-6.3100
FeHCO3+	4.427e-007	0.05170	0.9031	-6.3981
NaCl	3.803e-007	0.02221	1.0000	-6.4199
MnHCO3+	2.775e-007	0.03215	0.9031	-6.6010
H+	1.733e-007	0.0001745	0.9149	-6.7999
KCl	1.646e-007	0.01226	1.0000	-6.7837
FeCl+	6.043e-008	0.005513	0.9031	-7.2630
MgCO3	5.220e-008	0.004398	1.0000	-7.2823

OH-	4.781e-008	0.0008124	0.9017	-7.3654
FeSO4	4.546e-008	0.006900	1.0000	-7.3424
HAsO4--	4.118e-008	0.005758	0.6636	-7.5634
MnSO4	3.952e-008	0.005962	1.0000	-7.4032
FeCO3	2.990e-008	0.003461	1.0000	-7.5243
H2AsO4-	2.833e-008	0.003989	0.9031	-7.5921
MnCl+	1.531e-008	0.001383	0.9031	-7.8593
MnCO3	1.295e-008	0.001487	1.0000	-7.8879
NaCO3-	1.090e-008	0.0009041	0.9031	-8.0068

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08478	0.08486	1.0000	-1.0717
>(w)FeOH2+	0.02572	0.02574	1.7329	-1.5897
>(w)FeOCO2-	0.02382	0.02384	0.57707	-1.6230
>(w)FeOH	0.01442	0.01443	1.0000	-1.8411
>(s)FeOHCa++	0.003272	0.003275	3.0029	-2.4851
>(w)FeOHAsO4---	0.001071	0.001072	0.19217	-2.9702
>(s)FeOH2+	0.0003073	0.0003075	1.7329	-3.5125
>(w)FeO-	0.0001852	0.0001854	0.57707	-3.7324
>(s)FeOH	0.0001723	0.0001724	1.0000	-3.7638
>(w)FeHAsO4-	7.630e-005	7.636e-005	0.57707	-4.1175
>(w)FeOCa+	4.532e-005	4.536e-005	1.7329	-4.3437
>(w)FeOHSO4--	1.715e-005	1.716e-005	0.33301	-4.7657
>(w)FeSO4-	1.533e-005	1.535e-005	0.57707	-4.8143
>(w)FeH2AsO4	4.404e-006	4.407e-006	1.0000	-5.3562
>(s)FeO-	2.213e-006	2.214e-006	0.57707	-5.6551
>(w)FeH2AsO3	1.521e-006	1.522e-006	1.0000	-5.8179

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2585
Goethite	-0.4707	Monohydrocalcite	-1.5821
Calcite	-0.5986	Magnetite	-2.2633
Aragonite	-0.7638	Magnesite	-2.3202
Siderite	-0.8243	Dolomite-dis	-2.8404
Rhodochrosite	-0.8784	Gypsum	-2.9554
Dolomite	-1.2585		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03857	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.570e-044	-43.590
CH4(g)	1.103e-046	-45.957
O2(g)	1.802e-051	-50.744
S2(g)	6.284e-080	-79.202

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00115	7.00e-008	0.00999	0.00115	165.	
Ca++	0.00430	0.000976	39.1	0.00332	133.	
Cl-	0.00701	0.00701	248.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.109	109.	

H2O	56.6	55.6	9.99e+005	-0.110	-1.98e+003
HCO3-	0.115	0.00605	369.	0.109	6.62e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	0.000576	3.48e-008	0.00111	0.000576	18.4
SO4--	0.000140	0.000107	10.3	3.25e-005	3.12

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7728	-0.112
HCO3-	0.9473	-0.024
SO4--	0.2326	-0.633

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001154	6.998e-008	0.005235	0.001154	86.34
Calcium	0.004296	0.0009759	39.05	0.003320	132.9
Carbon	0.1148	0.006052	72.57	0.1087	1304.
Chlorine	0.007013	0.007013	248.3		
Hydrogen	111.1	111.1	1.118e+005	0.001962	1.974
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2220	3547.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001397	0.0001072	3.432	3.251e-005	1.041

0.0004341 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010207

Activity of water = 0.999744

Solvent mass = 0.999835 kg

Solution mass = 1.000606 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007341 molal

Dissolved solids = 771 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.45 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.50 uC/cm2

Surface potential = 15.0 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7485

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007315	259.1	0.8996	-2.1817
HCO3-	0.004379	267.0	0.9038	-2.4025
Na+	0.002985	68.56	0.9024	-2.5697
CO2(aq)	0.001605	70.58	1.0000	-2.7945
K+	0.001212	47.34	0.8996	-2.9625
Ca++	0.0009002	36.05	0.6769	-3.2151
Mg++	0.0001023	2.484	0.6909	-4.1508
SO4--	9.693e-005	9.304	0.6616	-4.1929
CaHCO3+	4.176e-005	4.218	0.9056	-4.4224
CaCl+	2.482e-005	1.873	0.9024	-4.6498
NaHCO3	1.592e-005	1.337	1.0000	-4.7979
CaSO4	8.017e-006	1.091	1.0000	-5.0960
Fe++	6.581e-006	0.3673	0.6769	-5.3512
Mn++	5.115e-006	0.2808	0.6769	-5.4606
MgHCO3+	3.122e-006	0.2662	0.9024	-5.5502
CO3--	1.499e-006	0.08991	0.6656	-6.0009
CaCO3	9.255e-007	0.09256	1.0000	-6.0336
NaSO4-	9.188e-007	0.1093	0.9024	-6.0814
MgCl+	7.855e-007	0.04690	0.9024	-6.1495
MgSO4	7.468e-007	0.08982	1.0000	-6.1268
KSO4-	5.420e-007	0.07320	0.9024	-6.3106
FeHCO3+	4.421e-007	0.05163	0.9024	-6.3990
NaCl	3.982e-007	0.02325	1.0000	-6.4000
MnHCO3+	2.772e-007	0.03212	0.9024	-6.6018
H+	1.733e-007	0.0001746	0.9144	-6.8000
KCl	1.723e-007	0.01283	1.0000	-6.7637

FeCl+	6.318e-008	0.005764	0.9024	-7.2440
MgCO3	5.212e-008	0.004391	1.0000	-7.2830
OH-	4.785e-008	0.0008132	0.9010	-7.3654
FeSO4	4.530e-008	0.006876	1.0000	-7.3439
MnSO4	3.939e-008	0.005942	1.0000	-7.4047
FeCO3	2.984e-008	0.003455	1.0000	-7.5252
MnCl+	1.601e-008	0.001446	0.9024	-7.8402
HAsO4--	1.402e-008	0.001961	0.6616	-8.0325
MnCO3	1.292e-008	0.001484	1.0000	-7.8886
NaCO3-	1.091e-008	0.0009050	0.9024	-8.0067

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08529	0.08528	1.0000	-1.0691
>(w)FeOH2+	0.02501	0.02501	1.7926	-1.6018
>(w)FeOCO2-	0.02480	0.02479	0.55784	-1.6056
>(w)FeOH	0.01451	0.01451	1.0000	-1.8383
>(s)FeOHCa++	0.003254	0.003254	3.2135	-2.4875
>(w)FeOHAsO4---	0.0004051	0.0004051	0.17359	-3.3924
>(s)FeOH2+	0.0003170	0.0003170	1.7926	-3.4989
>(w)FeO-	0.0001928	0.0001928	0.55784	-3.7149
>(s)FeOH	0.0001839	0.0001839	1.0000	-3.7354
>(w)FeOCa+	4.396e-005	4.395e-005	1.7926	-4.3570
>(w)FeHAsO4-	2.696e-005	2.696e-005	0.55784	-4.5693
>(w)FeOHSO4--	1.844e-005	1.844e-005	0.31118	-4.7343
>(w)FeSO4-	1.593e-005	1.593e-005	0.55784	-4.7977
>(s)FeO-	2.444e-006	2.444e-006	0.55784	-5.6119
>(w)FeH2AsO4	1.504e-006	1.504e-006	1.0000	-5.8228
>(w)FeH2AsO3	5.193e-007	5.192e-007	1.0000	-6.2846

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2605
Goethite	-0.4707	Monohydrocalcite	-1.5834
Calcite	-0.5999	Magnetite	-2.2640
Aragonite	-0.7652	Magnesite	-2.3209
Siderite	-0.8251	Dolomite-dis	-2.8424
Rhodochrosite	-0.8791	Gypsum	-2.9575
Dolomite	-1.2605		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03856	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.564e-044	-43.591
CH4(g)	1.103e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.256e-080	-79.204

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.000434	2.38e-008	0.00340	0.000434	62.0	
Ca++	0.00427	0.000976	39.1	0.00330	132.	
Cl-	0.00734	0.00734	260.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			

H+	-2.14	0.00160	1.61	0.110	110.
H2O	56.5	55.5	9.99e+005	-0.111	-1.99e+003
HCO3-	0.116	0.00605	369.	0.110	6.71e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	0.000217	1.18e-008	0.000378	0.000217	6.93
SO4--	0.000142	0.000107	10.3	3.44e-005	3.30

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7717	-0.113
HCO3-	0.9479	-0.023
SO4--	0.2427	-0.615

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0004341	2.378e-008	0.001781	0.0004340	32.50
Calcium	0.004273	0.0009755	39.08	0.003298	132.1
Carbon	0.1161	0.006047	72.59	0.1101	1321.
Chlorine	0.007340	0.007340	260.1		
Hydrogen	111.0	111.0	1.118e+005	0.0002806	0.2827
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2220	3549.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001416	0.0001072	3.436	3.437e-005	1.101

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010199

Activity of water = 0.999744

Solvent mass = 1.000835 kg

Solution mass = 1.001607 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007334 molal

Dissolved solids = 770 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.37 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.50 uC/cm2

Surface potential = 15.0 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1017	-1.7479

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007307	258.9	0.8997	-2.1822
HCO3-	0.004378	266.9	0.9038	-2.4027
Na+	0.002982	68.49	0.9025	-2.5701
CO2(aq)	0.001605	70.57	1.0000	-2.7946
K+	0.001211	47.30	0.8997	-2.9629
Ca++	0.0008997	36.03	0.6770	-3.2153
Mg++	0.0001022	2.482	0.6910	-4.1512
SO4--	9.685e-005	9.296	0.6617	-4.1932
CaHCO3+	4.172e-005	4.215	0.9056	-4.4227
CaCl+	2.478e-005	1.870	0.9025	-4.6504
NaHCO3	1.590e-005	1.335	1.0000	-4.7985
CaSO4	8.007e-006	1.089	1.0000	-5.0965
Fe++	6.575e-006	0.3669	0.6770	-5.3515
Mn++	5.110e-006	0.2805	0.6770	-5.4610
MgHCO3+	3.118e-006	0.2658	0.9025	-5.5507
CO3--	1.498e-006	0.08985	0.6657	-6.0011
CaCO3	9.246e-007	0.09247	1.0000	-6.0341
NaSO4-	9.172e-007	0.1091	0.9025	-6.0821
MgCl+	7.840e-007	0.04682	0.9025	-6.1502
MgSO4	7.456e-007	0.08968	1.0000	-6.1275
KSO4-	5.411e-007	0.07307	0.9025	-6.3113
FeHCO3+	4.416e-007	0.05157	0.9025	-6.3995
NaCl	3.974e-007	0.02321	1.0000	-6.4008
MnHCO3+	2.769e-007	0.03208	0.9025	-6.6023
H+	1.734e-007	0.0001746	0.9144	-6.7999
KCl	1.720e-007	0.01281	1.0000	-6.7646
FeCl+	6.306e-008	0.005753	0.9025	-7.2448
MgCO3	5.204e-008	0.004385	1.0000	-7.2836

OH-	4.784e-008	0.0008130	0.9011	-7.3654
FeSO4	4.523e-008	0.006865	1.0000	-7.3446
MnSO4	3.932e-008	0.005933	1.0000	-7.4054
FeCO3	2.980e-008	0.003450	1.0000	-7.5257
MnCl+	1.598e-008	0.001443	0.9025	-7.8410
HAsO4--	1.401e-008	0.001960	0.6617	-8.0327
MnCO3	1.291e-008	0.001482	1.0000	-7.8892
NaCO3-	1.090e-008	0.0009037	0.9025	-8.0073

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08520	0.08527	1.0000	-1.0696
>(w)FeOH2+	0.02499	0.02501	1.7930	-1.6022
>(w)FeOCO2-	0.02477	0.02479	0.55772	-1.6061
>(w)FeOH	0.01450	0.01451	1.0000	-1.8387
>(s)FeOHCa++	0.003251	0.003254	3.2149	-2.4880
>(w)FeOHAsO4---	0.0004047	0.0004051	0.17348	-3.3928
>(s)FeOH2+	0.0003169	0.0003172	1.7930	-3.4990
>(w)FeO-	0.0001927	0.0001928	0.55772	-3.7152
>(s)FeOH	0.0001839	0.0001840	1.0000	-3.7355
>(w)FeOCa+	4.388e-005	4.392e-005	1.7930	-4.3577
>(w)FeHAsO4-	2.693e-005	2.695e-005	0.55772	-4.5697
>(w)FeOHSO4--	1.842e-005	1.843e-005	0.31106	-4.7348
>(w)FeSO4-	1.591e-005	1.593e-005	0.55772	-4.7982
>(s)FeO-	2.443e-006	2.445e-006	0.55772	-5.6120
>(w)FeH2AsO4	1.502e-006	1.504e-006	1.0000	-5.8232
>(w)FeH2AsO3	5.188e-007	5.192e-007	1.0000	-6.2850

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

log Q/K log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2615
Goethite	-0.4707	Monohydrocalcite	-1.5838
Calcite	-0.6003	Magnetite	-2.2645
Aragonite	-0.7656	Magnesite	-2.3215
Siderite	-0.8257	Dolomite-dis	-2.8434
Rhodochrosite	-0.8797	Gypsum	-2.9580
Dolomite	-1.2615		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.564e-044	-43.591
CH4(g)	1.103e-046	-45.957
O2(g)	1.802e-051	-50.744
S2(g)	6.255e-080	-79.204

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.000434	2.38e-008	0.00340	0.000434	61.9	
Ca++	0.00427	0.000976	39.1	0.00330	132.	
Cl-	0.00734	0.00734	260.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	110.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	

HCO3-	0.116	0.00605	369.	0.110	6.70e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	0.000217	1.18e-008	0.000378	0.000217	6.92
SO4--	0.000142	0.000107	10.3	3.44e-005	3.30

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7716	-0.113
HCO3-	0.9479	-0.023
SO4--	0.2427	-0.615

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0004341	2.379e-008	0.001780	0.0004340	32.47
Calcium	0.004273	0.0009759	39.05	0.003297	132.0
Carbon	0.1161	0.006052	72.57	0.1101	1320.
Chlorine	0.007340	0.007340	259.8		
Hydrogen	111.1	111.1	1.118e+005	0.0002834	0.2852
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2220	3545.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001416	0.0001072	3.432	3.436e-005	1.100

0.0001331 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010274

Activity of water = 0.999739

Solvent mass = 0.999835 kg

Solution mass = 1.000611 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007477 molal

Dissolved solids = 775 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.54 uC/cm2

Surface potential = 15.4 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7480

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007450	263.9	0.8993	-2.1739
HCO3-	0.004380	267.0	0.9035	-2.4026
Na+	0.002985	68.56	0.9022	-2.5698
CO2(aq)	0.001605	70.57	1.0000	-2.7946
K+	0.001212	47.34	0.8993	-2.9626
Ca++	0.0008998	36.04	0.6762	-3.2158
Mg++	0.0001023	2.484	0.6902	-4.1512
SO4--	9.696e-005	9.306	0.6608	-4.1933
CaHCO3+	4.170e-005	4.212	0.9053	-4.4231
CaCl+	2.524e-005	1.905	0.9022	-4.6426
NaHCO3	1.592e-005	1.336	1.0000	-4.7981
CaSO4	7.997e-006	1.088	1.0000	-5.0971
Fe++	6.581e-006	0.3672	0.6762	-5.3517
Mn++	5.115e-006	0.2808	0.6762	-5.4611
MgHCO3+	3.119e-006	0.2659	0.9022	-5.5507
CO3--	1.501e-006	0.09000	0.6648	-6.0010
CaCO3	9.239e-007	0.09240	1.0000	-6.0344
NaSO4-	9.180e-007	0.1092	0.9022	-6.0819
MgCl+	7.992e-007	0.04772	0.9022	-6.1421
MgSO4	7.453e-007	0.08964	1.0000	-6.1277
KSO4-	5.415e-007	0.07313	0.9022	-6.3111
FeHCO3+	4.417e-007	0.05158	0.9022	-6.3996
NaCl	4.053e-007	0.02367	1.0000	-6.3922
MnHCO3+	2.769e-007	0.03209	0.9022	-6.6023
KCl	1.754e-007	0.01306	1.0000	-6.7560
H+	1.734e-007	0.0001746	0.9142	-6.8000

FeCl+	6.427e-008	0.005864	0.9022	-7.2367
MgCO3	5.205e-008	0.004385	1.0000	-7.2836
OH-	4.786e-008	0.0008134	0.9008	-7.3654
FeSO4	4.521e-008	0.006862	1.0000	-7.3448
MnSO4	3.931e-008	0.005930	1.0000	-7.4055
FeCO3	2.980e-008	0.003450	1.0000	-7.5257
MnCl+	1.629e-008	0.001471	0.9022	-7.8329
MnCO3	1.291e-008	0.001482	1.0000	-7.8892
NaCO3-	1.091e-008	0.0009049	0.9022	-8.0069

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08545	0.08544	1.0000	-1.0683
>(w)FeOCO2-	0.02520	0.02520	0.54996	-1.5986
>(w)FeOH2+	0.02471	0.02471	1.8183	-1.6071
>(w)FeOH	0.01454	0.01454	1.0000	-1.8374
>(s)FeOHCa++	0.003245	0.003245	3.3063	-2.4888
>(s)FeOH2+	0.0003211	0.0003211	1.8183	-3.4933
>(w)FeO-	0.0001960	0.0001960	0.54996	-3.7078
>(s)FeOH	0.0001890	0.0001889	1.0000	-3.7236
>(w)FeOHAsO4---	0.0001245	0.0001245	0.16634	-3.9048
>(w)FeOCa+	4.337e-005	4.336e-005	1.8183	-4.3629
>(w)FeOHSO4--	1.899e-005	1.899e-005	0.30245	-4.7214
>(w)FeSO4-	1.618e-005	1.618e-005	0.54996	-4.7910
>(w)FeHAsO4-	8.053e-006	8.052e-006	0.54996	-5.0940
>(s)FeO-	2.547e-006	2.547e-006	0.54996	-5.5940
>(w)FeH2AsO4	4.429e-007	4.428e-007	1.0000	-6.3537
>(w)FeH2AsO3	1.529e-007	1.529e-007	1.0000	-6.8155

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2618
Goethite	-0.4707	Monohydrocalcite	-1.5842
Calcite	-0.6006	Magnetite	-2.2645
Aragonite	-0.7659	Magnesite	-2.3214
Siderite	-0.8257	Dolomite-dis	-2.8436
Rhodochrosite	-0.8796	Gypsum	-2.9585
Dolomite	-1.2618		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.562e-044	-43.591
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.244e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.000133	7.00e-009	0.000999	0.000133	19.0	
Ca++	0.00426	0.000976	39.1	0.00329	132.	
Cl-	0.00748	0.00748	265.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-1.99e+003
HCO3-	0.117	0.00605	369.	0.111	6.75e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	6.65e-005	3.48e-009	0.000111	6.65e-005	2.13
SO4--	0.000142	0.000107	10.3	3.52e-005	3.38

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7712	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2470	-0.607

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001331	6.995e-009	0.0005238	0.0001331	9.969
Calcium	0.004264	0.0009755	39.08	0.003288	131.7
Carbon	0.1167	0.006047	72.59	0.1106	1328.
Chlorine	0.007476	0.007476	264.9		
Hydrogen	111.0	111.0	1.118e+005	-0.0004243	-0.4273
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001424	0.0001072	3.436	3.517e-005	1.127

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010266

Activity of water = 0.999739

Solvent mass = 1.000835 kg

Solution mass = 1.001611 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007470 molal

Dissolved solids = 775 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.38 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.54 uC/cm2

Surface potential = 15.4 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7474

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)	60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007443	263.7	0.8994	-2.1743
HCO3-	0.004378	266.9	0.9035	-2.4028
Na+	0.002982	68.49	0.9022	-2.5703
CO2(aq)	0.001604	70.56	1.0000	-2.7947
K+	0.001211	47.30	0.8994	-2.9631
Ca++	0.0008993	36.02	0.6763	-3.2160
Mg++	0.0001022	2.481	0.6903	-4.1516
SO4--	9.687e-005	9.298	0.6609	-4.1937
CaHCO3+	4.166e-005	4.209	0.9054	-4.4234
CaCl+	2.521e-005	1.902	0.9022	-4.6432
NaHCO3	1.590e-005	1.334	1.0000	-4.7987
CaSO4	7.988e-006	1.087	1.0000	-5.0976
Fe++	6.575e-006	0.3669	0.6763	-5.3520
Mn++	5.110e-006	0.2805	0.6763	-5.4614
MgHCO3+	3.115e-006	0.2656	0.9022	-5.5512
CO3--	1.500e-006	0.08994	0.6649	-6.0012
CaCO3	9.231e-007	0.09232	1.0000	-6.0348
NaSO4-	9.164e-007	0.1090	0.9022	-6.0826
MgCl+	7.977e-007	0.04763	0.9022	-6.1429
MgSO4	7.441e-007	0.08949	1.0000	-6.1284
KSO4-	5.405e-007	0.07300	0.9022	-6.3119
FeHCO3+	4.411e-007	0.05151	0.9022	-6.4001
NaCl	4.045e-007	0.02362	1.0000	-6.3931
MnHCO3+	2.766e-007	0.03205	0.9022	-6.6029
KCl	1.750e-007	0.01304	1.0000	-6.7569
H+	1.734e-007	0.0001746	0.9142	-6.7999
FeCl+	6.416e-008	0.005853	0.9022	-7.2375
MgCO3	5.198e-008	0.004379	1.0000	-7.2842

OH-	4.785e-008	0.0008132	0.9008	-7.3654
FeSO4	4.513e-008	0.006851	1.0000	-7.3455
MnSO4	3.924e-008	0.005921	1.0000	-7.4062
FeCO3	2.976e-008	0.003445	1.0000	-7.5263
MnCl+	1.626e-008	0.001468	0.9022	-7.8336
MnCO3	1.289e-008	0.001480	1.0000	-7.8898
NaCO3-	1.089e-008	0.0009035	0.9022	-8.0075

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08536	0.08544	1.0000	-1.0687
>(w)FeOCO2-	0.02517	0.02520	0.54985	-1.5990
>(w)FeOH2+	0.02469	0.02471	1.8187	-1.6075
>(w)FeOH	0.01453	0.01454	1.0000	-1.8378
>(s)FeOHCa++	0.003242	0.003244	3.3076	-2.4892
>(s)FeOH2+	0.0003210	0.0003213	1.8187	-3.4935
>(w)FeO-	0.0001958	0.0001960	0.54985	-3.7081
>(s)FeOH	0.0001889	0.0001891	1.0000	-3.7238
>(w)FeOHAsO4---	0.0001244	0.0001245	0.16623	-3.9052
>(w)FeOCa+	4.329e-005	4.333e-005	1.8187	-4.3636
>(w)FeOHSO4--	1.897e-005	1.899e-005	0.30233	-4.7219
>(w)FeSO4-	1.616e-005	1.618e-005	0.54985	-4.7915
>(w)FeHAsO4-	8.045e-006	8.052e-006	0.54985	-5.0945
>(s)FeO-	2.546e-006	2.548e-006	0.54985	-5.5941
>(w)FeH2AsO4	4.424e-007	4.428e-007	1.0000	-6.3542
>(w)FeH2AsO3	1.528e-007	1.529e-007	1.0000	-6.8159

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2628
Goethite	-0.4707	Monohydrocalcite	-1.5846
Calcite	-0.6010	Magnetite	-2.2650
Aragonite	-0.7663	Magnesite	-2.3220
Siderite	-0.8263	Dolomite-dis	-2.8447
Rhodochrosite	-0.8802	Gypsum	-2.9590
Dolomite	-1.2628		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.562e-044	-43.591
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.243e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.000133	7.00e-009	0.000999	0.000133	19.0	
Ca++	0.00426	0.000976	39.1	0.00329	132.	
Cl-	0.00748	0.00748	265.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	
HCO3-	0.117	0.00605	369.	0.111	6.74e+003	

K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	6.65e-005	3.48e-009	0.000111	6.65e-005	2.12
SO4--	0.000142	0.000107	10.3	3.52e-005	3.37

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7711	-0.113
HCO3-	0.9481	-0.023
SO4--	0.2469	-0.607

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001331	6.998e-009	0.0005235	0.0001331	9.959
Calcium	0.004264	0.0009759	39.05	0.003288	131.6
Carbon	0.1167	0.006052	72.57	0.1106	1327.
Chlorine	0.007476	0.007476	264.6		
Hydrogen	111.1	111.1	1.118e+005	-0.0004215	-0.4242
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3545.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001424	0.0001072	3.432	3.516e-005	1.125

4.582e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010294

Activity of water = 0.999738

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007516 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007490	265.3	0.8993	-2.1717
HCO3-	0.004380	267.0	0.9034	-2.4026
Na+	0.002985	68.56	0.9021	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8993	-2.9627
Ca++	0.0008997	36.03	0.6760	-3.2160
Mg++	0.0001023	2.484	0.6900	-4.1514
SO4--	9.696e-005	9.307	0.6606	-4.1935
CaHCO3+	4.168e-005	4.211	0.9053	-4.4233
CaCl+	2.536e-005	1.914	0.9021	-4.6405
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.992e-006	1.087	1.0000	-5.0974
Fe++	6.581e-006	0.3672	0.6760	-5.3518
Mn++	5.115e-006	0.2808	0.6760	-5.4612
MgHCO3+	3.118e-006	0.2658	0.9021	-5.5509
CO3--	1.501e-006	0.09002	0.6646	-6.0010
CaCO3	9.235e-007	0.09236	1.0000	-6.0346
NaSO4-	9.177e-007	0.1092	0.9021	-6.0821
MgCl+	8.032e-007	0.04796	0.9021	-6.1399
MgSO4	7.449e-007	0.08959	1.0000	-6.1279
KSO4-	5.413e-007	0.07311	0.9021	-6.3113
FeHCO3+	4.415e-007	0.05156	0.9021	-6.3998
NaCl	4.074e-007	0.02379	1.0000	-6.3900
MnHCO3+	2.769e-007	0.03208	0.9021	-6.6025
KCl	1.763e-007	0.01313	1.0000	-6.7538
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.459e-008	0.005893	0.9021	-7.2346
MgCO3	5.203e-008	0.004384	1.0000	-7.2837
OH-	4.787e-008	0.0008135	0.9007	-7.3654
FeSO4	4.518e-008	0.006857	1.0000	-7.3451
MnSO4	3.928e-008	0.005927	1.0000	-7.4058
FeCO3	2.979e-008	0.003449	1.0000	-7.5259
MnCl+	1.637e-008	0.001478	0.9021	-7.8307
MnCO3	1.290e-008	0.001482	1.0000	-7.8893
NaCO3-	1.091e-008	0.0009048	0.9021	-8.0069

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08550	0.08549	1.0000	-1.0680
>(w)FeOCO2-	0.02532	0.02531	0.54769	-1.5966
>(w)FeOH2+	0.02463	0.02462	1.8258	-1.6086
>(w)FeOH	0.01455	0.01455	1.0000	-1.8372
>(s)FeOHCa++	0.003243	0.003242	3.3337	-2.4891
>(s)FeOH2+	0.0003223	0.0003223	1.8258	-3.4917
>(w)FeO-	0.0001969	0.0001969	0.54769	-3.7057
>(s)FeOH	0.0001904	0.0001904	1.0000	-3.7202
>(w)FeOCa+	4.319e-005	4.319e-005	1.8258	-4.3646
>(w)FeOHAsO4---	4.288e-005	4.287e-005	0.16429	-4.3678
>(w)FeOHSO4--	1.916e-005	1.915e-005	0.29997	-4.7177
>(w)FeSO4-	1.625e-005	1.625e-005	0.54769	-4.7890
>(w)FeHAsO4-	2.750e-006	2.750e-006	0.54769	-5.5606
>(s)FeO-	2.578e-006	2.577e-006	0.54769	-5.5888
>(w)FeH2AsO4	1.506e-007	1.506e-007	1.0000	-6.8220
>(w)FeH2AsO3	5.202e-008	5.201e-008	1.0000	-7.2838

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2622
Goethite	-0.4707	Monohydrocalcite	-1.5844
Calcite	-0.6008	Magnetite	-2.2646
Aragonite	-0.7661	Magnesite	-2.3216
Siderite	-0.8258	Dolomite-dis	-2.8440
Rhodochrosite	-0.8798	Gypsum	-2.9588
Dolomite	-1.2621		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.241e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.58e-005	2.38e-009	0.000340	4.58e-005	6.55	
Ca++	0.00426	0.000976	39.1	0.00329	132.	
Cl-	0.00752	0.00752	266.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	2.29e-005	1.18e-009	3.78e-005	2.29e-005	0.732
SO4--	0.000143	0.000107	10.3	3.54e-005	3.40

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2482	-0.605

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.582e-005	2.378e-009	0.0001781	4.582e-005	3.431
Calcium	0.004261	0.0009755	39.08	0.003285	131.6
Carbon	0.1168	0.006047	72.59	0.1108	1330.
Chlorine	0.007515	0.007515	266.3		
Hydrogen	111.0	111.0	1.118e+005	-0.0006292	-0.6338
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001426	0.0001072	3.436	3.540e-005	1.134

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010286

Activity of water = 0.999738

Solvent mass = 1.000835 kg

Solution mass = 1.001613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007509 molal

Dissolved solids = 776 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7473

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)	60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007482	265.1	0.8993	-2.1721
HCO3-	0.004378	266.9	0.9035	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8993	-2.9631
Ca++	0.0008992	36.01	0.6761	-3.2161
Mg++	0.0001022	2.481	0.6901	-4.1517
SO4--	9.688e-005	9.299	0.6607	-4.1938
CaHCO3+	4.165e-005	4.207	0.9053	-4.4236
CaCl+	2.533e-005	1.912	0.9021	-4.6411
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.982e-006	1.086	1.0000	-5.0979
Fe++	6.574e-006	0.3669	0.6761	-5.3522
Mn++	5.110e-006	0.2805	0.6761	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5514
CO3--	1.500e-006	0.08996	0.6647	-6.0012
CaCO3	9.226e-007	0.09227	1.0000	-6.0350
NaSO4-	9.161e-007	0.1090	0.9021	-6.0828
MgCl+	8.017e-007	0.04787	0.9021	-6.1407
MgSO4	7.437e-007	0.08944	1.0000	-6.1286
KSO4-	5.404e-007	0.07298	0.9021	-6.3120
FeHCO3+	4.410e-007	0.05150	0.9021	-6.4003
NaCl	4.066e-007	0.02374	1.0000	-6.3909
MnHCO3+	2.765e-007	0.03204	0.9021	-6.6030
KCl	1.759e-007	0.01311	1.0000	-6.7547
H+	1.734e-007	0.0001746	0.9142	-6.7999
FeCl+	6.447e-008	0.005882	0.9021	-7.2354
MgCO3	5.196e-008	0.004378	1.0000	-7.2843

OH-	4.786e-008	0.0008133	0.9007	-7.3654
FeSO4	4.511e-008	0.006847	1.0000	-7.3458
MnSO4	3.922e-008	0.005918	1.0000	-7.4065
FeCO3	2.975e-008	0.003444	1.0000	-7.5265
MnCl+	1.634e-008	0.001476	0.9021	-7.8315
MnCO3	1.288e-008	0.001480	1.0000	-7.8899
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08541	0.08548	1.0000	-1.0685
>(w)FeOCO2-	0.02529	0.02531	0.54758	-1.5970
>(w)FeOH2+	0.02460	0.02462	1.8262	-1.6090
>(w)FeOH	0.01454	0.01455	1.0000	-1.8375
>(s)FeOHCa++	0.003239	0.003242	3.3350	-2.4896
>(s)FeOH2+	0.0003222	0.0003225	1.8262	-3.4918
>(w)FeO-	0.0001968	0.0001969	0.54758	-3.7061
>(s)FeOH	0.0001904	0.0001905	1.0000	-3.7204
>(w)FeOCa+	4.312e-005	4.316e-005	1.8262	-4.3653
>(w)FeOHAsO4---	4.283e-005	4.287e-005	0.16419	-4.3682
>(w)FeOHSO4--	1.913e-005	1.915e-005	0.29985	-4.7182
>(w)FeSO4-	1.623e-005	1.625e-005	0.54758	-4.7896
>(w)FeHAsO4-	2.748e-006	2.750e-006	0.54758	-5.5611
>(s)FeO-	2.577e-006	2.579e-006	0.54758	-5.5889
>(w)FeH2AsO4	1.505e-007	1.506e-007	1.0000	-6.8225
>(w)FeH2AsO3	5.197e-008	5.201e-008	1.0000	-7.2843

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2632
Goethite	-0.4707	Monohydrocalcite	-1.5848
Calcite	-0.6012	Magnetite	-2.2651
Aragonite	-0.7665	Magnesite	-2.3222
Siderite	-0.8264	Dolomite-dis	-2.8450
Rhodochrosite	-0.8804	Gypsum	-2.9593
Dolomite	-1.2631		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.239e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.58e-005	2.38e-009	0.000340	4.58e-005	6.54	
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00752	0.00752	266.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	
HCO3-	0.117	0.00605	369.	0.111	6.75e+003	

K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	2.29e-005	1.18e-009	3.78e-005	2.29e-005	0.731
SO4--	0.000143	0.000107	10.3	3.54e-005	3.39

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2482	-0.605

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.582e-005	2.379e-009	0.0001780	4.582e-005	3.428
Calcium	0.004261	0.0009759	39.05	0.003285	131.4
Carbon	0.1168	0.006052	72.57	0.1108	1329.
Chlorine	0.007515	0.007515	266.0		
Hydrogen	111.1	111.1	1.118e+005	-0.0006264	-0.6304
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3545.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001426	0.0001072	3.432	3.540e-005	1.133

1.354e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010301

Activity of water = 0.999737

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007531 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007504	265.8	0.8992	-2.1708
HCO3-	0.004380	267.0	0.9034	-2.4027
Na+	0.002985	68.56	0.9020	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8992	-2.9627
Ca++	0.0008997	36.03	0.6759	-3.2160
Mg++	0.0001023	2.484	0.6900	-4.1514
SO4--	9.697e-005	9.307	0.6605	-4.1935
CaHCO3+	4.168e-005	4.210	0.9052	-4.4234
CaCl+	2.541e-005	1.918	0.9020	-4.6398
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.990e-006	1.087	1.0000	-5.0975
Fe++	6.581e-006	0.3672	0.6759	-5.3519
Mn++	5.115e-006	0.2808	0.6759	-5.4612
MgHCO3+	3.118e-006	0.2658	0.9020	-5.5509
CO3--	1.501e-006	0.09003	0.6645	-6.0010
CaCO3	9.233e-007	0.09234	1.0000	-6.0346
NaSO4-	9.176e-007	0.1092	0.9020	-6.0821
MgCl+	8.046e-007	0.04805	0.9020	-6.1392
MgSO4	7.447e-007	0.08957	1.0000	-6.1280
KSO4-	5.413e-007	0.07310	0.9020	-6.3114
FeHCO3+	4.415e-007	0.05156	0.9020	-6.3998
NaCl	4.081e-007	0.02383	1.0000	-6.3892
MnHCO3+	2.768e-007	0.03207	0.9020	-6.6026
KCl	1.766e-007	0.01316	1.0000	-6.7530
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.471e-008	0.005903	0.9020	-7.2338
MgCO3	5.202e-008	0.004383	1.0000	-7.2838
OH-	4.787e-008	0.0008135	0.9007	-7.3654
FeSO4	4.517e-008	0.006856	1.0000	-7.3452
MnSO4	3.927e-008	0.005926	1.0000	-7.4059
FeCO3	2.979e-008	0.003448	1.0000	-7.5260
MnCl+	1.640e-008	0.001481	0.9020	-7.8300
MnCO3	1.290e-008	0.001482	1.0000	-7.8894
NaCO3-	1.091e-008	0.0009048	0.9020	-8.0070

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08552	0.08550	1.0000	-1.0679
>(w)FeOCO2-	0.02536	0.02536	0.54686	-1.5958
>(w)FeOH2+	0.02459	0.02459	1.8286	-1.6092
>(w)FeOH	0.01455	0.01455	1.0000	-1.8371
>(s)FeOHCa++	0.003242	0.003241	3.3439	-2.4893
>(s)FeOH2+	0.0003228	0.0003227	1.8286	-3.4911
>(w)FeO-	0.0001973	0.0001972	0.54686	-3.7049
>(s)FeOH	0.0001910	0.0001910	1.0000	-3.7190
>(w)FeOCa+	4.313e-005	4.312e-005	1.8286	-4.3652
>(w)FeOHSO4--	1.922e-005	1.921e-005	0.29906	-4.7163
>(w)FeSO4-	1.628e-005	1.628e-005	0.54686	-4.7883
>(w)FeOHAsO4---	1.267e-005	1.267e-005	0.16354	-4.8972
>(s)FeO-	2.589e-006	2.589e-006	0.54686	-5.5869
>(w)FeHAsO4-	8.103e-007	8.102e-007	0.54686	-6.0913
>(w)FeH2AsO4	4.431e-008	4.431e-008	1.0000	-7.3535
>(w)FeH2AsO3	1.530e-008	1.530e-008	1.0000	-7.8153

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2623
Goethite	-0.4707	Monohydrocalcite	-1.5844
Calcite	-0.6009	Magnetite	-2.2647
Aragonite	-0.7662	Magnesite	-2.3216
Siderite	-0.8259	Dolomite-dis	-2.8441
Rhodochrosite	-0.8798	Gypsum	-2.9589
Dolomite	-1.2623		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.240e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	1.35e-005	7.00e-010	9.99e-005	1.35e-005	1.93	
Ca++	0.00426	0.000976	39.1	0.00328	132.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	6.76e-006	3.48e-010	1.11e-005	6.76e-006	0.216
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9483	-0.023
SO4--	0.2487	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.354e-005	6.995e-010	5.238e-005	1.354e-005	1.014
Calcium	0.004260	0.0009755	39.08	0.003284	131.5
Carbon	0.1169	0.006047	72.59	0.1109	1331.
Chlorine	0.007530	0.007530	266.8		
Hydrogen	111.0	111.0	1.118e+005	-0.0007050	-0.7101
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001427	0.0001072	3.436	3.549e-005	1.137

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010293

Activity of water = 0.999737

Solvent mass = 1.000835 kg

Solution mass = 1.001613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007524 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7472

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total) 60.00 11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007497	265.6	0.8993	-2.1712
HCO3-	0.004378	266.9	0.9034	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8993	-2.9631
Ca++	0.0008992	36.01	0.6760	-3.2162
Mg++	0.0001022	2.481	0.6900	-4.1518
SO4--	9.688e-005	9.299	0.6606	-4.1938
CaHCO3+	4.164e-005	4.207	0.9053	-4.4237
CaCl+	2.537e-005	1.915	0.9021	-4.6404
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.980e-006	1.086	1.0000	-5.0980
Fe++	6.574e-006	0.3669	0.6760	-5.3522
Mn++	5.110e-006	0.2805	0.6760	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5514
CO3--	1.501e-006	0.08997	0.6646	-6.0012
CaCO3	9.225e-007	0.09226	1.0000	-6.0351
NaSO4-	9.160e-007	0.1090	0.9021	-6.0829
MgCl+	8.031e-007	0.04796	0.9021	-6.1400
MgSO4	7.435e-007	0.08942	1.0000	-6.1287
KSO4-	5.403e-007	0.07297	0.9021	-6.3121
FeHCO3+	4.410e-007	0.05149	0.9021	-6.4004
NaCl	4.073e-007	0.02379	1.0000	-6.3900
MnHCO3+	2.765e-007	0.03204	0.9021	-6.6031
KCl	1.763e-007	0.01313	1.0000	-6.7538
H+	1.734e-007	0.0001746	0.9141	-6.7999
FeCl+	6.459e-008	0.005893	0.9021	-7.2346
MgCO3	5.195e-008	0.004377	1.0000	-7.2844

OH-	4.786e-008	0.0008133	0.9007	-7.3654
FeSO4	4.510e-008	0.006845	1.0000	-7.3459
MnSO4	3.921e-008	0.005916	1.0000	-7.4066
FeCO3	2.975e-008	0.003444	1.0000	-7.5266
MnCl+	1.637e-008	0.001478	0.9021	-7.8308
MnCO3	1.288e-008	0.001480	1.0000	-7.8900
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08543	0.08550	1.0000	-1.0684
>(w)FeOCO2-	0.02534	0.02536	0.54675	-1.5963
>(w)FeOH2+	0.02457	0.02459	1.8290	-1.6096
>(w)FeOH	0.01454	0.01455	1.0000	-1.8374
>(s)FeOHCa++	0.003238	0.003241	3.3452	-2.4897
>(s)FeOH2+	0.0003227	0.0003229	1.8290	-3.4912
>(w)FeO-	0.0001971	0.0001973	0.54675	-3.7053
>(s)FeOH	0.0001909	0.0001911	1.0000	-3.7191
>(w)FeOCa+	4.306e-005	4.309e-005	1.8290	-4.3659
>(w)FeOHSO4--	1.919e-005	1.921e-005	0.29893	-4.7168
>(w)FeSO4-	1.626e-005	1.627e-005	0.54675	-4.7889
>(w)FeOHAsO4---	1.266e-005	1.267e-005	0.16344	-4.8976
>(s)FeO-	2.588e-006	2.591e-006	0.54675	-5.5870
>(w)FeHAsO4-	8.095e-007	8.101e-007	0.54675	-6.0918
>(w)FeH2AsO4	4.426e-008	4.430e-008	1.0000	-7.3539
>(w)FeH2AsO3	1.529e-008	1.530e-008	1.0000	-7.8157

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

log Q/K log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2633
Goethite	-0.4707	Monohydrocalcite	-1.5848
Calcite	-0.6013	Magnetite	-2.2652
Aragonite	-0.7666	Magnesite	-2.3222
Siderite	-0.8265	Dolomite-dis	-2.8452
Rhodochrosite	-0.8804	Gypsum	-2.9594
Dolomite	-1.2633		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.238e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	1.35e-005	7.00e-010	9.99e-005	1.35e-005	1.93	
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	
HCO3-	0.117	0.00605	369.	0.111	6.75e+003	

K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	6.76e-006	3.48e-010	1.11e-005	6.76e-006	0.216
SO4--	0.000143	0.000107	10.3	3.55e-005	3.40

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2486	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.354e-005	6.998e-010	5.235e-005	1.354e-005	1.013
Calcium	0.004260	0.0009759	39.05	0.003284	131.4
Carbon	0.1169	0.006052	72.57	0.1109	1329.
Chlorine	0.007530	0.007530	266.5		
Hydrogen	111.1	111.1	1.118e+005	-0.0007022	-0.7067
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3544.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001427	0.0001072	3.432	3.548e-005	1.136

0.003916 total moles arsenic

Step #   0   Xi = 0.0000

Temperature = 20.0 C   Pressure = 1.013 bars

pH = 6.800   log fO2 = -50.744

Eh =   0.0970 volts   pe =   1.6677

Ionic strength   =   0.009423

Activity of water   =   0.999798

Solvent mass   =   0.999835 kg

Solution mass   =   1.000550 kg

Solution density   =   1.016   g/cm3

Chlorinity   =   0.005760 molal

Dissolved solids   =   715 mg/kg sol'n

Rock mass   =   0.060000 kg

Carbonate alkalinity=   221.26 mg/kg as CaCO3

HFO sorbing surface:

Surface charge   =   1.08 uC/cm2

Surface potential =   10.8 mV

Surface area   =   3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1020	-1.7545

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.005739	203.3	0.9030	-2.2855
HCO3-	0.004375	266.7	0.9069	-2.4015
Na+	0.002985	68.57	0.9056	-2.5682
CO2(aq)	0.001609	70.75	1.0000	-2.7935
K+	0.001212	47.35	0.9030	-2.9609
Ca++	0.0009043	36.22	0.6856	-3.2076
Mg++	0.0001024	2.487	0.6989	-4.1453
SO4--	9.666e-005	9.279	0.6712	-4.1879
CaHCO3+	4.245e-005	4.288	0.9086	-4.4138
CaCl+	1.982e-005	1.496	0.9056	-4.7460
NaHCO3	1.602e-005	1.345	1.0000	-4.7954
CaSO4	8.251e-006	1.122	1.0000	-5.0835
Fe++	6.587e-006	0.3676	0.6856	-5.3452
Mn++	5.114e-006	0.2808	0.6856	-5.4551
MgHCO3+	3.158e-006	0.2692	0.9056	-5.5437
CO3--	1.482e-006	0.08889	0.6749	-5.9998
CaCO3	9.439e-007	0.09440	1.0000	-6.0251
NaSO4-	9.295e-007	0.1106	0.9056	-6.0748
MgSO4	7.650e-007	0.09201	1.0000	-6.1163
MgCl+	6.242e-007	0.03728	0.9056	-6.2477
KSO4-	5.484e-007	0.07407	0.9056	-6.3039
FeHCO3+	4.477e-007	0.05229	0.9056	-6.3920
NaCl	3.147e-007	0.01838	1.0000	-6.5021
MnHCO3+	2.804e-007	0.03249	0.9056	-6.5953
HAsO4--	2.053e-007	0.02871	0.6712	-6.8607
H+	1.729e-007	0.0001741	0.9169	-6.8000

H2AsO4-	1.424e-007	0.02006	0.9056	-6.8895
KCl	1.362e-007	0.01015	1.0000	-6.8658
MgCO3	5.290e-008	0.004457	1.0000	-7.2765
FeCl+	5.026e-008	0.004586	0.9056	-7.3418
OH-	4.768e-008	0.0008103	0.9043	-7.3653
FeSO4	4.646e-008	0.007052	1.0000	-7.3329
MnSO4	4.035e-008	0.006088	1.0000	-7.3942
FeCO3	3.033e-008	0.003511	1.0000	-7.5182
MnCO3	1.312e-008	0.001507	1.0000	-7.8821
MnCl+	1.272e-008	0.001149	0.9056	-7.9385
NaCO3-	1.094e-008	0.0009073	0.9056	-8.0041

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08298	0.08297	1.0000	-1.0810
>(w)FeOH2+	0.02864	0.02864	1.5196	-1.5430
>(w)FeOCO2-	0.02045	0.02045	0.65805	-1.6893
>(w)FeOH	0.01408	0.01408	1.0000	-1.8513
>(w)FeOHAsO4---	0.003558	0.003557	0.28496	-2.4488
>(s)FeOHCa++	0.003351	0.003350	2.3093	-2.4749
>(w)FeHAsO4-	0.0003295	0.0003294	0.65805	-3.4822
>(s)FeOH2+	0.0002720	0.0002719	1.5196	-3.5655
>(w)FeO-	0.0001587	0.0001586	0.65805	-3.7995
>(s)FeOH	0.0001337	0.0001337	1.0000	-3.8738
>(w)FeOCa+	5.121e-005	5.120e-005	1.5196	-4.2906
>(w)FeH2AsO4	2.168e-005	2.168e-005	1.0000	-4.6639
>(w)FeSO4-	1.326e-005	1.326e-005	0.65805	-4.8773
>(w)FeOHSO4--	1.301e-005	1.301e-005	0.43303	-4.8857
>(w)FeH2AsO3	7.486e-006	7.485e-006	1.0000	-5.1257
>(s)FeO-	1.506e-006	1.506e-006	0.65805	-5.8220

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2455
Goethite	-0.4707	Monohydrocalcite	-1.5749
Calcite	-0.5913	Magnetite	-2.2580
Aragonite	-0.7566	Magnesite	-2.3144
Siderite	-0.8181	Dolomite-dis	-2.8273
Rhodochrosite	-0.8726	Gypsum	-2.9449
Dolomite	-1.2455		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03865	-1.413
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.593e-044	-43.586
CH4(g)	1.105e-046	-45.957
O2(g)	1.803e-051	-50.744
S2(g)	6.399e-080	-79.194

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00392	3.50e-007	0.0500	0.00392	559.	
Ca++	0.00438	0.000976	39.1	0.00340	136.	
Cl-	0.00576	0.00576	204.			
Fe++	7.16e-006	7.16e-006	0.400			

Fe+++	0.751	1.11e-012	6.20e-008		
H+	-2.15	0.00161	1.62	0.105	105.
H2O	56.5	55.5	9.99e+005	-0.108	-1.94e+003
HCO3-	0.109	0.00605	369.	0.103	6.31e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	0.00195	1.74e-007	0.00556	0.00195	62.5
SO4--	0.000133	0.000107	10.3	2.63e-005	2.52

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7771	-0.110
HCO3-	0.9448	-0.025
SO4--	0.1968	-0.706

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003916	3.498e-007	0.02619	0.003916	293.2
Calcium	0.004377	0.0009755	39.08	0.003401	136.2
Carbon	0.1095	0.006047	72.60	0.1034	1241.
Chlorine	0.005759	0.005759	204.1		
Hydrogen	111.0	111.0	1.118e+005	0.008265	8.326
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.599		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2222	3554.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		

Sulfur	0.0001335	0.0001072	3.436	2.627e-005	0.8417

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.009416

Activity of water = 0.999799

Solvent mass = 1.000835 kg

Solution mass = 1.001551 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.005754 molal

Dissolved solids = 714 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.17 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.08 uC/cm2

Surface potential = 10.8 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1020	-1.7539

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.005733	203.1	0.9030	-2.2859
HCO3-	0.004373	266.6	0.9069	-2.4016
Na+	0.002982	68.50	0.9056	-2.5686
CO2(aq)	0.001609	70.74	1.0000	-2.7936
K+	0.001211	47.30	0.9030	-2.9613
Ca++	0.0009037	36.19	0.6857	-3.2078
Mg++	0.0001023	2.484	0.6990	-4.1457
SO4--	9.658e-005	9.270	0.6713	-4.1882
CaHCO3+	4.241e-005	4.284	0.9086	-4.4142
CaCl+	1.979e-005	1.494	0.9056	-4.7467
NaHCO3	1.600e-005	1.343	1.0000	-4.7959
CaSO4	8.241e-006	1.121	1.0000	-5.0840
Fe++	6.581e-006	0.3673	0.6857	-5.3456
Mn++	5.109e-006	0.2805	0.6857	-5.4555
MgHCO3+	3.154e-006	0.2689	0.9056	-5.5442
CO3--	1.481e-006	0.08883	0.6750	-6.0001
CaCO3	9.429e-007	0.09431	1.0000	-6.0255
NaSO4-	9.278e-007	0.1104	0.9056	-6.0756
MgSO4	7.638e-007	0.09186	1.0000	-6.1170
MgCl+	6.230e-007	0.03721	0.9056	-6.2485
KSO4-	5.475e-007	0.07394	0.9056	-6.3047
FeHCO3+	4.472e-007	0.05222	0.9056	-6.3926
NaCl	3.141e-007	0.01834	1.0000	-6.5030
MnHCO3+	2.801e-007	0.03245	0.9056	-6.5958
HAsO4--	2.052e-007	0.02869	0.6713	-6.8610
H+	1.729e-007	0.0001741	0.9169	-6.7999
H2AsO4-	1.424e-007	0.02005	0.9056	-6.8897
KCl	1.359e-007	0.01013	1.0000	-6.8667

MgCO3	5.283e-008	0.004451	1.0000	-7.2771
FeCl+	5.017e-008	0.004577	0.9056	-7.3426
OH-	4.767e-008	0.0008101	0.9044	-7.3654
FeSO4	4.638e-008	0.007041	1.0000	-7.3336
MnSO4	4.028e-008	0.006078	1.0000	-7.3949
FeCO3	3.028e-008	0.003506	1.0000	-7.5188
MnCO3	1.310e-008	0.001505	1.0000	-7.8827
MnCl+	1.270e-008	0.001147	0.9056	-7.9393
NaCO3-	1.092e-008	0.0009059	0.9056	-8.0047

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08290	0.08297	1.0000	-1.0815
>(w)FeOH2+	0.02862	0.02864	1.5200	-1.5434
>(w)FeOCO2-	0.02043	0.02045	0.65791	-1.6897
>(w)FeOH	0.01407	0.01408	1.0000	-1.8516
>(w)FeOHAsO4---	0.003554	0.003557	0.28478	-2.4492
>(s)FeOHCa++	0.003347	0.003350	2.3103	-2.4753
>(w)FeHAsO4-	0.0003291	0.0003294	0.65791	-3.4827
>(s)FeOH2+	0.0002719	0.0002721	1.5200	-3.5656
>(w)FeO-	0.0001585	0.0001587	0.65791	-3.7999
>(s)FeOH	0.0001337	0.0001338	1.0000	-3.8739
>(w)FeOCa+	5.112e-005	5.117e-005	1.5200	-4.2914
>(w)FeH2AsO4	2.166e-005	2.167e-005	1.0000	-4.6644
>(w)FeSO4-	1.325e-005	1.326e-005	0.65791	-4.8779
>(w)FeOHSO4--	1.299e-005	1.301e-005	0.43285	-4.8862
>(w)FeH2AsO3	7.479e-006	7.485e-006	1.0000	-5.1262
>(s)FeO-	1.506e-006	1.508e-006	0.65791	-5.8221

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2465
Goethite	-0.4707	Monohydrocalcite	-1.5753
Calcite	-0.5918	Magnetite	-2.2585
Aragonite	-0.7570	Magnesite	-2.3150
Siderite	-0.8187	Dolomite-dis	-2.8284
Rhodochrosite	-0.8732	Gypsum	-2.9454
Dolomite	-1.2465		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03864	-1.413
Steam	0.02292	-1.640
H2(g)	8.837e-018	-17.054
H2S(g)	2.593e-044	-43.586
CH4(g)	1.105e-046	-45.956
O2(g)	1.803e-051	-50.744
S2(g)	6.398e-080	-79.194

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	0.00392	3.50e-007	0.0499	0.00392	559.	
Ca++	0.00438	0.000976	39.1	0.00340	136.	
Cl-	0.00576	0.00576	204.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.20e-008			
H+	-2.15	0.00161	1.62	0.105	105.	

