500-MW DEMONSTRATION OF ADVANCED WALL-FIRED COMBUSTION TECHNIQUES FOR THE REDUCTION OF NITROGEN OXIDE (NO_x) EMISSIONS FROM COAL-FIRED BOILERS

Field Chemical Emissions Monitoring: Overfire Air and Overfire Air/Low NO_x Burner Operation

Final Report

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INNOVATIVE CLEAN COAL TECHNOLOGY (ICCT)

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INTRODUCTION

This report summarizes data gathered by Radian Corporation at a coal-fired power plant, designated Site 16, for a program sponsored by the United States Department of Energy (DOE), Southern Company Services (SCS), and the Electric Power Research Institute (EPRI). The concentrations of selected inorganic and organic substances were measured in the process and discharge streams of the plant operating under two different types of combustion modifications: overfire air (OFA) and a combination of overfire air with low-NO_x burners (OFA/LNB). The Site 16 plant is a participant in the DOE-sponsored Clean Coal Technology (CCT) program, and the information contained in this report will allow DOE and EPRI to determine the effects of low-NO_x modifications on plant emissions and discharges. In addition, SCS can use this information to make future decisions about plant modifications and control strategies.

Sampling was performed on an opposed wall-fired boiler burning medium-sulfur bituminous coal. Emissions were controlled by electrostatic precipitators (ESPs). The testing was conducted in two distinct sampling periods, with the OFA test performed in March of 1991 and the OFA/LNB test performed in May of 1993. The specific objectives for each test period were:

- To quantify emissions of target substances from the stack;
- To determine the efficiency of the ESPs for removing the target substances; and
- To determine the fate of target substances in the various plant discharge streams.

Table 1-1 lists the substances of interest to this project.

The Clean Coal Technology program, which DOE began in 1986, demonstrates the commercial readiness and monitors the environmental performance of new, advanced coal utilization technologies. DOE shares the cost on each project, with private sector sponsors providing at least 50% of the funds. Within the CCT program there are currently 46 projects, each of which was selected under one of five rounds of nationwide competition. The Site 16 project, which is a demonstration of advanced combustion techniques to reduce NO_x emissions, was selected under the second round of CCT.

DOE is actively involved in the measurement of potentially hazardous substances identified in Title III of the Clean Air Act Amendments (CAAA) of 1990. The intention of these efforts is to obtain data that will allow a better understanding of the principles

Table 1-1
Substances of Interest

Elements	Organic Compounds
Arsenic	Benzene
Barium	Toluene
Beryllium	Formaldehyde
Cadmium	Polycyclic Organic Matter (POM)[a]
Chlorine (as chloride)	
Chromium	
Cobalt	
Copper	
Fluorine (as fluoride)	
Lead	
Manganese	
Mercury	
Molybdenum	
Nickel	
Phosphorus	
Selenium	
Vanadium	

[a] Also referred to as semivolatile organic compounds. Includes polynuclear aromatic hydrocarbons (PAHs).

and processes involved with the formation, distribution, and fate of toxic substances in power plant systems. Some of the DOE toxics monitoring work is being performed under the CCT program. The first three of the five CCT solicitations were issued before the enactment of the CAAA in 1990, and did not originally include extensive air toxics monitoring activities. However, DOE has expanded several of these projects (including Site 16), through cooperative agreements with private industry and with EPRI, to emphasize measurement of Title III substances. Air toxics monitoring activities were included in the fourth and fifth CCT solicitations. In addition, DOE's Flue Gas Cleanup program issued a solicitation (Comprehensive Assessment of Toxic Emissions from Coal-Fired Power Plants) in 1992 to gather further information on Title III substances at coal-fired power plants participating in CCT.

EPRI is cosponsoring the work at Site 16 several reasons. During the Power Plant Integrated Systems Chemical Emissions Studies (PISCES) project (EPRI RP-2933-1), a number of data gaps were identified for certain streams and substances within specific power plant configurations. The work discussed here was done in response to EPRI member utility concerns about the concentrations of trace substances in process streams, the effectiveness of control technologies in reducing emissions of these substances, and the applicability of the results of previous studies discussed in the literature.

The Field Chemical Emissions Monitoring (FCEM) project (EPRI RP-3177-1) sponsored by EPRI was initiated to generate the missing data identified by the PISCES project. Although the Site 16 project was conducted separately from the FCEM project, most of the objectives were the same, and the sampling, analytical, and data handling procedures are consistent with those used in the FCEM project. Reports on several of the plants sampled have already been furnished to the U.S. Environmental Protection Agency (EPA) to use to study emissions from fossil-fuel-fired power plants, as mandated by the Clean Air Act Amendments of 1990.

Radian Corporation conducted the testing and has prepared this report using the following procedures to evaluate the data:

- The type and quantity of quality assurance samples were reviewed to determine the confidence that can be placed in the results; and
- The QA/QC results were compared with data quality objectives to evaluate precision and accuracy.

The results for each substance are presented by individual run and as averaged totals. To quantify the variability of the data, the 95% confidence interval about the mean is also presented. The confidence interval incorporates the combined process, sampling, and analytical variabilities.

Process Operation

The unit operated at nearly full load during each of the sampling periods. Operating parameters were monitored to verify the process stability during sampling. Process operation is discussed in more detail in Section 5. No unusual process upsets were encountered. By all indications, process operation was normal during the sampling.

Sampling and Analysis Protocol

Appendix A describes the sampling and analysis protocol for Site 16. The methods used are comparable to those used by Radian in the FCEM project. The major exception was at the ESP inlet during the OFA/LNB test, where metals, anions, and semivolatile compound trains were equipped with a cyclone precutter ahead of the thimble filter normally used. This prevented the loss of particulate matter from the probe, a problem identified from the OFA test.

Quality Assurance/Quality Control (QA/QC) Data Completeness

The completeness of the quality assurance data was reviewed to judge whether the quality of the measurement data could be evaluated with the available information. In general, the results of the QC checks available for Site 16 indicate that the samples are well characterized. An evaluation of the accuracy, precision, and bias of the data, even if only qualitative, is considered to be an important part of the data evaluation. A full discussion of each of these components of quality can be found in Section 5.

Standard QA/QC checks for this type of sampling program involve the use of: 1) replicate tests, duplicate field samples and lab analyses, and matrix spike and lab control duplicates to determine precision; 2) matrix spikes, surrogate spikes, and laboratory control samples to determine accuracy; and 3) field blanks, trip blanks, method blanks, and reagent blanks to determine if any of the samples were contaminated during collection or analysis. All of these standard QA/QC checks were used on various samples from Site 16. The absence of any of these quality control checks for a given measurement does not necessarily reflect poorly on the quality of the data but does limit the ability to measure the various components of measurement error.

Data Quality

The available QA/QC results were compared to the data quality objectives discussed in Section 5. QA/QC results outside the data quality objectives are noted and discussed, other quality assurance values are evaluated, and the potential effect on data quality is noted. From the detailed information in Section 5, several important issues have been identified that may affect the data.

For the OFA test:

- The high recoveries of copper and barium in a coal performance evaluation sample suggest that copper and barium concentrations in the coal may be biased high.
- The concentrations of molybdenum on the blank filters are significant, compared to the sample results, and may positively bias the results.
- The high spike recoveries and significant blank levels suggest that cadmium concentrations in the fly ash and flue gas samples may be biased high.
- The formaldehyde concentrations measured in the flue gas are highly suspect. Formaldehyde was detected in the lab, trip, and field blanks in concentrations comparable to those found in the samples.

For the OFA/LNB test:

- The PAH concentrations measured in the flue gas were highly variable and should be considered order-of-magnitude estimates. The internal standard and surrogate spike recovery data indicate acceptable analytical performance but suggest sample matrix interference problems.
- The formaldehyde concentrations measured in the stack were near detection limits and were indistinguishable from the lab, trip, reagent, and field blank results.
- High levels of Cr(VI) were found in the KOH reagent blanks, but these were found to be repeatable in three blanks and were subsequently corrected for in the sample results. However, the blank correction exceeded 50% of the result in two of the three samples.
- Toluene was detected in very low but similar concentrations in blank and actual VOST samples. The toluene concentrations measured in the stack may be biased slightly high if not artifacts of blank contamination.
- The variable spike recoveries by GFAAS show that selenium concentrations in the flue gas may show higher-than-expected variability.

Report Organization

Section 2 of this report briefly describes the plant and the sample locations. Section 3 discusses the chemical analyses of the coal, flue gas, and other process streams. Section 4 contains a discussion of the results, focusing primarily on the comparison of the OFA and OFA/LNB tests. Section 5 presents QA/QC and engineering evaluations of the data. Section 6 presents example calculations, and a glossary of terms is provided in Section 7. The appendices contain information on sampling and analytical methods, stream concentrations, sampling data, error propagation equations, and detailed QA/QC data.

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SITE DESCRIPTION

The FCEM project has a policy of assigning a site code to each plant sampled. The plant covered by this report has been designated Site 16. The test site and sampling locations are described in this section.

Facility Information

The characteristics of the unit are summarized in Table 2-1. The unit tested has a gross generating capacity of approximately 500 MW. The opposed wall-fired, subcritical boiler was designed by Foster Wheeler. A partial, vertical dividing plate within the furnace creates two combustion zones, and very little mixing of the flue gas occurs between the A and B sides.

Figure 2-1 is a process flow diagram of the unit. The plant burns a combination of bituminous coals that have a typical sulfur content of 1.6% and a typical ash content of 10 percent.

Bottom ash is removed from the boiler by an ash sluicing system. Electrostatic precipitators (ESPs) remove fly ash from the flue gases. The flue gas treatment and ash removal facilities are described in greater detail below.

Flue Gas Treatment Facilities

The flue gas exiting each side of the furnace flows into a separate duct, designated the A or B side. Two ESPs, one each for the A and B sides, remove particulate matter from the flue gas. The unit is equipped with a conditioning system capable of injecting SO_3 or NH_3 into the flue gas upstream of the ESPs to improve ESP performance. The conditioning system was not in use during the OFA testing. During the OFA/LNB test, NH_3 was injected at a rate of approximately 25 scfm, which is equivalent to a concentration of about 20 ppmv in the flue gas entering the ESPs. The NH_3 injection was used because of plant concerns about complying with particulate matter emission limits.

Table 2-1
Unit Summary

Maximum Gross Electrical Output (MW):	500
Particulate Emission Limit (lb/10^6 Btu):	0.24
Particulate Matter Controls:	Cold-Side ESPs
Flue Gas Conditioning:	SO_3 or NH_3[b]
Boiler Type:	Opposed Wall-Fired
Boiler Additives:	None
NO_x Control:	OFA or OFA/LNB
Fuel Type:	Bituminous Coal
Fuel Sulfur Content (% dry):	1.6[a]
Fuel Ash Content (% dry):	10[a]
Fuel Heating Value (Btu/lb, dry):	13,700[a]
Fly Ash Disposal:	Pond
Bottom Ash Disposal:	Pond
Ash Sluice Water Source:	Recycle from Pond
Cooling Water System:	Once Through
Cooling Water Source:	River

[a] Mean values measured during sampling.

[b] No conditioning was used during the OFA test. A concentration of approximately 20 ppmv NH_3 was used during the OFA/LNB test.

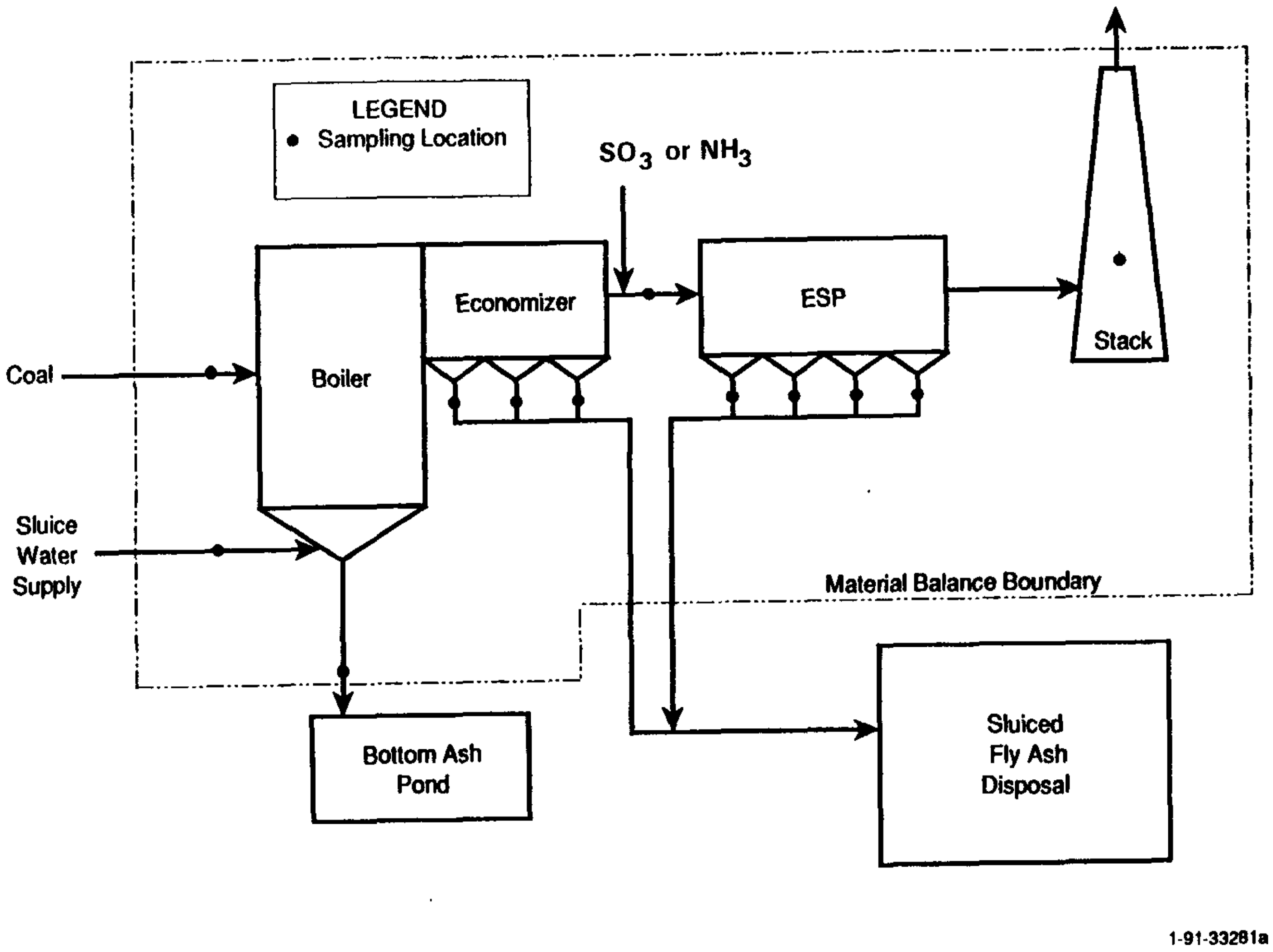

Figure 2-1
Process Flow Diagram and Sampling Locations for Site 16

Ash Removal Facilities

Dry ash collected in the economizer and ESP hoppers is pneumatically transported to a tank where it is mixed with water and sluiced to a settling pond. Bottom ash from the boiler is sluiced to a separate settling pond. The water used for ash sluicing is recycled water from the settling ponds.

NO_x Control

The overfire air ports were installed during a four-week outage in the spring of 1990 by Foster Wheeler Energy Corporation (FWEC). The design includes four overfire air ports on each side of the boiler directly above the top row of burners. Overfire air is diverted from the secondary air ductwork. At full load, approximately 20% of the secondary air is introduced through the overfire air ports.

The low-NO_x burners were installed during a seven-week outage in the spring of 1991. The FWEC burners are of the controlled flow/split flame (CFSF) design. The 24 burners are arranged on opposing walls, with three rows of four burners on each wall. The low-NO_x burners replaced the pre-NSPS Intervane burners previously in service that were in place during the OFA test.

Sampling Locations

Samples were collected at several locations, identified on the process flow diagram, Figure 2-1. Each sampling location is briefly described below:

- During the OFA test, coal composite samples were collected through "clean-out" ports at the bottom of the bunkers that feed each of the six coal mills. For the OFA/LNB test, samples were collected from taps (which weren't present during the OFA test) on each of the six coal feeders directly below the bunkers. Because the samples were collected upstream of the mills in both tests, they were taken before the rejection of pyrites.

- Flue gas entering the ESPs was sampled through four-inch sampling ports on both the A and B inlet ducts. The ducts were angled approximately 20 degrees from horizontal, and each duct had 7 ports.

- Stack gas samples were collected from six horizontal ports on the stack at the 250-foot level.

- Bottom ash that had accumulated in the boiler during testing was sampled from the discharge of the sluice pipe during a sluicing event. The sluice water was sampled concurrently.

- Dry ESP fly ash samples were collected from each of the 16 ESP hoppers through ports located near the bottom of each hopper.
- Sluice water supply samples were collected from the recycled pond water intake.

The procedures for collecting, pretreating, and analyzing the samples are discussed in Appendix A. Table 2-2 presents an overview of the types of analyses performed on these streams. Several analyses were not performed during the OFA/LNB test because of the extremely low concentrations found in the OFA test or, in the case of ESP ash, because of concerns about the representativeness of a composite sample of the 16 hopper fractions.

Table 2-2
Process Stream Analyses Performed

Stream	Metals	Anions	Semivolatile Organic Compounds	Volatile Organic Compounds	Aldehydes
Coal	X,O	X,O			
Bottom Ash	X,O	X,O	X		
Bottom Ash Water	X	X	X		
Sluice Supply Water	X	X	X		
ESP Ash	X	X	X		
ESP Inlet Gas	X,O	X,O	X,O	X	X
Stack Gas	X,O	X,O	X,O	X,O	X,O

X = OFA Test
O = OFA/LNB Test

3

RESULTS

This section summarizes the results of the stream characterization for both the OFA and LNB tests. Sampling, preparation, and analytical methods are summarized in Appendix A. Detailed analytical data can be found in Appendices B and C.

Sampling Schedule

The OFA sampling was conducted in March 1991. The OFA/LNB test was conducted in May 1993. Flue gas samples were collected from the A and B ESP inlet ducts and the stack. Multi-metals trains and Modified Method 5 (MM5, semivolatile organic compound) trains were used to traverse the ducts during each sampling run. Anions, aldehydes, VOST, impactors, Cr(VI), and mercury speciation trains were used to collect samples at single points of average velocity.

Figure 3-1 shows the sample collection schedule for the OFA test; Figure 3-2 shows the schedule for the OFA/LNB test. Three valid runs for each train were completed.

Data Treatment

Several conventions have been developed for treating the test data and developing average concentrations of substances in the various streams.

To determine the total gas concentration for each run, both the solid- and vapor-phase contributions were considered; however, the absence of some detectable concentrations in either (or both) phase(s) required that conventions be developed for dealing with these data. These conventions are summarized below.

For each substance, there are three possible combinations of vapor- and solid-phase concentrations in the flue gas stream. These are:

Case 1: The concentrations in both the solid and vapor phases are above detection limits.

Case 2: The concentrations in both the solid and vapor phases are below the detection limits.

