Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Revised Surface Water Monitoring Plan for the Emory, Clinch and Tennessee Rivers

Date submitted
8/ 25/ 2009

Submitted to whom
Leo Francendese, EPA

Concurrence

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Approvals

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Consulted w/ TDEC B. Scott et al.

cc:

- ☒ Anda Ray, TVA
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August 25, 2009

Mr. Leo Francendese
U.S. Environmental Protection Agency
Region 4
61 Forsyth Street Southwest
Atlanta, Georgia 30303

Dear Mr. Francendese:

Please find enclosed the revised Surface Water Monitoring Plan for the Emory, Clinch, and Tennessee Rivers. The enclosed plan fulfills the requirements of Section IX, paragraph 28, item i. of the Administrative Order and Agreement on Consent. Please contact me if you have any questions.

Sincerely,

(Original signed by)

Anda A. Ray
Senior Vice President
Office of Environment and Research
WT 11A-K

AMC:JJW
Enclosure
cc (Enclosure):

- A. Michelle Cagley, KFP 1T-KST
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Surface Water Monitoring Plan
For the
Emory, Clinch, and Tennessee Rivers

Kingston Fossil Plant Ash Recovery Project

August 2009

Table of Contents

1.0 Introduction and Background

This plan is prepared in accordance with the Administrative Order and Agreement on Consent between the United States Environmental Protection Agency (EPA) Region 4 and the Tennessee Valley Authority (TVA) in May 2009 to address the December 2008 ash release from the TVA Kingston Fossil Plant (KIF). It is a required submittal pursuant to EPA's approval of the Time-Critical Removal Action Memorandum. The scope of this plan focuses on the time-critical removal action tasks; however, it acknowledges that non-time critical removal actions are being planned concurrent with the time-critical actions and, therefore, incorporates data quality needs associated with the non-time critical actions (e.g., surface water component of human health risk assessment).

This plan addresses continued routine surface water monitoring at fixed locations on the Emory, Clinch and Tennessee Rivers and monitoring associated with the *Revised Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project, August 2009,* which contemplates more aggressive ash recovery operations scheduled to start in August 2009. It supersedes Sections 4.2 and 4.3 of the *Field Sampling Plan (FSP) for the KIF Ash Recovery Project* currently under review by EPA and the Tennessee Department of Environment and Conservation (TDEC). It also supersedes the TVA KIF Ash Recovery Project *Sampling and Analysis Plan for Phase 1 Dredging Operations* that was issued in March 2009 with the commencement of Phase 1 dredging operations.

Key elements of this plan are as follows:

- Routine surface water monitoring at 10 (or 11 based on a turbidity measurement action level) fixed locations on the Emory, Clinch, and Tennessee Rivers will continue to be performed by TVA 2 days per week (Monday and Friday), complementing the Tuesday/Thursday schedule for the same stations by TDEC. The previously scheduled Wednesday sampling will be changed to conduct or support special studies requested by project management and regulatory oversight personnel.
- Additional sampling at these locations also will be triggered by either a 24-hour rainfall ≥1.0" measured by the KIF meteorological station or predicted Emory River flow of ≥5,000 cubic feet per second (cfs).
- Fixed Hydrolab® locations will be reduced to five: Emory River Mile 4.0, Emory River Mile 0.5, the KIF Intake Channel, the KIF Effluent Channel, and the KIF Stilling Pond,

with an increased servicing/instrument changeout frequency to improve the usefulness of that data.

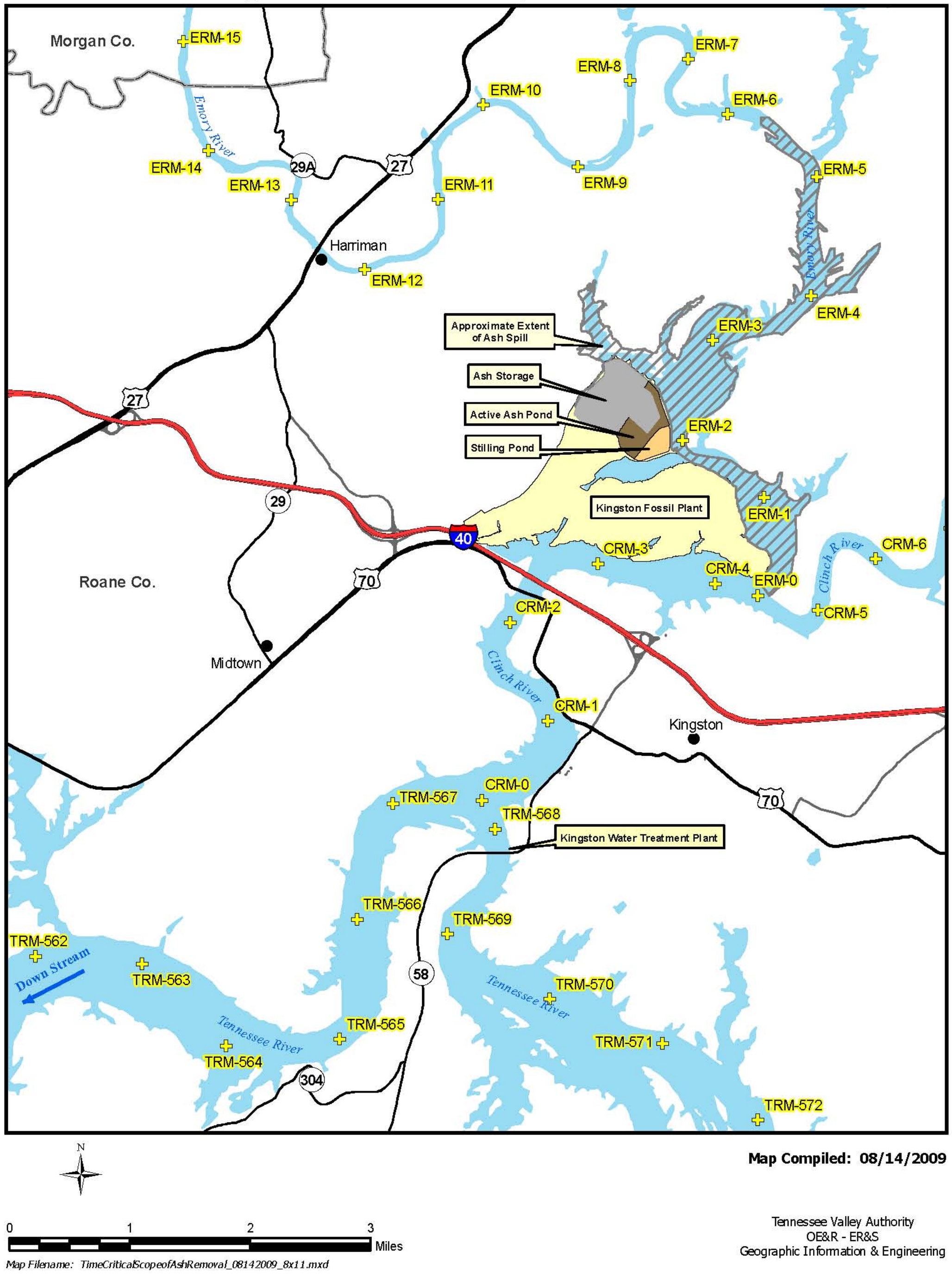
- The KIF Stilling Pond National Pollutant Discharge Elimination System (NPDES)-permitted outfall will be monitored five times per week (Monday through Friday) for total suspended solids (TSS) and three times weekly (Monday, Wednesday, and Friday) for ash-related metal constituents. Stilling Pond effluent samples will be collected initially once per week for acute toxicity testing (Ceriodaphnia and Fathead Minnows). Once fully representative operational conditions of the more aggressive dredging approach have been sustained over a one-month period, data will be evaluated and EPA and TDEC consulted to determine any adjustments to the monitoring frequency.
- Dredge plume monitoring will be performed daily during daylight hours of dredging operations for an initial two-week period; data will be evaluated and EPA and TDEC consulted to determine any adjustments to this monitoring.

Reference is made to several documents that are currently undergoing review by EPA and TDEC. These documents provide additional detailed information on sample collection procedures, sample analyses, and the quality assurance/quality control (QA/QC) elements that will govern the implementation of this plan. Appendix A of the above-referenced TVA FSP contains the standard operating procedures (SOPs) that will be utilized by TVA field personnel. The TVA April 2009 draft *KIF Ash Recovery Project Quality Assurance Project Plan (QAPP)* provides the detail for overall sampling and analysis QA/QC that will be implemented for this plan.

The plan organization includes: Section 2.0 Surface Water Monitoring Plan Objectives; Section 3.0 Evaluation of Existing Surface Water Monitoring Data; Section 4.0 Fixed-location Monitoring; Section 5.0 Dredging Operations – Surface Water Plume Monitoring; Section 6.0 Data Management; Section 7.0 Sampling Procedures; Section 8.0 Quality Assurance/Quality Control.

The remainder of Section 1.0 provides background information for the TVA KIF, ash spill event and the surface water monitoring performed to date. Figure 1 shows the location of KIF in the vicinity of Kingston, Tennessee and the Emory and Clinch Rivers.

Figure 1. Time Critical Scope of Ash Removal



Map Compiled: 08/14/2009

Tennessee Valley Authority
OE&R - ER&S
Geographic Information & Engineering

1.1 Description of the Area and Location

The KIF is located at the confluence of the Emory and Clinch Rivers on Watts Bar Reservoir near Kingston, Tennessee. Kingston is one of the Tennessee Valley Authority's (TVA's) larger fossil plants. It generates 10 billion kilowatt-hours of electricity a year, enough to supply the needs of about 670,000 homes in the Tennessee Valley. Plant construction began in 1951 and was completed in 1955. Kingston has nine coal-fired generating units. The winter net dependable generating capacity (approximately 100%) is 1,456 megawatts. The plant consumes some 14,000 tons of coal a day.

The KIF is located on the Emory River arm of Watts Bar Reservoir, which feeds into the Clinch River. The Emory River borders the KIF ash cells to the east. The Emory River rises on the Cumberland Plateau in Morgan County, Tennessee and crosses into Roane County near Harriman, Tennessee. Flow on the Emory River in the vicinity of KIF is not controlled upstream by flood control or navigation structures. The river elevation is controlled by Watts Bar Dam located downstream of KIF. Summer pool elevation for the Emory River at KIF is approximately 740 to741 feet mean sea level (msl) and winter pool elevation is 735 to 740 feet msl based on Watts Bar headwater. The Watts Bar annual spring reservoir fill-period is from March 15 to May 15. The Emory River typical flow volume in the winter and spring ranges from 500 to 50,000 cubic feet per second (cfs). The 10-year flood flow rate is anticipated to be 110,000 cfs.

1.2 Description of the Ash Release

On Monday, December 22, 2008, just before 1 a.m., a coal fly ash spill occurred at TVA's KIF, allowing a large amount of fly ash to escape into the adjacent waters of the Emory River. Ash, a by-product of a coal-fired power plant, is stored in containment areas. Failure of the dredge cell dike caused about 60 acres of ash in the 84-acre containment area to be displaced. At the time of the slide, the area contained about 9.4 million cubic yards (cy) of ash. The dike failure released about 5.4 million cy of coal ash that now covers about 275 acres.

Fly ash filled the Swan Pond Embayment on the north side of the KIF property adjacent to the failed dredge cell. A dike (Dike #2) has been constructed in the eastern portion of the Swan Pond Embayment to contain the fly ash to the west of the dike until a non-time critical removal action plan is developed, approved by the regulators, and implemented. Fly ash also entered the channel and overbank areas of the riverine section of the Emory River. TVA plans to recover the submerged fly ash in the Emory River by use of hydraulic dredging operations.

As TVA and EPA continue recovery of the Kingston ash spill, larger hydraulic equipment is being brought in to expedite the removal of ash from the Emory River. To keep the river as safe as possible, the Emory River will be closed from mile marker 1.5 to mile marker 3 for a minimum of 30 days. During the closure, no river traffic will be allowed through this area. After that time, the EPA and TVA will review the situation and determine when the river can be re-opened.

TVA installed an underwater rock weir (Weir 1) built in the Emory River, just north of the existing plant intake skimmer wall. Weir 1 allows water to continue flowing and retains the ash at the bottom of the river channel. Weir 1 is about 615 feet long.

1.3 Surface Water Monitoring to Date

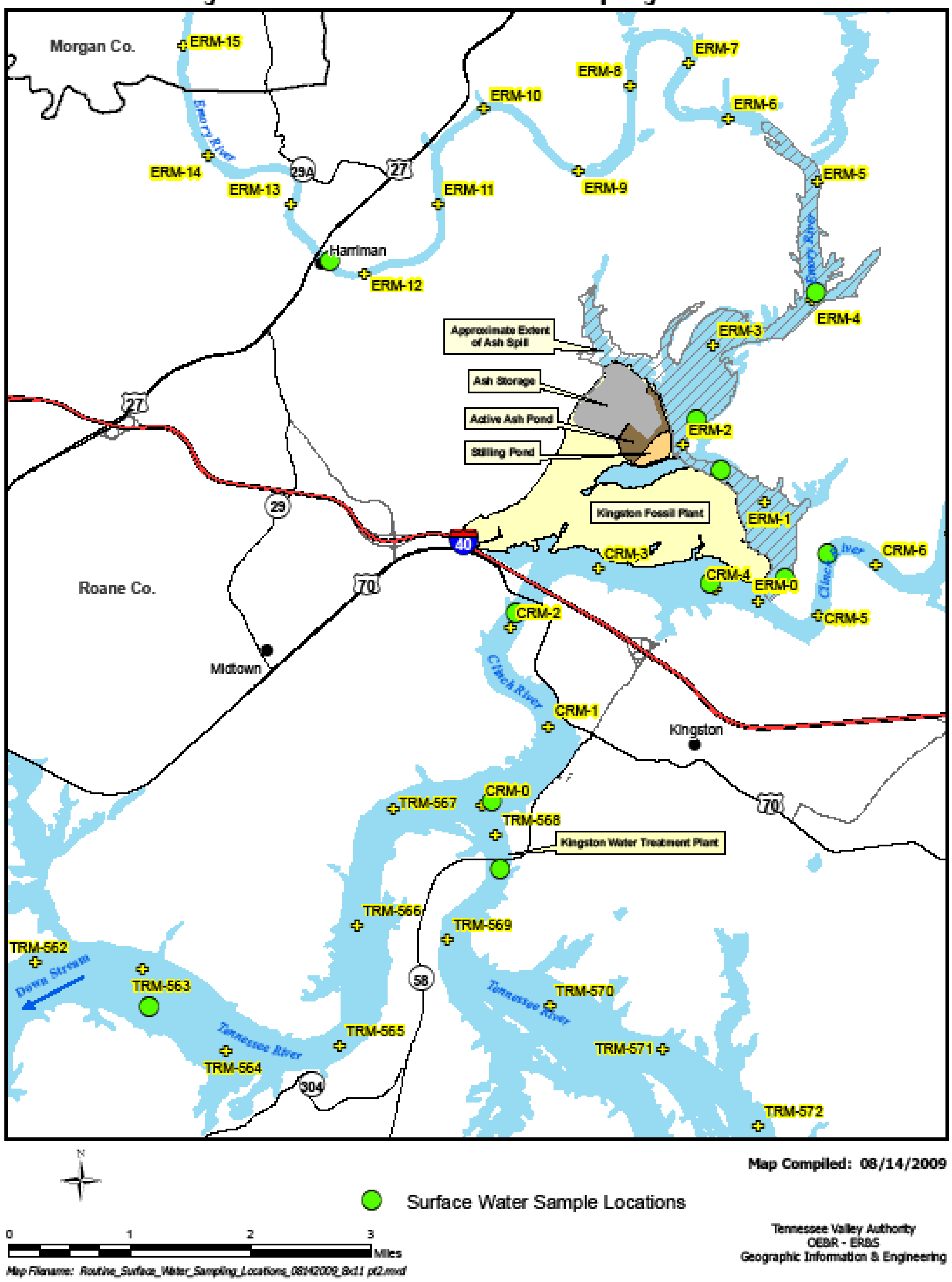
In response to the spill, TVA, the TDEC and EPA Region 4 have collected surface water samples in the Emory, Clinch, and Tennessee Rivers since immediately after the incident in December 2008. Sampling locations were selected on the rivers to bracket the fly ash release area at the KIF plant and currently encompass approximately 14 miles of the local river system. The objectives of the initial surface water monitoring were to determine whether there was any immediate down river migration of ash-related constituents that posed an imminent public health or environmental threat. The intakes for two municipal public drinking water treatment systems (Kingston and Rockwood) are downstream from the spill area, so additional monitoring was initiated there. TDEC performs weekly sampling and analysis of the raw and finished water at the Kingston and Rockwood plants. TVA reimburses the city of Kingston for daily sampling and analysis of raw and finished water at the Kingston plant.