H2O	56.6	55.6	9.99e+005	-0.108	-1.94e+003
HCO3-	0.109	0.00605	369.	0.103	6.30e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	0.00195	1.74e-007	0.00556	0.00195	62.4
SO4--	0.000133	0.000107	10.3	2.63e-005	2.52

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7770	-0.110
HCO3-	0.9447	-0.025
SO4--	0.1967	-0.706

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003916	3.499e-007	0.02618	0.003916	292.9
Calcium	0.004377	0.0009759	39.05	0.003401	136.1
Carbon	0.1095	0.006052	72.57	0.1034	1240.
Chlorine	0.005759	0.005759	203.9		
Hydrogen	111.1	111.1	1.118e+005	0.008268	8.321
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2222	3550.
Potassium	0.001212	0.001212	47.33		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001335	0.0001072	3.433	2.626e-005	0.8407

1.356e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010304

Activity of water = 0.999737

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007537 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007510	266.0	0.8992	-2.1705
HCO3-	0.004380	267.0	0.9034	-2.4027
Na+	0.002985	68.56	0.9020	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8992	-2.9627
Ca++	0.0008997	36.03	0.6759	-3.2160
Mg++	0.0001023	2.484	0.6899	-4.1514
SO4--	9.697e-005	9.307	0.6605	-4.1935
CaHCO3+	4.167e-005	4.210	0.9052	-4.4234
CaCl+	2.543e-005	1.919	0.9020	-4.6395
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.989e-006	1.087	1.0000	-5.0975
Fe++	6.581e-006	0.3672	0.6759	-5.3519
Mn++	5.115e-006	0.2808	0.6759	-5.4613
MgHCO3+	3.118e-006	0.2658	0.9020	-5.5509
CO3--	1.502e-006	0.09004	0.6645	-6.0010
CaCO3	9.233e-007	0.09234	1.0000	-6.0347
NaSO4-	9.176e-007	0.1091	0.9020	-6.0821
MgCl+	8.052e-007	0.04808	0.9020	-6.1389
MgSO4	7.447e-007	0.08956	1.0000	-6.1280
KSO4-	5.412e-007	0.07310	0.9020	-6.3114
FeHCO3+	4.415e-007	0.05155	0.9020	-6.3999
NaCl	4.084e-007	0.02385	1.0000	-6.3889
MnHCO3+	2.768e-007	0.03207	0.9020	-6.6026
KCl	1.767e-007	0.01316	1.0000	-6.7527
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.475e-008	0.005907	0.9020	-7.2335
MgCO3	5.202e-008	0.004383	1.0000	-7.2838
OH-	4.787e-008	0.0008135	0.9006	-7.3654
FeSO4	4.516e-008	0.006855	1.0000	-7.3452
MnSO4	3.927e-008	0.005925	1.0000	-7.4059
FeCO3	2.979e-008	0.003448	1.0000	-7.5260
MnCl+	1.641e-008	0.001482	0.9020	-7.8297
MnCO3	1.290e-008	0.001482	1.0000	-7.8894
NaCO3-	1.091e-008	0.0009048	0.9020	-8.0070

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08552	0.08551	1.0000	-1.0679
>(w)FeOCO2-	0.02538	0.02537	0.54654	-1.5955
>(w)FeOH2+	0.02458	0.02458	1.8297	-1.6094
>(w)FeOH	0.01455	0.01455	1.0000	-1.8370
>(s)FeOHCa++	0.003241	0.003241	3.3477	-2.4893
>(s)FeOH2+	0.0003229	0.0003229	1.8297	-3.4909
>(w)FeO-	0.0001974	0.0001974	0.54654	-3.7047
>(s)FeOH	0.0001912	0.0001912	1.0000	-3.7185
>(w)FeOCa+	4.311e-005	4.310e-005	1.8297	-4.3654
>(w)FeOHSO4--	1.924e-005	1.924e-005	0.29871	-4.7158
>(w)FeSO4-	1.629e-005	1.629e-005	0.54654	-4.7881
>(s)FeO-	2.593e-006	2.593e-006	0.54654	-5.5861
>(w)FeOHAsO4---	1.269e-006	1.269e-006	0.16326	-5.8964
>(w)FeHAsO4-	8.108e-008	8.107e-008	0.54654	-7.0911
>(w)FeH2AsO4	4.431e-009	4.431e-009	1.0000	-8.3534
>(w)FeH2AsO3	1.530e-009	1.530e-009	1.0000	-8.8152

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2624
Goethite	-0.4707	Monohydrocalcite	-1.5845
Calcite	-0.6009	Magnetite	-2.2647
Aragonite	-0.7662	Magnesite	-2.3217
Siderite	-0.8259	Dolomite-dis	-2.8442
Rhodochrosite	-0.8799	Gypsum	-2.9590
Dolomite	-1.2623		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.239e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	1.36e-006	7.00e-011	9.99e-006	1.36e-006	0.194	
Ca++	0.00426	0.000976	39.1	0.00328	132.	
Cl-	0.00754	0.00754	267.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	6.77e-007	3.48e-011	1.11e-006	6.77e-007	0.0217
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9483	-0.023
SO4--	0.2489	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.356e-006	6.995e-011	5.238e-006	1.356e-006	0.1015
Calcium	0.004259	0.0009755	39.08	0.003284	131.5
Carbon	0.1169	0.006047	72.59	0.1109	1331.
Chlorine	0.007535	0.007535	267.0		
Hydrogen	111.0	111.0	1.118e+005	-0.0007336	-0.7389
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001428	0.0001072	3.436	3.552e-005	1.138

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010296

Activity of water = 0.999737

Solvent mass = 1.000835 kg

Solution mass = 1.001614 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007529 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7472

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)	60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007502	265.8	0.8992	-2.1709
HCO3-	0.004378	266.9	0.9034	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8992	-2.9631
Ca++	0.0008992	36.01	0.6760	-3.2162
Mg++	0.0001022	2.481	0.6900	-4.1518
SO4--	9.688e-005	9.299	0.6606	-4.1938
CaHCO3+	4.164e-005	4.206	0.9053	-4.4237
CaCl+	2.539e-005	1.916	0.9021	-4.6401
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.979e-006	1.085	1.0000	-5.0980
Fe++	6.574e-006	0.3669	0.6760	-5.3522
Mn++	5.110e-006	0.2805	0.6760	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5515
CO3--	1.501e-006	0.08998	0.6645	-6.0012
CaCO3	9.224e-007	0.09225	1.0000	-6.0351
NaSO4-	9.160e-007	0.1090	0.9021	-6.0829
MgCl+	8.037e-007	0.04799	0.9021	-6.1397
MgSO4	7.435e-007	0.08941	1.0000	-6.1287
KSO4-	5.403e-007	0.07297	0.9021	-6.3121
FeHCO3+	4.409e-007	0.05149	0.9021	-6.4004
NaCl	4.076e-007	0.02380	1.0000	-6.3897
MnHCO3+	2.765e-007	0.03203	0.9021	-6.6031
KCl	1.764e-007	0.01314	1.0000	-6.7535
H+	1.734e-007	0.0001746	0.9141	-6.7999
FeCl+	6.463e-008	0.005897	0.9021	-7.2343

MgCO3	5.195e-008	0.004377	1.0000	-7.2844
OH-	4.786e-008	0.0008134	0.9007	-7.3654
FeSO4	4.509e-008	0.006844	1.0000	-7.3459
MnSO4	3.921e-008	0.005916	1.0000	-7.4066
FeCO3	2.974e-008	0.003443	1.0000	-7.5266
MnCl+	1.638e-008	0.001479	0.9021	-7.8305
MnCO3	1.288e-008	0.001480	1.0000	-7.8900
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08543	0.08551	1.0000	-1.0684
>(w)FeOCO2-	0.02535	0.02537	0.54643	-1.5960
>(w)FeOH2+	0.02456	0.02458	1.8301	-1.6098
>(w)FeOH	0.01454	0.01455	1.0000	-1.8374
>(s)FeOHCa++	0.003238	0.003240	3.3491	-2.4898
>(s)FeOH2+	0.0003228	0.0003231	1.8301	-3.4910
>(w)FeO-	0.0001972	0.0001974	0.54643	-3.7050
>(s)FeOH	0.0001911	0.0001913	1.0000	-3.7186
>(w)FeOCa+	4.304e-005	4.307e-005	1.8301	-4.3662
>(w)FeOHSO4--	1.922e-005	1.923e-005	0.29859	-4.7163
>(w)FeSO4-	1.627e-005	1.628e-005	0.54643	-4.7886
>(s)FeO-	2.593e-006	2.595e-006	0.54643	-5.5862
>(w)FeOHAsO4---	1.268e-006	1.269e-006	0.16316	-5.8969
>(w)FeHAsO4-	8.100e-008	8.106e-008	0.54643	-7.0915
>(w)FeH2AsO4	4.427e-009	4.430e-009	1.0000	-8.3539
>(w)FeH2AsO3	1.529e-009	1.530e-009	1.0000	-8.8157

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

log Q/K log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2634
Goethite	-0.4707	Monohydrocalcite	-1.5849
Calcite	-0.6013	Magnetite	-2.2652
Aragonite	-0.7666	Magnesite	-2.3223
Siderite	-0.8265	Dolomite-dis	-2.8452
Rhodochrosite	-0.8805	Gypsum	-2.9595
Dolomite	-1.2633		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.238e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	1.36e-006	7.00e-011	9.99e-006	1.36e-006	0.194	
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00754	0.00754	267.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	

HCO3-	0.117	0.00605	369.	0.111	6.75e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	6.77e-007	3.48e-011	1.11e-006	6.77e-007	0.0216
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.356e-006	6.998e-011	5.235e-006	1.356e-006	0.1014
Calcium	0.004259	0.0009759	39.05	0.003283	131.4
Carbon	0.1169	0.006052	72.57	0.1109	1330.
Chlorine	0.007535	0.007535	266.7		
Hydrogen	111.1	111.1	1.118e+005	-0.0007309	-0.7354
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3544.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001428	0.0001072	3.432	3.552e-005	1.137

4.612e-007 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010304

Activity of water = 0.999737

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007537 molal

Dissolved solids = 778 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007510	266.0	0.8992	-2.1705
HCO3-	0.004380	267.0	0.9034	-2.4027
Na+	0.002985	68.56	0.9020	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8992	-2.9627
Ca++	0.0008997	36.03	0.6759	-3.2160
Mg++	0.0001023	2.484	0.6899	-4.1514
SO4--	9.697e-005	9.307	0.6605	-4.1935
CaHCO3+	4.167e-005	4.210	0.9052	-4.4234
CaCl+	2.543e-005	1.919	0.9020	-4.6395
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.989e-006	1.087	1.0000	-5.0975
Fe++	6.581e-006	0.3672	0.6759	-5.3519
Mn++	5.115e-006	0.2808	0.6759	-5.4613
MgHCO3+	3.118e-006	0.2658	0.9020	-5.5509
CO3--	1.502e-006	0.09004	0.6645	-6.0010
CaCO3	9.233e-007	0.09234	1.0000	-6.0347
NaSO4-	9.176e-007	0.1091	0.9020	-6.0821
MgCl+	8.052e-007	0.04808	0.9020	-6.1389
MgSO4	7.446e-007	0.08956	1.0000	-6.1280
KSO4-	5.412e-007	0.07309	0.9020	-6.3114
FeHCO3+	4.415e-007	0.05155	0.9020	-6.3999
NaCl	4.084e-007	0.02385	1.0000	-6.3889
MnHCO3+	2.768e-007	0.03207	0.9020	-6.6026
KCl	1.767e-007	0.01317	1.0000	-6.7527
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.476e-008	0.005908	0.9020	-7.2335
MgCO3	5.202e-008	0.004383	1.0000	-7.2838
OH-	4.787e-008	0.0008135	0.9006	-7.3654
FeSO4	4.516e-008	0.006855	1.0000	-7.3452
MnSO4	3.927e-008	0.005925	1.0000	-7.4059
FeCO3	2.978e-008	0.003448	1.0000	-7.5260
MnCl+	1.641e-008	0.001482	0.9020	-7.8296
MnCO3	1.290e-008	0.001482	1.0000	-7.8894
NaCO3-	1.091e-008	0.0009048	0.9020	-8.0070

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08552	0.08551	1.0000	-1.0679
>(w)FeOCO2-	0.02538	0.02538	0.54652	-1.5955
>(w)FeOH2+	0.02458	0.02458	1.8298	-1.6094
>(w)FeOH	0.01455	0.01455	1.0000	-1.8370
>(s)FeOHCa++	0.003241	0.003241	3.3480	-2.4893
>(s)FeOH2+	0.0003229	0.0003229	1.8298	-3.4909
>(w)FeO-	0.0001974	0.0001974	0.54652	-3.7046
>(s)FeOH	0.0001912	0.0001912	1.0000	-3.7185
>(w)FeOCa+	4.311e-005	4.310e-005	1.8298	-4.3655
>(w)FeOHSO4--	1.924e-005	1.924e-005	0.29869	-4.7158
>(w)FeSO4-	1.629e-005	1.629e-005	0.54652	-4.7880
>(s)FeO-	2.594e-006	2.593e-006	0.54652	-5.5861
>(w)FeOHAsO4---	4.316e-007	4.315e-007	0.16324	-6.3649
>(w)FeHAsO4-	2.757e-008	2.756e-008	0.54652	-7.5596
>(w)FeH2AsO4	1.507e-009	1.506e-009	1.0000	-8.8220
>(w)FeH2AsO3	5.203e-010	5.202e-010	1.0000	-9.2838

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2624
Goethite	-0.4707	Monohydrocalcite	-1.5845
Calcite	-0.6009	Magnetite	-2.2647
Aragonite	-0.7662	Magnesite	-2.3217
Siderite	-0.8259	Dolomite-dis	-2.8442
Rhodochrosite	-0.8799	Gypsum	-2.9590
Dolomite	-1.2623		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.239e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-007	2.38e-011	3.40e-006	4.61e-007	0.0659	
Ca++	0.00426	0.000976	39.1	0.00328	132.	
Cl-	0.00754	0.00754	267.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	2.30e-007	1.18e-011	3.78e-007	2.30e-007	0.00736
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9483	-0.023
SO4--	0.2489	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.612e-007	2.378e-011	1.781e-006	4.611e-007	0.03453
Calcium	0.004259	0.0009755	39.08	0.003284	131.5
Carbon	0.1169	0.006047	72.59	0.1109	1331.
Chlorine	0.007536	0.007536	267.0		
Hydrogen	111.0	111.0	1.118e+005	-0.0007357	-0.7411
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001428	0.0001072	3.436	3.553e-005	1.138

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010296

Activity of water = 0.999737

Solvent mass = 1.000835 kg

Solution mass = 1.001614 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007529 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7472

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)	60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007503	265.8	0.8992	-2.1709
HCO3-	0.004378	266.9	0.9034	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8992	-2.9631
Ca++	0.0008992	36.01	0.6759	-3.2162
Mg++	0.0001022	2.481	0.6900	-4.1518
SO4--	9.688e-005	9.299	0.6606	-4.1938
CaHCO3+	4.164e-005	4.206	0.9053	-4.4237
CaCl+	2.539e-005	1.916	0.9021	-4.6401
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.979e-006	1.085	1.0000	-5.0980
Fe++	6.574e-006	0.3669	0.6759	-5.3522
Mn++	5.110e-006	0.2805	0.6759	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5515
CO3--	1.501e-006	0.08998	0.6645	-6.0012
CaCO3	9.224e-007	0.09225	1.0000	-6.0351
NaSO4-	9.160e-007	0.1090	0.9021	-6.0829
MgCl+	8.037e-007	0.04799	0.9021	-6.1396
MgSO4	7.435e-007	0.08941	1.0000	-6.1287
KSO4-	5.403e-007	0.07297	0.9021	-6.3121
FeHCO3+	4.409e-007	0.05149	0.9021	-6.4004
NaCl	4.076e-007	0.02381	1.0000	-6.3897
MnHCO3+	2.765e-007	0.03203	0.9021	-6.6031
KCl	1.764e-007	0.01314	1.0000	-6.7535
H+	1.734e-007	0.0001746	0.9141	-6.7999
FeCl+	6.464e-008	0.005897	0.9021	-7.2343

MgCO3	5.195e-008	0.004377	1.0000	-7.2844
OH-	4.786e-008	0.0008134	0.9007	-7.3654
FeSO4	4.509e-008	0.006844	1.0000	-7.3459
MnSO4	3.921e-008	0.005916	1.0000	-7.4066
FeCO3	2.974e-008	0.003443	1.0000	-7.5266
MnCl+	1.638e-008	0.001479	0.9021	-7.8304
MnCO3	1.288e-008	0.001480	1.0000	-7.8900
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08543	0.08551	1.0000	-1.0684
>(w)FeOCO2-	0.02535	0.02537	0.54641	-1.5960
>(w)FeOH2+	0.02456	0.02458	1.8301	-1.6098
>(w)FeOH	0.01454	0.01455	1.0000	-1.8374
>(s)FeOHCa++	0.003237	0.003240	3.3494	-2.4898
>(s)FeOH2+	0.0003228	0.0003231	1.8301	-3.4910
>(w)FeO-	0.0001972	0.0001974	0.54641	-3.7050
>(s)FeOH	0.0001912	0.0001913	1.0000	-3.7186
>(w)FeOCa+	4.303e-005	4.307e-005	1.8301	-4.3662
>(w)FeOHSO4--	1.922e-005	1.923e-005	0.29856	-4.7163
>(w)FeSO4-	1.627e-005	1.628e-005	0.54641	-4.7886
>(s)FeO-	2.593e-006	2.595e-006	0.54641	-5.5862
>(w)FeOHAsO4---	4.312e-007	4.315e-007	0.16314	-6.3653
>(w)FeHAsO4-	2.754e-008	2.756e-008	0.54641	-7.5600
>(w)FeH2AsO4	1.505e-009	1.506e-009	1.0000	-8.8224
>(w)FeH2AsO3	5.198e-010	5.202e-010	1.0000	-9.2842

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

log Q/K log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2634
Goethite	-0.4707	Monohydrocalcite	-1.5849
Calcite	-0.6013	Magnetite	-2.2652
Aragonite	-0.7666	Magnesite	-2.3223
Siderite	-0.8265	Dolomite-dis	-2.8452
Rhodochrosite	-0.8805	Gypsum	-2.9595
Dolomite	-1.2633		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.238e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-007	2.38e-011	3.40e-006	4.61e-007	0.0658	
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00754	0.00754	267.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	

HCO3-	0.117	0.00605	369.	0.111	6.75e+003
K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	2.30e-007	1.18e-011	3.78e-007	2.30e-007	0.00736
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.612e-007	2.379e-011	1.780e-006	4.611e-007	0.03449
Calcium	0.004259	0.0009759	39.05	0.003283	131.4
Carbon	0.1169	0.006052	72.57	0.1109	1330.
Chlorine	0.007536	0.007536	266.7		
Hydrogen	111.1	111.1	1.118e+005	-0.0007330	-0.7376
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3544.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001428	0.0001072	3.432	3.552e-005	1.137

4.609e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010303

Activity of water = 0.999737

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007535 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007508	266.0	0.8992	-2.1706
HCO3-	0.004380	267.0	0.9034	-2.4027
Na+	0.002985	68.56	0.9020	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8992	-2.9627
Ca++	0.0008997	36.03	0.6759	-3.2160
Mg++	0.0001023	2.484	0.6899	-4.1514
SO4--	9.697e-005	9.307	0.6605	-4.1935
CaHCO3+	4.167e-005	4.210	0.9052	-4.4234
CaCl+	2.542e-005	1.919	0.9020	-4.6396
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.989e-006	1.087	1.0000	-5.0975
Fe++	6.581e-006	0.3672	0.6759	-5.3519
Mn++	5.115e-006	0.2808	0.6759	-5.4612
MgHCO3+	3.118e-006	0.2658	0.9020	-5.5509
CO3--	1.502e-006	0.09004	0.6645	-6.0010
CaCO3	9.233e-007	0.09234	1.0000	-6.0347
NaSO4-	9.176e-007	0.1091	0.9020	-6.0821
MgCl+	8.050e-007	0.04807	0.9020	-6.1390
MgSO4	7.447e-007	0.08956	1.0000	-6.1280
KSO4-	5.412e-007	0.07310	0.9020	-6.3114
FeHCO3+	4.415e-007	0.05155	0.9020	-6.3999
NaCl	4.083e-007	0.02385	1.0000	-6.3890
MnHCO3+	2.768e-007	0.03207	0.9020	-6.6026
KCl	1.767e-007	0.01316	1.0000	-6.7528
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.474e-008	0.005906	0.9020	-7.2336
MgCO3	5.202e-008	0.004383	1.0000	-7.2838
OH-	4.787e-008	0.0008135	0.9006	-7.3654
FeSO4	4.516e-008	0.006855	1.0000	-7.3452
MnSO4	3.927e-008	0.005925	1.0000	-7.4059
FeCO3	2.979e-008	0.003448	1.0000	-7.5260
MnCl+	1.641e-008	0.001482	0.9020	-7.8297
MnCO3	1.290e-008	0.001482	1.0000	-7.8894
NaCO3-	1.091e-008	0.0009048	0.9020	-8.0070

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08552	0.08551	1.0000	-1.0679
>(w)FeOCO2-	0.02537	0.02537	0.54663	-1.5956
>(w)FeOH2+	0.02458	0.02458	1.8294	-1.6093
>(w)FeOH	0.01455	0.01455	1.0000	-1.8370
>(s)FeOHCa++	0.003241	0.003241	3.3467	-2.4893
>(s)FeOH2+	0.0003229	0.0003228	1.8294	-3.4909
>(w)FeO-	0.0001974	0.0001973	0.54663	-3.7047
>(s)FeOH	0.0001911	0.0001911	1.0000	-3.7186
>(w)FeOCa+	4.311e-005	4.311e-005	1.8294	-4.3654
>(w)FeOHSO4--	1.923e-005	1.923e-005	0.29880	-4.7159
>(w)FeSO4-	1.629e-005	1.629e-005	0.54663	-4.7881
>(w)FeOHAsO4---	4.314e-006	4.313e-006	0.16333	-5.3652
>(s)FeO-	2.592e-006	2.592e-006	0.54663	-5.5863
>(w)FeHAsO4-	2.756e-007	2.756e-007	0.54663	-6.5597
>(w)FeH2AsO4	1.507e-008	1.506e-008	1.0000	-7.8220
>(w)FeH2AsO3	5.203e-009	5.202e-009	1.0000	-8.2838

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2623
Goethite	-0.4707	Monohydrocalcite	-1.5845
Calcite	-0.6009	Magnetite	-2.2647
Aragonite	-0.7662	Magnesite	-2.3216
Siderite	-0.8259	Dolomite-dis	-2.8442
Rhodochrosite	-0.8799	Gypsum	-2.9590
Dolomite	-1.2623		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.239e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-006	2.38e-010	3.40e-005	4.61e-006	0.658	
Ca++	0.00426	0.000976	39.1	0.00328	132.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	2.30e-006	1.18e-010	3.78e-006	2.30e-006	0.0736
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9483	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.609e-006	2.378e-010	1.781e-005	4.609e-006	0.3451
Calcium	0.004259	0.0009755	39.08	0.003284	131.5
Carbon	0.1169	0.006047	72.59	0.1109	1331.
Chlorine	0.007534	0.007534	266.9		
Hydrogen	111.0	111.0	1.118e+005	-0.0007260	-0.7313
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001427	0.0001072	3.436	3.552e-005	1.138

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010295

Activity of water = 0.999737

Solvent mass = 1.000835 kg

Solution mass = 1.001613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007528 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7472

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007501	265.7	0.8992	-2.1710
HCO3-	0.004378	266.9	0.9034	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8992	-2.9631
Ca++	0.0008992	36.01	0.6760	-3.2162
Mg++	0.0001022	2.481	0.6900	-4.1518
SO4--	9.688e-005	9.299	0.6606	-4.1938
CaHCO3+	4.164e-005	4.206	0.9053	-4.4237
CaCl+	2.539e-005	1.916	0.9021	-4.6402
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.980e-006	1.085	1.0000	-5.0980
Fe++	6.574e-006	0.3669	0.6760	-5.3522
Mn++	5.110e-006	0.2805	0.6760	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5515
CO3--	1.501e-006	0.08998	0.6646	-6.0012
CaCO3	9.224e-007	0.09225	1.0000	-6.0351
NaSO4-	9.160e-007	0.1090	0.9021	-6.0829
MgCl+	8.035e-007	0.04798	0.9021	-6.1397
MgSO4	7.435e-007	0.08942	1.0000	-6.1287
KSO4-	5.403e-007	0.07297	0.9021	-6.3121
FeHCO3+	4.409e-007	0.05149	0.9021	-6.4004
NaCl	4.075e-007	0.02380	1.0000	-6.3898
MnHCO3+	2.765e-007	0.03203	0.9021	-6.6031
KCl	1.764e-007	0.01314	1.0000	-6.7536
H+	1.734e-007	0.0001746	0.9141	-6.7999
FeCl+	6.462e-008	0.005895	0.9021	-7.2344
MgCO3	5.195e-008	0.004377	1.0000	-7.2844

OH-	4.786e-008	0.0008134	0.9007	-7.3654
FeSO4	4.509e-008	0.006845	1.0000	-7.3459
MnSO4	3.921e-008	0.005916	1.0000	-7.4066
FeCO3	2.975e-008	0.003443	1.0000	-7.5266
MnCl+	1.638e-008	0.001479	0.9021	-7.8305
MnCO3	1.288e-008	0.001480	1.0000	-7.8900
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08543	0.08550	1.0000	-1.0684
>(w)FeOCO2-	0.02535	0.02537	0.54652	-1.5961
>(w)FeOH2+	0.02456	0.02458	1.8298	-1.6097
>(w)FeOH	0.01454	0.01455	1.0000	-1.8374
>(s)FeOHCa++	0.003238	0.003240	3.3481	-2.4898
>(s)FeOH2+	0.0003228	0.0003231	1.8298	-3.4911
>(w)FeO-	0.0001972	0.0001974	0.54652	-3.7051
>(s)FeOH	0.0001911	0.0001913	1.0000	-3.7188
>(w)FeOCa+	4.304e-005	4.308e-005	1.8298	-4.3661
>(w)FeOHSO4--	1.921e-005	1.923e-005	0.29868	-4.7165
>(w)FeSO4-	1.627e-005	1.628e-005	0.54652	-4.7887
>(w)FeOHAsO4---	4.309e-006	4.313e-006	0.16323	-5.3656
>(s)FeO-	2.592e-006	2.594e-006	0.54652	-5.5864
>(w)FeHAsO4-	2.753e-007	2.756e-007	0.54652	-6.5601
>(w)FeH2AsO4	1.505e-008	1.506e-008	1.0000	-7.8225
>(w)FeH2AsO3	5.198e-009	5.202e-009	1.0000	-8.2842

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2633
Goethite	-0.4707	Monohydrocalcite	-1.5849
Calcite	-0.6013	Magnetite	-2.2652
Aragonite	-0.7666	Magnesite	-2.3222
Siderite	-0.8265	Dolomite-dis	-2.8452
Rhodochrosite	-0.8805	Gypsum	-2.9595
Dolomite	-1.2633		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.238e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-006	2.38e-010	3.40e-005	4.61e-006		0.658
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	
HCO3-	0.117	0.00605	369.	0.111	6.75e+003	

K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	2.30e-006	1.18e-010	3.78e-006	2.30e-006	0.0735
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.609e-006	2.379e-010	1.780e-005	4.609e-006	0.3447
Calcium	0.004259	0.0009759	39.05	0.003283	131.4
Carbon	0.1169	0.006052	72.57	0.1109	1330.
Chlorine	0.007534	0.007534	266.7		
Hydrogen	111.1	111.1	1.118e+005	-0.0007232	-0.7278
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3544.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001427	0.0001072	3.432	3.551e-005	1.137

ASH – MODEL OUTPUT

0.005926 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039359

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2178 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.145 uC/cm2

Surface potential = 1.45 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01889	433.3	0.8360	-1.8016
SO4--	0.009817	940.9	0.4841	-2.3231
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.88	0.5483	-3.0237
Ca++	0.0007886	31.54	0.5182	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007313	87.83	1.0000	-3.1359
Fe++	0.0006878	38.33	0.5182	-3.4481
CO2(aq)	0.0006315	27.73	1.0000	-3.1996
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004265	50.66	0.8360	-3.4479
CaSO4	0.0003924	53.31	1.0000	-3.4062
FeSO4	0.0002675	40.55	1.0000	-3.5727
NaHCO3	0.0001178	9.874	1.0000	-3.9289
MgHCO3+	5.437e-005	4.629	0.8360	-4.3424
FeHCO3+	4.877e-005	5.688	0.8360	-4.3896
CaHCO3+	3.610e-005	3.641	0.8449	-4.5157
Mn++	3.426e-005	1.878	0.5182	-4.7507
KSO4-	2.456e-005	3.312	0.8360	-4.6876
As(OH)3	2.077e-005	2.610	1.0000	-4.6825
MnSO4	1.442e-005	2.173	1.0000	-4.8410
FeCO3	9.932e-006	1.148	1.0000	-5.0030
CO3--	7.471e-006	0.4474	0.4930	-5.4337
MgCO3	2.473e-006	0.2080	1.0000	-5.6068
CaCO3	2.223e-006	0.2220	1.0000	-5.6530
MnHCO3+	1.846e-006	0.2136	0.8360	-5.8116

CaCl+	1.209e-006	0.09109	0.8360	-5.9955
MgCl+	7.555e-007	0.04505	0.8360	-6.1996
FeOH+	3.770e-007	0.02741	0.8360	-6.5014
Zn++	3.525e-007	0.02300	0.5182	-6.7383
FeCl+	3.230e-007	0.02943	0.8360	-6.5686
NaCO3-	2.678e-007	0.02218	0.8360	-6.6500
MnCO3	2.543e-007	0.02917	1.0000	-6.5946
As(OH)4-	2.224e-007	0.03173	0.8360	-6.7306
ZnSO4	1.742e-007	0.02806	1.0000	-6.7590
NaCl	1.439e-007	0.008389	1.0000	-6.8421
OH-	1.395e-007	0.002368	0.8320	-6.9352
H+	5.776e-008	5.809e-005	0.8678	-7.3000
HSe-	4.313e-008	0.003442	0.8360	-7.4430
HSO4-	2.271e-008	0.002200	0.8360	-7.7216
MgOH+	1.915e-008	0.0007892	0.8360	-7.7957
Mg2CO3++	1.875e-008	0.002033	0.5017	-8.0265
HAsO4--	1.621e-008	0.002263	0.4841	-8.1054

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.01016	0.005897	1.0000	-1.9932
>(w)FeOCO2H	0.004126	0.002396	1.0000	-2.3844
>(w)FeOCO2-	0.002239	0.001300	0.94502	-2.6499
>(w)FeOH	0.001902	0.001104	1.0000	-2.7207
>(w)FeOH2+	0.001757	0.001020	1.0582	-2.7553
>(s)FeOHCa++	0.0002498	0.0001450	1.1197	-3.6025
>(s)FeOZn+	0.0002469	0.0001433	1.0582	-3.6075
>(w)FeOZn+	6.706e-005	3.893e-005	1.0582	-4.1736
>(w)FeOHSO4--	6.242e-005	3.624e-005	0.89306	-4.2047
>(w)FeO-	4.719e-005	2.740e-005	0.94502	-4.3261
>(w)FeSO4-	2.889e-005	1.677e-005	0.94502	-4.5392

>(w)FeOHAsO4---	2.770e-005	1.608e-005	0.84397	-4.5576
>(w)FeOCa+	2.070e-005	1.202e-005	1.0582	-4.6839
>(s)FeOH	7.334e-006	4.258e-006	1.0000	-5.1347
>(s)FeOH2+	6.773e-006	3.932e-006	1.0582	-5.1692
>(w)FeHAsO4-	5.288e-007	3.070e-007	0.94502	-6.2767
>(s)FeO-	1.819e-007	1.056e-007	0.94502	-6.7401
>(w)FeH2AsO4	1.580e-008	9.175e-009	1.0000	-7.8013
>(w)FeHPO4-	3.049e-010	1.770e-010	0.94502	-9.5159
>(w)FePO4--	1.376e-010	7.990e-011	0.89306	-9.8613
>(w)FeH2PO4	1.147e-011	6.659e-012	1.0000	-10.9404
>(w)FeSeO3-	6.720e-019	3.901e-019	0.94502	-18.1726
>(w)FeOHSeO3--	4.285e-019	2.487e-019	0.89306	-18.3681
>(w)FeOHSeO4--	2.269e-042	1.318e-042	0.89306	-41.6441
>(w)FeSeO4-	9.149e-043	5.311e-043	0.94502	-42.0386

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9985s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6244s/sat	Dolomite-dis	-0.8052
Dolomite	0.7916s/sat	Monohydrocalcite	-1.1975
Dolomite-ord	0.7916s/sat	Gypsum	-1.2599
Magnetite	0.5337s/sat	Anhydrite	-1.5066
Rhodochrosite	0.3910s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1374
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3148
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3835		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.01440	-1.841
H2(g)	1.103e-011	-10.957
H2S(g)	9.493e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.442e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00593	1.22e-005	3.00	0.00591	1.45e+003	
Ca++	0.000866	0.000709	48.8	0.000157	10.8	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00908	15.7	
H2O	55.6	55.5	1.72e+006	-0.0155	-481.	
HCO3-	0.00755	0.00385	404.	0.00370	388.	
HPO4--	2.65e-010	1.00e-012	1.65e-007	2.64e-010	4.35e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	446.			
O2(aq)	-11.6	-11.6	-6.40e+005	8.20e-006	0.451	
SO4--	0.00683	0.00678	1.12e+003	5.30e-005	8.75	
SeO3--	2.50e-008	2.50e-008	0.00547	6.39e-019	1.39e-013	

Zn++	0.000183	3.06e-007	0.0344	0.000182	20.5

Sorbed	fraction	log fraction
As(OH)4-	0.9979	-0.001
Ca++	0.1814	-0.741
HCO3-	0.4897	-0.310
HPO4--	0.9962	-0.002
SO4--	0.007761	-2.110
SeO3--	2.551e-011	-10.593
Zn++	0.9983	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.005926	1.220e-005	1.571	0.005914	761.5
Calcium	0.0008656	0.0007086	48.81	0.0001570	10.82
Carbon	0.007547	0.003851	79.51	0.003696	76.29
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.005383	9.324
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01945	534.8
Phosphorus	2.646e-010	1.000e-012	5.324e-008	2.636e-010	1.403e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	6.389e-019	8.670e-014
Sodium	0.01128	0.01128	445.8		
Sulfur	0.006830	0.006777	373.4	5.301e-005	2.921
Zinc	0.0001826	3.059e-007	0.03437	0.0001823	20.48

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.032 log fO2 = -62.838

Eh = -0.0830 volts pe = -1.4363

Ionic strength = 0.037506

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581750 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2036 mg/kg sol'n

Rock mass = 0.004808 kg

Carbonate alkalinity= 222.43 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.932 uC/cm2

Surface potential = 9.32 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0830	-1.4363
e- + Fe+++ = Fe++	-0.1736	-3.0047

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	3.853e-005	-4.414	0.007104	0.002480
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	4.004e-007	-6.398	4.602e-005	1.244e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005554	-3.255	0.06434	0.01590
(total)			4.808	0.9163*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01890	433.7	0.8388	-1.7998
SO4--	0.009974	956.1	0.4908	-2.3103
HCO3-	0.004313	262.6	0.8425	-2.4397
Mg++	0.001672	40.55	0.5534	-3.0338
CO2(aq)	0.0008862	38.92	1.0000	-3.0525
Ca++	0.0007763	31.05	0.5240	-3.3906
K+	0.0007501	29.27	0.8308	-3.2054
MgSO4	0.0007360	88.41	1.0000	-3.1331
Cl-	0.0005129	18.15	0.8308	-3.3705
NaSO4-	0.0004396	52.23	0.8388	-3.4333
CaSO4	0.0004024	54.67	1.0000	-3.3953
NaHCO3	8.945e-005	7.499	1.0000	-4.0484
MgHCO3+	4.005e-005	3.410	0.8388	-4.4738
Fe++	3.963e-005	2.209	0.5240	-4.6826
Mn++	3.379e-005	1.852	0.5240	-4.7519
CaHCO3+	2.710e-005	2.734	0.8474	-4.6390
As(OH)3	2.566e-005	3.226	1.0000	-4.5907
KSO4-	2.528e-005	3.410	0.8388	-4.6736
FeSO4	1.605e-005	2.434	1.0000	-4.7944
MnSO4	1.481e-005	2.232	1.0000	-4.8293
CO3--	3.005e-006	0.1800	0.4995	-5.8236
FeHCO3+	2.142e-006	0.2498	0.8388	-5.7455
MnHCO3+	1.388e-006	0.1606	0.8388	-5.9341
CaCl+	1.204e-006	0.09079	0.8388	-5.9956

MgCO3	9.847e-007	0.08285	1.0000	-6.0067
CaCO3	9.021e-007	0.09010	1.0000	-6.0448
MgCl+	7.389e-007	0.04407	0.8388	-6.2077
Zn++	6.274e-007	0.04093	0.5240	-6.4831
ZnSO4	3.229e-007	0.05202	1.0000	-6.4910
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
As(OH)4-	1.476e-007	0.02106	0.8388	-6.9072
NaCl	1.451e-007	0.008462	1.0000	-6.8384
NaCO3-	1.092e-007	0.009046	0.8388	-7.0381
H+	1.070e-007	0.0001076	0.8695	-7.0315
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
OH-	7.494e-008	0.001272	0.8349	-7.2037
HSO4-	4.326e-008	0.004191	0.8388	-7.4403
FeCl+	1.884e-008	0.001716	0.8388	-7.8013
HAsO4--	1.437e-008	0.002006	0.4908	-8.1517
FeOH+	1.180e-008	0.0008579	0.8388	-8.0045
MgOH+	1.005e-008	0.0004143	0.8388	-8.0743

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.01015	0.005895	1.0000	-1.9934
>(w)FeOCO2H	0.004685	0.002720	1.0000	-2.3293
>(w)FeOH2+	0.001942	0.001127	1.4371	-2.7118
>(w)FeOCO2-	0.001861	0.001080	0.69583	-2.7303
>(w)FeOH	0.001539	0.0008935	1.0000	-2.8127
>(s)FeOZn+	0.0002748	0.0001595	1.4371	-3.5610
>(s)FeOHCa++	0.0002101	0.0001220	2.0654	-3.6776
>(w)FeOHSO4--	9.594e-005	5.570e-005	0.48417	-4.0180
>(w)FeSO4-	6.067e-005	3.522e-005	0.69583	-4.2170
>(w)FeOZn+	3.874e-005	2.249e-005	1.4371	-4.4118
>(w)FeO-	2.794e-005	1.622e-005	0.69583	-4.5537

>(w)FeOHAsO4---	2.719e-005	1.578e-005	0.33690	-4.5656
>(s)FeOH2+	1.442e-005	8.373e-006	1.4371	-4.8410
>(s)FeOH	1.143e-005	6.636e-006	1.0000	-4.9419
>(w)FeOCa+	6.617e-006	3.842e-006	1.4371	-5.1793
>(w)FeHAsO4-	9.691e-007	5.626e-007	0.69583	-6.0136
>(s)FeO-	2.075e-007	1.205e-007	0.69583	-6.6829
>(w)FeH2AsO4	3.957e-008	2.297e-008	1.0000	-7.4027
>(w)FeHPO4-	3.292e-010	1.911e-010	0.69583	-9.4826
>(w)FePO4--	1.088e-010	6.314e-011	0.48417	-9.9635
>(w)FeH2PO4	1.692e-011	9.824e-012	1.0000	-10.7716
>(w)FeSeO3-	2.506e-022	1.455e-022	0.69583	-21.6011
>(w)FeOHSeO3--	1.169e-022	6.789e-023	0.48417	-21.9321
>(w)FeOHSeO4--	1.551e-045	9.007e-046	0.48417	-44.8093
>(w)FeSeO4-	8.545e-046	4.961e-046	0.69583	-45.0683

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Magnetite	-1.2379
Dolomite	0.0000 sat	Gypsum	-1.2490
Siderite	0.0000 sat	Anhydrite	-1.4957
Se(black)	0.0000 sat	Monohydrocalcite	-1.5893
Rhodochrosite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1265
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3038
Calcite	-0.6097	FeO(c)	-2.3765
Aragonite	-0.7753	ZnSe	-2.4171
FeSe2	-0.9092	Smithsonite	-2.4668
Magnesite	-1.0630		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.02021	-1.694
H2(g)	4.405e-012	-11.356
H2S(g)	8.550e-020	-19.068
CH4(g)	7.274e-024	-23.138
S2(g)	1.752e-042	-41.756
O2(g)	1.452e-063	-62.838

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00593	1.50e-005	3.69	0.00591	1.45e+003	
Ca++	0.000866	0.000701	48.3	0.000126	8.67	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.37e-005	3.24	1.43e-020	1.37e-015	
Fe+++	0.0593	5.12e-013	4.92e-008			
H+	-0.169	0.000526	0.912	0.00955	16.5	
H2O	32.3	32.2	9.98e+005	-0.0156	-484.	
HCO3-	0.00755	0.00311	327.	0.00380	399.	
HPO4--	2.65e-010	4.76e-013	7.86e-008	2.64e-010	4.36e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00142	59.4			
Mn++	2.95e-005	2.91e-005	2.75			
Na+	0.0113	0.0113	446.			
O2(aq)	8.17e-006	5.53e-009	0.000304	8.19e-006	0.450	
SO4--	0.00683	0.00674	1.11e+003	9.09e-005	15.0	
SeO3--	2.50e-008	5.39e-013	1.18e-007	2.13e-022	4.66e-017	
Zn++	0.000183	5.52e-007	0.0620	0.000182	20.5	

Sorbed	fraction	log fraction
As(OH)4-	0.9975	-0.001
Ca++	0.1521	-0.818
HCO3-	0.5496	-0.260
HPO4--	0.9982	-0.001
SO4--	0.01331	-1.876
SeO3--	3.958e-010	-9.403
Zn++	0.9970	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.005926	1.500e-005	1.931	0.005911	761.2
Calcium	0.0008656	0.0007013	48.31	0.0001258	8.669
Carbon	0.007547	0.003114	64.30	0.003800	78.46
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.005713	9.897
Iron	0.05992	3.373e-005	3.238	1.428e-020	1.371e-015
Magnesium	0.001461	0.001422	59.41		
Manganese	2.949e-005	2.909e-005	2.747		
Oxygen	32.37	32.26	8.873e+005	0.01978	544.1
Phosphorus	2.646e-010	4.765e-013	2.537e-008	2.641e-010	1.406e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	5.391e-013	7.317e-008	2.134e-022	2.896e-017
Sodium	0.01128	0.01128	445.9		
Sulfur	0.006830	0.006739	371.4	9.092e-005	5.011
Zinc	0.0001826	5.519e-007	0.06202	0.0001820	20.46

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.032 log fO2 = -62.840

Eh = -0.0830 volts pe = -1.4374

Ionic strength = 0.037450

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582750 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2033 mg/kg sol'n

Rock mass = 0.004808 kg

Carbonate alkalinity= 222.26 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.932 uC/cm2

Surface potential = 9.32 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0830	-1.4374
e- + Fe+++ = Fe++	-0.1736	-3.0059

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	3.785e-005	-4.422	0.006979	0.002436
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	3.801e-007	-6.420	4.370e-005	1.181e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005554	-3.255	0.06434	0.01590
(total)			4.808	0.9163*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01887	433.0	0.8388	-1.8005
SO4--	0.009957	954.5	0.4910	-2.3108
HCO3-	0.004310	262.4	0.8425	-2.4400
Mg++	0.001670	40.51	0.5536	-3.0341
CO2(aq)	0.0008847	38.86	1.0000	-3.0532
Ca++	0.0007759	31.03	0.5242	-3.3907
K+	0.0007488	29.22	0.8309	-3.2061
MgSO4	0.0007346	88.24	1.0000	-3.1339
Cl-	0.0005120	18.11	0.8309	-3.3712
NaSO4-	0.0004383	52.08	0.8388	-3.4345
CaSO4	0.0004019	54.60	1.0000	-3.3959
NaHCO3	8.925e-005	7.482	1.0000	-4.0494
MgHCO3+	3.999e-005	3.405	0.8388	-4.4744
Fe++	3.960e-005	2.207	0.5242	-4.6828
Mn++	3.376e-005	1.851	0.5242	-4.7521
CaHCO3+	2.707e-005	2.732	0.8475	-4.6393
As(OH)3	2.564e-005	3.222	1.0000	-4.5911
KSO4-	2.521e-005	3.400	0.8388	-4.6748
FeSO4	1.603e-005	2.430	1.0000	-4.7951
MnSO4	1.479e-005	2.229	1.0000	-4.8300
CO3--	3.005e-006	0.1800	0.4997	-5.8234
FeHCO3+	2.140e-006	0.2495	0.8388	-5.7460
MnHCO3+	1.386e-006	0.1604	0.8388	-5.9345
CaCl+	1.202e-006	0.09062	0.8388	-5.9964

MgCO3	9.844e-007	0.08283	1.0000	-6.0068
CaCO3	9.023e-007	0.09013	1.0000	-6.0447
MgCl+	7.372e-007	0.04396	0.8388	-6.2087
Zn++	6.263e-007	0.04086	0.5242	-6.4837
ZnSO4	3.220e-007	0.05188	1.0000	-6.4921
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
As(OH)4-	1.476e-007	0.02105	0.8388	-6.9073
NaCl	1.446e-007	0.008435	1.0000	-6.8398
NaCO3-	1.091e-007	0.009035	0.8388	-7.0386
H+	1.068e-007	0.0001075	0.8696	-7.0320
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
OH-	7.501e-008	0.001273	0.8350	-7.2032
HSO4-	4.316e-008	0.004181	0.8388	-7.4412
FeCl+	1.880e-008	0.001713	0.8388	-7.8022
HAsO4--	1.434e-008	0.002002	0.4910	-8.1524
FeOH+	1.181e-008	0.0008583	0.8388	-8.0042
MgOH+	1.005e-008	0.0004144	0.8388	-8.0741

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.01014	0.005895	1.0000	-1.9941
>(w)FeOCO2H	0.004674	0.002718	1.0000	-2.3303
>(w)FeOH2+	0.001939	0.001128	1.4370	-2.7124
>(w)FeOCO2-	0.001858	0.001081	0.69590	-2.7309
>(w)FeOH	0.001538	0.0008945	1.0000	-2.8130
>(s)FeOZn+	0.0002743	0.0001595	1.4370	-3.5618
>(s)FeOHCa++	0.0002098	0.0001220	2.0649	-3.6782
>(w)FeOHSO4--	9.574e-005	5.568e-005	0.48428	-4.0189
>(w)FeSO4-	6.049e-005	3.518e-005	0.69590	-4.2183
>(w)FeOZn+	3.871e-005	2.251e-005	1.4370	-4.4122
>(w)FeO-	2.795e-005	1.626e-005	0.69590	-4.5536

>(w)FeOHAsO4---	2.714e-005	1.579e-005	0.33701	-4.5663
>(s)FeOH2+	1.439e-005	8.367e-006	1.4370	-4.8421
>(s)FeOH	1.141e-005	6.637e-006	1.0000	-4.9426
>(w)FeOCa+	6.619e-006	3.850e-006	1.4370	-5.1792
>(w)FeHAsO4-	9.657e-007	5.616e-007	0.69590	-6.0152
>(s)FeO-	2.074e-007	1.206e-007	0.69590	-6.6832
>(w)FeH2AsO4	3.939e-008	2.291e-008	1.0000	-7.4046
>(w)FeHPO4-	3.286e-010	1.911e-010	0.69590	-9.4834
>(w)FePO4--	1.086e-010	6.319e-011	0.48428	-9.9640
>(w)FeH2PO4	1.687e-011	9.813e-012	1.0000	-10.7728
>(w)FeSeO3-	2.493e-022	1.450e-022	0.69590	-21.6033
>(w)FeOHSeO3--	1.164e-022	6.772e-023	0.48428	-21.9339
>(w)FeOHSeO4--	1.541e-045	8.961e-046	0.48428	-44.8122
>(w)FeSeO4-	8.479e-046	4.931e-046	0.69590	-45.0716

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K			log Q/K
Hematite	0.0000	sat	Magnetite	-1.2372
Dolomite	0.0000	sat	Gypsum	-1.2496
Siderite	0.0000	sat	Anhydrite	-1.4963
Se(black)	0.0000	sat	Monohydrocalcite	-1.5891
Rhodochrosite	0.0000	sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000		Bassanite	-2.1271
Goethite	-0.4675		CaSO4^1/2H2O(bet	-2.3044
Calcite	-0.6096		FeO(c)	-2.3758
Aragonite	-0.7751		ZnSe	-2.4157
FeSe2	-0.9073		Smithsonite	-2.4672
Magnesite	-1.0631			

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.02018	-1.695
H2(g)	4.417e-012	-11.355
H2S(g)	8.614e-020	-19.065
CH4(g)	7.341e-024	-23.134
S2(g)	1.769e-042	-41.752
O2(g)	1.444e-063	-62.840

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00593	1.50e-005	3.68	0.00591	1.45e+003	
Ca++	0.000866	0.000702	48.3	0.000126	8.66	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.37e-005	3.23	1.43e-020	1.37e-015	
Fe+++	0.0593	5.13e-013	4.91e-008			
H+	-0.169	0.000526	0.910	0.00955	16.5	
H2O	32.4	32.3	9.98e+005	-0.0156	-483.	
HCO3-	0.00755	0.00312	326.	0.00380	398.	
HPO4--	2.65e-010	4.77e-013	7.85e-008	2.64e-010	4.35e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00142	59.3			
Mn++	2.95e-005	2.91e-005	2.74			
Na+	0.0113	0.0113	445.			
O2(aq)	8.17e-006	5.52e-009	0.000303	8.19e-006	0.449	
SO4--	0.00683	0.00674	1.11e+003	9.09e-005	15.0	
SeO3--	2.50e-008	5.42e-013	1.18e-007	2.13e-022	4.63e-017	
Zn++	0.000183	5.52e-007	0.0619	0.000182	20.4	