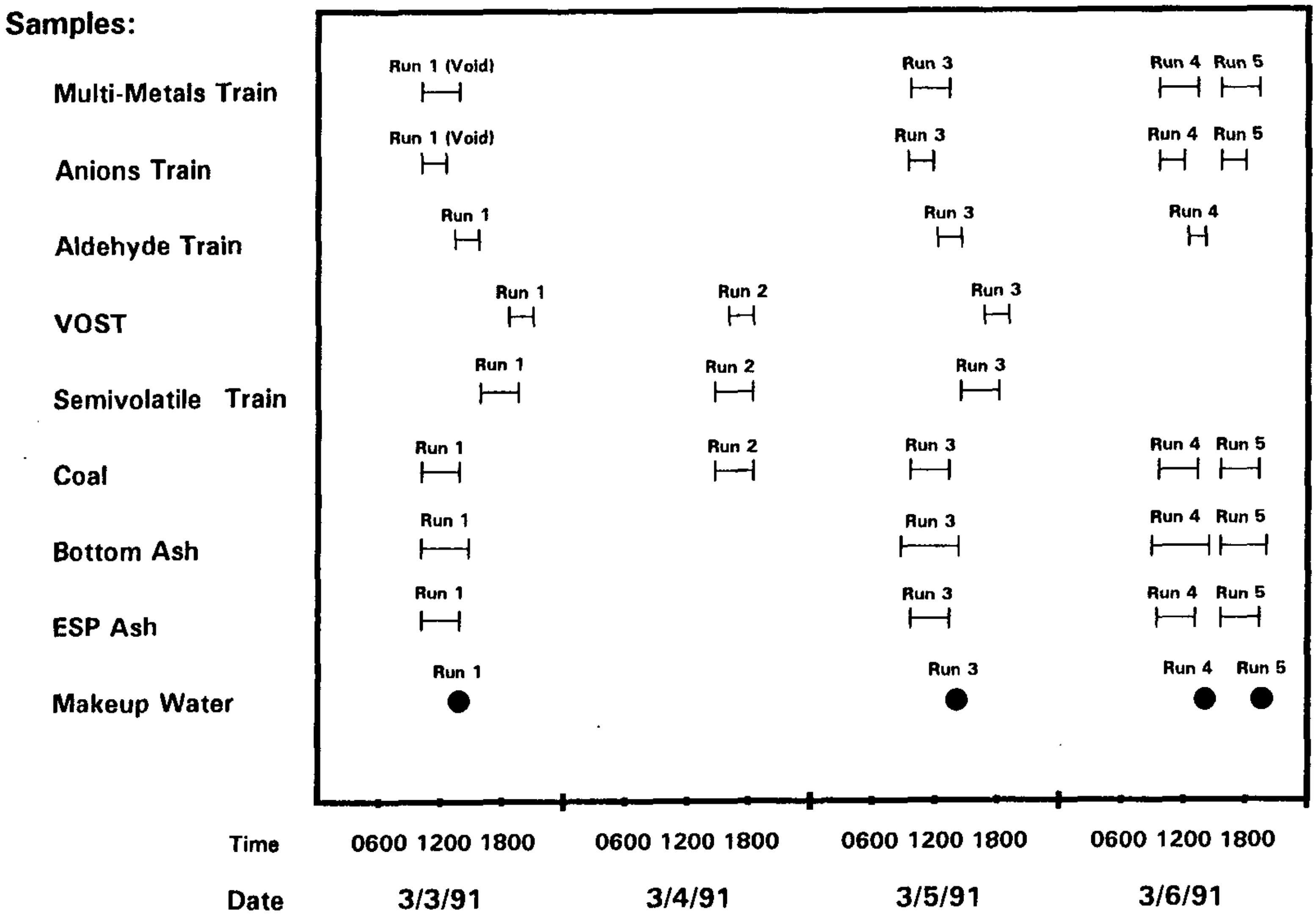

Figure 3-1
Sampling Schedule for OFA Test

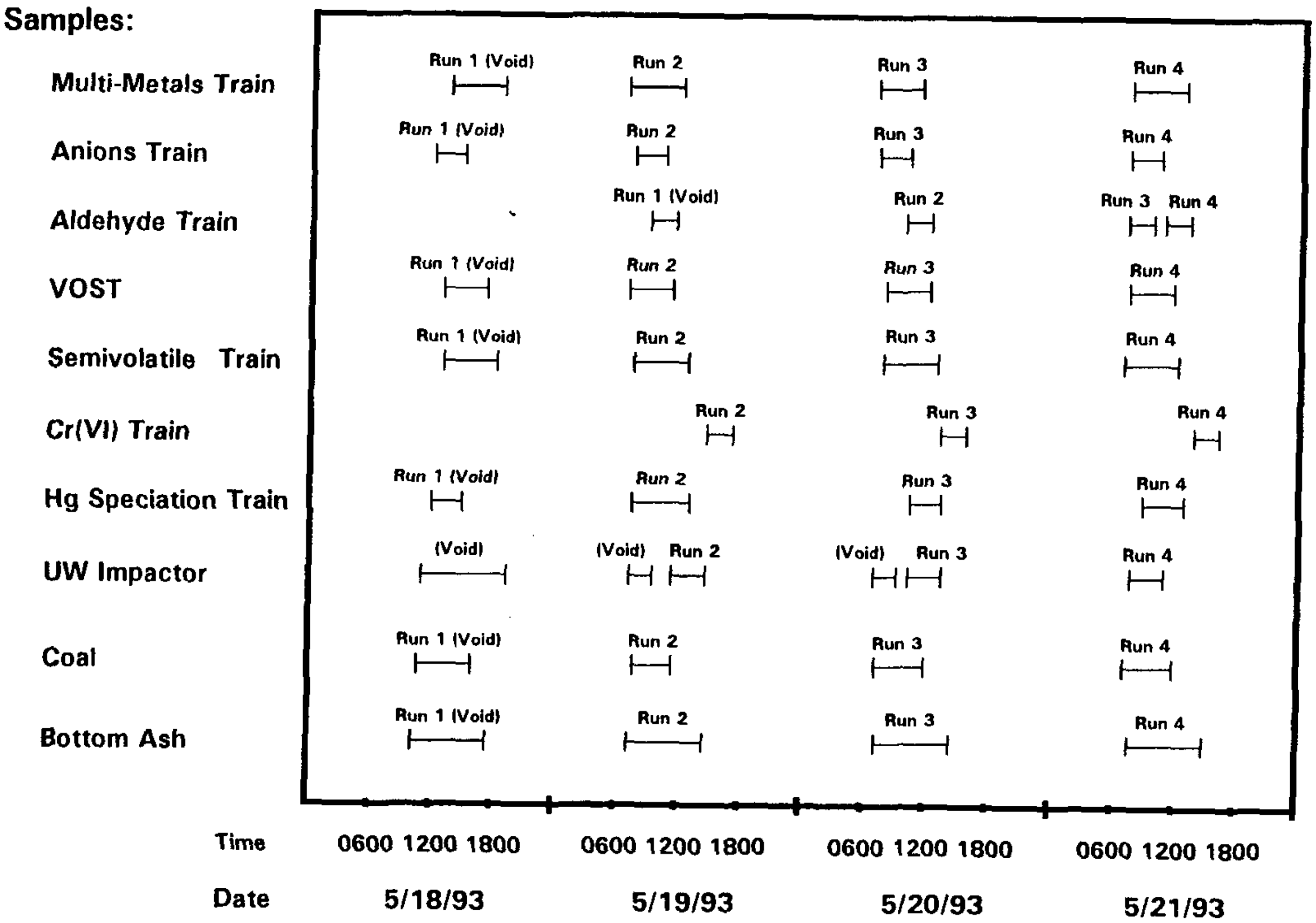

Figure 3-2
Sampling Schedule for OFA/LNB Test

Case 3: The concentration in one phase is above the detection limit, and the concentration in the other phase is below the detection limit.

For constituents of interest other than HCl, HF, and mercury, the flue gas stream data from previous studies of coal-fired power plants have shown that most of the material is present in the solid phase, and that only a small fraction is generally found in the vapor phase. Thus, the following conventions were selected for defining the total gas stream concentrations:

- For Case 1, the total concentration is the sum of the concentrations in the vapor and solid phases.

  For example, the total arsenic concentration in the stack gas for Run 2 (OFA/LNB test) is calculated as follows:

  As in the solid phase = 110 $\mu g/Nm^3$

  As in the vapor phase = 2.0 $\mu g/Nm^3$

  Total As in ESP inlet gas = 112 $\mu g/Nm^3$

- For Case 2, the total concentration is considered to be the detection limit in the solid phase.

  For example, the total molybdenum concentration in the ESP inlet gas for Run 3 (OFA test) is calculated as follows:

  Mo in the solid phase = ND(290 $\mu g/Nm^3$)

  Mo in the vapor phase = ND(22 $\mu g/Nm^3$)

  Total Mo in the ESP inlet gas = ND(290 $\mu g/Nm^3$)

- For Case 3, the total concentration is considered to be the one above the detection limit, regardless of which phase this represents.

  For example, the cobalt concentration in the stack gas for Run 3 (OFA test) is calculated as follows:

  Co in the solid phase = 7.6 $\mu g/Nm^3$

  Co in the vapor phase = ND(1.7 $\mu g/Nm^3$)

  Total Co in the stack gas = 7.6 $\mu g/Nm^3$

The above conventions also are in accordance with guidance provided by EPA (*Technical Implementation Document for EPA's Boiler and Industrial Furnace Regulations.* U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C., March 1992).

Testing at several sites has indicated that HCl, HF, and mercury are present primarily in the vapor phase (although mercury is sometimes also detected in the solid phase). For Case 2, then, the total concentration of each of these species is considered to be the detection limit in the vapor phase. For Cases 1 and 3 the methodologies are unchanged from those described above.

The following criteria were used when averaging the results of different runs:

- When all values for a given variable were above the detection limit, the mean concentration was calculated as the true arithmetic mean.

- For results that include values both above and below the detection limit, one-half the detection limit was used to calculate the mean. For example:

Analytical Values	Calculation	Mean Value
10, 12, ND(8)	[10+12+(8/2)]/3	8.7

By convention, the calculated mean is not allowed to be smaller than the largest detection limit value. In the following example, using one-half the detection limit would yield a calculated mean of 2.8. This is less than the highest detection level obtained; therefore, the reported mean is ND(4).

Analytical Values	Calculation	Mean Value
5, ND(4), ND(3)	[5+(4/2)+(3/2)]/3 = 2.8	ND(4)

- When all analytical results for a given variable are below the detection limit, the mean is reported as ND(x), where x is the largest detection limit. The bias estimate (used where calculating confidence intervals for other parameters) is one-half of the detection level, and no confidence interval is reported.

Coal

Tables 3-1 and 3-2 show the analytical results for the coal samples collected during the OFA and OFA/LNB tests, respectively. Appendix A describes the analytical methods used for each combination of substance and stream. Measurements of the concentrations reported here were made using what Radian considered to be the best method for each matrix. Typically, the method with the lowest detection limit was chosen, except

Table 3-1
Coal Composition - OFA Test (mg/kg dry unless noted)

Substance	Run 1	Run 3	Run 4	Run 5	Mean	95% CI
Date	3/3/91	3/5/91	3/6/91	3/6/91		
Gross Load (MW)	472	477	477	477	476	4
Coal Rate (lb/hr, dry)	330,000	335,000	328,000	326,000	330,000	6,100
HHV (Btu/lb, dry)	13,400	13,900	13,700	13,700	13,700	370
Ash (%, dry)	12	9.1	10	10	10	1.6
Moisture (%)	5.5	4.1	4.3	4.8	4.7	1.0
Sulfur (%, dry)	1.8	1.6	1.6	1.6	1.6	0.2
Major Species						
Aluminum		16,000	14,000	13,000	14,000	3,800
Iron		15,000	13,000	11,000	13,000	5,000
Sodium		288	266	260	270	37
Titanium		915	694	714	770	300
Target Species						
Arsenic		13	19	19	17	8.0
Barium		210	160	140	170	86
Beryllium		1.7	1.5	1.0@	1.4	0.93
Cadmium		ND(0.10)	0.16@	ND(0.11)	ND(0.11)	--
Chloride		310@	500@	400@	410	230
Chromium		26	21	19	22	8.6
Cobalt		8.9	8.3	7.8	8.3	1.4
Copper		56	29	31	38	37
Fluoride		73	38@	100	70	79
Lead		4.8	5.6	4.9	5.1	1.1
Manganese		14	16	22	17	11
Mercury		0.19	0.13	0.15	0.15	0.08
Molybdenum		3.8	5.2	ND(1.4)	3.2	5.7
Nickel		28	27	25	27	3.1
Phosphorus		210	260	270	240	76
Selenium		3.9	3.2	4.2	3.8	1.2
Vanadium		36	41	35	37	8.8

ND = Not detected at the concentration in parentheses.
CI = Confidence Interval.
@ = Result is less than five times the detection limit.

Table 3-2
Coal Composition - OFA/LNB Test (mg/kg dry unless noted)

Substance	Run 2	Run 3	Run 4	Mean	95% CI
Date	5/19/93	5/20/93	5/21/93		
Gross Load (MW)	467	472	470	470	6
Coal Rate (lb/hr, dry)	313,000	316,000	317,000	315,000	5,200
HHV (Btu/lb, dry)	13,700	13,700	13,900	13,800	200
Ash (%, dry)	9.5	10	8.9	9.5	1.3
Moisture (%)	4.3	4.0	3.0	3.8	1.7
Sulfur (%, dry)	1.8	1.7	1.6	1.7	0.27
Major Species					
Aluminum	12,000	15,000	15,000	14,000	4,590
Iron	14,000	10,000	9,500	11,000	6,200
Sodium	310	390	320	340	110
Titanium	740	980	800	840	310
Target Species					
Arsenic	23	22	24	23	2.3
Barium	94	120	86	99	39
Beryllium	1.9	2.4	2.4	2.2	0.72
Cadmium	ND(2.6)	ND(2.6)	ND(2.6)	ND(2.6)	--
Chloride	430@	280@	310@	340	200
Chromium	15	21	15	17	8.7
Cobalt	5.9	6.8	5.5	6.1	1.7
Copper	29	33	40	34	14
Fluoride	110	81	79	91	49
Lead	8.0	8.0	6.0	7.3	2.9
Manganese	14	14	14	14	0.8
Mercury	0.16	0.15	0.11	0.14	0.07
Molybdenum	3.2@	5.0@	ND(3.6)	ND(3.6)	--
Nickel	21	19	12	17	12
Phosphorus	170	140	110	140	75
Selenium	3.4	4.0	3.6	3.7	0.8
Vanadium	23	30	25	26	8.7

ND = Not detected at the concentration in parentheses.
CI = Confidence Interval.
@ = Result is less than five times the detection limit.

when the QA/QC results indicated significant problems with precision or bias for a particular technique. For each substance, a mean concentration was calculated, along with the 95% confidence interval about the mean. The confidence interval is the range about the mean wherein the probability is 95% that the true mean lies. For example, according to the three results shown in Table 3-1, it can be said, with 95% certainty, that the true mean cobalt concentration in the coal during the OFA test was between 6.9 and 9.7 mg/kg. Calculation of this confidence interval is discussed in Section 6.

For those substances that could not be quantified, the notation "ND(x)" is used. This term means "not detected at a concentration of x." The detection limit can vary according to sample size, sample preparation, and analytical method. For instance, the detection limit for cadmium in the coal is higher for the OFA/LNB test than for the OFA test, because only INAA was employed for the OFA/LNB test, as opposed to a specific cadmium analysis by GFAAS for the OFA test.

Calculations were performed with unrounded numbers, and the results were rounded for presentation in the table; therefore, slight differences in calculated means and confidence intervals are attributable to round-off errors.

Ash Streams

Table 3-3 shows the mean compositions of the bottom ash and fly ash samples. For the OFA test, bottom ash samples and fly ash samples (taken from the ESP hoppers) were collected and analyzed. For the OFA/LNB test, only the bottom ash samples were analyzed. Fly ash samples were collected from each of the 16 ESP hoppers, but they were archived for possible future analysis because of concern about the representativeness of a composite sample made from equal fractions of each of the 16 hopper samples (as was done for the OFA test). The ESP inlet particulate matter was deemed to be a better measure of the ash collected in the ESP.

In both tests, significant concentrations of mercury were detected in the fly ash. The concentrations are higher than observed for most FCEM project sites. The sorption of mercury onto the fly ash may be influenced by the level of unburned carbon in the ash. The loss on ignition (LOI) of the fly ash was not measured for the OFA test, but the LOI of the ESP inlet particulate matter collected during the OFA/LNB test was 6.2 ± 2.1 percent. This is a relatively high LOI and may be responsible for the higher-than-expected levels of mercury in the fly ash.

Water Streams

Table 3-4 shows the mean compositions of the sluice supply water and the bottom ash sluice water samples collected during the OFA test. These streams were also sampled during the OFA/LNB test, but the samples were archived for possible future analysis.

Table 3-3
Ash Stream Compositions - OFA and OFA LNB Tests (mg/kg dry unless noted)

	Bottom Ash OFA Test		**Bottom Ash OFA/LNB Test**		**ESP Collected Fly Ash OFA Test**		**ESP Inlet Particulate OFA/LNB Test**	
Substance	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**
Flow Rate (lb/hr, dry)	6,770	1,260	7,060	4,370	27,100	5,040	24,300	2,900
Major Species								
Aluminum	140,000	3,500	120,000	29,000	150,000	7,200	130,000	8,300
Iron	92,000	10,000	110,000	19,000	92,000	12,000	93,000	4,700
Sodium	1,800	210	3,600	900	1,900	490	3,400	670
Sulfur	440	900	71	200	2,000	330	4,200	8,800
Titanium	8,600	3,700	6,800	340	8,000	560	6,900	130
Target Species								
Arsenic	52	66	23	78	220	38	310	160
Barium	860	264	920	200	780	110	1,100	24
Beryllium	10	2.9	22	4.7	13	5.1	23	3.0
Cadmium	ND(1.0)	--	ND(1.0)	--	ND(1.0)	--	3.6	6.1
Chloride	ND(100)	--	ND(100)	--	ND(100)	--	2,300	1,100
Chromium	110	34	110	15	120	34	150	33
Cobalt	50	9.0	67	34	55	14	51	28
Copper	97	3.6	130	30	160	16	200	45
Fluoride	ND(17)	--	24	16	56	12	220	230
Lead	20	2.9	14	1.6	75	75	61	12
Manganese	120	51	150	19	140	190	160	44
Mercury	ND(0.020)	--	ND(0.012)	--	0.23	0.05	0.79	0.35
Molybdenum	ND(200)	--	24	41	ND(200)	--	15	22
Nickel	100	7.7	82	3.7	240	620	120	8.2
Phosphorus	1,120	820	540	19	1,400	1,300	810	240
Selenium	ND(5.0)	--	ND(1.2)	--	17	18	17	1.3
Vanadium	210	11	230	72	240	14	260	67

ND = Not detected at concentration in parentheses.
CI = Confidence Interval.

Table 3-4
Water Stream Compositions - OFA Test (μg/L)

	Sluice Supply Water		Bottom Ash Sluice Water	
Substance	**Mean**	**95% CI**	**Mean**	**95% CI**
Major Species				
Aluminum	680	53	200	220
Iron	790	46	240	220
Sodium	9,300	1,700	6,500	2,000
Sulfate	68,000	7,700	40,000	11,000
Titanium	ND(50)	--	ND(50)	--
Target Species				
Arsenic	16	0	7.2	1.9
Barium	150	3.0	98	17
Beryllium	ND(2.0)	--	ND(2.0)	--
Cadmium	1.5	0.4	ND(1.0)	--
Chloride	3,000	50	3,100	540
Chromium	ND(10)	--	ND(10)	--
Cobalt	ND(10)	--	ND(10)	--
Copper	35	1.4	ND(20)	--
Fluoride	180	11	130	21
Lead	3.7	5.7	ND(3.0)	--
Manganese	90	6.3	52	10
Mercury	ND(0.20)	--	ND(0.20)	--
Molybdenum	ND(50)	--	ND(50)	--
Nickel	ND(20)	--	ND(20)	--
Phosphorus	53	2.9	ND(50)	--
Selenium	ND(5.0)	--	ND(5.0)	--
Vanadium	ND(20)	--	ND(20)	--

ND = Not detected at concentration in parentheses.
CI = Confidence Interval.

ESP Inlet Gas

Tables 3-5 and 3-6 show the concentrations of the target analytes in the ESP inlet gas for the OFA and OFA/LNB tests, respectively. The A and B ducts were sampled sequentially with a single train for each type of gas sample, producing samples representative of the unit as a whole. The data are presented as solid and vapor compositions, along with the mean concentrations and confidence intervals in the combined phases.

For the OFA test, blank concentrations for both vapor-phase and solid-phase samples were significant for many of the substances when compared with the measured concentrations. Blank corrections were applied, and the details of these corrections can be found in Appendix I. For the OFA/LNB test, blank contributions to the target analyte results were not significant, and blank corrections were not applied.

The analytical results for semivolatile organic compounds were completely different for the two tests. For the OFA test, the samples collected with the MM5 train at the ESP inlet and the stack were analyzed by Method 8270 (GC-MS) for a long list of semivolatile organic compounds, some of which are classified as semivolatile organic matter (POM). During the OFA test, none of the POM compounds were present in the ESP inlet gas (or the stack gas) above detection limits, which were approximately 5-10 $\mu g/Nm^3$ for most of the compounds.

For the OFA/LNB test, the MM5 train samples collected at the ESP inlet and the stack were analyzed for a select group of polycyclic aromatic hydrocarbons (PAHs, a subset of POM) by high-resolution GC-MS. The concentrations of several of the compounds measured were above detection limits, but note that these levels are much lower (up to 3 orders of magnitude) than the detection limits available with the 8270 analysis used for the OFA test. The decision to use high-resolution GC-MS was made after the OFA test showed that all of the PAH concentrations were below 8270 analysis detection limits.

There are some anomalous results in the ESP inlet gas stream compositions for chloride, fluoride, mercury, and selenium. Each of these substances can potentially be present in the vapor phase. A problem that may have been encountered during sampling of the high-particulate ESP inlet gas is that, as the flue gas was drawn through the in situ thimble filter, reactions between the vapor and the large quantities of particulate in the thimble may have caused some vapor-phase species to be captured in the particulate fraction of the sampling train. While this would not affect the total concentration measured, it would attribute more of the substance to the particulate phase and less to the vapor phase than was actually present in the duct. Ash alkalinity may be a factor in the case of chloride, fluoride, and selenium, but it is also possible that unburned carbon in the ash may act as a sorbent for these vapor-phase species, including mercury.

For chloride, it appears that some reaction with the fly ash did occur during sampling in both the OFA and OFA/LNB tests. The total amount of chloride in the ESP inlet gas looks reasonable compared to the coal, but the vapor component measured at the ESP inlet is noticeably lower than at the stack. While the particulate/vapor chloride ratio

Table 3-5
ESP Inlet Gas Composition - OFA Test (μg/Nm³ unless noted)

	Solid Phase					Vapor Phase						
Substance	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Mean**	**95% CI**
Date	3/3/91	3/4/91	3/5/91	3/6/91	3/6/91							
Gas Flow Rate (dscfm)	1,240,000	1,300,000	1,280,000	1,300,000	1,310,000						1,290,000	34,700
Gas Flow Rate (Nm³/hr)	1,960,000	2,060,000	2,030,000	2,060,000	2,070,000						2,040,000	55,900
Particulate Matter (lb/hr)[a]			24,400	26,200	26,100						25,600	2,510
Particulate Matter (mg/Nm³)[a]			5,460	5,770	5,720						5,650	413
Major Species												
Aluminum			770,000	590,000	660,000			ND(87)	ND(93)	ND(90)	670,000	230,000
Iron			530,000	380,000	450,000			ND(17)	ND(19)	21@	450,000	190,000
Sodium			24,000@	18,000@	ND(5,700)			ND(430)	ND(470)	ND(450)	15,000	27,000
Sulfate			120,000	110,000	145,000			4,700,000	4,600,000	4,300,000	4,700,000	480,000
Titanium			47,000	36,000	41,000			ND(22)	ND(23)	ND(22)	41,000	14,000
Target Species												
Arsenic			2,200	1,300	1,900			ND(1.7)	ND(1.9)	ND(1.8)	1,800	1,100
Barium			7,500	5,300	6,000			ND(4.3)	ND(4.7)	ND(4.5)	6,300	2,800
Beryllium			110	100	120			ND(0.50)	ND(0.52)	ND(0.90)	109	15
Cadmium			6.6@	ND(11)	6.1@			ND(0.43)	ND(0.47)	ND(0.45)[b]	ND(11)	--
Chloride[c]			22,000	21,000	27,000			9,100	12,000	12,000	35,000	10,000
Chromium			1,100	840	930			ND(4.3)	ND(4.7)	ND(4.5)	940	290
Cobalt			420	320	360			ND(2.5)	ND(2.6)	ND(1.9)	370	110
Copper			1,300	1,200	1,300			ND(8.7)	ND(9.3)	ND(9.0)	1,200	200

Table 3-5 (Continued)

	Solid Phase					Vapor Phase						
Substance	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Mean**	**95% CI**
Fluoride[d]			1,100	1,400	1,400			1,700	2,200	1,700	3,100	1,200
Lead			270	520	530			ND(1.3)[b]	0.86@[b]	2.6@[b]	440	370
Manganese			980	600	680			ND(4.3)[b]	ND(4.7)[b]	ND(4.5)[b]	750	500
Mercury[e]			3.6@	0.050@	5.8			3.0	4.4	4.4	7.1	7.3
Molybdenum			ND(290)[b]	ND(260)[b]	ND(290)[b]			ND(22)	ND(23)	ND(22)	ND(290)	–
Nickel			810	540	630			ND(8.7)	ND(9.3)	ND(9.0)[b]	660	340
Phosphorus			9,300	4,000@	4,800@			ND(141)	ND(137)	ND(116)	6,000	7,100
Selenium[f]			310	540	570			ND(1.2)	ND(1.3)	1.7@	470	350
Vanadium			2,000	1,500	1,700			ND(8.7)	ND(9.3)	ND(9.0)	1,800	600
Benzene						1.0@	2.1@	0.67@			1.3	1.8
Toluene						ND(0.52)	ND(0.54)	ND(0.56)			ND(0.56)	--
Formaldehyde[g]						14@[b]		ND(6.5)[b]	ND(6.9)		ND(6.8)	--
POM											ND[h]	

[a] Calculated assuming 80:20 fly ash:bottom ash split

[b] Blank correction was greater than 50% of uncorrected result.

[c] Some of the solid-phase chloride measured at this location may have actually been vapor-phase chloride captured on the particulate fraction during sampling. See the discussion in the text under the ESP inlet results.

[d] The vapor-phase and total fluoride concentrations may be biased low. See the discussion in the text under the ESP inlet results.

[e] The vapor-phase and total mercury concentrations may be biased low. See the discussion in the text under the ESP inlet results.