<u>Routine Surface Water Monitoring</u>

As the KIF site transitioned from an emergency operation to a recovery phase, a routine surface water monitoring plan was developed, implemented, and continued in conjunction with the TDEC. TVA established five sampling locations on the Emory River (river mile locations 0.1, 1.75, 2.1, 4.0, and 12.2), four sampling locations on the Clinch River (river mile locations 0.0, 2.0, 4.0, and 5.5), and two sampling locations on the Tennessee River (river mile locations 563.5 and 568.5). Figure 2 illustrates these fixed locations. The locations were established to assess the impacts of the fly ash release on the local river system and to detect any changes to surface water quality associated with the continued presence of a large volume of ash in the Emory River. TVA continues to perform sampling at these locations three days per week (Monday, Wednesday, and Friday); TDEC performs surface water sampling at these locations two days per week (Tuesday and Thursday). In addition, both TVA and TDEC have performed additional sampling at these locations, triggered either by heavy local rainfall (currently ≥0.5" for TVA) or elevated flow events on the Emory River. Samples collected by TVA at these locations are analyzed for total and dissolved metals and total suspended solids (TSS). Additionally, field parameters are measured at each location using a multi-analyte programmable data logger (Hydrolab®), or equivalent instrument. The field parameters include temperature, dissolved oxygen, pH, conductivity, and turbidity.

Routine surface water monitoring continues to the present time. An overall evaluation of the data collected to date is presented in Section 3.0 as part of the basis for this plan.

Figure 2. Routine Surface Water Sampling Locations



Phase 1 Dredging Surface Water Monitoring

On March 17, 2009, TVA started the Phase 1 dredging operation using hydraulic dredges to remove ash from the Emory River. The objectives of this operation included initiating removal of ash from the Emory River to mitigate potential impacts from flooding due to blockage of the main channel of the river; and evaluating dredging and ash processing operations to optimize a subsequent scale-up of removal operations. TVA prepared and submitted a *Sampling Plan for Phase 1 Dredging Operations, March 2009* that was subsequently reviewed and approved by TDEC and EPA. Monitoring during the Phase 1 dredging operations included the following components:

- Continuous monitoring of temperature, dissolved oxygen, conductivity, pH, and turbidity by Hydrolab® instruments deployed from six floating platforms in the river, KIF Intake Channel, and KIF Stilling Pond;
- Daily field monitoring via boat using Hydrolab® or equivalent instrument to locate turbidity plumes, with subsequent sampling of the most turbid portions of identified plumes for total and dissolved metals, alkalinity, total hardness, TSS, and dissolved solids;
- Periodic acute toxicity testing for samples collected from the dredge plumes;
- Continued routine fixed station monitoring via boat at the 11 stations illustrated on Figure 2; and
- Analysis of water samples associated with ash pond management, sediment elutriates and whole sediment toxicity tests.

Dredge plume monitoring continues in accordance with the Phase 1 approach pending approval of this plan. An overall evaluation of the data collected is presented in Section 3.0 as part of the basis for this plan.

Monitoring of the KIF National Pollutant Discharge Elimination System (NPDES)-Permitted Outfall

On March 23, 2009, TVA initiated daily sampling of the NPDES permitted outfall, KIF 001. KIF 001 is the final point of discharge for water that conveys ash from plant operations as well as the current Phase 1 dredging operation. The overall ash recovery system is depicted in Figure 3. The Stilling Pond is the final solids settling location in the ash recovery system. TVA has collected daily samples for TSS (seven days per week), and total and dissolved metals (five days per week) from the outfall that discharges into the KIF plant intake channel. Periodic samples (~monthly) were collected for acute toxicity testing.

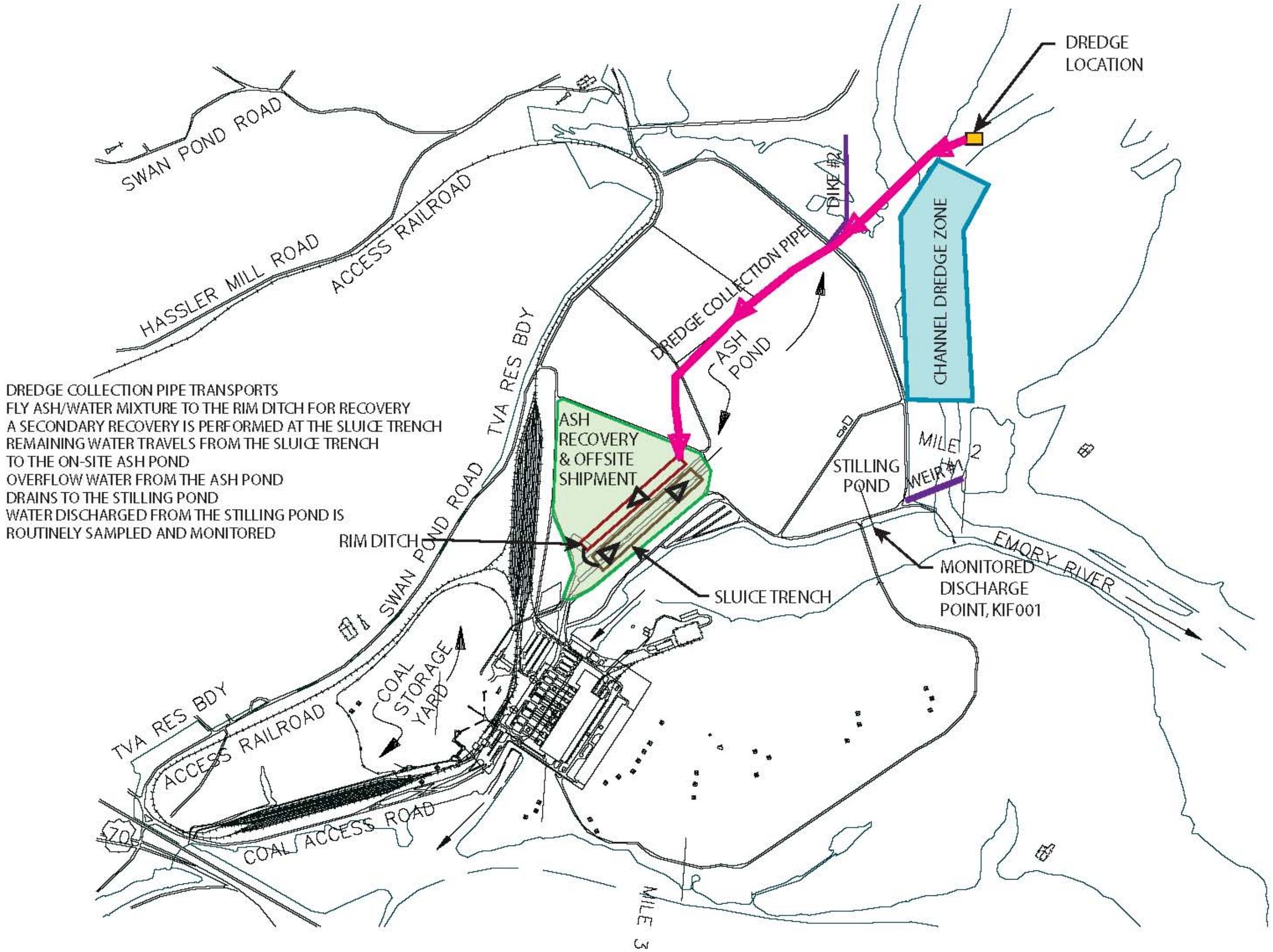
Monitoring of the KIF 001 outfall continues to the present time.

Monitoring of Surface Water Flow in Swan Pond Embayment

Surface water flows from the surrounding topography into Swan Pond Embayment and eventually to the Emory River. The water from Swan Pond Embayment previously discharged through culverts at two locations: Dike 2 and the East Embayment. An interim drainage system has been constructed that separates the clean water from the dirty water west of Dike 2 and sends water in contact with ash through a series of surface water settling basins to allow the solids to settle out of the water prior to discharge into the clean water system and eventual discharge from Swan Pond Embayment. Clean water is defined as surface run-on water that does not come in contact with the ash. The primary means of separating clean from dirty water in the East Embayment is through removal of the ash. Surface water samples are collected and analyzed in accordance with the approved *Swan Pond Embayment Sampling Plan (July 2009)* and is not further addressed in this plan.

FIGURE 3

RIVER DREDGING AND ASH RECOVERY



2.0 Surface Water Monitoring Plan Objectives

The primary objectives in support of time-critical removal actions include the following:

- Provide monitoring results for the Emory, Clinch, and Tennessee Rivers sufficient to detect significant changes in water quality that indicate immediate public health and/or environmental threats from the ash spill. Continue to assure the public that surface water use, consistent with any specific advisories issued by regulatory authorities, continues to be safe.
- Monitor time-critical removal activities, i.e., dredging and associated ash processing actions, to detect changes in surface water quality created by those actions that might impact public health and/or the environment. Data from this monitoring will be used to evaluate the effectiveness of best management practices, e.g. (silt curtains placed around mechanical dredging areas) used to mitigate removal action impacts.
- Monitor events, such as heavy rainfall in the immediate KIF site area, higher than normal flow of the Emory River, or any other unusual condition that has the potential to impact the transport of ash and its constituents in the Emory, Clinch, and Tennessee Rivers.
- Provide a data set that can be used to evaluate changes in water quality as the major source of ash is removed from the Emory River; and for comparative analyses in evaluating potential long-term remedial actions in the river system. This includes data to be used in human health and ecological risk assessments.

Recognizing that planning is underway for non-time critical removal actions, a secondary objective is to acquire data of sufficient quality that can be used to support future human health and ecological risk assessments.

2.1 Data Quality Objectives

The Data Quality Objectives (DQO) process is a series of planning steps based on a scientific method to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application. In general, DQOs provide a qualitative and quantitative framework around which data collection programs can be designed. The qualitative aspect of DQOs seeks to encourage good planning for field investigations. The quantitative aspect of DQOs involves designing an efficient field investigation that reduces the possibility of making an incorrect decision.

Based on the multiple objectives of the surface water monitoring plan, a Level IV data QA program will be executed by the laboratory for the chemical analysis specified to meet the DQOs. The surface water chemical data are compared to a variety of water quality criteria, including risk-based standards. Further, the data also may be used in support of the human health and ecological risk assessments that are part of the non-time critical removal action.

There are four levels of DQOs that have been developed for this project:

- Level I: Field screening or analysis using portable instruments (e.g., temperature probe). Results are often not compound specific but results are available in real time. Depending on the analysis being performed and the instrumentation used, the results may be considered qualitative, semi-quantitative, or quantitative.
- Level II: Field analysis using more sophisticated portable analytical instruments (e.g., Hydrolab® instrument). There is a wide range in the quality of data that can be generated depending on the use of suitable calibration standards, reference materials, and sample preparation equipment. Results are available in real-time or typically within hours of sample collection.
- Level III: All analyses performed in an off-site analytical laboratory using EPA-approved analytical methods. These data generally do not include the level of formal documentation required under Level IV and are not subject to formal data validation. These data are typically used for engineering studies (e.g., treatability testing), risk assessment, site investigations, and remedial design, and may be suitable for litigation/enforcement activities. Results are both qualitative and quantitative.
- Level IV: These data are generated using USEPA methods (e.g., Water and Wastewater Methods and SW846 Methods) and are supported by a rigorous QA program, supporting documentation, and data validation procedures. These data are suitable for use in site characterizations, risk assessments, enforcement/litigation activities, and design of remedial alternatives.

DQOs are assessed by monitoring QA measures, such as accuracy, precision, representativeness, comparability, and completeness, as discussed in the KIF draft QAPP, Section 14.0. Specific qualitative DQOs for the chemical analyses to be performed in association with the TVA KIF Ash Recovery Project are presented in detail in Section 14.0; in Appendix C; and in Tables D-3, E-3, F-4, and H-3. The objectives associated with accuracy and precision of laboratory results are assessed through an evaluation of the results of QC samples. The accuracy of field measurements for temperature and other field parameters will be assessed by calibration, as described in the associated field SOPs.

3.0 Evaluation of Existing Surface Water Monitoring Data

This section presents a summary evaluation of existing surface water monitoring data collected to date for the Emory, Clinch, and Tennessee Rivers fixed locations and for the Phase 1 dredge plume monitoring that has occurred since March 2009. Evaluation of the data collected to date provides a basis for proposed changes to the current surface water monitoring program, although any contemplated adjustments to the ongoing program must also consider that the revised dredging operations are expected to be more aggressive than Phase 1 dredging operations.

TVA also obtained a dataset from TDEC's independent surface water monitoring program and compared the results to the TVA dataset as a way to perform a general qualitative reliability evaluation of the TVA data. Overall, the results generally are consistent.

<u>Fixed-location Monitoring in the Emory River</u>

Table 1 provides summary statistics for four principal ash constituents of concern: arsenic, mercury, selenium, and thallium. These statistics compare concentrations of the four constituents at the Emory River Mile 12.2 background location, two locations in the immediate vicinity of the ash spill (Emory River Miles 2.1 and 1.75), one location immediately down river from the spill (Emory River Mile 1.0), and one location at the mouth of the Emory River as it enters the Clinch River (Emory River Mile 0.1). For comparison, summary statistics for the Phase 1 dredge plume monitoring since March 2009 are provided. Through the end of June 2009, dissolved arsenic in four surface water samples exceeded the Tennessee Domestic Water Supply Criterion of 0.01 mg/L; and, total arsenic exceeded the criterion five times. All of these exceedences were in the vicinity of the ash spill (Emory River Miles 2.1, 1.75, and 1.0) and resulted from samples collected in December 2008 immediately after the spill and in early January 2009 after a heavy rainfall event. No other analyte exceeded its Tennessee Domestic Water Supply Criterion.

Table 1

Summary Statistics for Selected Surface Water Monitoring Constituents

		Summary Statistics for Emory River Location 12.2 (Background)				Summary Statistics for Emory River Location 2.1-1.75				Summary Statistics for Emory River Location 0.1				Summary Statistics for Emory River Dredge Plume Surface Water Samples			
Analyte	Units	Maximum	Average	Number of Samples	Percent Detect	Maximum	Average	Number of Samples	Percent Detect	Maximum	Average	Number of Samples	Percent Detect	Maximum	Average	Number of Samples	Percent Detect
Arsenic	mg/L	Non detect	Non detect	71	0%	0.0281	0.00154	200	11%	0.0273	0.00151	94	10%	0.0128	0.00244	75	39%
Arsenic, Total	mg/L	Non detect	Non detect	71	0%	0.189	0.00345	203	17%	0.132	0.00280	94	12%	0.0498	0.00595	75	79%
Mercury	mg/L	Non detect	Non detect	55	0%	Non detect	Non detect	129	0%	Non detect	Non detect	62	0%	Non detect	Non detect	75	0%
Mercury, Total	mg/L	Non detect	Non detect	55	0%	0.00027	0.0001	129	1%	Non detect	Non detect	62	0%	Non detect	Non detect	75	0%
Selenium	mg/L	Non detect	Non detect	71	0%	0.00512	0.00102	200	1%	0.00335	0.00102	94	1%	0.00377	0.00104	75	1%
Selenium, Total	mg/L	Non detect	Non detect	71	0%	Non detect	Non detect	203	0%	Non detect	Non detect	94	0%	0.005	0.00109	75	1%
Thallium	mg/L	Non detect	Non detect	71	0%	Non detect	Non detect	200	0%	Non detect	Non detect	94	0%	Non detect	Non detect	75	0%
Thallium, Total	mg/L	Non detect	Non detect	71	0%	0.00491	0.0010	203	1%	0.00403	0.0010	94	1%	Non detect	Non detect	75	0%

Dissolved Arsenic in 4 surface water samples exceeded the Tennessee Domestic Water Supply Criterion of 0.01 mg/L in December and January, 2009. Similarly, Total Arsenic exceeded the criterion 5 times during the same time period. No other analyte exceeded its Tennessee Domestic Water Supply Criterion.