Sorbed	fraction	log fraction
As(OH)4-	0.9975	-0.001
Ca++	0.1520	-0.818
HCO3-	0.5493	-0.260
HPO4--	0.9982	-0.001
SO4--	0.01330	-1.876
SeO3--	3.924e-010	-9.406
Zn++	0.9970	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.005926	1.501e-005	1.929	0.005911	759.9
Calcium	0.0008656	0.0007019	48.28	0.0001259	8.656
Carbon	0.007547	0.003117	64.24	0.003799	78.30
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	0.005712	9.880
Iron	0.05992	3.375e-005	3.234	1.428e-020	1.368e-015
Magnesium	0.001461	0.001423	59.34		
Manganese	2.949e-005	2.911e-005	2.744		
Oxygen	32.43	32.32	8.873e+005	0.01978	543.1
Phosphorus	2.646e-010	4.769e-013	2.535e-008	2.641e-010	1.404e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	5.420e-013	7.344e-008	2.127e-022	2.882e-017
Sodium	0.01128	0.01128	445.1		
Sulfur	0.006830	0.006739	370.8	9.085e-005	4.998
Zinc	0.0001826	5.517e-007	0.06190	0.0001820	20.42

0.001075 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039386

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0319 uC/cm2

Surface potential = 0.319 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			______________	______________
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.6	0.8359	-1.8003
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007311	87.80	1.0000	-3.1360
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004276	50.79	0.8359	-3.4468
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.54	1.0000	-3.5728
NaHCO3	0.0001181	9.901	1.0000	-3.9277
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6877
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
As(OH)3	2.077e-006	0.2610	1.0000	-5.6825
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116

CaCl+	1.209e-006	0.09108	0.8359	-5.9956
MgCl+	7.555e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5686
NaCO3-	2.685e-007	0.02224	0.8359	-6.6488
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008413	1.0000	-6.8408
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.271e-008	0.002199	0.8359	-7.7217
As(OH)4-	2.224e-008	0.003173	0.8359	-7.7306
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.007498	0.004353	1.0000	-2.1251
>(w)FeOCO2-	0.003893	0.002260	0.98768	-2.4097
>(w)FeOH	0.003457	0.002007	1.0000	-2.4613
>(w)FeOH2+	0.003337	0.001937	1.0125	-2.4767
>(w)FeH2AsO3	0.001846	0.001072	1.0000	-2.7338
>(s)FeOHCa++	0.0002556	0.0001484	1.0251	-3.5925
>(s)FeOZn+	0.0002417	0.0001403	1.0125	-3.6167
>(w)FeOZn+	0.0001273	7.393e-005	1.0125	-3.8950
>(w)FeOHSO4--	0.0001038	6.027e-005	0.97550	-3.9838
>(w)FeO-	8.205e-005	4.764e-005	0.98768	-4.0859
>(w)FeSO4-	5.022e-005	2.915e-005	0.98768	-4.2991
>(w)FeOCa+	3.932e-005	2.283e-005	1.0125	-4.4054

>(s)FeOH	6.870e-006	3.989e-006	1.0000	-5.1630
>(s)FeOH2+	6.631e-006	3.850e-006	1.0125	-5.1784
>(w)FeOHAsO4---	4.408e-006	2.559e-006	0.96348	-5.3557
>(s)FeO-	1.631e-007	9.467e-008	0.98768	-6.7876
>(w)FeHAsO4-	9.194e-008	5.338e-008	0.98768	-7.0365
>(w)FeH2AsO4	2.872e-009	1.667e-009	1.0000	-8.5419
>(w)FeHPO4-	5.300e-010	3.077e-010	0.98768	-9.2757
>(w)FePO4--	2.289e-010	1.329e-010	0.97550	-9.6404
>(w)FeH2PO4	2.084e-011	1.210e-011	1.0000	-10.6811
>(w)FeSeO3-	1.168e-018	6.783e-019	0.98768	-17.9324
>(w)FeOHSeO3--	7.127e-019	4.138e-019	0.97550	-18.1471
>(w)FeOHSeO4--	3.775e-042	2.192e-042	0.97550	-41.4231
>(w)FeSeO4-	1.591e-042	9.234e-043	0.98768	-41.7984

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6244s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1975
Dolomite-ord	0.7915s/sat	Gypsum	-1.2600
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3835		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00108	1.22e-006	0.300	0.00107	264.	
Ca++	0.000880	0.000709	48.8	0.000171	11.8	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00710	12.3	
H2O	55.6	55.5	1.72e+006	-0.00879	-272.	
HCO3-	0.0105	0.00385	404.	0.00661	694.	
HPO4--	4.54e-010	1.00e-012	1.65e-007	4.53e-010	7.47e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.31e-006	0.0719	
SO4--	0.00687	0.00678	1.12e+003	8.94e-005	14.8	
SeO3--	2.50e-008	2.50e-008	0.00547	1.09e-018	2.38e-013	
Zn++	0.000215	3.06e-007	0.0344	0.000214	24.1	

Sorbed	fraction	log fraction
As(OH)4-	0.9989	-0.000
Ca++	0.1946	-0.711
HCO3-	0.6320	-0.199
HPO4--	0.9978	-0.001
SO4--	0.01302	-1.885
SeO3--	4.360e-011	-10.361
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001075	1.220e-006	0.1571	0.001074	138.3
Calcium	0.0008798	0.0007086	48.81	0.0001712	11.79
Carbon	0.01046	0.003851	79.51	0.006613	136.5
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.0004384	0.7594
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01571	432.0
Phosphorus	4.537e-010	1.000e-012	5.324e-008	4.527e-010	2.410e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.092e-018	1.482e-013
Sodium	0.01132	0.01132	447.1		
Sulfur	0.006867	0.006777	373.4	8.942e-005	4.927
Zinc	0.0002146	3.059e-007	0.03437	0.0002143	24.08

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.060 log fO2 = -63.069

Eh = -0.0880 volts pe = -1.5231

Ionic strength = 0.037241

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581736 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2012 mg/kg sol'n

Rock mass = 0.004818 kg

Carbonate alkalinity= 216.18 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.872 uC/cm2

Surface potential = 8.72 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0880	-1.5231
e- + Fe+++ = Fe++	-0.1776	-3.0748

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	8.634e-005	-4.064	0.01592	0.005557
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.555e-006	-5.808	0.0001787	4.831e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005567	-3.254	0.06450	0.01594
(total)			4.818	0.9195*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01896	435.1	0.8392	-1.7983
SO4--	0.009951	954.0	0.4918	-2.3104
HCO3-	0.004191	255.2	0.8429	-2.4519
Mg++	0.001616	39.19	0.5542	-3.0480
CO2(aq)	0.0008061	35.40	1.0000	-3.0936
K+	0.0007501	29.27	0.8313	-3.2052
Ca++	0.0007413	29.65	0.5249	-3.4099
MgSO4	0.0007121	85.54	1.0000	-3.1474
Cl-	0.0005129	18.15	0.8313	-3.3702
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003848	52.28	1.0000	-3.4148
NaHCO3	8.728e-005	7.317	1.0000	-4.0591
Fe++	3.806e-005	2.121	0.5249	-4.6994
MgHCO3+	3.767e-005	3.207	0.8392	-4.5002
Mn++	3.245e-005	1.779	0.5249	-4.7686
KSO4-	2.528e-005	3.409	0.8392	-4.6734
CaHCO3+	2.519e-005	2.542	0.8477	-4.6705
FeSO4	1.544e-005	2.341	1.0000	-4.8113
MnSO4	1.425e-005	2.147	1.0000	-4.8462
CO3--	3.118e-006	0.1867	0.5004	-5.8068
As(OH)3	2.423e-006	0.3045	1.0000	-5.6157
FeHCO3+	2.003e-006	0.2336	0.8392	-5.7745
MnHCO3+	1.298e-006	0.1502	0.8392	-5.9630
CaCl+	1.152e-006	0.08685	0.8392	-6.0146

MgCO3	9.905e-007	0.08334	1.0000	-6.0042
CaCO3	8.968e-007	0.08958	1.0000	-6.0473
MgCl+	7.153e-007	0.04266	0.8392	-6.2217
Zn++	6.286e-007	0.04102	0.5249	-6.4815
ZnSO4	3.240e-007	0.05220	1.0000	-6.4895
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.457e-007	0.008498	1.0000	-6.8365
NaCO3-	1.139e-007	0.009432	0.8392	-7.0198
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	1.000e-007	0.0001006	0.8698	-7.0605
OH-	8.006e-008	0.001359	0.8353	-7.1747
HSO4-	4.044e-008	0.003918	0.8392	-7.4693
FeCl+	1.813e-008	0.001652	0.8392	-7.8178
As(OH)4-	1.489e-008	0.002124	0.8392	-7.9033
FeOH+	1.213e-008	0.0008819	0.8392	-7.9923
MgOH+	1.039e-008	0.0004284	0.8392	-8.0595

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008205	0.004764	1.0000	-2.0859
>(w)FeOH2+	0.003580	0.002079	1.4042	-2.4461
>(w)FeOCO2-	0.003404	0.001976	0.71215	-2.4680
>(w)FeOH	0.002964	0.001721	1.0000	-2.5282
>(w)FeH2AsO3	0.001846	0.001071	1.0000	-2.7339
>(s)FeOZn+	0.0002867	0.0001665	1.4042	-3.5426
>(s)FeOHCa++	0.0002000	0.0001161	1.9718	-3.6989
>(w)FeOHSO4--	0.0001763	0.0001024	0.50716	-3.7537
>(w)FeSO4-	0.0001068	6.198e-005	0.71215	-3.9716
>(w)FeOZn+	8.191e-005	4.756e-005	1.4042	-4.0866
>(w)FeO-	5.620e-005	3.263e-005	0.71215	-4.2503
>(w)FeOCa+	1.333e-005	7.741e-006	1.4042	-4.8751

>(s)FeOH2+	1.312e-005	7.618e-006	1.4042	-4.8820
>(s)FeOH	1.086e-005	6.306e-006	1.0000	-4.9641
>(w)FeOHAsO4---	4.314e-006	2.505e-006	0.36117	-5.3651
>(s)FeO-	2.060e-007	1.196e-007	0.71215	-6.6862
>(w)FeHAsO4-	1.410e-007	8.183e-008	0.71215	-6.8509
>(w)FeH2AsO4	5.510e-009	3.199e-009	1.0000	-8.2588
>(w)FeHPO4-	5.599e-010	3.251e-010	0.71215	-9.2519
>(w)FePO4--	1.932e-010	1.122e-010	0.50716	-9.7140
>(w)FeH2PO4	2.756e-011	1.600e-011	1.0000	-10.5598
>(w)FeSeO3-	2.958e-022	1.717e-022	0.71215	-21.5290
>(w)FeOHSeO3--	1.442e-022	8.370e-023	0.50716	-21.8411
>(w)FeOHSeO4--	1.466e-045	8.509e-046	0.50716	-44.8340
>(w)FeSeO4-	7.729e-046	4.487e-046	0.71215	-45.1119

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.1968
Siderite	0.0000 sat	Gypsum	-1.2684
Hematite	0.0000 sat	Anhydrite	-1.5151
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5918
Se(black)	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1459
Goethite	-0.4675	ZnSe	-2.2419
Calcite	-0.6123	CaSO4^1/2H2O(bet	-2.3233
FeSe2	-0.7522	FeO(c)	-2.3354
Aragonite	-0.7778	Smithsonite	-2.4484
Magnesite	-1.0605		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01839	-1.735
H2(g)	5.750e-012	-11.240
H2S(g)	2.171e-019	-18.663
CH4(g)	1.920e-023	-22.717
S2(g)	6.632e-042	-41.178
O2(g)	8.524e-064	-63.069

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00108	1.42e-006	0.348	0.00107	264.	
Ca++	0.000880	0.000670	46.1	0.000124	8.53	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.24e-005	3.11	2.26e-021	2.17e-016	
Fe+++	0.0593	5.03e-013	4.83e-008			
H+	-0.171	0.000466	0.808	0.00772	13.4	
H2O	32.3	32.2	9.98e+005	-0.00895	-277.	
HCO3-	0.0105	0.00299	314.	0.00674	707.	
HPO4--	4.54e-010	4.46e-013	7.35e-008	4.53e-010	7.48e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.4			
Mn++	2.95e-005	2.79e-005	2.64			
Na+	0.0113	0.0113	447.			
O2(aq)	1.27e-006	4.48e-010	2.46e-005	1.29e-006	0.0712	
SO4--	0.00687	0.00670	1.11e+003	0.000164	27.1	
SeO3--	2.50e-008	7.52e-013	1.64e-007	2.55e-022	5.57e-017	
Zn++	0.000215	5.53e-007	0.0622	0.000214	24.1	

Sorbed	fraction	log fraction
As(OH)4-	0.9987	-0.001
Ca++	0.1561	-0.807
HCO3-	0.6924	-0.160
HPO4--	0.9990	-0.000
SO4--	0.02393	-1.621
SeO3--	3.398e-010	-9.469
Zn++	0.9974	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001075	1.416e-006	0.1824	0.001074	138.3
Calcium	0.0008798	0.0006696	46.13	0.0001239	8.535
Carbon	0.01046	0.002994	61.81	0.006740	139.2
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.0008649	1.499
Iron	0.05992	3.238e-005	3.109	2.262e-021	2.172e-016
Magnesium	0.001461	0.001374	57.42		
Manganese	2.949e-005	2.793e-005	2.638		
Oxygen	32.37	32.26	8.873e+005	0.01623	446.3
Phosphorus	4.537e-010	4.457e-013	2.373e-008	4.532e-010	2.413e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	7.518e-013	1.020e-007	2.554e-022	3.467e-017
Sodium	0.01132	0.01132	447.2		
Sulfur	0.006867	0.006702	369.4	0.0001643	9.057
Zinc	0.0002146	5.533e-007	0.06218	0.0002140	24.05

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.061 log fO2 = -63.071

Eh = -0.0880 volts pe = -1.5239

Ionic strength = 0.037185

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582737 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004817 kg

Carbonate alkalinity= 216.06 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.872 uC/cm2

Surface potential = 8.72 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0880	-1.5239
e- + Fe+++ = Fe++	-0.1777	-3.0756

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	8.555e-005	-4.068	0.01578	0.005506
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.531e-006	-5.815	0.0001760	4.758e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005567	-3.254	0.06450	0.01594
(total)			4.817	0.9194*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01893	434.3	0.8393	-1.7989
SO4--	0.009935	952.4	0.4920	-2.3109
HCO3-	0.004189	255.1	0.8429	-2.4521
Mg++	0.001614	39.15	0.5544	-3.0482
CO2(aq)	0.0008051	35.36	1.0000	-3.0941
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007410	29.64	0.5251	-3.4099
MgSO4	0.0007108	85.39	1.0000	-3.1482
Cl-	0.0005121	18.12	0.8314	-3.3709
NaSO4-	0.0004396	52.22	0.8393	-3.4331
CaSO4	0.0003843	52.22	1.0000	-3.4153
NaHCO3	8.710e-005	7.303	1.0000	-4.0600
Fe++	3.804e-005	2.120	0.5251	-4.6995
MgHCO3+	3.762e-005	3.204	0.8393	-4.5007
Mn++	3.243e-005	1.778	0.5251	-4.7688
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.518e-005	2.540	0.8478	-4.6707
FeSO4	1.542e-005	2.338	1.0000	-4.8119
MnSO4	1.423e-005	2.144	1.0000	-4.8468
CO3--	3.117e-006	0.1867	0.5006	-5.8067
As(OH)3	2.421e-006	0.3043	1.0000	-5.6160
FeHCO3+	2.001e-006	0.2334	0.8393	-5.7748
MnHCO3+	1.297e-006	0.1500	0.8393	-5.9633
CaCl+	1.150e-006	0.08671	0.8393	-6.0153

MgCO3	9.902e-007	0.08332	1.0000	-6.0043
CaCO3	8.971e-007	0.08960	1.0000	-6.0472
MgCl+	7.137e-007	0.04256	0.8393	-6.2226
Zn++	6.278e-007	0.04096	0.5251	-6.4819
ZnSO4	3.233e-007	0.05208	1.0000	-6.4904
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.452e-007	0.008471	1.0000	-6.8379
NaCO3-	1.137e-007	0.009418	0.8393	-7.0203
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.995e-008	0.0001005	0.8699	-7.0608
OH-	8.011e-008	0.001360	0.8354	-7.1744
HSO4-	4.036e-008	0.003910	0.8393	-7.4702
FeCl+	1.809e-008	0.001649	0.8393	-7.8186
As(OH)4-	1.489e-008	0.002124	0.8393	-7.9033
FeOH+	1.213e-008	0.0008822	0.8393	-7.9921
MgOH+	1.039e-008	0.0004284	0.8393	-8.0595

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008188	0.004762	1.0000	-2.0868
>(w)FeOH2+	0.003574	0.002079	1.4041	-2.4468
>(w)FeOCO2-	0.003399	0.001977	0.71219	-2.4687
>(w)FeOH	0.002961	0.001722	1.0000	-2.5286
>(w)FeH2AsO3	0.001842	0.001071	1.0000	-2.7346
>(s)FeOZn+	0.0002862	0.0001664	1.4041	-3.5434
>(s)FeOHCa++	0.0001997	0.0001162	1.9715	-3.6995
>(w)FeOHSO4--	0.0001759	0.0001023	0.50722	-3.7547
>(w)FeSO4-	0.0001064	6.190e-005	0.71219	-3.9729
>(w)FeOZn+	8.182e-005	4.758e-005	1.4041	-4.0872
>(w)FeO-	5.618e-005	3.267e-005	0.71219	-4.2504
>(w)FeOCa+	1.333e-005	7.753e-006	1.4041	-4.8751

>(s)FeOH2+	1.309e-005	7.614e-006	1.4041	-4.8830
>(s)FeOH	1.084e-005	6.307e-006	1.0000	-4.9648
>(w)FeOHAsO4---	4.307e-006	2.505e-006	0.36124	-5.3659
>(s)FeO-	2.058e-007	1.197e-007	0.71219	-6.6866
>(w)FeHAsO4-	1.405e-007	8.173e-008	0.71219	-6.8522
>(w)FeH2AsO4	5.490e-009	3.193e-009	1.0000	-8.2604
>(w)FeHPO4-	5.589e-010	3.250e-010	0.71219	-9.2527
>(w)FePO4--	1.930e-010	1.122e-010	0.50722	-9.7145
>(w)FeH2PO4	2.749e-011	1.599e-011	1.0000	-10.5609
>(w)FeSeO3-	2.946e-022	1.713e-022	0.71219	-21.5308
>(w)FeOHSeO3--	1.437e-022	8.355e-023	0.50722	-21.8426
>(w)FeOHSeO4--	1.458e-045	8.477e-046	0.50722	-44.8363
>(w)FeSeO4-	7.682e-046	4.468e-046	0.71219	-45.1145

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.1963
Siderite	0.0000 sat	Gypsum	-1.2690
Hematite	0.0000 sat	Anhydrite	-1.5156
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5917
Se(black)	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1464
Goethite	-0.4675	ZnSe	-2.2409
Calcite	-0.6121	CaSO4^1/2H2O(bet	-2.3238
FeSe2	-0.7509	FeO(c)	-2.3349
Aragonite	-0.7777	Smithsonite	-2.4488
Magnesite	-1.0606		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01837	-1.736
H2(g)	5.761e-012	-11.240
H2S(g)	2.182e-019	-18.661
CH4(g)	1.933e-023	-22.714
S2(g)	6.673e-042	-41.176
O2(g)	8.491e-064	-63.071

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00108	1.42e-006	0.348	0.00107	263.	
Ca++	0.000880	0.000670	46.1	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.24e-005	3.11	2.26e-021	2.17e-016	
Fe+++	0.0593	5.04e-013	4.83e-008			
H+	-0.171	0.000466	0.807	0.00772	13.4	
H2O	32.4	32.3	9.98e+005	-0.00895	-277.	
HCO3-	0.0105	0.00300	314.	0.00674	706.	
HPO4--	4.54e-010	4.46e-013	7.35e-008	4.53e-010	7.46e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00138	57.4			
Mn++	2.95e-005	2.80e-005	2.64			
Na+	0.0113	0.0113	446.			
O2(aq)	1.27e-006	4.48e-010	2.46e-005	1.29e-006	0.0711	
SO4--	0.00687	0.00670	1.10e+003	0.000164	27.1	
SeO3--	2.50e-008	7.55e-013	1.64e-007	2.55e-022	5.55e-017	
Zn++	0.000215	5.53e-007	0.0621	0.000214	24.0	

Sorbed	fraction	log fraction
As(OH)4-	0.9987	-0.001
Ca++	0.1560	-0.807
HCO3-	0.6922	-0.160
HPO4--	0.9990	-0.000
SO4--	0.02391	-1.621
SeO3--	3.376e-010	-9.472
Zn++	0.9974	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.001075	1.417e-006	0.1822	0.001074	138.1
Calcium	0.0008798	0.0006703	46.10	0.0001239	8.523
Carbon	0.01046	0.002997	61.77	0.006738	138.9
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	0.0008647	1.496
Iron	0.05992	3.241e-005	3.106	2.262e-021	2.168e-016
Magnesium	0.001461	0.001375	57.35		
Manganese	2.949e-005	2.796e-005	2.636		
Oxygen	32.42	32.32	8.873e+005	0.01622	445.5
Phosphorus	4.537e-010	4.461e-013	2.371e-008	4.532e-010	2.409e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	7.550e-013	1.023e-007	2.549e-022	3.453e-017
Sodium	0.01132	0.01132	446.4		
Sulfur	0.006867	0.006702	368.7	0.0001642	9.034
Zinc	0.0002146	5.533e-007	0.06208	0.0002140	24.01

0.0001171 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039390

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0184 uC/cm2

Surface potential = 0.184 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			_____________	_____________
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.7	0.8359	-1.8002
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007310	87.80	1.0000	-3.1361
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004277	50.81	0.8359	-3.4466
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.53	1.0000	-3.5728
NaHCO3	0.0001182	9.905	1.0000	-3.9275
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6877
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116
CaCl+	1.209e-006	0.09108	0.8359	-5.9956

MgCl+	7.554e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5687
NaCO3-	2.686e-007	0.02225	0.8359	-6.6487
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
As(OH)3	2.077e-007	0.02610	1.0000	-6.6825
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008416	1.0000	-6.8407
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.270e-008	0.002199	0.8359	-7.7217
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008164	0.004740	1.0000	-2.0881
>(w)FeOCO2-	0.004217	0.002448	0.99287	-2.3750
>(w)FeOH	0.003764	0.002185	1.0000	-2.4243
>(w)FeOH2+	0.003653	0.002121	1.0072	-2.4374
>(s)FeOHCa++	0.0002563	0.0001488	1.0144	-3.5913
>(s)FeOZn+	0.0002411	0.0001400	1.0072	-3.6178
>(w)FeH2AsO3	0.0002010	0.0001167	1.0000	-3.6968
>(w)FeOZn+	0.0001394	8.093e-005	1.0072	-3.8557
>(w)FeOHSO4--	0.0001119	6.494e-005	0.98580	-3.9513
>(w)FeO-	8.888e-005	5.160e-005	0.99287	-4.0512
>(w)FeSO4-	5.440e-005	3.158e-005	0.99287	-4.2644
>(w)FeOCa+	4.304e-005	2.499e-005	1.0072	-4.3661
>(s)FeOH	6.817e-006	3.958e-006	1.0000	-5.1664

>(s)FeOH2+	6.614e-006	3.840e-006	1.0072	-5.1795
>(w)FeOHAsO4---	4.725e-007	2.743e-007	0.97877	-6.3256
>(s)FeO-	1.610e-007	9.344e-008	0.99287	-6.7933
>(w)FeHAsO4-	9.960e-009	5.782e-009	0.99287	-8.0018
>(w)FeHPO4-	5.741e-010	3.333e-010	0.99287	-9.2410
>(w)FeH2AsO4	3.127e-010	1.815e-010	1.0000	-9.5049
>(w)FePO4--	2.467e-010	1.432e-010	0.98580	-9.6079
>(w)FeH2PO4	2.269e-011	1.317e-011	1.0000	-10.6441
>(w)FeSeO3-	1.266e-018	7.347e-019	0.99287	-17.8977
>(w)FeOHSeO3--	7.680e-019	4.459e-019	0.98580	-18.1146
>(w)FeOHSeO4--	4.068e-042	2.362e-042	0.98580	-41.3906
>(w)FeSeO4-	1.723e-042	1.000e-042	0.99287	-41.7637

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6243s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1976
Dolomite-ord	0.7915s/sat	Gypsum	-1.2601
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3836		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.000117	1.22e-007	0.0300	0.000117	28.7	
Ca++	0.000882	0.000709	48.8	0.000174	12.0	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00671	11.6	
H2O	55.6	55.5	1.72e+006	-0.00745	-231.	
HCO3-	0.0110	0.00385	404.	0.00719	754.	
HPO4--	4.91e-010	1.00e-012	1.65e-007	4.90e-010	8.08e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.40e-007	0.00771	
SO4--	0.00687	0.00678	1.12e+003	9.65e-005	15.9	
SeO3--	2.50e-008	2.50e-008	0.00547	1.18e-018	2.58e-013	
Zn++	0.000221	3.06e-007	0.0344	0.000221	24.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9990	-0.000
Ca++	0.1969	-0.706
HCO3-	0.6511	-0.186
HPO4--	0.9980	-0.001
SO4--	0.01404	-1.853
SeO3--	4.713e-011	-10.327
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001171	1.220e-007	0.01571	0.0001170	15.06
Calcium	0.0008823	0.0007086	48.81	0.0001738	11.97
Carbon	0.01104	0.003851	79.51	0.007188	148.4
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0005365	-0.9294
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01497	411.5
Phosphorus	4.907e-010	1.000e-012	5.324e-008	4.897e-010	2.607e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.181e-018	1.602e-013
Sodium	0.01132	0.01132	447.3		
Sulfur	0.006874	0.006777	373.4	9.652e-005	5.319
Zinc	0.0002212	3.059e-007	0.03437	0.0002209	24.82

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -63.171

Eh = -0.0897 volts pe = -1.5527

Ionic strength = 0.037196

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.40 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.863 uC/cm2

Surface potential = 8.63 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0897	-1.5527
e- + Fe+++ = Fe++	-0.1782	-3.0846

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.378e-005	-4.028	0.01729	0.006036
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.730e-006	-5.762	0.0001988	5.374e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005569	-3.254	0.06452	0.01594
			______________	______________
(total)			4.819	0.9199*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01897	435.2	0.8392	-1.7981
SO4--	0.009945	953.4	0.4919	-2.3105
HCO3-	0.004176	254.3	0.8429	-2.4534
Mg++	0.001607	38.98	0.5543	-3.0502
CO2(aq)	0.0007956	34.95	1.0000	-3.0993
K+	0.0007501	29.27	0.8313	-3.2051
Ca++	0.0007361	29.44	0.5251	-3.4129
MgSO4	0.0007083	85.08	1.0000	-3.1498
Cl-	0.0005130	18.15	0.8313	-3.3701
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003821	51.92	1.0000	-3.4178
NaHCO3	8.701e-005	7.295	1.0000	-4.0604
Fe++	3.783e-005	2.108	0.5251	-4.7020
MgHCO3+	3.734e-005	3.179	0.8392	-4.5040
Mn++	3.225e-005	1.768	0.5251	-4.7712
KSO4-	2.527e-005	3.409	0.8392	-4.6735
CaHCO3+	2.493e-005	2.515	0.8478	-4.6750
FeSO4	1.535e-005	2.327	1.0000	-4.8140
MnSO4	1.416e-005	2.134	1.0000	-4.8489
CO3--	3.135e-006	0.1878	0.5006	-5.8042
FeHCO3+	1.984e-006	0.2314	0.8392	-5.7786
MnHCO3+	1.285e-006	0.1487	0.8392	-5.9671
CaCl+	1.145e-006	0.08628	0.8392	-6.0175
MgCO3	9.913e-007	0.08341	1.0000	-6.0038

CaCO3	8.961e-007	0.08951	1.0000	-6.0477
MgCl+	7.116e-007	0.04244	0.8392	-6.2239
Zn++	6.303e-007	0.04112	0.5251	-6.4803
ZnSO4	3.248e-007	0.05233	1.0000	-6.4883
As(OH)3	2.404e-007	0.03021	1.0000	-6.6191
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.458e-007	0.008503	1.0000	-6.8363
NaCO3-	1.146e-007	0.009491	0.8392	-7.0170
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.907e-008	9.966e-005	0.8699	-7.0646
OH-	8.082e-008	0.001372	0.8354	-7.1706
HSO4-	4.005e-008	0.003879	0.8392	-7.4735
FeCl+	1.802e-008	0.001642	0.8392	-7.8203
FeOH+	1.217e-008	0.0008850	0.8392	-7.9908
MgOH+	1.043e-008	0.0004302	0.8392	-8.0576

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008890	0.005161	1.0000	-2.0511
>(w)FeOH2+	0.003907	0.002268	1.3992	-2.4082
>(w)FeOCO2-	0.003710	0.002154	0.71470	-2.4306
>(w)FeOH	0.003253	0.001889	1.0000	-2.4877
>(s)FeOZn+	0.0002887	0.0001676	1.3992	-3.5396
>(w)FeH2AsO3	0.0002010	0.0001167	1.0000	-3.6968
>(s)FeOHCa++	0.0001983	0.0001151	1.9577	-3.7026
>(w)FeOHSO4--	0.0001921	0.0001115	0.51080	-3.7164
>(w)FeSO4-	0.0001156	6.714e-005	0.71470	-3.9369
>(w)FeOZn+	9.136e-005	5.304e-005	1.3992	-4.0393
>(w)FeO-	6.205e-005	3.603e-005	0.71470	-4.2072
>(w)FeOCa+	1.473e-005	8.551e-006	1.3992	-4.8318
>(s)FeOH2+	1.293e-005	7.506e-006	1.3992	-4.8885

>(s)FeOH	1.076e-005	6.250e-006	1.0000	-4.9680
>(w)FeOHAsO4---	4.255e-007	2.470e-007	0.36507	-6.3712
>(s)FeO-	2.053e-007	1.192e-007	0.71470	-6.6875
>(w)FeHAsO4-	1.374e-008	7.976e-009	0.71470	-7.8621
>(w)FeHPO4-	6.048e-010	3.512e-010	0.71470	-9.2184
>(w)FeH2AsO4	5.339e-010	3.100e-010	1.0000	-9.2725
>(w)FePO4--	2.099e-010	1.219e-010	0.51080	-9.6779
>(w)FeH2PO4	2.959e-011	1.718e-011	1.0000	-10.5288
>(w)FeSeO3-	2.585e-022	1.501e-022	0.71470	-21.5876
>(w)FeOHSeO3--	1.267e-022	7.357e-023	0.51080	-21.8971
>(w)FeOHSeO4--	1.146e-045	6.653e-046	0.51080	-44.9408
>(w)FeSeO4-	6.008e-046	3.488e-046	0.71470	-45.2213

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.1911
Siderite	0.0000 sat	Gypsum	-1.2715
Hematite	0.0000 sat	Anhydrite	-1.5181
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5922
Se(black)	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1489
Goethite	-0.4675	ZnSe	-2.1817
Calcite	-0.6126	CaSO4^1/2H2O(bet	-2.3263
FeSe2	-0.6957	FeO(c)	-2.3297
Aragonite	-0.7781	Smithsonite	-2.4446
Magnesite	-1.0601		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01815	-1.741
H2(g)	6.463e-012	-11.190
H2S(g)	3.401e-019	-18.468
CH4(g)	3.027e-023	-22.519
S2(g)	1.288e-041	-40.890
O2(g)	6.746e-064	-63.171

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.000117	1.41e-007	0.0345	0.000117	28.7	
Ca++	0.000882	0.000665	45.8	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09	2.23e-022	2.14e-017	
Fe+++	0.0593	5.02e-013	4.82e-008			
H+	-0.171	0.000459	0.795	0.00736	12.7	
H2O	32.3	32.2	9.98e+005	-0.00762	-236.	
HCO3-	0.0110	0.00298	312.	0.00732	767.	
HPO4--	4.91e-010	4.42e-013	7.30e-008	4.90e-010	8.09e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.1			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	1.03e-007	3.90e-011	2.14e-006	1.28e-007	0.00702	
SO4--	0.00687	0.00670	1.11e+003	0.000179	29.5	
SeO3--	2.50e-008	8.53e-013	1.86e-007	2.24e-022	4.88e-017	
Zn++	0.000221	5.55e-007	0.0623	0.000221	24.8	

Sorbed fraction log fraction

As(OH)4-	0.9988	-0.001
Ca++	0.1569	-0.804
HCO3-	0.7107	-0.148
HPO4--	0.9991	-0.000
SO4--	0.02599	-1.585
SeO3--	2.621e-010	-9.581
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001171	1.405e-007	0.01810	0.0001170	15.06
Calcium	0.0008823	0.0006649	45.81	0.0001237	8.523
Carbon	0.01104	0.002978	61.49	0.007315	151.0
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-9.396e-005	-0.1628
Iron	0.05992	3.218e-005	3.089	2.231e-022	2.141e-017
Magnesium	0.001461	0.001367	57.11		
Manganese	2.949e-005	2.776e-005	2.621		
Oxygen	32.37	32.26	8.873e+005	0.01551	426.6
Phosphorus	4.907e-010	4.423e-013	2.355e-008	4.902e-010	2.610e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	8.531e-013	1.158e-007	2.236e-022	3.035e-017
Sodium	0.01132	0.01132	447.4		
Sulfur	0.006874	0.006695	369.0	0.0001787	9.847
Zinc	0.0002212	5.547e-007	0.06234	0.0002206	24.80

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -63.173

Eh = -0.0897 volts pe = -1.5533

Ionic strength = 0.037141

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582735 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2006 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.28 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.863 uC/cm2

Surface potential = 8.63 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0897	-1.5533
e- + Fe+++ = Fe++	-0.1782	-3.0854

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.297e-005	-4.032	0.01714	0.005984
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.705e-006	-5.768	0.0001960	5.299e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005569	-3.254	0.06452	0.01594
			______________	______________
(total)			4.819	0.9199*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01894	434.5	0.8393	-1.7987
SO4--	0.009929	951.8	0.4921	-2.3110
HCO3-	0.004174	254.2	0.8430	-2.4536
Mg++	0.001606	38.95	0.5545	-3.0505
CO2(aq)	0.0007948	34.91	1.0000	-3.0998
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007359	29.44	0.5252	-3.4128
MgSO4	0.0007070	84.93	1.0000	-3.1506
Cl-	0.0005121	18.12	0.8314	-3.3708
NaSO4-	0.0004396	52.23	0.8393	-3.4330
CaSO4	0.0003817	51.86	1.0000	-3.4183
NaHCO3	8.683e-005	7.280	1.0000	-4.0613
Fe++	3.781e-005	2.107	0.5252	-4.7021
MgHCO3+	3.730e-005	3.176	0.8393	-4.5044
Mn++	3.223e-005	1.767	0.5252	-4.7713
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.492e-005	2.514	0.8479	-4.6751
FeSO4	1.533e-005	2.323	1.0000	-4.8146
MnSO4	1.414e-005	2.131	1.0000	-4.8495
CO3--	3.135e-006	0.1877	0.5008	-5.8041
FeHCO3+	1.982e-006	0.2312	0.8393	-5.7789
MnHCO3+	1.284e-006	0.1486	0.8393	-5.9674
CaCl+	1.143e-006	0.08614	0.8393	-6.0182
MgCO3	9.909e-007	0.08338	1.0000	-6.0039

CaCO3	8.964e-007	0.08954	1.0000	-6.0475
MgCl+	7.100e-007	0.04235	0.8393	-6.2248
Zn++	6.294e-007	0.04107	0.5252	-6.4807
ZnSO4	3.241e-007	0.05222	1.0000	-6.4893
As(OH)3	2.402e-007	0.03019	1.0000	-6.6194
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.453e-007	0.008476	1.0000	-6.8377
NaCO3-	1.144e-007	0.009478	0.8393	-7.0176
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.900e-008	9.958e-005	0.8699	-7.0649
OH-	8.087e-008	0.001373	0.8355	-7.1703
HSO4-	3.997e-008	0.003872	0.8393	-7.4744
FeCl+	1.799e-008	0.001639	0.8393	-7.8211
FeOH+	1.218e-008	0.0008853	0.8393	-7.9906
MgOH+	1.043e-008	0.0004302	0.8393	-8.0576

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008871	0.005159	1.0000	-2.0520
>(w)FeOH2+	0.003901	0.002268	1.3991	-2.4089
>(w)FeOCO2-	0.003704	0.002154	0.71474	-2.4313
>(w)FeOH	0.003250	0.001890	1.0000	-2.4881
>(s)FeOZn+	0.0002882	0.0001676	1.3991	-3.5404
>(w)FeH2AsO3	0.0002007	0.0001167	1.0000	-3.6975
>(s)FeOHCa++	0.0001980	0.0001152	1.9575	-3.7032
>(w)FeOHSO4--	0.0001917	0.0001115	0.51085	-3.7175
>(w)FeSO4-	0.0001153	6.705e-005	0.71474	-3.9382
>(w)FeOZn+	9.124e-005	5.306e-005	1.3991	-4.0398
>(w)FeO-	6.203e-005	3.607e-005	0.71474	-4.2074
>(w)FeOCa+	1.473e-005	8.564e-006	1.3991	-4.8319
>(s)FeOH2+	1.290e-005	7.502e-006	1.3991	-4.8894

>(s)FeOH	1.075e-005	6.250e-006	1.0000	-4.9687
>(w)FeOHAsO4---	4.247e-007	2.470e-007	0.36513	-6.3719
>(s)FeO-	2.051e-007	1.193e-007	0.71474	-6.6880
>(w)FeHAsO4-	1.370e-008	7.966e-009	0.71474	-7.8633
>(w)FeHPO4-	6.037e-010	3.511e-010	0.71474	-9.2192
>(w)FeH2AsO4	5.320e-010	3.094e-010	1.0000	-9.2741
>(w)FePO4--	2.097e-010	1.219e-010	0.51085	-9.6784
>(w)FeH2PO4	2.952e-011	1.717e-011	1.0000	-10.5299
>(w)FeSeO3-	2.574e-022	1.497e-022	0.71474	-21.5893
>(w)FeOHSeO3--	1.263e-022	7.345e-023	0.51085	-21.8986
>(w)FeOHSeO4--	1.140e-045	6.630e-046	0.51085	-44.9431
>(w)FeSeO4-	5.973e-046	3.474e-046	0.71474	-45.2238

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.1906
Siderite	0.0000 sat	Gypsum	-1.2720
Hematite	0.0000 sat	Anhydrite	-1.5186
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5920
Se(black)	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1494
Goethite	-0.4675	ZnSe	-2.1807
Calcite	-0.6125	CaSO4^1/2H2O(bet	-2.3268
FeSe2	-0.6944	FeO(c)	-2.3293
Aragonite	-0.7780	Smithsonite	-2.4450
Magnesite	-1.0603		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

Steam	0.02024	-1.694
CO2(g)	0.01813	-1.742
H2(g)	6.475e-012	-11.189
H2S(g)	3.417e-019	-18.466
CH4(g)	3.046e-023	-22.516
S2(g)	1.295e-041	-40.888
O2(g)	6.721e-064	-63.173

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.000117	1.41e-007	0.0345	0.000117	28.7	
Ca++	0.000882	0.000666	45.8	0.000124	8.51	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09	2.23e-022	2.14e-017	
Fe+++	0.0593	5.03e-013	4.82e-008			
H+	-0.171	0.000459	0.794	0.00735	12.7	
H2O	32.4	32.3	9.98e+005	-0.00761	-235.	
HCO3-	0.0110	0.00298	312.	0.00731	766.	
HPO4--	4.91e-010	4.43e-013	7.29e-008	4.90e-010	8.07e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00137	57.0			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	1.03e-007	3.90e-011	2.14e-006	1.28e-007	0.00701	
SO4--	0.00687	0.00670	1.10e+003	0.000179	29.4	
SeO3--	2.50e-008	8.57e-013	1.87e-007	2.23e-022	4.86e-017	
Zn++	0.000221	5.55e-007	0.0622	0.000221	24.8	

Sorbed fraction log fraction

As(OH)4-	0.9988	-0.001
Ca++	0.1568	-0.805
HCO3-	0.7104	-0.148
HPO4--	0.9991	-0.000
SO4--	0.02597	-1.586
SeO3--	2.605e-010	-9.584
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.0001171	1.406e-007	0.01808	0.0001170	15.04
Calcium	0.0008823	0.0006656	45.78	0.0001237	8.511
Carbon	0.01104	0.002981	61.45	0.007314	150.7
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	-9.423e-005	-0.1630
Iron	0.05992	3.221e-005	3.087	2.231e-022	2.138e-017
Magnesium	0.001461	0.001368	57.04		
Manganese	2.949e-005	2.778e-005	2.619		
Oxygen	32.42	32.32	8.873e+005	0.01551	425.8
Phosphorus	4.907e-010	4.428e-013	2.353e-008	4.902e-010	2.606e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	8.566e-013	1.161e-007	2.232e-022	3.024e-017
Sodium	0.01132	0.01132	446.6		
Sulfur	0.006874	0.006695	368.3	0.0001785	9.822
Zinc	0.0002212	5.548e-007	0.06224	0.0002206	24.76

1.181e-005 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039390

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0170 uC/cm2

Surface potential = 0.170 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			______	______
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.8	0.8359	-1.8002
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007310	87.80	1.0000	-3.1361
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004278	50.81	0.8359	-3.4466
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.53	1.0000	-3.5728
NaHCO3	0.0001182	9.905	1.0000	-3.9275
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6878
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116
CaCl+	1.209e-006	0.09108	0.8359	-5.9956

MgCl+	7.554e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5687
NaCO3-	2.686e-007	0.02225	0.8359	-6.6487
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008416	1.0000	-6.8407
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.270e-008	0.002199	0.8359	-7.7217
As(OH)3	2.077e-008	0.002610	1.0000	-7.6825
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008238	0.004782	1.0000	-2.0842
>(w)FeOCO2-	0.004253	0.002469	0.99340	-2.3713
>(w)FeOH	0.003798	0.002205	1.0000	-2.4204
>(w)FeOH2+	0.003687	0.002141	1.0066	-2.4333
>(s)FeOHCa++	0.0002563	0.0001488	1.0133	-3.5912
>(s)FeOZn+	0.0002410	0.0001399	1.0066	-3.6179
>(w)FeOZn+	0.0001407	8.170e-005	1.0066	-3.8516
>(w)FeOHSO4--	0.0001127	6.545e-005	0.98685	-3.9479
>(w)FeO-	8.963e-005	5.204e-005	0.99340	-4.0475
>(w)FeSO4-	5.485e-005	3.185e-005	0.99340	-4.2608
>(w)FeOCa+	4.345e-005	2.523e-005	1.0066	-4.3620
>(w)FeH2AsO3	2.028e-005	1.177e-005	1.0000	-4.6929
>(s)FeOH	6.812e-006	3.955e-006	1.0000	-5.1668

>(s)FeOH2+	6.613e-006	3.839e-006	1.0066	-5.1796
>(s)FeO-	1.607e-007	9.332e-008	0.99340	-6.7939
>(w)FeOHAsO4---	4.760e-008	2.764e-008	0.98034	-7.3224
>(w)FeHAsO4-	1.004e-009	5.831e-010	0.99340	-8.9981
>(w)FeHPO4-	5.789e-010	3.361e-010	0.99340	-9.2374
>(w)FePO4--	2.486e-010	1.443e-010	0.98685	-9.6045
>(w)FeH2AsO4	3.155e-011	1.832e-011	1.0000	-10.5010
>(w)FeH2PO4	2.290e-011	1.329e-011	1.0000	-10.6403
>(w)FeSeO3-	1.276e-018	7.409e-019	0.99340	-17.8941
>(w)FeOHSeO3--	7.741e-019	4.494e-019	0.98685	-18.1112
>(w)FeOHSeO4--	4.100e-042	2.380e-042	0.98685	-41.3872
>(w)FeSeO4-	1.737e-042	1.009e-042	0.99340	-41.7601

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6243s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1976
Dolomite-ord	0.7915s/sat	Gypsum	-1.2601
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3836		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-005	1.22e-008	0.00300	1.18e-005	2.90	
Ca++	0.000883	0.000709	48.8	0.000174	12.0	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00667	11.6	
H2O	55.6	55.5	1.72e+006	-0.00731	-226.	
HCO3-	0.0111	0.00385	404.	0.00725	760.	
HPO4--	4.95e-010	1.00e-012	1.65e-007	4.94e-010	8.14e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.41e-008	0.000776	
SO4--	0.00687	0.00678	1.12e+003	9.73e-005	16.1	
SeO3--	2.50e-008	2.50e-008	0.00547	1.19e-018	2.60e-013	
Zn++	0.000222	3.06e-007	0.0344	0.000222	24.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9990	-0.000
Ca++	0.1972	-0.705
HCO3-	0.6531	-0.185
HPO4--	0.9980	-0.001
SO4--	0.01415	-1.849
SeO3--	4.752e-011	-10.323
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.181e-005	1.220e-008	0.001571	1.180e-005	1.520
Calcium	0.0008826	0.0007086	48.81	0.0001740	11.99
Carbon	0.01110	0.003851	79.51	0.007252	149.7
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0006436	-1.115
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01488	409.3
Phosphorus	4.947e-010	1.000e-012	5.324e-008	4.937e-010	2.628e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.190e-018	1.615e-013
Sodium	0.01132	0.01132	447.3		
Sulfur	0.006874	0.006777	373.4	9.730e-005	5.361
Zinc	0.0002219	3.059e-007	0.03437	0.0002216	24.90

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -64.560

Eh = -0.1098 volts pe = -1.9003

Ionic strength = 0.037191

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.32 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1098	-1.9003
e- + Fe+++ = Fe++	-0.1782	-3.0856

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.457e-005	-4.024	0.01744	0.006087
FeSe2	2.019e-009	-8.695	4.316e-007	6.049e-008

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.748e-006	-5.757	0.0002009	5.432e-005
Se(black)	2.101e-008	-7.678	1.659e-006	
Siderite	0.0005570	-3.254	0.06453	0.01595
			-------------	-------------
(total)			4.819	0.9200*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01897	435.3	0.8392	-1.7980
SO4--	0.009945	953.4	0.4919	-2.3105
HCO3-	0.004175	254.2	0.8429	-2.4536
Mg++	0.001606	38.96	0.5544	-3.0505
CO2(aq)	0.0007946	34.90	1.0000	-3.0999
K+	0.0007501	29.27	0.8314	-3.2051
Ca++	0.0007356	29.42	0.5251	-3.4132
MgSO4	0.0007079	85.03	1.0000	-3.1500
Cl-	0.0005130	18.15	0.8314	-3.3701
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003819	51.88	1.0000	-3.4181
NaHCO3	8.698e-005	7.293	1.0000	-4.0606
Fe++	3.780e-005	2.107	0.5251	-4.7023
MgHCO3+	3.730e-005	3.176	0.8392	-4.5044
Mn++	3.223e-005	1.767	0.5251	-4.7715
KSO4-	2.527e-005	3.409	0.8392	-4.6735
CaHCO3+	2.490e-005	2.513	0.8478	-4.6754
FeSO4	1.534e-005	2.325	1.0000	-4.8142
MnSO4	1.415e-005	2.133	1.0000	-4.8492
CO3--	3.137e-006	0.1879	0.5006	-5.8039
FeHCO3+	1.982e-006	0.2311	0.8392	-5.7790
MnHCO3+	1.284e-006	0.1486	0.8392	-5.9676
CaCl+	1.144e-006	0.08622	0.8392	-6.0178

MgCO3	9.913e-007	0.08342	1.0000	-6.0038
CaCO3	8.960e-007	0.08950	1.0000	-6.0477
MgCl+	7.113e-007	0.04242	0.8392	-6.2241
Zn++	6.304e-007	0.04114	0.5251	-6.4801
ZnSO4	3.249e-007	0.05235	1.0000	-6.4882
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.458e-007	0.008503	1.0000	-6.8363
NaCO3-	1.147e-007	0.009498	0.8392	-7.0167
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.898e-008	9.956e-005	0.8699	-7.0650
OH-	8.090e-008	0.001373	0.8354	-7.1702
HSO4-	4.001e-008	0.003875	0.8392	-7.4740
As(OH)3	2.406e-008	0.003024	1.0000	-7.6187
FeCl+	1.801e-008	0.001641	0.8392	-7.8206
FeOH+	1.218e-008	0.0008853	0.8392	-7.9906
MgOH+	1.044e-008	0.0004304	0.8392	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008965	0.005205	1.0000	-2.0474
>(w)FeOH2+	0.003943	0.002289	1.3987	-2.4042
>(w)FeOCO2-	0.003744	0.002173	0.71497	-2.4267
>(w)FeOH	0.003285	0.001907	1.0000	-2.4835
>(s)FeOZn+	0.0002889	0.0001677	1.3987	-3.5392
>(s)FeOHCa++	0.0001982	0.0001150	1.9562	-3.7030
>(w)FeOHSO4--	0.0001938	0.0001125	0.51119	-3.7125
>(w)FeSO4-	0.0001166	6.770e-005	0.71497	-3.9333
>(w)FeOZn+	9.241e-005	5.365e-005	1.3987	-4.0343
>(w)FeO-	6.270e-005	3.640e-005	0.71497	-4.2027
>(w)FeH2AsO3	2.032e-005	1.180e-005	1.0000	-4.6921
>(w)FeOCa+	1.488e-005	8.641e-006	1.3987	-4.8273

>(s)FeOH2+	1.291e-005	7.494e-006	1.3987	-4.8891
>(s)FeOH	1.075e-005	6.244e-006	1.0000	-4.9684
>(s)FeO-	2.053e-007	1.192e-007	0.71497	-6.6877
>(w)FeOHAsO4---	8.707e-009	5.055e-009	0.36548	-8.0601
>(w)FeHPO4-	6.098e-010	3.540e-010	0.71497	-9.2148
>(w)FeHAsO4-	2.808e-010	1.630e-010	0.71497	-9.5516
>(w)FePO4--	2.118e-010	1.230e-010	0.51119	-9.6741
>(w)FeH2PO4	2.981e-011	1.731e-011	1.0000	-10.5256
>(w)FeH2AsO4	1.091e-011	6.332e-012	1.0000	-10.9623
>(w)FeSeO3-	1.067e-023	6.194e-024	0.71497	-22.9719
>(w)FeOHSeO3--	5.234e-024	3.039e-024	0.51119	-23.2812
>(w)FeOHSeO4--	9.566e-048	5.554e-048	0.51119	-47.0193
>(w)FeSeO4-	5.012e-048	2.910e-048	0.71497	-47.3000

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Magnetite	-1.1905
Siderite	0.0000 sat	Gypsum	-1.2718
FeSe2	0.0000 sat	ZnSe	-1.4863
Rhodochrosite	0.0000 sat	Anhydrite	-1.5184
Se(black)	0.0000 sat	Monohydrocalcite	-1.5922
Dolomite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1492
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3266
Calcite	-0.6127	FeO(c)	-2.3291
Aragonite	-0.7782	Smithsonite	-2.4442
Magnesite	-1.0601		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

Steam	0.02024	-1.694
CO2(g)	0.01812	-1.742
H2(g)	3.198e-011	-10.495
H2S(g)	2.034e-016	-15.692
CH4(g)	1.811e-020	-19.742
S2(g)	1.881e-037	-36.726
O2(g)	2.756e-065	-64.560