[f] Vapor-phase selenium concentrations might be biased low, while particulate-phase and total selenium concentrations may be biased high. See the discussion in the text under the ESP inlet results.

[g] Formaldehyde was detected in blanks at concentrations similar to the samples. Results shown here are blank corrected.

[h] None of the polycyclic organic matter was measured in concentrations above detection limits. The results for the individual compounds can be found in Appendix B.

ND = Not detected at concentration in parentheses.
CI = Confidence Interval.
@ = Result is less than five times the detection limit.

Table 3-6
ESP Inlet Gas Composition - OFA/LNB Test ($\mu g/Nm^3$ unless noted)

	Solid Phase			Vapor Phase				
Substance	Run 2	Run 3	Run 4	Run 2	Run 3	Run 4	Mean	95% CI
Date	5/19/93	5/20/93	5/21/93					
Gas Flow Rate (dscfm)	1,270,000	1,260,000	1,230,000				1,250,000	44,000
Gas Flow Rate (Nm^3/hr)	2,010,000	1,990,000	1,950,000				1,980,000	70,000
Particulate Matter (lb/hr)	22,900	25,000	24,900				24,300	2,900
Particulate Matter (mg/Nm^3)	5,180	5,710	5,800				5,560	830
Major Species								
Aluminum	650,000	740,000	760,000	7.4 @	31 @	28 @	720,000	150,000
Iron	490,000	520,000	540,000	6.9 @	36 @	22 @	510,000	61,000
Sodium	19,000	18,000	19,000	18 @	81 @	59 @	19,000	1,400
Sulfate	63,000	13,000	130,000	4,800,000	4,800,000	4,700,000	4,900,000	62,000
Titanium	35,000	40,000	40,000	ND(0.21)	1.1	0.38	38,000	6,200
Target Species								
Arsenic	1,300	2,100	1,900	ND(0.14)	ND(0.14)	0.80	1,800	1,100
Barium	5,500	6,200	6,300	ND(0.11)	0.66 @	0.11	6,000	1,000
Beryllium	110	140	130	ND(0.12)	0.21 @	0.24 @	130	34
Cadmium	6.9 @	35	18 @	0.071 @	0.18	1.3	21	36
Chloride[a]	10,000	16,000	11,000	14,000	10,000	14,000	25,000	1,800
Chromium	760	950	810	1.3	3.0	3.5	840	250
Cobalt	200 @	340 @	320 @	ND(0.71)	ND(0.72)	ND(0.75)	290	190
Copper	980	1,300	1,100	ND(0.80)	1.1	0.58	1,100	370
Fluoride	680	1,800	1,300	5,200	4,000	4,500	5,800	250
Lead	290	380	360	2.1	2.1 @	5.2 @	340	110

Table 3-6 (Continued)

	Solid Phase			Vapor Phase				
Substance	Run 2	Run 3	Run 4	Run 2	Run 3	Run 4	Mean	95% CI
Manganese	940	850	870	0.57	1.0	1.8	890	110
Mercury	3.2	4.8	5.2	5.2	6.9	6.8	11	4.9
Molybdenum	ND(54)	110 @	120 @	ND(1.0)	ND(0.97)	ND(1.0)	86	130
Nickel	640	680	680	0.61 @	1.8 @	2.4 @	660	58
Phosphorus	4,700	4,400	4,200	ND(180)	ND(180)	ND(190)	4,500	650
Selenium[b]	90	100	98	3.5	2.2 @	2.1 @	99	14
Vanadium	1,200	1,600	1,500	ND(0.50)	0.47	ND(0.53)	1,500	560
PAHs[c]								
5-methyl chrysene	ND(0.0013)	ND(0.00035)	ND(0.0048)				ND(0.0048)	--
7H-dibenzo[c,g]carbazole	ND(0.019)	ND(0.015)	ND(0.078)				ND(0.078)	--
Acenaphthene	0.0063	0.0048	0.033				0.015	0.039
Acenaphthylene	0.0024	0.0052	0.0058				0.0045	0.0045
Anthracene	0.0044	0.0046	0.0058				0.0049	0.0019
Benzo[a]pyrene	0.023	ND(0.0036)	ND(0.0068)				0.0094	0.029
Benzo[b,j&k]fluoranthenes	ND(0.0085)	0.00070	ND(0.032)				ND(0.032)	--
Benzo[ghi]perylene	ND(0.0027)	ND(0.0037)	ND(0.041)				ND(0.041)	--
Benz[a]anthracene	0.0011	0.0020	ND(0.015)				ND(0.015)	--
Chrysene	0.0055	0.0017	0.0063				0.0045	0.0061
Dibenzo[a,e]pyrene	ND(0.0023)	ND(0.0015)	ND(0.012)				ND(0.012)	--
Dibenzo[a,h]pyrene	ND(0.0033)	ND(0.0027)	ND(0.058)				ND(0.058)	--
Dibenzo[a,i]pyrene	ND(0.0042)	ND(0.0026)	ND(0.018)				ND(0.018)	--
Dibenz[a,h]acridine	ND(0.011)	ND(0.0027)	ND(0.032)				ND(0.032)	--
Dibenz[a,h]anthracene	ND(0.0015)	ND(0.00087)	ND(0.053)				ND(0.053)	--
Dibenz[a,i]acridine	ND(0.0080)	ND(0.0030)	ND(0.022)				ND(0.022)	--

Table 3-6 (Continued)

	Solid Phase			Vapor Phase				
Substance	**Run 2**	**Run 3**	**Run 4**	**Run 2**	**Run 3**	**Run 4**	**Mean**	**95% CI**
Fluoranthene	0.024	0.0061	0.0085				0.013	0.024
Fluorene	0.015	0.0049	0.0061				0.0087	0.014
Indeno[1,2,3-cd]pyrene	ND(0.0017)	ND(0.0031)	ND(0.021)				ND(0.021)	--
Phenanthrene	0.076	0.022	0.021				0.040	0.078
Pyrene	0.015	0.0049	0.0092				0.0097	0.012

[a] Some of the solid-phase chloride measured at this location may have actually been vapor-phase chloride captured on the particulate fraction during sampling. See the discussion in the text under the ESP inlet results.

[b] Vapor-phase and total selenium concentrations may be biased low. See the discussion in the text under the ESP inlet results.

[c] PAHs are total particulate + vapor measurements. PAH results are considered order-of-magnitude estimates because of matrix interference problems. See Section 5 for further details.

ND = Not detected at the concentration in parentheses.
CI = Confidence Interval.
@ = Result is less than five times the detection limit.

may have been overestimated, it appears that there was at least some chloride actually present in the particulate phase. The total concentrations of chloride are lower at the stack than at the ESP inlet, which suggests removal of particulate-phase chloride across the ESP.

For fluoride, the OFA/LNB results are consistent, with no evidence of artifacts. However, for the OFA test, the ESP inlet vapor-phase and total concentrations appear to be biased low when compared to the coal and stack gas fluoride concentrations, but not because of reaction with the fly ash in the sampling train. The total concentration of fluoride at the ESP inlet for the OFA test is only about 40% of the concentration at the stack, which is clearly inconsistent. The ESP inlet fluoride results obtained during the OFA/LNB test are probably more representative.

For mercury, the OFA test results indicate that the total concentration of mercury measured in the ESP inlet gas, which is only about 60% of that expected based on the coal composition, may be biased low. There is also evidence of vapor-phase mercury being sorbed onto the fly ash during sampling. The concentrations of mercury in the ESP inlet particulate are, on average, more than twice those measured in the ash collected by the ESP, while the vapor-phase mercury concentrations are lower at the ESP inlet than at the stack.

For the OFA/LNB test, the ESP inlet mercury total concentrations agree well with those expected based on the coal mercury concentrations, and the vapor-phase levels are consistent with those measured at the stack. There is no evidence of artifacts, and it appears that the high level of mercury in the ESP inlet particulate, which accounts for roughly half of the total mercury, may reflect the true distribution in this stream. As was previously discussed under the ash stream results, the relatively high levels of unburned carbon in the ash may be sorbing the mercury onto the ash.

For selenium, the OFA test results suggest that both the vapor-phase and total selenium concentrations measured at the ESP inlet are biased low. The total ESP inlet selenium concentration is only about 40% of that expected based on the coal measurements, and the vapor-phase concentrations of selenium are dramatically lower than those measured at the stack. While it is possible that there may be some of the vapor-phase selenium reacting with the fly ash during sampling, there is an indication that significant amounts of vapor-phase selenium may not have been recovered from the ESP inlet sampling train. The multi-metals train used at the ESP inlet location (described in Appendix A) was modified to use an in situ filter for particulate capture, with a Teflon® transfer line transporting the vapor to the impinger train. Because the Teflon® line was not heated to duct temperatures, vapor-phase selenium may have condensed in this line. Even though the transfer line was rinsed during recovery, Radian's experience with selenium deposits indicates that, if selenium had condensed in the transfer line, it could not have been recovered by rinsing with dilute nitric acid. The Method 5 sampling train used at the stack, with its heated glass-lined probe, does not suffer from this same limitation.

For the OFA test, the selenium ESP inlet results are less clear. As with the OFA/LNB test, there is very little vapor-phase selenium measured in the ESP inlet gas. However, considering that the total amount of selenium in the ESP inlet gas is about 170% of that expected based on the coal measurements, it doesn't appear that any selenium was lost during sampling. The lack of vapor-phase selenium in the ESP inlet gas might be attributed to reaction with the fly ash in the sampling train, but there is also an apparent high bias in the total selenium results at this location.

Stack Gas

Tables 3-7 and 3-8 show the concentrations of the target analytes measured in the stack gas during the OFA and OFA/LNB tests, respectively. For the OFA test, blank corrections were applied for many of the target substances. The details of these corrections can be found in Appendix I.

For the OFA/LNB test, blank contributions for most of the target analytes were not significant; therefore, no blank corrections were applied. The exceptions are Cr(VI) and formaldehyde. For Cr(VI), a consistent, significant background concentration was measured in the KOH reagent used in the sampling train. This background contribution was subtracted from the sample results. The details of the blank correction are included in Appendix I. For formaldehyde, blank contributions from field, trip, and reagent blanks were as large as or even greater than the sample results. However, a consistent contamination level could not be defined; therefore, the results were not corrected for the blank results.

Emission Factors

Table 3-9 presents the mean emission factors for target species in the stack gas during both the OFA and OFA/LNB tests. The mass emission rates (lb/hr) for each substance were divided by the heat input (Btu/hr) of the coal.

Mean particulate matter emissions at the stack were 0.21 lb/10^6 Btu for the OFA test and 0.12 lb/10^6 Btu for the OFA/LNB test. Chloride and fluoride emission factors are the highest of the target species, which is expected because the vapor-phase species (HCl and HF) are not effectively removed by the ESP, and because the concentrations of chloride and fluoride in the coal are higher than those of the other target species.

ESP Performance

Table 3-10 shows the removal efficiencies for the target species across the ESP for both the OFA and OFA/LNB tests. Most of the inorganic species are effectively removed by the ESP, except for chloride, fluoride, and mercury. Although selenium shows a removal of 72% for the OFA test, essentially no removal of selenium was measured during the

Table 3-7
Stack Gas Composition - OFA Test ($\mu g/Nm^3$ unless noted)

	Solid Phase					Vapor Phase						
Substance	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Mean**	**95% CI**
Date	3/3/91	3/4/91	3/5/91	3/6/91	3/6/91							
Gas Flow Rate (dscfm)	1,200,000	1,140,000	1,080,000	1,060,000	1,060,000						1,110,000	75,700
Gas Flow Rate (Nm^3/hr)	1,900,000	1,800,000	1,710,000	1,680,000	1,680,000						1,750,000	118,000
Particulate Matter (lb/hr)			486	1,290	962						913	1,000
Particulate Matter (mg/Nm^3)			129	349	260						246	275
Major Species												
Aluminum			12,000	27,000	23,000			ND(73)	ND(77)	ND(68)	21,000	19,000
Iron			9,000	21,000	17,000			ND(15)	ND(15)	ND(14)	16,000	15,000
Sodium			330@	670@	580@			ND(370)	ND(380)	ND(340)	530	440
Sulfate			8,200	15,000	14,000			4,100,000	4,000,000	4,100,000	4,100,000	140,000
Titanium			610	1,400	1,300			ND(18)	ND(19)	ND(17)	1,100	1,100
Target Species												
Arsenic			71	--	150			ND(1.5)	ND(1.5)	ND(1.4)	110	500
Barium			160	320	290			ND(3.7)	ND(3.8)	ND(3.4)	260	210
Beryllium			2.2	5.5	5.1			ND(0.73)	ND(0.44)	ND(0.39)	4.3	4.5
Cadmium			0.34@	--	0.83@			ND(0.37)	ND(0.38)	ND(0.34)^b	0.59	3.1
Chloride			13	24	57			21000	22000	23000	22000	3200
Chromium			26	53	51			ND(3.7)	ND(3.8)	ND(3.4)	44	37
Cobalt			7.6@	17	15			ND(1.7)	ND(2.2)	ND(1.9)	13	13
Copper			27	59	59			ND(7.3)	ND(7.7)	ND(6.8)	48	46

Table 3-7 (Continued)

	Solid Phase					Vapor Phase						
Substance	Run 1	Run 2	Run 3	Run 4	Run 5	Run 1	Run 2	Run 3	Run 4	Run 5	Mean	95% CI
Fluoride			470	380	490			7200	6700	6800	7300	630
Lead			42	--	36			ND(1.1)[b]	ND(1.2)[b]	ND(1.0)[b]	39	38
Manganese			20	36	30			ND(3.7)[b]	ND(3.8)[b]	ND(3.4)[b]	29	21
Mercury			0.13@	0.54	0.37			6.6	7.2	7.6	7.5	1.6
Molybdenum			ND(8.7)[b]	ND(14)[b]	16@[b]			ND(18)	ND(19)	ND(17)	ND(14)	--
Nickel			18	34	33			ND(7.3)	ND(7.7)	ND(6.8)	28	22
Phosphorus			160@	330@	320@			ND(96)	ND(111)	ND(120)	270	230
Selenium			7.9	--	34			130	130	120	150	100
Vanadium			50	100	100			ND(7.3)	ND(7.7)	ND(6.8)	84	73
Benzene						1.3@	3.3	0.65@			1.7	3.4
Toluene						ND(0.58)	ND(0.57)	ND(0.54)			ND(0.58)	--
Formaldehyde[c]						2.7@[b]		ND(4.2)	ND(4.7)		ND(4.7)	--
POM											ND[a]	

[a] None of the compounds classified as POM were present in concentrations above detection limits. The results for individual compounds can be found in Appendix B.

[b] Blank corrections were greater than 50% of uncorrected result.

[c] Formaldehyde was detected in blanks in concentrations similar to those in the samples. Results shown here are corrected for the blank results.

ND = Not detected at concentration in parentheses.
CI = Confidence Interval.
@ = Results is less than five times the detection limit.

Table 3-8
Stack Gas Composition - OFA/LNB Test ($\mu g/Nm^3$ unless noted)

	Solid Phase			Vapor Phase				
Substance	**Run 2**	**Run 3**	**Run 4**	**Run 2**	**Run 3**	**Run 4**	**Mean**	**95% CI**
Date	5/19/93	5/20/93	5/21/93					
Gas Flow Rate (dscfm)	1,070,000	1,090,000	1,080,000				1,080,000	19,000
Gas Flow Rate (Nm^3/hr)	1,690,000	1,720,000	1,710,000				1,710,000	31,000
Particulate Matter (lb/hr)	427	642	502				524	271
Particulate Matter (mg/Nm^3)	114	170	133				139	70
Major Species								
Aluminum	12,000	17,000	11,000	14@	7.5@	20%	13,000	7,500
Iron	9,700	13,000	10,000	ND(4.4)	ND(3.4)	ND(5.0)	11,000	3,700
Sodium	420	730	470	70	15@	23@	570	360
Sulfate	13,000	16,000	17,000					210,000
Titanium	760	1,000	840	030@	ND(0.14)	ND(0.21)	880	340
Target Species								
Arsenic	110	110	150	2.0	1.1	2.1	120	65
Barium	150	190	150	0.11@	ND(0.07)	0.32@	160	67
Beryllium	2.6	4.2	3.4	0.28@	0.10@	ND(0.11)	3.5	1.8
Cadmium	2.9@	4.7@	4.8	ND(0.058)	ND(0.045)	ND(0.066)	4.2	2.7
Chloride	400	230	200	17,000	17,000	19,000	18,000	2,600
Chromium	20	27	23	1.0	0.77	1.1	24	8.6
Chromium (VI)^a	6.8^b	2.6@^{b}	9.3				6.2	8.4
Cobalt	6.4	8.9	7.2	ND(0.62)	ND(0.47)	ND(0.70)	7.5	3.3
Copper	29	43	33	ND(0.69)	ND(0.53)	ND(0.79)	35	18

Table 3-8 (Continued)

	Solid Phase			Vapor Phase				
Substance	**Run 2**	**Run 3**	**Run 4**	**Run 2**	**Run 3**	**Run 4**	**Mean**	**95% CI**
Fluoride	98	64	77	5,500	5,700	6,100	5,900	750
Lead	10	15	14	0.31@	ND(0.15)	ND(0.23)	13	5.8
Manganese	22	26	22	0.53	0.14@	0.24@	24	5.5
Mercury	0.29	0.12	0.17	4.4	5.3	6.4	5.5	2.3
Molybdenum	13	15	14	ND(0.83)	ND(0.64)	ND(1.0)	14	1.9
Nickel	16	21	19	0.82@	0.50@	0.64@	19	5.1
Phosphorus	190	220	210	ND(150)	ND(120)	ND(170)	210	33
Selenium	14	16	16	110	120	210	160	140
Vanadium	39	56	47	ND(0.44)	ND(0.34)	ND(0.50)	47	20
Benzene				ND(0.59)	ND(0.52)	0.88@	ND(0.59)	-
Toluene				0.72@[d]	0.79@[d]	0.91@[d]	0.81	0.24
Formaldehyde[e]				2.7[c]	0.54[c]	1.4[c]	1.5	2.7
PAHs[a, f]								
5-methyl chrysene	0.00028	ND(0.00017)	ND(0.00098)				ND(0.00098)	-
7H-dibenzo[c,g]carbazole	0.0051	ND(0.0052)	ND(0.018)				ND(0.018)	-
Acenaphthene	0.018	0.0077	0.0025				0.0094	0.019
Acenaphthylene	0.0041	0.0027	0.0036				0.0035	0.0018
Anthracene	0.0069	0.0014	0.0044				0.0042	0.0069
Benzo[a]pyrene	0.0028	ND(0.0025)	ND(0.0048)				ND(0.0048)	-
Benzo[b,j&k]fluoranthene	0.0037	0.00059	0.00078				0.0017	0.0044
Benzo[ghi]perylene	0.0036	ND(0.0018)	ND(0.0019)				ND(0.0036)	-
Benz[a]anthracene	0.023	0.00063	0.00077				0.0081	0.032

Table 3-8 (Continued)

	Solid Phase			Vapor Phase				
Substance	**Run 2**	**Run 3**	**Run 4**	**Run 2**	**Run 3**	**Run 4**	**Mean**	**95% CI**
Chrysene	0.0036	0.0016	0.00091				0.0020	0.0034
Dibenzo[a,e]pyrene	ND(0.0023)	ND(0.00095)	ND(0.0034)				ND(0.0034)	-
Dibenzo[a,h]pyrene	ND(0.0037)	ND(0.00076)	ND(0.0034)				ND(0.0037)	-
Dibenzo[a,i]pyrene	ND(0.0033)	ND(0.0011)	ND(0.0049)				ND(0.0049)	-
Dibenz[a,h]acridine	ND(0.0018)	ND(0.0016)	ND(0.0018)				ND(0.0018)	-
Dibenz[a,h]anthracene	ND(0.0015)	ND(0.00089)	ND(0.0043)				ND(0.0043)	-
Dibenz[a,i]acridine	ND(0.0048)	ND(0.0015)	ND(0.0011)				ND(0.0048)	-
Fluoranthene	0.026	0.0045	0.0049				0.012	0.030
Fluorene	0.024	0.0047	0.0059				0.011	0.026
Indeno[1,2,3-cd]pyrene	0.0031	0.00074	ND(0.0028)				ND(0.0031)	-
Phenanthrene	0.10	0.025	0.025				0.051	0.11
Pyrene	0.031	0.0036	0.0023				0.012	0.040

[a] PAHs and Cr(VI) are total particulate matter plus vapor measurements.

[b] Blank concentration exceeds 50% of the uncorrected result. Blank contribution was subtracted.

[c] Blank concentration exceeds 50% of the uncorrected result. Not corrected for the blank results.

[d] Toluene was detected in blank samples at similar levels. Results not corrected for the blank results.

[e] Formaldehyde was detected in blanks in concentrations similar to those of the samples. Results shown here are not corrected for the blank results.

[f] PAH results are considered order-of-magnitude estimates because of matrix interference problems. See Section 5 for further details.

ND = Not detected at the concentration in parentheses.

CI = Confidence Interval.

@ = Result is less than dive times the detection limit.

Table 3-9
Stack Emission Factors - OFA and OFA/LNB Tests (lb/10^{12} Btu unless noted)

	OFA Test		OFA/LNB Test	
Substance	Combined Mean	95% CI	Combined Mean	95% CI
Gas Flow Rate (dscfm)	1,110,000	75,700	1,080,000	19,000
Gas Flow Rate (Nm^3/hr)	1,750,000	118,000	1,710,000	31,000
Coal Flow Rate (lb/hr, dry)	330,000	6,100	315,000	5,200
Heating Value (Btu/lb, dry)	13,700	370	13,800	200
Particulate Matter (lb/10^6 Btu)	0.21	0.24	0.12	0.061
Target Species				
Arsenic	94	430	110	56
Barium	220	180	140	58
Beryllium	3.7	3.8	3.1	1.5
Cadmium	0.50	2.7	3.6	2.4
Chloride	19,000	2,400	15,000	2,400
Chromium	38	32	21	7.5
Chromium (VI)	NA	--	5.4	7.3
Cobalt	11	11	6.5	2.9
Copper	41	41	30	15
Fluoride	6,200	570	5,100	710
Lead	33	34	11	5.1
Manganese	25	18	21	4.9
Mercury	6.4	1.1	4.8	2.0
Molybdenum	ND(12)	--	12	1.8
Nickel	24	19	17	4.5
Phosphorus	230	200	180	31
Selenium	128	33	140	120
Vanadium	72	64	41	18
Benzene	1.4	3.0	ND(0.51)	--
Toluene	ND(0.49)	--	0.70	0.21
Formaldehyde	ND(4.0)	--	1.3	2.4

Table 3-9 (Continued)

	OFA Test		OFA/LNB Test	
Substance	**Combined Mean**	**95% CI**	**Combined Mean**	**95% CI**
PAHs				
5-methyl chrysene	NA	--	ND(0.0009)	--
17H-dibenzo[c,g]carbazole	NA	--	ND(0.016)	--
Acenaphthene	ND(5)	--	0.0081	0.017
Acenaphthylene	ND(5)	--	0.0030	0.0016
Anthracene	ND(5)	--	0.0037	0.0060
Benzo[a]pyrene	ND(5)	--	ND(0.0041)	--
Benzo[b,j&k]fluoranthenes	NA	--	0.0015	0.0038
Benzo[ghi]perylene	ND(5)	--	ND(0.0031)	--
Benz[a]anthracene	ND(5)	--	0.0070	0.02748
Chrysene	ND(5)	--	0.0018	0.0030
Dibenzo[a,e]pyrene	NA	--	ND(0.0030)	--
Dibenzo[a,h]pyrene	NA	--	ND(0.0032)	--
Dibenzo[a,i]pyrene	NA	--	ND(0.0042)	--
Dibenz[a,h]acridine	NA	--	ND(0.0016)	--
Dibenz[a,h]anthracene	ND(5)	--	ND(0.0037)	--
Dibenz[a,i]acridine	NA	--	ND(0.0042)	--
Fluoranthene	ND(5)	--	0.010	0.026
Fluorene	ND(5)	--	0.0099	0.023
Indeno[1,2,3-cd]pyrene	ND(5)	--	ND(0.0027)	--
Phenanthrene	ND(5)	--	0.044	0.098
Pyrene	ND(5)	--	0.011	0.035

ND = Not Detected. Value in parentheses is based on the detection limit.
CI = Confidence Interval.
NA = Not Analyzed.