Notes:

Denotes highest value

Similarly, the only exceedences of the Tennessee Domestic Water Supply Criteria reported in TDEC data through May 2009 were for arsenic in samples collected immediately adjacent to the ash spill at Emory River Mile 1.7 and 2.1 (11 times, January through May 2009).

Fixed-location Monitoring in the Clinch and Tennessee Rivers

Through June of 2009, TVA data reported exceedences of the Tennessee Domestic Water Supply Criteria for arsenic three times, once each at Clinch River Mile 0.0, Clinch River Mile 2.0, and Clinch River Mile 5.0. These samples all were collected on January 7, 2009, after a period of heavy rainfall. No exceedences of the criteria have been reported at any other fixed locations on the Clinch or Tennessee Rivers by either TVA or TDEC.

The maximum detected concentrations of any analyte occur during periods of elevated Emory River flow (greater than 3000 cubic feet per second as measured by the United States Geological Survey at Oakdale, TN). However, elevated concentrations of some parameters are reported in the lower reach of the Emory River during periods of low or average flow in the late spring and summer months, associated with the filling and maintenance of Watts Bar Reservoir summer pool elevation and intake of water for KIF operations. This is further supported by data on flow rate and direction obtained from in-stream Hydrolab® equipment.

Emory River Dredge Plume Monitoring

None of the dredge plume samples collected during the Phase 1 Emory River dredging operations had concentrations of arsenic, mercury, selenium, or thallium exceed the domestic water supply criteria. These samples were obtained by first identifying the most turbid part of a visual dredge plume via Hydrolab® measurements, then collecting the samples from that location within the plume. The average of the 96 highest turbidity measurements in dredge plumes through the end of Phase 1 dredging was 67 nephelometric turbidity units (NTU). Only two of these measurements exceeded 200 NTU. The TSS average for all samples collected from dredge plumes was 32 mg/L. Only one TSS result exceeded 100 mg/L.

Further, several samples were collected from within the dredge plumes and subjected to acute toxicity testing. Test results showed no difference in effect between the controls and the samples.

This evaluation indicates that even during dredging activities, most ash related constituents settle out of the water column or are rapidly diluted. For those constituents whose maximum and average concentrations are greatest at ERM 0.1 this evaluation demonstrates the influence from the Clinch River/Watts Bar Reservoir during reservoir and plant operations.

Hydrolab® Monitoring at Fixed Locations

Water quality parameters were measured at four locations in the Emory River, and at the Stilling Pond discharge, KIF Intake Channel, and KIF Effluent Channel using multi-analyte programmable data loggers (Hydrolab®). The water quality parameters measured include temperature, dissolved oxygen, saturated oxygen, pH, conductivity, and turbidity, with turbidity being the primary measurement of interest. The dissolved oxygen, saturated oxygen, pH, and conductivity measurements have remained stable with only minor fluctuations since dredging began in March. The water temperature has started to gradually increase with the warmer weather in May and June. The turbidity generally spikes with rainfall events and increased river flow. However, with the warmer weather and increased algae growth the instruments are susceptible to biological fouling causing false positive readings for turbidity.

Conclusions

- The maximum detected ash-related surface water constituent concentrations occur during periods of elevated Emory River flow.
    - For those constituents whose maximum and average concentrations are greatest at ERM 0.1 this evaluation demonstrates the influence from the Clinch River/Watts Bar Reservoir during reservoir and plant operations.

- This evaluation indicates that the Phase 1 dredging activities did not result in significant increases of ash-related constituents that affected the down river water quality. For example, the maximum detected selenium concentration in a dredge plume (75 samples) was 0.005 mg/L (total), compared to the maximum detected selenium concentration of 0.00335 mg/L (dissolved-total not detected) at Emory River mile 0.1 (94 samples).

- For water quality parameters measured using multi-analyte programmable data loggers (Hydrolab®), the following conclusions may be drawn:
    - Dissolved oxygen, saturated oxygen, pH, and conductivity measurements have remained stable with only minor fluctuations since dredging began in March.
    - Water temperature has started to gradually increase with the warmer weather in May and June.
    - Turbidity generally increases with rainfall events and increased river flow, and has not been significantly impacted by dredging operations to date. However,

with the warmer weather and increased algae growth the instruments are susceptible to biological fouling causing false positive readings for turbidity.

- A comparison of surface water data collected by TVA to data collected by TDEC provides a qualitative evaluation of reliability of the TVA data. Overall, the data are generally similar, with no apparent significant discrepancies.

4.0 Routine, Fixed-station Monitoring

Based upon the evaluation of existing surface water monitoring data and the onset of a revised dredging operations plan, the following presents the scope for continued surface water monitoring.

4.1 Monitoring Scope

- Routine Surface Water Sampling and Analysis - Continuation of routine sampling and analysis at 10 fixed locations along the Emory, Clinch, and Tennessee Rivers, two times per week (Monday/Friday), complementing the Tuesday/Thursday schedule for the same stations sampled by TDEC. Samples will be collected at Tennessee River Mile 563.5 only when the field turbidity measurement at the Clinch River Mile 0.0 station exceeds 20 NTU. These are the same locations that have been monitored by TVA and TDEC since shortly after the ash spill. The samples are collected at mid-depth (approximately 15 feet) when the river is well mixed. When evidence of thermal stratification exists, samples will be collected from both the mid-epilimnion and mid-hypolimnion layers.

  The previously scheduled Wednesday sampling will be changed to conduct or support special studies requested by project management and regulatory oversight personnel.

- Event-driven Sampling and Analysis at Fixed Stations - Additional sampling and analysis at the same 10 fixed locations (including the criterion to trigger sampling at Tennessee River Mile 563.5) will be driven by either of the following two events: Predicted Emory River flow of ≥5,000 cubic feet per second or rainfall ≥1.0” in a 24-hour period as measured at the KIF on-site meteorological station.

- Hydrolab® Monitoring at Fixed Locations – TVA has been operating Hydrolab® instruments at a number of fixed locations since immediately prior to the start of Phase 1 dredging operations. Five have been located in the Emory River and three additional instruments were added to the KIF Stilling Pond, the KIF Intake Channel, and the KIF Effluent Channel. These instruments have been providing real-time measurements of temperature, dissolved oxygen, pH, conductivity, flow direction, and turbidity, with turbidity being the primary measurement of interest. TVA has concluded that these instruments provide somewhat limited value due principally to the high frequency of false elevated turbidity readings caused by algal growth and/or debris interfering with the detector window. Frequent cleaning/debris removal has become the norm. The false readings divert significant personnel resources to clean or change out instruments and require notifications to TDEC and EPA that the data are spurious. Accordingly, TVA proposes to reduce the number of fixed Hydrolab® instruments to five current locations: Emory River Mile 4.0, Emory River Mile 0.5, the KIF Intake Channel, the KIF Effluent Channel, and the KIF Stilling Pond. While the existing instruments provide adequate water quality data when not impacted by river conditions, TVA is also evaluating other equipment manufacturers of turbidity instrumentation and may elect to make instrument changes to make improvements in data collection.

- Special Evaluations - Recently, TVA has been evaluating the fixed locations for the presence of thermal stratification. Sample collection has been initiated at multiple depths when a temperature difference of two degrees per meter is measured. However, currently insufficient data are available to evaluate trends or draw conclusions from the thermal stratification sampling. This assessment is ongoing.

  TVA will also continue to assess data and information to determine whether surface water monitoring at other points in the river system might yield additional useful data. Additional unique circumstances may require surface water monitoring (e.g., evaluate performance of ash settling system). Plans for special evaluations will solicit input from EPA and TDEC; and might necessitate adjustments to the fixed-location monitoring frequency to best utilize available resources.

  Sampling crews will continue to use a Hydrolab® or equivalent instrument to record field measurements at the fixed locations and for directly monitoring dredge operation plumes prior to collecting samples for laboratory analyses.

- KIF Stilling Pond NPDES-permitted Outfall – TVA will collect samples five days per week (Monday through Friday) for TSS analyses at the Stilling Pond Outfall. Additionally, samples will be collected from the outfall for metals analyses three days per week (Monday, Wednesday, and Friday). Periodic toxicity testing will also be performed on samples from the outfall. During the initial start of the more aggressive dredging operations, acute toxicity testing will be performed once per week (Ceriodaphnia /Fathead Minnows). Following the evaluation of data, this testing may be reduced. Additional operational testing on the components of the ash recovery system will continue as more aggressive dredging becomes fully mobilized. This is being addressed in a separate work plan.

4.2 Sample Locations, Collection, and Analyses

Sample Locations

Sample locations for the routine surface water monitoring are summarized in Table 2 below. Figure 2 illustrates the locations on a map of the river system. The following factors were considered in sample point selection: free-flowing river water to ensure that samples represent current river water quality, position relative to known fly ash deposits to monitor stability of the fly ash deposit, and reasonable distribution to obtain a representative sampling of that section of the river.

Table 2
Routine Surface Water Sampling Locations

Routine Surface Water Sampling Locations							
Location Number	**Location**	**RM**	**Site Label**	**Sample Type**	**Depth (ft)**	**Latitude**	**Longitude**
1	Clinch River	0.0	KIF-CRM0.0	Grab	15	N35.86364	W84.53181
2	Clinch River	2.0	KIF-CRM2.0	Grab	15	N35.88621	W84.52778
3	Clinch River	4.0	KIF-CRM4.0	Grab	15	N35.88956	W84.49892
4	Clinch River	5.5	KIF-CRM5.5	Grab	15	N35.89274	W84.48142
5	Emory River	0.1	KIF-ERM0.1	Grab	15	N35.88986	W84.48778
6	Emory River	1.75	KIF-ERM1.75	Grab	15	N35.90305	W84.49708
7	Emory River	2.1	KIF-ERM2.1	Grab	mid-depth	N35.90925	W84.50055
8	Emory River	4.0	KIF-ERM4.0	Grab	15	N35.92416	W84.48255
9	Emory River	12.2	KIF-ERM12.2	Grab	0.5	N35.92899	W84.55450
10*	Tennessee River	563.5	KIF-TRM563.5	Grab	15	N35.83941	W84.58283
11	Tennessee River	568.5	KIF-TRM568.5	Grab	15	N35.85539	W84.53068

*This location will be sampled only when the field turbidity measurement at Location1 exceeds 20 NTU.

TVA will continue to collect samples from the Stilling Pond outfall for metals, TSS analyses, and toxicity testing in order to monitor the performance of the ash recovery system and detect changes in the chemical nature of the discharge as dredging operations progress.

TVA also will collect samples once per week at the 10 routine monitoring stations to determine if there is any adverse impact to water quality from the periodic application of fertilizer (nitrogen/phosphorous based) on the land-based ash. TVA has been seeding that portion of the ash spill that will remain in place for an extended period of time in an effort to establish grass coverage to assist in dust suppression and erosion control. The analytes for these samples are listed in Table 3.

Sample Collection

Water sampling and analysis will be performed in accordance with EPA Region 4 and TDEC guidance for standard NPDES sampling and analysis. This guidance includes the EPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, 40 CFR 136.3 requirements for analyte holding time, preservatives, and analytical methods; TDEC Rules Chapter 1200-4-3 for required detection levels and laboratory certifications, and EPA analytical methods such as Method 200.7 for total and dissolved metals and other EPA/TDEC-approved methods.

TVA has developed and implemented a set of project-specific SOPs that have been issued in draft, appended to the draft TVA KIF FSP, and are currently undergoing review by EPA and TDEC. The TVA SOPs were prepared and reviewed by KIF project staff cognizant of and experienced in implementing EPA Region 4 and TDEC field procedures. Pending receipt of comments for the SOPs and any subsequent revisions thereto, TVA will continue to perform work in accordance with these procedures. Copies of the relevant draft TVA SOPs for surface water monitoring are included with this plan as Attachment 1 for the convenience of reviewers of this document. The following sections briefly summarize sample collection procedures.

Samples will be collected following the procedures outlined in the SOP for Surface Water Sampling (TVA-KIF-SOP 01). Duplicate turbidity, temperature, dissolved oxygen, conductivity, and pH field samples will be conducted on a 1/10 sample frequency. Duplicate samples will also be collected on a 1/10 frequency for TSS, total dissolved solids (TDS), total metals, dissolved metals, total hardness, dissolved silica, and alkalinity. Additionally, a matrix spike/matrix spike duplicate pair (MS/MSD) will be taken on a 1/10 frequency and submitted to the laboratory.

TVA will collect field parameters using a multi-analyte programmable data logger (Hydrolab®) at each sample location described on Table 1. Parameters of interest that will be documented include temperature, dissolved oxygen, pH, turbidity, and conductivity. Daily accuracy checks will be performed using a daily calibrated Hydrolab®. Details on field instrument calibration will be documented in field logbooks.

Following collection, the surface water sample will be transferred into appropriately clean, preserved bottleware (as required); see TVA KIF QAPP Section 7.2. A chain-of-custody (COC) record will be completed as samples are collected in the field and will remain with the samples until the samples arrive at the laboratory for analysis. The samples will be shipped to the laboratory(-ies) via overnight carrier or laboratory courier. Signatures indicating the succession of sample custody will be documented on the COC record.

Sample Analyses

Surface water samples will be sent to TVA contract laboratories for analyses. TVA maintains a rigorous contract laboratory program that includes periodic audits (by a TVA quality assurance subcontractor) to ensure compliance with analytical specifications. Table 3 summarizes the analytical parameters, test methods, and reporting limits that will be used to fulfill the DQOs of the surface water monitoring program. The analyte list is based on initial characterization of the ash and affected environmental media for a broader range of constituents (e.g., organic compounds) that was performed by TVA, EPA, and TDEC immediately after the spill. Toxicity testing for the Stilling Pond outfall will be conducted per EPA Method 2002.0 for Ceriodaphnia and EPA Method 2000.0 for Fathead Minnows. Additional detail for analytical methods is found in the KIF draft QAPP.