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-005	1.41e-008	0.00345	1.18e-005	2.90	
Ca++	0.000883	0.000664	45.8	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09	4.14e-024	3.97e-019	
Fe+++	0.0593	5.02e-013	4.82e-008			
H+	-0.171	0.000458	0.794	0.00731	12.7	
H2O	32.3	32.2	9.98e+005	-0.00747	-231.	
HCO3-	0.0111	0.00298	312.	0.00738	774.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.94e-010	8.15e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.1			
Mn++	2.95e-005	2.77e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-2.34e-008	-5.53e-012	-3.04e-007	2.61e-009	0.000144	
SO4--	0.00687	0.00669	1.11e+003	0.000180	29.8	
SeO3--	2.50e-008	4.22e-012	9.22e-007	9.93e-024	2.17e-018	
Zn++	0.000222	5.55e-007	0.0624	0.000221	24.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1569	-0.804
HCO3-	0.7125	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02622	-1.581
SeO3--	2.349e-012	-11.629
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.181e-005	1.406e-008	0.001810	1.180e-005	1.520
Calcium	0.0008826	0.0006644	45.77	0.0001237	8.522
Carbon	0.01110	0.002977	61.46	0.007378	152.3
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0001993	-0.3453
Iron	0.05992	3.216e-005	3.087		
Magnesium	0.001461	0.001366	57.07		
Manganese	2.949e-005	2.774e-005	2.620		
Oxygen	32.37	32.26	8.873e+005	0.01543	424.5
Phosphorus	4.947e-010	4.420e-013	2.353e-008	4.943e-010	2.632e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	4.225e-012	5.735e-007	9.926e-024	1.347e-018
Sodium	0.01132	0.01132	447.4		
Sulfur	0.006874	0.006694	368.9	0.0001802	9.933
Zinc	0.0002219	5.548e-007	0.06236	0.0002214	24.88

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -64.559

Eh = -0.1098 volts pe = -1.9003

Ionic strength = 0.037136

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2006 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.20 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1098	-1.9003
e- + Fe+++ = Fe++	-0.1783	-3.0864

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.376e-005	-4.028	0.01729	0.006035
FeSe2	2.034e-009	-8.692	4.349e-007	6.095e-008

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.724e-006	-5.764	0.0001981	5.356e-005
Se(black)	2.097e-008	-7.678	1.656e-006	
Siderite	0.0005569	-3.254	0.06452	0.01594
			—————	—————
(total)			4.819	0.9199*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01894	434.5	0.8393	-1.7987
SO4--	0.009928	951.8	0.4921	-2.3110
HCO3-	0.004173	254.1	0.8430	-2.4538
Mg++	0.001605	38.92	0.5545	-3.0507
CO2(aq)	0.0007937	34.86	1.0000	-3.1004
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007354	29.41	0.5253	-3.4131
MgSO4	0.0007066	84.88	1.0000	-3.1508
Cl-	0.0005121	18.12	0.8314	-3.3708
NaSO4-	0.0004396	52.23	0.8393	-3.4330
CaSO4	0.0003814	51.82	1.0000	-3.4186
NaHCO3	8.681e-005	7.278	1.0000	-4.0614
Fe++	3.778e-005	2.106	0.5253	-4.7024
MgHCO3+	3.726e-005	3.173	0.8393	-4.5048
Mn++	3.221e-005	1.766	0.5253	-4.7716
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.489e-005	2.512	0.8479	-4.6756
FeSO4	1.531e-005	2.322	1.0000	-4.8149
MnSO4	1.413e-005	2.130	1.0000	-4.8498
CO3--	3.137e-006	0.1879	0.5008	-5.8038
FeHCO3+	1.980e-006	0.2310	0.8393	-5.7793
MnHCO3+	1.283e-006	0.1485	0.8393	-5.9679
CaCl+	1.142e-006	0.08608	0.8393	-6.0185

MgCO3	9.910e-007	0.08339	1.0000	-6.0039
CaCO3	8.963e-007	0.08953	1.0000	-6.0476
MgCl+	7.097e-007	0.04232	0.8393	-6.2250
Zn++	6.296e-007	0.04108	0.5253	-6.4805
ZnSO4	3.242e-007	0.05224	1.0000	-6.4892
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.453e-007	0.008476	1.0000	-6.8377
NaCO3-	1.145e-007	0.009484	0.8393	-7.0173
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.890e-008	9.949e-005	0.8699	-7.0653
OH-	8.095e-008	0.001374	0.8355	-7.1699
HSO4-	3.993e-008	0.003868	0.8393	-7.4748
As(OH)3	2.404e-008	0.003022	1.0000	-7.6190
FeCl+	1.798e-008	0.001638	0.8393	-7.8214
FeOH+	1.218e-008	0.0008856	0.8393	-7.9904
MgOH+	1.044e-008	0.0004304	0.8393	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008946	0.005203	1.0000	-2.0484
>(w)FeOH2+	0.003936	0.002289	1.3986	-2.4049
>(w)FeOCO2-	0.003738	0.002174	0.71501	-2.4274
>(w)FeOH	0.003282	0.001909	1.0000	-2.4839
>(s)FeOZn+	0.0002884	0.0001677	1.3986	-3.5400
>(s)FeOHCa++	0.0001979	0.0001151	1.9560	-3.7036
>(w)FeOHSO4--	0.0001934	0.0001125	0.51124	-3.7136
>(w)FeSO4-	0.0001163	6.762e-005	0.71501	-3.9345
>(w)FeOZn+	9.229e-005	5.368e-005	1.3986	-4.0348
>(w)FeO-	6.268e-005	3.645e-005	0.71501	-4.2029
>(w)FeH2AsO3	2.028e-005	1.180e-005	1.0000	-4.6929
>(w)FeOCa+	1.488e-005	8.654e-006	1.3986	-4.8274

>(s)FeOH2+	1.288e-005	7.490e-006	1.3986	-4.8901
>(s)FeOH	1.074e-005	6.244e-006	1.0000	-4.9691
>(s)FeO-	2.051e-007	1.193e-007	0.71501	-6.6881
>(w)FeOHAsO4---	8.718e-009	5.070e-009	0.36554	-8.0596
>(w)FeHPO4-	6.086e-010	3.540e-010	0.71501	-9.2156
>(w)FeHAsO4-	2.808e-010	1.633e-010	0.71501	-9.5516
>(w)FePO4--	2.115e-010	1.230e-010	0.51124	-9.6746
>(w)FeH2PO4	2.974e-011	1.730e-011	1.0000	-10.5266
>(w)FeH2AsO4	1.090e-011	6.339e-012	1.0000	-10.9626
>(w)FeSeO3-	1.069e-023	6.216e-024	0.71501	-22.9711
>(w)FeOHSeO3--	5.247e-024	3.051e-024	0.51124	-23.2801
>(w)FeOHSeO4--	9.600e-048	5.583e-048	0.51124	-47.0177
>(w)FeSeO4-	5.027e-048	2.923e-048	0.71501	-47.2987

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Magnetite	-1.1900
Siderite	0.0000 sat	Gypsum	-1.2723
FeSe2	0.0000 sat	ZnSe	-1.4866
Rhodochrosite	0.0000 sat	Anhydrite	-1.5189
Se(black)	0.0000 sat	Monohydrocalcite	-1.5920
Dolomite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1497
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3271
Calcite	-0.6125	FeO(c)	-2.3287
Aragonite	-0.7780	Smithsonite	-2.4445
Magnesite	-1.0602		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

Steam	0.02024	-1.694
CO2(g)	0.01810	-1.742
H2(g)	3.194e-011	-10.496
H2S(g)	2.020e-016	-15.695
CH4(g)	1.801e-020	-19.744
S2(g)	1.859e-037	-36.731
O2(g)	2.762e-065	-64.559

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-005	1.41e-008	0.00345	1.18e-005	2.89	
Ca++	0.000883	0.000665	45.7	0.000124	8.51	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.08	4.14e-024	3.96e-019	
Fe+++	0.0593	5.03e-013	4.82e-008			
H+	-0.171	0.000458	0.793	0.00731	12.6	
H2O	32.4	32.3	9.98e+005	-0.00747	-231.	
HCO3-	0.0111	0.00298	312.	0.00738	772.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.94e-010	8.14e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00137	57.0			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-2.34e-008	-5.53e-012	-3.04e-007	2.62e-009	0.000144	
SO4--	0.00687	0.00669	1.10e+003	0.000180	29.7	
SeO3--	2.50e-008	4.23e-012	9.22e-007	8.27e-024	1.80e-018	
Zn++	0.000222	5.55e-007	0.0623	0.000221	24.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1568	-0.805
HCO3-	0.7123	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02620	-1.582
SeO3--	1.956e-012	-11.709
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.181e-005	1.407e-008	0.001809	1.180e-005	1.517
Calcium	0.0008826	0.0006651	45.75	0.0001237	8.510
Carbon	0.01110	0.002980	61.42	0.007377	152.0
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	-0.0001996	-0.3452
Iron	0.05992	3.219e-005	3.084		
Magnesium	0.001461	0.001367	57.01		
Manganese	2.949e-005	2.776e-005	2.617		
Oxygen	32.42	32.32	8.873e+005	0.01543	423.6
Phosphorus	4.947e-010	4.424e-013	2.352e-008	4.943e-010	2.627e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	4.230e-012	5.732e-007	8.272e-024	1.121e-018
Sodium	0.01132	0.01132	446.6		
Sulfur	0.006874	0.006694	368.3	0.0001801	9.908
Zinc	0.0002219	5.549e-007	0.06226	0.0002214	24.84

1.1831e-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039390

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0169 uC/cm2

Surface potential = 0.169 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			______	______
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.8	0.8359	-1.8002
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007310	87.80	1.0000	-3.1361
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004278	50.81	0.8359	-3.4466
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.53	1.0000	-3.5728
NaHCO3	0.0001182	9.905	1.0000	-3.9275
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6878
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116
CaCl+	1.209e-006	0.09108	0.8359	-5.9956

MgCl+	7.554e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5687
NaCO3-	2.686e-007	0.02225	0.8359	-6.6487
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008416	1.0000	-6.8407
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.270e-008	0.002199	0.8359	-7.7217
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008245	0.004787	1.0000	-2.0838
>(w)FeOCO2-	0.004256	0.002471	0.99346	-2.3710
>(w)FeOH	0.003802	0.002207	1.0000	-2.4200
>(w)FeOH2+	0.003691	0.002143	1.0066	-2.4329
>(s)FeOHCa++	0.0002563	0.0001488	1.0132	-3.5912
>(s)FeOZn+	0.0002410	0.0001399	1.0066	-3.6180
>(w)FeOZn+	0.0001409	8.178e-005	1.0066	-3.8512
>(w)FeOHSO4--	0.0001128	6.550e-005	0.98696	-3.9476
>(w)FeO-	8.971e-005	5.208e-005	0.99346	-4.0472
>(w)FeSO4-	5.490e-005	3.187e-005	0.99346	-4.2604
>(w)FeOCa+	4.349e-005	2.525e-005	1.0066	-4.3616
>(s)FeOH	6.811e-006	3.954e-006	1.0000	-5.1668
>(s)FeOH2+	6.612e-006	3.839e-006	1.0066	-5.1796
>(w)FeH2AsO3	2.030e-006	1.178e-006	1.0000	-5.6925

>(s)FeO-	1.607e-007	9.331e-008	0.99346	-6.7939
>(w)FeOHAsO4---	4.764e-009	2.766e-009	0.98050	-8.3221
>(w)FeHPO4-	5.794e-010	3.364e-010	0.99346	-9.2370
>(w)FePO4--	2.488e-010	1.444e-010	0.98696	-9.6042
>(w)FeHAsO4-	1.005e-010	5.836e-011	0.99346	-9.9977
>(w)FeH2PO4	2.292e-011	1.330e-011	1.0000	-10.6399
>(w)FeH2AsO4	3.158e-012	1.833e-012	1.0000	-11.5006
>(w)FeSeO3-	1.277e-018	7.415e-019	0.99346	-17.8937
>(w)FeOHSeO3--	7.747e-019	4.498e-019	0.98696	-18.1109
>(w)FeOHSeO4--	4.103e-042	2.382e-042	0.98696	-41.3869
>(w)FeSeO4-	1.739e-042	1.010e-042	0.99346	-41.7597

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6243s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1976
Dolomite-ord	0.7915s/sat	Gypsum	-1.2601
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3836		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-006	1.22e-009	0.000300	1.18e-006	0.290	
Ca++	0.000883	0.000709	48.8	0.000174	12.0	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00667	11.5	
H2O	55.6	55.5	1.72e+006	-0.00729	-226.	
HCO3-	0.0111	0.00385	404.	0.00726	761.	
HPO4--	4.95e-010	1.00e-012	1.65e-007	4.94e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.41e-009	7.77e-005	
SO4--	0.00687	0.00678	1.12e+003	9.74e-005	16.1	
SeO3--	2.50e-008	2.50e-008	0.00547	1.19e-018	2.60e-013	
Zn++	0.000222	3.06e-007	0.0344	0.000222	24.9	

Sorbed fraction log fraction

As(OH)4-	0.9990	-0.000
Ca++	0.1972	-0.705
HCO3-	0.6533	-0.185
HPO4--	0.9980	-0.001
SO4--	0.01416	-1.849
SeO3--	4.756e-011	-10.323
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-006	1.220e-009	0.0001571	1.181e-006	0.1521
Calcium	0.0008827	0.0007086	48.81	0.0001741	11.99
Carbon	0.01111	0.003851	79.51	0.007258	149.8
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0006544	-1.134
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01488	409.1
Phosphorus	4.951e-010	1.000e-012	5.324e-008	4.941e-010	2.631e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.191e-018	1.617e-013
Sodium	0.01132	0.01132	447.3		
Sulfur	0.006875	0.006777	373.4	9.738e-005	5.366
Zinc	0.0002220	3.059e-007	0.03437	0.0002217	24.91

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4508

Ionic strength = 0.037191

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.31 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4508
e- + Fe+++ = Fe++	-0.1782	-3.0857

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.464e-005	-4.024	0.01745	0.006092
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.750e-006	-5.757	0.0002011	5.437e-005
Siderite	0.0005569	-3.254	0.06453	0.01595
Sphalerite	2.429e-009	-8.615	2.366e-007	5.787e-008
			______________	______________
(total)			4.819	0.9200

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01897	435.3	0.8392	-1.7980
SO4--	0.009945	953.3	0.4919	-2.3105
HCO3-	0.004175	254.2	0.8429	-2.4536
Mg++	0.001606	38.95	0.5544	-3.0505
CO2(aq)	0.0007945	34.89	1.0000	-3.0999
K+	0.0007501	29.27	0.8314	-3.2051
Ca++	0.0007355	29.42	0.5251	-3.4132
MgSO4	0.0007078	85.03	1.0000	-3.1501
Cl-	0.0005130	18.15	0.8314	-3.3701
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003818	51.88	1.0000	-3.4181
NaHCO3	8.698e-005	7.292	1.0000	-4.0606
Fe++	3.780e-005	2.107	0.5251	-4.7023
MgHCO3+	3.730e-005	3.176	0.8392	-4.5044
Mn++	3.223e-005	1.767	0.5251	-4.7715
KSO4-	2.527e-005	3.409	0.8392	-4.6735
CaHCO3+	2.490e-005	2.512	0.8478	-4.6755
FeSO4	1.534e-005	2.325	1.0000	-4.8143
MnSO4	1.415e-005	2.133	1.0000	-4.8492
CO3--	3.137e-006	0.1879	0.5006	-5.8039
FeHCO3+	1.982e-006	0.2311	0.8392	-5.7791
MnHCO3+	1.284e-006	0.1486	0.8392	-5.9676
CaCl+	1.144e-006	0.08621	0.8392	-6.0178

MgCO3	9.913e-007	0.08342	1.0000	-6.0038
CaCO3	8.960e-007	0.08950	1.0000	-6.0477
MgCl+	7.112e-007	0.04242	0.8392	-6.2241
Zn++	6.305e-007	0.04114	0.5251	-6.4801
ZnSO4	3.249e-007	0.05235	1.0000	-6.4882
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.458e-007	0.008503	1.0000	-6.8363
NaCO3-	1.147e-007	0.009498	0.8392	-7.0167
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.897e-008	9.955e-005	0.8699	-7.0651
OH-	8.091e-008	0.001373	0.8354	-7.1701
HSO4-	4.000e-008	0.003875	0.8392	-7.4740
FeCl+	1.801e-008	0.001641	0.8392	-7.8206
FeOH+	1.218e-008	0.0008853	0.8392	-7.9906
MgOH+	1.044e-008	0.0004304	0.8392	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008973	0.005209	1.0000	-2.0471
>(w)FeOH2+	0.003946	0.002291	1.3986	-2.4038
>(w)FeOCO2-	0.003747	0.002175	0.71501	-2.4263
>(w)FeOH	0.003288	0.001909	1.0000	-2.4830
>(s)FeOZn+	0.0002889	0.0001677	1.3986	-3.5392
>(s)FeOHCa++	0.0001981	0.0001150	1.9561	-3.7030
>(w)FeOHSO4--	0.0001940	0.0001126	0.51123	-3.7122
>(w)FeSO4-	0.0001167	6.776e-005	0.71501	-3.9329
>(w)FeOZn+	9.251e-005	5.371e-005	1.3986	-4.0338
>(w)FeO-	6.276e-005	3.644e-005	0.71501	-4.2023
>(w)FeOCa+	1.490e-005	8.650e-006	1.3986	-4.8269
>(s)FeOH2+	1.291e-005	7.493e-006	1.3986	-4.8892
>(s)FeOH	1.075e-005	6.243e-006	1.0000	-4.9685

>(w)FeH2AsO3	2.034e-006	1.181e-006	1.0000	-5.6916
>(s)FeO-	2.053e-007	1.192e-007	0.71501	-6.6877
>(w)FeHPO4-	6.103e-010	3.543e-010	0.71501	-9.2145
>(w)FePO4--	2.120e-010	1.231e-010	0.51123	-9.6737
>(w)FeOHAsO4---	6.912e-011	4.013e-011	0.36553	-10.1604
>(w)FeH2PO4	2.984e-011	1.732e-011	1.0000	-10.5252
>(w)FeHAsO4-	2.229e-012	1.294e-012	0.71501	-11.6519
>(w)FeH2AsO4	8.657e-014	5.026e-014	1.0000	-13.0626
>(w)FeSeO3-	1.887e-026	1.095e-026	0.71501	-25.7243
>(w)FeOHSeO3--	9.257e-027	5.374e-027	0.51123	-26.0335
>(w)FeOHSeO4--	1.341e-051	7.786e-052	0.51123	-50.8725
>(w)FeSeO4-	7.026e-052	4.079e-052	0.71501	-51.1533

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0601
Dolomite	0.0000 sat	Magnetite	-1.1905
Hematite	0.0000 sat	Gypsum	-1.2718
Sphalerite	0.0000 sat	Anhydrite	-1.5185
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5922
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1493
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3266
Se(black)	-0.5510	FeO(c)	-2.3291
Calcite	-0.6127	Wurtzite	-2.3558
Aragonite	-0.7782	Smithsonite	-2.4442
ZnSe	-0.9363		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01812	-1.742
H2(g)	4.034e-010	-9.394
H2S(g)	5.151e-012	-11.288
CH4(g)	4.588e-016	-15.338
S2(g)	7.582e-031	-30.120
O2(g)	1.731e-067	-66.762

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-006	1.41e-009	0.000346	1.18e-006	0.290	
Ca++	0.000883	0.000664	45.8	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09	-1.43e-042	-1.38e-037	
Fe+++	0.0593	5.02e-013	4.82e-008			
H+	-0.171	0.000458	0.794	0.00731	12.7	
H2O	32.3	32.2	9.98e+005	-0.00745	-231.	
HCO3-	0.0111	0.00298	312.	0.00738	775.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.16e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.1			
Mn++	2.95e-005	2.77e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.62e-008	-2.44e-011	-1.34e-006	2.07e-011	1.14e-006	
SO4--	0.00687	0.00669	1.11e+003	0.000180	29.8	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0624	0.000221	24.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1570	-0.804
HCO3-	0.7127	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02624	-1.581
SeO3--	1.089e-015	-14.963
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-006	1.406e-009	0.0001811	1.181e-006	0.1521
Calcium	0.0008827	0.0006643	45.77	0.0001237	8.522
Carbon	0.01111	0.002977	61.46	0.007385	152.5
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0002099	-0.3637
Iron	0.05992	3.215e-005	3.087	4.305e-042	4.133e-037
Magnesium	0.001461	0.001366	57.07		
Manganese	2.949e-005	2.774e-005	2.620		
Oxygen	32.37	32.26	8.873e+005	0.01543	424.3
Phosphorus	4.951e-010	4.419e-013	2.353e-008	4.947e-010	2.634e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	1.499e-011	2.034e-006	1.633e-026	2.216e-021
Sodium	0.01132	0.01132	447.4		
Sulfur	0.006875	0.006694	368.9	0.0001804	9.942
Zinc	0.0002220	5.549e-007	0.06236	0.0002215	24.89

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4512

Ionic strength = 0.037136

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2006 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.19 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4512
e- + Fe+++ = Fe++	-0.1783	-3.0865

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.383e-005	-4.028	0.01730	0.006040
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.725e-006	-5.763	0.0001983	5.362e-005
Siderite	0.0005569	-3.254	0.06452	0.01594
Sphalerite	2.429e-009	-8.615	2.366e-007	5.787e-008
			______________	______________
(total)			4.819	0.9199

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01894	434.5	0.8393	-1.7987
SO4--	0.009928	951.8	0.4921	-2.3110
HCO3-	0.004172	254.1	0.8430	-2.4538
Mg++	0.001605	38.92	0.5545	-3.0507
CO2(aq)	0.0007936	34.86	1.0000	-3.1004
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007353	29.41	0.5253	-3.4132
MgSO4	0.0007066	84.88	1.0000	-3.1508
Cl-	0.0005121	18.12	0.8314	-3.3708
NaSO4-	0.0004396	52.23	0.8393	-3.4330
CaSO4	0.0003814	51.82	1.0000	-3.4186
NaHCO3	8.681e-005	7.278	1.0000	-4.0615
Fe++	3.778e-005	2.106	0.5253	-4.7024
MgHCO3+	3.726e-005	3.173	0.8393	-4.5048
Mn++	3.221e-005	1.766	0.5253	-4.7716
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.489e-005	2.511	0.8479	-4.6756
FeSO4	1.531e-005	2.322	1.0000	-4.8149
MnSO4	1.413e-005	2.129	1.0000	-4.8498
CO3--	3.137e-006	0.1879	0.5008	-5.8038
FeHCO3+	1.980e-006	0.2309	0.8393	-5.7794
MnHCO3+	1.283e-006	0.1485	0.8393	-5.9679
CaCl+	1.142e-006	0.08607	0.8393	-6.0185

MgCO3	9.910e-007	0.08339	1.0000	-6.0039
CaCO3	8.963e-007	0.08953	1.0000	-6.0476
MgCl+	7.096e-007	0.04232	0.8393	-6.2250
Zn++	6.296e-007	0.04108	0.5253	-6.4805
ZnSO4	3.242e-007	0.05224	1.0000	-6.4892
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.453e-007	0.008476	1.0000	-6.8377
NaCO3-	1.145e-007	0.009485	0.8393	-7.0173
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.889e-008	9.948e-005	0.8699	-7.0654
OH-	8.095e-008	0.001374	0.8355	-7.1698
HSO4-	3.992e-008	0.003867	0.8393	-7.4749
FeCl+	1.797e-008	0.001638	0.8393	-7.8214
FeOH+	1.218e-008	0.0008856	0.8393	-7.9904
MgOH+	1.044e-008	0.0004304	0.8393	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008954	0.005207	1.0000	-2.0480
>(w)FeOH2+	0.003940	0.002291	1.3985	-2.4045
>(w)FeOCO2-	0.003741	0.002176	0.71504	-2.4270
>(w)FeOH	0.003285	0.001910	1.0000	-2.4835
>(s)FeOZn+	0.0002884	0.0001677	1.3985	-3.5400
>(s)FeOHCa++	0.0001979	0.0001151	1.9559	-3.7037
>(w)FeOHSO4--	0.0001936	0.0001126	0.51128	-3.7132
>(w)FeSO4-	0.0001164	6.767e-005	0.71504	-3.9342
>(w)FeOZn+	9.240e-005	5.374e-005	1.3985	-4.0343
>(w)FeO-	6.274e-005	3.649e-005	0.71504	-4.2025
>(w)FeOCa+	1.490e-005	8.663e-006	1.3985	-4.8269
>(s)FeOH2+	1.288e-005	7.489e-006	1.3985	-4.8902
>(s)FeOH	1.074e-005	6.244e-006	1.0000	-4.9692

>(w)FeH2AsO3	2.031e-006	1.181e-006	1.0000	-5.6923
>(s)FeO-	2.050e-007	1.192e-007	0.71504	-6.6881
>(w)FeHPO4-	6.091e-010	3.543e-010	0.71504	-9.2153
>(w)FePO4--	2.117e-010	1.231e-010	0.51128	-9.6743
>(w)FeOHAsO4---	6.909e-011	4.018e-011	0.36559	-10.1606
>(w)FeH2PO4	2.976e-011	1.731e-011	1.0000	-10.5263
>(w)FeHAsO4-	2.225e-012	1.294e-012	0.71504	-11.6526
>(w)FeH2AsO4	8.637e-014	5.023e-014	1.0000	-13.0636
>(w)FeSeO3-	1.882e-026	1.095e-026	0.71504	-25.7253
>(w)FeOHSeO3--	9.241e-027	5.374e-027	0.51128	-26.0343
>(w)FeOHSeO4--	1.338e-051	7.782e-052	0.51128	-50.8735
>(w)FeSeO4-	7.006e-052	4.075e-052	0.71504	-51.1545

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0602
Dolomite	0.0000 sat	Magnetite	-1.1900
Hematite	0.0000 sat	Gypsum	-1.2723
Sphalerite	0.0000 sat	Anhydrite	-1.5190
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5921
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1498
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3271
Se(black)	-0.5514	FeO(c)	-2.3286
Calcite	-0.6125	Wurtzite	-2.3558
Aragonite	-0.7780	Smithsonite	-2.4445
ZnSe	-0.9362		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01810	-1.742
H2(g)	4.036e-010	-9.394
H2S(g)	5.149e-012	-11.288
CH4(g)	4.593e-016	-15.338
S2(g)	7.568e-031	-30.121
O2(g)	1.730e-067	-66.762

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-006	1.41e-009	0.000345	1.18e-006	0.290	
Ca++	0.000883	0.000665	45.7	0.000124	8.51	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.08	-1.43e-042	-1.38e-037	
Fe+++	0.0593	5.03e-013	4.82e-008			
H+	-0.171	0.000458	0.793	0.00731	12.6	
H2O	32.4	32.3	9.98e+005	-0.00745	-230.	
HCO3-	0.0111	0.00298	312.	0.00738	773.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00137	57.0			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.62e-008	-2.44e-011	-1.34e-006	2.08e-011	1.14e-006	
SO4--	0.00687	0.00669	1.10e+003	0.000180	29.7	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0623	0.000221	24.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1569	-0.805
HCO3-	0.7125	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02622	-1.581
SeO3--	1.087e-015	-14.964
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-006	1.407e-009	0.0001810	1.181e-006	0.1519
Calcium	0.0008827	0.0006651	45.74	0.0001237	8.510
Carbon	0.01111	0.002980	61.42	0.007383	152.2
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	-0.0002102	-0.3635
Iron	0.05992	3.218e-005	3.084	4.305e-042	4.126e-037
Magnesium	0.001461	0.001367	57.01		
Manganese	2.949e-005	2.776e-005	2.617		
Oxygen	32.42	32.32	8.873e+005	0.01542	423.4
Phosphorus	4.951e-010	4.424e-013	2.351e-008	4.947e-010	2.629e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	1.502e-011	2.035e-006	1.632e-026	2.212e-021
Sodium	0.01132	0.01132	446.6		
Sulfur	0.006875	0.006694	368.3	0.0001802	9.916
Zinc	0.0002220	5.549e-007	0.06226	0.0002215	24.85

1.183e-007 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039390

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0169 uC/cm2

Surface potential = 0.169 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			______________	______________
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.8	0.8359	-1.8002
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007310	87.80	1.0000	-3.1361
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004278	50.81	0.8359	-3.4466
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.53	1.0000	-3.5728
NaHCO3	0.0001182	9.905	1.0000	-3.9275
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6878
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116
CaCl+	1.209e-006	0.09108	0.8359	-5.9956

MgCl+	7.554e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5687
NaCO3-	2.686e-007	0.02225	0.8359	-6.6487
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008416	1.0000	-6.8407
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.270e-008	0.002199	0.8359	-7.7217
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008246	0.004787	1.0000	-2.0838
>(w)FeOCO2-	0.004257	0.002471	0.99346	-2.3709
>(w)FeOH	0.003802	0.002207	1.0000	-2.4200
>(w)FeOH2+	0.003691	0.002143	1.0066	-2.4328
>(s)FeOHCa++	0.0002563	0.0001488	1.0132	-3.5912
>(s)FeOZn+	0.0002410	0.0001399	1.0066	-3.6180
>(w)FeOZn+	0.0001409	8.179e-005	1.0066	-3.8512
>(w)FeOHSO4--	0.0001128	6.551e-005	0.98697	-3.9475
>(w)FeO-	8.971e-005	5.208e-005	0.99346	-4.0471
>(w)FeSO4-	5.491e-005	3.188e-005	0.99346	-4.2604
>(w)FeOCa+	4.350e-005	2.525e-005	1.0066	-4.3615
>(s)FeOH	6.811e-006	3.954e-006	1.0000	-5.1668
>(s)FeOH2+	6.612e-006	3.839e-006	1.0066	-5.1796
>(w)FeH2AsO3	2.030e-007	1.179e-007	1.0000	-6.6925

>(s)FeO-	1.607e-007	9.331e-008	0.99346	-6.7939
>(w)FeHPO4-	5.795e-010	3.364e-010	0.99346	-9.2370
>(w)FeOHAsO4---	4.764e-010	2.766e-010	0.98051	-9.3220
>(w)FePO4--	2.488e-010	1.445e-010	0.98697	-9.6041
>(w)FeH2PO4	2.292e-011	1.331e-011	1.0000	-10.6398
>(w)FeHAsO4-	1.005e-011	5.836e-012	0.99346	-10.9977
>(w)FeH2AsO4	3.158e-013	1.834e-013	1.0000	-12.5006
>(w)FeSeO3-	1.277e-018	7.416e-019	0.99346	-17.8937
>(w)FeOHSeO3--	7.748e-019	4.498e-019	0.98697	-18.1108
>(w)FeOHSeO4--	4.104e-042	2.382e-042	0.98697	-41.3868
>(w)FeSeO4-	1.739e-042	1.010e-042	0.99346	-41.7597

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6243s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1976
Dolomite-ord	0.7915s/sat	Gypsum	-1.2601
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3836		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-007	1.22e-010	3.00e-005	1.18e-007	0.0290	
Ca++	0.000883	0.000709	48.8	0.000174	12.0	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00667	11.5	
H2O	55.6	55.5	1.72e+006	-0.00729	-226.	
HCO3-	0.0111	0.00385	404.	0.00726	761.	
HPO4--	4.95e-010	1.00e-012	1.65e-007	4.94e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.41e-010	7.77e-006	
SO4--	0.00687	0.00678	1.12e+003	9.74e-005	16.1	
SeO3--	2.50e-008	2.50e-008	0.00547	1.19e-018	2.60e-013	
Zn++	0.000222	3.06e-007	0.0344	0.000222	24.9	

Sorbed	fraction	log fraction

As(OH)4-	0.9990	-0.000
Ca++	0.1972	-0.705
HCO3-	0.6533	-0.185
HPO4--	0.9980	-0.001
SO4--	0.01417	-1.849
SeO3--	4.757e-011	-10.323
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-007	1.220e-010	1.571e-005	1.181e-007	0.01521
Calcium	0.0008827	0.0007086	48.81	0.0001741	11.99
Carbon	0.01111	0.003851	79.51	0.007259	149.8
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0006555	-1.135
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01487	409.0
Phosphorus	4.952e-010	1.000e-012	5.324e-008	4.942e-010	2.631e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.191e-018	1.617e-013
Sodium	0.01132	0.01132	447.3		
Sulfur	0.006875	0.006777	373.4	9.739e-005	5.366
Zinc	0.0002220	3.059e-007	0.03437	0.0002217	24.91

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4508

Ionic strength = 0.037191

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.31 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4508
e- + Fe+++ = Fe++	-0.1783	-3.0857

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.465e-005	-4.024	0.01745	0.006092
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.750e-006	-5.757	0.0002011	5.437e-005
Siderite	0.0005569	-3.254	0.06453	0.01595
Sphalerite	3.055e-009	-8.515	2.977e-007	7.281e-008
			-------------	-------------
(total)			4.819	0.9200

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01897	435.3	0.8392	-1.7980
SO4--	0.009945	953.3	0.4919	-2.3105
HCO3-	0.004175	254.2	0.8429	-2.4536
Mg++	0.001606	38.95	0.5544	-3.0505
CO2(aq)	0.0007945	34.89	1.0000	-3.0999
K+	0.0007501	29.27	0.8314	-3.2051
Ca++	0.0007355	29.42	0.5251	-3.4132
MgSO4	0.0007078	85.03	1.0000	-3.1501
Cl-	0.0005130	18.15	0.8314	-3.3701
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003818	51.88	1.0000	-3.4181
NaHCO3	8.698e-005	7.292	1.0000	-4.0606
Fe++	3.780e-005	2.107	0.5251	-4.7023
MgHCO3+	3.730e-005	3.176	0.8392	-4.5044
Mn++	3.223e-005	1.767	0.5251	-4.7715
KSO4-	2.527e-005	3.409	0.8392	-4.6735
CaHCO3+	2.490e-005	2.512	0.8478	-4.6755
FeSO4	1.534e-005	2.325	1.0000	-4.8143
MnSO4	1.415e-005	2.133	1.0000	-4.8492
CO3--	3.137e-006	0.1879	0.5006	-5.8039
FeHCO3+	1.982e-006	0.2311	0.8392	-5.7791
MnHCO3+	1.284e-006	0.1486	0.8392	-5.9676
CaCl+	1.144e-006	0.08621	0.8392	-6.0178

MgCO3	9.914e-007	0.08342	1.0000	-6.0038
CaCO3	8.960e-007	0.08950	1.0000	-6.0477
MgCl+	7.112e-007	0.04242	0.8392	-6.2241
Zn++	6.305e-007	0.04114	0.5251	-6.4801
ZnSO4	3.249e-007	0.05235	1.0000	-6.4882
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.458e-007	0.008503	1.0000	-6.8363
NaCO3-	1.147e-007	0.009498	0.8392	-7.0167
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.897e-008	9.955e-005	0.8699	-7.0651
OH-	8.091e-008	0.001373	0.8354	-7.1701
HSO4-	4.000e-008	0.003875	0.8392	-7.4740
FeCl+	1.801e-008	0.001641	0.8392	-7.8206
FeOH+	1.218e-008	0.0008853	0.8392	-7.9906
MgOH+	1.044e-008	0.0004304	0.8392	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008974	0.005210	1.0000	-2.0470
>(w)FeOH2+	0.003947	0.002291	1.3986	-2.4037
>(w)FeOCO2-	0.003747	0.002176	0.71501	-2.4263
>(w)FeOH	0.003289	0.001909	1.0000	-2.4830
>(s)FeOZn+	0.0002889	0.0001677	1.3986	-3.5392
>(s)FeOHCa++	0.0001981	0.0001150	1.9560	-3.7030
>(w)FeOHSO4--	0.0001940	0.0001127	0.51124	-3.7121
>(w)FeSO4-	0.0001167	6.776e-005	0.71501	-3.9329
>(w)FeOZn+	9.252e-005	5.372e-005	1.3986	-4.0337
>(w)FeO-	6.277e-005	3.644e-005	0.71501	-4.2022
>(w)FeOCa+	1.490e-005	8.650e-006	1.3986	-4.8268
>(s)FeOH2+	1.291e-005	7.493e-006	1.3986	-4.8892
>(s)FeOH	1.075e-005	6.243e-006	1.0000	-4.9685

>(s)FeO-	2.053e-007	1.192e-007	0.71501	-6.6877
>(w)FeH2AsO3	2.035e-007	1.181e-007	1.0000	-6.6915
>(w)FeHPO4-	6.103e-010	3.543e-010	0.71501	-9.2144
>(w)FePO4--	2.120e-010	1.231e-010	0.51124	-9.6737
>(w)FeH2PO4	2.984e-011	1.732e-011	1.0000	-10.5252
>(w)FeOHAsO4---	6.913e-012	4.013e-012	0.36554	-11.1604
>(w)FeHAsO4-	2.229e-013	1.294e-013	0.71501	-12.6519
>(w)FeH2AsO4	8.658e-015	5.026e-015	1.0000	-14.0626
>(w)FeSeO3-	1.887e-026	1.095e-026	0.71501	-25.7242
>(w)FeOHSeO3--	9.258e-027	5.375e-027	0.51124	-26.0335
>(w)FeOHSeO4--	1.341e-051	7.787e-052	0.51124	-50.8725
>(w)FeSeO4-	7.027e-052	4.080e-052	0.71501	-51.1532

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0601
Dolomite	0.0000 sat	Magnetite	-1.1905
Hematite	0.0000 sat	Gypsum	-1.2718
Sphalerite	0.0000 sat	Anhydrite	-1.5185
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5922
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1493
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3266
Se(black)	-0.5510	FeO(c)	-2.3291
Calcite	-0.6127	Wurtzite	-2.3558
Aragonite	-0.7782	Smithsonite	-2.4442
ZnSe	-0.9363		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01812	-1.742
H2(g)	4.034e-010	-9.394
H2S(g)	5.151e-012	-11.288
CH4(g)	4.588e-016	-15.338
S2(g)	7.582e-031	-30.120
O2(g)	1.731e-067	-66.762

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-007	1.41e-010	3.46e-005	1.18e-007	0.0290	
Ca++	0.000883	0.000664	45.8	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09			
Fe+++	0.0593	5.02e-013	4.82e-008			
H+	-0.171	0.000458	0.794	0.00731	12.7	
H2O	32.3	32.2	9.98e+005	-0.00745	-231.	
HCO3-	0.0111	0.00298	312.	0.00739	775.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.16e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.1			
Mn++	2.95e-005	2.77e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.74e-008	-2.44e-011	-1.34e-006	2.07e-012	1.14e-007	
SO4--	0.00687	0.00669	1.11e+003	0.000180	29.8	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0624	0.000221	24.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1570	-0.804
HCO3-	0.7127	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02624	-1.581
SeO3--	1.090e-015	-14.963
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-007	1.406e-010	1.811e-005	1.181e-007	0.01521
Calcium	0.0008827	0.0006643	45.77	0.0001237	8.522
Carbon	0.01111	0.002977	61.46	0.007385	152.5
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0002110	-0.3655
Iron	0.05992	3.215e-005	3.087	5.740e-042	5.510e-037
Magnesium	0.001461	0.001366	57.07		
Manganese	2.949e-005	2.774e-005	2.620		
Oxygen	32.37	32.26	8.873e+005	0.01542	424.2
Phosphorus	4.952e-010	4.419e-013	2.353e-008	4.947e-010	2.634e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	1.499e-011	2.034e-006	1.633e-026	2.216e-021
Sodium	0.01132	0.01132	447.4		
Sulfur	0.006875	0.006694	368.9	0.0001804	9.943
Zinc	0.0002220	5.549e-007	0.06236	0.0002215	24.89

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4512

Ionic strength = 0.037136

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2006 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.19 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4512
e- + Fe+++ = Fe++	-0.1783	-3.0865

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.384e-005	-4.028	0.01730	0.006040
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.726e-006	-5.763	0.0001984	5.362e-005
Siderite	0.0005569	-3.254	0.06452	0.01594
Sphalerite	3.055e-009	-8.515	2.977e-007	7.281e-008
			______________	______________
(total)			4.819	0.9199

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01894	434.5	0.8393	-1.7987
SO4--	0.009928	951.8	0.4921	-2.3110
HCO3-	0.004172	254.1	0.8430	-2.4538
Mg++	0.001605	38.92	0.5545	-3.0507
CO2(aq)	0.0007936	34.86	1.0000	-3.1004
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007353	29.41	0.5253	-3.4132
MgSO4	0.0007066	84.88	1.0000	-3.1508
Cl-	0.0005121	18.12	0.8314	-3.3708
NaSO4-	0.0004396	52.23	0.8393	-3.4330
CaSO4	0.0003814	51.82	1.0000	-3.4186
NaHCO3	8.680e-005	7.278	1.0000	-4.0615
Fe++	3.778e-005	2.106	0.5253	-4.7024
MgHCO3+	3.726e-005	3.173	0.8393	-4.5048
Mn++	3.221e-005	1.766	0.5253	-4.7716
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.489e-005	2.511	0.8479	-4.6756
FeSO4	1.531e-005	2.322	1.0000	-4.8149
MnSO4	1.413e-005	2.129	1.0000	-4.8498
CO3--	3.137e-006	0.1879	0.5008	-5.8038
FeHCO3+	1.980e-006	0.2309	0.8393	-5.7794
MnHCO3+	1.283e-006	0.1485	0.8393	-5.9679
CaCl+	1.142e-006	0.08607	0.8393	-6.0185

MgCO3	9.910e-007	0.08339	1.0000	-6.0039
CaCO3	8.963e-007	0.08953	1.0000	-6.0476
MgCl+	7.096e-007	0.04232	0.8393	-6.2250
Zn++	6.296e-007	0.04108	0.5253	-6.4805
ZnSO4	3.242e-007	0.05224	1.0000	-6.4892
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.453e-007	0.008476	1.0000	-6.8377
NaCO3-	1.145e-007	0.009485	0.8393	-7.0172
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.889e-008	9.948e-005	0.8699	-7.0654
OH-	8.095e-008	0.001374	0.8355	-7.1698
HSO4-	3.992e-008	0.003867	0.8393	-7.4749
FeCl+	1.797e-008	0.001638	0.8393	-7.8214
FeOH+	1.218e-008	0.0008856	0.8393	-7.9904
MgOH+	1.044e-008	0.0004304	0.8393	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008955	0.005208	1.0000	-2.0479
>(w)FeOH2+	0.003940	0.002292	1.3985	-2.4045
>(w)FeOCO2-	0.003742	0.002176	0.71504	-2.4269
>(w)FeOH	0.003285	0.001911	1.0000	-2.4834
>(s)FeOZn+	0.0002884	0.0001677	1.3985	-3.5400
>(s)FeOHCa++	0.0001979	0.0001151	1.9558	-3.7037
>(w)FeOHSO4--	0.0001936	0.0001126	0.51129	-3.7131
>(w)FeSO4-	0.0001164	6.768e-005	0.71504	-3.9342
>(w)FeOZn+	9.241e-005	5.374e-005	1.3985	-4.0343
>(w)FeO-	6.275e-005	3.649e-005	0.71504	-4.2024
>(w)FeOCa+	1.490e-005	8.664e-006	1.3985	-4.8269
>(s)FeOH2+	1.288e-005	7.489e-006	1.3985	-4.8902
>(s)FeOH	1.074e-005	6.243e-006	1.0000	-4.9692

>(s)FeO-	2.050e-007	1.192e-007	0.71504	-6.6882
>(w)FeH2AsO3	2.031e-007	1.181e-007	1.0000	-6.6923
>(w)FeHPO4-	6.092e-010	3.543e-010	0.71504	-9.2152
>(w)FePO4--	2.117e-010	1.231e-010	0.51129	-9.6742
>(w)FeH2PO4	2.977e-011	1.731e-011	1.0000	-10.5263
>(w)FeOHAsO4---	6.910e-012	4.018e-012	0.36559	-11.1605
>(w)FeHAsO4-	2.226e-013	1.294e-013	0.71504	-12.6526
>(w)FeH2AsO4	8.638e-015	5.023e-015	1.0000	-14.0636
>(w)FeSeO3-	1.883e-026	1.095e-026	0.71504	-25.7252
>(w)FeOHSeO3--	9.242e-027	5.375e-027	0.51129	-26.0342
>(w)FeOHSeO4--	1.338e-051	7.783e-052	0.51129	-50.8735
>(w)FeSeO4-	7.007e-052	4.075e-052	0.71504	-51.1545

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0602
Dolomite	0.0000 sat	Magnetite	-1.1900
Hematite	0.0000 sat	Gypsum	-1.2723
Sphalerite	0.0000 sat	Anhydrite	-1.5190
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5921
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1498
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3272
Se(black)	-0.5514	FeO(c)	-2.3286
Calcite	-0.6125	Wurtzite	-2.3558
Aragonite	-0.7780	Smithsonite	-2.4445
ZnSe	-0.9362		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01810	-1.742
H2(g)	4.036e-010	-9.394
H2S(g)	5.149e-012	-11.288
CH4(g)	4.593e-016	-15.338
S2(g)	7.567e-031	-30.121
O2(g)	1.730e-067	-66.762

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-007	1.41e-010	3.45e-005	1.18e-007	0.0290	
Ca++	0.000883	0.000665	45.7	0.000124	8.51	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.08	-1.43e-042	-1.38e-037	
Fe+++	0.0593	5.03e-013	4.82e-008			
H+	-0.171	0.000458	0.793	0.00731	12.6	
H2O	32.4	32.3	9.98e+005	-0.00745	-230.	
HCO3-	0.0111	0.00298	312.	0.00738	773.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00137	57.0			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.74e-008	-2.44e-011	-1.34e-006	2.08e-012	1.14e-007	
SO4--	0.00687	0.00669	1.10e+003	0.000180	29.7	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0623	0.000221	24.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1569	-0.805
HCO3-	0.7125	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02622	-1.581
SeO3--	1.087e-015	-14.964
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-007	1.407e-010	1.810e-005	1.181e-007	0.01519
Calcium	0.0008827	0.0006651	45.74	0.0001237	8.510
Carbon	0.01111	0.002980	61.42	0.007384	152.2
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	-0.0002112	-0.3654
Iron	0.05992	3.218e-005	3.084	4.305e-042	4.126e-037
Magnesium	0.001461	0.001367	57.01		
Manganese	2.949e-005	2.776e-005	2.617		
Oxygen	32.42	32.32	8.873e+005	0.01542	423.4
Phosphorus	4.952e-010	4.424e-013	2.351e-008	4.947e-010	2.630e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	1.502e-011	2.035e-006	1.632e-026	2.212e-021
Sodium	0.01132	0.01132	446.6		
Sulfur	0.006875	0.006694	368.3	0.0001803	9.917
Zinc	0.0002220	5.549e-007	0.06226	0.0002215	24.85

1.183e-008 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039390

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.77 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0169 uC/cm2

Surface potential = 0.169 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			___________	___________
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.8	0.8359	-1.8002
SO4--	0.009816	940.8	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007310	87.80	1.0000	-3.1361
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006314	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004278	50.81	0.8359	-3.4466
CaSO4	0.0003923	53.29	1.0000	-3.4064
FeSO4	0.0002674	40.53	1.0000	-3.5728
NaHCO3	0.0001182	9.905	1.0000	-3.9275
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6878
MnSO4	1.442e-005	2.172	1.0000	-4.8412
FeCO3	9.930e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4929	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6531
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116
CaCl+	1.209e-006	0.09108	0.8359	-5.9956

MgCl+	7.554e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5687
NaCO3-	2.686e-007	0.02225	0.8359	-6.6487
MnCO3	2.543e-007	0.02917	1.0000	-6.5947
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.443e-007	0.008416	1.0000	-6.8407
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.270e-008	0.002199	0.8359	-7.7217
MgOH+	1.915e-008	0.0007893	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008246	0.004787	1.0000	-2.0838
>(w)FeOCO2-	0.004257	0.002471	0.99346	-2.3709
>(w)FeOH	0.003802	0.002207	1.0000	-2.4200
>(w)FeOH2+	0.003691	0.002143	1.0066	-2.4328
>(s)FeOHCa++	0.0002563	0.0001488	1.0132	-3.5912
>(s)FeOZn+	0.0002410	0.0001399	1.0066	-3.6180
>(w)FeOZn+	0.0001409	8.179e-005	1.0066	-3.8512
>(w)FeOHSO4--	0.0001128	6.551e-005	0.98697	-3.9475
>(w)FeO-	8.971e-005	5.208e-005	0.99346	-4.0471
>(w)FeSO4-	5.491e-005	3.188e-005	0.99346	-4.2604
>(w)FeOCa+	4.350e-005	2.525e-005	1.0066	-4.3615
>(s)FeOH	6.811e-006	3.954e-006	1.0000	-5.1668
>(s)FeOH2+	6.612e-006	3.839e-006	1.0066	-5.1796
>(s)FeO-	1.607e-007	9.330e-008	0.99346	-6.7939

>(w)FeH2AsO3 2.030e-008 1.179e-008 1.0000 -7.6925

>(w)FeHPO4- 5.795e-010 3.364e-010 0.99346 -9.2370

>(w)FePO4-- 2.488e-010 1.445e-010 0.98697 -9.6041

>(w)FeOHAsO4--- 4.764e-011 2.766e-011 0.98052 -10.3220

>(w)FeH2PO4 2.292e-011 1.331e-011 1.0000 -10.6398

>(w)FeHAsO4- 1.005e-012 5.836e-013 0.99346 -11.9977

>(w)FeH2AsO4 3.158e-014 1.834e-014 1.0000 -13.5006

>(w)FeSeO3- 1.277e-018 7.416e-019 0.99346 -17.8937

>(w)FeOHSeO3-- 7.748e-019 4.498e-019 0.98697 -18.1108

>(w)FeOHSeO4-- 4.104e-042 2.382e-042 0.98697 -41.3868

>(w)FeSeO4- 1.739e-042 1.010e-042 0.99346 -41.7597

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6243s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1976
Dolomite-ord	0.7915s/sat	Gypsum	-1.2601
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3836		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.490e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-008	1.22e-011	3.00e-006	1.18e-008	0.00290	
Ca++	0.000883	0.000709	48.8	0.000174	12.0	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00667	11.5	
H2O	55.6	55.5	1.72e+006	-0.00729	-226.	
HCO3-	0.0111	0.00385	404.	0.00726	761.	
HPO4--	4.95e-010	1.00e-012	1.65e-007	4.94e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	1.41e-011	7.77e-007	
SO4--	0.00687	0.00678	1.12e+003	9.74e-005	16.1	
SeO3--	2.50e-008	2.50e-008	0.00547	1.19e-018	2.60e-013	
Zn++	0.000222	3.06e-007	0.0344	0.000222	24.9	

Sorbed	fraction	log fraction

As(OH)4-	0.9990	-0.000
Ca++	0.1972	-0.705
HCO3-	0.6533	-0.185
HPO4--	0.9980	-0.001
SO4--	0.01417	-1.849
SeO3--	4.757e-011	-10.323
Zn++	0.9986	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-008	1.220e-011	1.571e-006	1.181e-008	0.001521
Calcium	0.0008827	0.0007086	48.81	0.0001741	11.99
Carbon	0.01111	0.003851	79.51	0.007259	149.8
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0006556	-1.136
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01487	409.0
Phosphorus	4.952e-010	1.000e-012	5.324e-008	4.942e-010	2.631e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	1.191e-018	1.617e-013
Sodium	0.01132	0.01132	447.3		
Sulfur	0.006875	0.006777	373.4	9.739e-005	5.366
Zinc	0.0002220	3.059e-007	0.03437	0.0002217	24.91

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4508

Ionic strength = 0.037191

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2009 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.31 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4508
e- + Fe+++ = Fe++	-0.1783	-3.0857

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.465e-005	-4.024	0.01745	0.006092
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.750e-006	-5.757	0.0002011	5.437e-005
Siderite	0.0005569	-3.254	0.06453	0.01595
Sphalerite	3.118e-009	-8.506	3.038e-007	7.430e-008
			________	________
(total)			4.819	0.9200

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01897	435.3	0.8392	-1.7980
SO4--	0.009945	953.3	0.4919	-2.3105
HCO3-	0.004175	254.2	0.8429	-2.4536
Mg++	0.001606	38.95	0.5544	-3.0505
CO2(aq)	0.0007945	34.89	1.0000	-3.0999
K+	0.0007501	29.27	0.8314	-3.2051
Ca++	0.0007355	29.42	0.5251	-3.4132
MgSO4	0.0007078	85.03	1.0000	-3.1501
Cl-	0.0005130	18.15	0.8314	-3.3701
NaSO4-	0.0004409	52.38	0.8392	-3.4318
CaSO4	0.0003818	51.88	1.0000	-3.4181
NaHCO3	8.698e-005	7.292	1.0000	-4.0606
Fe++	3.780e-005	2.107	0.5251	-4.7023
MgHCO3+	3.730e-005	3.176	0.8392	-4.5044
Mn++	3.223e-005	1.767	0.5251	-4.7715
KSO4-	2.527e-005	3.409	0.8392	-4.6735
CaHCO3+	2.490e-005	2.512	0.8478	-4.6755
FeSO4	1.534e-005	2.325	1.0000	-4.8143
MnSO4	1.415e-005	2.133	1.0000	-4.8492
CO3--	3.137e-006	0.1879	0.5006	-5.8039
FeHCO3+	1.982e-006	0.2311	0.8392	-5.7791
MnHCO3+	1.284e-006	0.1486	0.8392	-5.9676
CaCl+	1.144e-006	0.08621	0.8392	-6.0178