Table 3-10
ESP Removal Efficiency - OFA and OFA/LNB Tests

	OFA Test		OFA/LNB Test	
Substance	**Removal (%)** [a]	**95% CI (%)**	**Removal (%)** [a]	**95% CI (%)**
Particulate Matter	96	4	98	1
Target Species				
Arsenic	95	25	94	3
Barium	96	2	98	1
Benzene	0 [b]	190	NA	--
Beryllium	97	4	98	1
Cadmium	NC	--	83	18
Chloride	46	11	39	7
Chromium	96	3	98	1
Cobalt	97	3	98	1
Copper	97	3	98	1
Fluoride	0 [b]	56	13	9
Formaldehyde	NC	--	NA	--
Lead	92	4	97	1
Manganese	97	2	98	0.4
Mercury	9 [c]	80	55	17
Molybdenum	NC	--	86	16
Nickel	96	3	98	1
Phosphorus	96	3	96	1
Selenium	72	14	0 [a]	130
Toluene	NC	--	NA	--
Vanadium	96	3	97	1
PAHs				
5-methyl chrysene	NA	--	NC	--
7H-dibenzo[c,g]carbazole	NC	--	NC	--
Acenaphthene	NC	--	45	93
Acenaphthylene	NC	--	33	48
Anthracene	NC	--	26	123

Table 3-10 (Continued)

	OFA Test		OFA/LNB Test	
Substance	**Removal (%)**[a]	**95% CI (%)**	**Removal (%)**[a]	**95% CI (%)**
Benzo[a]pyrene	NC	--	> 56	--
Benzo[b,j&k]fluoranthenes	NA	--	NC	--
Benzo[ghi]perylene	NC	--	NC	--
Benz[a]anthracene	NC	--	NC	--
Chrysene	NC	--	61	57
Dibenzo[a,e]pyrene	NA	--	NC	--
Dibenzo[a,h]pyrene	NA	--	NC	--
Dibenzo[a,i]pyrene	NA	--	NC	--
Dibenz[a,h]acridine	NA	--	NC	--
Dibenz[a,h]anthracene	NC	--	NC	--
Dibenz[a,i]acridine	NA	--	NC	--
Fluoranthene	NC	--	21	170
Fluorene	NC	--	0[b]	220
Indeno[1,2,3-cd]pyrene	NC	--	NC	--
Phenanthrene	NC	--	0[b]	210
Pyrene	NC	--	0[b]	370

[a] Removal efficiencies were calculated based on mass rates, i.e., concentration times flow rate, rather than concentrations alone.

[b] Calculated removal was negative but is shown as zero.

[c] Based on an ESP inlet concentration that may be biased low. See the discussion in the text under the ESP inlet results.

NC = Not calculated because substance concentration was below the detection limit at the ESP inlet.

NA = Not applicable because substance was not analyzed at the ESP inlet.

CI = Confidence Interval.

OFA/LNB test. However, the confidence interval is very large, indicating considerable uncertainty in this measurement.

The removal efficiencies for volatile organic compounds were measured during the OFA test. Essentially no benzene was removed and the removal efficiencies for toluene and formaldehyde were not calculated because their concentrations in the ESP inlet gas were below detection limits. The removal efficiencies for these substances during the OFA/LNB test could not be determined because they were not sampled in the ESP inlet gas. This decision was made because the concentrations of benzene, toluene, and formaldehyde were low for the OFA test and are not expected to be controlled by the ESP.

The removal efficiencies for the PAHs were measured during the OFA/LNB test. Several of the compounds were below detection limits in the ESP inlet gas; therefore, their removal efficiencies were not calculated. For those compounds for which a removal efficiency could be calculated, the large confidence intervals indicate high uncertainties.

Speciation of Mercury

Stack gas samples were collected with the Frontier Geoscience's mercury speciation train during the OFA/LNB test, and the results are shown in Table 3-11. The analysis only included vapor-phase mercury. The results show that 40% of the stack mercury is present as ionic inorganic mercury, 54% as elemental mercury, and 6% as methyl mercury. These results are discussed and compared to the multi-metals train results in Section 4.

Mercury speciation samples were also collected during the OFA test, but by a substantially different technique that has since been shown to be invalid. These results are presented in Appendix D.

Size-Fractionated Stack Particulate Matter

Table 3-12 shows the results obtained from the chemical analysis of size-fractionated stack particulate matter from the OFA/LNB test. The samples were collected with University of Washington Mark 5 cascade impactors. Individual impactor stages were combined before analysis to produce three target size ranges: $< 3\,\mu m$, $3\text{-}10\,\mu m$, and $> 10\,\mu m$. The actual size ranges obtained were $< 4\,\mu m$, $4\text{-}9\,\mu m$, and $> 9\,\mu m$. Samples were digested in the microwave and analyzed using inductively coupled plasma mass spectrometry (ICP-MS). The results are reported as mg/kg of the target analytes in each size fraction.

Size-fractionated particulate matter samples were also collected during the OFA test. The samples were analyzed by instrumental neutron activation analysis (INAA), but the

Table 3-11
Mercury Speciation in Stack Gas - OFA/LNB Test ($\mu g/Nm^3$ unless noted)

Component[a]	Run 2 5/19/93	Run 3 5/20/93	Run 4 5/21/93	Mean	95% CI	Percent of Vapor Hg
Ionic Inorganic Hg	2.4	3.3	2.1	2.6	1.6	39%
Elemental Hg	4.1	3.4	3.3	3.6	1.1	54%
Methyl Hg	0.16	0.97	0.20	0.44	1.1	7%
Total Vapor Hg	6.7	7.7	5.6	6.6	2.6	--

[a] Results determined using Frontier Geoscience's mercury speciation train.

CI = Confidence Interval.

Table 3-12
Size-Fractionated Stack Particulate Matter - OFA/LNB Test (mg/kg)

Substance	Run 2 5/19/93	Run 3 5/20/93	Run 4 5/21/93	Mean	95% CI
Gas Volume (Nm^3)	3.74	3.75	3.96	--	--
< 4 μm Fraction					
Collected Mass (mg)	35.4	29.6	27.7	--	--
Antimony	83	87	94	88	13
Arsenic	1,400	1,900	1,700	1,700	580
Barium	2,000	1,900	2,100	2,000	330
Beryllium	24	33	29	29	11
Cadmium	6.4	5.7	8.7	6.9	3.8
Chromium	390	490	430	440	130
Cobalt	56	68	58	61	17
Copper	420	400	360	390	82
Lead	320	200	220	250	160
Manganese	200	230	180	200	65
Mercury	2.6	2.8	1.2	2.2	2.2
Molybdenum	240	280	290	270	76
Nickel	170	200	170	180	33
Selenium	100	130	140	120	46
Vanadium	610	770	730	700	200
4-9 μm Fraction					
Collected Mass (mg)	40.7	33.7	34.4	--	--
Antimony	43	44	42	43	3.1
Arsenic	690	790	740	740	130
Barium	1,800	1,700	1,700	1,700	160
Beryllium	38	41	39	39	3.3
Cadmium	4.2	7.3	3.6	5.0	4.9
Chromium	380	400	370	380	33
Cobalt	98	97	94	96	5.6
Copper	700	400	400	500	430
Lead	270	200	170	210	130
Manganese	300	250	240	260	81
Mercury	3.2	2.2	1.2	2.2	2.6
Molybdenum	64	62	56	61	11
Nickel	240	220	220	230	22
Selenium	53	36	42	44	21
Vanadium	630	640	640	640	8.9

Table 3-12 (Continued)

Substance	Run 2 5/19/93	Run 3 5/20/93	Run 4 5/21/93	Mean	95% CI
> 9 μm Fraction					
Collected Mass (mg)	164	207	164	--	--
Antimony	17	21	18	19	5
Arsenic	310	410	410	380	140
Barium	1,200	1,400	1,300	1,300	240
Beryllium	22	25	28	25	8
Cadmium	3.2	5.1	1.7	3.4	4.3
Chromium	240	230	370	280	190
Cobalt	58	59	71	62	18
Copper	1,700	620	430	900	1,600
Lead	120	120	92	110	35
Manganese	230	280	220	250	75
Mercury	2.4	5.6	1.6	3.2	5.3
Molybdenum	26	29	29	28	4
Nickel	150	140	220	170	110
Selenium	63	100	120	96	77
Vanadium	350	350	430	380	110

CI = Confidence Interval.

quality of the results was poor because of the relatively low concentrations. These results are presented in Appendix D. (The results from the OFA test led to the modification of the techniques used for the OFA/LNB test.)

Other Species Detected

Other substances not on the target analyte list but listed in Title III of the Clean Air Act Amendments of 1990 were also measured as part of the multi-substance techniques used for the target analytes. Additional Title III substances include antimony and organic compounds available from the VOST, semivolatile compounds, and aldehydes analyses. Table 3-13 shows the concentrations of antimony and organic compounds that were detected in at least one flue gas sample.

Table 3-13
Other Species Detected

	Concentrations ($\mu g/Nm^3$ unless noted)[a]						
Substance	Run 1	Run 2	Run 3	Run 4	Run 5	Mean	95% CI
ESP Inlet Gas - OFA Test							
Acetaldehyde[b]	65		ND(7.8)	ND(8.3)		24	87
Acrolein	12@		ND(9.4)	ND(10)		ND(10)	--
Antimony			ND(590)	ND(540)	ND(590)	ND(590)	--
Bis(2-ethlyhexyl)phthalate[b]	400	55	7.7@			150	530
Bromomethane	0.68@	1.7@	ND(0.56)			0.89	1.8
Dibutylphthalate[b]	270	30	ND(5.0)			100	360
Methylene chloride[b]	1.3@	ND(0.54)	3.4			1.7	4.0
Phenol	ND(5.8)	ND(4.9)	ND(5.0)			ND(5.8)	--
1,1,1-Trichloroethane	0.58@	1.0@	4.5			2.0	5.3
Stack Gas - OFA Test							
Acetaldehyde[b]	4.9@		8.1@	ND(5.6)		ND(5.6)	--
Acrolein	ND(2.3)		ND(6.2)	ND(6.8)		ND(6.8)	--
Antimony			ND(17)	ND(29)	ND(29)	ND(29)	--
Bis(2-ethlyhexyl)phthalate[b]	11@	ND(5.6)	8.3@			7.3	10
Bromomethane	ND(0.58)	ND(0.57)	ND(0.54)			ND(0.58)	--
Dibutylphthalate[b]	ND(5.3)	ND(5.6)	ND(5.3)			ND(5.6)	--
Methylene chloride[b]	ND(0.58)	2.5@	10			4.4	13
Phenol	ND(5.3)	14@	ND(5.3)			6.4	16
1,1,1-Trichloroethane	ND(0.58)	ND(0.57)	ND(0.54)			ND(0.58)	--
Coal - OFA Test							
Antimony (mg/kg)			0.91	1.9	1.3	1.4	1.2

Table 3-13 (Continued)

Substance	Concentrations ($\mu g/Nm^3$ unless noted)[a] Run 1	Run 2	Run 3	Run 4	Run 5	Mean	95% CI
ESP Inlet Gas - OFA/LNB Test							
Antimony		ND(78)	ND(85)	ND(87)		ND(87)	--
Stack Gas - OFA/LNB Test							
Acetaldehyde[b]		5.8	2.4	6.5		4.9	5.5
Antimony		2.4	2.9	2.6		2.6	0.59
Bromomethane		ND(0.59)	1.9@	ND(0.58)		0.83	2.3
Carbon disulfide		ND(0.59)	ND(0.59)	0.61@		ND(0.59)	--
Methylene chloride[b]		6.9	1.1	40		16	52
Coal - OFA/LNB Test							
Antimony (mg/kg)		1.3	1.8	1.3		1.5	0.69

[a] Total of solid- and vapor-phase concentrations for gas streams.

[b] Substances were detected in lab blanks and field blanks. Suspected contaminants.

ND = Not detected at the concentration in parentheses.
CI = Confidence Interval.
@ = Result is less than five times the detection limit.

4

DISCUSSION

This section discusses the important results of the testing at Site 16. The results from the OFA and OFA/LNB tests are compared. In addition, special topics such as mercury speciation, chromium speciation, size-fractionation, and elemental enrichment are discussed.

Coal Composition Comparison

Figures 4-1a and 4-1b show the trace element compositions of the coal fired during the OFA and OFA/LNB tests. The error bars represent the 95% confidence intervals about the mean values. The trace element compositions for the two tests are statistically equivalent; for every element, the 95% confidence intervals for the two tests overlap. Cadmium was not detected during either test. The detection limit was higher for the OFA/LNB test, because only INAA was employed, as opposed to a specific Cd analysis by GFAAS for the OFA test. Other coal measurements, such as heating value, moisture, sulfur content, ash content, and major element concentrations are similar for the two tests. Therefore, the coal composition can be considered consistent, and any differences in the emission results between OFA operation and OFA/LNB operation must be attributed to other factors.

Emissions Comparison

Figures 4-2a, 4-2b, and 4-2c show the emission factors for metals, acid gases, and volatile organic compounds for the two tests. The 95% confidence intervals overlap for all of the species shown, indicating that there is not a significant difference between the emissions of the unit under OFA operation or OFA/LNB operation. There is, however, a slight downward trend in the emissions during OFA/LNB operation. For elements primarily associated with the particulate matter, ten (barium, beryllium, chromium, cobalt, copper, lead, manganese, nickel, phosphorus, and vanadium) show lower mean emissions during OFA/LNB operation; only two (arsenic and cadmium) show higher mean emissions during OFA/LNB operation. The total particulate matter emissions were also lower during the OFA/LNB test.

The slight trend toward lower emissions of particulate-phase elements is more a reflection of the ESP performance than it is of the low-NO_x burners. The system