Table 3
Analytes, Methods, and Target Reporting Limits
For
Surface Water Monitoring

Test Parameter	Test Method	Reporting Limit
Basic Water Chemistry		
pH	150.2	0.1 pH Units
Alkalinity	310.2/SM 2310B	10 mg/L
Total Hardness	200.7/200.8/SM 2340B	1 mg/L
Total Suspended Solids (TSS)	160.2/SM2540D	1.0 mg/L
Total Dissolved Solids (TDS)	SM 2540C	1.0 mg/L
Metals –Total and Dissolved		
Aluminum	6010B/6020/200.8	100 µg/L
Antimony	6010B/6020/200.8	2 µg/L
Arsenic	6010B/6020/200.8	2 µg/L
Barium	6010B/6020/200.8	200 µg/L
Beryllium	6010B/6020/200.8	2 µg/L
Boron	6010B/6020/200.8	200 µg/L
Cadmium	6010B/6020/200.8	1 µg/L
Calcium	6010B/6020/200.8	100 µg/L
Chromium	6010B/6020/200.8	2 µg/L
Cobalt	6010B/6020/200.8	10 µg/L
Copper	6010B/6020/200.8	5 µg/L
Iron	6010B/6020/200.8	100 µg/L
Lead	6010B/6020/200.8	2 µg/L
Magnesium	6010B/6020/200.8	1000 µg/L
Manganese	6010B/6020/200.8	10 µg/L
Mercury	7470/245.1	0.2 µg/L
Molybdenum	6010B/6020/200.8	40 µg/L
Nickel	6010B/6020/200.8	5 µg/L
Potassium	6010B/6020/200.8	1000 µg/L
Selenium	6010B/6020/200.8	2 µg/L
Silver	6010B/6020/200.8	2 µg/L
Sodium	6010B/6020/200.8	1000 µg/L
Thallium	6010B/6020/200.8	2 µg/L
Vanadium	6010B/6020/200.8	4 µg/L
Zinc	6010B/6020/200.8	50 µg/L
Nutrient Analyses		
Ammonia as N	EPA 350.1	0.100 mg/L
Phosphorus	EPA 365.4	0.100 mg/L
Total Kjeldahl Nitrogen	EPA 351.2	0.100 mg/L
Nitrate/Nitrate as N	EPA 353.2	0.100 mg/L
Orthophosphate	SM4500 P E	0.100 mg/L
Anions (chloride, fluoride, and sulfate)	EPA 300	Chloride – 1.00 mg/L Fluoride – 0.100 mg/L Sulfate – 1.00 mg/L

5.0 Dredging Operations - Surface Water Plume Monitoring

The Phase 1 dredging operation provided the opportunity to assess the degree to which hydraulic dredging re-suspends ash in the Emory River water column. TVA has performed surface water monitoring of the dredging operations plumes since Phase 1 dredging began on March 17, 2009. Monitoring has been performed every day that the dredges have been in operation. During June and July, three 10" and one 14" hydraulic dredges were operational on the Emory River. Based on the data evaluation in Section 3.0, TVA concluded that the hydraulic dredging operations have not resulted in significant re-suspension events, nor created adverse water quality impacts.

A revised Emory River dredging plan has been prepared that will employ a more aggressive approach to remove most of the ash from the river and the area east of Dike 2 by spring of 2010. The revised plan incorporates two larger hydraulic dredges (20" and 14"), mechanical dredging, and mechanical removal of debris to support hydraulic dredge operations. Turbidity curtains will be deployed around all mechanical dredging operations.

5.1 Dredge Plume Sampling and Analysis

Until laboratory data are received for the first two weeks of dredging, field crews will be deployed in boats during daylight hours to monitor turbidity plumes and to define the three-dimensional boundaries of any observed plumes. To ensure representativeness, plumes from the 14" and 20" hydraulic dredge and mechanical dredging/debris removal operations will be monitored during this initial period. The crews will identify turbidity plumes visually, and then will use a combination of visual observations and turbidity measurements via Hydrolab® to identify the horizontal and vertical boundaries of the plume.

After locating the most turbid part of the plume (depth and horizontal location), a water sample will be collected using a peristaltic pump following the procedure in the KIF SOP for surface water sampling (TVA-KIF-SOP 01). Samples will be analyzed for the analytes listed in Table 3 above (except the nutrient list). During the first two weeks, 24-hour turnaround will be requested for TSS analyses.

All samples will be collected, documented, and managed in accordance with the TVA KIF project SOPs referenced in Attachment 1. QA/QC will be in accordance with the draft KIF QAPP.

In addition, a dredge plume sample will be collected for acute toxicity testing once per week during the first month of full aggressive dredging operations. The frequency of this testing will be reduced pending evaluation of the data and consultation with EPA and TDEC. The toxicity tests will be conducted per EPA Method 2002.0 for Ceriodaphnia and EPA Method 2000.0 for Fathead Minnows.

5.2 Dredge Plume Data Evaluation

Upon receipt of the laboratory data from the first two weeks of dredging, data evaluation will be performed to assess any impacts from the revised dredging operations. Prior to the cessation of sampling and analysis during this initial period, TVA will consult with EPA and TDEC to obtain concurrence that fully representative operational conditions have been achieved.

The evaluation will include a review of hydraulic and mechanical dredging operation records to ensure that the monitoring has been performed during a typical/representative level of dredging activity, i.e., both hydraulic dredges in operation and mechanical dredging active. Laboratory data, plume toxicity test results, field measurements, field observations, and data from the routine surface water monitoring locations for the same time period will be reviewed. The data will be compared to that collected during the Phase 1 dredging operation to determine whether there are any significant adverse trends resulting from the more aggressive operation. Any surface water monitoring data collected independently by TDEC will also be included in the evaluation.

The results of the evaluation will be shared with EPA and TDEC, with a consensus reached on the frequency and nature of further dredge plume monitoring.

6.0 Data Management

A KIF Project Data Management Plan (DMP) has been prepared to manage technical data from a wide array of sources. This DMP is intended to provide a basis for supporting a full technical data management cycle from pre-planning of sampling events to reporting and analysis with a particular emphasis on ensuring completeness, data usability, and most importantly, defensibility of the data. As the TVA data are verified and validated, the data will be migrated to the EPA SCRIBE data management system. The draft DMP is currently being reviewed by EPA.

The major objectives of the DMP are to:

- Maintain data control, consistency, reliability, and reproducibility throughout the life of the project;
- Establish the framework for consistent documentation of the quality and validity of field and laboratory data compiled during all investigations;
- Describe in detail the data management procedures for all site-related data including groundwater, surface water, soil, sediment, air, biological, toxicological, and any other site-specific data collected;
- Describe how these new data will be integrated and comprehensively managed with previously collected and historical data; and
- Include procedures and timelines for sharing data with stakeholders, and procedures for providing both electronic and hardcopies to specified recipients of each type of data.

Figure 4 is a simplified illustration of the data management process.

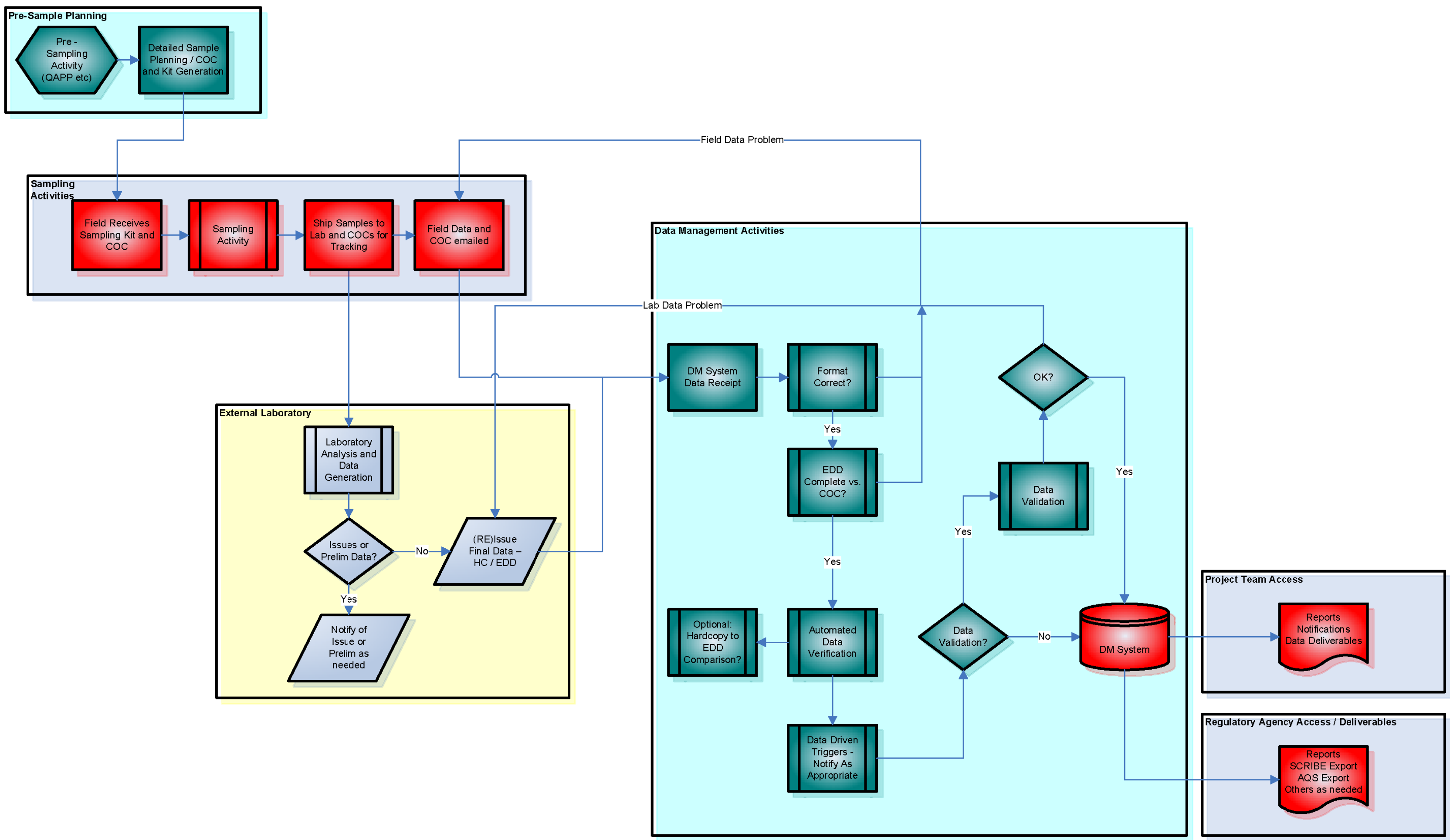


Figure 4. TVA KIF Data Management Process
Updated 07/22/2009

7.0 Sampling Procedures

As previously referenced in this plan, TVA prepared and issued a draft FSP that is currently under review by EPA Region 4 and TDEC.

Appendix A of the TVA FSP includes the TVA SOPs that have been developed and implemented for the KIF Ash Recovery Project. The SOPs are based on EPA Region 4 and TDEC procedures. The procedures that will be utilized to this Surface Water Monitoring Plan include the following:

- Standard Operating Procedure for: Surface Water Sampling, TVA-KIF-SOP-01
- Standard Operating Procedure for: Field Documentation, TVA-KIF-SOP-06
- Standard Operating Procedure for: Sample Labeling, Packing, and Shipping, TVA-KIF-SOP-07
- Standard Operating Procedure for: Decontamination of Equipment, TVA-KIF-SOP-08
- Standard Operating Procedure for: Field Quality Control Sampling, TVA-KIF-SOP-11
- Standard Operating Procedure for: Hydrolab Datasonde® Standardization and Field Parameter Measurement

The sample/data collection for implementing this plan will be in accordance with these procedures.

8.0 Quality Assurance/Quality Control

As previously referenced in this plan, TVA prepared and issued a draft QAPP that is currently under review by EPA and TDEC. The QAPP details the requirements for the performance of all field sampling and laboratory analyses in support of the TVA KIF Ash Recovery Project objectives. It also identifies the roles and responsibilities of TVA and contractor staff who implement the QAPP requirements. Embodied within the QAPP are the fundamental elements that ensure project objectives are met. These include:

- Data collection activities are documented in sampling and analysis plans.
- Field sampling and data plans are implemented following standard procedures.
- Field personnel are trained to the procedures.
- Independent assessments are performed and documented to ensure adherence to procedures in the field and to identify opportunities for continuous improvement.
- Sample analyses are performed by laboratories qualified to national standards.

- Periodic independent audits are performed on laboratories to ensure adherence to procedures and good practices.
- Data deliverables include the necessary documentation to perform independent, third-party validation of data in accordance with EPA national functional guidelines.
- Data are validated in accordance with EPA national functional guidelines.
- Data are managed in a controlled environment that also provides flexibility for data use and interpretation.

The primary goal of TVA's QA program is to generate defensible analytical data to characterize the extent of the fly ash deposition, to monitor the spill containment and removal and remedial operations, and to assess the potential short-term and long-term health hazards and biological impact. The QA program ensures that the data generated from site-wide sampling and monitoring activities are of sufficient quality to meet the objectives of the TVA KIF Ash Recovery Project. The scope of this document is to provide the appropriate QA procedures and QC measures to be applied to all sampling and monitoring activities associated with the TVA KIF Ash Recovery Project and to address the following items:

- QA objectives.
- Laboratory procedures.
- Sample collection, handling, and preservation.
- Sample analysis, data reduction, validation, and reporting.
- Internal QC checks.
- QA performance and system audits.
- Preventive maintenance procedures and schedules.
- Data assessment procedures, including processing, interpretation, and presentation.
- Corrective actions.
- QA reports to management.

Key references upon which the TVA QAPP is based include the following:

- *US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. US EPA Region IV, November 2001.
- *Quality Management Data Plan for EPA Region 4, Revision 2.* US EPA Region IV; May 2003.
- *US EPA Region IV Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services, Revision 2.1.* US EPA Region IV; July 1999.
- *Test Methods for Evaluating Solid Waste, Physical and Chemical (SW-846), 3rd Edition including Final Update IV*. US EPA; November 2000.
- US EPA 40 CFR Part 136 Final Methods Update Rule. US EPA; March 2008
- *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (Inland Testing Manual) http://www.epa.gov/waterscience/itm/itmpdf.html *National Functional Guidelines for Inorganic Data Review.* US EPA; October 2004.
- *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations – Chemical Evaluations*. US EPA; 1995.

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Attachment 1
TVA Kingston Ash Recovery Project
Standard Operating Procedures
For
Surface Water Sample Collection

Attachment 1
TVA Kingston Ash Recovery Project
Standard Operating Procedures
For
Surface Water Sample Collection

STANDARD OPERATING PROCEDURE FOR:

SURFACE WATER SAMPLING

TVA-KIF-SOP-01

Prepared by
Environmental Standards, Inc.

for

Tennessee Valley Authority
Office of Environment and Research
Environmental Resources and Services

March 2009

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe methods that will ensure that representative samples of surface water are collected around Kingston Fossil Plant (KIF), that appropriate documentation is maintained, and that samples are properly preserved.

The procedure is applicable to sampling surface waters in ponds, rivers, and streams in the areas surrounding KIF.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The site-specific health and safety plan (HASP) provides a description of potential hazards and associated safety and control measures.

Sampling personnel who must enter the water shall remain downstream of the sampling location. The appropriate level of personal protection equipment (PPE) shall be worn at all times when entering the water as defined in the site-specific Health and Safety Plan (HASP). In general, personnel should not wade into flowing water when the product of depth (in feet) and velocity (in feet per second) equals 10 or greater ("rule of thumb" from U.S. Geological Survey [USGS]). If flow data are unavailable, personnel shall not exceed a water depth of knee height. Every attempt shall be made to utilize a sampling device such that personnel entry into the water body is avoided. For sample locations that are a considerable distance from the shoreline, a boat, barge, dock, or bridge may be employed for sampling. Water safety hazards and associated precautions shall be thoroughly considered and understood prior to conducting sampling activities in the vicinity of surface water.

Surface water samples will be collected at locations that are most likely to be impacted based on factors such as source, drainage patterns, and environmental features of concern or as specified in project work control documents. Surface water samples will be collected prior to the collection of sediment, benthic, or fish samples to avoid contamination of the sample by agitation of the bottom sediments. Consideration shall be given to using a container large enough to collect samples for both field and laboratory analysis. Surface water sampling guidance can be found in the Tennessee Department of Environment and Conservation (TCEC) document *Quality System Standard Operating Procedure (SOP) for Chemical and Bacteriological Sampling of Surface Water.*

Field sampling equipment shall be decontaminated in accordance with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08) prior to use.

Surface waters generally fall into either of two categories—flowing surface waters or still / stagnant waters. Surface water samples will generally be listed as grab or composite samples. Specific considerations associated with sampling each type of surface water encountered are discussed in the following sections.

The following devices are generally used for surface water sampling:

- Laboratory-cleaned sample bottle,
- Peristaltic pump and associated tubing,
- Kemmerer depth sampler,
- Extended pond dipper sampler,
- Water bottle sampler,
- Automated composite sampler (such as ISCO brand), and
- Handheld or portable Global Positioning System (GPS), to identify sample location.