MgCO3	9.914e-007	0.08342	1.0000	-6.0038
CaCO3	8.960e-007	0.08950	1.0000	-6.0477
MgCl+	7.112e-007	0.04242	0.8392	-6.2241
Zn++	6.305e-007	0.04114	0.5251	-6.4801
ZnSO4	3.249e-007	0.05235	1.0000	-6.4882
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.458e-007	0.008503	1.0000	-6.8363
NaCO3-	1.147e-007	0.009498	0.8392	-7.0167
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.897e-008	9.955e-005	0.8699	-7.0651
OH-	8.091e-008	0.001373	0.8354	-7.1701
HSO4-	4.000e-008	0.003875	0.8392	-7.4740
FeCl+	1.801e-008	0.001641	0.8392	-7.8206
FeOH+	1.218e-008	0.0008853	0.8392	-7.9906
MgOH+	1.044e-008	0.0004304	0.8392	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008974	0.005210	1.0000	-2.0470
>(w)FeOH2+	0.003947	0.002291	1.3986	-2.4037
>(w)FeOCO2-	0.003747	0.002176	0.71501	-2.4263
>(w)FeOH	0.003289	0.001909	1.0000	-2.4830
>(s)FeOZn+	0.0002889	0.0001677	1.3986	-3.5392
>(s)FeOHCa++	0.0001981	0.0001150	1.9560	-3.7030
>(w)FeOHSO4--	0.0001940	0.0001127	0.51124	-3.7121
>(w)FeSO4-	0.0001167	6.776e-005	0.71501	-3.9329
>(w)FeOZn+	9.253e-005	5.372e-005	1.3986	-4.0337
>(w)FeO-	6.277e-005	3.644e-005	0.71501	-4.2022
>(w)FeOCa+	1.490e-005	8.651e-006	1.3986	-4.8268
>(s)FeOH2+	1.291e-005	7.493e-006	1.3986	-4.8892
>(s)FeOH	1.075e-005	6.243e-006	1.0000	-4.9685

>(s)FeO-	2.053e-007	1.192e-007	0.71501	-6.6877
>(w)FeH2AsO3	2.035e-008	1.181e-008	1.0000	-7.6915
>(w)FeHPO4-	6.103e-010	3.543e-010	0.71501	-9.2144
>(w)FePO4--	2.120e-010	1.231e-010	0.51124	-9.6737
>(w)FeH2PO4	2.984e-011	1.732e-011	1.0000	-10.5252
>(w)FeOHAsO4---	6.913e-013	4.013e-013	0.36554	-12.1604
>(w)FeHAsO4-	2.229e-014	1.294e-014	0.71501	-13.6519
>(w)FeH2AsO4	8.658e-016	5.026e-016	1.0000	-15.0626
>(w)FeSeO3-	1.887e-026	1.096e-026	0.71501	-25.7242
>(w)FeOHSeO3--	9.258e-027	5.375e-027	0.51124	-26.0335
>(w)FeOHSeO4--	1.341e-051	7.787e-052	0.51124	-50.8725
>(w)FeSeO4-	7.027e-052	4.080e-052	0.71501	-51.1532

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0601
Dolomite	0.0000 sat	Magnetite	-1.1905
Hematite	0.0000 sat	Gypsum	-1.2718
Sphalerite	0.0000 sat	Anhydrite	-1.5185
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5922
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1493
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3266
Se(black)	-0.5510	FeO(c)	-2.3291
Calcite	-0.6127	Wurtzite	-2.3558
Aragonite	-0.7782	Smithsonite	-2.4442
ZnSe	-0.9363		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01812	-1.742
H2(g)	4.034e-010	-9.394
H2S(g)	5.151e-012	-11.288
CH4(g)	4.588e-016	-15.338
S2(g)	7.582e-031	-30.120
O2(g)	1.731e-067	-66.762

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-008	1.41e-011	3.46e-006	1.18e-008	0.00290	
Ca++	0.000883	0.000664	45.8	0.000124	8.52	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.09			
Fe+++	0.0593	5.02e-013	4.82e-008			
H+	-0.171	0.000458	0.794	0.00731	12.7	
H2O	32.3	32.2	9.98e+005	-0.00745	-231.	
HCO3-	0.0111	0.00298	312.	0.00739	775.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.16e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00137	57.1			
Mn++	2.95e-005	2.77e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.76e-008	-2.44e-011	-1.34e-006	2.07e-013	1.14e-008	
SO4--	0.00687	0.00669	1.11e+003	0.000180	29.8	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0624	0.000221	24.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1570	-0.804
HCO3-	0.7127	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02624	-1.581
SeO3--	1.090e-015	-14.963
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-008	1.406e-011	1.811e-006	1.181e-008	0.001521
Calcium	0.0008827	0.0006643	45.77	0.0001237	8.522
Carbon	0.01111	0.002977	61.46	0.007385	152.5
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	-0.0002111	-0.3657
Iron	0.05992	3.215e-005	3.087	5.740e-042	5.510e-037
Magnesium	0.001461	0.001366	57.07		
Manganese	2.949e-005	2.774e-005	2.620		
Oxygen	32.37	32.26	8.873e+005	0.01542	424.2
Phosphorus	4.952e-010	4.419e-013	2.353e-008	4.947e-010	2.634e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	1.499e-011	2.034e-006	1.633e-026	2.216e-021
Sodium	0.01132	0.01132	447.4		
Sulfur	0.006875	0.006694	368.9	0.0001804	9.943
Zinc	0.0002220	5.549e-007	0.06236	0.0002215	24.89

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.065 log fO2 = -66.762

Eh = -0.1416 volts pe = -2.4512

Ionic strength = 0.037136

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582734 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2006 mg/kg sol'n

Rock mass = 0.004819 kg

Carbonate alkalinity= 215.19 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.862 uC/cm2

Surface potential = 8.62 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1416	-2.4512
e- + Fe+++ = Fe++	-0.1783	-3.0865

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	9.384e-005	-4.028	0.01730	0.006040
FeSe2	1.252e-008	-7.903	2.676e-006	3.750e-007

Hematite	0.02966	-1.528	4.737	0.8979
Rhodochrosite	1.726e-006	-5.763	0.0001984	5.362e-005
Siderite	0.0005569	-3.254	0.06452	0.01594
Sphalerite	3.118e-009	-8.506	3.038e-007	7.430e-008
			-------------	-------------
(total)			4.819	0.9199

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01894	434.5	0.8393	-1.7987
SO4--	0.009928	951.8	0.4921	-2.3110
HCO3-	0.004172	254.1	0.8430	-2.4538
Mg++	0.001605	38.92	0.5545	-3.0507
CO2(aq)	0.0007936	34.86	1.0000	-3.1004
K+	0.0007488	29.22	0.8314	-3.2058
Ca++	0.0007353	29.41	0.5253	-3.4132
MgSO4	0.0007066	84.88	1.0000	-3.1508
Cl-	0.0005121	18.12	0.8314	-3.3708
NaSO4-	0.0004396	52.23	0.8393	-3.4330
CaSO4	0.0003814	51.82	1.0000	-3.4186
NaHCO3	8.680e-005	7.278	1.0000	-4.0615
Fe++	3.778e-005	2.106	0.5253	-4.7024
MgHCO3+	3.726e-005	3.173	0.8393	-4.5048
Mn++	3.221e-005	1.766	0.5253	-4.7716
KSO4-	2.520e-005	3.399	0.8393	-4.6747
CaHCO3+	2.489e-005	2.511	0.8479	-4.6756
FeSO4	1.531e-005	2.322	1.0000	-4.8149
MnSO4	1.413e-005	2.129	1.0000	-4.8498
CO3--	3.137e-006	0.1879	0.5008	-5.8038
FeHCO3+	1.980e-006	0.2309	0.8393	-5.7794
MnHCO3+	1.283e-006	0.1485	0.8393	-5.9679
CaCl+	1.142e-006	0.08607	0.8393	-6.0185

MgCO3	9.910e-007	0.08339	1.0000	-6.0039
CaCO3	8.963e-007	0.08953	1.0000	-6.0476
MgCl+	7.096e-007	0.04232	0.8393	-6.2250
Zn++	6.296e-007	0.04108	0.5253	-6.4805
ZnSO4	3.242e-007	0.05224	1.0000	-6.4892
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.453e-007	0.008476	1.0000	-6.8377
NaCO3-	1.145e-007	0.009485	0.8393	-7.0172
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	9.889e-008	9.948e-005	0.8699	-7.0654
OH-	8.095e-008	0.001374	0.8355	-7.1698
HSO4-	3.992e-008	0.003867	0.8393	-7.4749
FeCl+	1.797e-008	0.001638	0.8393	-7.8214
FeOH+	1.218e-008	0.0008856	0.8393	-7.9904
MgOH+	1.044e-008	0.0004304	0.8393	-8.0574

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.008955	0.005208	1.0000	-2.0479
>(w)FeOH2+	0.003940	0.002292	1.3985	-2.4045
>(w)FeOCO2-	0.003742	0.002176	0.71505	-2.4269
>(w)FeOH	0.003285	0.001911	1.0000	-2.4834
>(s)FeOZn+	0.0002884	0.0001677	1.3985	-3.5400
>(s)FeOHCa++	0.0001979	0.0001151	1.9558	-3.7037
>(w)FeOHSO4--	0.0001936	0.0001126	0.51129	-3.7131
>(w)FeSO4-	0.0001164	6.768e-005	0.71505	-3.9341
>(w)FeOZn+	9.241e-005	5.374e-005	1.3985	-4.0343
>(w)FeO-	6.275e-005	3.649e-005	0.71505	-4.2024
>(w)FeOCa+	1.490e-005	8.664e-006	1.3985	-4.8269
>(s)FeOH2+	1.288e-005	7.489e-006	1.3985	-4.8902
>(s)FeOH	1.074e-005	6.243e-006	1.0000	-4.9692

>(s)FeO-	2.050e-007	1.192e-007	0.71505	-6.6882
>(w)FeH2AsO3	2.031e-008	1.181e-008	1.0000	-7.6923
>(w)FeHPO4-	6.092e-010	3.543e-010	0.71505	-9.2152
>(w)FePO4--	2.117e-010	1.231e-010	0.51129	-9.6742
>(w)FeH2PO4	2.977e-011	1.731e-011	1.0000	-10.5263
>(w)FeOHAsO4---	6.910e-013	4.019e-013	0.36560	-12.1605
>(w)FeHAsO4-	2.226e-014	1.294e-014	0.71505	-13.6526
>(w)FeH2AsO4	8.638e-016	5.024e-016	1.0000	-15.0636
>(w)FeSeO3-	1.883e-026	1.095e-026	0.71505	-25.7252
>(w)FeOHSeO3--	9.242e-027	5.375e-027	0.51129	-26.0342
>(w)FeOHSeO4--	1.338e-051	7.783e-052	0.51129	-50.8735
>(w)FeSeO4-	7.007e-052	4.075e-052	0.71505	-51.1545

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	0.0000 sat	Magnesite	-1.0602
Dolomite	0.0000 sat	Magnetite	-1.1900
Hematite	0.0000 sat	Gypsum	-1.2723
Sphalerite	0.0000 sat	Anhydrite	-1.5190
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5921
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1498
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3272
Se(black)	-0.5514	FeO(c)	-2.3286
Calcite	-0.6125	Wurtzite	-2.3558
Aragonite	-0.7780	Smithsonite	-2.4445
ZnSe	-0.9362		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01810	-1.742
H2(g)	4.036e-010	-9.394
H2S(g)	5.149e-012	-11.288
CH4(g)	4.593e-016	-15.338
S2(g)	7.567e-031	-30.121
O2(g)	1.730e-067	-66.762

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	1.18e-008	1.41e-011	3.45e-006	1.18e-008	0.00290	
Ca++	0.000883	0.000665	45.7	0.000124	8.51	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.22e-005	3.08			
Fe+++	0.0593	5.03e-013	4.82e-008			
H+	-0.171	0.000458	0.793	0.00731	12.6	
H2O	32.4	32.3	9.98e+005	-0.00745	-230.	
HCO3-	0.0111	0.00298	312.	0.00738	773.	
HPO4--	4.95e-010	4.42e-013	7.29e-008	4.95e-010	8.15e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00137	57.0			
Mn++	2.95e-005	2.78e-005	2.62			
Na+	0.0113	0.0113	447.			
O2(aq)	-3.76e-008	-2.44e-011	-1.34e-006	2.08e-013	1.14e-008	
SO4--	0.00687	0.00669	1.10e+003	0.000180	29.7	
SeO3--	2.50e-008	1.50e-011	3.27e-006	1.63e-026	3.56e-021	
Zn++	0.000222	5.55e-007	0.0623	0.000221	24.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9988	-0.001
Ca++	0.1569	-0.805
HCO3-	0.7125	-0.147
HPO4--	0.9991	-0.000
SO4--	0.02622	-1.581
SeO3--	1.087e-015	-14.964
Zn++	0.9975	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	1.183e-008	1.407e-011	1.810e-006	1.181e-008	0.001519
Calcium	0.0008827	0.0006651	45.74	0.0001237	8.510
Carbon	0.01111	0.002980	61.42	0.007384	152.2
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	-0.0002114	-0.3656
Iron	0.05992	3.218e-005	3.084	5.740e-042	5.501e-037
Magnesium	0.001461	0.001367	57.01		
Manganese	2.949e-005	2.776e-005	2.617		
Oxygen	32.42	32.32	8.873e+005	0.01542	423.4
Phosphorus	4.952e-010	4.424e-013	2.351e-008	4.947e-010	2.630e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	1.502e-011	2.035e-006	1.632e-026	2.212e-021
Sodium	0.01132	0.01132	446.6		
Sulfur	0.006875	0.006694	368.3	0.0001803	9.917
Zinc	0.0002220	5.549e-007	0.06226	0.0002215	24.85

0.003947 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039373

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2178 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0867 uC/cm2

Surface potential = 0.867 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
			____________	____________
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01892	434.0	0.8360	-1.8009
SO4--	0.009816	940.9	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.88	0.5482	-3.0237
Ca++	0.0007886	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007312	87.81	1.0000	-3.1360
Fe++	0.0006878	38.33	0.5181	-3.4481
CO2(aq)	0.0006315	27.73	1.0000	-3.1996
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004271	50.73	0.8360	-3.4473
CaSO4	0.0003924	53.30	1.0000	-3.4063
FeSO4	0.0002675	40.54	1.0000	-3.5727
NaHCO3	0.0001180	9.888	1.0000	-3.9283
MgHCO3+	5.437e-005	4.629	0.8360	-4.3425
FeHCO3+	4.877e-005	5.687	0.8360	-4.3896
CaHCO3+	3.610e-005	3.641	0.8449	-4.5157
Mn++	3.426e-005	1.878	0.5181	-4.7507
KSO4-	2.456e-005	3.312	0.8360	-4.6877
MnSO4	1.442e-005	2.172	1.0000	-4.8411
As(OH)3	1.039e-005	1.305	1.0000	-4.9835
FeCO3	9.931e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4930	-5.4338
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6530
MnHCO3+	1.846e-006	0.2136	0.8360	-5.8116

CaCl+	1.209e-006	0.09108	0.8360	-5.9956
MgCl+	7.555e-007	0.04505	0.8360	-6.1996
FeOH+	3.770e-007	0.02741	0.8360	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8360	-6.5686
NaCO3-	2.682e-007	0.02221	0.8360	-6.6494
MnCO3	2.543e-007	0.02917	1.0000	-6.5946
ZnSO4	1.742e-007	0.02805	1.0000	-6.7591
NaCl	1.441e-007	0.008402	1.0000	-6.8414
OH-	1.395e-007	0.002368	0.8319	-6.9352
As(OH)4-	1.112e-007	0.01586	0.8360	-7.0316
H+	5.776e-008	5.809e-005	0.8677	-7.3000
HSe-	4.313e-008	0.003442	0.8360	-7.4430
HSO4-	2.271e-008	0.002199	0.8360	-7.7216
MgOH+	1.915e-008	0.0007892	0.8360	-7.7957
Mg2CO3++	1.875e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.006771	0.003931	1.0000	-2.1694
>(w)FeOCO2H	0.005501	0.003194	1.0000	-2.2596
>(w)FeOCO2-	0.002918	0.001694	0.96682	-2.5349
>(w)FeOH	0.002536	0.001472	1.0000	-2.5958
>(w)FeOH2+	0.002396	0.001391	1.0343	-2.6205
>(s)FeOHCa++	0.0002528	0.0001467	1.0698	-3.5973
>(s)FeOZn+	0.0002442	0.0001418	1.0343	-3.6122
>(w)FeOZn+	9.145e-005	5.310e-005	1.0343	-4.0388
>(w)FeOHSO4--	7.949e-005	4.615e-005	0.93473	-4.0997
>(w)FeO-	6.149e-005	3.570e-005	0.96682	-4.2112
>(w)FeSO4-	3.764e-005	2.185e-005	0.96682	-4.4243
>(w)FeOCa+	2.824e-005	1.639e-005	1.0343	-4.5492

>(w)FeOHAsO4---	1.724e-005	1.001e-005	0.90372	-4.7635
>(s)FeOH	7.091e-006	4.117e-006	1.0000	-5.1493
>(s)FeOH2+	6.700e-006	3.890e-006	1.0343	-5.1739
>(w)FeHAsO4-	3.445e-007	2.000e-007	0.96682	-6.4628
>(s)FeO-	1.719e-007	9.982e-008	0.96682	-6.7646
>(w)FeH2AsO4	1.053e-008	6.115e-009	1.0000	-7.9774
>(w)FeHPO4-	3.972e-010	2.306e-010	0.96682	-9.4010
>(w)FePO4--	1.753e-010	1.018e-010	0.93473	-9.7563
>(w)FeH2PO4	1.529e-011	8.876e-012	1.0000	-10.8156
>(w)FeSeO3-	8.756e-019	5.083e-019	0.96682	-18.0577
>(w)FeOHSeO3--	5.457e-019	3.168e-019	0.93473	-18.2630
>(w)FeOHSeO4--	2.890e-042	1.678e-042	0.93473	-41.5390
>(w)FeSeO4-	1.192e-042	6.921e-043	0.96682	-41.9237

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6244s/sat	Dolomite-dis	-0.8053
Dolomite	0.7916s/sat	Monohydrocalcite	-1.1975
Dolomite-ord	0.7915s/sat	Gypsum	-1.2600
Magnetite	0.5336s/sat	Anhydrite	-1.5066
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1374
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3148
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3835		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.492e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.441e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00395	6.10e-006	1.50	0.00394	968.	
Ca++	0.000872	0.000709	48.8	0.000163	11.2	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00827	14.3	
H2O	55.6	55.5	1.72e+006	-0.0128	-396.	
HCO3-	0.00874	0.00385	404.	0.00489	513.	
HPO4--	3.42e-010	1.00e-012	1.65e-007	3.41e-010	5.63e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	446.			
O2(aq)	-11.6	-11.6	-6.40e+005	5.11e-006	0.281	
SO4--	0.00685	0.00678	1.12e+003	6.80e-005	11.2	
SeO3--	2.50e-008	2.50e-008	0.00547	8.25e-019	1.80e-013	
Zn++	0.000195	3.06e-007	0.0344	0.000195	21.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9985	-0.001
Ca++	0.1871	-0.728
HCO3-	0.5593	-0.252
HPO4--	0.9971	-0.001
SO4--	0.009934	-2.003
SeO3--	3.294e-011	-10.482
Zn++	0.9984	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003947	6.100e-006	0.7855	0.003941	507.5
Calcium	0.0008717	0.0007086	48.81	0.0001631	11.24
Carbon	0.008739	0.003851	79.51	0.004888	100.9
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.003363	5.826
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01793	493.0
Phosphorus	3.422e-010	1.000e-012	5.324e-008	3.412e-010	1.817e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	8.252e-019	1.120e-013
Sodium	0.01130	0.01130	446.5		
Sulfur	0.006845	0.006777	373.4	6.800e-005	3.747
Zinc	0.0001952	3.059e-007	0.03437	0.0001949	21.90

Step #   0   Xi = 0.0000

Temperature = 18.0 C   Pressure = 1.013 bars

pH = 7.045   log fO2 = -62.952

Eh = -0.0854 volts   pe = -1.4786

Ionic strength   =   0.037388

Activity of water   =   0.999982

Solvent mass   =   0.580566 kg

Solution mass   =   0.581744 kg

Solution density   =   1.018   g/cm3

Chlorinity   =   0.000515 molal

Dissolved solids   =   2025 mg/kg sol'n

Rock mass   =   0.004813 kg

Carbonate alkalinity=   219.32 mg/kg as CaCO3

HFO sorbing surface:

Surface charge   =   0.905 uC/cm2

Surface potential =   9.05 mV

Surface area   =   2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0854	-1.4786
e- + Fe+++ = Fe++	-0.1755	-3.0384

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	6.059e-005	-4.218	0.01117	0.003900
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	9.404e-007	-6.027	0.0001081	2.922e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005560	-3.255	0.06442	0.01592
(total)			4.813	0.9178*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01893	434.4	0.8389	-1.7990
SO4--	0.009966	955.4	0.4912	-2.3102
HCO3-	0.004252	258.9	0.8426	-2.4457
Mg++	0.001646	39.92	0.5538	-3.0403
CO2(aq)	0.0008465	37.18	1.0000	-3.0724
Ca++	0.0007597	30.39	0.5244	-3.3997
K+	0.0007501	29.27	0.8310	-3.2053
MgSO4	0.0007251	87.10	1.0000	-3.1396
Cl-	0.0005129	18.15	0.8310	-3.3703
NaSO4-	0.0004404	52.32	0.8389	-3.4324
CaSO4	0.0003942	53.55	1.0000	-3.4043
NaHCO3	8.837e-005	7.409	1.0000	-4.0537
MgHCO3+	3.889e-005	3.312	0.8389	-4.4864
Fe++	3.889e-005	2.168	0.5244	-4.6904
Mn++	3.316e-005	1.818	0.5244	-4.7597
CaHCO3+	2.617e-005	2.640	0.8475	-4.6541
KSO4-	2.529e-005	3.411	0.8389	-4.6734
FeSO4	1.577e-005	2.391	1.0000	-4.8021
MnSO4	1.455e-005	2.193	1.0000	-4.8370
As(OH)3	1.248e-005	1.569	1.0000	-4.9037
CO3--	3.057e-006	0.1831	0.4999	-5.8158
FeHCO3+	2.074e-006	0.2419	0.8389	-5.7594
MnHCO3+	1.344e-006	0.1555	0.8389	-5.9479
CaCl+	1.180e-006	0.08892	0.8389	-6.0045

MgCO3	9.875e-007	0.08309	1.0000	-6.0054
CaCO3	8.995e-007	0.08984	1.0000	-6.0460
MgCl+	7.280e-007	0.04341	0.8389	-6.2141
Zn++	6.254e-007	0.04081	0.5244	-6.4842
ZnSO4	3.222e-007	0.05190	1.0000	-6.4919
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.454e-007	0.008480	1.0000	-6.8375
NaCO3-	1.114e-007	0.009225	0.8389	-7.0295
H+	1.036e-007	0.0001042	0.8697	-7.0453
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
OH-	7.735e-008	0.001313	0.8351	-7.1898
As(OH)4-	7.410e-008	0.01057	0.8389	-7.2065
HSO4-	4.190e-008	0.004059	0.8389	-7.4540
FeCl+	1.851e-008	0.001686	0.8389	-7.8090
FeOH+	1.196e-008	0.0008697	0.8389	-7.9985
MgOH+	1.022e-008	0.0004212	0.8389	-8.0670

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.006769	0.003930	1.0000	-2.1695
>(w)FeOCO2H	0.006134	0.003561	1.0000	-2.2122
>(w)FeOH2+	0.002606	0.001513	1.4220	-2.5840
>(w)FeOCO2-	0.002489	0.001445	0.70324	-2.6040
>(w)FeOH	0.002110	0.001225	1.0000	-2.6758
>(s)FeOZn+	0.0002800	0.0001625	1.4220	-3.5529
>(s)FeOHCa++	0.0002058	0.0001195	2.0220	-3.6867
>(w)FeOHSO4--	0.0001288	7.476e-005	0.49455	-3.8902
>(w)FeSO4-	7.972e-005	4.628e-005	0.70324	-4.0984
>(w)FeOZn+	5.527e-005	3.209e-005	1.4220	-4.2575
>(w)FeO-	3.913e-005	2.272e-005	0.70324	-4.4075
>(w)FeOHAsO4---	1.695e-005	9.841e-006	0.34779	-4.7708

>(s)FeOH2+	1.382e-005	8.024e-006	1.4220	-4.8594
>(s)FeOH	1.119e-005	6.496e-006	1.0000	-4.9512
>(w)FeOCa+	9.269e-006	5.381e-006	1.4220	-5.0330
>(w)FeHAsO4-	5.790e-007	3.362e-007	0.70324	-6.2373
>(s)FeO-	2.075e-007	1.205e-007	0.70324	-6.6830
>(w)FeH2AsO4	2.315e-008	1.344e-008	1.0000	-7.6355
>(w)FeHPO4-	4.242e-010	2.463e-010	0.70324	-9.3724
>(w)FePO4--	1.432e-010	8.311e-011	0.49455	-9.8442
>(w)FeH2PO4	2.135e-011	1.239e-011	1.0000	-10.6707
>(w)FeSeO3-	2.701e-022	1.568e-022	0.70324	-21.5685
>(w)FeOHSeO3--	1.288e-022	7.475e-023	0.49455	-21.8902
>(w)FeOHSeO4--	1.499e-045	8.703e-046	0.49455	-44.8242
>(w)FeSeO4-	8.083e-046	4.693e-046	0.70324	-45.0924

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.2180
Se(black)	0.0000 sat	Gypsum	-1.2580
Hematite	0.0000 sat	Anhydrite	-1.5046
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5905
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1354
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3128
Calcite	-0.6110	ZnSe	-2.3337
Aragonite	-0.7765	FeO(c)	-2.3567
FeSe2	-0.8324	Smithsonite	-2.4601
Magnesite	-1.0618		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01931	-1.714
H2(g)	5.020e-012	-11.299
H2S(g)	1.354e-019	-18.868
CH4(g)	1.172e-023	-22.931
S2(g)	3.381e-042	-41.471
O2(g)	1.118e-063	-62.952

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00395	7.29e-006	1.79	0.00394	968.	
Ca++	0.000872	0.000686	47.3	0.000125	8.60	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.31e-005	3.18	8.90e-021	8.54e-016	
Fe+++	0.0593	5.08e-013	4.87e-008			
H+	-0.169	0.000496	0.859	0.00882	15.3	
H2O	32.3	32.2	9.98e+005	-0.0129	-400.	
HCO3-	0.00874	0.00305	320.	0.00501	525.	
HPO4--	3.42e-010	4.60e-013	7.59e-008	3.42e-010	5.64e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00140	58.5			
Mn++	2.95e-005	2.85e-005	2.70			
Na+	0.0113	0.0113	447.			
O2(aq)	5.07e-006	2.49e-009	0.000137	5.10e-006	0.280	
SO4--	0.00685	0.00672	1.11e+003	0.000121	20.0	
SeO3--	2.50e-008	6.34e-013	1.38e-007	2.32e-022	5.05e-017	
Zn++	0.000195	5.50e-007	0.0618	0.000195	21.9	

Sorbed	fraction	log fraction
As(OH)4-	0.9982	-0.001
Ca++	0.1539	-0.813
HCO3-	0.6211	-0.207
HPO4--	0.9987	-0.001
SO4--	0.01768	-1.752
SeO3--	3.652e-010	-9.438
Zn++	0.9972	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003947	7.294e-006	0.9394	0.003940	507.4
Calcium	0.0008717	0.0006863	47.28	0.0001248	8.601
Carbon	0.008739	0.003054	63.06	0.005006	103.4
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.003737	6.474
Iron	0.05992	3.310e-005	3.177	8.896e-021	8.540e-016
Magnesium	0.001461	0.001400	58.49		
Manganese	2.949e-005	2.855e-005	2.696		
Oxygen	32.37	32.26	8.873e+005	0.01835	504.7
Phosphorus	3.422e-010	4.601e-013	2.450e-008	3.418e-010	1.820e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	6.342e-013	8.607e-008	2.316e-022	3.143e-017
Sodium	0.01130	0.01130	446.6		
Sulfur	0.006845	0.006724	370.6	0.0001210	6.671
Zinc	0.0001952	5.503e-007	0.06185	0.0001946	21.87

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.046 log fO2 = -62.954

Eh = -0.0855 volts pe = -1.4794

Ionic strength = 0.037332

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582744 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2022 mg/kg sol'n

Rock mass = 0.004813 kg

Carbonate alkalinity= 219.17 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.904 uC/cm2

Surface potential = 9.04 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0855	-1.4794
e- + Fe+++ = Fe++	-0.1756	-3.0394

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	5.986e-005	-4.223	0.01104	0.003853
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	9.186e-007	-6.037	0.0001056	2.854e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005560	-3.255	0.06441	0.01592
			______________	______________
(total)			4.813	0.9177*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01890	433.7	0.8390	-1.7997
SO4--	0.009950	953.8	0.4914	-2.3107
HCO3-	0.004250	258.8	0.8427	-2.4460
Mg++	0.001644	39.88	0.5539	-3.0406
CO2(aq)	0.0008453	37.13	1.0000	-3.0730
Ca++	0.0007594	30.38	0.5246	-3.3997
K+	0.0007488	29.22	0.8311	-3.2060
MgSO4	0.0007238	86.94	1.0000	-3.1404
Cl-	0.0005120	18.12	0.8311	-3.3710
NaSO4-	0.0004391	52.17	0.8390	-3.4337
CaSO4	0.0003937	53.48	1.0000	-3.4049
NaHCO3	8.818e-005	7.393	1.0000	-4.0546
Fe++	3.887e-005	2.166	0.5246	-4.6906
MgHCO3+	3.885e-005	3.308	0.8390	-4.4869
Mn++	3.314e-005	1.817	0.5246	-4.7598
CaHCO3+	2.615e-005	2.638	0.8476	-4.6543
KSO4-	2.521e-005	3.401	0.8390	-4.6746
FeSO4	1.575e-005	2.387	1.0000	-4.8028
MnSO4	1.453e-005	2.190	1.0000	-4.8377
As(OH)3	1.247e-005	1.567	1.0000	-4.9041
CO3--	3.057e-006	0.1831	0.5001	-5.8156
FeHCO3+	2.072e-006	0.2417	0.8390	-5.7598
MnHCO3+	1.343e-006	0.1554	0.8390	-5.9483
CaCl+	1.178e-006	0.08877	0.8390	-6.0052

MgCO3	9.873e-007	0.08307	1.0000	-6.0056
CaCO3	8.997e-007	0.08987	1.0000	-6.0459
MgCl+	7.263e-007	0.04331	0.8390	-6.2151
Zn++	6.244e-007	0.04074	0.5246	-6.4847
ZnSO4	3.214e-007	0.05178	1.0000	-6.4930
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.449e-007	0.008453	1.0000	-6.8389
NaCO3-	1.112e-007	0.009212	0.8390	-7.0300
H+	1.035e-007	0.0001041	0.8697	-7.0457
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
OH-	7.741e-008	0.001314	0.8352	-7.1895
As(OH)4-	7.409e-008	0.01057	0.8390	-7.2065
HSO4-	4.181e-008	0.004050	0.8390	-7.4549
FeCl+	1.847e-008	0.001683	0.8390	-7.8098
FeOH+	1.197e-008	0.0008701	0.8390	-7.9982
MgOH+	1.022e-008	0.0004213	0.8390	-8.0668

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeH2AsO3	0.006757	0.003930	1.0000	-2.1702
>(w)FeOCO2H	0.006121	0.003560	1.0000	-2.2132
>(w)FeOH2+	0.002602	0.001513	1.4219	-2.5847
>(w)FeOCO2-	0.002485	0.001445	0.70331	-2.6046
>(w)FeOH	0.002108	0.001226	1.0000	-2.6761
>(s)FeOZn+	0.0002794	0.0001625	1.4219	-3.5537
>(s)FeOHCa++	0.0002054	0.0001195	2.0217	-3.6873
>(w)FeOHSO4--	0.0001285	7.472e-005	0.49464	-3.8911
>(w)FeSO4-	7.948e-005	4.623e-005	0.70331	-4.0997
>(w)FeOZn+	5.522e-005	3.211e-005	1.4219	-4.2579
>(w)FeO-	3.913e-005	2.275e-005	0.70331	-4.4075
>(w)FeOHAsO4---	1.692e-005	9.841e-006	0.34788	-4.7715

>(s)FeOH2+	1.379e-005	8.019e-006	1.4219	-4.8605
>(s)FeOH	1.117e-005	6.497e-006	1.0000	-4.9519
>(w)FeOCa+	9.270e-006	5.391e-006	1.4219	-5.0329
>(w)FeHAsO4-	5.772e-007	3.357e-007	0.70331	-6.2387
>(s)FeO-	2.073e-007	1.206e-007	0.70331	-6.6833
>(w)FeH2AsO4	2.305e-008	1.341e-008	1.0000	-7.6373
>(w)FeHPO4-	4.234e-010	2.462e-010	0.70331	-9.3732
>(w)FePO4--	1.430e-010	8.316e-011	0.49464	-9.8447
>(w)FeH2PO4	2.129e-011	1.238e-011	1.0000	-10.6718
>(w)FeSeO3-	2.689e-022	1.564e-022	0.70331	-21.5705
>(w)FeOHSeO3--	1.283e-022	7.460e-023	0.49464	-21.8919
>(w)FeOHSeO4--	1.490e-045	8.664e-046	0.49464	-44.8269
>(w)FeSeO4-	8.027e-046	4.668e-046	0.70331	-45.0954

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.2174
Se(black)	0.0000 sat	Gypsum	-1.2586
Hematite	0.0000 sat	Anhydrite	-1.5052
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5904
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1360
Goethite	-0.4675	CaSO4^1/2H2O(bet	-2.3134
Calcite	-0.6109	ZnSe	-2.3325
Aragonite	-0.7764	FeO(c)	-2.3561
FeSe2	-0.8308	Smithsonite	-2.4604
Magnesite	-1.0619		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01928	-1.715
H2(g)	5.032e-012	-11.298
H2S(g)	1.362e-019	-18.866
CH4(g)	1.182e-023	-22.928
S2(g)	3.408e-042	-41.467
O2(g)	1.113e-063	-62.954

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00395	7.30e-006	1.79	0.00394	966.	
Ca++	0.000872	0.000687	47.3	0.000125	8.59	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.31e-005	3.17	8.90e-021	8.53e-016	
Fe+++	0.0593	5.09e-013	4.87e-008			
H+	-0.169	0.000496	0.857	0.00881	15.2	
H2O	32.4	32.3	9.98e+005	-0.0129	-399.	
HCO3-	0.00874	0.00306	320.	0.00501	524.	
HPO4--	3.42e-010	4.61e-013	7.59e-008	3.42e-010	5.63e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00140	58.4			
Mn++	2.95e-005	2.86e-005	2.69			
Na+	0.0113	0.0113	446.			
O2(aq)	5.07e-006	2.49e-009	0.000137	5.10e-006	0.280	
SO4--	0.00685	0.00672	1.11e+003	0.000121	19.9	
SeO3--	2.50e-008	6.37e-013	1.39e-007	2.31e-022	5.03e-017	
Zn++	0.000195	5.50e-007	0.0617	0.000195	21.8	

Sorbed	fraction	log fraction
As(OH)4-	0.9982	-0.001
Ca++	0.1538	-0.813
HCO3-	0.6208	-0.207
HPO4--	0.9987	-0.001
SO4--	0.01767	-1.753
SeO3--	3.625e-010	-9.441
Zn++	0.9972	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.003947	7.300e-006	0.9386	0.003940	506.5
Calcium	0.0008717	0.0006870	47.25	0.0001249	8.588
Carbon	0.008739	0.003057	63.01	0.005005	103.2
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	0.003736	6.462
Iron	0.05992	3.312e-005	3.174	8.896e-021	8.525e-016
Magnesium	0.001461	0.001401	58.42		
Manganese	2.949e-005	2.857e-005	2.693		
Oxygen	32.43	32.32	8.873e+005	0.01835	503.7
Phosphorus	3.422e-010	4.606e-013	2.448e-008	3.418e-010	1.817e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	6.372e-013	8.634e-008	2.310e-022	3.129e-017
Sodium	0.01130	0.01130	445.8		
Sulfur	0.006845	0.006724	369.9	0.0001209	6.654
Zinc	0.0001952	5.502e-007	0.06173	0.0001946	21.84

0.002367 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.300 log fO2 = -63.636

Eh = -0.1100 volts pe = -1.9042

Ionic strength = 0.039381

Activity of water = 0.999982

Solvent mass = 0.580561 kg

Solution mass = 0.581828 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2177 mg/kg sol'n

Rock mass = 0.004737 kg

Carbonate alkalinity= 298.76 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.0534 uC/cm2

Surface potential = 0.534 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.1100	-1.9042
e- + Fe+++ = Fe++	-0.2914	-5.0447

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.02966	-1.528	4.737	0.8979
(total)			4.737	0.8979

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01893	434.4	0.8359	-1.8006
SO4--	0.009816	940.9	0.4840	-2.3232
HCO3-	0.005721	348.3	0.8398	-2.3184
Mg++	0.001727	41.89	0.5482	-3.0237
Ca++	0.0007887	31.54	0.5181	-3.3887
K+	0.0007508	29.29	0.8277	-3.2066
MgSO4	0.0007311	87.81	1.0000	-3.1360
Fe++	0.0006879	38.33	0.5181	-3.4481
CO2(aq)	0.0006315	27.73	1.0000	-3.1997
Cl-	0.0005126	18.13	0.8277	-3.3724
NaSO4-	0.0004274	50.77	0.8359	-3.4470
CaSO4	0.0003923	53.29	1.0000	-3.4063
FeSO4	0.0002674	40.54	1.0000	-3.5728
NaHCO3	0.0001181	9.896	1.0000	-3.9279
MgHCO3+	5.437e-005	4.629	0.8359	-4.3425
FeHCO3+	4.877e-005	5.687	0.8359	-4.3897
CaHCO3+	3.610e-005	3.641	0.8449	-4.5158
Mn++	3.426e-005	1.878	0.5181	-4.7508
KSO4-	2.455e-005	3.311	0.8359	-4.6877
MnSO4	1.442e-005	2.172	1.0000	-4.8411
FeCO3	9.931e-006	1.148	1.0000	-5.0030
CO3--	7.472e-006	0.4474	0.4930	-5.4338
As(OH)3	5.193e-006	0.6526	1.0000	-5.2846
MgCO3	2.472e-006	0.2080	1.0000	-5.6069
CaCO3	2.223e-006	0.2220	1.0000	-5.6530
MnHCO3+	1.846e-006	0.2136	0.8359	-5.8116

CaCl+	1.209e-006	0.09108	0.8359	-5.9956
MgCl+	7.555e-007	0.04505	0.8359	-6.1996
FeOH+	3.770e-007	0.02741	0.8359	-6.5014
Zn++	3.526e-007	0.02300	0.5181	-6.7383
FeCl+	3.230e-007	0.02942	0.8359	-6.5686
NaCO3-	2.684e-007	0.02223	0.8359	-6.6490
MnCO3	2.543e-007	0.02917	1.0000	-6.5946
ZnSO4	1.741e-007	0.02805	1.0000	-6.7591
NaCl	1.442e-007	0.008409	1.0000	-6.8411
OH-	1.396e-007	0.002368	0.8319	-6.9352
H+	5.776e-008	5.809e-005	0.8677	-7.3000
As(OH)4-	5.561e-008	0.007932	0.8359	-7.3327
HSe-	4.313e-008	0.003442	0.8359	-7.4430
HSO4-	2.271e-008	0.002199	0.8359	-7.7217
MgOH+	1.915e-008	0.0007892	0.8359	-7.7957
Mg2CO3++	1.876e-008	0.002033	0.5016	-8.0265

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.006599	0.003831	1.0000	-2.1805
>(w)FeH2AsO3	0.004062	0.002358	1.0000	-2.3913
>(w)FeOCO2-	0.003456	0.002006	0.97945	-2.4615
>(w)FeOH	0.003043	0.001766	1.0000	-2.5167
>(w)FeOH2+	0.002912	0.001691	1.0210	-2.5358
>(s)FeOHCa++	0.0002545	0.0001477	1.0424	-3.5944
>(s)FeOZn+	0.0002427	0.0001409	1.0210	-3.6150
>(w)FeOZn+	0.0001112	6.453e-005	1.0210	-3.9541
>(w)FeOHSO4--	9.292e-005	5.394e-005	0.95931	-4.0319
>(w)FeO-	7.283e-005	4.228e-005	0.97945	-4.1377
>(w)FeSO4-	4.457e-005	2.588e-005	0.97945	-4.3509
>(w)FeOCa+	3.432e-005	1.993e-005	1.0210	-4.4644

>(w)FeOHAsO4---	9.947e-006	5.775e-006	0.93959	-5.0023
>(s)FeOH	6.956e-006	4.039e-006	1.0000	-5.1576
>(s)FeOH2+	6.658e-006	3.865e-006	1.0210	-5.1766
>(w)FeHAsO4-	2.040e-007	1.184e-007	0.97945	-6.6903
>(s)FeO-	1.665e-007	9.666e-008	0.97945	-6.7786
>(w)FeH2AsO4	6.319e-009	3.668e-009	1.0000	-8.1994
>(w)FeHPO4-	4.704e-010	2.731e-010	0.97945	-9.3275
>(w)FePO4--	2.049e-010	1.189e-010	0.95931	-9.6885
>(w)FeH2PO4	1.834e-011	1.065e-011	1.0000	-10.7365
>(w)FeSeO3-	1.037e-018	6.020e-019	0.97945	-17.9842
>(w)FeOHSeO3--	6.379e-019	3.704e-019	0.95931	-18.1952
>(w)FeOHSeO4--	3.379e-042	1.962e-042	0.95931	-41.4712
>(w)FeSeO4-	1.412e-042	8.196e-043	0.97945	-41.8502

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
FeSe2	9.2585s/sat	Goethite	-0.4675
Se(black)	3.9984s/sat	FeO(c)	-0.6050
ZnSe	2.2619s/sat	Magnesite	-0.6632
Siderite	1.6244s/sat	Dolomite-dis	-0.8053
Dolomite	0.7915s/sat	Monohydrocalcite	-1.1975
Dolomite-ord	0.7915s/sat	Gypsum	-1.2600
Magnetite	0.5336s/sat	Anhydrite	-1.5067
Rhodochrosite	0.3909s/sat	Fe(OH)2(ppd)	-2.0765
Hematite	0.0000 sat	Bassanite	-2.1375
FeSe	-0.1820	CaSO4^1/2H2O(bet	-2.3149
Calcite	-0.2180	Smithsonite	-2.3322
Aragonite	-0.3835		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
Steam	0.02024	-1.694
CO2(g)	0.01440	-1.842
H2(g)	1.103e-011	-10.957
H2S(g)	9.491e-019	-18.023
CH4(g)	2.041e-022	-21.690
S2(g)	3.440e-041	-40.463
O2(g)	2.314e-064	-63.636

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00237	3.05e-006	0.749	0.00236	581.	
Ca++	0.000876	0.000709	48.8	0.000168	11.5	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	0.000589	56.5			
Fe+++	0.0593	4.51e-013	4.32e-008			
H+	-46.7	-46.6	-8.07e+004	0.00763	13.2	
H2O	55.6	55.5	1.72e+006	-0.0106	-328.	
HCO3-	0.00969	0.00385	404.	0.00584	612.	
HPO4--	4.04e-010	1.00e-012	1.65e-007	4.03e-010	6.64e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00146	61.0			
Mn++	2.95e-005	2.95e-005	2.78			
Na+	0.0113	0.0113	447.			
O2(aq)	-11.6	-11.6	-6.40e+005	2.95e-006	0.162	
SO4--	0.00686	0.00678	1.12e+003	7.98e-005	13.2	
SeO3--	2.50e-008	2.50e-008	0.00547	9.72e-019	2.12e-013	
Zn++	0.000206	3.06e-007	0.0344	0.000205	23.1	

Sorbed	fraction	log fraction
As(OH)4-	0.9987	-0.001
Ca++	0.1913	-0.718
HCO3-	0.6025	-0.220
HPO4--	0.9975	-0.001
SO4--	0.01164	-1.934
SeO3--	3.882e-011	-10.411
Zn++	0.9985	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002367	3.050e-006	0.3927	0.002364	304.4
Calcium	0.0008762	0.0007086	48.81	0.0001677	11.55
Carbon	0.009689	0.003851	79.51	0.005838	120.5
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.001753	3.037
Iron	0.05992	0.0005891	56.55		
Magnesium	0.001461	0.001461	61.01		
Manganese	2.949e-005	2.949e-005	2.784		
Oxygen	32.37	32.26	8.872e+005	0.01671	459.4
Phosphorus	4.037e-010	1.000e-012	5.324e-008	4.027e-010	2.144e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	2.505e-008	0.003399	9.724e-019	1.320e-013
Sodium	0.01131	0.01131	446.9		
Sulfur	0.006857	0.006777	373.4	7.982e-005	4.398
Zinc	0.0002057	3.059e-007	0.03437	0.0002054	23.08

Step # 0 Xi = 0.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.054 log fO2 = -63.020

Eh = -0.0869 volts pe = -1.5046

Ionic strength = 0.037304

Activity of water = 0.999982

Solvent mass = 0.580566 kg

Solution mass = 0.581739 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000515 molal

Dissolved solids = 2017 mg/kg sol'n

Rock mass = 0.004816 kg

Carbonate alkalinity= 217.43 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.886 uC/cm2

Surface potential = 8.86 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0869	-1.5046
e- + Fe+++ = Fe++	-0.1768	-3.0599

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	7.548e-005	-4.122	0.01392	0.004858
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.298e-006	-5.887	0.0001492	4.032e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005564	-3.255	0.06447	0.01593
			————	————
(total)			4.816	0.9187*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01895	434.8	0.8391	-1.7986
SO4--	0.009959	954.7	0.4915	-2.3103
HCO3-	0.004216	256.7	0.8428	-2.4494
Mg++	0.001628	39.50	0.5540	-3.0447
CO2(aq)	0.0008223	36.12	1.0000	-3.0850
K+	0.0007501	29.27	0.8312	-3.2052
Ca++	0.0007489	29.96	0.5247	-3.4056
MgSO4	0.0007177	86.20	1.0000	-3.1441
Cl-	0.0005129	18.15	0.8312	-3.3703
NaSO4-	0.0004407	52.36	0.8391	-3.4320
CaSO4	0.0003887	52.81	1.0000	-3.4104
NaHCO3	8.771e-005	7.354	1.0000	-4.0569
Fe++	3.841e-005	2.141	0.5247	-4.6956
MgHCO3+	3.817e-005	3.250	0.8391	-4.4945
Mn++	3.275e-005	1.796	0.5247	-4.7649
CaHCO3+	2.559e-005	2.582	0.8477	-4.6637
KSO4-	2.528e-005	3.410	0.8391	-4.6734
FeSO4	1.558e-005	2.362	1.0000	-4.8074
MnSO4	1.438e-005	2.167	1.0000	-4.8423
As(OH)3	6.131e-006	0.7706	1.0000	-5.2125
CO3--	3.092e-006	0.1852	0.5002	-5.8106
FeHCO3+	2.032e-006	0.2370	0.8391	-5.7683
MnHCO3+	1.316e-006	0.1523	0.8391	-5.9568
CaCl+	1.164e-006	0.08771	0.8391	-6.0104

MgCO3	9.893e-007	0.08324	1.0000	-6.0047
CaCO3	8.979e-007	0.08968	1.0000	-6.0468
MgCl+	7.206e-007	0.04298	0.8391	-6.2185
Zn++	6.267e-007	0.04089	0.5247	-6.4830
ZnSO4	3.230e-007	0.05203	1.0000	-6.4908
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.456e-007	0.008491	1.0000	-6.8369
NaCO3-	1.128e-007	0.009345	0.8391	-7.0238
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	1.015e-007	0.0001021	0.8697	-7.0543
OH-	7.894e-008	0.001340	0.8352	-7.1809
HSO4-	4.104e-008	0.003976	0.8391	-7.4630
As(OH)4-	3.715e-008	0.005299	0.8391	-7.5063
FeCl+	1.829e-008	0.001666	0.8391	-7.8141
FeOH+	1.206e-008	0.0008770	0.8391	-7.9948
MgOH+	1.032e-008	0.0004255	0.8391	-8.0625

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.007278	0.004225	1.0000	-2.1380
>(w)FeH2AsO3	0.004061	0.002358	1.0000	-2.3914
>(w)FeOH2+	0.003141	0.001824	1.4116	-2.5029
>(w)FeOCO2-	0.002992	0.001737	0.70840	-2.5240
>(w)FeOH	0.002577	0.001496	1.0000	-2.5889
>(s)FeOZn+	0.0002838	0.0001648	1.4116	-3.5470
>(s)FeOHCa++	0.0002025	0.0001176	1.9927	-3.6936
>(w)FeOHSO4--	0.0001550	8.997e-005	0.50183	-3.8098
>(w)FeSO4-	9.468e-005	5.497e-005	0.70840	-4.0237
>(w)FeOZn+	6.960e-005	4.041e-005	1.4116	-4.1574
>(w)FeO-	4.842e-005	2.811e-005	0.70840	-4.3150
>(s)FeOH2+	1.341e-005	7.787e-006	1.4116	-4.8725

>(w)FeOCa+	1.148e-005	6.665e-006	1.4116	-4.9401
>(s)FeOH	1.100e-005	6.388e-006	1.0000	-4.9585
>(w)FeOHAsO4---	9.777e-006	5.676e-006	0.35549	-5.0098
>(w)FeHAsO4-	3.253e-007	1.888e-007	0.70840	-6.4877
>(s)FeO-	2.068e-007	1.200e-007	0.70840	-6.6845
>(w)FeH2AsO4	1.283e-008	7.450e-009	1.0000	-7.8917
>(w)FeHPO4-	4.991e-010	2.898e-010	0.70840	-9.3018
>(w)FePO4--	1.707e-010	9.909e-011	0.50183	-9.7678
>(w)FeH2PO4	2.479e-011	1.439e-011	1.0000	-10.6058
>(w)FeSeO3-	2.855e-022	1.657e-022	0.70840	-21.5445
>(w)FeOHSeO3--	1.379e-022	8.005e-023	0.50183	-21.8605
>(w)FeOHSeO4--	1.483e-045	8.612e-046	0.50183	-44.8288
>(w)FeSeO4-	7.894e-046	4.583e-046	0.70840	-45.1027

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Dolomite	0.0000 sat	Magnetite	-1.2054
Se(black)	0.0000 sat	Gypsum	-1.2640
Hematite	0.0000 sat	Anhydrite	-1.5107
Rhodochrosite	0.0000 sat	Monohydrocalcite	-1.5913
Siderite	0.0000 sat	Dolomite-dis	-1.5968
Dolomite-ord	-0.0000	Bassanite	-2.1415
Goethite	-0.4675	ZnSe	-2.2805
Calcite	-0.6118	CaSO4^1/2H2O(bet	-2.3189
Aragonite	-0.7773	FeO(c)	-2.3441
FeSe2	-0.7855	Smithsonite	-2.4537
Magnesite	-1.0610		

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01876	-1.727
H2(g)	5.433e-012	-11.265
H2S(g)	1.782e-019	-18.749
CH4(g)	1.562e-023	-22.806
S2(g)	5.001e-042	-41.301
O2(g)	9.547e-064	-63.020