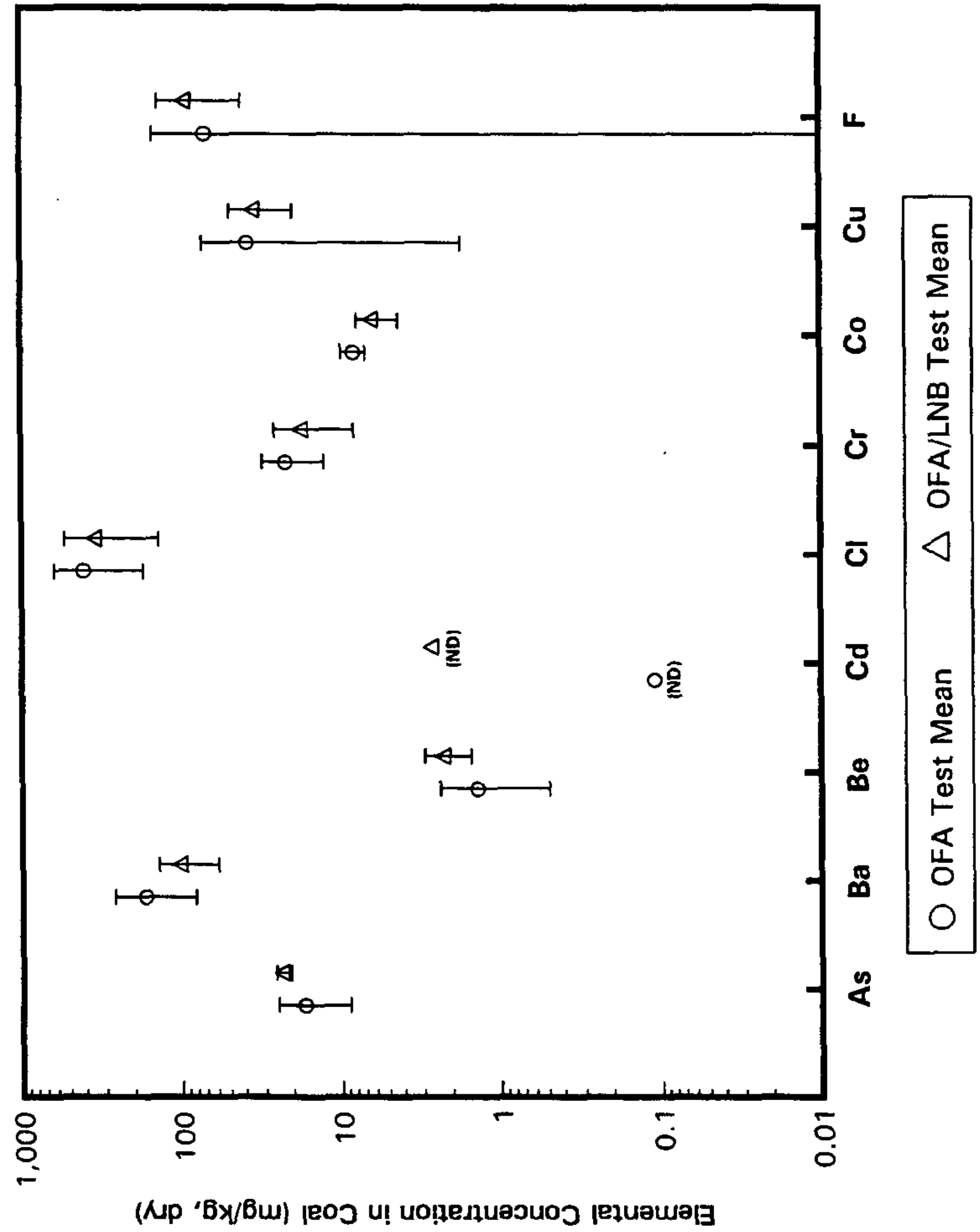

Figure 4-1a
Comparison of Coal Compositions

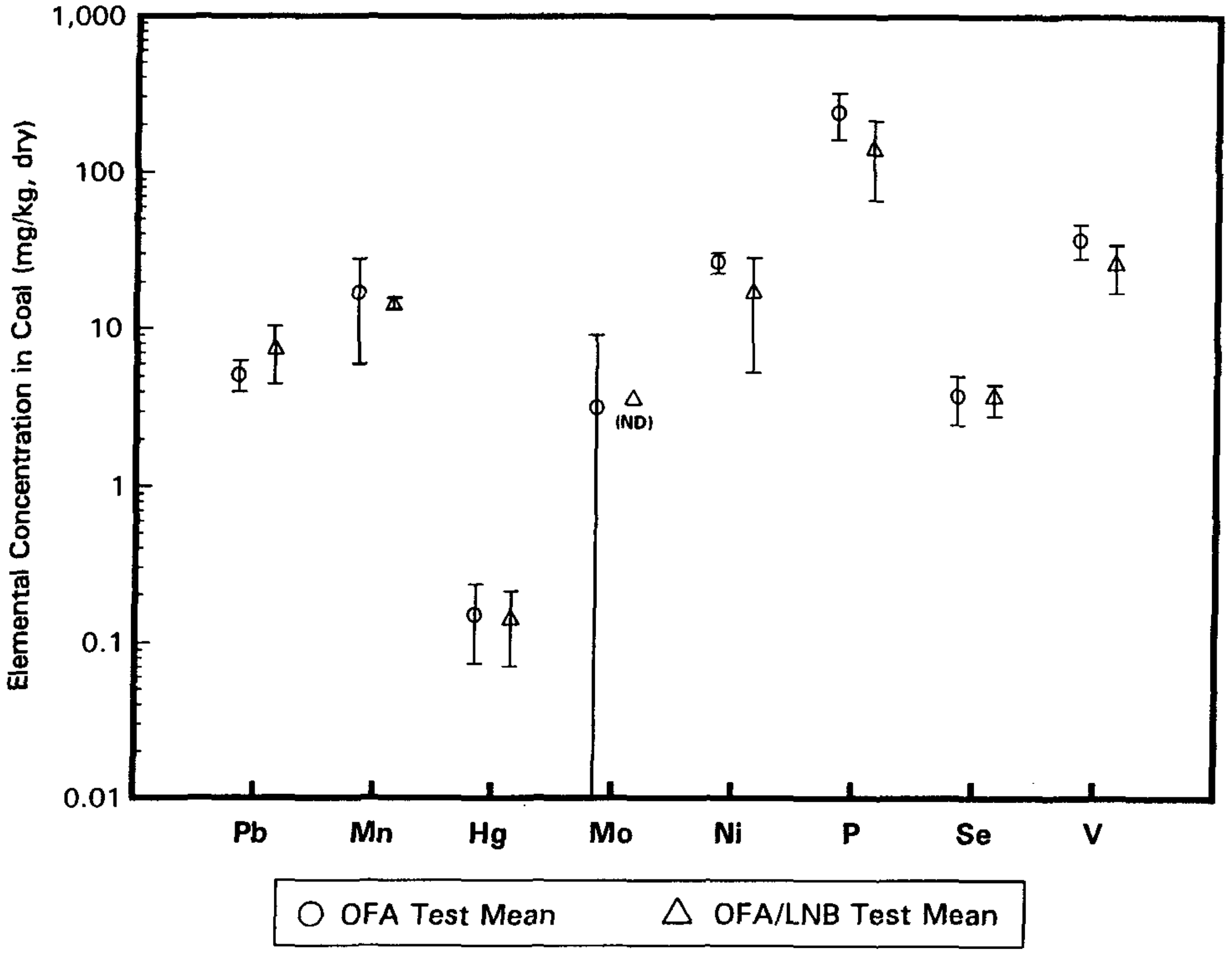

Figure 4-1b
Comparison of Coal Compositions

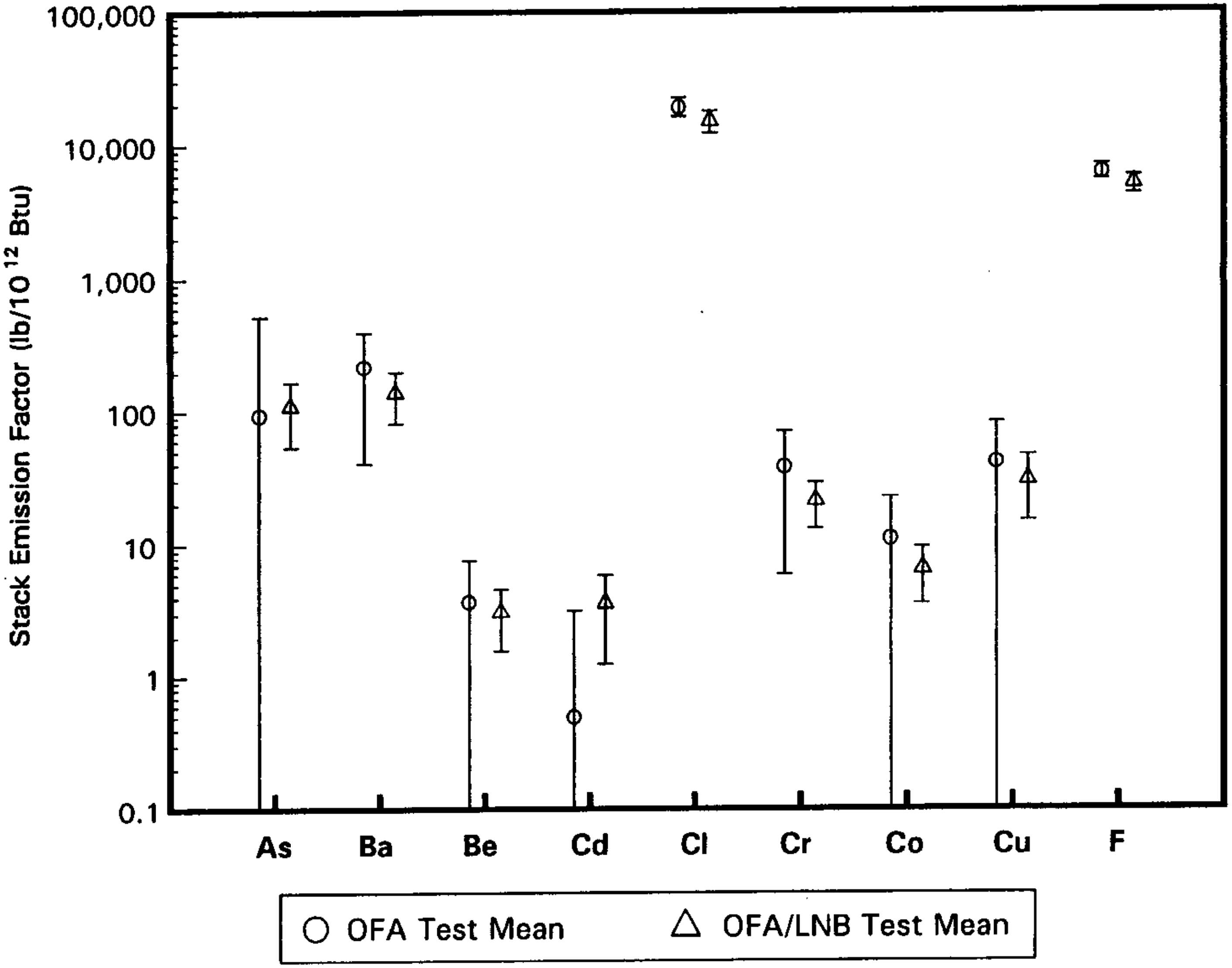

Figure 4-2a
Comparison of Emission Factors

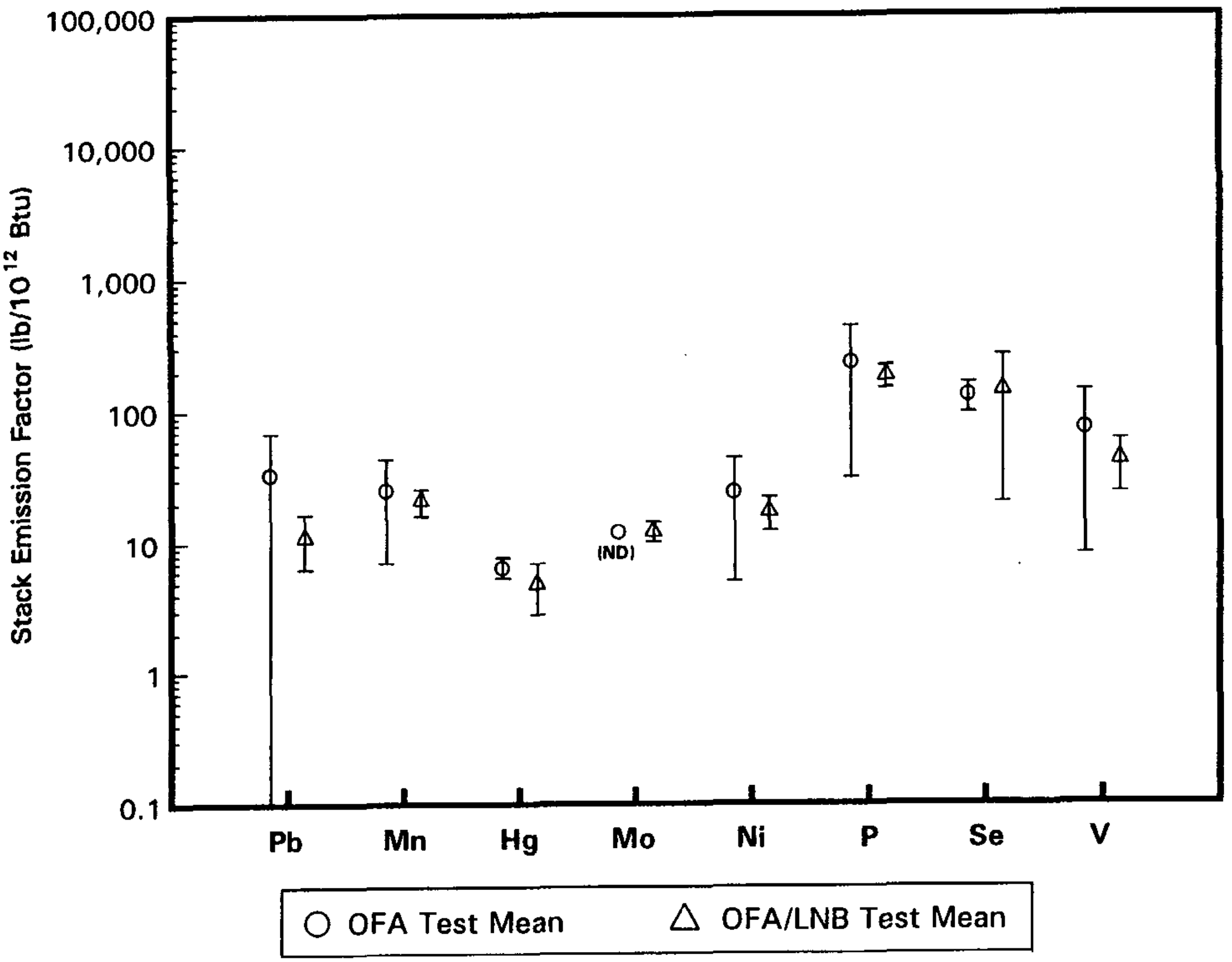

Figure 4-2b
Comparison of Emission Factors

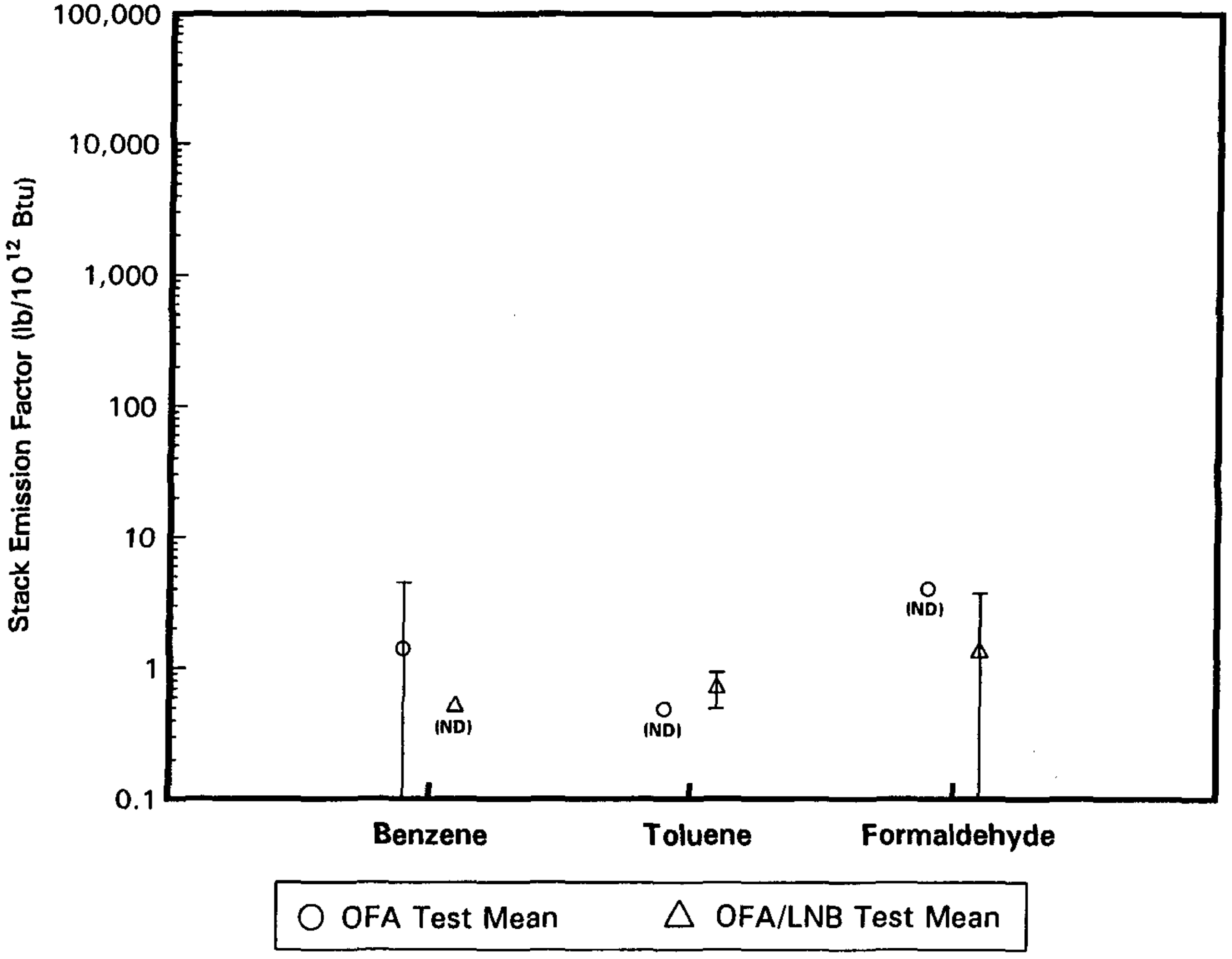

Figure 4-2c
Comparison of Emission Factors

appeared to be more "in tune" during the OFA/LNB test, as shown by the greater overall particulate matter removal efficiency (98% for OFA/LNB vs. 96% for OFA).

Precipitator performance is very sensitive to ash resistivity which, in turn, is sensitive to the unburned carbon content of the fly ash. After the low-NO_x burners were first installed, ESP performance was very poor. However, the burners were tuned by the vendor a short time before Radian conducted the OFA/LNB testing, decreasing the carbon content of the fly ash and improving ESP performance. In addition, NH_3 conditioning during the OFA/LNB test further improved performance. No conditioning was used during the OFA test.

There is some concern that combustion modifications designed to reduce NO_x emissions may also increase the emissions of organic compounds. In response to this, it can be said that the emissions of benzene, toluene, and formaldehyde were very low (either below detection limits or less than five times the detection limits) during both OFA and OFA/LNB operation. Furthermore, the presence of these compounds in laboratory and field blanks makes their measured concentrations in the flue gas highly uncertain.

Comparison of PAH Results

The analysis of PAHs was significantly different for the two tests. For the OFA test, samples were analyzed by GC-MS (Method 8270). For the OFA/LNB test, high-resolution GC-MS was employed for a selected list of PAHs pre-approved by Southern Company Services. The detection limits for high resolution GC-MS were much lower (up to 3 orders of magnitude) than those available through standard GC-MS. As a consequence, the PAH results are difficult to compare.

Table 4-1 lists the PAHs for which results were obtained, along with the range of concentrations measured in the ESP inlet gas and stack gas by each technique. Thirteen of the compounds were measured during both tests. During the OFA test, none of the PAHs were detected; detection limits were about 6 $\mu g/Nm^3$ for most of the compounds. For the OFA/LNB test, many of the compounds were detected by high-resolution GC-MS but at concentrations one to four orders of magnitude lower than the detection limits available for the OFA test.

The PAH concentrations measured during the OFA/LNB test show very high variability. As discussed in Section 5, the recoveries of surrogate compounds in actual samples were poor; however, acceptable recoveries of standards spiked into blank samples show that no problem existed with the analytical procedure, and the problem lies with the sample matrix. Possibly, carbonaceous material in the flue gas particulate matter interferes with the analysis; however, high-resolution GC-MS still represents the state of the art for analyzing low levels of PAHs. The PAH results for the OFA/LNB test should be considered order-of-magnitude estimates.

Table 4-1
Comparison of PAH Results

PAH Compounds	OFA Test[a] Range of Results ($\mu g/Nm^3$)	OFA/LNB Test[b] Range of Results ($\mu g/Nm^3$)
Acenaphthene	<6	0.0025 - 0.033
Acenaphthylene	<6	0.0027 - 0.0058
Anthracene	<6	0.0014 - 0.0069
Benz[a]anthracene	<6	0.00063 - 0.023
Benzo[b]fluoranthene	<6	NA
Benzo[k]fluoranthene	<6	NA
Benzo[b,j&k]fluoranthenes	NA	<0.032
Benzo[ghi]perylene	<6	<0.041
Benzo[a]pyrene	<6	<0.0025 - 0.023
Chrysene	<6	0.00091 - 0.0063
Dibenz[a,h]acridine	NA	<0.032
Dibenz[a,i]acridine	NA	<0.022
Dibenz[a,h]anthracene	<6	<0.053
7H-Dibenzo[c,g]carbazole	NA	<0.078
Dibenzo[a,e]pyrene	NA	<0.012
Dibenzo[a,h]pyrene	NA	<0.058
Dibenzo[a,i]pyrene	NA	<0.018
7,12-Dimethylbenz[a]anthracene	<15	NA
Fluoranthene	<6	0.0044 - 0.026
Fluorene	<6	0.0047 - 0.024
Indeno[1,2,3-cd]pyrene	<6	<0.021
3-Methylcholanthrene	<6	NA
5-Methyl chrysene	NA	<0.0048
2-Methylnaphthalene	<6	NA
Naphthalene	<6	NA
Phenanthrene	<6	0.021 - 0.10
Pyrene	<6	0.0023 - 0.031

[a] Compounds measured by Method 8270 (GC-MS).
[b] Compounds measured by high-resolution GC-MS.

NA = Not Analyzed.
< = Indicates a detection limit value.

Mercury Speciation

Table 4-2 shows the mercury concentrations measured in the stack gas during the OFA/LNB test using the Frontier Geosciences mercury speciation train and the multi-metals train. A different type of mercury speciation train, since shown to be invalid, was used during the OFA test, and those results are discussed in Appendix D.

The Frontier Geosciences train used for the OFA/LNB test is described in detail in Appendix A. The technique was developed by Nicholas Bloom, now with Frontier Geosciences, Inc., but formerly with Brooks Rand, Ltd. The solid sorbent technique uses KCl/soda lime to capture ionic forms of mercury (inorganic Hg^{2+} as well as monomethyl species such as CH_3HgCl), and iodated charcoal to capture elemental mercury. The samples were collected nonisokinetically from a fixed point in the stack. A glass wool plug ahead of the sorbent cartridges prevented particulate matter from entering the sorbents, and this plug was not analyzed; therefore, the results apply to the vapor phase only. Because the particulate loading in the stack gas is relatively low, it is not expected that particulate trapped on the glass wool would have absorbed significant quantities of vapor-phase mercury.

The multi-metals train, also described in Appendix A, uses aqueous impinger solutions to capture vapor-phase metals, including mercury. Samples were collected isokinetically while traversing the stack. Although the multi-metals train was not designed to provide speciation information, it may still give some insight into the mercury species present. Ionic forms of mercury are water-soluble and should be readily captured in the HNO_3/H_2O_2 impingers. Elemental mercury, on the other hand, should pass through the HNO_3/H_2O_2 solutions, because the solubility of elemental mercury in aqueous solutions is very low and the H_2O_2 cannot efficiently oxidize it. The elemental mercury is oxidized and captured in the $H_2SO_4/KMnO_4$ impingers.

The total vapor-phase mercury concentrations measured by the two techniques show good agreement. The mean vapor concentrations are $6.6 \pm 2.6\ \mu g/Nm^3$ by the Bloom train and $5.3 \pm 2.5\ \mu g/Nm^3$ by the multi-metals train. However, the results for the individual species do not agree as well; the Frontier Geosciences train shows a mean of 39% oxidized mercury, compared with 69% oxidized mercury measured by the multi-metals train.

Blank contamination was not a problem for either type of train, and spike recoveries were within acceptance limits. However, the issue of species conversion during sampling has not been addressed; therefore, although each method can be considered to give reliable results for the total concentration of vapor-phase mercury, less confidence can be placed in the speciation results for either type of train. The possibility of one species converting to another within the sampling equipment or in the sampling media makes it less certain that the species were actually present in the flue gas at the measured levels.

The Frontier Geosciences train is a technique still being developed. Extensive work has been done to improve the capture efficiency of the traps, to increase the analytical

Table 4-2
Comparison of Mercury Methods - OFA/LNB Test

Component	Stack Concentrations, $\mu g/Nm^3$ Run 2 5/19/93	Run 3 5/20/93	Run 4 5/21/93	Mean	95% CI	Percent of Vapor Hg
Frontier Geosciences Hg Speciation Train						
Ionic Inorganic Hg	2.4	3.3	2.1	2.6	1.6	39%
Elemental Hg	4.1	3.4	3.3	3.6	1.1	54%
Methyl Hg	0.16	0.97	0.20	0.4	1.1	7%
Total Vapor	6.7	7.7	5.6	6.6	2.6	--
Multi-Metals Train						
Ionic Hg[a]	2.7	3.1	5.2	3.7	3.3	69%
Elemental Hg[b]	1.7	2.1	1.2	1.7	1.1	31%
Total Vapor	4.4	5.2	6.4	5.3	2.5	--
Solid	0.29	0.12	0.17	0.19	0.22	--
Total Vapor + Solid	4.7	5.3	6.6	5.5	2.4	--

[a] Mercury collected in the HNO_3/H_2O_2 impingers.

[b] Mercury collected in the $H_2SO_4/KMnO_4$ impingers

CI = Confidence Interval.

efficiency, and to minimize the chance for species conversion. However, there are no studies that would conclusively demonstrate the validity of the method for mercury speciation, such as the spiking of specific mercury compounds into the flue gas ahead of the sampling train. Therefore, the method can be considered unproven for mercury speciation.

No reported studies have been done on the ability of the multi-metals train to provide mercury speciation information. The interpretation of the results thus far relies largely on chemical theory. The efficiencies of the HNO_3/H_2O_2 impingers for capturing ionic mercury and for allowing elemental mercury to pass through have not been established. In addition, the extent of species conversion within the train is unknown. Therefore, the method can be considered unproven for mercury speciation.

Chromium(VI)

Table 4-3 shows the concentrations of total chromium and of chromium(VI) measured in the stack gas during OFA/LNB operation. An attempt was made to measure Cr(VI) in the particulate matter during the OFA test by a different technique, and these results are shown in Appendix D. The OFA results are judged to be nonrepresentative because of shortcomings in the sampling method.

The EPA Cr(VI) train, described in Appendix A, was used for the OFA/LNB test. This train does not use a filter; instead, particulate matter is allowed to enter the KOH impinger solution. A portion of this solution is continuously circulated to the tip of the probe. The KOH solution is used to maintain a pH of 8.5 or higher to prevent the reduction of any Cr(VI) species to Cr(III). The analytical result includes both vapor-phase Cr(VI) and soluble particulate-phase Cr(VI) contributions.

The multi-metals train showed that most of the total chromium was in the particulate phase. Total Cr concentrations exhibited relatively low variability ($24 \pm 8.6\ \mu g/Nm^3$). However, the measured concentrations of Cr(VI) were highly variable ($6.2 \pm 8.4\ \mu g/Nm^3$). It is not known whether the variability in Cr(VI) was due to the process or the sampling and analytical methods.

The KOH impinger solution contributed significant background concentrations of Cr(VI), which were subtracted from the results. The background concentrations measured in three KOH reagent blanks showed very low variability, but the background itself accounted for 48% to 83% of the three uncorrected sample results, contributing considerable uncertainty to the corrected results. The EPA Cr(VI) method calls for a 0.1 N KOH solution, but the technique was not designed to sample gases with the high levels of CO_2 and SO_2 typically found in power plant flue stacks. A 10 N KOH solution was used to guarantee a high pH, but in retrospect this contributed to the high Cr(VI) background. Future measurements made with this technique should focus on determining the minimum required KOH concentration and/or on using higher purity KOH reagents.

Table 4-3
Comparison of Chromium Methods - OFA/LNB Test

	Stack Gas Concentrations, $\mu g/Nm^3$				
	Run 2 **5/19/93**	**Run 3** **5/20/93**	**Run 4** **5/21/93**	**Mean**	**95% CI**
Multi-Metals Train Results					
Solid Phase Chromium	20	27	23	23	8.6
Vapor Phase Chromium	1.0	0.77	1.1	0.96	0.42
Total Chromium (Solid + Vapor)	21	28	24	24	8.6
Cr(VI) Train Results					
Chromium (VI) (Solid + Vapor)	6.8	2.6	9.3	6.2	8.4
Chromium (VI) Percent[a]				26%	

[a] Mean Cr(VI) result divided by mean total Cr result from the multi-metals train.

CI = Confidence Interval.

Size-Fractionated Particulate Matter

Table 4-4 compares, for the OFA/LNB test, the total (sum of size fractions) concentrations of metals in size-fractionated particulate matter samples to those measured using the multi-metals train. The results are shown on a gas basis in $\mu g/Nm^3$.

The mean concentration of total particulate matter collected with the impactor is only 43% of the loading measured with the multi-metals train. The concentrations of the individual metals are, for the most part, also lower in the impactor samples than in the multi-metals train. This is not surprising, because it is difficult to completely recover the particulate matter from the inside surfaces of the impactor. Conversely, the recovery of particulate matter from the multi-metals train is much more complete. Because of the possibility of incomplete recovery from the impactor, the size-fractionated compositions are more meaningful when expressed on a solid-phase basis (mg/kg of particulate matter, as presented in Table 3-12).

Other factors contribute, to a lesser degree, to the difference between the impactor and multi-metals train results. First, the impactor sample was collected at a single point within the stack, while the multi-metals train traversed the stack. Second, since the impactor was inside the stack during sampling, the particulate matter was collected at stack temperature. The multi-metals train, on the other hand, used an out-of-stack filter maintained at 250° F.