3.0 PROCEDURES

The following sections describe the procedures for sampling surface waters. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting sampling activities. If the immediate supervisor cannot rectify the circumstances leading to the deviation, then the immediate supervisor shall contact the Quality Assurance/Quality Control (QA/QC) Lead to-determine if the deviation is acceptable from the standpoint of effecting data reliability. If the deviation is not acceptable to the QA/QC lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the field logbook.

3.1 Pre-Job Preparation

The Field Team Leader will ensure that the following activities have been completed prior to leaving for the water sampling site.

a. Obtain equipment necessary for completing the sampling activities such as Kemmerer depth sampler, peristaltic pump and associated tubing, automated composite sampler, or equivalent equipment.

b. Obtain appropriate sample bottles both for the required sample analyses and the required quality control (QC) sample analyses. In addition, confirm that the analytical laboratory has been contacted and is prepared to receive the samples.

c. If sampling is conducted on personal property, provide the TVA Project Manager with the schedule for sampling and verify that site/sampling area access and legal right-of-entry have been obtained, where required.

d. Review the Field Sampling Plan (FSP), site-specific Quality Assurance Project Plan (QAPP), HASP, and appropriate SOPs with the TVA Project Manager to determine specific sampling requirements. In general, the equipment listed on the Equipment Checklist provided in Table 1 will be adequate for small bodies of water; however, a boat or other specialized sampling equipment may be necessary to obtain samples from large water bodies.

e. Obtain appropriate site maps. If the site maps do not have surface water sampling locations already indicated, review sampling locations with the TVA Project Manager and mark maps appropriately. Identify location (that is, GPS coordinates) and staking requirements as applicable.

3.2 Field Preparation

Upon arrival at the site, the Field Team Leader will identify the field team to the property owner, if present.

a. Set up a centralized decontamination facility/area at the KIF property away from potentially contaminated areas (if possible). Specialty needs for on-site decontamination activities that necessitate a separate decontamination area will be addressed on a site-specific basis. Decontaminate reusable sampling equipment that will contact the sample matrix prior to use in accordance with *Decontamination of Equipment* SOP (TVA-KIF-SOP-08).

b. If necessary, obtain both potable and deionized (DI) water for decontamination and ensure that sufficient quantities are available to accommodate the work. Record the water source in the field logbook.

3.3 Sampling Flowing Surface Waters (Rivers, Streams, or Drainage Ditches)

Project-specific requirements may necessitate a specific sampling location; in general, however, the preferable sampling location of flowing water bodies is where the water is well mixed laterally and vertically. These locations are characterized by fast moving or turbulent waters. Sites immediately below riffle areas are generally representative of the entire flow.

In the case of calmer waters, the preferred sampling location is the area of highest flow rate.

a. Begin by selecting the farthest downstream sampling location. In general, collect downstream samples first, followed by upstream samples to minimize the disturbance of bottom sediments and potential downstream sample locations.

b. Collect a single sample at mid-depth and the mid-point of the main current, conditions permitting, for most streams where there is good lateral and vertical mixing.

3.3.1 Grab (or Discrete) Sample Collection

When the collection of a discrete sample at a certain depth is required, a Kemmerer depth sampler or Peristaltic pump and associated tubing should be used. A Kemmerer depth sampler is comprised of an open tube that is allowed to float between its top and bottom caps. At a desired sample depth, a weighted messenger is sent down the associated towline compressing the top cap into the tube and into the bottom cap, thereby closing the sample tube on both ends. A Peristaltic pump is comprised of a flexible tube fitted inside a circular pump casing (though linear peristaltic pumps have been made). A rotor with a number of "rollers" attached to the external circumference compresses the flexible tube. As the rotor turns, the part of tube under compression closes, thereby forcing the fluid to be pumped to move through the tube.

3.3.1.1 Kemmerer Depth Sampler

a. Lower the Kemmerer depth sampler to the appropriate depth.

b. Once at the desired depth, use the weighted messenger or similar trigger to close the sampling device.

c. Filter the samples collected for dissolved metals analysis using a 0.45-μ filter.

d. Fill the appropriate certified-clean bottleware.

3.3.1.2 Peristaltic Pump Sampling

a. For inorganic sampling, use new certified-clean disposable Silastic®, Teflon®, Tygon®, or equivalent tubing.

b. Use dedicated tubing and inert weights at each sampling location. Change dedicated tubing monthly (<32 days) or when visual indications of stains are observed or there are indications of contamination from equipment blanks.

c. Lower the weighted Peristaltic pump tubing to the appropriate depth.

d. Once at the desired depth, turn on pump and begin purging for approximately one to two minutes before sampling.

e. Filter the samples collected for dissolved metals analysis using a 0.45-μ filter.

f. Fill the appropriate certified-clean bottleware.

3.3.1.3 Water Bottle Sampler

A water bottle sampler may be used to collect surface water samples at a limited depth or at the surface.

When the laboratory-supplied sample bottle is unpreserved, proceed as follows.

a. Lower the capped unpreserved sample container to the desired depth oriented so that the capped end of the bottle faces downstream to minimize potential entrainment or debris into the sample.

b. Remove the cap allowing the sample container to fill.

c. Replace the cap and remove the container from the water.

When using sample bottles containing preservatives, first fill a separate, clean, unpreserved bottle as defined in steps a through c above, then follow step below.

d. Immediately decant from the clean, unpreserved bottle into the sample bottle containing preservative.

Any of the following field conditions may necessitate the collection of a surface grab sample: when stream velocity is such that penetration to depth is not easily obtained, when surface sheen/film is identified, when low water exists, or when a sample from the upper surface of the water body is required.

Note: If a surface film is suspected (or visible), the surface of the water will be sampled by gently lowering the sample bottle horizontally into the water with the mouth of the bottle directed upstream, taking reasonable measures to avoid suspended/floating debris.

3.3.2 Composite (or Time-Weighted) Sample Collection

When the collection of a sample will be used to characterize general water-quality bracketing a period of time, an automated composite sampler can be used.

a. Determine total sample time, total sample volume, and time between aliquots (sub-samples) when programming automated composite samplers are used to obtain a representative time-weighted sample.

b. Once all sample aliquots have been collected, combine the water from the individual sub-sample containers into a clean composite container.

c. Decant water from the composite sample container into the laboratory sample container. If a significant amount of time exists between the first and last sub-sample, swirl the composite container lightly prior to sample collection to aid in mixing of stratification that may have occurred.

d. To create composite samples, combine sub-samples collected at varying locations.

e. Filter the samples collected for dissolved metals analysis using a 0.45-μ filter.

f. Fill the appropriate certified-clean bottleware.

3.4 Sampling Still or Stagnant Waters (Ponds)

Project-specific requirements may necessitate a specific sampling location; in general, however, when sampling still or stagnant waters, it is important to collect a "vertical" sample of the water because still waters have a greater tendency to stratify than rivers or streams. A sample will be collected near the bottom of the body of water (without disturbing the sediment).

If the pond is so large that the sample location cannot be reached from the bank, it may be necessary to use a small boat to reach the sampling area. Gentle rowing in a small boat will cause less sediment disturbance than wading through the pond.

3.4.1 Grab (or Discrete) Sample Collection

Grab samples can be collected using a Peristaltic pump and associated tubing, Kemmerer depth sampler (or similar device), or clean sample bottle. Refer to Section 3.3.1 of this SOP for details on the use of the selected sample device.

3.4.2 Composite (or Time-Weighted) Sample Collection

Procedures for collecting samples from still/stagnant waters are similar to the procedures for samples collected from flowing surface waters. Composite sample collection methods are described in Section 3.3.2 of this SOP.

3.5 Sample Collection from a Vessel

It will be necessary, in some cases, to use a vessel (boat or barge) to collect surface water samples. Sampling devices used to collect surface water samples from a vessel should be selected by considering the depth of the sample and the flow of water above the sample depth. Usually, manual grab equipment cannot be used for off-shore sampling.

a. Make sure that the sampling vessel is registered for use in the state in which it will enter a body of water.

b. Predetermine sampling locations and reference in project-specific documentation. Record the sampling locations and mark with either a buoy or GPS device.

c. If buoys are used, navigate the sampling vessel to the buoy and tie the vessel to the buoy. (The buoys will be set in a manner that will hold the boat within approximately 10 feet of the sampling location.)

d. When buoys are not used, navigate the sampling vessel to the coordinates stored in the GPS unit. Use an anchor (or spuds if available) in a manner that will hold the sampling vessel within approximately 10 feet of the target coordinates.

e. If anchors or spuds are used, allow five minutes to elapse before commencing sampling to allow any suspended solids to settle downstream.

Note: Field conditions may be such that anchoring or using spuds is not effective (such as rock bottom or high-flow velocity). At these locations, the vessel's engine should be used to maintain position over the sampling location.

3.6 Collection of Field Measured Water-Quality Parameters

Field-measured water-quality parameters (such as temperature, dissolved oxygen, pH, conductivity, or turbidity) may need to be measured. These parameters should be measured in the field, as a grab sample, using a multi-analyte programmable data logger (Hydrolab® or equivalent). There are a variety of water-quality data loggers available that measure the water-quality parameters identified above. It is preferred, but not required, to utilize one water-quality data logger capable of measuring each of the water-quality parameters identified in the work plan. The field personnel should be familiar with the data logger and should reference the user's manual of the data logger for familiarity.

a. Calibrate the instruments used to measure water-quality parameters in accordance with the instruments' manufacturer recommendations by following the calibration procedures specified in the instruction manual.

b. Document calibration procedures including calibration solutions used, expiration date(s), lot numbers, and calibration results in the project field logbook.

c. Collect field-measured water quality parameters from the same location and depth as the sample location for laboratory analysis.

d. Collect field measurements *in-situ* by deploying the data logger to the desired sample location (except for turbidity).

e. Allow a one- to two-minute equilibration period following the data logger deployment.

f. Record the measurements in the field logbook.

3.7 Sampling Site Field Location

Each sample collection location must be demarcated in the field using stakes, flagging tape, or GPS for general location and future sampling purposes. The sample collection device shall be placed on the upstream left bank for consistency purposes. If it is deemed not appropriate to field locate the sampling location(s) by GPS, a concise descriptive location and sketch map of the sampling location(s) must be included in the field logbook or site map, as appropriate.

3.8 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, will be maintained by the Field Team Leader. Information will be entered into the field logbook by the appropriate field team member using waterproof ink. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks should document those sampling characteristics specific to this SOP and as defined in the applicable project work control documents.

The Field Team Leader and/or designee will review the field logbook entries on a weekly basis (at a minimum - daily review is preferred) for completeness and accuracy and indicate this review by initialing the entries. As specified in the FSP, the Field Team Leader is also responsible for the completion of all required data collection forms.

3.9 Collection of Field Quality Control Samples

Field Quality Control (QC) samples include DI blanks, duplicate samples, and split samples. The purpose of the DI blank is to evaluate the quality of the DI water used during decontamination of the sample collection bottleware and the cleanliness of the laboratory-provided bottleware. The required frequency and protocols for field QC samples are presented in the project QAPP.

3.10 Sample Handling, Packing, and Shipping

Samples will be marked, labeled, packaged, and shipped in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

3.11 Decontamination and Waste Management

All sampling equipment will be decontaminated in a manner consistent with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08). Decontamination procedures shall be documented in the field logbook. Investigation-derived wastes produced during sampling or decontamination will be managed in accordance with *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12).

4.0 REFERENCES

- Tennessee Department of Environment and Conservation (TDEC), *Quality System Standard Operating Procedure (SOP) for Chemical and Bacteriological Sampling of Surface Water*; Division of Water Pollution Control. 2008
- Tennessee Valley Authority (TVA). *Decontamination of Equipment* SOP (TVA-KIF-SOP-08), February 2009.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), March 2009.
- TVA. *Field Sampling Plan* (FSP), TVA, 2009.

- TVA. *Health and Safety Plan* (HASP), Kingston site-specific plan, 2009.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), March 2009.
- TVA. *Quality Assurance Project Plan* (QAPP), TVA, 2009.
- TVA. *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), March 2009.
- U.S. Geological Survey. *National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations*, Book 9, Chapters. A1-A9, variously dated, http://pubs.water.usgs.gov/twri9A.

Table 1: Surface Water Sampling Equipment and Materials Checklist

Item Description	Check
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Barricades, cones, flashing lights, signs (if sampling from a bridge)	
U.S. Coast Guard-approved flotation device	
Sufficient length of rescue line	
Hip waders	
Life preserver (if sampling from boat/barge)	
Paperwork	
Health & Safety Plan	
Project work control documents	
Location map, field data from previous sampling events	
Field logbook	
Chain-of-custody forms and custody seals	
Equipment/Materials	
Surface water sampling devices: • Peristaltic pump and associated tubing • Kemmerer Depth Sampler • Manual or Composite Sampler (and instruction manual) • Water bottle sampler	
Laboratory-supplied bottleware	
Laboratory-supplied bottleware with preservatives	
Decontamination and Waste Management Equipment	
Deionized water	
Buckets or tubs	

End of Procedure

STANDARD OPERATING PROCEDURE FOR:

FIELD DOCUMENTATION

TVA-KIF-SOP-06

Prepared by

Environmental Standards, Inc.

for

Tennessee Valley Authority

Office of Environment and Research

Environmental Resources and Services

March 2009

1.0 PURPOSE

This standard operation procedure (SOP) describes the requirements associated with documenting Kingston Fossil Plant (KIF) field investigation and remediation activities. The procedures described in this SOP are applicable to field logbooks, sample labels, and chain-of-custody documentation.

2.0 GENERAL CONSIDERATIONS

Proper documentation of field activities is a crucial part of the field investigation and remediation process. Documentation must be maintained to trace the possession and handling of samples from the time of collection through submittal to the laboratory, to allow sampling locations to be located in the future, to record sampling methods and equipment, and to identify field personnel responsibilities (among other important information). Field documentation procedures are important both from both a technical and a legal perspective.

In addition, this procedure further describes the actions and protocols for field data entry into the field logbooks. These protocols are not typically discussed in recent regulatory guidance concerning field investigation activities because they were addressed in detail during early policy development periods of the environmental industry. Some examples of the early U.S. Environmental Protection Agency (EPA) publications that address field documentation are listed below.

- A Compendium of Superfund Field Operations Methods
- Compliance-Focused Environmental Management System - Enforcement Agreement Guidance
- Contract Laboratory Program Guidance for Field Samplers
- Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Guidance for Performing Preliminary Assessments Under CERCLA
- Guidance for Performing Site Inspections Under CERCLA
- Logbook Operating Procedure

The complete references for these documents are provided in Section 4.0 of this SOP.

3.0 PROCEDURES

The following sections describe the procedures for field documentation. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting field activities.

3.1 Field Logbook

Each field crew conducting sampling activities shall maintain a field logbook to document the activities conducted by the field crew every day that field work is conducted. At a minimum, the following information shall be recorded in the field logbook:

- Name and location of the site,
- Date(s) of sample collection or event,
- Name and affiliation of the Field Team Leader,
- Names of field team members and responsibilities,
- Daily time of arrival to the site,
- Daily weather conditions,
- Pertinent field observations,
- Daily summary of equipment preparation procedures, if appropriate,
- Time of sample collection,
- Numbers and types of samples collected and sample identification numbers,
- A description of sampling methodology by reference to the project control documents (such as TVA's Field Sampling Plan, Quality Assurance Project Plan, and SOPs),
- Specific sampling characteristics (such as depth, temperature, turbidity, etc.) as outlined in specific work control documents,
- Physical description and sketch of the sample collection location(s),
- Provide a reference to Global Positioning System (GPS) data collected, if applicable,
- Record of daily phone calls and/or contact with individuals at the site, and
- Management or disposal of investigation-derived wastes.