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00237	3.58e-006	0.881	0.00236	581.	
Ca++	0.000876	0.000677	46.6	0.000124	8.56	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.27e-005	3.14	5.13e-021	4.92e-016	
Fe+++	0.0593	5.05e-013	4.85e-008			
H+	-0.170	0.000478	0.828	0.00822	14.2	
H2O	32.3	32.2	9.98e+005	-0.0107	-333.	
HCO3-	0.00969	0.00302	317.	0.00596	625.	
HPO4--	4.04e-010	4.51e-013	7.45e-008	4.03e-010	6.65e-005	
K+	0.000450	0.000450	30.3			
Mg++	0.00146	0.00139	57.9			
Mn++	2.95e-005	2.82e-005	2.66			
Na+	0.0113	0.0113	447.			
O2(aq)	2.91e-006	1.17e-009	6.44e-005	2.94e-006	0.162	
SO4--	0.00686	0.00671	1.11e+003	0.000145	23.9	
SeO3--	2.50e-008	7.00e-013	1.53e-007	2.46e-022	5.36e-017	
Zn++	0.000206	5.52e-007	0.0620	0.000205	23.1	

Sorbed	fraction	log fraction
As(OH)4-	0.9985	-0.001
Ca++	0.1551	-0.809
HCO3-	0.6639	-0.178
HPO4--	0.9989	-0.000
SO4--	0.02114	-1.675
SeO3--	3.509e-010	-9.455
Zn++	0.9973	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002367	3.583e-006	0.4615	0.002363	304.4
Calcium	0.0008762	0.0006765	46.61	0.0001242	8.559
Carbon	0.009689	0.003018	62.31	0.005962	123.1
Chlorine	0.0002990	0.0002990	18.22		
Hydrogen	64.46	64.46	1.117e+005	0.002157	3.737
Iron	0.05992	3.268e-005	3.137	5.128e-021	4.923e-016
Magnesium	0.001461	0.001385	57.87		
Manganese	2.949e-005	2.819e-005	2.662		
Oxygen	32.37	32.26	8.873e+005	0.01719	472.7
Phosphorus	4.037e-010	4.513e-013	2.403e-008	4.032e-010	2.147e-005
Potassium	0.0004501	0.0004501	30.25		
Selenium	2.505e-008	7.003e-013	9.506e-008	2.458e-022	3.336e-017
Sodium	0.01131	0.01131	446.9		
Sulfur	0.006857	0.006712	369.9	0.0001449	7.988
Zinc	0.0002057	5.516e-007	0.06199	0.0002052	23.06

Step # 100 Xi = 1.0000

Temperature = 18.0 C Pressure = 1.013 bars

pH = 7.055 log fO2 = -63.022

Eh = -0.0870 volts pe = -1.5054

Ionic strength = 0.037249

Activity of water = 0.999982

Solvent mass = 0.581566 kg

Solution mass = 0.582740 kg

Solution density = 1.018 g/cm3

Chlorinity = 0.000514 molal

Dissolved solids = 2014 mg/kg sol'n

Rock mass = 0.004815 kg

Carbonate alkalinity= 217.30 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 0.886 uC/cm2

Surface potential = 8.86 mV

Surface area = 2.84e+007 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	-0.0870	-1.5054
e- + Fe+++ = Fe++	-0.1768	-3.0608

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Dolomite	7.471e-005	-4.127	0.01378	0.004809
Hematite	0.02966	-1.528	4.737	0.8979

Rhodochrosite	1.275e-006	-5.895	0.0001465	3.961e-005
Se(black)	2.505e-008	-7.601	1.978e-006	
Siderite	0.0005564	-3.255	0.06446	0.01593
			-------------	-------------
(total)			4.815	0.9187*

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Na+	0.01892	434.1	0.8392	-1.7992
SO4--	0.009942	953.1	0.4917	-2.3108
HCO3-	0.004213	256.6	0.8428	-2.4496
Mg++	0.001627	39.46	0.5542	-3.0450
CO2(aq)	0.0008213	36.07	1.0000	-3.0855
K+	0.0007488	29.22	0.8313	-3.2059
Ca++	0.0007487	29.95	0.5249	-3.4056
MgSO4	0.0007163	86.05	1.0000	-3.1449
Cl-	0.0005121	18.12	0.8313	-3.3710
NaSO4-	0.0004394	52.21	0.8392	-3.4333
CaSO4	0.0003882	52.75	1.0000	-3.4109
NaHCO3	8.753e-005	7.338	1.0000	-4.0578
Fe++	3.839e-005	2.139	0.5249	-4.6958
MgHCO3+	3.812e-005	3.246	0.8392	-4.4950
Mn++	3.273e-005	1.794	0.5249	-4.7650
CaHCO3+	2.557e-005	2.580	0.8477	-4.6640
KSO4-	2.521e-005	3.400	0.8392	-4.6746
FeSO4	1.556e-005	2.359	1.0000	-4.8081
MnSO4	1.436e-005	2.163	1.0000	-4.8430
As(OH)3	6.126e-006	0.7700	1.0000	-5.2128
CO3--	3.092e-006	0.1852	0.5004	-5.8104
FeHCO3+	2.030e-006	0.2368	0.8392	-5.7686
MnHCO3+	1.315e-006	0.1522	0.8392	-5.9571
CaCl+	1.162e-006	0.08756	0.8392	-6.0111

MgCO3	9.890e-007	0.08322	1.0000	-6.0048
CaCO3	8.981e-007	0.08971	1.0000	-6.0467
MgCl+	7.190e-007	0.04288	0.8392	-6.2194
Zn++	6.258e-007	0.04084	0.5249	-6.4835
ZnSO4	3.222e-007	0.05191	1.0000	-6.4919
FeCO3	2.358e-007	0.02727	1.0000	-6.6274
NaCl	1.451e-007	0.008463	1.0000	-6.8383
NaCO3-	1.127e-007	0.009332	0.8392	-7.0244
MnCO3	1.034e-007	0.01186	1.0000	-6.9856
H+	1.014e-007	0.0001020	0.8698	-7.0546
OH-	7.899e-008	0.001341	0.8353	-7.1806
HSO4-	4.095e-008	0.003967	0.8392	-7.4639
As(OH)4-	3.714e-008	0.005299	0.8392	-7.5063
FeCl+	1.825e-008	0.001663	0.8392	-7.8149
FeOH+	1.207e-008	0.0008774	0.8392	-7.9945
MgOH+	1.032e-008	0.0004256	0.8392	-8.0624

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.007262	0.004223	1.0000	-2.1389
>(w)FeH2AsO3	0.004054	0.002358	1.0000	-2.3921
>(w)FeOH2+	0.003136	0.001824	1.4115	-2.5036
>(w)FeOCO2-	0.002988	0.001738	0.70845	-2.5247
>(w)FeOH	0.002574	0.001497	1.0000	-2.5893
>(s)FeOZn+	0.0002833	0.0001648	1.4115	-3.5478
>(s)FeOHCa++	0.0002022	0.0001176	1.9924	-3.6942
>(w)FeOHSO4--	0.0001546	8.992e-005	0.50190	-3.8108
>(w)FeSO4-	9.440e-005	5.490e-005	0.70845	-4.0250
>(w)FeOZn+	6.952e-005	4.043e-005	1.4115	-4.1579
>(w)FeO-	4.841e-005	2.815e-005	0.70845	-4.3151
>(s)FeOH2+	1.338e-005	7.782e-006	1.4115	-4.8735

>(w)FeOCa+ 1.148e-005 6.676e-006 1.4115 -4.9401

>(s)FeOH 1.098e-005 6.388e-006 1.0000 -4.9592

>(w)FeOHAsO4--- 9.760e-006 5.676e-006 0.35557 -5.0105

>(w)FeHAsO4- 3.243e-007 1.886e-007 0.70845 -6.4891

>(s)FeO- 2.066e-007 1.201e-007 0.70845 -6.6849

>(w)FeH2AsO4 1.278e-008 7.434e-009 1.0000 -7.8934

>(w)FeHPO4- 4.982e-010 2.897e-010 0.70845 -9.3026

>(w)FePO4-- 1.705e-010 9.914e-011 0.50190 -9.7683

>(w)FeH2PO4 2.472e-011 1.438e-011 1.0000 -10.6069

>(w)FeSeO3- 2.842e-022 1.653e-022 0.70845 -21.5464

>(w)FeOHSeO3-- 1.374e-022 7.990e-023 0.50190 -21.8621

>(w)FeOHSeO4-- 1.475e-045 8.577e-046 0.50190 -44.8312

>(w)FeSeO4- 7.843e-046 4.561e-046 0.70845 -45.1055

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

log Q/K log Q/K

Dolomite 0.0000 sat Magnetite -1.2049

Se(black) 0.0000 sat Gypsum -1.2646

Hematite 0.0000 sat Anhydrite -1.5112

Rhodochrosite 0.0000 sat Monohydrocalcite -1.5912

Siderite 0.0000 sat Dolomite-dis -1.5968

Dolomite-ord -0.0000 Bassanite -2.1420

Goethite -0.4675 ZnSe -2.2794

Calcite -0.6116 CaSO4^1/2H2O(bet -2.3194

Aragonite -0.7772 FeO(c) -2.3435

FeSe2 -0.7841 Smithsonite -2.4541

Magnesite -1.0611

(only minerals with log Q/K > -3 listed)

Gases fugacity log fug.

Steam	0.02024	-1.694
CO2(g)	0.01873	-1.727
H2(g)	5.444e-012	-11.264
H2S(g)	1.791e-019	-18.747
CH4(g)	1.573e-023	-22.803
S2(g)	5.036e-042	-41.298
O2(g)	9.508e-064	-63.022

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
>(s)FeOH	0.000297					
>(w)FeOH	0.0119					
As(OH)4-	0.00237	3.59e-006	0.880	0.00236	580.	
Ca++	0.000876	0.000677	46.6	0.000124	8.55	
Cl-	0.000299	0.000299	18.2			
Fe++	0.000589	3.27e-005	3.13	5.13e-021	4.91e-016	
Fe+++	0.0593	5.06e-013	4.85e-008			
H+	-0.170	0.000478	0.827	0.00822	14.2	
H2O	32.4	32.3	9.98e+005	-0.0107	-332.	
HCO3-	0.00969	0.00302	316.	0.00596	624.	
HPO4--	4.04e-010	4.52e-013	7.44e-008	4.03e-010	6.64e-005	
K+	0.000450	0.000450	30.2			
Mg++	0.00146	0.00139	57.8			
Mn++	2.95e-005	2.82e-005	2.66			
Na+	0.0113	0.0113	446.			
O2(aq)	2.91e-006	1.17e-009	6.43e-005	2.94e-006	0.161	
SO4--	0.00686	0.00671	1.11e+003	0.000145	23.9	
SeO3--	2.50e-008	7.03e-013	1.53e-007	2.45e-022	5.34e-017	
Zn++	0.000206	5.52e-007	0.0619	0.000205	23.0	

Sorbed	fraction	log fraction
As(OH)4-	0.9985	-0.001
Ca++	0.1550	-0.810
HCO3-	0.6637	-0.178
HPO4--	0.9989	-0.000
SO4--	0.02112	-1.675
SeO3--	3.485e-010	-9.458
Zn++	0.9973	-0.001

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	0.002367	3.587e-006	0.4611	0.002363	303.9
Calcium	0.0008762	0.0006773	46.58	0.0001243	8.547
Carbon	0.009689	0.003021	62.27	0.005961	122.9
Chlorine	0.0002990	0.0002990	18.19		
Hydrogen	64.57	64.57	1.117e+005	0.002157	3.730
Iron	0.05992	3.271e-005	3.134	5.129e-021	4.915e-016
Magnesium	0.001461	0.001386	57.80		
Manganese	2.949e-005	2.821e-005	2.660		
Oxygen	32.43	32.32	8.873e+005	0.01718	471.8
Phosphorus	4.037e-010	4.517e-013	2.401e-008	4.032e-010	2.143e-005
Potassium	0.0004501	0.0004501	30.20		
Selenium	2.505e-008	7.035e-013	9.532e-008	2.452e-022	3.322e-017
Sodium	0.01131	0.01131	446.2		
Sulfur	0.006857	0.006712	369.3	0.0001448	7.967
Zinc	0.0002057	5.516e-007	0.06188	0.0002052	23.02

4.609E-006 total moles arsenic

Step # 0 Xi = 0.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6677

Ionic strength = 0.010303

Activity of water = 0.999737

Solvent mass = 0.999835 kg

Solution mass = 1.000613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007535 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.47 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6677
e- + Fe+++ = Fe++	-0.1017	-1.7478

	moles	moles	grams	cm3
Reactants	remaining	reacted	reacted	reacted
H2O	0.05551	0.0000	0.0000	

Minerals in system	moles	log moles	grams	volume (cm3)

Hematite	0.3757	-0.425	60.00	11.37
			____________	____________
(total)			60.00	11.37

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007508	266.0	0.8992	-2.1706
HCO3-	0.004380	267.0	0.9034	-2.4027
Na+	0.002985	68.56	0.9020	-2.5699
CO2(aq)	0.001605	70.56	1.0000	-2.7946
K+	0.001212	47.34	0.8992	-2.9627
Ca++	0.0008997	36.03	0.6759	-3.2160
Mg++	0.0001023	2.484	0.6899	-4.1514
SO4--	9.697e-005	9.307	0.6605	-4.1935
CaHCO3+	4.167e-005	4.210	0.9052	-4.4234
CaCl+	2.542e-005	1.919	0.9020	-4.6396
NaHCO3	1.591e-005	1.336	1.0000	-4.7982
CaSO4	7.989e-006	1.087	1.0000	-5.0975
Fe++	6.581e-006	0.3672	0.6759	-5.3519
Mn++	5.115e-006	0.2808	0.6759	-5.4612
MgHCO3+	3.118e-006	0.2658	0.9020	-5.5509
CO3--	1.502e-006	0.09004	0.6645	-6.0010
CaCO3	9.233e-007	0.09234	1.0000	-6.0347
NaSO4-	9.176e-007	0.1091	0.9020	-6.0821
MgCl+	8.050e-007	0.04807	0.9020	-6.1390
MgSO4	7.447e-007	0.08956	1.0000	-6.1280
KSO4-	5.412e-007	0.07310	0.9020	-6.3114
FeHCO3+	4.415e-007	0.05155	0.9020	-6.3999
NaCl	4.083e-007	0.02385	1.0000	-6.3890
MnHCO3+	2.768e-007	0.03207	0.9020	-6.6026
KCl	1.767e-007	0.01316	1.0000	-6.7528
H+	1.734e-007	0.0001746	0.9141	-6.8000

FeCl+	6.474e-008	0.005906	0.9020	-7.2336
MgCO3	5.202e-008	0.004383	1.0000	-7.2838
OH-	4.787e-008	0.0008135	0.9006	-7.3654
FeSO4	4.516e-008	0.006855	1.0000	-7.3452
MnSO4	3.927e-008	0.005925	1.0000	-7.4059
FeCO3	2.979e-008	0.003448	1.0000	-7.5260
MnCl+	1.641e-008	0.001482	0.9020	-7.8297
MnCO3	1.290e-008	0.001482	1.0000	-7.8894
NaCO3-	1.091e-008	0.0009048	0.9020	-8.0070

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08552	0.08551	1.0000	-1.0679
>(w)FeOCO2-	0.02537	0.02537	0.54663	-1.5956
>(w)FeOH2+	0.02458	0.02458	1.8294	-1.6093
>(w)FeOH	0.01455	0.01455	1.0000	-1.8370
>(s)FeOHCa++	0.003241	0.003241	3.3467	-2.4893
>(s)FeOH2+	0.0003229	0.0003228	1.8294	-3.4909
>(w)FeO-	0.0001974	0.0001973	0.54663	-3.7047
>(s)FeOH	0.0001911	0.0001911	1.0000	-3.7186
>(w)FeOCa+	4.311e-005	4.311e-005	1.8294	-4.3654
>(w)FeOHSO4--	1.923e-005	1.923e-005	0.29880	-4.7159
>(w)FeSO4-	1.629e-005	1.629e-005	0.54663	-4.7881
>(w)FeOHAsO4---	4.314e-006	4.313e-006	0.16333	-5.3652
>(s)FeO-	2.592e-006	2.592e-006	0.54663	-5.5863
>(w)FeHAsO4-	2.756e-007	2.756e-007	0.54663	-6.5597
>(w)FeH2AsO4	1.507e-008	1.506e-008	1.0000	-7.8220
>(w)FeH2AsO3	5.203e-009	5.202e-009	1.0000	-8.2838

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K
Hematite	0.0000 sat	Dolomite-ord	-1.2623
Goethite	-0.4707	Monohydrocalcite	-1.5845
Calcite	-0.6009	Magnetite	-2.2647
Aragonite	-0.7662	Magnesite	-2.3216
Siderite	-0.8259	Dolomite-dis	-2.8442
Rhodochrosite	-0.8799	Gypsum	-2.9590
Dolomite	-1.2623		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03855	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.102e-046	-45.958
O2(g)	1.803e-051	-50.744
S2(g)	6.239e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-006	2.38e-010	3.40e-005	4.61e-006	0.658	
Ca++	0.00426	0.000976	39.1	0.00328	132.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.400			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	

H2O	56.5	55.5	9.99e+005	-0.111	-2.00e+003
HCO3-	0.117	0.00605	369.	0.111	6.76e+003
K+	0.00121	0.00121	47.4		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	69.0		
O2(aq)	2.30e-006	1.18e-010	3.78e-006	2.30e-006	0.0736
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7710	-0.113
HCO3-	0.9483	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.609e-006	2.378e-010	1.781e-005	4.609e-006	0.3451
Calcium	0.004259	0.0009755	39.08	0.003284	131.5
Carbon	0.1169	0.006047	72.59	0.1109	1331.
Chlorine	0.007534	0.007534	266.9		
Hydrogen	111.0	111.0	1.118e+005	-0.0007260	-0.7313
Iron	0.7515	7.162e-006	0.3998		
Magnesium	0.0001070	0.0001070	2.598		
Manganese	5.461e-006	5.461e-006	0.2998		
Oxygen	56.87	55.52	8.877e+005	0.2219	3548.
Potassium	0.001212	0.001212	47.37		
Sodium	0.003001	0.003001	68.96		
Sulfur	0.0001427	0.0001072	3.436	3.552e-005	1.138

Step # 100 Xi = 1.0000

Temperature = 20.0 C Pressure = 1.013 bars

pH = 6.800 log fO2 = -50.744

Eh = 0.0970 volts pe = 1.6678

Ionic strength = 0.010295

Activity of water = 0.999737

Solvent mass = 1.000835 kg

Solution mass = 1.001613 kg

Solution density = 1.016 g/cm3

Chlorinity = 0.007528 molal

Dissolved solids = 777 mg/kg sol'n

Rock mass = 0.060000 kg

Carbonate alkalinity= 221.39 mg/kg as CaCO3

HFO sorbing surface:

Surface charge = 1.55 uC/cm2

Surface potential = 15.5 mV

Surface area = 3.60e+008 cm2

Nernst redox couples	Eh (volts)	pe
e- + .25*O2(aq) + H+ = .5*H2O	0.0970	1.6678
e- + Fe+++ = Fe++	-0.1016	-1.7472

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
H2O	6.993e-017	0.05551	1.000	

Minerals in system	moles	log moles	grams	volume (cm3)
Hematite	0.3757	-0.425	60.00	11.37

(total)		60.00	11.37	

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.007501	265.7	0.8992	-2.1710
HCO3-	0.004378	266.9	0.9034	-2.4028
Na+	0.002982	68.49	0.9021	-2.5703
CO2(aq)	0.001604	70.55	1.0000	-2.7947
K+	0.001211	47.30	0.8992	-2.9631
Ca++	0.0008992	36.01	0.6760	-3.2162
Mg++	0.0001022	2.481	0.6900	-4.1518
SO4--	9.688e-005	9.299	0.6606	-4.1938
CaHCO3+	4.164e-005	4.206	0.9053	-4.4237
CaCl+	2.539e-005	1.916	0.9021	-4.6402
NaHCO3	1.589e-005	1.334	1.0000	-4.7988
CaSO4	7.980e-006	1.085	1.0000	-5.0980
Fe++	6.574e-006	0.3669	0.6760	-5.3522
Mn++	5.110e-006	0.2805	0.6760	-5.4616
MgHCO3+	3.114e-006	0.2655	0.9021	-5.5515
CO3--	1.501e-006	0.08998	0.6646	-6.0012
CaCO3	9.224e-007	0.09225	1.0000	-6.0351
NaSO4-	9.160e-007	0.1090	0.9021	-6.0829
MgCl+	8.035e-007	0.04798	0.9021	-6.1397
MgSO4	7.435e-007	0.08942	1.0000	-6.1287
KSO4-	5.403e-007	0.07297	0.9021	-6.3121
FeHCO3+	4.409e-007	0.05149	0.9021	-6.4004
NaCl	4.075e-007	0.02380	1.0000	-6.3898
MnHCO3+	2.765e-007	0.03203	0.9021	-6.6031
KCl	1.764e-007	0.01314	1.0000	-6.7536
H+	1.734e-007	0.0001746	0.9141	-6.7999
FeCl+	6.462e-008	0.005895	0.9021	-7.2344
MgCO3	5.195e-008	0.004377	1.0000	-7.2844

OH-	4.786e-008	0.0008134	0.9007	-7.3654
FeSO4	4.509e-008	0.006845	1.0000	-7.3459
MnSO4	3.921e-008	0.005916	1.0000	-7.4066
FeCO3	2.975e-008	0.003443	1.0000	-7.5266
MnCl+	1.638e-008	0.001479	0.9021	-7.8305
MnCO3	1.288e-008	0.001480	1.0000	-7.8900
NaCO3-	1.089e-008	0.0009034	0.9021	-8.0076

(only species > 1e-8 molal listed)

Surface species	molality	moles	Boltzman fct.	log molality
>(w)FeOCO2H	0.08543	0.08550	1.0000	-1.0684
>(w)FeOCO2-	0.02535	0.02537	0.54652	-1.5961
>(w)FeOH2+	0.02456	0.02458	1.8298	-1.6097
>(w)FeOH	0.01454	0.01455	1.0000	-1.8374
>(s)FeOHCa++	0.003238	0.003240	3.3481	-2.4898
>(s)FeOH2+	0.0003228	0.0003231	1.8298	-3.4911
>(w)FeO-	0.0001972	0.0001974	0.54652	-3.7051
>(s)FeOH	0.0001911	0.0001913	1.0000	-3.7188
>(w)FeOCa+	4.304e-005	4.308e-005	1.8298	-4.3661
>(w)FeOHSO4--	1.921e-005	1.923e-005	0.29868	-4.7165
>(w)FeSO4-	1.627e-005	1.628e-005	0.54652	-4.7887
>(w)FeOHAsO4---	4.309e-006	4.313e-006	0.16323	-5.3656
>(s)FeO-	2.592e-006	2.594e-006	0.54652	-5.5864
>(w)FeHAsO4-	2.753e-007	2.756e-007	0.54652	-6.5601
>(w)FeH2AsO4	1.505e-008	1.506e-008	1.0000	-7.8225
>(w)FeH2AsO3	5.198e-009	5.202e-009	1.0000	-8.2842

(Boltzman factor = exp(zF PSI/RT), where PSI is surface potential)

Mineral saturation states

	log Q/K		log Q/K

Hematite	0.0000 sat	Dolomite-ord	-1.2633
Goethite	-0.4707	Monohydrocalcite	-1.5849
Calcite	-0.6013	Magnetite	-2.2652
Aragonite	-0.7666	Magnesite	-2.3222
Siderite	-0.8265	Dolomite-dis	-2.8452
Rhodochrosite	-0.8805	Gypsum	-2.9595
Dolomite	-1.2633		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.03854	-1.414
Steam	0.02292	-1.640
H2(g)	8.836e-018	-17.054
H2S(g)	2.561e-044	-43.592
CH4(g)	1.103e-046	-45.958
O2(g)	1.802e-051	-50.744
S2(g)	6.238e-080	-79.205

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
>(s)FeOH	0.00376					
>(w)FeOH	0.150					
As(OH)4-	4.61e-006	2.38e-010	3.40e-005	4.61e-006	0.658	
Ca++	0.00426	0.000976	39.1	0.00328	131.	
Cl-	0.00753	0.00753	267.			
Fe++	7.16e-006	7.16e-006	0.399			
Fe+++	0.751	1.11e-012	6.21e-008			
H+	-2.14	0.00160	1.61	0.110	111.	
H2O	56.6	55.6	9.99e+005	-0.111	-1.99e+003	
HCO3-	0.117	0.00605	369.	0.111	6.75e+003	

K+	0.00121	0.00121	47.3		
Mg++	0.000107	0.000107	2.60		
Mn++	5.46e-006	5.46e-006	0.300		
Na+	0.00300	0.00300	68.9		
O2(aq)	2.30e-006	1.18e-010	3.78e-006	2.30e-006	0.0735
SO4--	0.000143	0.000107	10.3	3.55e-005	3.41

Sorbed	fraction	log fraction
As(OH)4-	0.9999	-0.000
Ca++	0.7709	-0.113
HCO3-	0.9482	-0.023
SO4--	0.2488	-0.604

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
Arsenic	4.609e-006	2.379e-010	1.780e-005	4.609e-006	0.3447
Calcium	0.004259	0.0009759	39.05	0.003283	131.4
Carbon	0.1169	0.006052	72.57	0.1109	1330.
Chlorine	0.007534	0.007534	266.7		
Hydrogen	111.1	111.1	1.118e+005	-0.0007232	-0.7278
Iron	0.7515	7.162e-006	0.3994		
Magnesium	0.0001070	0.0001070	2.596		
Manganese	5.461e-006	5.461e-006	0.2995		
Oxygen	56.92	55.57	8.877e+005	0.2219	3544.
Potassium	0.001212	0.001212	47.32		
Sodium	0.003001	0.003001	68.89		
Sulfur	0.0001427	0.0001072	3.432	3.551e-005	1.137

APPENDIX I

Tabulated Boring Data and Tabulated Fly Ash and Bottom Ash Boring Data

APPENDIX I-1 . Lithology Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
09-100	CPT Boring	AECOM (2009)	2440203	557566	767.1	0.0	0.3	35.0	44.5	61.3	61.5	767.1	766.8	732.1	722.6	705.8	705.6
09-101	CPT Boring	AECOM (2009)	2440344	557686	768.3	na	0.0	na	41.5	50.5	56.5		768.3		726.8	717.8	711.8
09-102	CPT Boring	AECOM (2009)	2440512	557772	761.9	na	0.0	31.5	34.0	47.7	53.0		761.9	730.4	727.9	714.2	708.9
09-103	CPT Boring	AECOM (2009)	2440705	557713	766.3	na	0.0	37.0	44.5	51.5	58.5		766.3	729.3	721.8	714.8	707.8
09-104	CPT Boring	AECOM (2009)	2440857	557587	761.3	na	0.0	23.5	31.5	49.0	50.5		761.3	737.8	729.8	712.3	710.8
09-105	CPT Boring	AECOM (2009)	2441010	557465	748.4	na	0.0	13.0	20.0	45.5	46.0		748.4	735.4	728.4	702.9	702.4
09-106	CPT Boring	AECOM (2009)	2441194	557304	755.1	na	0.0	24.0	40.0	49.5	56.6		755.1	731.1	715.1	705.6	698.5
09-107	CPT Boring	AECOM (2009)	2441336	557207	762.4	na	0.0	28.5	34.5	57.7	59.3		762.4	733.9	727.9	704.7	703.1
09-108	CPT Boring	AECOM (2009)	2441485	557084	759.8	na	0.0	24.8	33.0	56.0	56.9		759.8	735.0	726.8	703.8	702.9
09-109	CPT Boring	AECOM (2009)	2441627	556972	763.6	na	0.0	26.0	34.0	62.4	68.0		763.6	737.6	729.6	701.2	695.6
09-110	CPT Boring	AECOM (2009)	2441755	556900	774.6	0.0	2.6	38.0	44.0	73.5	78.0	774.6	772.0	736.6	730.6	701.1	696.6
09-200	CPT Boring	AECOM (2009)	2440072	557895	764.9	0.0	3.0	34.0	42.0	44.5	47.0	764.9	761.9	730.9	722.9	720.4	717.9
09-201	CPT Boring	AECOM (2009)	2440260	558003	760.7	na	0.0	25.5	31.5	48.2	51.3		760.7	735.2	729.2	712.5	709.4
09-202	CPT Boring	AECOM (2009)	2440411	558101	761.5	na	0.0	29.8	37.5	47.5	47.5		761.5	731.7	724.0	714.0	714.0
09-203	CPT Boring	AECOM (2009)	2440604	558105	759.6	na	0.0	24.5	36.0	40.0	40.4		759.6	735.1	723.6	719.6	719.2
09-204	CPT Boring	AECOM (2009)	2440843	557991	750.1	na	0.0	13.0	25.0	32.5	34.3		750.1	737.1	725.1	717.6	715.8
09-205	CPT Boring	AECOM (2009)	2440978	557913	754.6	na	0.0	14.3	30.0	37.0	37.8		754.6	740.3	724.6	717.6	716.8
09-206	CPT Boring	AECOM (2009)	2441115	557767	754.6	na	0.0	22.0	33.5	37.0	38.0		754.6	732.6	721.1	717.6	716.6
09-207	CPT Boring	AECOM (2009)	2441278	557644	747.1	na	0.0	14.0	30.0	32.8	34.8		747.1	733.1	717.1	714.3	712.3
09-208	CPT Boring	AECOM (2009)	2441472	557505	744.8	na	0.0	6.5	12.0	29.1	40.0		744.8	738.3	732.8	715.7	704.8
09-209	CPT Boring	AECOM (2009)	2441606	557410	746.2	na	0.0	6.6	14.0	31.0	34.5		746.2	739.6	732.2	715.2	711.7
09-210	CPT Boring	AECOM (2009)	2441762	557293	749.6	na	0.0	11.0	14.5	34.5	38.0		749.6	738.6	735.1	715.1	711.6
09-211	CPT Boring	AECOM (2009)	2441967	557054	765.6	0.0	15.3	25.0	32.0	53.5	69.5	765.6	750.3	740.6	733.6	712.1	696.1
09-301	CPT Boring	AECOM (2009)	2440166	555335	816.0	na	0.0	88.0	na	94.0	94.0		816.0	728.0			722.0
09-302	CPT Boring	AECOM (2009)	2439297	555665	817.4	na	0.0	93.0	na	97.0	97.0		817.4	724.4			720.4
09-303	CPT Boring	AECOM (2009)	2439974	555756	817.4	na	0.0	88.5	107.5	112.2	121.5		817.4	728.9	709.9	705.2	695.9
09-304	CPT Boring	AECOM (2009)	2439240	555555	819.5	na	0.0	na	na	na	50.0		819.5				769.5
09-400	CPT Boring	AECOM (2009)	2438673	555672	766.8	na	8.0	37.0	54.0	60.0	74.0		758.8	729.8	712.8	706.8	692.8
09-402	CPT Boring	AECOM (2009)	2438839	556093	764.9	na	0.0	32.0	50.0	59.5	60.5		764.9	732.9	714.9	705.4	704.4
09-404	CPT Boring	AECOM (2009)	2439084	556363	763.4	na	0.0	34.0	46.0	59.0	59.3		763.4	729.4	717.4	704.4	704.1
09-406	CPT Boring	AECOM (2009)	2439332	556710	764.3	0.0	6.0	22.0	48.0	60.0	62.0	764.3	758.3		716.3	704.3	702.3
09-408	CPT Boring	AECOM (2009)	2439699	556901	764.8	na	0.0	35.5	46.0	64.0	64.0		764.8	729.3	718.8	700.8	700.8
09-409	CPT Boring	AECOM (2009)	2439770	557107	762.6	na	0.0	26.0	44.0	60.0	60.0		762.6	736.6	718.6	702.6	702.6
09-410	CPT Boring	AECOM (2009)	2439904	557238	762.5	na	0.0	26.5	40.5	59.0	59.0		762.5	736.0	722.0	703.5	703.5
09-412	CPT Boring	AECOM (2009)	2440043	557614	764.8	na	0.0	32.0	42.0	48.0	48.5		764.8	732.8	722.8	716.8	716.3
09-413	CPT Boring	AECOM (2009)	2440033	557798	764.4	0.0	22.0	27.0	38.5	49.0	60.5	764.4	742.4	737.4	725.9	715.4	703.9
09-500	CPT Boring	AECOM (2009)	2440227	556617	757.3	na	0.0	30.0	36.0	51.6	67.0		757.3	727.3	721.3	705.7	690.3
09-501	CPT Boring	AECOM (2009)	2440546	557396	765.0	0.0	4.2	36.0	42.0	64.8	64.8	765.0	760.8	729.0	723.0	700.2	700.2
09-502	CPT Boring	AECOM (2009)	2440883	556615	752.9	na	0.0	23.0	28.0	45.5	47.5		752.9	729.9	724.9	707.4	705.4
09-503	CPT Boring	AECOM (2009)	2439865	556861	764.7	na	0.0	33.5	46.0	64.0	77.0		764.7	731.2	718.7	700.7	687.7
09-600	CPT Boring	AECOM (2009)	2441424	556463	776.4	na	0.0	45.0	55.0	74.5	75.0		776.4	731.4	721.4	701.9	701.4
09-601	CPT Boring	AECOM (2009)	2441602	556710	773.4	0.0	0.5	37.5	45.5	69.0	69.0	773.4	772.9	735.9	727.9	704.4	704.4
09-602	CPT Boring	AECOM (2009)	2440866	555307	781.5	0.0	2.0	55.0	66.0	78.5	85.0	781.5	779.5	726.5	715.5	703.0	696.5
09-603	CPT Boring	AECOM (2009)	2441187	555810	780.6	0.0	1.2	50.5	52.5	75.0	76.0	780.6	779.4	730.1		705.6	704.6
09-604	CPT Boring	AECOM (2009)	2440526	554800	782.5	0.0	3.0	62.0	74.0	83.0	94.0	782.5	779.5	720.5	708.5	699.5	688.5
09-605	CPT Boring	AECOM (2009)	2441498	556277	781.7	0.0	2.5	48.0	59.0	75.0	82.0	781.7	779.2	733.7	722.7	706.7	699.7

APPENDIX I-1 . Lithology Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
09-700	CPT Boring	AECOM (2009)	2442058	556511	764.6	na	0.0	24.0	32.0	60.5	65.0		764.6	740.6	732.6	704.1	699.6
09-702	CPT Boring	AECOM (2009)	2442138	556325	764.4	na	0.0	26.5	28.0	61.0	64.0		764.4	737.9		703.4	700.4
09-704	CPT Boring	AECOM (2009)	2442278	555952	764.6	na	0.0	27.8	40.0	63.0	66.0		764.6	736.8	724.6	701.6	698.6
09-706	CPT Boring	AECOM (2009)	2442418	555579	763.6	na	0.0	28.0	32.0	58.0	62.0		763.6	735.6		705.6	701.6
09-708	CPT Boring	AECOM (2009)	2442216	555236	763.6	na	0.0	29.0	44.0	60.5	64.5		763.6	734.6	719.6	703.1	699.1
09-710	CPT Boring	AECOM (2009)	2441962	554927	763.0	na	0.0	38.0	49.0	59.5	62.5		763.0	725.0	714.0	703.5	700.5
09-712	CPT Boring	AECOM (2009)	2441617	555085	763.8	na	0.0	40.0	48.0	61.5	65.0		763.8	723.8	715.8	702.3	698.8
09-714	CPT Boring	AECOM (2009)	2441323	555356	764.2	na	0.0	34.5	46.0	60.3	64.3		764.2	729.7	718.2	703.9	699.9
09-800	CPT Boring	AECOM (2009)	2441700	554405	763.1	na	0.0	28.0	35.8	42.0	48.0		763.1	735.1	727.3		715.1
09-801	CPT Boring	AECOM (2009)	2442160	554812	765.3	0.0	0.5	39.0	50.0	61.0	64.0	765.3	764.8	726.3	715.3	704.3	701.3
09-900SH1	CPT Boring	AECOM (2009)	2440758	557741	766.1	na	na	na	na	na	105.0						661.1
09-900SH2	CPT Boring	AECOM (2009)	2440757	557731	766.1	na	na	na	na	50.0	103.5					716.1	662.6
09-900SH3	CPT Boring	AECOM (2009)	2440756	557721	766.3	na	na	na	na	na	105.0						661.3
J-1	soil boring	EPA (1980)			765.2	na	na	0.0	na	13.4	27.9					751.8	737.3
J-2	soil boring	EPA (1980)	2439273	554760	765.6	na	0.0	44.0	52.5	60.4	70.0		765.6	721.6	713.1	705.2	695.6
J-3	soil boring	EPA (1980)	2440438	554568	752.8	na	0.0	31.8	36.4	49.2	60.0		752.8	720.9	716.4	703.6	692.8
J-4	soil boring	EPA (1980)	2440264	556510	753.1	na	na	0.0	26.2	35.8	50.0						703.1
J-5	soil boring	EPA (1980)	2442354	556697	751.8	na	na	0.0	33.5	38.7	50.0					713.1	701.8
J-6	soil boring	EPA (1980)			749.8	na	na	0.0	37.4	47.6	60.0				712.4	702.2	689.8
J-7	soil boring	EPA (1980)			745.9	na	na	0.0	28.9	44.0	45.9				717.0	701.9	700.0
J-8	soil boring	EPA (1980)	2438240	552317	767.8	na	na	na	na	0.0	24.6					767.8	743.2
J-9A	Well	LAW (1988)	2439695	554059	769.4	na	0.0	na	na	67.7	67.7		769.4			701.7	701.7
J-9B	Well	LAW (1988)	2439694	554058	769.6	na	0.0	35.0	na	67.5	82.4		769.6	734.6		702.1	687.2
J-10B	Well	LAW (1988)	2439952	553355	753.6	0.0	na	na	na	49.4	49.4	753.6				704.2	704.2
J-12A	Well	LAW (1988)	2438622	554245	764.3	0.0	2.5	9.0	na	24.8	24.8	764.3	761.8			739.5	739.5
J-12B	Well	LAW (1988)	2438622	554245	764.1	0.0	3.0	na	na	28.0	54.2	764.1	761.1			736.1	709.9
J-13A	Well	LAW (1988)	2440347	554473	766.5	0.0	1.5	na	47.5	64.0	64.0	766.5	765.0		719.0	702.5	702.5
J-13B	Well	LAW (1988)	2440346	554473	767.4	0.0	4.0	na	na	65.0	82.0	767.4	763.4			702.4	685.4
J-14	Well	LAW (1988)			757.3	0.0	na	na	11.0	22.5	25.3	757.3			746.3	734.8	732.0
J-14A	Well	LAW (1988)			758.3	0.0	17.0	na	na	19.0	25.0	758.3	741.3			739.3	733.3
J-14B	Well	LAW (1988)			756.3	0.0	18.0	na	na	24.5	40.0	756.3	738.3			731.8	716.3
J-15	Well	LAW (1988)	2438208	554441	793.0	0.0	na	4.0	na	10.5	12.0	793.0				782.5	781.0
J-15A	Well	LAW (1988)	2438208	554441	793.1	na	na	0.0	na	13.5	25.2					779.6	767.9
J-15B	Well	LAW (1988)	2438208	554441	792.9	0.0	na	3.0	na	14.0	44.2	792.9				778.9	748.7
J-16A	Well	LAW (1988)	2439242	556782	756.6	0.0	na	na	na	64.7	64.7	756.6					691.9
J-16B	Well	LAW (1988)	2439241	556782	765.4	0.0	na	na	na	66.0	73.0	765.4				699.4	692.4
17	well	Law (1992)	2442287	556685	762.4	na	na	na	na	na	37.0						725.4
18	well	Law (1992)	2442306	556694	764.3	na	na	na	na	na	38.7						725.6
19	well	Law (1992)	2442331	556705	763.9	na	na	na	na	na	33.0						730.9
20	well	Law (1992)	2442382	556726	750.1	na	na	na	na	na	17.0						733.1
22	well	TVA (2002)	2442743	555664	753.2	0.0	na	na	30.0	49.0	49.0	753.2			723.2	704.2	704.2
SS-1	Soil Boring	Singleton Lab (1994)	2440719	558032	752.0	0.0	30.0	na	na	39.0	39.0	752.0	722.0			713.0	713.0
SS-2	Soil Boring	Singleton Lab (1994)	2440699	557996	764.0	0.0	20.0	40.0	45.0	51.8	51.8	764.0	744.0		719.0	712.2	712.2
SS-3	Soil Boring	Singleton Lab (1994)	2440674	557948	773.0	na	0.0	55.0	na	58.1	58.1		773.0			714.9	714.9
SS-4	Soil Boring	Singleton Lab (1994)	2441348	557582	752.0	0.0	15.0	na	20.0	38.8	38.8	752.0	737.0		732.0	713.2	713.2
SS-5	Soil Boring	Singleton Lab (1994)	2441319	557546	764.0	na	20.0	na	na	56.0	56.0		744.0			708.0	708.0

APPENDIX I-1 . Lithology Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
SS-6	Soil Boring	Singleton Lab (1994)	2441277	557494	773.0	na	0.0	na	na	62.8	62.8		773.0			710.2	710.2
SS-8	Soil Boring	Singleton Lab (1994)	2440745	555956	782.0	na	0.0	50.0	65.0	77.0	77.0		782.0	732.0	717.0	705.0	705.0
SS-9	Soil Boring	Singleton Lab (1994)	2440674	555997	795.0	na	0.0	70.0	80.0	94.0	94.0		795.0	725.0	715.0	711.0	701.0
SS-10	Soil Boring	Singleton Lab (1994)	2439540	555299	797.5	na	0.0	75.0	85.0	96.5	96.5		797.5	722.5	712.5	701.0	701.0
STN-2	Soil Boring	Stantec (2009)	2442329	556805	751.2	0.0	3.5	12.0	32.0	37.5	41.0	751.2	747.7	739.2	719.2	713.7	710.2
STN-3	Soil Boring	Stantec (2009)	2442264	556757	763.7	0.0	0.5	28.8	34.0	49.0	50.3	763.7	763.2	734.9	729.7	714.7	713.4
STN-4**	Soil Boring	Stantec (2009)	2442047	556626	763.3	na	0.0	25.0	31.5	61.0	83.0		763.3	738.3	731.8	702.3	680.3
STN-5	Soil Boring	Stantec (2009)	2442365	556611	764.9	0.0	16.5	26.5	40.5	52.5	54.0	764.9	748.4	738.4	724.4	712.4	710.9
STN-6	Soil Boring	Stantec (2009)	2442407	556416	763.4	0.0	1.5	31.5	51.0	64.0	64.5	763.4	761.9	731.9	712.4	699.4	698.9
STN-8**	Soil Boring	Stantec (2009)	2442540	556249	752.2	0.0	2.5	14.0	17.5	53.5	76.7	752.2	749.7	738.2		698.7	675.5
STN-9	Soil Boring	Stantec (2009)	2442500	556234	764.8	0.0	18.3	na	24.3	62.5	63.4	764.8	746.5			702.3	701.4
STN-10**	Soil Boring	Stantec (2009)	2442252	556163	765.0	na	0.0	34.0	52.0	59.5	81.0		765.0	731.0	713.0	705.5	684.0
STN-11	Soil Boring	Stantec (2009)	2442535	556035	763.2	0.0	1.5	na	33.0	58.5	62.0	763.2	761.7			704.7	701.2
STN-12	Soil Boring	Stantec (2009)	2442622	555873	765.1	0.0	na	35.5	49.0	61.0	62.0	765.1		729.6	716.1	704.1	703.1
STN-14	Soil Boring	Stantec (2009)	2442733	555686	753.1	0.0	4.5	21.0	25.0	47.0	51.0	753.1	748.6	732.1		706.1	702.1
STN-15	Soil Boring	Stantec (2009)	2442668	555663	763.7	0.0	0.5	33.5	39.5	57.5	58.9	763.7	763.2	730.2	724.2	706.2	704.8
STN-16	Soil Boring	Stantec (2009)	2442726	555501	764.5	0.0	1.0	na	30.5	58.0	58.5	764.5	763.5			706.5	706.0
STN-18**	Soil Boring	Stantec (2009)	2442894	555205	751.0	0.0	2.5	24.0	27.5	48.5	71.5	751.0	748.5	727.0	723.5	702.5	679.5
STN-19	Soil Boring	Stantec (2009)	2442843	555205	765.6	0.0	0.5	37.5	41.0	64.5	65.0	765.6	765.1	728.1	724.6	701.1	700.6
STN-20	Soil Boring	Stantec (2009)	2442667	555169	762.9	0.0	2.0	31.0	41.0	59.0	61.0	762.9	760.9	731.9	721.9	703.9	701.9
STN-21**	Soil Boring	Stantec (2009)	2442150	555077	765.0	na	0.0	36.0	38.0	56.0	77.5		765.0	729.0		709.0	687.5
STN-22**	Soil Boring	Stantec (2009)	2441723	554990	765.0	na	0.0	46.0	51.5	58.0	79.0		765.0	719.0	713.5	707.0	686.0
STN-23	Soil Boring	Stantec (2009)	2442857	555020	764.7	0.0	0.2	40.5	51.5	61.0	62.0	764.7	764.5	724.2	713.2	703.7	702.7
STN-24	Soil Boring	Stantec (2009)	2442843	554803	765.1	0.0	0.8	34.5	36.0	63.5	64.2	765.1	764.3	730.6	713.2	701.6	700.9
STN-26	Soil Boring	Stantec (2009)	2442889	554625	750.0	0.0	2.0	20.0	23.0	54.0	57.3	750.0	748.0	730.0	727.0	696.0	692.7
STN-27	Soil Boring	Stantec (2009)	2442851	554602	765.1	0.0	22.0	na	34.5	65.0	67.5	765.1	743.1			700.1	697.6
STN-28	Soil Boring	Stantec (2009)	2442841	554406	764.8	0.0	17.7	33.0	48.3	64.3	64.6	764.8	747.1	731.8	716.5	700.5	700.2
STN-29	Soil Boring	Stantec (2009)	2442855	554155	764.7	0.0	23.0	34.8	61.8	67.5	67.7	764.7	741.7	729.9		697.2	697.0
STN-31	Soil Boring	Stantec (2009)	2442758	553955	749.5	0.0	na	25.0	52.5	53.0	54.0	749.5		724.5	697.0	696.5	695.5
STN-32	Soil Boring	Stantec (2009)	2442746	553995	764.8	0.0	22.5	41.0	68.0	68.5	69.0	764.8	742.3	723.8	696.8	696.3	695.8
STN-34	Soil Boring	Stantec (2009)	2442184	553854	764.7	0.0	19.5	39.5	45.5	65.0	76.0	764.7	745.2		719.2		688.7
STN-36	Soil Boring	Stantec (2009)	2442199	553777	751.9	0.0	1.0	18.0	30.5	39.5	44.0	751.9	750.9	733.9	721.4	712.4	707.9
STN-37	Soil Boring	Stantec (2009)	2442184	553800	763.8	0.0	na	28.0	34.5	46.5	54.2	763.8		735.8		717.3	709.6
STN-38	Soil Boring	Stantec (2009)	2441989	553731	764.1	0.0	na	28.5	33.0	49.0	51.3	764.1		735.6	731.1	715.1	712.8
STN-41**	Soil Boring	Stantec (2009)	2441511	553583	752.7	0.0	2.5	NA	17.0	38.0	63.0	752.7	750.2			714.7	689.7
STN-42	Soil Boring	Stantec (2009)	2441514	553623	764.7	0.0	18.4	na	26.5	51.0	51.5	764.7	746.3			713.7	713.2
STN-43	Soil Boring	Stantec (2009)	2441549	554005	765.9	0.0	2.5	28.0	40.0	47.0	54.0	765.9	763.4	737.9	725.9	718.9	711.9
STN-45	Soil Boring	Stantec (2009)	2441308	553741	763.9	0.0	1.0	28.5	40.0	47.5	48.5	763.9	762.9	735.4	723.9	716.4	715.4
STN-47	Soil Boring	Stantec (2009)	2441147	553747	753.4	0.0	1.5	8.0	12.5	36.0	39.5	753.4	751.9			717.4	713.9
STN-48	Soil Boring	Stantec (2009)	2441155	553773	765.3	0.0	20.0	24.0	27.5	49.0	54.0	765.3	745.3			716.3	711.3
STN-49	Soil Boring	Stantec (2009)	2441024	553922	763.1	0.0	1.5	25.5	39.0	45.0	47.5	763.1	761.6	737.6	724.1	718.1	715.6
STN-50**	Soil Boring	Stantec (2009)	2440497	553632	741.6	0.0	8.5	18.0	23.5	35.7	57.0	741.6	733.1	723.6	718.1		684.6
STN-51	Soil Boring	Stantec (2009)	2440548	553696	750.4	0.0	na	25.0	31.4	48.9	49.6	750.4		725.4	719.0	701.5	700.8
STN-52	Soil Boring	Stantec (2009)	2440817	553993	753.2	0.0	na	24.0	29.0	39.0	39.5	753.2		729.2	724.2	714.2	713.7
STN-53	Soil Boring	Stantec (2009)	2440902	554011	763.9	na	0.0	na	23.0	50.0	51.5		763.9			713.9	712.4
STN-54	Soil Boring	Stantec (2009)	2441476	555264	765.0	na	0.0	37.5	48.5	58.0	59.0		765.0	727.5	716.5	707.0	706.0