Elemental Enrichment in Ashes and Particulate Matter

The relative enrichment factor, RE, is defined here as the ratio of the concentration of an element in the ash or flue gas particulate matter to its equivalent concentration in the coal ash:

$$RE = X_S X_A / X_C$$

where:

X_S = the concentration of the element in the ash or particulate matter (mg/kg);

X_A = the fraction of ash in the coal; and

X_C = the concentration of the element in the coal (mg/kg).

If an element is uniformly distributed throughout the bottom ash and all size fractions of the fly ash, the enrichment factor for all ash and particulate matter samples would be unity. Factors greater than unity indicate enrichment of the element in a specific solid. This enrichment can occur as the result of vaporization within the boiler and recondensation on the particulate matter. In addition, an element that is undergoing vaporization

Table 4-4
Comparison of Impactor and Multi-Metals Train Results - OFA/LNB Test

Substance	Impactor Total Mean Concentration ($\mu g/Nm^3$)	Multi-Metals Mean Concentration ($\mu g/Nm^3$)	Ratio Impactor/MM (%)
Particulate Matter (mg/Nm^3)	60	139	43%
Antimony	2.0	2.6	77%
Arsenic	38	121	31%
Barium	94	161	58%
Beryllium	1.8	3.4	52%
Cadmium	0.27	4.2	6%
Chromium	20	23	87%
Cobalt	4.3	7.5	58%
Copper	50	35	142%
Lead	9.2	13	70%
Manganese	15.8	23	67%
Mercury	0.20	0.19	103%
Molybdenum	4.1	14	29%
Nickel	11.2	19	60%
Selenium	5.9	15	38%
Vanadium	29	47	62%

MM = Multi-Metals Train.

and recondensation should be enriched to the greatest extent in the finest particulate fractions, because the surface area per unit mass increases with decreasing particle size.

Tables 4-5 and 4-6 present the elemental enrichments determined from the concentrations measured during the OFA and OFA/LNB tests, respectively. The interpretation of these factors is limited by the potential biases and imprecisions associated with the measured coal and ash compositions. However, three elements -- arsenic, lead, and selenium -- show signs of significant enrichment in the fine particulate matter for both tests, suggesting that these elements are subject to a vaporization/recondensation mechanism. Mercury tends to vaporize almost completely within the boiler but recondensation is limited, as evidenced by the less-than-unity REs for all but the finest (stack) particulate matter.

Table 4-5
Enrichment Factors - OFA Test

Substance	Bottom Ash	ESP Ash	ESP Inlet Particulate	Stack Particulate
Arsenic	0.31	1.3	1.8	3.4
Barium	0.52	0.47	0.65	0.66
Beryllium	0.73	0.89	1.4	1.2
Cadmium	NC	NC	NC	NC
Chloride	NC	NC	NC	NC
Chromium	0.52	0.56	0.77	0.87
Cobalt	0.61	0.67	0.78	0.68
Copper	0.26	0.42	0.58	0.54
Fluoride	NC	0.081	NC	NC
Lead	0.41	1.5	1.6	4.6
Manganese	0.72	0.84	0.77	0.74
Mercury	NC	0.16	0.36	0.87
Molybdenum	NC	NC	NC	NC
Nickel	0.38	0.92	0.44	0.46
Phosphorus	0.48	0.60	0.43	0.48
Selenium	NC	0.46	2.3	2.6
Vanadium	0.58	0.66	0.84	1.0

NC = Not calculated because substance was below the detection limit in the coal, ash, or both.

Table 4-6
Enrichment Factors - OFA/LNB Test

Substance	Bottom Ash	ESP Inlet Partic.	Stack Part. Multi-Metals	Stack <4 μm	Stack 4-9 μm	Stack >9 μm	Impactor Wghtd Avg
Arsenic	0.10	1.3	3.7	6.7	3.0	1.5	2.4
Barium	0.88	1.0	1.1	1.9	1.7	1.2	1.4
Beryllium	0.93	0.96	1.0	1.2	1.7	1.1	1.2
Cadmium	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	0.63	0.59	NA	NA	NA	NA
Chromium	0.61	0.84	0.93	2.4	2.1	1.6	1.8
Cobalt	1.0	0.79	0.84	0.94	1.5	0.97	1.0
Copper	0.37	0.57	0.71	1.1	1.4	2.5	2.2
Fluoride	0.024	0.23	0.62	NA	NA	NA	NA
Lead	0.18	0.79	1.2	3.2	2.7	1.4	1.8
Manganese	1.0	1.1	1.1	1.3	1.7	1.6	1.6
Mercury	NC	0.53	1.0	1.5	1.5	2.2	2.0
Molybdenum	NC	NC	NC	NC	NC	NC	NC
Nickel	0.45	0.66	0.75	1.0	1.2	0.92	0.98
Phosphorus	0.36	0.55	1.0	NA	NA	NA	NA
Selenium	NC	0.45	2.9	3.2	1.1	2.5	2.4
Vanadium	0.83	0.95	1.2	2.6	2.3	1.4	1.7

NA = Not Analyzed.

NC = Not calculated because concentration of substance was below the detection limit in the coal, ash, or both.

5

DATA EVALUATION

Several procedures can be used to evaluate the information developed during a field sampling program. In the case of Site 16, three methods were used to evaluate the quality of the data. First, the process data were examined to determine if the unit operated at normal, steady-state conditions during the sampling periods. Second, the QA/QC protocol for sampling and analytical procedures used at Site 16 (i.e., equipment calibration and leak checks, duplicates, blanks, spikes, standards, etc.) was evaluated. Site 16 QA/QC data were compared with project objectives. Third, material balances were calculated around the unit. Material balances involve the summation and comparison of mass flow rates in several streams, often sampled and analyzed by different methods. Closure within an acceptable range can be used as an indicator of accurate results for streams that contribute significantly to the overall inlet or outlet mass rates.

Process Operation

Process operating data were examined to ensure that operation was stable during the sampling periods. Measurements were available in 5-minute intervals from the plant computerized data acquisition system. Tables 5-1 and 5-2 show the key parameters monitored for the OFA test and the OFA/LNB test, respectively. In addition, process trend plots are included in Appendix H.

The coefficients of variation (CV, standard deviation divided by the mean) were calculated to evaluate the process variability. Steady boiler operation (between 93% and 95% of full load) was maintained during each of the test runs, as indicated by the low CVs for the load, the coal feed rate, and the economizer outlet oxygen levels. Stack opacity and stack CO levels were typically more variable than the other parameters; Cvs for opacity ranged from 13% to 22%, and Cvs for CO ranged from 8% to 60%.

A comparison of the operating parameters between the OFA and OFA/LNB tests showed that only the NO_x levels were substantially different. The stack concentrations of NO_x were, on average, about 50% lower during OFA/LNB operation than during OFA operation.

For one day during each of the two test efforts, operating problems were encountered. On March 3, 1991 (OFA test), two of the burners were feeding coal but were not ignited, and they remained unlit throughout the sampling period. As a result, elevated stack CO levels were observed on this day compared to the other runs. The metals and anions

Table 5-1
Summary of Process Monitoring Data - OFA Test

	Run 1		**Run 2**		**Run 3**		**Run 4**		**Run 5**	
	3/3/91		**3/4/91**		**3/5/91**		**3/6/91**		**3/6/91**	
	Mean	**CV(%)**	**Mean**	**CV(%)**	**Mean**	**CV(%)**	**Mean**	**CV(%)**	**Mean**	**CV(%)**
Load (MWe)	472	0.23	477	0.52	477	0.15	477	0.13	477	0.15
Coal Flow Rate (1000 lb/hr)	349	0.62	354	0.88	349	0.48	343	0.43	342	0.45
Feedwater Flow Rate(in H_2O diff)	247	0.81	266	1.2	265	0.35	271	0.78	267	0.41
Main Steam Pressure (psia)	2227	0.21	2250	0.42	2228	0.13	2262	0.14	2262	0.15
Ambient Temperature (°F)	43	19	41	3.5	54	9.2	66	4.1	67	7.2
Ambient Pressure (in Hg)	28.85	0.25	29.28	0.10	29.37	0.14	29.02	0.11	29.01	0.10
Opacity (%)	23	15	18	13	14	20	18	23	21	15
Stack CO (ppmv)	31	47	5.9	8.3	11	32	13	23	16	23
Stack NO_x (ppmv)	554	2.8	570	1.6	544	1.6	514	1.3	529	1.4
Stack SO_2 (ppmv)	776	7.5	754	1.5	932	0.93	904	0.88	910	2.3
Stack O_2 (%)	7.7	1.9	7.2	2.0	6.3	2.7	6.0	2.2	6.1	2.0
Economizer Outlet O_2 (%):										
Duct A	4.8	2.4	4.6	1.7	3.5	4.4	3.2	2.6	3.3	2.0
Duct B	5.0	2.4	4.0	1.9	3.5	1.2	3.3	1.3	3.2	2.1

CV = Coefficient of Variation (standard deviation divided by the mean).

Table 5-2
Summary of Process Monitoring Data - OFA/LNB Test

	Run 1		Run 2		Run 3		Run 4	
	5/18/93		5/19/93		5/20/93		5/21/93	
	Mean	CV(%)	Mean	CV(%)	Mean	CV(%)	Mean	CV(%)
Load (MWe)	473	1.6	467	0.84	472	0.81	470	0.77
Coal Flow Rate (1000 lb/hr)	333	3.2	327	1.2	329	1.2	327	1.1
Overfire Air Flow Rate (1000 lb/hr)	568	3.4	743	3.7	734	1.3	713	1.7
Feedwater Flow Rate (1000 lb/hr)	3554	1.7	3411	1.1	3432	1.0	3394	0.95
Main Steam Pressure (psia)	2297	0.78	2336	0.41	2345	0.39	2331	0.30
Ambient Temperature (°F)	80	3.2	66	6.1	64	3.5	59	8.7
Ambient Pressure (in Hg)	29.35	0.20	29.28	0.062	29.35	0	29.54	0.033
Opacity (%)	24	14	18	22	19	18	17	19
Stack CO (ppmv)	11	37	9.4	60	13	38	15	36
Stack NO_x (ppmv)	251	3.1	282	3.2	277	1.4	260	2.6
Stack SO_2 (ppmv)	965	2.1	912	2.6	954	1.4	970	2.0
Stack O_2 (%)	5.7	3.4	5.9	3.5	5.4	2.4	5.1	4.1
Economizer Outlet O_2 (%):								
Duct A	3.8	4.8	4.4	4.8	3.9	2.7	3.6	6.8
Duct B	3.8	6.1	4.2	9.6	4.2	5.1	3.8	7.2
Secondary Air Heaters:								
A Inlet Gas Temp. (°F)	744	0.72	755	0.71	760	0.56	754	0.40
B Inlet Gas Temp. (°F)	730	0.55	743	0.55	747	0.62	742	0.31
A Outlet Gas Temp. (°F)	326	0.97	321	1.4	320	1.6	318	2.0
B Outlet Gas Temp. (°F)	311	1.0	300	1.5	304	1.3	299	2.0

CV = Coefficient of Variation (standard deviation divided by the mean).

samples collected on March 3 were not analyzed, and an extra set of samples was collected on March 6. Samples for organic compounds collected on March 3 were analyzed and included in the data set; however, no unusual results were obtained when compared with the results for samples collected during the other runs.

On March 18, 1993 (OFA/LNB test), samples were collected while the unit operated with one burner out of service. An extra day of testing was added to the schedule, and the samples collected on March 18 were not analyzed because of concerns about the non-representativeness of the process on that day.

Sample Collection

Several factors indicate the acceptable collection of gas samples. Key components of the sampling equipment -- pitot tubes, thermocouples, orifice meters, dry gas meters, and sampling nozzles -- were calibrated before use in the field, and those calibrations were checked at the end of sampling. These calibrations are on file at Radian. The methods used to collect samples were comparable to those used at other sites sampled by Radian in the FCEM project. The sampling runs were well documented, and all flue gas samples were collected at rates between 90 and 110% of isokinesis, except for the semivolatile train (86% isokinetic) and the aldehyde train (80% isokinetic) at the ESP inlet on March 3, 1991. Sufficient data were collected using standard sampling and analysis methods to ensure acceptable data completeness and the comparability of the measurements.

Flue gas samples were collected at both the ESP inlet and the stack. It was easier to collect representative samples at the stack, because the flow was more fully developed and the particulate loading was much lower. During the OFA test, difficulty was encountered in obtaining representative particulate loadings at the ESP inlet. The particulate loadings measured at the ESP inlet showed approximately 40-50% of the coal ash partitioning to fly ash. For this type of boiler, a split closer to 80:20 (fly ash to bottom ash) would be expected, and the 80% fly ash figure was later confirmed by another contractor (SRI) and again by Radian during the OFA/LNB test. It is now suspected that particulate matter was lost from the sampling nozzle. An in-stack thimble was used at this location, and because of the inclined orientation of the ESP inlet duct, the nozzle actually faced 20 degrees downward during sampling. Particulate matter captured in the thimble could have fallen out through the nozzle under the force of gravity when the sample flow was halted. For the OFA/LNB test, the sampling probe was fitted with a cyclone precutter ahead of the thimble to prevent the loss of particulate matter.

Because the particulate loadings measured at the ESP inlet during the OFA test were not considered valid, the particulate loading in this stream was calculated from the coal ash content, assuming an 80:20 fly ash to bottom ash split. The gas-based concentrations of particulate phase analytes in this case were obtained by multiplying the assumed particulate loading (g/Nm^3) by the concentration of the analytes in the particulate matter (μg/g).

The flue gas flow rates measured at the ESP inlet during both the OFA and OFA/LNB tests were about 15% higher than at the stack, although the O_2 concentration was slightly higher at the stack (which indicates the inleakage of air between the two locations). To check the consistency of the measurements, a combustion calculation was performed using the mean coal composition, the mean coal flow rate, and the mean oxygen concentration at each location to predict a "theoretical" flue gas flow rate. The measured stack gas flow rates agreed with the theoretical flow rates within 5%. However, the measured ESP inlet flow rates were approximately 15% higher than the theoretical flow rates, indicating that the measured flow rates may be biased high at the ESP inlet.

Coal samples are considered to be representative of the coal fired during flue gas sampling. Coal samples for each run were composites of multiple grab samples obtained from every mill. For the OFA test, samples were collected through "clean-out" ports at the bottom of each coal bunker. During the OFA/LNB test, samples were collected from newly installed taps on each of the coal feeders. Although the locations were slightly different, both the clean-out ports and the feeder taps provided samples of the coal immediately before it entered the mills. The coal was sampled before the rejection of pyrites, but this is not expected to affect the results because pyrite rejects are a minute fraction of the total coal feed.

Bottom ash samples are also considered representative. Bottom ash was allowed to accumulate in the bottom of the boiler during each of the test periods, and samples were collected as the ash was sluiced to the pond. Multiple grab samples were taken throughout the sluicing period so that the composite would represent the bottom ash generated during the test.

Freshly-generated ESP ash samples were collected from each of the 16 hoppers. For the OFA test, equal portions of the ash from each hopper were combined into a single composite. It was not known what fraction each hopper contributed to the total ash flow rate; therefore, the results are subject to this limitation. For the OFA/LNB test, the samples from each of the 16 hoppers were kept separate, and these samples were archived for possible analysis in the future.

Analytical Quality Control Results

Generally, the type of quality control information obtained pertains to measurement precision, accuracy (which included precision and bias), and blank effects, determined using various types of replicate, spiked, and blank samples. The specific characteristics evaluated depend on the type of quality control checks performed. For example, blanks may be prepared at different stages in the sampling and analysis process to isolate the source of a blank effect. Similarly, replicate samples may be generated at different stages to isolate and measure the sources of variability. The QA/QC measures commonly used as part of the data evaluation protocol, and the characteristic information obtained, are summarized in Table 5-3. The absence of any of these types of quality control checks from the data does not necessarily reflect poorly on the quality of the data but does limit the ability to estimate the magnitude of the measurement error and, hence, prevents estimating the confidence in the results.

As shown in Table 5-3, different QC checks provide different types of information, particularly pertaining to the sources of inaccuracy, imprecision, and blank effects. Measurement precision and accuracy are typically estimated from QC indicators that cover as much of the total sampling and analytical process as feasible. Precision and accuracy measurements are based primarily on the actual sample matrix. The precision and accuracy estimates obtained experimentally during the test program are compared with the established data quality objectives (DQOs).

These DQOs are not intended to be used as validation criteria but as empirical estimates of the precision and accuracy expected from existing reference measurement methods and that would be considered acceptable. Although analytical precision and accuracy are relatively easy to quantify and control, sampling precision and accuracy are unique to each site and each sample matrix. Data that do not meet these DQOs are not necessarily unacceptable; the intent is to document the precision and accuracy actually obtained, and the objectives serve as benchmarks for comparison. The effects of not meeting the objectives are considered in light of the intended use of the data.

Tables 5-4 and 5-5 present the types of quality control information reported for the OFA and OFA/LNB tests. The results for QC sample analyses can be found in Appendix F. Tables 5-6 and 5-7 present summaries of precision and accuracy estimates obtained during the OFA and OFA/LNB tests, respectively.

Evaluation of the measurement results for the OFA test, conducted in March 1991, are based on QC results previously reported in the "Field Chemical Emission Monitoring Project: Site 16 Report" (1992). Some features of the QC data presentation differ slightly between the 1991 OFA and 1993 OFA/LNB tests. For example, QC data for the 1991 OFA test were presented (as shown in Appendix F.1) in summarized form only, whereas the 1993 OFA/LNB QC data are presented as individual results as well as summaries. The OFA QC data summaries were also broken down by train fraction; the OFA/LNB QC data include all individual fraction results but are summarized in terms of whole trains because no significant performance distinction was evident for the separate fractions. Overall, however, the data sets for the two tests are comparable in terms of both quality control activities performed and performance results.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sampling data should be comparable with other measurement data for similar samples collected under similar conditions. This goal is achieved using standard techniques to collect and analyze representative samples and by

Table 5-3
Types of Quality Control Samples

QC Activity	Characteristic Measured
Precision	
Replicate samples collected over time under the same conditions	Total variability, including process or temporal, sampling, and analytical, but not bias.
Duplicate field samples collected simultaneously	Sampling plus analytical variability at the actual sample concentrations.
Duplicate analyses of a single sample	Analytical variability at the actual sample concentrations.
Matrix- or media-spiked duplicates	Sampling plus analytical variability at an established concentration.
Laboratory control sample duplicates	Analytical variability in the absence of sample matrix effects.
Surrogate-spiked sample sets	Analytical variability in the sample matrix but at an established concentration.
Accuracy (Including Bias and Precision)	
Matrix-spiked samples	Analyte recovery in the sample matrix, indicating possible matrix interferences and other effects. In a single sample, includes both random error (imprecision) and systematic error (bias).
Media-spiked samples	Same as matrix-spiked samples. Used where a matrix-spiked sample is not feasible, such as certain stack sampling methods.
Surrogate-spiked samples	Analyte recovery in the sample matrix, to the extent that the surrogate compounds are chemically similar to the compounds of interest. Primarily used as indicator of analytical efficacy.
Laboratory control samples (LCS)	Analyte recovery in the absence of actual sample matrix effects. Used as an indicator of analytical control.
Standard Reference Material	Analyte recovery in a matrix similar to the actual samples.
Blank Effects	
Field Blank	Total sampling plus analytical blank effect, including sampling equipment and reagents, sample transport and storage, and analytical reagents and equipment.
Trip Blank	Blank effects arising from sample transport and storage. Typically used only for volatile organic compound analyses.
Method Blank	Blank effects inherent in analytical method, including reagents and equipment.
Reagent Blank	Blank effects from reagents used.