Key procedures of field documentation described in the reference documents (see Section 4.0) and other pertinent documents are provided below.

a. Ensure logbooks are bound.

b. Consecutively number each page of the logbook.

c. Make entries into the logbook chronological so that a time notation introduces each entry.

d. Use only indelible ink for logbook entries.

e. Record data directly and legibly in the field logbook.

f. Line out errors in the logbook (a single line strike-through) and initial and date the correction.

g. Avoid leaving any blank line(s) between logbook entries. Cross out any blank spaces that exist with a single line and initial and date the cross out.

h. Sign and date each page of the logbook (field team member responsible for keeping the logbook).

Field documentation is a crucial element of field activities and, therefore, field crew members shall strictly adhere to logbook entry protocol. Field logbook entries shall include the information requested in the project control documents and shall be recorded in a manner consistent with this procedure.

3.2 Sample Labels

Sample labels should include the unique sample ID and sample location, parameter sampled, date and time sampled, sampler's initials, preservative, and site name or location. Sample containers must be pre-labeled with as much of this information as possible before departing for the field. Any remaining information (such as sample time) should be filled out immediately prior to sample collection. Once the labels are completely filled out, cover the labels with clear tape (prior to sample collection).

When completing sample labels, field personnel should employ the applicable field documentation techniques described previously for field logbooks.

3.3 Chain-of-Custody Documentation

The Chain-of-Custody (COC) form is intended to be a legal record of possession of samples for laboratory analysis. The COC will be created during pre-job preparations using the Sample Planning Module (SPM) of Equis®. The COC will be provided to the field sampling personnel prior to sampling activities and should accompany the sample bottles through transport to the field site. The COC should be completed by the field sampling personnel at the time of sample collection and should bear the name of the person responsible for the secure and appropriate handling of the samples.

The Field Team Leader should maintain the COC during sample collection activities. The following is the minimum information required for COC documentation:

- Name and location of the site,
- Name and affiliation of samplers,

- Sample identification number,
- Date and time of sample collection,
- Matrix and type of sample collected (such as grab or composite),
- Number of containers per sample,
- Preservatives and fixatives,
- Parameters to be analyzed,
- Identification of couriers, and
- Identification of laboratory.

When completing COCs, field personnel shall employ the applicable field documentation techniques described previously for field logbooks. Blank spaces should be lined through unless it is obvious from the nature of the form that they may be left blank or are intended to be utilized during a subsequent step of the shipping and receiving process.

3.4 Field Records Management

Records associated with field sampling must be managed in accordance with TVA document GLP-0002 *Records Management*.

In addition to the original COC that accompanies each sample shipment, a copy of each COC must be provided to Project Files. A working copy of the COC shall be retained in working files in the field sampling work area for reference. The Field Sampling Manager will maintain a list of people requiring courtesy copies of the COC. Courtesy copies may be distributed by either hard copy (mail) or electronic copy (email) and shall be distributed the next working day after sample collection.

The receiving laboratory may provide a completed copy of the COC as part of data deliverables or as part of routine sample receipt notification (usually by email). A copy released as part of data deliverables will become part of Project Files. Any electronic copy may be printed and retained as a working copy in the field sampling work area for reference (such as a cross-reference to the laboratory identifier).

Field logbooks shall have a unique identifier and shall have pre-numbered pages. Logbooks that are carried into the field shall have completed pages copied to Project Files on at least a weekly basis so that loss or accidental destruction in the field will involve a minimum of lost data. The copies shall be reviewed to ensure they are entirely legible. Filled logbooks, once completely duplicated to Project Files, may be retained in the field sampling work area for reference. The copy in Project Files becomes the primary record, and the filled logbook becomes a working copy. At the end of the project, the field logbooks shall also be filed in Project Files.

4.0 REFERENCES

- Tennessee Valley Authority (TVA). *Field Sampling Plan* (FSP), 2009.
- TVA. *Quality Assurance Project Plan* (QAPP), TVA, 2009.
- TVA. *Records Management*, TVA GLP-0002.
- U.S. EPA. *A Compendium of Superfund Field Operations Methods*. Office of Solid Waste and Emergency Response. Directive 9355.0-14, 1987. http://www.hanford.gov/dqo/project/level5/Sfcompnd.pdf.
- U.S. EPA. *Compliance-Focused Environmental Management System - Enforcement Agreement Guidance*. National Enforcement Investigations Center. EPA-330/9-97-002R, 2005. http://www.epa.gov/oecaerth/resources/policies/neic/cfems_05.pdf.
- U.S. EPA. *Contract Laboratory Program Guidance for Field Samplers*. Office of Superfund Remediation and Technology Innovation. OSWER 9240.0-44, EPA 540-R-17-06, July 2007: http://www.epa.gov/superfund/programs/clp/download/sampler/clp_sampler_guidance.pdf.
- U.S. EPA. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Office of Solid Waste and Emergency Response. Directive 9355.3-01, 1988. http://www.epa.gov/superfund/policy/remedy/pdfs/540g-89004-s.pdf.
- U.S. EPA. *Guidance for Performing Preliminary Assessments Under CERCLA*. Office of Solid Waste and Emergency Response. Directive 9345.0-01A, 1991. http://www. epa.gov/superfund/sites/npl/hrsres/#PA%20Guidance.
- U.S. EPA. *Guidance for Performing Site Inspections Under CERCLA*. Office of Solid Waste and Emergency Response. Directive 9345.1-05, 1991. http://www.epa.gov/ superfund/sites/npl/hrsres/#PA%20Guidance.
- U.S. EPA. Region 4, *Logbook Operating Procedure*. Document # SESDPROC-010-R3, November 2007.

End of Procedure

STANDARD OPERATING PROCEDURE FOR:

SAMPLE LABELING, PACKING, AND SHIPPING

TVA-KIF-SOP-07

Prepared by

Environmental Standards, Inc.

for

Tennessee Valley Authority

Office of Environment and Research

Environmental Resources and Services

March 2009

1.0 PURPOSE

This standard operating procedure (SOP) provides the general technical requirements and operational guidelines for the proper labeling, packing, and shipping of environmental samples to a laboratory for analysis for Kingston Fossil Plant (KIF). These procedures have been developed to reduce the risk of damage to the samples (such as breakage of the sample containers) and to maintain sample temperature (as required) within the cooler. This SOP includes the guidance and regulatory requirements that ensure proper labeling, packing, and shipping of environmental samples classified as "hazardous material" and "dangerous goods" in accordance with the following documents (see Section 4.0 for full reference).

- 49 Code of Federal Regulations (CFR) Parts 171-180
- U.S. Department of Transportation (DOT)
- International Air Transport Association (IATA) standards as detailed in the most current edition of the IATA Dangerous Goods Regulations
- International Civil Air Organization (ICAO) Technical Instructions
- International Maritime Organization (IMO)
- International Maritime Dangerous Goods (IMDG) Code

IATA and ICAO regulations apply strictly to commercial air transportation - both domestic and international. The IMDG regulations apply to the international transport of dangerous goods by waterway. DOT regulations apply to domestic and international shipments originating in or imported to the United States.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks should be thoroughly evaluated prior to conducting field activities. The site-specific Health and Safety Plan (HASP) provides a description of potential hazards and associated safety and control measures.

Protocols for sample temperature maintenance and sample packing will be applicable to collection of samples year-round or as otherwise specified. The intent is to ensure that samples arrive at the laboratory in good condition—both physically intact and appropriately preserved.

3.0 PROCEDURES

The following sections describe the procedures for sample labeling, packing, and shipping. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure.

3.1 Pre-Job Preparation

The Project Manager is responsible for overall implementation of this procedure and ensuring that it complies with current regulations and standards since the regulations and standards may be periodically revised.

a. Check with the Field Team Leader regarding the equipment required, sample types and preservatives, and anticipated range of contaminant concentrations.

b. Obtain labeling, packing, and shipping materials as listed in the example checklist provided in Table 1; the field logbook; and copies of the Quality Assurance Project Plan (QAPP), site-specific HASP, and Field Sampling Plan (FSP).

c. Verify methods to be used to transport materials (such as the contractor's courier or commercial driver). Identify the telephone numbers, locations, and any special requirements of couriers that are used.

d. Prepare DOT paperwork in advance where practical.

3.2 Sample Labeling

Sample containers must be pre-labeled before sample collection, and the labels should be protected from the sample matrix with a clear tape covering. For instances when labeling errors have occurred, a Sharpie or Rite-in-the-Rain pen shall be used to write the correct information over the clear tape. Sample labels should include the unique sample ID, location code, parameter sampled, date and time sampled, sampler's initials, preservative, and site name or location.

3.3 Sample Temperature Maintenance

In order to facilitate preservation of samples, samples requiring preservation by chilling should be cooled to an appropriate temperature (<6°C) and maintained at this temperature from the point of collection through transport and receipt at the laboratory. To achieve this chilling and temperature maintenance, the procedures listed below should be followed for samples collected from May through September (or during warm periods of other months).

a. Prepare an ice bath(s) prior to sample collection. Obtain ample amounts of ice and potable water and place the ice and water in a container large enough to accommodate several sample jars (for example, a 5-gallon bucket or sample cooler). Depending on the number of sample containers anticipated, more than one ice bath may be necessary.

b. Place trip blank vials (as appropriate) and the temperature blank bottle (sealed in Ziploc® bags) in the ice bath immediately after preparation. Whenever possible, locate the ice bath(s) out of direct sunlight or other sources of heat. Label the trip blank bottles in accordance with Section 3.2 of this SOP.

c. Immediately after sample collection, wipe off each container and place each container individually in an appropriately sized Ziploc® bag (however, up to three 40-mL vials can be placed in one bag). Place the sealed samples in the prepared ice bath. Place samples in the ice bath such that bottles will not be broken. Avoid placing too many containers in an ice bath at one time.

d. Allow samples to remain in the ice bath for a minimum of 30 minutes in order for the samples to be sufficiently chilled. After icing, remove the samples and place in a dry cooler containing sufficient amounts of ice in order to maintain the samples in a chilled condition. Allow samples to remain in the iced cooler until preparations are made for packing the samples for shipment.

e. Place samples that do not requiring icing in a cooler with sufficient packing material to immobilize the samples during shipment.

3.4 Sample Packing

Environmental samples shall be collected as outlined in the Standard Operating Procedures (SOPs) for *Surface Water Sampling* (TVA-KIF-SOP-01), *Groundwater Sampling* (TVA-KIF-SOP-02), *Potable Water Supply Sampling* (TVA-KIF-SOP-03), *Soil Sampling for Inorganic Analysis* (TVA-KIF-SOP-04), and *Sediment Sampling* (TVA-KIF-SOP-05).

The following is a summary of steps required for packing the samples for shipment.

a. Collect samples in the laboratory-specified container and complete the sample identification information on the label as described in Section 3.1 prior to sampling.

b. Seal individual sample jars in re-sealable plastic bags, chill in an ice bath, if necessary (see Section 3.3), and place in coolers. Place the temperature blank in the center of the cooler.

c. Place bubble wrap or other inert packing material around the bags in the cooler. Place ample amounts of wet ice (approximately 10 pounds) contained in doubled zip-lock bags in the cooler.

d. Place the completed Chain-of-Custody (COC) form in a large re-sealable plastic bag and tape to the inside lid of the cooler. Write the shipper's tracking number (such as courier and courier airbill number) on the COC form when a commercial courier is used. If multiple coolers are needed, a copy of the original COC form should accompany each cooler that contains the samples identified on the COC.

e. Tape the cooler closed with strapping tape and seal with custody tape on two sides such that opening the cooler will break the custody tape.

3.5 Shipping Procedures for Environmental Samples

A transportation subject matter expert should be consulted to determine the proper shipping category for samples—either "non-hazardous material" or "hazardous material or dangerous goods." Once the sample category has been determined, the following steps shall be followed.

3.5.1 Environmental Samples Shipped as **Non-Hazardous** Material

Environmental samples should be shipped as non-hazardous material unless the samples meet the established DOT criteria for a "hazardous material" or the International Air Transport Association, ICAO Technical Instructions, and IMDG Code definition of "dangerous goods" (see Section 3.5.2). When preparing the cooler for shipment, all labels from the outside of the container should be removed. When completing the paperwork for shipment, the standard non-hazardous shipping forms provided by the courier should be completed.

3.5.2 Environmental Samples Shipped as **Dangerous Goods** or **Hazardous Material**

DOT, IATA, and IMDG regulations governing the shipment of hazardous materials and dangerous goods must be followed. These regulations (49 CFR Parts 171 - 180 and the Dangerous Goods Regulations (DGR) for IATA and IMDG) describe proper marking, labeling, placarding, packaging, and shipping of hazardous materials. IATA regulations apply strictly to both domestic and international commercial air transportation. The IMDG regulations apply to the international transport of dangerous goods by waterway. DOT regulations apply to domestic and international shipments originating in or imported to the United States.

The definitions of dangerous goods and hazardous materials, as defined by IATA, IMDG and DOT, respectively, are presented below.

Dangerous Goods – "Articles or substances which are capable of posing a significant risk to health, safety, or to property when transported by air and which are classified according to the UN hazard classes".

Hazardous Material – "A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials."

Quantities of certain dangerous goods may be transported as "Small Quantity Exception" or "Limited Quantity Exception."

Shippers and transporters of hazardous materials or dangerous goods are required to have specialized training (DGR, 1.5.0.2 and 49 CFR Part 172, Subpart H). Hazardous material or dangerous goods should only be shipped by appropriately trained personnel.

3.6 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, will be maintained by the Field Team Leader. Information will be entered into the field logbook by the appropriate field team member. Entries will be made in waterproof ink.

In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks should document the following shipping activities:

- Method of transportation,
- Courier tracking number,
- Material shipped (for example, sample ID numbers) associated with each courier tracking number, and
- Date shipped.

The shipper's copies of the manifest or the shipper's copy of the courier's airbill should be retained in the central data management files.

4.0 REFERENCES

- International Air Transport Association (IATA). *Dangerous Goods Regulations*, 49th Edition, Montreal, 2008.
- International Civil Aviation Organization (ICAO). *The ICAO Technical Instructions on the Safe Transport of Dangerous Goods by Air,* 2007 - 2008 Edition.
- International Maritime Organization (IMO). *International Maritime Dangerous Goods Code*, 2006 Edition.
- Office of the Federal Register, National Archives and Records Administration, 49 CFR Parts 171-179, US Government Printing Office, Washington, DC, 2006.
- Tennessee Valley Authority (TVA). *Field Documentation* SOP (TVA-KIF-SOP-06), March 2009.
- TVA. *Field Sampling Plan* (FSP), TVA, 2009.
- TVA. *Groundwater Sampling* SOP (TVA-KIF-SOP-02), March 2009
- TVA. *Health and Safety Plan* (HASP), Kingston site-specific plan, 2009.
- TVA. *Potable Water Supply Sampling* SOP (TVA-KIF-SOP-03), March 2009
- TVA. *Quality* Assurance *Project Plan* (QAPP), TVA, 2009.
- TVA. *Sediment Sampling* SOP (TVA-KIF-SOP-05), March 2009
- TVA. *Soil Sampling for Inorganic Analyses* SOP (TVA-KIF-SOP-04), March 2009
- TVA. *Surface Water Sampling* SOP (TVA-KIF-SOP-01), March 2009.
- United States Environmental Protection Agency (EPA). Region 4, *Packing, Marking, Labeling and Shipping of Environmental and Waste Samples Operating Procedure.* Document Number SESDPROC-209-R1, November 2007.