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Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
STN-55	Soil Boring	Stantec (2009)	2442287	554944	764.1	0.0	1.5	38.0	55.0	61.0	64.2	764.1	762.6	726.1	709.1	703.1	699.9
STN-56**	Soil Boring	Stantec (2009)	2441999	554556	765.8	0.0	2.5	40.0	43.0	62.1	82.0	765.8	763.3	725.8	722.8	703.7	683.8
STN-59	Soil Boring	Stantec (2009)	2442603	556076	752.2	0.0	3.0	na	14.0	51.0	51.5	752.2	749.2			701.2	700.7
STN-60	Soil Boring	Stantec (2009)	2442663	555887	752.5	0.0	4.0	20.0	26.5	51.5	53.5	752.5	748.5	732.5		701.0	699.0
STN-61	Soil Boring	Stantec (2009)	2442793	555514	752.5	0.0	6.0	18.0	27.0	46.0	51.5	752.5	746.5	734.5		706.5	701.0
STN-62	Soil Boring	Stantec (2009)	2442907	555021	749.8	0.0	3.0	25.0	33.0	47.0	49.0	749.8	746.8	724.8	716.8	702.8	700.8
STN-63	Soil Boring	Stantec (2009)	2442911	554823	750.0	0.0	2.0	na	16.0	47.5	49.0	750.0	748.0		716.8	702.5	701.0
STN-64	Soil Boring	Stantec (2009)	2442911	554411	749.4	0.0	6.0	23.0	35.0	46.5	55.5	749.4	743.4	726.4	714.4	702.9	693.9
STN-65	Soil Boring	Stantec (2009)	2442915	554148	748.6	0.0	1.5	24.5	45.0	48.0	50.0	748.6	747.1	724.1	703.6	700.6	698.8
STN-66	Soil Boring	Stantec (2009)	2442564	553889	750.9	0.0	na	21.0	27.5	55.0	57.0	750.9		729.9	723.4	695.9	693.9
STN-69	Soil Boring	Stantec (2009)	2441718	553608	752.3	0.0	na	13.5	19.5	45.0	59.5	752.3		738.8	732.8	707.3	692.8
STN-71	Soil Boring	Stantec (2009)	2440981	553840	752.0	0.0	na	9.0	15.0	35.0	45.5	752.0				717.0	706.5
B-1	slope inclinometer hole	Stantec (2009)	2441564	556623	774.2	0.0	1.7	na	37.5	66.7	73.7	774.2	772.5			707.5	700.5
B-2	slope inclinometer hole	Stantec (2009)	2441745	556877	774.1	na	0.0	na	43.5	73.6	78.0		774.1		730.6	700.5	696.1
B-3	slope inclinometer hole	Stantec (2009)	2441888	557062	770.9	na	0.0	na	42.0	56.5	60.2		770.9		728.9	714.4	710.7
B-4	slope inclinometer hole	Stantec (2009)	2442066	556935	764.2	na	0.0	na	35.4	52.1	59.5		764.2		728.8	712.1	704.7
PZ-1	PZ	Stantec (2009)	2441468	556651	765.3	na	0.0	na	na	na	26.5		765.3				738.8
PZ-2	PZ	Stantec (2009)	2441500	556636	766.9	0.0	4.5	na	na	na	16.5	766.9	762.4				750.4
PZ-3	PZ	Stantec (2009)	2441589	556823	766.3	0.0	3.0	na	na	na	26.5	766.3	763.3				739.8
PZ-4	PZ	Stantec (2009)	2441602	556814	766.0	0.0	4.0	na	na	na	16.5	766.0	762.0				749.5
PZ-5	PZ	Stantec (2009)	2441691	556959	763.7	0.0	13.0	30.5	na	na	31.5	763.7	750.7	733.2			732.2
PZ-6	PZ	Stantec (2009)	2441709	556942	763.7	0.0	6.5	na	na	na	16.5	763.7	757.2				747.2
PZ-7	PZ	Stantec (2009)	2441791	557107	760.0	0.0	5.0	23.2	na	na	26.5	760.0	755.0	736.8			733.5
PZ-8	PZ	Stantec (2009)	2441819	557092	760.1	0.0	7.3	na	na	na	16.5	760.1	752.8				743.6
B-1	Boring Hole	MACTEC (2009)	2438967	554943	767.0	0.0	3.5	37.5	57.5	61.2	61.2	767.0	763.5	729.5	709.5	705.8	705.8
B-3	Boring Hole	MACTEC (2009)	2439790	554474	766.9	na	0.0	47.5	52.0	62.6	62.6		766.9	719.4	714.9	704.3	704.3
B-5	Boring Hole	MACTEC (2009)	2439730	554122	768.5	0.0	1.0	32.0	42.0	61.7	61.7	768.5	767.5	736.5		706.8	706.8
B-7	Boring Hole	MACTEC (2009)	2438786	555196	766.3	na	0.0	39.0	na	63.6	63.6		766.3	727.3		702.7	702.7
B-8	Boring Hole	MACTEC (2009)	2438977	555194	769.5	0.0	5.0	44.0	59.0	69.0	69.0	769.5	764.5	725.5	710.5	700.5	700.5
B-10	Boring Hole	MACTEC (2009)	2438785	555006	764.8	0.0	3.0	39.8	49.0	64.0	64.2	764.8	761.8	725.0	715.8	700.8	700.6
B-12	Boring Hole	MACTEC (2009)	2439276	554995	767.9	0.0	3.5	39.0	na	59.0	60.3	767.9	764.4	728.9		708.9	707.6
B-13	Boring Hole	MACTEC (2009)	2439475	554994	767.1	0.0	3.5	43.5	53.5	62.5	64.0	767.1	763.6	723.6	713.6	704.6	703.1
B-14	Boring Hole	MACTEC (2009)	2439684	554997	767.8	na	0.0	49.0	na	63.4	63.4		767.8	718.8		704.4	704.4
B-15	Boring Hole	MACTEC (2009)	2438787	554804	764.0	0.0	2.0	35.0	49.0	60.0	64.0	764.0	762.0	729.0	715.0	704.0	700.0
B-17	Boring Hole	MACTEC (2009)	2439176	554795	767.8	0.0	2.0	44.0	62.5	63.5	64.8	767.8	765.8	723.8	705.3	704.3	703.0
B-18	Boring Hole	MACTEC (2009)	2439387	554788	767.7	0.0	3.0	49.0	64.0	64.5	64.8	767.7	764.7	718.7	703.7	703.2	702.9
B-21	Boring Hole	MACTEC (2009)	2439975	554795	772.7	0.0	7.5	54.0	62.0	66.1	66.1	772.7	765.2	718.7	710.7	706.6	706.6
B-26	Boring Hole	MACTEC (2009)	2440056	554603	767.5	0.0	1.5	49.0	59.0	65.0	65.0	767.5	766.0	718.5	708.5	702.5	702.5
B-27	Boring Hole	MACTEC (2009)	2440246	554612	770.8	0.0	7.0	54.0	64.0	69.0	69.4	770.8	763.8	716.8	706.8	701.8	701.4
B-29	Boring Hole	MACTEC (2009)	2439027	555534	797.3	0.0	1.5	74.0	89.0	98.5	98.5	797.3	795.8	723.3	708.3	698.8	698.8
B-32	Boring Hole	MACTEC (2009)	2439758	555207	796.0	0.0	4.5	na	74.0	91.5	91.5	796.0	791.5			704.5	704.5
B-33	Boring Hole	MACTEC (2009)	2439735	554301	767.2	0.0	1.0	44.5	49.0	61.2	61.2	767.2	766.2	722.7	718.2	706.0	706.0
B-35	Boring Hole	MACTEC (2009)	2439797	553979	766.1	na	0.0	34.0	44.0	58.6	58.6		766.1	732.1		707.5	707.5
B-36	Boring Hole	MACTEC (2009)	2439340	553905	769.5	0.0	1.5	na	59.0	65.5	67.4	769.5	768.0		710.5	704.0	702.1
B-39	Boring Hole	MACTEC (2009)	2439438	553701	769.1	na	0.0	49.0	61.0	67.5	67.9		769.1	720.1	708.1	701.6	701.2
B-40	Boring Hole	MACTEC (2009)	2439085	553392	769.9	0.0	3.0	56.0	64.0	69.0	69.5	769.9	766.9	713.9	705.9	700.9	700.4

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Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
B-43	Boring Hole	MACTEC (2009)	2438873	554174	767.6	0.0	0.5	49.0	na	64.0	65.0	767.6	767.1			703.6	702.6
B-45	Boring Hole	MACTEC (2009)	2440531	554140	765.5	na	0.0	34.0	na	51.0	54.3		765.5	731.5		714.5	711.2
B-46	Boring Hole	MACTEC (2009)	2439379	553159	766.6	0.0	1.5	49.0	54.0	64.0	66.5	766.6	765.1	717.6	712.6	702.6	700.1
B-47	Boring Hole	MACTEC (2009)	2439815	553523	767.0	na	0.0	39.0	54.0	59.0	64.9		767.0	728.0	713.0	708.0	702.1
CPT-2	CPT	MACTEC (2009)	2439377	554569	767.4	na	na	50.0	na	na	na			717.4			
CPT-4	CPT	MACTEC (2009)	2439023	554364	767.5	na	na	na	na	na	na						
CPT-4A	CPT	MACTEC (2009)	2439023	554364	767.5	na	na	49.0	na	63.0	63.0			718.5	708.0	704.5	704.5
CPT-4B	CPT	MACTEC (2009)	2439023	554364	767.5	na	na	na	na	63.2	63.2					704.3	704.3
CPT-6	CPT	MACTEC (2009)	2439219	553737	769.6	na	na	49.0	na	na	na			720.6			
CPT-9	CPT	MACTEC (2009)	2439171	555164	767.4	na	na	na	na	na	na						
CPT-10	CPT	MACTEC (2009)	2439075	553811	767.9	na	na	46.0	na	64.0	64.0			721.9		703.9	703.9
CPT-10A	CPT	MACTEC (2009)	2439075	553811	767.9	na	na	na	na	na	na						
CPT-10B	CPT	MACTEC (2009)	2439075	553811	767.9	na	na	na	na	64.1	64.1					703.8	703.8
CPT-15	CPT	MACTEC (2009)	2439575	554192	766.6	na	na	na	na	59.6	59.6					707.1	707.1
CPT-15A	CPT	MACTEC (2009)	2439575	554192	766.6	na	na	na	na	59.4	59.4					707.2	707.2
CPT-16	CPT	MACTEC (2009)	2438976	554795	766.3	na	na	42.0	na	na	na			724.3			
CPT-20	CPT	MACTEC (2009)	2439889	554891	767.7	na	na	50.0	na	na	na			717.7			
CPT-28	CPT	MACTEC (2009)	2439974	554403	767.8	na	na	44.0	na	na	na			723.8			
CPT-44	CPT	MACTEC (2009)	2440069	553757	767.2	na	na	na	na	na	6.1						761.1
CPT-48	CPT	MACTEC (2009)	2440183	554344	765.0	na	na	35.0	na	65.6	65.6			730.0		699.4	699.4
B-2	CPT	MACTEC (2009)	2439377	554569	767.4	na	na	na	na	59.7	59.7					707.7	707.7
B-4	CPT	MACTEC (2009)	2439023	554364	767.5	na	na	na	na	3.6	3.6					763.8	763.8
B-6	CPT	MACTEC (2009)	2439219	553737	769.6	na	na	na	na	64.8	64.8					704.8	704.8
B-9	CPT	MACTEC (2009)	2439171	555164	767.4	na	na	na	na	65.3	65.3					702.1	702.1
B-20	CPT	MACTEC (2009)	2439889	554891	767.7	na	na	na	na	66.3	66.3					701.4	701.4
B-28	CPT	MACTEC (2009)	2439974	554403	767.8	na	na	na	na	63.0	63.0					704.8	704.8
PZ-1	PZ	Stantec (2009)	2440140	556602	757.3	na	0.0	33.0	41.0	na	44.5		757.3	724.3	716.3		712.8
PZ-2	PZ	Stantec (2009)	2440294	556495	760.2	na	0.0	33.0	46.0	na	48.2		760.2	727.2	714.2		712.0
PZ-3	PZ	Stantec (2009)	2440383	556391	760.3	na	0.0	30.5	41.0	na	44.5		760.3	729.8	719.3		715.8
PZ-4	PZ	Stantec (2009)	2440238	556436	760.5	na	0.0	34.0	45.0	na	48.0		760.5	726.5	715.5		712.5
PZ-5	PZ	Stantec (2009)	2440335	556313	769.0	na	0.0	39.5	47.0	na	50.0		769.0	729.5	722.0		719.0
PZ-6	PZ	Stantec (2009)	2440547	556150	777.3	na	0.0	49.0	55.0	na	65.0		777.3	728.3	722.3		712.3
PZ-7	PZ	Stantec (2009)	2440168	556361	771.3	na	0.0	44.0	51.5	na	55.0		771.3	727.3	719.8		716.3
PZ-8	PZ	Stantec (2009)	2440302	556241	773.1	na	0.0	45.0	51.5	na	54.5		773.1	728.1	721.6		718.6
PZ-9	PZ	Stantec (2009)	2441018	556372	757.7	na	0.0	27.0	38.0	na	51.0		757.7	730.7	719.7		706.7
PZ-11	PZ	Stantec (2009)	2441170	556251	764.8	na	0.0	37.0	43.5	na	51.0		764.8	727.8	721.3		713.8
PZ-12	PZ	Stantec (2009)	2441003	555918	772.2	na	0.0	45.2	51.8	na	58.0		772.2	727.0	720.4		714.2
PZ-13	PZ	Stantec (2009)	2440943	555965	761.6	na	0.0	34.8	41.8	na	51.0		761.6	726.8	719.8		710.6
SI-1	slope inclinometer hole	Stantec (2009)	2439955	556399	777.2	na	0.0	na	na	72.0	74.0		777.2			705.2	703.2
SI-2	slope inclinometer hole	Stantec (2009)	2440413	556717	757.7	na	0.0	na	na	50.0	59.0		757.7			707.7	698.7
SI-3	slope inclinometer hole	Stantec (2009)	2440332	556569	758.9	na	0.0	na	na	55.0	65.6		758.9			703.9	693.3
SI-4	slope inclinometer hole	Stantec (2009)	2440480	556450	765.8	na	0.0	na	na	60.5	70.5		765.8			705.3	695.3
SI-5	slope inclinometer hole	Stantec (2009)	2440609	556229	774.0	na	0.0	na	na	70.6	74.6		774.0			703.4	699.4
SI-6	slope inclinometer hole	Stantec (2009)	2440274	556496	777.9	na	na	na	na	na	na						
SI-9	slope inclinometer hole	Stantec (2009)	2440790	556088	777.9	na	0.0	na	na	72.9	83.3		777.9			705.0	694.6
SI-10	slope inclinometer hole	Stantec (2009)	2440921	556448	753.2	na	0.0	na	na	46.7	55.0		753.2			706.5	698.2

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SI-11	slope inclinometer hole	Stantec (2009)	2441440	557066	758.0	na	0.0	na	na	55.0	59.0		758.0			703.0	699.0
SI-12	slope inclinometer hole	Stantec (2009)	2441064	555869	783.8	na	0.0	na	na	78.5	89.5		783.8			705.3	694.3
SP-1	SP	Stantec (2009)	2440227	556424	766.2	na	na	na	na	na	na						
SP-2	SP	Stantec (2009)	2440156	556342	773.2	na	na	na	na	na	na						
SP-3	SP	Stantec (2009)	2440204	556258	773.1	na	na	na	na	na	na						
SP-4	SP	Stantec (2009)	2440519	556113	777.9	na	na	na	na	na	na						
B-3	Boring Hole	MACTEC (2004)	2439865	556859	810.8	na	na	na	na	na	na						
B-4	Boring Hole	MACTEC (2004)	2440897	556619	810.6	na	na	na	na	na	na						
B-5	Boring Hole	MACTEC (2004)	2440246	555594	810.2	na	na	na	na	na	na						
B-5A	Boring Hole	MACTEC (2004)	2440247	555597	810.2	na	na	na	na	na	na						
B-6	Boring Hole	MACTEC (2004)	2439808	555292	809.5	na	na	na	na	na	na						
B-8A	Boring Hole	MACTEC (2004)	2440526	554787	773.6	na	na	na	na	na	na						
B-1	Boring Hole	TVA	2439763	556953	781.8	0.0	1.0	52.5	63.5	82.2	82.2	781.8	780.8	729.3	718.3	699.6	699.6
B-2	Boring Hole	TVA	2439814	556903	795.3	0.0	1.0	62.5	77.5	87.5	87.5	795.3	794.3	732.8	717.8	707.8	707.8
B-9	Boring Hole	TVA	2442197	554858	764.4	0.0	2.5	35.5	57.5	61.1	61.9	764.4	761.9	728.9	706.9	703.3	702.5
B-10	Boring Hole	TVA	2441665	554428	762.6	na	0.0	na	27.5	38.0	39.2		762.6				723.4
B-11	Boring Hole	TVA	2442844	554761	765.0	0.0	20.1	32.5	47.5	62.5	62.5	765.0	744.9	732.5		702.5	702.5
B-12	Boring Hole	TVA	2442464	556266	763.9	0.0	17.5	27.5	52.5	59.7	60.6	763.9	746.4	736.4	711.4	704.2	703.3
A-1	Boring Hole	MACTEC (2010)	2439677	553307	757.0	0.0	6.0	31.5	40.5	52.5	54.1	757.0	751.0	725.5	716.5	704.5	702.9
A-2	Boring Hole	MACTEC (2010)	2439700	553255	754.8	0.0	na	30.0	45.0	48.5	50.2	754.8		724.8	709.8	706.3	704.6
A-3	Boring Hole	MACTEC (2010)	2439728	553231	747.1	0.0	na	23.3	37.5	44.4	44.4	747.1		723.8	709.6	702.7	702.7
B-1	Boring Hole	MACTEC (2010)	2439911	553532	759.5	0.0	1.5	na	28.5	47.1	47.1	759.5	758.0			712.4	712.4
B-2	Boring Hole	MACTEC (2010)	2439947	553470	753.2	0.0	na	na	25.5	48.0	48.0	753.2				705.2	705.2
B-3	Boring Hole	MACTEC (2010)	2439942	553417	748.5	0.0	na	23.5	29.0	40.3	40.3	748.5		725.0	719.5	708.2	708.2
B-1	Boring Hole	LAW (2001)	2438665	552525	765.5	0.0	na	0.5	na	12.8	12.8	765.5		765.0	760.0	752.7	752.7
B-2	Boring Hole	LAW (2001)	2438646	552580	765.5	0.0	na	0.3	na	10.4	10.4	765.5		765.2		755.1	755.1
B-3	Boring Hole	LAW (2001)	2438721	552585	765.5	0.0	na	0.4	na	10.0	10.0	765.5		765.1		755.5	755.5
B-4	Boring Hole	LAW (2001)	2438690	552724	765.5	0.0	na	na	na	13.9	13.9	765.5				751.6	751.6
B-5	Boring Hole	LAW (2001)	2438765	552728	765.5	0.0	na	0.2	na	11.0	11.0	765.5		765.3		754.5	754.5
A	well	S&ME, Inc. (2004)	2442296	556668	763.1	0.0	2.0	na	na	na	15.0	763.1	761.1				748.1
B	well	S&ME, Inc. (2004)	2442295	556671	762.9	0.0	2.0	na	22.0	na	38.0	762.9	760.9				724.9
C	well	S&ME, Inc. (2004)	2442293	556674	762.9	0.0	2.0	na	30.0	na	50.0	762.9	760.9				712.9
D	well	S&ME, Inc. (2004)	2442336	556689	764.5	0.0	22.0	na	30.0	na	37.5	764.5	742.5				727.0
E	well	S&ME, Inc. (2004)	2442334	556693	764.5	0.0	20.0	35.0	39.0	na	50.0	764.5	744.5		725.5		714.5
F	well	S&ME, Inc. (2004)	2442386	556715	750.6	0.0	na	15.0	na	na	33.0	750.6		735.6			717.6
A-22+00	Boring Hole	TVA (1965)	2437765	552273	767.2	na	na	na	na	18.6	52.7					767.2	714.5
A-26+00	Boring Hole	TVA (1965)	2437756	552679	785.7	na	na	na	na	24.0	29.4					785.7	756.3
A-30+00	Boring Hole	TVA (1965)	2437737	553076	796.1	na	na	na	na	33.8	39.4					794.6	756.7
C-12+00	Boring Hole	TVA (1965)	2437999	551274	751.2	na	na	na	na	5.0	9.3					750.4	741.9
C-14+00	Boring Hole	TVA (1965)	2437989	551480	767.0	na	na	na	na	19.0	27.3					765.7	739.7
C-16+00	Boring Hole	TVA (1965)	2437980	551680	753.2	na	na	na	na	2.5	40.0					750.7	713.2
C-18+00	Boring Hole	TVA (1965)	2437980	551881	750.0	na	na	na	na	1.2	11.0					748.8	739.0
C-20+00	Boring Hole	TVA (1965)	2437971	552082	765.0	na	na	na	na	0.5	31.5					764.5	733.5
C-22+00	Boring Hole	TVA (1965)	2437961	552282	763.3	na	na	na	na	20.5	53.1					763.3	710.2
E-12+00	Boring Hole	TVA (1965)	2438199	551288	755.7	na	na	na	na	26.4	45.0					755.7	710.7
E-14+00	Boring Hole	TVA (1965)	2438190	551484	764.3	na	na	na	na	12.2	55.0					762.8	709.3

APPENDIX I-1 . Lithology Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
E-16+00	Boring Hole	TVA (1965)	2438185	551680	772.9	na	na	na	na	1.2	37.1					771.7	735.8
E-18+00	Boring Hole	TVA (1965)	2438181	551886	756.2	na	na	na	na	0.6	16.3					755.6	739.9
E-20+00	Boring Hole	TVA (1965)	2438171	552096	763.4	na	na	na	na	15.0	53.0					763.4	710.4
E-22+00	Boring Hole	TVA (1965)	2438167	552287	773.1	na	na	na	na	10.0	64.0					773.1	709.1
E-26+00	Boring Hole	TVA (1965)	2438153	552688	776.4	na	na	na	na	19.2	66.0					776.4	710.4
E-30+00	Boring Hole	TVA (1965)	2438143	553085	785.5	na	na	na	na	16.0	74.3					784.0	711.2
G-12+00	Boring Hole	TVA (1965)	2438395	551288	759.6	na	na	na	na	16.0	21.0					759.6	738.6
G-14+00	Boring Hole	TVA (1965)	2438391	551489	766.4	na	na	na	na	12.2	26.2					766.4	740.2
G-16+00	Boring Hole	TVA (1965)	2438386	551690	772.9	na	na	na	na	39.8	62.0					772.9	710.9
G-18+00	Boring Hole	TVA (1965)	2438381	551895	770.2	na	na	na	na	26.8	59.8					768.4	710.4
G-20+00	Boring Hole	TVA (1965)	2438372	552091	765.5	na	na	na	na	9.7	55.0					763.7	710.5
G-22+00	Boring Hole	TVA (1965)	2438367	552296	764.7	na	na	na	na	11.0	50.0					763.2	714.7
H-14+00	Boring Hole	TVA (1965)	2438592	551498	756.2	na	na	na	na	22.0	41.5					756.2	714.7
H-16+00	Boring Hole	TVA (1965)	2438582	551694	758.5	na	na	na	na	22.1	50.0					756.9	708.5
H-18+00	Boring Hole	TVA (1965)	2438582	551890	762.4	na	na	na	na	20.6	53.0					761.2	709.4
H-20+00	Boring Hole	TVA (1965)	2438573	552105	753.1	na	na	na	na	5.0	45.0					752.1	708.1
H-22+00	Boring Hole	TVA (1965)	2438568	552296	766.5	na	na	na	na	15.6	58.0					765.5	708.5
L-16+00	Boring Hole	TVA (1965)	2438788	551699	736.6	na	na	na	na	25.5	26.0					733.1	710.6
L-18+00	Boring Hole	TVA (1965)	2438778	551900	745.7	na	na	na	na	10.5	17.0					745.7	728.7
N-18+00	Boring Hole	TVA (1965)	2438979	551904	758.1	na	na	na	na	5.0	27.0					758.1	731.1
R- 6+00	Boring Hole	TVA (1965)	2439422	550714	790.5	na	na	na	na	14.4	31.6					776.1	758.9
R-20+00	Boring Hole	TVA (1965)	2439380	552124	750.6	na	na	na	na	16.4	50.0					750.6	700.6
T- 6+00	Boring Hole	TVA (1965)	2439628	550719	828.8	na	na	na	na	46.1	70.6					782.7	758.2
T-20+00	Boring Hole	TVA (1965)	2439581	552128	760.4	na	na	na	na	12.3	50.0					759.4	710.4
V- 4+00	Boring Hole	TVA (1965)	2439828	550523	831.5	na	na	na	na	57.7	60.0					798.6	771.5
V- 6+00	Boring Hole	TVA (1965)	2439819	550724	848.4	na	na	na	na	88.0	90.0					787.4	758.4
V- 8+00	Boring Hole	TVA (1965)	2439814	550924	835.1	na	na	na	na	42.2	65.6					802.7	769.5
EE-22+00	Boring Hole	TVA (1965)	2437364	552264	750.7	na	na	na	na	12.9	18.0					747.9	732.7
EE-26+00	Boring Hole	TVA (1965)	2437355	552665	760.1	na	na	na	na	13.0	23.8					758.9	736.3
EE-30+00	Boring Hole	TVA (1965)	2437336	553066	779.2	na	na	na	na	13.0	19.0					779.2	760.2
MW-1	Well	MACTEC (2004)	2439747	556924	781.6	na	na	na	na	na	20.0						761.6
MW-2	Well	MACTEC (2004)	2439797	556874	795.0	na	na	na	na	na	35.0						760.0
MW-3	Well	MACTEC (2004)	2439823	556814	811.1	na	na	na	na	na	40.0						771.1
MW-3B	Well	MACTEC (2004)	2439847	556835	810.7	na	na	na	na	na	na						
MW-4A	Well	MACTEC (2004)	2439688	557004	766.8	na	na	na	na	na	na						
MW-4B	Well	MACTEC (2004)	2439696	557004	766.6	na	na	na	na	na	na						
MW-5A	Well	MACTEC (2004)	2440254	556608	804.1	na	na	na	na	na	na						
MW-5B	Well	MACTEC (2004)	2440253	556618	804.4	na	na	na	na	na	na						
MW-6A	Well	MACTEC (2004)	2439500	555879	808.3	na	na	na	na	na	na						
MW-6B	Well	MACTEC (2004)	2439491	555879	807.9	na	na	na	na	na	na						
MW-7A	Well	MACTEC (2004)	2439191	556157	811.7	na	na	na	na	na	na						
MW-7B	Well	MACTEC (2004)	2439191	556157	811.9	na	na	na	na	na	na						
MW-8A	Well	MACTEC (2004)	2439075	556236	784.8	na	na	na	na	na	na						
MW-8B	Well	MACTEC (2004)	2439058	556256	785.7	na	na	na	na	na	na						
MW-9A	Well	MACTEC (2004)	2438974	556326	764.7	na	na	na	na	na	na						
MW-9B	Well	MACTEC (2004)	2438958	556316	765.1	na	na	na	na	na	na						

APPENDIX I-1 . Lithology Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Depth to Top of Soil/Fill (ft)	Depth to Top of Ash (ft)	Depth to Top of Alluvial Clay-Silt (ft)	Depth to Top of Alluvial Sands (ft)	Depth to Top of Bedrock (ft)	Boring Termination Depth (ft)	Elevation Top of Soil/Fill (ft-msl)	Elevation Top of Ash (ft-msl)	Elevation Top of Alluvial Clay-Silt (ft-msl)	Elevation Top of Alluvial Sands (ft-msl)	Elevation Top of Bedrock (ft-msl)	Elevation Termination Depth (ft-msl)
GW-01	Well	TVA (2010)	2438364	555585	777.0	0.2	na	na	na	30.5	30.5	776.8				755.0	746.5
TWP-04	Well	TVA (2010)	2439793	556467	782.8	na	na	na	na	74.0	74.0						708.8
TWP-04A	Well	TVA (2010)	2439793	556467	782.8	na	0.0	56.0	na	78.0	78.7		782.8	726.8		704.8	704.1
TWP-04B	Well	TVA (2010)	2439793	556467	782.8	na	0.0	na	26.0	na	30.0		782.8				752.8
TWP-22	Well	TVA (2010)	2438713	552678	766.9	0.0	na	1.8	na	2.3	4.8	766.9				764.6	762.1
TWP-5	Well	TVA (2010)	2441057	555671	788.2	na	0.0	60.0	na	87.0	87.0		788.2	728.2		701.2	701.2
TWP-6	Well	TVA (2010)	2442112	554746	766.6	na	0.0	na	51.0	61.0	62.0		766.6		715.6	705.6	704.6
MW-AD1	Well	MACTEC	2438378	555442	777.3	2.0	na	na	na	na	na	775.3					
MW-AD2	Well	MACTEC	2439781	553295	753.3	2.0	na	na	na	na	na	751.3					
MW-AD3	Well	MACTEC	2440722	553770	748.9	0.0	8.2	8.2	13.1	na	17.1	748.9	740.7				731.8
PZ-123	Boring Hole	Stantec (2010)	2442544	556265	754.8	0.0	na	na	17.1	na	34.0	754.8			737.7		720.8
PZ-124	Boring Hole	Stantec (2010)	2442849	555189	766.2	0.0	18.3	na	na	na	34.0	766.2	747.9				732.2
PZ-125	Boring Hole	Stantec (2010)	2442849	555185	765.7	na	na	38.7	50.0	na	56.0			727.0	715.7		709.7
PZ-126	Boring Hole	Stantec (2010)	2442896	555195	754.0	0.0	7.0	25.0	30.3	na	33.0	754.0	747.0	729.0	723.7		721.0
PZ-129	Boring Hole	Stantec (2010)	2442405	553846	754.8	5.0	1.0	na	na	na	20.4	749.8	753.8				734.4
PZ-129-offset	Boring Hole	Stantec (2010)	2442405	553846	755.0	na	na	na	na	na	40.0						715.0
PZ-121/122	Boring Hole	Stantec (2010)	2442498	556244	765.7	0.0	22.0	26.1	32.0	na	59.0	765.7	743.7	739.6	733.7		706.7
PZ-127/128	Boring Hole	Stantec (2010)	2442380	553924	761.9	0.0	19.6	36.0	48.0	na	54.0	761.9	742.3	725.9	713.9		707.9
C-1	Boring Hole	Mactec (2010)	2440473	553670	748.4	0.0	na	na	31.0	47.2	47.2	748.4			717.4	701.2	701.2
C-2	Boring Hole	Mactec (2010)	2440492	553633	743.9	0.0	na	na	28.5	43.4	43.4	743.9			715.4	700.5	700.5
D-1	Boring Hole	Mactec (2010)	2440700	553759	748.7	0.0	na	na	37.5	53.7	53.7	748.7			711.2	695.0	695.0
D-2	Boring Hole	Mactec (2010)	2440712	553722	743.3	0.0	na	na	31.0	44.9	44.9	743.3			712.3	698.4	698.4

Appendix I-2. Fly Ash - Bottom Ash Distribution Analysis Summary

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Elevation Termination Depth (ft-msl)	Battom Ash (BA) Distribution in Depth (ft)								BA Distribution in Elevation (ft-msl)								BA Thickness (ft) in the 10-ft Intervals			
							BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	780-770	770-760	760--750	750--740
TWP-26	Well	TVA (2010)	2442112.71	554746.27	767.13	654.13	10.00	17.50	30.00	35.00					757.1	749.6	737.1	732.1						0.0	7.1	0.0
TWP-25	Well	TVA (2010)	2441047.21	555658.10	788.93	673.43	19.00	20.00	30.00	32.00					769.9	768.9	758.9	756.9					0.0	1.0	2.0	0.0
TWP-04	Well	TVA (2010)	2439792.55	556466.84	782.91	708.91	17.00	21.00	30.00	32.00					765.9	761.9	752.9	750.9					0.0	4.0	2.0	0.0
GP-16	Well	TVA (2010)	2441998.70	556624.30	766.85	705.75	none																	0.0	0.0	0.0
PZ-129	PZ	Stantec (2010)	2442405.17	553846.49	754.80	734.40	none																		0.0	0.0
PZ-127/128	PZ	Stantec (2010)	2442380.21	553923.59	761.90	707.90	none																	0.0	0.0	0.0
PZ-126	PZ	Stantec (2010)	2442895.83	555194.95	754.00	721.00	5.00	16.40							749.0	737.6									0.0	9.0
PZ-125	PZ	Stantec (2010)	2442849.41	555184.59	765.70	709.70	18.30	26.00							747.4	739.7								0.0	0.0	7.4
PZ-124	PZ	Stantec (2010)	2442848.68	555189.21	766.20	732.20	18.30	26.00							747.9	740.2								0.0	0.0	7.7
PZ-123	PZ	Stantec (2010)	2442544.34	556264.59	754.80	720.80	none																		0.0	0.0
PZ-121/122	PZ	Stantec (2010)	2442498.40	556243.56	765.70	706.70	20.00	26.10							745.7	739.6								0.0	0.0	5.7
PZ-8	PZ	Stantec (2009)	2441819.11	557091.55	760.10	743.60	7.30	16.50							752.8	743.6									2.8	6.4
PZ-7	jk	Stantec (2009)	2441791.01	557106.66	760.00	733.50	5.00	10.00							755.0	750.0									5.0	0.0
PZ-6	PZ	Stantec (2009)	2441708.59	556942.41	763.70	747.20	2.50	10.50							761.2	753.2								1.2	6.8	0.0
PZ-5	PZ	Stantec (2009)	2441690.87	556958.55	763.70	732.20	13.00	21.00							750.7	742.7								0.0	0.7	7.3
PZ-4	PZ	Stantec (2009)	2441602.15	556814.34	766.00	749.50	4.00	11.50							762.0	754.5								2.0	5.5	
PZ-3	PZ	Stantec (2009)	2441588.54	556822.95	766.30	739.80	3.00	15.00							763.3	751.3								3.3	8.7	0.0
PZ-2	PZ	Stantec (2009)	2441500.11	556636.44	766.90	750.40	4.50	16.50							762.4	750.4								2.4	9.6	
PZ-1	PZ	Stantec (2009)	2441468.15	556650.76	765.30	738.80	0.00	20.50							765.3	744.8								5.3	10.0	5.2
B-4	slope inclinometer hole	Stantec (2009)	2442066.28	556934.61	764.20	704.70	0.00	4.50	7.80	15.90	22.60	35.40			764.2	759.7	756.4	748.3	741.6	728.8				4.2	0.0	1.7
B-3	slope inclinometer hole	Stantec (2009)	2441887.56	557061.67	770.90	710.70	0.00	42.00							770.9	728.9								10.0	10.0	10.0
B-2	slope inclinometer hole	Stantec (2009)	2441744.70	556877.44	774.10	696.10	0.00	43.50							774.1	730.6							4.1	10.0	10.0	10.0
B-1	slope inclinometer hole	Stantec (2009)	2441563.81	556623.08	774.20	700.50	1.70	37.50							772.5	736.7							2.5	10.0	10.0	10.0
STN-9	Soil Boring	Stantec (2009)	2442499.72	556233.82	764.80	701.40	18.30	24.30							746.5	740.5								0.0	0.0	6.0
STN-8**	Soil Boring	Stantec (2009)	2442540.30	556248.52	752.20	675.50	2.50	3.00	4.00	5.50					749.7	749.2	748.2	746.7							0.0	0.5
STN-71	Soil Boring	Stantec (2009)	2440981.04	553840.20	752.00	706.50	none																		0.0	0.0
STN-69	Soil Boring	Stantec (2009)	2441718.01	553607.58	752.30	692.80	none																		0.0	0.0
STN-66	Soil Boring	Stantec (2009)	2442564.24	553888.83	750.90	693.90	none																			0.0
STN-65	Soil Boring	Stantec (2009)	2442915.09	554147.51	748.60	698.60	1.50	8.00							747.1	740.6										6.5
STN-64	Soil Boring	Stantec (2009)	2442911.08	554411.29	749.40	693.90	6.00	8.00							743.4	741.4										2.0
STN-63	Soil Boring	Stantec (2009)	2442910.57	554822.75	750.00	701.00	2.00	7.00							748.0	743.0										5.0
STN-62	Soil Boring	Stantec (2009)	2442907.23	555020.69	749.80	700.80	none																			0.0
STN-61	Soil Boring	Stantec (2009)	2442792.80	555513.59	752.50	701.00	none																		0.0	0.0
STN-60	Soil Boring	Stantec (2009)	2442663.31	555886.92	752.50	699.00	4.00	5.00							748.5	747.5									0.0	1.0
STN-6	Soil Boring	Stantec (2009)	2442407.10	556416.17	763.40	698.90	15.00	31.50							748.4	731.9								0.0	0.0	8.4
STN-59	Soil Boring	Stantec (2009)	2442603.06	556075.53	752.20	700.70	3.00	3.50	4.00	5.00					749.2	748.7	748.2	747.2							0.0	0.5
STN-56**	Soil Boring	Stantec (2009)	2441998.50	554555.61	765.80	683.80	2.50	20.50							763.3	745.3								3.3	10.0	4.7
STN-55	Soil Boring	Stantec (2009)	2442287.49	554943.73	764.10	699.90	1.50	5.50	11.50	20.00					762.6	758.6	752.6	744.1						2.6	1.4	5.9
STN-54	Soil Boring	Stantec (2009)	2441476.12	555263.94	765.00	706.00	0.00	1.50							765.0	763.5								1.5	0.0	0.0
STN-53	Soil Boring	Stantec (2009)	2440902.46	554011.12	763.90	712.40	0.00	6.60	14.60	23.00					763.9	757.3	749.3	740.9						3.9	2.7	8.4
STN-52	Soil Boring	Stantec (2009)	2440817.40	553992.98	753.20	713.70	none																		0.0	0.0
STN-51	Soil Boring	Stantec (2009)	2440548.46	553696.02	750.40	700.80	none																			0.0

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Elevation Termination Depth (ft-msl)	Battom Ash (BA) Distribution in Depth (ft)								BA Distribution in Elevation (ft-msl)								BA Thickness (ft) in the 10-ft Intervals			
							BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	780-770	770-760	760--750	750--740
STN-50**	Soil Boring	Stantec (2009)	2440496.85	553631.96	741.60	684.60	none																			
STN-5	Soil Boring	Stantec (2009)	2442365.31	556611.15	764.90	710.90	16.50	26.50							748.4	738.4								0.0	0.0	8.4
STN-49	Soil Boring	Stantec (2009)	2441024.39	553921.85	763.10	715.60	13.50	19.50	22.50	25.50					749.6	743.6	740.6	737.6						0.0	0.0	6.0
STN-48	Soil Boring	Stantec (2009)	2441154.53	553773.29	765.30	711.30	20.00	24.00							745.3	741.3								0.0	0.0	4.0
STN-47	Soil Boring	Stantec (2009)	2441146.83	553747.39	753.40	713.90	1.50	3.50							751.9	749.9									1.9	0.1
STN-45	Soil Boring	Stantec (2009)	2441308.40	553740.50	763.90	715.40	1.00	3.50	5.50	6.50	12.50	17.00	22.00	25.00	762.9	760.4	758.4	757.4	751.4	746.9	741.9	738.9		2.5	1.0	3.1
STN-43	Soil Boring	Stantec (2009)	2441548.50	554004.68	765.90	711.90	2.50	3.50							763.4	762.4								1.0	0.0	0.0
STN-42	Soil Boring	Stantec (2009)	2441513.69	553623.48	764.70	713.20	18.40	26.50							746.3	738.2								0.0	0.0	6.3
STN-41**	Soil Boring	Stantec (2009)	2441510.71	553583.10	752.70	689.70	none																		0.0	0.0
STN-4**	Soil Boring	Stantec (2009)	2442047.01	556625.56	763.30	680.30	0.00	14.00							763.3	749.3								3.3	10.0	0.7
STN-38	Soil Boring	Stantec (2009)	2441988.70	553730.83	764.10	712.80	none																	0.0	0.0	0.0
STN-37	Soil Boring	Stantec (2009)	2442184.40	553799.90	763.80	709.60	25.00	28.00							738.8	735.8								0.0	0.0	0.0
STN-36	Soil Boring	Stantec (2009)	2442198.78	553776.74	751.90	707.90	13.50	18.00							738.4	733.9									0.0	0.0
STN-34	Soil Boring	Stantec (2009)	2442184.35	553853.66	764.70	688.70	19.50	25.50	32.00	39.50					745.2	739.2	732.7	725.2						0.0	0.0	5.2
STN-32	Soil Boring	Stantec (2009)	2442746.44	553994.90	764.80	695.80	22.50	27.00							742.3	737.8								0.0	0.0	2.3
STN-31	Soil Boring	Stantec (2009)	2442758.22	553954.94	749.50	695.50	3.50	10.00							746.0	739.5										6.0
STN-3	Soil Boring	Stantec (2009)	2442263.59	556756.78	763.70	713.40	0.50	6.30	14.00	25.80					763.2	757.4	749.7	737.9						3.2	2.6	9.7
STN-29	Soil Boring	Stantec (2009)	2442854.72	554155.15	764.70	697.00	23.00	34.80							741.7	729.9								0.0	0.0	1.7
STN-28	Soil Boring	Stantec (2009)	2442841.10	554406.25	764.80	700.20	17.70	23.50							747.1	741.3								0.0	0.0	5.8
STN-27	Soil Boring	Stantec (2009)	2442850.67	554601.77	765.10	697.60	22.00	28.00	32.00	34.50					743.1	737.1	733.1	730.6						0.0	0.0	3.1
STN-26	Soil Boring	Stantec (2009)	2442889.00	554624.86	750.00	692.70	2.00	7.00							748.0	743.0										5.0
STN-24	Soil Boring	Stantec (2009)	2442843.16	554803.45	765.10	700.90	17.40	28.40							747.7	736.7								0.0	0.0	7.7
STN-23	Soil Boring	Stantec (2009)	2442857.46	555020.22	764.70	702.70	0.20	1.50	23.00	30.00					764.5	763.2	741.7	734.7						1.3	0.0	1.7
STN-22**	Soil Boring	Stantec (2009)	2441723.40	554990.27	765.00	686.00	0.00	3.00							765.0	762.0								3.0	0.0	0.0
STN-21**	Soil Boring	Stantec (2009)	2442149.85	555076.61	765.00	687.50	0.00	6.00	11.00	18.00					765.0	759.0	754.0	747.0						5.0	4.0	3.0
STN-20	Soil Boring	Stantec (2009)	2442666.59	555168.84	762.90	701.90	6.00	12.50							756.9	750.4								0.0	6.5	0.0
STN-2	Soil Boring	Stantec (2009)	2442329.32	556804.57	751.20	710.20	3.50	4.00	5.50	6.50					747.7	747.2	745.7	744.7							0.0	0.5
STN-19	Soil Boring	Stantec (2009)	2442842.94	555204.68	765.60	700.60	0.50	1.50	19.00	26.50					765.1	764.1	746.6	739.1						1.0	0.0	6.6
STN-18**	Soil Boring	Stantec (2009)	2442894.11	555204.87	751.00	679.50	2.50	16.00							748.5	735.0									0.0	8.5
STN-16	Soil Boring	Stantec (2009)	2442725.94	555501.40	764.50	706.00	1.00	6.50	18.50	30.50					763.5	758.0	746.0	734.0						3.5	2.0	6.0
STN-15	Soil Boring	Stantec (2009)	2442667.52	555662.69	763.70	704.80	14.50	30.00							749.2	733.7								0.0	0.0	9.2
STN-14	Soil Boring	Stantec (2009)	2442733.21	555685.58	753.10	702.10	4.50	6.50							748.6	746.6									0.0	2.0
STN-12	Soil Boring	Stantec (2009)	2442622.48	555873.09	765.10	703.10	none																	0.0	0.0	0.0
STN-11	Soil Boring	Stantec (2009)	2442535.05	556034.83	763.20	701.20	13.00	15.00	25.50	33.00					750.2	748.2	737.7	730.2						0.0	0.2	1.8
STN-10**	Soil Boring	Stantec (2009)	2442251.63	556162.76	765.00	684.00	0.00	3.00							765.0	762.0								3.0	0.0	0.0
F	well	S&ME, Inc. (2004)	2442385.90	556714.87	750.59	717.59	none																			
E	well	S&ME, Inc. (2004)	2442334.28	556692.61	764.50	714.50	20.00	35.00							744.5	729.5								0.0	0.0	4.5
D	well	S&ME, Inc. (2004)	2442335.87	556689.39	764.50	727.00	none																	0.0	0.0	0.0
C	well	S&ME, Inc. (2004)	2442292.79	556674.21	762.85	712.85	29.00	37.00							733.9	725.9								0.0	0.0	0.0
B	well	S&ME, Inc. (2004)	2442294.89	556671.00	762.89	724.89	none																	0.0	0.0	0.0
D-2	Boring	Mactec (2010)	2440711.65	553721.60	743.30	698.40	none																			
D-1	Boring	Mactec (2010)	2440699.51	553759.38	748.70	695.00	none																			0.0
C-2	Boring	Mactec (2010)	2440491.73	553632.55	743.90	700.50	none																			
C-1	Boring	Mactec (2010)	2440472.84	553670.33	748.44	701.24	none																			0.0
B-3	Boring	MACTEC (2010)	2439942.30	553416.90	748.49	708.19	none																			0.0

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Elevation Termination Depth (ft-msl)	Battom Ash (BA) Distribution in Depth (ft)								BA Distribution in Elevation (ft-msl)								BA Thickness (ft) in the 10-ft Intervals			
							BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	780-770	770-760	760--750	750--740
B-2	Boring	MACTEC (2010)	2439946.54	553469.68	753.17	705.17	none																		0.0	0.0
B-1	Boring	MACTEC (2010)	2439911.34	553531.64	759.45	712.35	1.50	16.50							758.0	743.0									8.0	7.0
A-3	Boring	MACTEC (2010)	2439727.62	553231.32	747.09	702.69	none																			0.0
A-2	Boring	MACTEC (2010)	2439700.02	553255.32	754.82	704.62	1.00	3.50							753.8	751.3									2.5	0.0
A-1	Boring	MACTEC (2010)	2439676.67	553306.68	757.02	702.92	6.00	27.00							751.0	730.0									1.0	10.0
B-8	Boring	MACTEC (2009)	2438976.97	555194.27	769.45	700.45	5.00	6.00	19.00	29.00					764.5	763.5	750.5	740.5						1.0	0.0	9.5
B-7	Boring	MACTEC (2009)	2438785.76	555195.57	766.33	702.73	19.00	24.00							747.3	742.3								0.0	0.0	5.0
B-5	Boring	MACTEC (2009)	2439729.54	554121.54	768.46	706.76	none																	0.0	0.0	0.0
B-47	Boring	MACTEC (2009)	2439814.58	553522.72	767.00	702.10	1.50	29.00							765.5	738.0								5.5	10.0	10.0
B-46	Boring	MACTEC (2009)	2439379.41	553159.40	766.59	700.09	3.00	34.00							763.6	732.6								3.6	10.0	10.0
B-45	Boring	MACTEC (2009)	2440531.09	554140.13	765.47	711.17	8.00	19.50	24.50	29.00					757.5	746.0	741.0	736.5						0.0	7.5	4.0
B-43	Boring	MACTEC (2009)	2438873.26	554174.42	767.62	702.62	none																	0.0	0.0	0.0
B-40	Boring	MACTEC (2009)	2439084.58	553391.69	769.88	700.38	6.00	9.00	14.50	44.00					763.9	760.9	755.4	725.9						3.0	5.4	10.0
B-39	Boring	MACTEC (2009)	2439437.63	553700.64	769.08	701.18	14.00	39.00							755.1	730.1								0.0	5.1	10.0
B-36	Boring	MACTEC (2009)	2439340.15	553904.86	769.48	702.08	6.00	39.00	54.50	59.00					763.5	730.5	715.0	710.5						3.5	10.0	10.0
B-35	Boring	MACTEC (2009)	2439796.71	553979.18	766.10	707.50	17.50	24.00							748.6	742.1								0.0	0.0	6.5
B-33	Boring	MACTEC (2009)	2439735.27	554301.31	767.17	705.97	24.00	29.00							743.2	738.2								0.0	0.0	3.2
B-32	Boring	MACTEC (2009)	2439757.71	555207.02	796.02	704.52	none																0.0	0.0	0.0	0.0
B-3	Boring	MACTEC (2009)	2439790.02	554474.13	766.90	704.30	22.50	27.50							744.4	739.4								0.0	0.0	4.4
B-29	Boring	MACTEC (2009)	2439027.14	555534.23	797.25	698.75	34.00	39.00	44.00	59.00					763.3	758.3	753.3	738.3					0.0	3.3	3.3	10.0
B-27	Boring	MACTEC (2009)	2440245.70	554612.40	770.80	701.40	7.00	49.00							763.8	721.8								3.8	10.0	10.0
B-26	Boring	MACTEC (2009)	2440055.65	554603.47	767.51	702.51	14.00	29.00							753.5	738.5								0.0	3.5	10.0
B-21	Boring	MACTEC (2009)	2439975.32	554794.73	772.65	706.55	7.50	49.00							765.2	723.7							0.0	5.1	10.0	10.0
B-18	Boring	MACTEC (2009)	2439387.44	554787.52	767.72	702.92	24.00	29.00							743.7	738.7								0.0	0.0	3.7
B-17	Boring	MACTEC (2009)	2439175.78	554794.82	767.82	703.02	24.00	29.00							743.8	738.8								0.0	0.0	3.8
B-15	Boring	MACTEC (2009)	2438786.81	554804.02	763.95	699.95	2.00	9.00	20.00	29.00					762.0	755.0	744.0	735.0						2.0	5.0	4.0
B-14	Boring	MACTEC (2009)	2439684.15	554997.14	767.80	704.40	3.50	8.00	19.00	34.00					764.3	759.8	748.8	733.8						4.3	0.0	8.8
B-13	Boring	MACTEC (2009)	2439475.42	554993.89	767.12	703.12	3.50	7.50	23.50	33.50					763.6	759.6	743.6	733.6						3.6	0.0	3.6
B-12	Boring	MACTEC (2009)	2439275.99	554995.33	767.86	707.56	6.00	24.00	29.00	39.00					761.9	743.9	738.9	728.9						1.9	10.0	6.1
B-10	Boring	MACTEC (2009)	2438784.64	555006.27	764.81	700.61	3.00	9.00							761.8	755.8								1.8	4.2	0.0
B-1	Boring	MACTEC (2009)	2438966.89	554943.05	767.00	705.80	3.50	22.50	32.50	37.50					763.5	744.5	734.5	729.5						3.5	10.0	5.5
AD2	Well	MACTEC (2009)	2439781.47	553295.14	753.30	728.30	none																		0.0	0.0
AD1	Well	MACTEC (2009)	2438377.73	555441.86	777.30	744.80	none																0.0	0.0	0.0	0.0
B-9	Boring	MACTEC (2004)	2442197.42	554857.59	764.40	702.50	7.50	17.50							756.9	746.9								0.0	6.9	3.1
B-6	Boring	MACTEC (2004)	2439807.55	555292.24	809.47	722.97	62.50	67.50							747.0	742.0							0.0	0.0	0.0	5.0
B-3	Boring	MACTEC (2004)	2439865.37	556858.79	810.81	740.81	2.50	47.50	52.50	57.50					808.3	763.3	758.3	753.3					10.0	6.7	5.0	0.0
B-2	Boring	MACTEC (2004)	2439813.67	556902.74	795.30	707.80	none																0.0	0.0	0.0	0.0
B-12	Boring	MACTEC (2004)	2442463.64	556266.19	763.90	703.30	1.00	2.50	17.50	26.00					762.9	761.4	746.4	737.9						1.5	0.0	6.4
B-11	Boring	MACTEC (2004)	2442843.61	554760.74	765.00	702.50	20.00	22.50							745.0	742.5								0.0	0.0	2.5
B-10	Boring	MACTEC (2004)	2441665.30	554428.09	762.60	723.40	14.50	27.50							748.1	735.1								0.0	0.0	8.1
B-1	Boring	MACTEC (2004)	2439763.46	556952.51	781.80	699.60	3.00	42.50							778.8	739.3							8.8	10.0	10.0	10.0
09-801	CPT Boring	AECOM (2009)	2442159.64	554811.85	765.26	701.26	0.50	18.00							764.8	747.3								4.8	10.0	2.7
09-800	CPT Boring	AECOM (2009)	2441700.05	554405.13	763.09	715.09	4.00	9.50	21.90	26.40					759.1	753.6	741.2	736.7						0.0	5.5	1.2
09-714	CPT Boring	AECOM (2009)	2441323.20	555356.02	764.16	699.86	3.50	6.00							760.7	758.2								0.7	1.8	0.0
09-712	CPT Boring	AECOM (2009)	2441617.48	555085.11	763.83	698.83	0.00	2.20							763.8	761.6								2.2	0.0	0.0