Table 5-4
Types of Quality Control Data Reported - OFA

	Precision					Accuracy				Blank			
Analysis	Replicate Runs	Duplicate Field Samples	Duplicate Lab Analysis	MSD	LCSD	MS	Surrogate Spike	LCS	Std. Ref. Mat'l	Field Blank	Trip Blank	Method Blank	Reagent Blank
Gas Samples													
Metals	✓	✓		✓		✓		✓	✓	✓	✓	✓	
Anions	✓	✓		✓		✓		✓		✓	✓	✓	
Semivolatile Organic Compounds	✓			✓		✓	✓	✓		✓		✓	
Volatile Organic Compounds	✓						✓	✓		✓		✓	
Aldehydes	✓									✓	✓	✓	
Coal Samples													
Metals	✓	✓		✓		✓		✓	✓			✓	
Anions	✓	✓											
Ultimate/Proximate	✓	✓							✓				
Ash Samples													
Metals	✓	✓		✓		✓		✓				✓	
Anions	✓	✓											

Table 5-5
Types of Quality Control Data Reported - OFA/LNB

	Precision					Accuracy				Blank			
Analysis	Replicate Runs	Duplicate Field Samples	Duplicate Lab Analysis	MSD	LCSD	MS	Surrogate Spike	LCS	Std. Ref. Mat'l	Field Blank	Trip Blank	Method Blank	Reagent Blank
Gas Samples													
Metals (ICP-MS)	✓		✓		✓			✓	✓		✓	✓	✓
Metals (ICP-AES/AAS)	✓			✓	✓	✓		✓	✓	✓		✓	✓
Hg Speciation	✓							✓		✓			
Cr (VI)	✓			✓		✓						✓	✓
Anions	✓			✓	✓	✓		✓		✓		✓	
Semivolatile Organic Compounds	✓					✓	✓	✓		✓		✓	
Volatile Organic Compounds	✓			✓		✓	✓			✓		✓	
Aldehydes	✓					✓		✓			✓	✓	✓
Coal Samples													
Metals	✓	✓	✓						✓			✓	
Anions	✓	✓		✓		✓						✓	
Ultimate/Proximate	✓	✓											
Ash Samples													
Metals	✓	✓		✓	✓	✓		✓	✓			✓	
Anions	✓	✓		✓	✓	✓		✓				✓	

Table 5-6
Summary of Precision and Accuracy Estimates - OFA

Measurement Parameter	How Measured	Objectives % RPD	Objectives (% Rec)	Measured % RPD	Measured (% Rec)
Ash - Semivolatile Organics	Spiked Samples				
Acenaphthene		35(CV)	50-150	7.8	64
4-Chloro-3-methylphenol		35(CV)	50-150	3.6	82
2-Chlorophenol		35(CV)	50-150	6.1	82
1,4-Dichlorobenzene		35(CV)	50-150	6.8	88
2,4-Dinitrotuluene		35(CV)	50-150	4.4	68
N-Nitrosodipropylamine		35(CV)	50-150	6.2	80
4-Nitrophenol		35(CV)	50-150	0	63
Pentachlorophenol		35(CV)	50-150	5.2	96
Phenol		35(CV)	50-150	3.6	84
Pyrene		35(CV)	50-150	11.2	125
1,2,4-Trichlorobenzene		35(CV)	50-150	3.2	94
Anions	Spiked Samples				
Chloride (solids)		20	80-120	4.8	94
Chloride (liquid)		20	80-120	-	100
Fluoride (gas)		20	80-120	-	103
Fluoride (solids)		20	80-120	23.2	77
Fluoride (liquid)		20	80-120	11.3	100
Phosphate (liquid)		20	80-120	-	105
Phosphate (solids)		20	80-120	-	76
Metals (Inlet Gas-Impingers)	Spiked Samples				
Arsenic		20	75-125	1.3	74
Barium		20	75-125	1.1	94
Beryllium		20	75-125	1.0	96
Cadmium		20	75-125	7.5	106
Chromium		20	75-125	0	92
Cobalt		20	75-125	1.1	92
Copper		20	75-125	0	91
Lead		20	75-125	1.3	74
Manganese		20	75-125	1.1	91
Mercury		20	75-125	0	98
Molybdenum		20	75-125	1.2	94
Nickel		20	75-125	1.1	94
Selenium		20	75-125	5.1	70
Vanadium		20	75-125	0	92

Table 5-6 (Continued)

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Metals (Inlet Gas-Filter)	Spiked Samples				
Arsenic		20	75-125	2.8	71
Barium		20	75-125	6.2	80
Beryllium		20	75-125	4.0	74
Cadmium		20	75-125	2.2	91
Chromium		20	75-125	2.4	83
Cobalt		20	75-125	2.4	85
Copper		20	75-125	3.6	84
Lead		20	75-125	1.1	92
Manganese		20	75-125	6.0	84
Mercury		20	75-125	2.9	310
Molybdenum		20	75-125	25	79
Nickel		20	75-125	1.2	82
Selenium		20	75-125	13	92
Vanadium		20	75-125	2.4	83
Metals (Stack Gas)	Spiked Samples				
Barium		20	75-125	2.0	94
Beryllium		20	75-125	0	86
Chromium		20	75-125	1.0	95
Cobalt		20	75-125	2.1	96
Copper		20	75-125	61	92
Manganese		20	75-125	0	91
Molybdenum		20	75-125	0	95
Nickel		20	75-125	4.3	92
Selenium		20	75-125	63	72
Vanadium		20	75-125	0	94

Table 5-6 (Continued)

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Metals (Coals)	Spiked Samples				
Arsenic		20	75-125	8.3	108
Barium		20	75-125	7.5	102
Beryllium		20	75-125	5.4	84
Cadmium		20	75-125	12.3	99
Chromium		20	75-125	14.6	86
Cobalt		20	75-125	3.9	94
Copper		20	75-125	33	98
Lead		20	75-125	32	116
Manganese		20	75-125	2.6	95
Mercury		20	75-125	22	57
Molybdenum		20	75-125	2.9	95
Nickel		20	75-125	20	88
Selenium		20	75-125	16	110
Vanadium		20	75-125	4.2	97
Metals (Fly Ash)	Spiked Samples				
Arsenic		20	75-125	11.2	89
Barium		20	75-125	7.5	80
Beryllium		20	75-125	0	80
Cadmium		20	75-125	5.3	150
Chromium		20	75-125	0	86
Cobalt		20	75-125	1.1	90
Copper		20	75-125	0	90
Lead		20	75-125	21	67
Manganese		20	75-125	2.4	82
Mercury		20	75-125	2.1	97
Molybdenum		20	75-125	3.6	84
Nickel		20	75-125	1.1	88
Selenium		20	75-125	0	88
Vanadium		20	75-125	0	88
Metals (Bottom Ash-Sluice H_2O)	Spiked Samples				
Barium		20	75-125	1.0	97
Beryllium		20	75-125	0	96
Chromium		20	75-125	1.1	94
Cobalt		20	75-125	0	94
Copper		20	75-125	0	94
Manganese		20	75-125	1.1	94
Molybdenum		20	75-125	1.1	92
Nickel		20	75-125	1.1	94
Vanadium		20	75-125	0	93

Table 5-6 (Continued)

Measurement Parameter	How Measured	Objectives % RPD	Objectives (% Rec)	Measured % RPD	Measured (% Rec)
Metals (Sluice H_2O Supply)	Spiked Samples				
Barium		20	75-125	1.0	96
Beryllium		20	75-125	1.1	96
Chromium		20	75-125	1.1	94
Cobalt		20	75-125	1.1	94
Copper		20	75-125	1.1	94
Manganese		20	75-125	1.1	94
Molybdenum		20	75-125	1.1	92
Nickel		20	75-125	1.0	96
Vanadium		20	75-125	2.2	93
VOST (Inlet Gas)	Surrogates				
1,4-Bromofluorobenzene		35 (CV)	50-150	12 (CV)	103
1,2-Dichloroethane-d14		35 (CV)	50-150	15 (CV)	92
Toluene-d8		35 (CV)	50-150	6.0 (CV)	104
VOST (Stack Gas)	Surrogates				
1,4-Bromofluorobenzene		35 (CV)	50-150	14 (CV)	110
1,2-Dichloroethane-d14		35 (CV)	50-150	7.0 (CV)	94
Toluene-d8		35 (CV)	50-150	9.7 (CV)	109
Semivolatiles (Gas)	Surrogates				
2-Fluorobiphenyl		35 (CV)	50-150	26	88
2-Fluorophenol		35 (CV)	50-150	33	70
Nitrobenzene-d5		35 (CV)	50-150	28	80
Phenol-d5		35 (CV)	50-150	27	80
Terphenyl-d14		35 (CV)	50-150	34	91
2,4,6-Tribromophenol		35 (CV)	50-150	30	109
Semivolatiles (Solids)	Surrogates				
2-Fluorobiphenyl		35 (CV)	50-150	2.5	102
2-Fluorophenol		35 (CV)	50-150	4.0	86
Nitrobenzene-d5		35 (CV)	50-150	2.4	92
Phenol-d5		35 (CV)	50-150	5.1	91
Terphenyl-d14		35 (CV)	50-150	23	94
2,4,6-Tribromophenol		35 (CV)	50-150	7.4	70

Table 5-6 (Continued)

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Semivolatiles (Liquid)	Surrogates				
2-Fluorobiphenyl		35 (CV)	50-150	11	67
2-Fluorophenol		35 (CV)	50-150	6.3	65
Nitrobenzene-d5		35 (CV)	50-150	5.8	86
Phenol-d5		35 (CV)	50-150	3.2	85
Terphenyl-d14		35 (CV)	50-150	11	130
2,4,6-Tribromophenol		35 (CV)	50-150	17	81
Anions (Coal)	Duplicate Samples				
Chloride		20		13.1	
Phosphate		20		0	
Total Phosphorus		20		28.9	
Anions (Bottom Ash)	Duplicate Samples				
Chloride		20		>50	
Fluoride		20		23.6	
Total Sulfur		20		NC	
Anions (Fly Ash)	Duplicate Samples				
Chloride		20		NC	
Fluoride		20		11.2	
Total Sulfur		20		12.8	

Table 5-7
Summary of Precision and Accuracy Estimates - OFA/LNB

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Metals in Gas Samples	Precision and Accuracy, MS/MSD				
Arsenic		20	75-125	2.1	93-100
Barium		20	75-125	4.7	73-109
Beryllium		20	75-125	0.5	89-96
Cadmium		20	75-125	2.7	97-116
Chromium		20	75-125	5.4	97-110
Chromium (VI)		20	75-125	8.0	90-111
Cobalt		20	75-125	0.8	88-94
Copper		20	75-125	0.9	88-101
Lead		20	75-125	9.2	65-109
Manganese		20	75-125	1.5	82-92
Mercury		20	75-125	6.8	50-132
Molybdenum		20	75-125	0.9	86-93
Nickel		20	75-125	5.6	80-110
Phosphorus		20	75-125	1.8	79-114
Selenium		20	75-125	15.7	67-142
Vanadium		20	75-125	1.1	89-98
Anions in Gas Samples	Precision and Accuracy, MS/MSD				
Chloride		20	80-120	4.8	90-114
Fluoride		20	80-120	4.8	85-102
Sulfate		20	80-120	14.4	74-123
Semivolatiles in Gas Samples	Precision and Accuracy, Surrogate Spike Recoveries				
Biphenyl-d10		35(CV)	50-150	290	102-918
Hexachlorobenzene-16		35(CV)	50-150	30	66-160
Perylene-d12		35(CV)	50-150	50	0-126
Volatiles in Gas Samples	Precision and Accuracy, Surrogate Spike Recoveries				
1,2-Dichloroethane-d4		35(CV)	50-150	13.7(CV)	92-128
4-Bromofluorobenzene		35(CV)	50-150	12.8(CV)	78-117
Toluene-d8		35(CV)	50-150	10.9(CV)	80-116

Table 5-7 (Continued)

		Objectives		Measured	
Measurement Parameter	**How Measured**	**% RPD**	**(% Rec)**	**% RPD**	**(% Rec)**
Aldehydes in Gas Samples	Precision - NA; Accuracy - Matrix Spike Recovery				
Acetaldehyde		40	50-150	NA	92
Formaldehyde		40	50-150	NA	90
Mercury Speciation	Precision - NA; Accuracy - Laboratory Control Sample				
Mercury (0)		20	75-125	NA	88
Mercury (II)		20	75-125	NA	94-97
Methyl Mercury		20	75-125	NA	106
Metals in Ash (ICP-AES)	Precision - Duplicate Samples; Accuracy - Standard Reference Material (NIST1633a)				
Arsenic (GFAAS)		20	75-125	19.1	125-130
Barium		20	75-125	20.7	85-89
Beryllium		20	75-125	5.0	130-137
Cadmium		20	75-125	NC	NA
Chromium		20	75-125	5.7	90-94
Cobalt		20	75-125	7.4	NA
Copper		20	75-125	5.7	-
Lead (GFAAS)		20	75-125	106	69-83
Manganese		20	75-125	6.1	93-101
Mercury (CVAAS)		20	75-125	NC	NA
Molybdenum		20	75-125	NC	NA
Nickel (GFAAS)		20	75-125	0.8	97-104
Phosphorus		20	75-125	24.1	NA
Selenium		20	75-125	NC	NA
Vanadium		20	75-125	13.1	NA

Table 5-7 (Continued)

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Metals in Ash (ICP-MS)	Precision and Accuracy, Standard Reference Material				
Arsenic		20	75-125	0.7	88-89
Barium		20	75-125	NA	NA
Beryllium		20	75-125	2.7	84-86
Cadmium		20	75-125	16.7	51-60
Chromium		20	75-125	9.8	89-99
Cobalt		20	75-125	7.3	68-73
Copper		20	75-125	8.3	94-102
Lead		20	75-125	0.7	88-89
Manganese		20	75-125	4.5	104-109
Mercury		20	75-125	29.7	133-179
Molybdenum		20	75-125	12.0	86-97
Nickel		20	75-125	6.8	69-74
Phosphorus		20	75-125	NA	NA
Selenium		20	75-125	9.8	98-108
Vanadium		20	75-125	3.7	82-85
Metals in Ash (ICP-AES/AAS)	Precision and Accuracy, MS/MSD				
Arsenic		20	75-125	1.9	104-106
Barium		20	75-125	13.6	82-94
Beryllium		20	75-125	3.5	84-87
Cadmium		20	75-125	6.5	94-106
Chromium		20	75-125	1.1	90-91
Cobalt		20	75-125	2.2	89-91
Copper		20	75-125	1.1	91-92
Lead		20	75-125	2.1	96-98
Manganese		20	75-125	1.1	90-91
Mercury		20	75-125	0.0	97-97
Molybdenum		20	75-125	1.0	102-103
Nickel		20	75-125	2.2	89-91
Phosphorus		20	75-125	0.0	95-95
Selenium		20	75-125	4.7	84-88
Vanadium		20	75-125	1.1	91-92
Anions in Ash	Precision and Accuracy, MS/MSD				
Chloride		20	80-120	1.3	98-99
Fluoride		20	80-120	46.1	29-88

Table 5-7 (Continued)

Measurement Parameter	How Measured	Objectives		Measured	
		% RPD	(% Rec)	% RPD	(% Rec)
Metals in Coal (INAA)	Precision - Duplicate Samples; Accuracy - Standard Reference Material (NIST1632a)				
Arsenic		20	75-125	5.8	100
Barium		20	75-125	5.8	97
Beryllium (ICP-AES) (SARM20)		20	75-125	10.0	72
Cadmium		20	75-125	0.4	NA
Chromium		20	75-125	10.2	99
Cobalt		20	75-125	5.2	106
Copper		20	75-125	17.0	113
Lead (ICP-AES) (SARM20)		20	75-125	13.3	104
Manganese		20	75-125	7.1	95
Mercury (SARM20)		20	75-125	15.0	149
Mercury (CVAAS) (SARM20)		20	75-125	37.0	100
Molybdenum		20	75-125	4.6	104
Nickel		20	75-125	9.2	108
Phosphorus (SARM 20)		20	75-125	19.4	106
Selenium		20	75-125	4.9	101
Vanadium		20	75-125	1.8	95
Anions in Coal	Precision and Accuracy, MS/MSD				
Chloride		20	80-120	2.1	95-97
Fluoride		20	80-120	11.6	49-91
Ultimate/Proximate Coal	Precision - Duplicate Samples; Accuracy -				
Moisture		20	NS	8.2	
Carbon		20	NS	0.1	
Hydrogen		20	NS	0.8	
Nitrogen		20	NS	0.7	
Sulfur		20	NS	12.9	
Ash		20	NS	2.9	
Oxygen		20	NS	7.7	
Volatiles		20	NS	1.3	
Fixed Carbon		20	NS	0.3	
HHV		20	NS	0.4	

reporting analytical results in appropriate units. Data sets can be compared with confidence when the precision and accuracy are known.

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The representativeness criterion is based on making certain that sampling locations are properly selected and that a sufficient number of samples are collected. The results of both the OFA and OFA/LNB tests are considered representative and comparable.

Key characteristics of the QC results for the two tests are discussed separately in the following subsections, including a discussion of the overall measurement precision, accuracy, and blank effects.

Precision is a measure of the reproducibility of measurements under a given set of conditions. It is expressed in terms of the distribution, or scatter, of the data, calculated as the standard deviation or coefficient of variation (CV, standard deviation divided by the mean). For duplicates, precision is expressed as the relative percent difference (RPD).

Accuracy is a measure of the degree of conformity of a value generated by a specific procedure with the assumed or accepted true value, and includes both precision and bias. Bias is the persistent positive or negative deviation of the method average value from the assumed or accepted true value. The efficiency of the analytical procedure for a given sample matrix is quantified by the analysis of spiked samples containing target or indicator analytes or other quality assurance measures, as necessary. However, all spikes, unless made to the flowing stream ahead of sampling, produce only estimates of recovery of the analyte through all of the measurement steps occurring after the addition of the spike. A good spike recovery tells little about the true value of the sample before spiking.

Blank effects, including contamination and other artifacts, contribute to low-level measurement bias, which may or may not be significant, depending on the relative quantity of measure found in the investigative samples. A well-known blank may be corrected for, but spurious blank effects generally cannot.

OFA Test Analytical QC Data

The following potential areas of concern were indicated by the OFA test quality control data.

Fly Ash

- A standard fly ash performance evaluation (PE) sample (NIST 1633a) was submitted double blind and analyzed by ICP/AAS following microwave digestion, instrumental neutron activation (INAA), and x-ray fluorescence (XRF). Recoveries for chromium (229%), nickel (202%), and arsenic (148%) were high when the sample was analyzed after digestion in the microwave. Recoveries were high for nickel (140%) when analyzed by INAA, and the recovery of manganese (440%) was high when analyzed by XRF. These results may indicate a high bias for these analytes (when prepared by the respective methods) in flue gas particulate samples. However, neither the XRF nor the INAA analyses were selected as the primary methods for these analytes.

- Recoveries from the fly ash PE sample were low for mercury (65%) after digestion in the microwave. This result may indicate a low bias for mercury in samples prepared by this method.

- The fly ash PE sample was also analyzed after being aspirated into the impinger train. Recoveries indicating a high bias included arsenic (144%) and cadmium (198%). The barium recovery (63%) indicated a low bias after being corrected for the blank results.

- Lead recoveries (average recovery 67%) for spike samples in fly ash indicated low bias.

- Cadmium recoveries (average 150%) in spike samples for fly ash indicated a high bias for this matrix.

Coal

- Recoveries for a standard coal sample (NIST 1632a) indicated a high bias for barium (145%) and selenium (127%) by INAA. The recovery was excessively high for copper (878%).

- The recovery of copper by ICP-AES was low in two spiked samples, and high in one spiked sample. These results indicate higher than expected variability for copper in coal, and the quantitation of the field samples may be suspect.

Gas Streams

- The mean recoveries for selenium (70%) and lead (74%) were slightly below the 75-125% objective in the impinger solution spike samples. Selenium recoveries were also low (72%) in the stack gas probe and nozzle spike samples.

- The mean recovery for arsenic (71%) was slightly low in the ESP inlet gas spike samples.

- Barium and molybdenum are reported in both the field and trip blanks for filters at concentrations greater than five times the detection limits. The filter field sample results may be biased high because of contamination.

- Lead and cadmium are reported in the blanks associated with the impingers in concentrations greater than five times the detection limits. Impinger samples results for these metals near the detection limit may be biased high because of contamination.

- Chloride and sulfate were reported in both the filter trip blank and the field blank samples; however, the blank levels were insignificant compared to the sample concentrations.

- The concentration of formaldehyde was reported above the detection limit in the lab, trip, and field blanks. The field sample data may be biased high because of contamination.

Metals

Precision. The precision of metals analyses was estimated using duplicate spike samples and field duplicate samples. All of the calculated relative percent differences (RPDs) for field duplicate samples met the precision acceptance objective (20%). The spike duplicate RPDs for copper (61%), selenium (63%), and molybdenum (25%) indicate that field sample results for these analytes may be more variable than anticipated.

A majority of the calculated RPDs for metals in coal were acceptable in the field duplicate samples. RPDs for copper (23.9%) and molybdenum (34.9%) were above the 20% objective, but acceptable considering the low concentrations and heterogenous sample material. Six duplicate spiked sample RPDs were reported outside the 20% objective, including copper (33%), lead (32%), and mercury (22%).

RPDs for duplicate fly ash sample analyses were within the precision objective. Duplicate bottom ash samples results met the 20% RPD objective except chromium (160%), manganese (60%), nickel (129%), cadmium (27%), lead (65%), and selenium (65%). These results indicate that the corresponding field sample analyte results for fly ash may also have higher than anticipated variability. No duplicate spike samples were analyzed for bottom ash; however, all but two of the fly ash duplicate spike RPDs were within the acceptance limits.

The field duplicate and duplicate spike sample RPDs for bottom ash sluice water and sluice water supply met the precision acceptance objective.

Accuracy. Accuracy for the metals analyses in stack gas was estimated using laboratory control samples (LCS) and spike samples. The majority of LCS recoveries for metals were within the accuracy acceptance limits (75-125%) and indicate that the analytical systems were in control during gas sample analyses. A majority of recoveries in the spike gas samples (impinger solutions, stack gas probe and nozzle rinses, and inlet gas filters) were also reported within the acceptance limits.

Mercury was recovered high (average recovery 310%) in both spike ESP inlet gas filter samples; however, these spikes were referenced to an anomalously low unspiked sample result (Run 4), and probably do not indicate a positive bias in the particulate-phase mercury results. Selenium recoveries (average 70% and 72%) were slightly low in both impinger solution samples and both spiked stack gas probe and nozzle rinses. Lead (average recovery 74%) was recovered just below the acceptance limit in both spike impinger solutions, and the concentration of arsenic was recovered slightly low (average recovery 71%) in both ESP inlet gas filter spike samples. Concentrations of these analytes may also be biased slightly low in the field sample results for the corresponding matrices.

The accuracy of the measurements of metals in coal was estimated using LCSs, spiked samples, and PE samples. The majority of LCS recoveries for metals were within the accuracy acceptance limits and indicate that the analytical systems were in control during the analysis of coal samples. The recoveries of three analytes were high in the coal PE sample (NIST 1632a). PE sample recoveries for barium (145%), copper (878%), and selenium (127%) indicate a high bias by INAA for these analytes in coal. The concentration of barium was within the acceptance limits in all four spiked samples, selenium recoveries were acceptable in three of four spiked samples, but copper recoveries were acceptable in only one of four spiked samples. The recovery of copper was low in two of four samples and high in one of four spiked samples. These results do not show any definite trends, but the quantitation of copper in coal may be suspect.

The accuracy of measurements of metals in fly ash was estimated using LCSs, spike samples, and PE samples. The majority of LCS recoveries for metals were within the accuracy acceptance limits and indicate that the analytical systems were in control during analysis for fly ash samples. A majority of the spike sample recoveries were also reported as acceptable; however, the recovery of cadmium was high (average recovery 150%) and the recovery of lead was low (average recovery 67%) in both fly ash spike samples. These recoveries indicate that cadmium results may be biased high and the lead result may be biased low in the fly ash field samples. Fly ash PE samples were analyzed after preparation by microwave digestion, INAA, XRF, and after being aspirated into the impinger train. Recoveries were above the acceptance limits for chromium (229%), nickel (202%), and arsenic (148%) when prepared using microwave digestion. The recovery of nickel (140%) was also high when analyzed by INAA. The recovery of manganese was high (440%) when analyzed by XRF. The recoveries of arsenic (144%) and cadmium (198%) were high for the fly ash sample after being aspirated into the impinger train. The nickel and arsenic results indicate that the field sample results may be biased high. Unlike nickel and arsenic, the remaining PE sample recoveries listed above were high in only one analysis. This does not necessarily indicate an analytical bias for these analytes, but may indicate a non-systematic preparation or analytical problem.

PE sample recoveries were low for mercury (65%) after digestion in the microwave, and for barium (63%) after the aspirated fly ash result was corrected for the blank result. These recoveries indicate that the corresponding field sample results may also be biased low.

Blank Effects. One field blank and one trip blank were reported for filter samples. A majority of the target metals were detected in the filter field blank and the filter trip blank. These are trace impurities in the quartz fiber filters. Results above the detection limits were reported for barium (6.75 μg), chromium (2.13 μg), manganese (1.28 μg), molybdenum (29.2 μg), nickel (2.10 μg), and lead (0.56 μg) in the filter field blank. Only barium and molybdenum results were greater than five times the detection limits; all other analytes were less than three times the detection limits. The filter trip blank had results above the detection limits reported for barium (6.27 μg), chromium (2.06 μg), manganese (1.17 μg), molybdenum (29.6 μg), lead (0.57 μg), and mercury (0.0424 μg). Again, barium and molybdenum had results greater than five times the detection limit. Mercury was reported in concentrations greater than four times the detection limit, but the concentrations of all other trip blank analytes were two times the detection limits or less. All of the analytes listed above, except for nickel and mercury, were detected in both the field and trip blanks for filters. The stack results were corrected for the blank values, the details of which are shown in Appendix I. The corrections were small, with the exception of molybdenum.

One laboratory blank was reported for coal. All of the ICP metals and none of the AAS metals were detected in the coal lab blank. Only molybdenum (6.95 mg/kg) was reported above the detection limit (5 mg/kg). The concentration of this analyte may be biased high in the coal field sample results because of low-level laboratory contamination.