Table 1: Sample Labeling, Packing, and Shipping Equipment & Material Checklist	
Item Description	**Check**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Respirator and cartridges (if necessary)	
Saranex™/Tyvek® suits and booties (if necessary)	
Paperwork	
HASP	
Project work control documents	
Chain-of-custody forms	
Field logbook	
Packing and Shipping Supplies	
Packing Tape	
Custody seals/tape	
Coolers	
Ice	
Permanent Markers	
Shipping Labels	
Ziploc® bags (gallon and pint sizes)	
Shipping forms (or courier forms)	
Scale	
IATA Dangerous Goods Regulations Manual	

End of Procedure

STANDARD OPERATING PROCEDURE FOR:

DECONTAMINATION OF EQUIPMENT

TVA-KIF-SOP-08

Prepared by

Environmental Standards, Inc.

for

Tennessee Valley Authority

Office of Environment and Research

Environmental Resources and Services

March 2009

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the methods to be used when decontaminating field equipment that has had the potential to contact investigated media (including soil, groundwater, surface water, sediment, and other media) at Kingston Fossil Plant (KIF) in Tennessee. It is important to follow these procedures from a quality control (QC) perspective to ensure that environmental data generated in the field are of the highest quality and are not misrepresented or misinterpreted due to cross-contamination.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks should be thoroughly evaluated prior to conducting KIF field activities. The site-specific Health and Safety Plan (HASP) provides a description of potential hazards and associated safety and control measures.

Consideration should be given to the order in which the samples are collected. In general, samples should be collected from areas suspected to be least impacted by contamination followed by areas suspected to be most impacted by contamination, thereby minimizing the potential for cross-contamination

Prior to field activities, the field team should consider how investigation-derived waste (such as decontamination fluids) is to be handled.

If containerization of decontamination fluids associated with decontaminating large equipment (such as drilling rigs, backhoes/excavators, *etc.*) is required, it is imperative to ensure that the subcontractor will have appropriate equipment onsite. This equipment may include a portable electric generator and a high-pressure steam-cleaner or steam-jenny. In addition, a decontamination pad or portable containment system should be used to collect fluids. Typical decontamination pads are constructed of polysheeting draped over hay bales or a wooden frame and sloped to accommodate the collection of liquids by sump or other suitable means.

3.0 PROCEDURES

The following sections describe the procedures for decontamination of equipment. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting sampling activities. If the immediate supervisor cannot rectify the circumstances leading to the deviation, then the immediate supervisor shall contact the Quality Assurance/ Quality Control (QA/QC) Lead to determine if the deviation is acceptable from the standpoint of effecting data reliability. If the deviation is not acceptable to the QA/QC Lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the field logbook.

3.1 Pre-Job Preparation

Prior to initiating sampling activities, the Field Team Leader will ensure that the following activities have been completed.

a. Verify that an adequate supply of equipment, solvents, and water (both potable and deionized [DI]) necessary for completing decontamination are available for the planned sampling activities at the site. See Table 1 for an example checklist of decontamination equipment and materials.

b. Obtain the field logbook and copies of the Quality Assurance Project Plan (QAPP), site-specific HASP, and Field Sampling Plan (FSP).

3.2 Field Preparation and Set-up

The field set-up for decontamination will vary depending on the type of equipment to be used as described in the following steps.

a. Establish a centralized equipment decontamination area at KIF for the day-to-day decontamination of general sampling equipment. Set up the decontamination area away from and preferably upwind from areas of remediation, construction, and site operation activities.

b. For decontamination of hand-held sampling equipment, spread plastic sheeting on the ground and place the decontamination tubs and/or buckets and rinse bottles in order of use on top of the plastic. Prepare an ample volume of decontamination solution containing a non-phosphate detergent (such as LiquiNox® detergent solution) and potable water. Record the source of the water in the field logbook.

c. For decontamination of drilling rigs or backhoes/excavators, establish an area for decontamination that will meet the program and site-specific requirements for collection of decontamination fluids. If necessary, set up a decontamination pad as discussed in Section 2.0 at the KIF decontamination area. Conduct gross decontamination (removing general mud, etc. from large equipment) prior to demobilization from the site back to the KIF decontamination area.

3.3 Decontamination

All equipment used for sampling, testing, or measuring, including excavating and drilling equipment, that comes in contact with potentially sampled media will be decontaminated prior to use unless the equipment is prepackaged and sealed by a manufacturer of environmental sampling equipment. Reusable sampling equipment will also be decontaminated between sampling locations. If disposable sampling equipment (clean prepackaged materials) is used, this equipment will not be decontaminated before use and will be disposed of properly after one use. Disposable equipment will not be used at more than one sampling location.

Dedicated sampling equipment, such as individual sampling/purging pumps that are used to sample one well, will be decontaminated prior to the first use, but will not require decontamination between uses at the same well. Dedicated sampling equipment will be secured in clean zip-loc bags between uses and will be replaced monthly (<32 days) or when visual indications of stains are observed or there are indications of contamination from equipment blanks.

The following presents decontamination procedures for manual sampling equipment and heavy equipment.

3.3.1 Manual Sampling Equipment

The following general decontamination steps should be applied to all equipment prior to initial use (unless using clean prepackaged environmental sampling equipment) or that have been utilized to collect sample media for analytical purposes. Site-specific project control documents may specify modifications to these procedures and should be followed when applicable. It is important to note that no acids or solvents will be used to decontaminate any electrical or electronic instrumentation unless specified by the manufacturer.

a. Physically remove visible material from the sampling equipment to the extent practical before decontaminating the equipment with decontamination fluids. If this material appears to be impacted based on visual observation, instrument readings, or other credible indication, collect and manage this material in accordance with the *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP- 012).

b. Immerse (to the extent practicable) the equipment in the detergent solution and scrub the equipment thoroughly with a stiff brush until visible residual material is removed and the equipment is visibly clean. Circulate detergent solution through equipment that cannot be disassembled such as submersible pumps (ASTM, 1990).

c. Rinse the equipment thoroughly with potable water.

d. Rinse the equipment with inorganic desorbing agent such as dilute (10%) reagent grade nitric acid. If samples are not being collected for analysis of inorganic compounds, omit this step (ASTM, 1990).

e. Rinse the equipment thoroughly with potable water.

f. Rinse the equipment with organic desorbing agent (isopropyl alcohol). If samples are not being collected for analysis of organic compounds, omit this step (ASTM, 1990).

g. Rinse the equipment thoroughly with potable water.

h. Rinse the equipment with DI water (use reagent-grade DI water from a known source).

i. To the extent practicable, allow the equipment to air dry in a clean area (equipment does not need to be completely dry before reuse; under certain weather conditions, complete air drying is not possible).

j. Change the initial decontamination solution daily and/or between sites at a **minimum** and more frequently as needed. Collect decontamination solvents in a separate container from water/detergent solutions and properly containerize, store, and dispose of decontamination solutions in accordance with the *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-012).

If decontaminated equipment will not be used immediately, the equipment may be wrapped in aluminum foil (if used for organics only) or sealed in a plastic bag for storage.

Decontamination activities, including date, time, and reagents used, should be documented in the field logbook and decontaminated sampling equipment should be labeled with this information as appropriate.

3.3.2 Decontamination of Heavy Equipment

The following steps for decontamination can be applied to heavy equipment.

a. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate container. Otherwise, return the material to the area where it originated.

b. Place the heavy equipment on the decontamination pad in the decontamination area. If wash water is to be collected, ensure that the collection mechanism functions properly and that the decontamination pad has no leaks.

c. Steam clean parts of the heavy machinery that come into contact with visible material (such as tires, bulldozer bucket, augers, and back of drill rig).

d. For any portion of the heavy equipment that comes into contact with the sampling media, decontaminate by following steps b through i of Section 3.3.1.

e. Containerize fluids, if appropriate. Place solids in a drum or other appropriate container.

3.4 Field Logbook Documentation

Field logbooks will be maintained by the Field Team Leader to record daily activities. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks should document those decontamination activities specific to this SOP.

The Field Team Leader and/or designee will review the field logbook entries for completeness and accuracy and will indicate this review by initialing each page of the logbook. The Field Team Leader or designee is responsible for completion of the required data collection forms.

4.0 REFERENCES

- ASTM. *Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites*: D 5088-90. 1990.
- United States Environmental Protection Agency (U.S. EPA). Region 4, *Field Equipment Cleaning and Decontamination Operating Procedure.* Document # SESDPROC-205-R1, November 2007.
- Tennessee Valley Authority (TVA). *Field Documentation* SOP (TVA-KIF-SOP-06). February 2009.
- TVA. *Field Sampling Plan* (FSP), March 2009.
- TVA. *Health and Safety Plan* (HASP), KIF Site Specific, most recent revision.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-012). February 2009.
- TVA. Quality Assurance Project Plan (QAPP), most recent revision.

Table 1: Decontamination Checklist for Equipment and Materials	
Item Description	**Check**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses or face shield (for use when steam cleaning)	
Barricades, cones, flashing lights, signs	
Respirator and cartridges (if necessary)	
Saranex™/Tyvek® suits and booties (if necessary)	
Paperwork	
Health and Safety Plan	
Project work control documents	
Well construction data, location map, field data from previous sampling events	
Field logbook	
Potable water	
Drums (with labels)	
Equipment	
Non-phosphate detergent (LiquiNox®)	
Decontamination solvents (isopropyl alcohol, nitric acid)	
Buckets or washtubs	
Spray bottles	
Plastic sheeting	
Brushes	
Steam cleaner/generator	
Potable water/Deionized water	
Aluminum foil	
Plastic bags	
Drying shelves	

End of Procedure

STANDARD OPERATING PROCEDURE FOR:

FIELD QUALITY CONTROL SAMPLING

TVA-KIF-SOP-11

Prepared by
Environmental Standards, Inc.
for
Tennessee Valley Authority
Office of Environment and Research
Environmental Resources and Services

April 2009

1.0 PURPOSE

This standard operating procedure (SOP) provides the general technical requirements and operational guidelines for the proper collection of field quality control samples at Kingston Fossil Plant (KIF) and to ensure that appropriate documentation is maintained and that samples are properly preserved.

The requirements of this SOP are applicable to field blanks, equipment rinsate blanks, field duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The site-specific Health and Safety Plan (HASP) provides a description of potential hazards and associated safety and control measures.

Quality assurance (QA) will be verified by maintaining site logs, by documenting field activities, and by collecting and analyzing quality control (QC) samples. QC samples will be used to assess laboratory performance and to gauge the likelihood of cross-contamination associated with both field and laboratory activities. QC samples will be collected and analyzed in conjunction with samples designated for laboratory analysis using U.S. Environmental Protection Agency (EPA) methods.

The QC samples and associated frequencies presented in this SOP are to be used as guidance. The specific type of QC samples and frequencies be will presented in project-specific control documents to meet project-specific data objectives and regulatory requirements. Project guidance documents (including applicable SOPs) should be reviewed prior to initiating field activities to determine QC sampling requirements.

3.0 FIELD QC SAMPLING PROCEDURES

This section documents general operating procedures and methods associated with sediment sampling activities. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting sampling activities. If the immediate supervisor cannot rectify the circumstances leading to the deviation, then the immediate supervisor shall contact the Quality Assurance/Quality Control (QA/QC) Lead to determine if the deviation is acceptable from the standpoint of affecting data reliability. If the deviation is not acceptable to the QA/QC Lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the field logbook.

This SOP describes the requirements associated with field QC sampling. Standard analytical QC checks that will be instituted by field personnel include the following:

- Field Blanks
- Equipment rinsate blanks,
- Field duplicate samples, and
- MS/MSD samples.

3.1 Field Blanks

Field blanks are used to assess the potential for cross-contamination during the sampling process due to ambient conditions and to validate the cleanliness of sample containers. The collection of field blanks is recommended if known or suspected sources of contamination are located within close proximity to the sampling activities or if field instruments indicate the presence of contamination above background levels.

a. Collect field blanks by pouring analyte-free reagent water into appropriate certified clean, laboratory-supplied preserved (if necessary) bottleware at the sample collection site.

b. After sample collection, seal the containers properly and immediately place upright in an iced cooler.

c. Ship the field blanks with the associated investigative samples to the analytical laboratory.

Field blanks will be collected at the discretion of the Project Manager.

3.2 Equipment Rinsate Blanks

Equipment rinsate blanks are used to assess the effectiveness of field equipment decontamination procedures in preventing cross-contamination between samples and to assess the cleanliness of reusable dedicated and new disposable equipment.

a. Collect equipment rinsate blanks by pouring analyte-free reagent water into, through, and/or over clean (properly decontaminated) sampling equipment.

b. Collect and containerize the rinsate that has contacted the sampling equipment in appropriate certified clean, laboratory-supplied preserved (if necessary) bottleware.

c. After sample collection, seal the containers properly and immediately place upright in an iced cooler.

d. Ship the equipment rinsate blank with the associated investigative samples to the analytical laboratory.

The minimum frequency is one equipment rinsate blank per matrix per day; however, the appropriate project control documents should be referenced to assess project-specific frequencies.

At the discretion of the Project Manager, equipment rinsate blanks may not be required when pre-cleaned, dedicated, or disposable sampling equipment is used.

3.3 Field Duplicate Samples

Field duplicate samples are used to assess the reproducibility of laboratory analytical results. Field duplicates are typically collected and submitted to the laboratory as "blind" samples labeled with the project designated "A" nomenclature for duplicate samples. Duplicate samples are collected simultaneously with the investigative sample. The procedures for collecting duplicate samples in soil/sediment and aqueous media are stipulated as follows.

a. Prior to collecting investigative and duplicate soil/sediment samples for non-VOC parameters, composite and homogenize the sample material. Alternately fill the investigative and duplicate sample bottleware by thirds from the homogenized material until both sets of bottleware are filled. Collect duplicate samples one parameter at a time.

b. For aqueous samples, alternately fill by thirds the investigative sample and duplicate sample bottleware until both sets of bottleware are filled. . If a temporary transfer container is being used for aqueous sample collection, then agitate the sample between filling each third (at a minimum), to help keep the sample homogenized. As with solid matrices, collect duplicate aqueous samples one parameter at a time.

c. After sample collection, seal the containers properly and immediately place upright in an iced cooler.

d. Ship the equipment field duplicate samples with the associated investigative samples to the analytical laboratory.

The minimum frequency is one field duplicate sample for every 20 investigative samples per matrix type; however, the appropriate project control documents should be referenced to determine project-specific frequencies.

3.4 MS/MSD Samples (Organic Analyses)

MS/MSD samples are investigative samples to which known amounts of compounds are added in the laboratory before extraction and analysis. The recoveries for spiked compounds can be used to assess how well the method used for analysis recovers target compounds in the site-specific sample matrices.

a. Collect MS/MSD samples by collecting a triple volume of an investigative sample.

b. Prior to collecting investigative and MS/MSD samples for non-VOC parameters, composite and homogenize soil/sediment. Alternately fill the investigative and MS/MSD sample bottleware by thirds from the homogenized material until all three sets of bottleware are filled. Collect MS/MSD samples one parameter at a time.

c. For aqueous samples, alternately fill the investigative sample and MS/MSD sample bottleware by thirds until all three sets of bottleware are filled. . If a temporary transfer container is being used for aqueous sample collection, then agitate the sample between filling each third (at a minimum) to help keep the sample homogenized. Collect MS/MSD samples one parameter at a time.

d. Label MS/MSD samples as such when submitted to the analytical laboratory.

e. After sample collection, seal the containers properly and immediately place upright in an iced cooler.

f. Ship the MS/MSD samples with the associated investigative samples to the analytical laboratory.

The order for filling samples for MS/MSD analysis is the same as the order specified for duplicate samples.

The minimum frequency is one set of MS/MSD samples for every 20 investigative samples per matrix type; however, the appropriate project control documents should be referenced to assess project-specific frequencies.

3.5 Sample Handling, Packing, and Shipping

Samples will be marked, labeled, packaged, and shipped in accordance with the *Sampling Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

3.6 Field Logbook Documentation

Field logbooks will be maintained by the Field Team Leader to record daily activities. The minimum requirements for field logbook documentation are discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06).

The Field Team Leader and/or designee will review the field logbook entries for completeness and accuracy and will indicate this review by initialing each page of the logbook. The Field Team Leader or designee is responsible for completion of the required data collection forms.

3.7 Decontamination and Waste Management

All sampling equipment decontamination will be performed in a manner consistent with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08). Investigation-derived waste (IDW) which includes excess samples, cuttings, decontamination fluids, disposable sampling equipment, and disposable personal protective equipment (PPE), should be containerized and managed according to the *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12).