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Elevation Termination Depth (ft-msl)	Battom Ash (BA) Distribution in Depth (ft)								BA Distribution in Elevation (ft-msl)								BA Thickness (ft) in the 10-ft Intervals			
							BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	780-770	770-760	760--750	750--740
09-710	CPT Boring	AECOM (2009)	2441961.70	554926.60	762.98	700.48	0.00	6.00	10.00	12.00					763.0	757.0	753.0	751.0						3.0	3.0	0.0
09-708	CPT Boring	AECOM (2009)	2442216.09	555235.77	763.64	699.14	14.00	18.00							749.6	745.6								0.0	0.0	4.0
09-706	CPT Boring	AECOM (2009)	2442418.13	555578.92	763.58	701.58	0.00	12.00							763.6	751.6								3.6	8.4	0.0
09-704	CPT Boring	AECOM (2009)	2442277.86	555951.66	764.57	698.57	20.00	22.00							744.6	742.6								0.0	0.0	2.0
09-702	CPT Boring	AECOM (2009)	2442137.60	556325.37	764.40	700.40	0.00	3.20							764.4	761.2								3.2	0.0	0.0
09-700	CPT Boring	AECOM (2009)	2442058.49	556511.08	764.55	699.55	0.00	6.00							764.6	758.6								4.5	1.5	0.0
09-605	CPT Boring	AECOM (2009)	2441498.35	556277.45	781.74	699.74	2.50	4.00	10.00	18.00	20.00	26.00	34.00	40.00	779.2	777.7	771.7	763.7	761.7	755.7	747.7	741.7	1.5	6.3	4.3	6.0
09-604	CPT Boring	AECOM (2009)	2440526.16	554800.42	782.48	688.48	18.00	22.00	28.00	44.00	50.00	52.00			764.5	760.5	754.5	738.5	732.5	730.5			0.0	4.0	4.5	10.0
09-603	CPT Boring	AECOM (2009)	2441187.46	555809.89	780.61	704.61	16.40	22.80	36.00	38.60					764.2	757.8	744.6	742.0					0.0	4.2	2.2	2.6
09-602	CPT Boring	AECOM (2009)	2440865.75	555306.82	781.50	696.50	14.00	18.00	22.00	28.00					767.5	763.5	759.5	753.5					0.0	4.0	6.0	0.0
09-601	CPT Boring	AECOM (2009)	2441602.14	556709.83	773.44	704.44	15.00	17.00	19.00	29.50					758.4	756.4	754.4	743.9					0.0	0.0	2.0	6.1
09-600	CPT Boring	AECOM (2009)	2441424.47	556462.75	776.35	701.35	15.00	17.00							761.4	759.4							0.0	1.4	0.6	0.0
09-503	CPT Boring	AECOM (2009)	2439865.48	556860.52	764.65	687.65	none																	0.0	0.0	0.0
09-501	CPT Boring	AECOM (2009)	2440546.47	557396.40	765.02	700.22	4.20	11.80	18.00	32.00					760.8	753.2	747.0	733.0						0.8	6.8	7.0
09-500	CPT Boring	AECOM (2009)	2440227.18	556616.93	757.29	690.29	2.00	8.00							755.3	749.3									5.3	0.7
09-413	CPT Boring	AECOM (2009)	2440033.31	557798.09	764.42	703.92	26.00	27.00							738.4	737.4								0.0	0.0	0.0
09-412	CPT Boring	AECOM (2009)	2440043.37	557613.53	764.83	716.33	0.00	4.00	22.00	24.00					764.8	760.8	742.8	740.8						4.0	0.0	2.0
09-410	CPT Boring	AECOM (2009)	2439904.44	557238.48	762.50	703.50	8.00	10.00	17.50	18.00					754.5	752.5	745.0	744.5						0.0	2.0	0.5
09-409	CPT Boring	AECOM (2009)	2439769.63	557107.02	762.61	702.61	0.00	8.00							762.6	754.6								2.6	5.4	0.0
09-408	CPT Boring	AECOM (2009)	2439698.90	556900.86	764.76	700.76	none																	0.0	0.0	0.0
09-406	CPT Boring	AECOM (2009)	2439331.95	556709.89	764.33	702.33	15.00	20.00							749.3	744.3								0.0	0.0	5.0
09-404	CPT Boring	AECOM (2009)	2439083.64	556363.00	763.41	704.11	4.00	10.00	23.00	26.00	32.00	34.00			759.4	753.4	740.4	737.4	731.4	729.4				0.0	6.0	0.4
09-402	CPT Boring	AECOM (2009)	2438838.54	556092.73	764.93	704.43	0.00	10.00	14.50	16.00					764.9	754.9	750.4	748.9						4.9	5.1	1.1
09-400	CPT Boring	AECOM (2009)	2438673.31	555671.52	766.75	692.75	8.00	10.00	18.00	28.50					758.8	756.8	748.8	738.3						0.0	2.0	8.8
09-304	CPT Boring	AECOM (2009)	2439240.10	555555.20	819.50	769.50	10.50	12.50	46.00	48.00					809.0	807.0	773.5	771.5					2.0			
09-303	CPT Boring	AECOM (2009)	2439974.35	555755.80	817.43	695.93	45.00	46.00	62.00	67.50	75.50	77.50			772.4	771.4	755.4	749.9	741.9	739.9			1.0	0.0	5.4	1.9
09-302	CPT Boring	AECOM (2009)	2439297.28	555664.92	817.38	720.38	73.00	74.00	76.40	80.00					744.4	743.4	741.0	737.4					0.0	0.0	0.0	1.0
09-301	CPT Boring	AECOM (2009)	2440166.15	555335.00	815.95	721.95	60.00	66.00							756.0	750.0							0.0	0.0	6.0	0.0
09-211	CPT Boring	AECOM (2009)	2441966.50	557054.25	765.55	696.05	15.30	20.00							750.3	745.6								0.0	0.3	4.5
09-210	CPT Boring	AECOM (2009)	2441762.30	557293.27	749.55	711.55	none																			0.0
09-209	CPT Boring	AECOM (2009)	2441605.58	557409.86	746.19	711.69	none																			0.0
09-208	CPT Boring	AECOM (2009)	2441472.19	557505.10	744.78	704.78	none																			
09-207	CPT Boring	AECOM (2009)	2441277.57	557643.84	747.11	712.31	none																			0.0
09-206	CPT Boring	AECOM (2009)	2441114.96	557766.73	754.56	716.56	none																		0.0	0.0
09-205	CPT Boring	AECOM (2009)	2440978.41	557913.31	754.57	716.77	none																		0.0	0.0
09-204	CPT Boring	AECOM (2009)	2440842.52	557991.42	750.14	715.84	none																			0.0
09-203	CPT Boring	AECOM (2009)	2440604.25	558105.48	759.59	719.19	none																		0.0	0.0
09-202	CPT Boring	AECOM (2009)	2440411.12	558101.06	761.47	713.97	none																	0.0	0.0	0.0
09-201	CPT Boring	AECOM (2009)	2440259.58	558003.36	760.74	709.44	none																	0.0	0.0	0.0
09-200	CPT Boring	AECOM (2009)	2440072.01	557894.56	764.91	717.91	none																	0.0	0.0	0.0
09-110	CPT Boring	AECOM (2009)	2441755.38	556899.87	774.57	696.57	12.00	28.00							762.6	746.6							0.0	2.6	10.0	3.4
09-109	CPT Boring	AECOM (2009)	2441627.44	556971.56	763.59	695.59	6.00	10.00							757.6	753.6								0.0	4.0	0.0
09-108	CPT Boring	AECOM (2009)	2441485.11	557083.91	759.77	702.87	none																		0.0	0.0
09-107	CPT Boring	AECOM (2009)	2441335.66	557206.53	762.44	703.14	6.00	10.00	18.00	20.30					756.4	752.4	744.4	742.1						0.0	4.0	2.3
09-106	CPT Boring	AECOM (2009)	2441194.41	557303.70	755.05	698.45	14.00	20.00							741.1	735.1									0.0	1.0

Boring ID	Boring Type	Data Source	TN STP (27) Easting (ft)	TN STP (27) Northing (ft)	Ground Surface Elevation (ft-msl)	Elevation Termination Depth (ft-msl)	Battom Ash (BA) Distribution in Depth (ft)								BA Distribution in Elevation (ft-msl)								BA Thickness (ft) in the 10-ft Intervals			
							BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	BA-1-top	BA-1-bot	BA-2-top	BA-2-bot	BA-3-top	BA-3-bot	BA-4-top	BA-4-bot	780-770	770-760	760--750	750--740
09-105	CPT Boring	AECOM (2009)	2441010.27	557465.36	748.35	702.35	none																			0.0
09-104	CPT Boring	AECOM (2009)	2440856.52	557587.27	761.29	710.79	6.00	8.00							755.3	753.3								0.0	2.0	0.0
09-103	CPT Boring	AECOM (2009)	2440704.68	557713.03	766.31	707.81	14.50	16.50							751.8	749.8								0.0	1.8	0.2
09-102	CPT Boring	AECOM (2009)	2440511.51	557771.87	761.91	708.91	none																	0.0	0.0	0.0
09-101	CPT Boring	AECOM (2009)	2440344.29	557686.43	768.31	711.81	33.00	35.50							735.3	732.8								0.0	0.0	0.0
09-100	CPT Boring	AECOM (2009)	2440202.63	557565.54	767.11	705.61	18.00	26.00							749.1	741.1								0.0	0.0	8.0
PZ-R4	PZ	MACTEC (2010)	2440073.69	555986.50	807.83	729.83	18.50	43.50							789.3	764.3							10.0	5.7	0.0	0.0
PZ-R3	PZ	MACTEC (2010)	2439760.22	556420.38	783.30	757.80	19.00	25.50							764.3	757.8							0.0	4.3	2.2	
PZ-R2	PZ	MACTEC (2010)	2439705.62	556102.21	805.45	729.65	58.50	75.80							747.0	729.7							0.0	0.0	0.0	7.0

APPENDIX J

Porewater and Groundwater Chemistry Data

APPENDIX J. Ash Pore Water and Alluvial and Bedrock Groundwater Results

Location	Easting (ft)	Northing (ft)	Sampling Matrix	Actinium-228	Aluminum	AMERICIUM-241	AMMONIA, AS N	Antimony	Arsenic	Barium	Beryllium	Bismuth-214
Units -->				pCi/L	mg/L	pCi/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L
GP07	2439136	553718	Ash	1.31E+01	5.00E-02	1.09E+01	1.21E+00	5.05E-04	5.52E-02	2.76E-02	3.30E-04	7.74E+00
GP08	2438942	554286	Ash	1.25E+01	5.00E-02	1.06E+01	4.95E-01	8.20E-04	6.66E-02	8.03E-02	3.30E-04	1.54E+01
GP09	2439518	554076	Ash	1.43E+01	5.00E-02	2.37E+01	3.34E+00	7.70E-04	4.81E-02	6.94E-02	3.30E-04	9.24E+00
GP10	2439573	554916	Ash	1.39E+01	5.00E-02	1.76E+01	8.79E-01	3.30E-04	4.35E-02	2.74E-02	3.30E-04	2.16E+01
GP11	2439243	555887	Ash	1.35E+01	6.40E-02	1.05E+01	1.03E+00	7.67E-03	3.82E-01	1.12E-01	3.30E-04	7.62E+00
GP12	2439957	555240	Ash	1.33E+01	6.69E-02	2.22E+01	8.14E-01	1.98E-03	9.15E-01	1.36E-01	3.30E-04	7.47E+00
GP13	2440981	556184	Ash	nm	4.28E-01	nm	nm	2.25E-02	4.63E-01	8.74E-02	3.30E-04	nm
GP14	2440496	557530	Ash	1.37E+01	5.00E-02	1.14E+01	1.41E+00	9.10E-04	9.05E-01	7.69E-02	3.30E-04	8.42E+00
GP15	2441030	557053	Ash	1.27E+01	5.00E-02	1.35E+01	5.36E+00	1.29E-03	3.39E-01	7.95E-02	3.30E-04	1.33E+01
GP16	2441999	556624	Ash	nm	2.12E-01	nm	3.29E-01	2.39E-03	8.87E-03	1.29E-01	3.30E-04	nm
GP18	2442157	555245	Ash	1.26E+01	5.71E+01	1.23E+01	1.24E+00	1.58E-03	3.93E-03	6.80E+00	3.30E-04	8.65E+00
22	2442743	555664	Alluvium	1.73E+01	5.00E-02	3.19E+01	1.06E+00	3.30E-04	7.20E-04	3.11E-02	3.30E-04	4.62E+01
6AR	2442760	553950	Alluvium	1.39E+01	1.14E-01	2.25E+01	4.27E-01	3.30E-04	3.30E-04	2.70E-02	6.60E-04	4.06E+01
TWP04	2439793	556467	Alluvium	1.27E+01	5.00E-02	1.47E+01	2.44E+00	6.30E-04	5.94E-01	1.88E-01	3.30E-04	4.85E+01
TWP05	2441057	555671	Alluvium	1.34E+01	5.00E-02	2.48E+01	5.14E-01	3.30E-04	1.19E-01	9.47E-02	3.30E-04	1.11E+01
TWP06	2442124	554760	Alluvium	1.55E+01	5.00E-02	2.53E+01	9.94E-01	3.30E-04	1.73E-02	2.48E-01	3.30E-04	5.38E+01
TWP24	2439787	556447	Bedrock	1.56E+01	5.00E-02	1.97E+01	7.30E-01	3.90E-04	2.72E-03	3.04E-01	3.30E-04	4.16E+01
TWP25	2441047	555658	Bedrock	1.42E+01	9.21E-01	2.87E+01	6.43E-01	3.50E-04	3.30E-04	5.44E-01	3.30E-04	1.77E+01
TWP26	2442113	554746	Bedrock	1.32E+01	1.18E+00	1.19E+01	4.18E-01	3.30E-04	7.60E-04	1.28E-01	3.30E-04	1.94E+01
GW01	2438383	555460	Bedrock	1.22E+01	2.34E-01	1.16E+01	5.03E-01	3.30E-04	2.54E-03	3.15E-02	3.30E-04	9.24E+00
GW03	2439734	557353	Bedrock	1.33E+01	5.00E-02	1.42E+01	2.05E-01	3.30E-04	3.30E-04	8.34E-02	3.30E-04	2.86E+01
AD2	2439781	553295	Residuum	nm	5.00E-02	nm	3.39E-01	3.30E-04	1.64E-03	4.78E-02	3.30E-04	nm
AD3	2440722	553770	Residuum	nm	5.00E-02	nm	1.82E-01	3.30E-04	5.00E-04	4.90E-02	3.30E-04	nm
AD1	2438378	555442	Residuum	nm	5.00E-02	nm	1.00E-01	3.30E-04	3.70E-04	4.89E-02	3.30E-04	nm
GW02	2439721	557338	Residuum	1.44E+01	5.00E-02	3.09E+01	1.29E-01	3.30E-04	3.30E-04	7.63E-02	3.30E-04	4.45E+01
ADEQ.BLANK				nm	5.00E-02	nm	1.38E-01	3.30E-04	3.30E-04	1.00E-02	3.30E-04	nm
EB				1.18E+01	5.00E-02	8.05E+00	1.00E-01	3.30E-04	3.30E-04	1.00E-02	3.30E-04	6.63E+00

Note: For the ND sample, detection limit for the sample is listed.
nm - not measured

Location	Boron	Cadmium	Calcium	Cesium-137	Chloride	Chromium	Cobalt	COBALT-60	Copper	Fluoride	Iron	Lead	LEAD-212
Units -->	mg/L	mg/L	mg/L	pCi/L	mg/L	mg/L	mg/L	pCi/L	mg/L	mg/L	mg/L	mg/L	pCi/L
GP07	7.06E-01	3.30E-04	9.33E+01	2.91E+00	4.57E+00	3.80E-04	1.64E-03	2.95E+00	3.30E-04	2.81E-01	3.10E+01	3.30E-04	7.06E+00
GP08	1.20E+00	3.30E-04	5.57E+02	3.02E+00	5.53E+00	3.30E-04	4.23E-03	2.80E+00	4.10E-04	5.61E-01	1.26E+02	3.30E-04	5.89E+00
GP09	1.92E+00	3.30E-04	2.84E+02	3.73E+00	3.14E+01	4.10E-04	2.92E-03	3.73E+00	3.30E-04	4.45E-01	1.56E+01	3.30E-04	8.13E+00
GP10	2.24E+00	3.30E-04	5.37E+02	3.21E+00	6.76E+00	4.50E-04	3.20E-03	3.29E+00	3.30E-04	1.34E-01	1.16E+02	3.30E-04	7.62E+00
GP11	3.09E+00	3.30E-04	1.14E+02	2.94E+00	1.27E+01	3.70E-04	9.60E-04	3.06E+00	5.90E-04	2.26E+00	2.50E-02	3.30E-04	6.83E+00
GP12	3.88E+00	3.30E-04	1.10E+02	3.06E+00	1.21E+01	3.30E-04	7.40E-04	3.27E+00	3.30E-04	1.09E+00	4.48E+00	3.30E-04	6.52E+00
GP13	5.06E+00	3.30E-04	9.25E+01	nm	nm	5.10E-04	3.50E-04	nm	1.36E-03	nm	3.51E-02	3.30E-04	nm
GP14	4.25E+00	3.30E-04	5.78E+02	2.88E+00	7.08E+00	3.40E-04	3.97E-03	2.88E+00	3.30E-04	9.39E-01	5.63E+01	3.30E-04	7.13E+00
GP15	7.80E+00	3.30E-04	2.67E+02	3.01E+00	5.52E+00	3.80E-04	3.30E-03	3.65E+00	3.30E-04	1.25E+00	1.22E+01	3.30E-04	6.20E+00
GP16	3.92E+00	3.30E-04	2.67E+02	nm	2.99E+00	3.30E-04	3.30E-04	nm	3.30E-04	7.70E-01	2.50E-02	3.30E-04	nm
GP18	1.22E+01	3.30E-04	2.24E+02	2.97E+00	1.69E+01	3.30E-04	3.30E-04	3.26E+00	9.30E-03	2.49E+00	2.50E-02	3.30E-04	1.15E+01
22	1.03E+00	3.30E-04	3.90E+01	3.51E+00	7.47E+00	3.30E-04	1.32E-03	4.01E+00	3.30E-04	1.00E-01	5.10E-02	3.30E-04	7.95E+00
6AR	6.52E-01	2.37E-03	4.79E+01	3.78E+00	4.95E+00	3.30E-04	9.39E-02	4.03E+00	3.30E-04	2.43E-01	3.05E-01	3.30E-04	7.59E+00
TWP04	2.75E+00	3.30E-04	1.56E+02	3.03E+00	3.93E+00	3.30E-04	7.70E-04	3.50E+00	3.30E-04	6.09E-01	7.15E+00	3.30E-04	6.50E+00
TWP05	2.29E+00	3.30E-04	4.07E+01	3.63E+00	4.48E+00	3.30E-04	1.48E-03	3.99E+00	3.30E-04	5.07E-01	6.73E+00	3.30E-04	7.49E+00
TWP06	1.71E+00	3.30E-04	1.36E+01	3.37E+00	3.17E+00	3.30E-04	9.83E-03	3.85E+00	3.30E-04	2.49E-01	5.23E+01	3.30E-04	8.96E+00
TWP24	6.32E-02	3.30E-04	4.39E+01	3.77E+00	5.31E+00	3.30E-04	3.30E-04	3.61E+00	3.30E-04	5.74E-01	1.16E+00	3.30E-04	7.76E+00
TWP25	3.47E-02	3.30E-04	6.08E+01	4.23E+00	1.50E+00	6.40E-04	3.30E-04	3.85E+00	3.40E-04	2.47E-01	2.50E-02	3.30E-04	7.37E+00
TWP26	2.35E-01	3.30E-04	1.25E+01	3.03E+00	2.49E+00	3.30E-04	3.30E-04	3.25E+00	3.30E-04	1.78E+00	2.50E-02	5.00E-04	7.52E+00
GW01	1.36E-01	3.30E-04	6.89E+00	3.12E+00	3.20E+00	1.54E-03	3.30E-04	3.42E+00	7.20E-04	4.96E-01	2.50E-02	5.00E-04	7.22E+00
GW03	2.28E-02	3.30E-04	2.65E+01	3.29E+00	1.24E+00	4.20E-04	3.30E-04	3.56E+00	3.30E-04	3.14E-01	2.50E-02	3.30E-04	6.57E+00
AD2	5.46E-01	3.30E-04	6.51E+01	nm	8.54E+00	3.30E-04	6.38E-03	nm	3.30E-04	1.12E-01	1.71E+00	3.30E-04	nm
AD3	1.07E+00	3.30E-04	1.78E+02	nm	6.94E+00	3.30E-04	3.96E-03	nm	3.30E-04	4.26E-01	5.87E-02	3.30E-04	nm
AD1	1.27E-01	3.30E-04	4.29E+00	nm	1.76E+00	3.30E-04	3.30E-04	nm	3.30E-04	4.29E-01	2.50E-02	3.30E-04	nm
GW02	1.44E+00	3.30E-04	6.62E+01	2.98E+00	4.41E+00	5.10E-04	3.40E-04	3.47E+00	3.30E-04	1.56E-01	2.50E-02	3.30E-04	7.34E+00
ADEQ.BLANK	1.25E-02	3.30E-04	5.00E-01	nm	1.00E+00	3.30E-04	3.30E-04	nm	3.30E-04	1.00E-01	2.50E-02	3.30E-04	nm
EB	1.25E-02	3.30E-04	5.00E-01	3.37E+00	1.00E+00	3.30E-04	3.30E-04	2.66E+00	3.30E-04	1.00E-01	2.50E-02	3.30E-04	5.61E+00

Note: For the ND sample, detection limit for the sample is listed.
nm - not measured

Location	LEAD-214	Magnesium	Manganese	Mercury	Molybdenum	Nickel	nitrate-nitrite nitrogen	Potassium	POTASSIUM-40	RADIUM-226	RADIUM-228
Units -->	pCi/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L	pCi/L
GP07	7.67E+00	1.86E+01	1.59E+00	1.50E-04	5.02E-02	3.47E-02	nm	8.68E+00	4.43E+01	6.17E-01	7.04E-01
GP08	8.81E+00	3.88E+01	3.91E+00	1.50E-04	2.50E-02	6.67E-02	nm	4.79E+01	5.08E+01	4.78E-01	1.22E+00
GP09	1.11E+01	5.75E+01	3.65E+00	1.50E-04	1.09E-01	2.82E-02	nm	3.33E+01	3.33E+01	5.23E-01	5.08E-01
GP10	1.42E+01	4.83E+01	4.26E+00	1.50E-04	7.42E-03	3.02E-02	nm	3.27E+01	7.54E+01	5.26E-01	6.21E-01
GP11	7.46E+00	2.50E+01	2.55E-01	1.50E-04	5.20E-01	1.18E-02	nm	5.75E+00	4.80E+01	7.07E-01	5.31E-01
GP12	8.76E+00	1.80E+01	2.77E-01	1.50E-04	3.58E-01	9.14E-03	nm	6.72E+00	4.33E+01	6.36E-01	6.65E-01
GP13	nm	2.31E+01	1.36E-01	nm	6.95E-01	3.51E-03	nm	4.03E+00	nm	nm	nm
GP14	8.07E+00	6.71E+01	2.96E+00	1.50E-04	1.64E-01	2.53E-02	nm	2.59E+01	5.63E+01	8.61E-01	5.70E-01
GP15	8.58E+00	6.88E+01	6.36E-01	1.50E-04	3.01E+00	4.00E-02	nm	2.20E+01	4.48E+01	6.46E-01	7.73E-01
GP16	nm	2.55E+01	1.49E-01	1.50E-04	1.51E-01	2.39E-03	nm	6.64E+00	nm	nm	nm
GP18	8.17E+00	2.50E-01	3.30E-04	1.50E-04	5.13E-01	4.60E-04	nm	3.38E-01	3.77E+01	2.35E+00	4.97E+00
22	6.36E+01	1.09E+01	1.84E+00	1.50E-04	4.21E-03	1.05E-03	1.00E-01	2.78E+00	5.41E+01	5.84E-01	8.43E-01
6AR	4.55E+01	1.31E+01	3.11E+01	1.50E-04	3.30E-04	3.97E-02	1.00E-01	8.16E-01	4.11E+01	4.68E-01	1.41E+00
TWP04	3.70E+01	4.72E+01	1.09E+00	2.00E-04	6.10E-01	3.30E-04	nm	6.23E+00	4.49E+01	1.02E+00	7.50E-01
TWP05	9.69E+00	1.00E+01	1.27E+00	2.00E-04	3.87E-01	1.23E-03	nm	5.25E+00	5.43E+01	3.57E-01	7.21E-01
TWP06	5.37E+01	4.30E+00	1.10E+01	1.50E-04	1.27E-03	3.30E-04	nm	1.73E+00	4.83E+01	5.94E-01	9.64E-01
TWP24	4.23E+01	7.24E+00	9.78E-01	2.00E-04	5.14E-03	3.30E-04	nm	4.34E+00	4.57E+01	6.45E-01	8.65E-01
TWP25	1.26E+01	2.50E-01	1.04E-03	2.00E-04	1.61E-03	3.30E-04	nm	1.07E+01	5.28E+01	8.15E-01	1.12E+00
TWP26	1.24E+01	2.50E-01	3.30E-04	1.50E-04	6.05E-03	1.00E-03	nm	5.14E+00	4.37E+01	2.83E-01	5.86E-01
GW01	1.47E+01	6.39E-01	1.54E-03	1.50E-04	2.61E-03	1.00E-03	nm	2.62E+00	4.14E+01	5.85E-01	7.87E-01
GW03	3.02E+01	4.36E+00	1.51E-01	1.50E-04	3.30E-04	3.30E-04	nm	1.71E+00	3.75E+01	6.58E-01	5.43E-01
AD2	nm	1.05E+01	9.98E-01	1.50E-04	3.40E-04	2.81E-03	1.00E-01	5.14E+00	nm	nm	nm
AD3	nm	2.26E+01	7.17E+00	1.50E-04	4.20E-04	1.61E-03	1.00E-01	5.01E+00	nm	nm	nm
AD1	nm	1.02E+00	7.80E-02	1.50E-04	3.30E-04	3.30E-04	1.00E-01	1.44E+00	nm	nm	nm
GW02	4.96E+01	1.91E+01	1.33E-01	1.50E-04	3.30E-04	1.14E-03	nm	4.05E+00	4.81E+01	1.58E+00	5.54E-01
ADEQ.BLANK	nm	2.50E-01	5.54E-03	1.50E-04	3.30E-04	3.30E-04	1.00E-01	2.50E-01	nm	nm	nm
EB	6.70E+00	2.50E-01	6.88E-03	1.50E-04	3.30E-04	3.30E-04	nm	2.50E-01	4.13E+01	5.05E-01	1.05E+00

Note: For the ND sample, detection limit for the sample is listed.
nm - not measured

Location	Selenium	Silver	Sodium	Solids, Total Dissolved	Strontium	Sulfate	Thallium	Thallium-208	thorium-228	Thorium-230	Thorium-232
Units -->	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L	pCi/L	pCi/L
GP07	3.30E-04	3.30E-04	8.48E+00	4.81E+02	1.04E+00	3.31E+02	5.00E-04	3.91E+00	6.21E-02	3.35E-02	3.34E-02
GP08	3.50E-04	3.30E-04	2.14E+01	1.96E+03	3.81E+00	1.49E+03	1.10E-03	3.56E+00	1.02E-01	4.09E-02	6.51E-02
GP09	3.30E-04	3.30E-04	2.58E+01	1.32E+03	3.12E+00	6.81E+02	5.00E-04	4.15E+00	1.08E-01	9.02E-02	7.78E-02
GP10	3.30E-04	3.30E-04	8.65E+00	1.96E+03	2.29E+00	1.28E+03	5.05E-04	3.87E+00	1.23E-01	8.32E-02	5.16E-02
GP11	5.30E-04	3.30E-04	3.70E+00	4.44E+02	2.35E+00	1.73E+02	5.00E-04	3.53E+00	6.64E-02	2.83E-02	4.51E-02
GP12	9.70E-04	3.30E-04	4.47E+00	4.12E+02	1.84E+00	1.90E+02	5.00E-04	3.74E+00	4.33E-02	5.45E-02	4.30E-02
GP13	1.65E-02	3.30E-04	1.77E+00	nm	1.98E+00	nm	1.78E-03	nm	nm	nm	nm
GP14	3.30E-04	3.30E-04	8.22E+00	2.43E+03	5.46E+00	1.56E+03	6.60E-04	3.64E+00	9.18E-02	6.90E-02	6.24E-02
GP15	4.00E-04	3.30E-04	4.43E+00	6.84E+02	5.86E+00	6.81E+02	7.20E-04	3.16E+00	1.10E-01	4.96E-02	4.95E-02
GP16	9.20E-04	3.30E-04	1.55E+01	1.11E+03	3.62E+00	7.73E+02	5.00E-04	nm	nm	nm	nm
GP18	1.96E-02	3.30E-04	1.06E+00	7.76E+02	1.58E+01	2.13E+00	5.20E-04	4.95E+00	1.28E-01	9.99E-02	8.10E-02
22	3.30E-04	3.30E-04	8.49E+00	2.15E+02	5.28E-01	1.17E+02	5.80E-04	4.24E+00	4.94E-02	7.25E-02	4.91E-02
6AR	3.30E-04	3.30E-04	6.77E+00	3.70E+02	1.20E-01	2.53E+02	5.00E-04	4.17E+00	8.11E-02	8.04E-02	5.49E-02
TWP04	3.30E-04	3.30E-04	2.49E+01	7.22E+02	3.40E+00	3.87E+02	5.00E-04	3.46E+00	9.38E-02	4.56E-02	4.55E-02
TWP05	3.30E-04	3.30E-04	1.16E+01	2.22E+02	9.83E-01	5.87E+01	5.00E-04	3.87E+00	8.80E-02	5.53E-02	1.11E-01
TWP06	3.30E-04	3.30E-04	1.94E+01	1.20E+02	1.51E-01	1.91E+00	5.00E-04	3.68E+00	8.67E-02	4.68E-02	8.61E-02
TWP24	3.30E-04	3.30E-04	3.74E+01	2.39E+02	3.55E-01	7.21E+00	5.00E-04	4.12E+00	8.43E-02	7.78E-02	3.79E-02
TWP25	3.30E-04	3.30E-04	6.52E+01	2.40E+02	1.07E+00	4.45E+00	5.00E-04	4.57E+00	8.06E-02	9.44E-02	4.31E-02
TWP26	3.30E-04	3.30E-04	1.04E+02	2.65E+02	3.50E-01	1.93E+01	5.00E-04	3.96E+00	8.47E-02	4.11E-02	4.10E-02
GW01	3.30E-04	3.30E-04	1.15E+02	3.32E+02	1.30E-01	5.06E+01	5.00E-04	3.88E+00	1.38E-01	1.02E-01	8.81E-02
GW03	3.30E-04	3.30E-04	1.96E+01	1.55E+02	2.20E-01	3.24E+01	5.00E-04	3.52E+00	3.40E-02	5.41E-02	5.39E-02
AD2	3.30E-04	3.30E-04	1.47E+01	3.37E+02	6.46E-01	1.98E+02	5.00E-04	nm	nm	nm	nm
AD3	3.30E-04	3.30E-04	1.23E+01	6.98E+02	9.03E-01	2.59E+02	6.50E-04	nm	nm	nm	nm
AD1	3.30E-04	3.30E-04	8.52E+01	2.46E+02	1.15E-01	2.52E+01	5.00E-04	nm	nm	nm	nm
GW02	3.30E-04	3.30E-04	3.57E+00	3.21E+02	3.94E-01	1.87E+02	5.00E-04	3.73E+00	3.24E-02	3.22E-02	5.13E-02
ADEQ.BLANK	3.30E-04	3.30E-04	2.50E-01	1.00E+01	1.25E-02	1.00E+00	5.00E-04	nm	nm	nm	nm
EB	3.30E-04	3.30E-04	2.50E-01	1.00E+01	1.25E-02	1.00E+00	5.00E-04	3.45E+00	7.63E-02	3.59E-02	3.58E-02

Note: For the ND sample, detection limit for the sample is listed.
nm - not measured

Location	THORIUM-234	Total Inorganic Carbon	Total Kjeldahl Nitrogen	Total Suspended Solids	Uranium-234	URANIUM-235	Uranium-238	Vanadium	Zinc
Units -->	pCi/L	mg/L	mg/L	mg/L	pCi/L	pCi/L	pCi/L	mg/L	mg/L
GP07	1.28E+02	nm	nm	3.38E+03	1.36E+00	1.26E-01	1.27E+00	1.48E-03	2.36E-01
GP08	1.12E+02	nm	nm	6.82E+03	7.10E-01	1.30E-01	5.89E-01	3.33E-03	7.45E-01
GP09	2.21E+02	nm	nm	2.48E+03	7.41E-01	8.38E-02	6.78E-01	1.73E-03	2.37E-01
GP10	1.72E+02	nm	nm	1.02E+04	6.24E-01	1.11E-01	4.52E-01	1.00E-03	3.52E-01
GP11	1.15E+02	nm	nm	2.49E+05	6.00E+00	3.04E-01	6.45E+00	1.20E-02	8.30E-03
GP12	1.95E+02	nm	nm	1.64E+04	3.20E-01	8.17E-02	4.30E-01	1.00E-03	8.30E-03
GP13	nm	nm	nm	nm	nm	nm	nm	1.50E-01	8.30E-03
GP14	1.22E+02	nm	nm	2.83E+03	9.23E-01	7.62E-02	1.29E+00	1.00E-03	9.96E-02
GP15	1.47E+02	nm	nm	3.62E+03	4.08E+00	3.47E-01	3.69E+00	2.01E-03	1.03E-01
GP16	nm	nm	nm	5.18E+03	nm	nm	nm	9.65E-03	8.30E-03
GP18	1.40E+02	nm	nm	4.54E+03	6.23E-02	7.70E-02	9.95E-02	4.49E-02	8.30E-03
22	2.59E+02	1.98E+01	1.27E+00	1.40E+01	5.65E-02	1.29E-01	1.04E-01	1.00E-03	8.30E-03
6AR	2.07E+02	7.27E+01	6.55E-01	3.10E+00	1.71E-01	1.45E-01	6.37E-02	1.00E-03	3.33E-02
TWP04	1.48E+02	nm	nm	3.54E+01	1.01E+00	6.33E-02	8.49E-01	1.00E-03	8.30E-03
TWP05	2.50E+02	nm	nm	1.27E+02	9.35E-02	5.68E-02	1.19E-01	1.00E-03	8.30E-03
TWP06	2.31E+02	nm	nm	5.94E+01	6.18E-02	7.64E-02	9.88E-02	1.00E-03	8.30E-03
TWP24	1.97E+02	nm	nm	2.06E+01	1.48E-01	1.08E-01	1.74E-01	1.00E-03	1.30E-02
TWP25	2.18E+02	nm	nm	3.71E+01	4.83E-01	7.12E-02	4.57E-01	2.63E-03	8.30E-03
TWP26	1.28E+02	nm	nm	8.13E+01	1.33E-01	8.89E-02	1.33E-01	7.05E-03	8.30E-03
GW01	1.26E+02	nm	nm	1.30E+00	5.13E-01	1.08E-01	4.39E-01	8.34E-03	8.30E-03
GW03	1.48E+02	nm	nm	1.00E+00	1.69E-01	9.52E-02	1.03E-01	1.00E-03	8.30E-03
AD2	nm	1.53E+01	6.90E-01	1.00E+00	nm	nm	nm	1.00E-03	8.30E-03
AD3	nm	7.61E+01	1.00E-01	1.00E+00	nm	nm	nm	1.00E-03	8.30E-03
AD1	nm	4.38E+01	1.00E-01	1.00E+00	nm	nm	nm	1.00E-03	8.30E-03
GW02	2.50E+02	nm	nm	2.60E+00	1.66E-01	8.31E-02	1.07E-01	1.00E-03	8.30E-03
ADEQ.BLANK	nm	1.00E+00	1.82E-01	1.00E+00	nm	nm	nm	1.00E-03	8.30E-03
EB	8.81E+01	nm	nm	1.05E+00	1.53E-01	1.38E-01	8.46E-02	1.00E-03	8.30E-03

Note: For the ND sample, detection limit for the sample is listed.
nm - not measured

APPENDIX K

Groundwater Flow and Transport Model, Data Delivery Report

Kingston Ash Recovery Project

Groundwater Flow and Transport Model

Data Delivery Report

Prepared by:

Geosyntec Consultants, Inc., Jacobs Engineering and Tennessee Valley Authority

March 29, 2011

Background

Contiguous ash deposits within the former Dredge Cell, the active Ash Pond, and the Lateral Expansion Area at Kingston Fossil Plant (KIF) will be closed under the Comprehensive Environment Response, Compensation, and Liability Act as a single ash landfill. Future human health and ecological risks associated with the landfill are to be evaluated based on applicable federal and state regulations. To support this effort, a comprehensive three-dimensional groundwater flow and transport model has been developed.

The goal of groundwater flow and transport modeling is to quantify groundwater discharge and ash-related constituent concentrations and mass loadings entering the Emory River, Swan Pond Embayment, and a portion of the Intake Channel via groundwater seepage from ash source areas. These predictions will subsequently be used in evaluating long-term risks to human and ecological receptors. The *Kingston Ash Recovery Project, Non-Time-Critical Removal, Action Sampling and Analysis Plan (SAP)* (prepared by Jacobs in February 2010) initially identified six constituents of concern (COCs). The COCs included arsenic (As), mercury (Hg), chromium (Cr), selenium (Se), radium-226 (Ra-226), and thorium-228 (Th-228).

A white paper (*Kingston Ash Recovery Project, Natural Attenuation of Chromium, Mercury, Selenium and Thorium-228*, March 07, 2011) was prepared to demonstrate that Hg, Cr, Se, and Th-228 are subject to natural attenuation at the site or occur at negligible concentrations such that transport modeling was unwarranted. These constituents are subject to natural attenuation by adsorption, ion-exchange, and chemical precipitation or exist at concentrations less than applicable risk-based screening levels. Although Hg, Cr, and Th-228 were eliminated as COCs, Se was retained for groundwater transport modeling to address concerns that might arise from subsequent biomagnification by organisms. Hence, groundwater transport modeling included the following COCs: As, Se, and Ra-226.

Objectives

The objective of this data delivery report is to transfer groundwater flow and transport modeling results to those parties that will conduct human health and ecological risk analyses. Additionally, results presented herein will be used later in designing the post-closure groundwater compliance monitoring well network for the KIF Ash Landfill.

Key Input Assumptions

Input parameters necessary for transport modeling include dispersivity, bulk density, and porosity. Bulk density and porosity values are based on lab measurements for ash and native soils at the site and dispersivity values were estimated from the literature. Chemical species parameters required for transport modeling are the soil/water distribution coefficient (Kd) and degradation rate. The degradation rate is a first-order irreversible rate reaction term used to represent the decay of contaminant concentrations due to factors other than dispersion. No degradation is assumed for As and Se in transport modeling. A half-life of 1600 yr was assigned for radioactive decay of Ra-226.

Transport simulation results are sensitive to Kd assigned within the transport model. Kd is the quantity of a chemical sorbed by soil, per unit weight of the soil, divided by the quantity dissolved in the water, per unit volume of water (at equilibrium). Kds assigned to model media for each COC are provided in Table 1.

For As, three unique ash Kd values are used to provide a range of the possible site conditions. The ash Kd value of 61.6 L/kg is derived from the highest measured porewater (aqueous) concentration (915 ug/L) relative to the mean ash solids concentration (56.37 mg/kg; 67 detections). All other Kd values for As (Table 1) were obtained by modeling geochemical reactions for As between ash leachate, transport media (i.e., ash, alluvial clay, alluvial sand, and residuum), minerals, and reactants. The geochemical model utilized KIF-specific ash data, groundwater composition data, mineralogy, and hydraulic parameters. The As Kd value of 9.2 for bedrock was the lowest value obtained from geochemical modeling and relied on alluvial clay as a surrogate. However, this Kd value is considered to be conservative.

Kd values for Se are bounded by two values for ash. Calculations based on batch test results contained in *Kingston Ash Recovery Project, Non-Time-Critical Removal Action for the River System, Ash Leaching Test Results* (prepared by Jacobs in December 2010) provide a Kd value of 21 L/kg for ash at a liquid:solid ratio of 0.5. The Se ash Kd value of 250 L/kg is derived from the highest measured porewater (aqueous) concentration (19.6 ug/L) relative to the mean ash solids concentration (4.94 mg/kg; 48 detections). Dissolved selenium was not detected in the porewater of underlying alluvial clay, alluvial sand or bedrock. Furthermore, geochemical modeling of selenium at the site predicted selenium to be precipitated as elemental selenium with site geochemical conditions favoring natural attenuation. The value of 4 L/kg for Se in media underlying ash was obtained from the literature, but is considered conservatively low. It represents the lowest Kd value observed for Se(+6) at a southeast fossil plant site in the Electric Power Research Institute study: *Chemical Attenuation Coefficients for Selenium Species Using Soil Samples Collected from Selected Power Plant Sites, Laboratory Studies* (November 2006).

The ash Kd value for Ra-226 is derived from the highest measured porewater (aqueous) concentration (2.35 pCi/L) relative to the mean ash solids concentration (7.93 pCi/g). An absence of data for Ra-226 required development of Kd values for underlying media using regression equations developed by S. C. Sheppard (*Robust Prediction of Kd from Soil Properties for Environmental Assessment, 2011*). Resulting values are shown in Table 1.

Recharge concentrations represent leachate contributions from ash based upon a small amount of net infiltration (0.372 inches/year) through the flexible membrane liner capping the ash landfill. Recharge concentration values are derived from the highest porewater concentration measured in ash for each species and the associated ash Kd value.

Background groundwater concentrations for COCs were obtained from upgradient groundwater sampling data of wells GW-01, GW-02, GW-03, and AD-1. Background concentrations for As, Se, and Ra-226 are 0.45 ug/L, 0.33 ug/L (minimum detection level), and 0.903 pCi/L, respectively. These values were used in conjunction with porewater sampling results to develop initial aqueous concentration distributions for transport modeling.

Data Spatial Distribution

In meetings and correspondence with Risk Analysts from Jacobs and Arcadis, it was determined that surface waters receiving groundwater flow should be subdivided into three segments due to differences in geography, hydrology (e.g., minimum surface water flows, groundwater fluxes, etc), and potential receptors. Figure 1 illustrates aerial coverage of each segment: Swan Pond Embayment, Emory River, and the Intake Channel (eastern portion). It is important to note that the Intake Channel segment only includes the eastern portion to evaluate COC contributions from the Stilling Pond area and proposed ash landfill..

Discretization results in dimensions of 10 ft x 10 ft in the horizontal for each model cell. Subsequent to model simulations, cell-by-cell groundwater flux and COC concentration values were exported. The data were then processed such that groundwater and concentration values are prescribed for each cell contributing contaminant mass to the prescribed surface water segment. A sum of cell-by-cell values are also provided in Table 2 for each surface water segment.

Summary of Results

Table 2 summarizes groundwater fluxes to surface water segments, noting that groundwater flow simulations were defined by steady-state conditions. Average water elevations for the groundwater flow model assume mean elevations for the Emory River (including Swan Pond Embayment) and Intake Channel of 740.84 and 740.70 ft-msl, respectively.

Tables 3, 4, and 5 summarize transport results by surface water segment for individual COCs at 30 and 100 yr time intervals. The tables are arranged by ash Kd in relation to Table 1.

File Catalogue

File nomenclature is designated by COC and ash Kd values. Table 6 provides a complete listing of model output files transmitted as part of this data delivery.

Table 1. COC Soil/Water Distribution Coefficients (Kd) and Applicable Recharge Concentrations

Arsenic		
Media	Kd (L/kg)	Recharge Concentration (ug/L)
Ash	61.6	915
alluvial clay	14.0	
alluvial sand	17.0	
residuum	379.3	
bedrock	9.2	
Ash	100.0	564
alluvial clay	14.0	
alluvial sand	17.0	
residuum	379.3	
bedrock	9.2	
Ash	180.0	313
alluvial clay	14.0	
alluvial sand	17.0	
residuum	379.3	
bedrock	9.2	

Selenium		
Media	Kd (L/kg)	Recharge Concentration (ug/L)
Ash	21.0	235
alluvial clay	4.0	
alluvial sand	4.0	
residuum	4.0	
bedrock	4.0	
Ash	250.0	19.6
alluvial clay	4.0	
alluvial sand	4.0	
residuum	4.0	
bedrock	4.0	

Radium-226		
Media	Kd (L/kg)	Recharge Concentration (pCi/L = ug/L)
Ash	3370.0	2.35 = 2.377E-06
alluvial clay	19.1	
alluvial sand	19.1	
residuum	282.0	
bedrock	90.5	

Table 2. Summary of Groundwater Fluxes to Surface Water Segments

	Swan Pond Embayment	Emory River	Intake Channel
Number of Model Cells[1]	5100	10722	4480
Segment Area (ft^2)	510,000	1,072,200	448,000
Minimum Cell Flux (ft^3/d)	0.00	0.00	0.01
Maximum Cell Flux (ft^3/d)	11.69	5.70	7.89
Average Cell Flux (ft^3/d)	0.38	0.18	0.28
Segment Water Flux (ft^3/d)	1930.58	1963.00	1258.46
Segment Water Flux (gpm)	10.03	10.20	6.54

[1] *Model cells are 10 ft x 10 ft in horizontal*

Table 3. Summary of Transport Results for Arsenic

	Swan Pond Embayment		Emory River		Intake Channel		Ash Kd (L/kg)
	30-Year	**100-Year**	**30-Year**	**100-Year**	**30-Year**	**100-Year**	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.30	**61.6**
Maximum Concentration (ug/L)	2.10	13.49	0.81	1.27	31.01	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (gram/d)	0.028	0.072	0.026	0.026	0.099	0.105	
	30-Year	**100-Year**	**30-Year**	**100-Year**	**30-Year**	**100-Year**	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.30	**100**
Maximum Concentration (ug/L)	2.06	13.47	0.81	0.92	31.00	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (gram/d)	0.028	0.072	0.026	0.025	0.099	0.105	
	30-Year	**100-Year**	**30-Year**	**100-Year**	**30-Year**	**100-Year**	
Minimum Concentration (ug/L)	0.37	0.38	0.31	0.22	0.40	0.29	**180**
Maximum Concentration (ug/L)	2.04	13.41	0.81	0.82	30.99	31.43	
Average Concentration (ug/L)	0.45	0.52	0.45	0.45	0.96	0.97	
Segment Mass Flux (gram/d)	0.028	0.071	0.026	0.025	0.099	0.105	

Table 4. Summary of Transport Results for Selenium

	Swan Pond Embayment		Emory River		Intake Channel		Ash Kd (L/kg)
	30-Year	100-Year	30-Year	100-Year	30-Year	100-Year	
Minimum Cell Concentration (ug/L)	0.26	0.26	0.15	0.08	0.21	0.11	**21**
Maximum Cell Concentration (ug/L)	0.33	0.39	0.70	0.96	1.07	1.02	
Average Cell Concentration (ug/L)	0.33	0.33	0.33	0.34	0.35	0.35	
Segment Mass Flux (gram/d)	0.018	0.017	0.019	0.020	0.015	0.015	
	30-Year	100-Year	30-Year	100-Year	30-Year	100-Year	
Minimum Cell Concentration (ug/L)	0.29	0.27	0.15	0.08	0.20	0.11	**250**
Maximum Cell Concentration (ug/L)	0.33	0.33	0.65	0.67	1.05	1.07	
Average Cell Concentration (ug/L)	0.33	0.33	0.33	0.33	0.35	0.35	
Segment Mass Flux (gram/d)	0.018	0.018	0.019	0.019	0.015	0.015	

Table 5. Summary of Transport Results for Radium-226 (Ash Kd = 3370 L/kg)

	Swan Pond Embayment		Emory River		Intake Channel	
	30-Year	**100-Year**	**30-Year**	**100-Year**	**30-Year**	**100-Year**
Minimum Concentration (ug/L)	7.11E-07	6.27E-07	6.42E-07	4.52E-07	8.14E-07	6.05E-07
Maximum Concentration (ug/L)	8.97E-07	8.61E-07	9.31E-07	8.85E-07	9.25E-07	8.75E-07
Average Concentration (ug/L)	8.94E-07	8.52E-07	8.95E-07	8.53E-07	8.95E-07	8.50E-07
Minimum Concentration (pCi/L)	7.03E-01	6.20E-01	6.35E-01	4.47E-01	8.04E-01	5.98E-01
Maximum Concentration (pCi/L)	8.87E-01	8.52E-01	9.20E-01	8.75E-01	9.14E-01	8.66E-01
Average Concentration (pCi/L)	8.84E-01	8.43E-01	8.85E-01	8.43E-01	8.85E-01	8.40E-01
Segment Mass Flux (gram/d)	4.78E-08	4.42E-08	4.87E-08	4.45E-08	3.16E-08	2.90E-08

Table 6. Catalogue of Data Files

Species	File Name	Ash Kd (L/kg)	Description
all	file_catalogue.xlsx	all	this file
all	model_data_delivery_report.pdf	all	data delivery report
all	species_Kds.xlsx	all	tabulated Kd values for all species
all	groundwater_flux_by_segment.xlsx	all	summary table of groundwater flux by segment
As	flux_summary_As_with_BG.xlsx	all	summary table of segment concentration (min, max, mean) and groundwater flux for 30 and 100 year time intervals
As	flux_As_Kd_61.6_with_BG.xlsx	61.6	cell-by-cell concentrations, groundwater fluxes, and mass fluxes
As	flux_As_Kd_100_with_BG.xlsx	100	cell-by-cell concentrations, groundwater fluxes, and mass fluxes
As	flux_As_Kd_180_with_BG.xlsx	180	cell-by-cell concentrations, groundwater fluxes, and mass fluxes
Se	flux_summary_Se_with_BG.xlsx	all	summary table of segment concentration (min, max, mean) and groundwater flux for 30 and 100 year time intervals
Se	flux_Se_Kd_21_with_BG.xlsx	21	cell-by-cell concentrations, groundwater fluxes, and mass fluxes
Se	flux_Se_Kd_250_with_BG.xlsx	250	cell-by-cell concentrations, groundwater fluxes, and mass fluxes
Ra-226	flux_summary_Ra-226_with_BG.xlsx	all	summary table of segment concentration (min, max, mean) and groundwater flux for 30 and 100 year time intervals
Ra-226	flux_Ra-226_Kd_3370_with_BG.xlsx	3370	cell-by-cell concentrations, groundwater fluxes, and mass fluxes

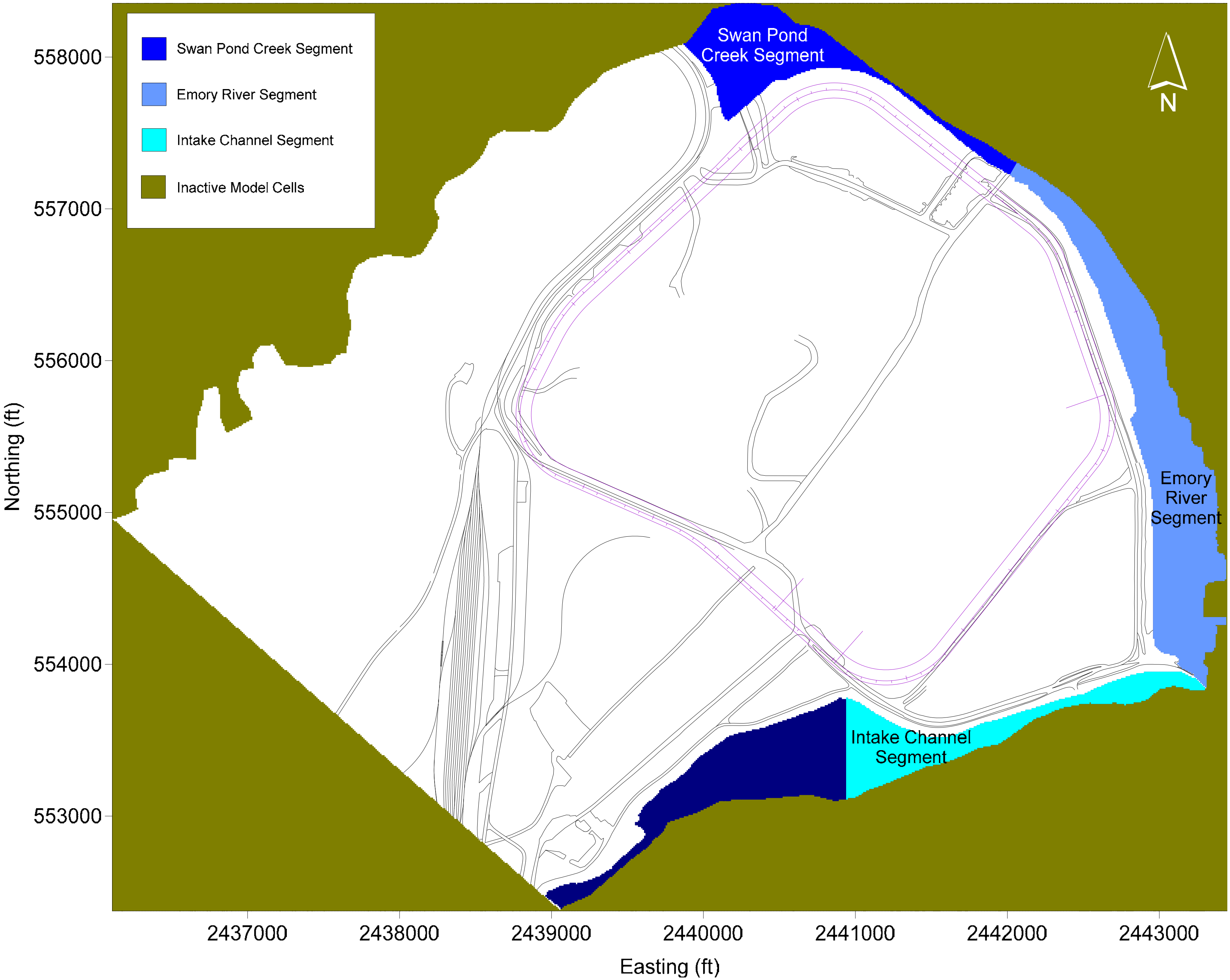

Figure 1. Receiving Water Segments