4.0 REFERENCES

- Tennessee Valley Authority (TVA). *Decontamination of Equipment* SOP (TVA-KIF-SOP-08), February 2009.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), March 2009.
- TVA. *Field Sampling Plan* (FSP), TVA, 2009.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-12), March 2009.
- TVA. *Quality Assurance Project Plan* (QAPP), TVA, 2009.
- TVA. *Sampling Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), February 2009.

Table 1: Field QC Sampling Equipment & Material Checklist	
Item Description	**Check**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Respirator and cartridges (if necessary)	
Saranex/Tyvek suits and booties (if necessary)	
Sampling Equipment	
Portable table	
Plastic sheeting	
Analyte-free water	
Tape measure	
Digital camera	
Groundwater sampling equipment	
Soil sampling equipment	
Laboratory-supplied bottleware	
Chain-of-custody forms and custody seals	
Packing tape	
Field logbook	
Permanent marker	
Decontamination and Waste Management Equipment	
US DOT-approved 55-gallon drums or other appropriate containers	
Drum wrench	
Duct tape	
Rinse bottle	
Potable water	
Non-phosphate detergent	
Decontamination fluids (deionized water, nitric acid, isopropyl alcohol, methanol)	
Buckets or tubs	
Brushes	
Trash bags	
Paper towels	

End of Procedure

TVA

STANDARD OPERATING PROCEDURE FOR:

HYDROLAB DATASONDE® STANDARDIZATION AND FIELD PARAMETER MEASUREMENT

TVA-KIF-SOP-14

DRAFT

Prepared by

Environmental Standards, Inc.

for

Tennessee Valley Authority

Office of Environment and Research

Environmental Resources and Services

July 2009

1.0 PURPOSE

This standard operation procedure (SOP) describes the standardization, collection methods, and documentation and maintenance requirements for using a Hydrolab DataSonde® (Hydrolab) at the Kingston Fossil Plant (KIF) Ash Recovery Project Site. The procedures described in this SOP are applicable to the Hydrolab Datasonde DS5, DS5X, and MS5 models.

This SOP specifically details how to:

- Standardize the instrument
- Collect field chemistry parameters
- Conduct the necessary documentation requirements
- Store the instrument
- Schedule and conduct Hydrolab change outs
- Perform general maintenance

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks should be thoroughly evaluated prior to conducting field activities. Refer to the site-specific Health and Safety Plan (HASP) for a description of potential hazards and associated safety and control measures.

Field personnel operating the instruments are required to be familiar with the procedures detailed in this SOP. These protocols are not specifically discussed in regulatory guidance concerning the collection of quantitative field measurements for certain chemistry parameters of aqueous media. The procedures described in this SOP follow the procedures described in the *Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes – User Manual. Catalog Number 003078HY Edition 3, February 2006.* (Hydrolab User Manual). Additionally, this SOP employs some guidelines in the Standards Methods for the Evaluation of Water and Wastewater (Standard Methods) referenced below. For turbidity, this SOP employs some guidelines in the International Organization for Standardization - Water Quality: Determination of Turbidity, 1999 (ISO 7027) standard rather than those in Standard Methods.

Parameter	**Standard Method Section**
Temperature	2550-B
Dissolved Oxygen (DO)	4500-O^{+}G
Specific Conductance (SC)	2510-B
pH	4500-H^{+}B

3.0 PROCEDURES

This section documents general operating procedures and methods associated with the maintenance, standardization, use, and documentation requirements for the Hydrolab DS5, DS5X, and MS5. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting sampling activities. If the immediate supervisor cannot rectify the circumstances leading to the deviation, then the immediate supervisor shall contact the Quality Assurance/Quality Control (QA/QC) Lead to determine if the deviation is acceptable relative to affecting data reliability. If the deviation is not acceptable to the QA/QC lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the field logbook.

3.1 Standardization of the Hydrolab

The portable Hydrolabs being utilized for routine surface water sampling shall be standardized prior to use each sampling day. The Hydrolabs being utilized as fixed river monitoring stations shall be standardized a minimum of once per week.

Use a Surveyor®4 or Lap-top with Hydras3 LT software to standardize the Hydrolabs. Refer to Section 4.1 and Section 4.2 of the Hydrolab User Manual. Fill out the Standardization of Hydrolab Form (Attachment A) during standardization. Personnel conducting standardization activities shall maintain a designated field logbook to track/record:

- Time and date of Hydrolab standardization
- Hydrolab serial number (SN)
- Personnel performing standardization
- Date of factory calibration
- Buffer solution information including date received, expiration date, and lot number.

3.1.1 Temperature

- Place the Hydrolab and the NIST thermometer in the same container of water.
- Allow both thermometers to stabilize (readings do not change in approximately 20 - 30 seconds).
- If the temperature readings recorded from the Hydrolab are not within ± 0.4 °C agreement with the NIST thermometer, a correction factor (≥0.4 °C) will be applied to the field temperature readings.
- To verify that the Hydrolab temperature sensor maintained accuracy in the field, perform a post-field temperature comparison by repeating the steps above.

3.1.2 DO

- Before DO standardization, set up a bucket filled with air saturated tap water.

- Install an aeration system consisting of a small aquarium-grade pump and filter.
- Allow the aeration system to run continuously to guarantee full saturation.

- Obtain an accurate barometric pressure reading for the Site immediately prior to DO standardization.
  - Obtain barometric pressure reading from the on-site air monitoring and sampling crew or the National Oceanic and Atmospheric Administration (NOAA) website.
- Place Hydrolab in bucket filled with air saturated water.
- Enter barometric pressure in mmHg.
- Standardize DO to 100% saturation and the equivalent mg/L concentration given the barometric pressure.
- The acceptable standardization range for DO is ±0.5%.
- To verify that the Hydrolab DO sensor maintained accuracy in the field, perform a post-field DO accuracy check by repeating the steps above.

3.1.3 SC

- SC requires a two-point standardization.
- A low concentration and a high concentration standard are required to bracket typical field SC readings.
- Use the low concentration or "zero" buffer solution first.
- Pour a small amount of fresh buffer solution (using the buffer solution next to be used for standardization) in the storage cup and rinse the sensors, each time properly discarding the rinse.
- Pour fresh buffer solutions to within 1 cm of the top of the storage cup.
- Turn the Hydrolab upside down to eliminate trapped air bubbles near the sensors.
- Standardize SC to each buffer solution's concentration in µS/cm.
- Properly discard the buffer solution after each use and triple rinse the sensors and storage cup with DI water.
- After the two-point standardization, pour fresh low-concentration buffer solution in the storage cup. Record the measurement. The acceptable standardization range for DO is ±0.05%.
- To verify that the Hydrolab SC sensor maintained accuracy in the field, perform a post-field SC accuracy check by repeating the steps above.

3.1.4 pH

- pH requires a three-point standardization.
- A pH buffer solution of 7.0 shall be the "zero" standard. Additionally, use pH 4.0 and pH 10.0 buffer solutions to bracket typical field pH readings.
- Use the "zero" buffer solution first.
- Pour a small amount of fresh buffer solution (using the buffer solution next to be used for standardization) in the storage cup and rinse the sensors, each time properly discarding the rinse.

- Pour fresh buffer solutions to within 1 cm of the top of the storage cup.
- Turn the Hydrolab upside down to eliminate trapped air bubbles near the sensors.
- Properly discard the buffer solution after each use and triple rinse the sensors and storage cup with DI water.
- After the three-point standardization, pour fresh "zero" buffer solution in the storage cup. Record the measurement. The acceptable standardization range for pH is ±0.2 standard units.
- To verify that the Hydrolab pH sensor maintained accuracy in the field, perform a post-field pH accuracy check by repeating the steps above.

3.1.5 Turbidity

- Turbidity requires a four-point linear standardization.
- Use the <0.1 nephelometric turbidity unit (NTU) buffer solution first - followed by 100 NTU, 400 NTU, and 3,000 NTU buffer solutions.
- Pour a small amount of fresh buffer solution (using the buffer solution next to be used for standardization) in the storage cup and rinse the sensors, each time properly discarding the rinse.
- Pour fresh buffer solutions to within 1 cm of the top of the storage cup.
- Care should be taken not to stir the buffer solution. Adding air bubbles to the turbidity buffer solutions may cause inaccurate instrument readings.
- Properly discard the buffer solution after each use and triple rinse the sensors and storage cup with DI water.
- To verify that the Hydrolab turbidity sensor maintained accuracy in the field, perform a post-field turbidity accuracy check by repeating the steps above. The acceptable standardization range for turbidity is ± 1% for <0.1 NTU and 100 NTU buffer solutions, ± 3% for 400 NTU buffer solutions, and ± 5% for 3,000 NTU buffer solution.

3.2 Collection of Quantitative Field Chemistry Parameters of Aqueous Media

Use a Trimble® GeoXH™ (Trimble) with Hydras3 LT software to connect to the standardized Hydrolabs in order to collect field chemistry parameters. Refer to Sections 4.1 and 4.3 of the Hydrolab User Manual for operations and data collection information. Refer to Section 5 of the Hydrolab User Manual for field deployment considerations.

3.2.1 Set Up Logging Files Using a Trimble or Lap-top With Hydras3 LT

- Start the Hydras 3 LT software. The software will automatically search for a Hydrolab connection.
  - Click on the Log Files tab.
  - Click the Create button.
- Provide a unique and descriptive name for the new file log.

- To customize the new log file, select the start and end time of the logging session and the logging interval.
  - Select the field chemistry parameters in the 'Parameter in Sonde' and click the add button to place the parameters into the "Parameters in log file' list.
  - If desired, change the order of the parameters using the arrow button.
- Click 'Enable' to start collecting data. Click 'Disable' to stop collecting data.

3.2.2 Collect Quantitative Field Chemistry Parameters at Routine Surface Water Sample Locations

- Use the weighted sensor guard to help protect the sensors and keep the Hydrolab from moving during high-flow events.
- Deploy the standardized Hydrolab to the depth equal to the sample collection depth.
- Collect temperature, DO, SC, pH, depth, and turbidity.
  - Allow the field chemistry parameters to stabilize
  - The Hydrolab will confirm when a parameter is stable when the parameter icon turns green.
- Record final, stabilized Hydrolab readings in the appropriate surface water field logbook as a backup to the Log File.
- Decontaminate the Hydrolab after every deployment utilizing the steps presented in Section 3.3.1 of this SOP.
- There are some instances (*i.e.,* thermal stratification monitoring) when deviations to Section 3.2.2 will occur. An approved Field Guide shall be created to dictate changes to these procedures.

3.2.3 Collect Quantitative Field Chemistry Parameters at Fixed River Monitoring Stations

The fixed river monitoring stations shall be named and clearly labeled based on their relative location (*i.e.,* river mile marker or project/plant specific identifier). The fixed river monitoring stations shall also be situated in areas of the main current, if applicable, of surface water bodies (where there is good lateral and vertical mixing), or at critical discharge locations.

- Use the weighted sensor guard to help protect the sensors and keep the Hydrolab from moving during high flow events.
- Deploy the Hydrolab to approximately 1 meter below the top of the water.
- Verify that the battery source and solar panels on the floats are functioning properly.
- Verify that the Hydrolab is communicating properly with the modem and data are logging in 15 minute intervals.
- Decontaminate the Hydrolab after every deployment utilizing the steps presented in Section 3.3.1 of this SOP.
- A designated Hydrolab field logbook shall be used to track/record:

- Time and date of Hydrolab servicing or change out.
- Confirmation that a Hydrolab Change Out Record Form was filled out.
- Personnel performing servicing or change out.
- Field observations.

3.2.3.1 Change Outs

- Hydrolabs deployed at fixed river monitoring stations will require a change out once per week, at a minimum.
- A schedule or calendar shall be maintained to confirm change out requirements.
- Complete the Hydrolab Change Out Record Form (Attachment B) for every fixed river monitoring station Hydrolab change out.
  - Collect a final set of field parameter measurements on the existing Hydrolab and fill out the "In Situ Hydrolab" portion of Attachment B.
  - Collect an initial set of field parameters (immediately following deployment and after 15-minute equilibration) of the new, standardized Hydrolab and fill out the "Newly Standardized Hydrolab for Change Out" portion of Attachment B.
- Change outs or servicing may occur more frequently if inaccurate or biased (high or low) readings are observed.
  - First, decontaminate the fixed Hydrolab using steps presented in Section 3.3.1 of this SOP.
  - Second, perform a side-by-side comparison using a newly standardized Hydrolab to verify inaccurate or biased (high or low) readings.
  - If inaccuracies are verified, change out the Hydrolab accordingly.

3.3 Maintenance of Hydrolab

Refer to Section 6 of the Hydrolab User Manual for maintenance considerations.

3.3.1 Decontamination

Perform decontamination of Hydrolabs in a manner consistent with the Decontamination of Equipment SOP (TVA-KIF-SOP-08).

- Use DI water to rinse the probes after every deployment in the field. Hydrolab units shall not be rinsed with alcohols or acid rinses.
- Paper towels may be used to remove heavy solids accumulation on the Hydrolab.
- If needed, soak the sensors with non-phosphate detergent and water to remove biological, oil, or sediment buildup.

3.3.2 Factory Calibration

- The DataSonde DS5X, DS5, or MS5 factory calibration form (Traveler) must accompany each Hydrolab unit that is used at the KIF Ash Recovery Project.

- These traveler forms shall be scanned and stored on a TVA internal drive. The hardcopy shall continue to accompany the units and be stored near where the units are stored.
- At a minimum, the Hydrolab units shall be sent for a factory performance test and evaluation (PT&E) once per year. A completed PT&E form will be returned with the Hydrolab units. These PT&E forms shall be scanned and stored on a TVA internal drive. The hardcopy shall continue to accompany the units and be stored near where the units are stored.
- A schedule or calendar shall be maintained to confirm factory calibration needs.

3.3.3 Storage

- Store the Hydrolab in an area where freezing will not occur.
- Fill the storage cup with one inch of clean potable water to prevent the sensors from drying out. Do not use DI water in this application. pH probes in DI water for prolonged periods are prone to malfunctioning.
- Store the buffer solutions in accordance with the requirements of the product material safety data sheet (MSDS).
  - MSDS of each buffer solution shall be readily available and stored near the buffer solutions.
- If possible, store the buffer solutions at the same temperature as the Hydrolab units to reduce the time for standardization.

4.0 REFERENCES

- Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes: User's Manual. Catalog Number 003078HY Edition 3, February 2006.
- Standard Method (SM) 2550 B. Temperature (Laboratory and Field Methods). 1993.
- Standard Method (SM) 4500-H^+ B. pH (Electrometric Method). 1996.
- Standard Method (SM) 2510 B. Conductivity Laboratory Method. 1997.
- Standard Method (SM) 4500-O G. Dissolved Oxygen (Membrane Electrode Method). 1993.
- US EPA, Method # 170.1. Temperature (Thermometric). Issued 1974.
- International Organization for Standardization - Water Quality: Determination of Turbidity (ISO 7027), 1999.

TABLE 1: HYDROLAB EQUIPMENT & MATERIAL CHECKLIST	
Item Description	**CHECK ✓**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Paperwork	
Hydrolab User manual	
Work Plan	
Logbook and indelible ink marker	
Applicable sampling SOPs	
Standardization of Hydrolab Form (Attachment A)	
Hydrolab Change Out Form (Attachment B)	
Equipment	
Hydrolab DS5, DS5X, or MS5 unit	
Trimble GeoXH with Hydras3 LT software	
Surveyor®4	
Lap-top computer with Hydras3 LT software	
Spare batteries	
DI water	
Potable water	
Tool kit	
Additional items recommended by instrument manufacturer	
NIST thermometer	
Bucket with air saturated water	
Aquarium-grade pump and filter	
pH buffer solution (pH 4, pH7, pH10)	
Specific conductance buffer solutions (100μS/cm, and 500 μS/cm)	
Turbidity buffer solutions (<0.1NTU, 100 NTU, 400 NTU, 3,000 NTU)	

End of Procedure