One lab blank, two field blanks, and one trip blank were reported for impinger solutions. The concentrations of three analytes were reported above the detection limits in the lab blank, including arsenic (0.005 mg/L), cadmium (0.006 mg/L), and lead (0.0049 mg/L). The cadmium result was six times the detection limit, whereas arsenic and lead were reported at less than two times the detection limits. A majority of the target analytes were reported in the impinger field blanks. Only manganese (0.017 and 0.025 mg/L), molybdenum (0.054 mg/L), and lead (0.0068 and 0.0122 mg/L) were reported in concentrations above the detection limits (0.01, 0.05, and 0.003 mg/L, respectively). A majority of the target analytes were detected in the impinger trip blank. Analytes reported above the detection limits include manganese (0.02 mg/L), molybdenum (0.059 mg/L), nickel (0.022 mg/L), cadmium (0.0014 mg/L), and lead (0.015 mg/L). These analytes were reported in concentrations less than two times the detection limits, except for lead, which was five times the detection limit. The results from the lab, field, and trip blanks for impinger solutions indicates that the impinger field sample results may be biased high for the listed analytes. Lead and cadmium may have significant bias because of the relatively high concentrations reported in these blanks.

One field blank and one trip blank for probe and nozzle rinses were reported. A majority of the target analytes were detected in both blanks. Those analytes reported in concentrations above the detection limits in the field blank include barium (1.46 μg), arsenic (0.63 μg), and lead (0.50 μg). These concentrations are less than two times the detection limits. Mercury (at 0.0302 μg) and cadmium (at 0.17 μg) are the only analytes reported in concentrations above the detection limits (0.009 μg and 0.1 μg, respectively) in the trip blank. These data indicate that the results may be biased slightly high in the probe and nozzle rinse samples because of contamination.

Anions

Precision. The precision for anions was estimated using field duplicate samples. The RPDs were above the precision acceptance limit (20%) for total phosphorus (28.9%) in the coal, and fluoride (23.6%) in the bottom ash. The variability may be higher than expected for these analytes in field samples.

Accuracy. The accuracy for anions was estimated using LCSs and spiked samples. All of the LCS recoveries and most of the spiked sample recoveries were within the accuracy acceptance limits (80-120%). Only fluoride (77%) and phosphate (76%) in solids were recovered low. These parameters may also be biased low in the field sample results.

Blank Effects. Lab blanks, field blanks, and trip blanks were reported for solids, filters, impingers, and waters. No analytes were reported in any of the lab blanks. Chloride (4.34 μg) and sulfate (0.0421 mg) were reported in concentrations above the detection limit in the filter field blank. Chloride (3.75 μg) and sulfate (0.0398 and 0.052 mg) were also reported in concentrations above the detection limit in the filter trip blanks. These analytes may be biased high in the filter field sample results. Concentrations of phosphate (0.228 mg/L) and sulfate (2.04 mg/L) were reported just below the detection limits (0.3 and 2.4 mg/L, respectively) in the impinger field blank. Chloride was detected in the impinger trip blank in a concentration above the detection limit (0.036 mg/L). Overall, chloride and sulfate appear to have significant results reported in the filter field and trip blanks.

Volatile Organic Compounds

Precision. Precision is estimated for volatile organic compounds using LCS data. The percent coefficient of variation (CV) for the target compounds is 15.7% for benzene and 2.2% for toluene, which is well within the 35% precision objective. The percent CV for surrogates in gas samples (using mean recoveries) ranges from 6.0% to 13.7%. These results indicate that the precision is acceptable for this analytical method.

Accuracy. Accuracy is estimated for volatile organic compounds by LCS and surrogate recoveries. All of the LCS recoveries reported were within the accuracy acceptance limits. All but one of the surrogate recoveries were within the accuracy acceptance limits. These results indicate that the system was in control during sample analysis.

Blank Effects. Lab blanks and field blanks were analyzed for volatile organic compounds. No target compounds were detected in any of the lab blanks. A total of six field blanks were analyzed, three ESP inlet blanks and three stack blanks. No target analytes were detected in any of the field blanks.

Semivolatile Organic Compounds

Precision. Precision is estimated for semivolatile organic compounds using LCS and duplicate spike sample results. The percent CVs for LCSs ranged from 0 to 5.2%, and all were within the 35% precision objective. The duplicate spike sample precision data were also acceptable.

Accuracy. Accuracy for semivolatile organic compounds is estimated by LCS, spike sample, and surrogate recoveries. All of the LCS recoveries were reported as acceptable. Both spike sample recoveries were reported low for acenaphthene (average recovery 64%), 2,4-dinitrotoluene (average recovery 68%), and 4-nitrophenol (average recovery 63%). The results for these compounds may be biased low in the field sample results.

Blank Effects. Lab blanks and field blanks were analyzed for semivolatile organic compounds. No compounds were reported in concentrations above the detection limit in the lab blanks. Three compounds were reported in the field blanks above the detection limit (10 μg), including diethylphthalate (106 μg), dibutylphthalate (13.8 μg), and bis(2-ethylhexyl)phthalate (26.3 μg). Concentrations of these compounds may be biased high in the field sample results.

Aldehydes

Precision. No precision data were available for aldehydes.

Accuracy. No accuracy data were available for aldehydes.

Blank Effects. One lab blank, one field blank, and one trip blank were analyzed for aldehydes. Formaldehyde was reported in all three blanks in concentrations approximately two times the detection limits. The lab blank had 1.32 μg reported, the field blank had 5.4 μg reported, and the trip blank had 3.06 μg reported as present. These results indicate that the field sample data for formaldehyde may be biased high because of contamination.

OFA/LNB Test Analytical QC Data

The following potential concerns were identified by the quality control data.

Coal Samples

- The coal standard reference material sample analysis showed a high recovery for mercury (149%) analyzed by INAA, and variable recoveries for fluoride (49-91%). Mercury was also analyzed by CVAAS in the coal reference material, with 100% recovery, but the results of duplicate coal sample analyses showed high variability (37% RPD). Although the INAA and CVAAS QC results for mercury differ, these differences are based on limited data and do not definitively identify which method is superior.

- Duplicate sample results for arsenic in coal by INAA showed variability (58% RPD) outside the 20% objective, although the concentrations were very low.

Bottom Ash Samples

- Recoveries for fluoride in bottom ash samples were variable, measured first at 29 and 71% recovery, and then 81% and 88% in two MS/MSD pairs. Laboratory control sample results for fluoride (71-98% recovery) were outside the 80-120% objective. The results for fluoride in solid matrix laboratory method blanks were about twice the detection limit. For the water blanks, the fluoride results are only slightly above the detection limit. Overall, fluoride results are slightly outside the project accuracy objectives, but may be considered valid, recognizing the limitations in accuracy.

Gas Samples

- Based on internal standard and surrogate spike recovery data, the results for semivolatile organic compounds in gas samples should be considered qualitative or semi-quantitative estimates. Relatively heavy loading of high-carbon particulate matter appears to have interfered with accurate quantitation. Laboratory controls that are independent of the sample matrix effects indicate acceptable analytical performance and suggest that the recovery problems are sample matrix related.

- The results for aldehydes were near detection limits and were not distinguishable from blank results, yielding no positive quantitative results for aldehydes.

- High levels of hexavalent chromium were found in the KOH impinger blanks but were found to be repeatable in three blanks and were consequently corrected for in the sample results.

- Frontier Geosciences reports that the mercury speciation results for the OFA/LNB test should not be compared with the OFA test results because of the experimental nature of the method at the time of the earlier test. Even now, the mercury speciation reports do not include QC results that permit a thorough evaluation of the measurements. Laboratory recovery checks are good, and the field blank results indicate no significant contamination problems (Mercury (II) and methyl mercury were both detected in the field blank at about twice the detection limit). Despite this, no results were given to verify the absence of species conversion during sampling, so the speciation results should be considered with caution.

- The spike recoveries for mercury were low (50-69%) in the permanganate impingers.

- The spike recoveries for selenium in gas samples were variable, ranging from 67% to 142%.

- Recoveries were slightly above the 75-125% objective for arsenic (125-130%) and beryllium (130-137%) in fly ash standard reference material samples analyzed by GFAAS and ICP-AES.

- Recoveries were low for cadmium (51-60%) and cobalt (68-73%) in ash standard reference material samples analyzed by ICP-MS for the size-fractionated particulate matter samples. Recoveries were high (133-179%) and variable (30% RPD) for mercury in the same samples. The recoveries were only slightly low for nickel (69-74%).

- The rinsates from Kapton trip blank samples analyzed for metals by ICP-MS showed concentrations of most metals from 10 to 100 times the reported detection limit. ICP-MS is very sensitive and likely to detect metals in blanks at concentrations much lower than ICP-AES or GFAAS, but the extremely low detection limits reported may reflect how low the method can quantitate elements, but not how low a sample may be distinguished from a blank, or how difficult it may be to obtain sufficiently analyte-free sampling media. For example, relative to the reported detection limits, quite high levels were reported for chromium (4 μg/filter, DL=0.01 μg), selenium (2 μg/filter, DL=0.04 μg), and vanadium (2 μg/filter, DL=0.003 μg).

- Filter blank samples for stack gas showed appreciable amounts of barium, chromium, manganese, molybdenum, nickel, copper, mercury, and vanadium. These generally contribute only a small bias to the total sample train measurement, but they are repeatable and may be corrected for.

- Sample results for PAHs showed very high variability. Internal standard and surrogate recoveries indicate significant matrix interferences. The PAH results should be considered order-of-magnitude estimates.

- Field blank results for PAHs were generally very low, except for acenapththene and phenanthrene, which showed 469 and 120 ng/sample, respectively. The high sensitivity of the HRGC/HRMS method results in the detection of numerous compounds, although mostly at extremely low levels. No significant contamination is suspected.

- Toluene was detected at very low, but similar concentrations in blank and regular VOST samples. The toluene results in the sample may be biased slightly high if not artifacts of blank contamination.

Metals

Precision. The precision of metals analyses was estimated for coal samples using duplicate samples, which include a component of sampling variability. The 20% RPD precision objective was met for all of the target metals, except arsenic (58% RPD). In addition to the INAA analysis, mercury was analyzed by CVAAS and had a duplicate sample precision of 37% RPD, greater than the 15% RPD by INAA. The mercury concentrations measured were low, however, (0.1-0.2 mg/kg) and agreed reasonably well between the methods. These results are presented in Appendix Table F.2-13.

In bottom ash samples, precision was estimated from matrix spike duplicate analyses, all of which were within the precision objective for the target metals. These results are included in Table F.2-7. Duplicate ash sample results also provide a measure of precision, although many of the metals were not detected. In the duplicate samples, precision estimates were slightly higher than the MSD pairs, with RPDs greater than 20% for barium (21%), lead (106%), and phosphorus (24%). Except for lead, these results are typical, compared to previous FCEM data. The lead results show greater variability than expected, but the measured values in the duplicate samples were relatively low (6 and 20 mg/kg).

Precision estimates for ICP-MS analysis of size-fractionated particulate matter were based on replicate analyses of NIST 1633a fly ash reference standard, as shown in Table F.2-10. Only the precision for mercury (29.7% RPD) was outside the 20% objective, but it was acceptable, considering the low concentration in the standard.

Precision estimates for metals in gas samples, based on matrix spike duplicate samples results, were within the 20% objective for all target metals. These results are presented in Table F.2-7.

Another measure of precision for metals analyzed by ICP-AES and AAS techniques is the relative standard deviation (also known as % coefficient of variation, %CV) for laboratory control sample recoveries. Although not indicative of the sample matrix, the percent CV provides a measure of laboratory method repeatability. As shown in Appendix Table F.2-5, the precision is good for all target metals. (Arsenic and selenium results by ICP-AES do not meet the objective, but GFAAS is the primary analytical technique. The ICP-AES results are available because it is a multi-element technique, but it is not recommended for these metals.)

Accuracy. The accuracy of the metals analyses was estimated for coal samples using NIST 1632a and SARM 20 standard reference coal sample results, which are presented in Table F.2-13. All of the target metals analyzed in the reference sample were within the 75-125% recovery objective, except beryllium by ICP-AES (72%) and mercury by INAA (149%). Mercury was also analyzed by CVAAS and had a recovery of 100%.

The accuracy of metal results from ash samples was estimated from matrix spike (Table F.2-7) recoveries. Matrix spike recoveries were all within the 75-125% objective for target metals.

Analysis of NIST fly ash standard reference material (Table F.2-9) was used to represent metal recoveries in particulate phase gas samples. The matrix of the standard is not identical to that of the samples, especially since stack gas particulate matter samples are digested along with the filters. Recoveries in the ash standard were slightly high for arsenic (125-130%) and beryllium (130-137%). Quartz filters were also digested and subsequently spiked to determine the effects of the filter digestate on recovery. These results, summarized in Table F.2-11, show a tendency to low recoveries for lead (61-67%), selenium (24-76%), molybdenum (40-92%) and mercury (45-46%).

Matrix spikes were used to estimate the accuracy of metal analyses in vapor-phase gas samples. Matrix spike results are presented in Table F.2-7. Recoveries were outside the 75-125% objective for mercury (50-132%) and selenium (67-142%). It has been seen from previous FCEM data that these are difficult elements and such recoveries are not uncommon.

The accuracy of ICP-MS analyses of size-fractionated particulate matter samples was estimated from NIST 1633a fly ash recoveries. Recoveries were rather low for cadmium (51-60%) and high for mercury (133-179%), but the reference concentrations were very small, 1 mg/kg Cd and 0.2 mg/kg Hg. Recoveries were slightly low for cobalt (68-73%) and nickel (69-74%).

Laboratory control sample recoveries for metals (Tables F.2-5 and F.2-6), which demonstrate the analytical accuracy in the absence of sample matrix effects, were all within expected limits.

Blank Effects. Laboratory method blanks, presented in Table F.2-2, representing both solid and liquid sample types, indicated no significant laboratory contamination problems affecting quantitation of target metals. ICP-MS method blanks showed metals detectable above the reported detection limit, but well below amounts measured in samples. Unlike the reports submitted with ICP-AES and AAS measurements, it appears that the reported detection limit for ICP-MS reflects the sensitivity of the method (i.e., the ability to measure extremely low quantities) and not the probability of detecting (or not detecting) an analyte in a blank.

Reagent blank results, presented in Table F.2-3, show relatively high amounts of barium (27 μg) and molybdenum (30 μg) in the "final filter blanks" analyzed by ICP-MS. Quartz filter blanks analyzed by ICP-AES and AAS also showed relatively high amounts of molybdenum (30 μg) and low amounts of the other target metals. This represents a potential low-level bias for molybdenum in this sample fraction, but barium results were much higher in the samples and not affected by the blank. Significant amounts of hexavalent chromium were detected in the potassium hydroxide impinger solutions, which would bias sample results. Triplicate reagent blanks were analyzed and showed very repeatable results, so reliable blank correction could be performed, as appropriate.

Rinsates from two Kapton blanks were analyzed for metals by ICP-MS. The results of these analyses are shown in Table F.2-4. There were no significantly high levels of any metals. Small amounts of arsenic (1.5 μg), chromium (4 μg), selenium (2 μg), and vanadium (2 μg) were detected, but should not affect the sample results. In contrast to the "final filter blanks," barium and molybdenum results in the Kapton blank rinsates were quite low.

The field blank results for metals, based on the recovery of assembled sample trains that were leak-checked at the sample location, are summarized in Table F.2-1. These results show small detectable amounts of arsenic (4 μg), barium (15 μg), manganese (7 μg), nickel (4 μg), and phosphorus (50 μg) in the ESP inlet gas thimble/precutter fraction. These are about the same magnitude as measured for arsenic, manganese, and nickel in the actual samples and represent a potential low-level bias for these metals in this sample fraction. No significant blank effects were detected in the field blank impinger samples analyzed for metals.

Anions

Precision. Estimates of precision for anion measurements in bottom ash samples were based on matrix spike duplicate recovery data, which are presented in Appendix Table F.2-7. In these samples, the 20% RPD precision objective was met for chloride, but not for fluoride (46% RPD). In bottom ash duplicate samples, only fluoride was detected, and with good agreement between results (3% RPD).

In gas samples, the precision for anions, based on MS/MSD recoveries in impinger solutions, were within the 20% RPD objective.

The precision of anion laboratory control samples results was very good (less than 10% CV).

Accuracy. Estimates of accuracy for anion measurements in bottom ash samples were based on matrix spike recoveries. These results are presented in Table F.2-7. Recoveries of chloride met the 80-120% objective. Two sets of MS/MSD samples were analyzed for fluoride. Recoveries were 29 and 71% in one pair; 81 and 88% in the second pair. While matrix spike data include a component of error (the spiking process) not inherent in unspiked sample measurements, these results suggest that the accuracy of the fluoride measurements does not meet the 80-120% objective.

In gas samples, the accuracy for anions, as determined from matrix spike recovery in impinger solutions, were within the 80-120% objective for chloride and fluoride and slightly outside the objective for sulfate (74-123%).

The accuracy of laboratory control sample results for anions was very good, within 90-110% recovery, except for fluoride. Fluoride recoveries ranged from 71 to 98%, but averaged 90±7.4%, indicating a slight negative bias.

Blank Effects. The laboratory method blank results associated with solid-phase analyses for fluoride were about twice the detection limit and about the same magnitude as measured in bottom ash samples, contributing a significant potential bias to those analyses, although fluoride contamination was not significant in the field blank impinger. No problems were identified with anion method blanks associated with impinger sample analyses.

The field blank results for anions in impinger solutions showed no problems. On the filter blank, chloride was found at levels similar to those in the samples, although the contribution to the total chloride in the train is small.

Volatile Organic Compounds

Precision. Precision estimates for measurements of volatile organic compounds in gas samples were based on the dispersion of surrogate spike recovery data, expressed as the percent coefficient of variation (%CV). The precision was within the 35% CV objective for each of the three surrogate spike compounds. These results are summarized in Table F.2-19.

Precision was also measured as the relative percent difference for duplicate method spike recoveries. These results, presented in Appendix Table F.2-18, showed very good precision. The RPDs were less than 30% RPD for 37 of 39 spike compounds. For the target compounds, the RPDs were 3.6% for toluene and 6.5% for benzene. The RPDs were relatively high only for vinyl acetate (55% RPD) and chloromethane (53% RPD).

Accuracy. Accuracy estimates for volatile organic analyses of VOST samples, expressed in terms of surrogate spike recoveries (Table F.2-19) and method spike (spiked blank VOST tubes) recoveries (Table F.2-18), were within the recovery objective of 50-150% for all analytes. Method spike recoveries for toluene, although within the objective, were somewhat high, 137-142%. Recoveries for benzene were 89-95%.

Blank Effects. The analytical results for VOST method blanks showed no significant contamination. Methylene chloride and toluene were found just above the 10 ng detection limit, up to 13 ng.

VOST field blanks showed relatively high amounts of acetone (150 ng), methylene chloride (2700 ng), and trichlorofluoromethane (55 ng). The concentration of toluene

(11 ng) was just above the 10 ng detection limit. Similar levels of toluene were detected in a small number of samples and may be biased slightly high if they are not contamination artifacts.

Semivolatile Organic Compounds (PAHs)

Precision. Precision estimates for PAHs in gas samples were based on the dispersion of surrogate spike recovery data. These results are summarized in Table F.2-17. These results show extremely high variability and suggest poor precision in the PAH measurements.

As shown in Table F.2-17, surrogate spike recoveries were acceptable in clean matrix samples, such as the XAD trip spike, lab spike, and lab blank, but very poor in actual project samples. This indicates a matrix interference in the flue gas samples.

Accuracy. Recovery data for the PAHs, like the precision estimates, indicate analytical problems. Surrogate spike recoveries in gas samples ranged from 0-43%, 66-101%, and 102-918% for the three surrogate compounds. In the virgin (not used for sampling) XAD samples, surrogate and analyte spike recoveries were all very good, indicating acceptable laboratory performance.

Internal standard recovery data, shown in Table F.2-15, are excessively low, more so in the ESP inlet samples than in the stack. The samples had high particulate matter levels, and it is presumed that unburned carbon in the particulate matter caused significant interference with the measurements, resulting in the extremely low internal standard recoveries. Because measurement results are factored by the inverse of the internal standard recovery, the effects of bias would tend to be lessened, but the imprecision associated with the standards adds further imprecision to the results.

The PAH measurements should be considered order-of-magnitude estimates.

Blank Effects. Blank results did not show significant problems. Field blank results showed somewhat high levels of acenaphthene (469 ng) and phenanthrene (120 ng). Because of the extreme sensitivity of the method, lesser levels of other semivolatile organic compounds were also detected, but at concentrations that should not be of concern.

Aldehydes

Precision. Duplicate analytical results for aldehydes produced no precision estimates because the analytes were not detected.

Accuracy. Accuracy estimates for aldehydes were based on matrix spike recoveries, which were 90% for formaldehyde and 92% for acetaldehyde. Trip spikes and lab spikes were also performed, yielding results of 83% and 89% for formaldehyde, 81% and 100% for acetaldehyde. These are all well within the accuracy objective of 50-150% recovery.

Blank Effects. Aldehyde results in samples were not distinguishable from those in the blank samples, which included field, trip, reagent, and lab blanks, precluding the ability to determine whether aldehydes were present in the gas samples.

Mercury Speciation (Frontier Geosciences Method)

Precision. No precision data were available for mercury speciation results.

Accuracy. Lab spikes were performed to demonstrate instrumental accuracy. Recoveries were good, ranging from 88% to 106%, but these do not address matrix effects or address the sample collection effectiveness, with respect to representative speciation. The method has demonstrably reliable features that make it a useful empirical tool, but species conversion in the sampling train cannot be discounted.

Blank Effects. Field blanks analyzed for mercury speciation showed no blank contamination problems.

Material Balances

Evaluating data consistency can be another overall data quality evaluation tool. Material balances for major elements can be used to verify the internal consistency of stream flow rates. Material balance closures for trace species can be used to indicate whether the samples collected were representative with respect to the trace element concentrations and can help identify analytical biases in one or more types of samples.

The results of material balances around the unit for the OFA and OFA/LNB tests are shown in Table 5-8. Closure is defined as the ratio of outlet to inlet mass rates for a particular substance. A 100% closure indicates perfect agreement. When trace substances are analyzed, a closure of between 70 and 130% has been set as a goal for the project. This range reflects the typical level of uncertainty in the measurements and, therefore, allows one to interpret the inlet and outlet mass flow rates as being equivalent. The 95% confidence intervals about the closures have been calculated using an error propagation analysis, which is discussed in detail in Appendix E.

The material balance calculation included a single inlet stream (coal), and three outlet streams: bottom ash, ESP ash, and stack gas. For the OFA/LNB test, the ESP hopper ash was not analyzed, so its composition was assumed to be equal to that of the ESP inlet particulate matter.

Closures for the major species (except for sodium in the OFA test) met the project goal, which supports the stream flow rates used in the material balances. For the OFA test, 8

Table 5-8
Material Balance Results - OFA and OFA/LNB Tests

	OFA Test		OFA/LNB Test	
Substance	**Out/In, %**	**95% CI, %**	**Out/In, %**	**95% CI, %**
Major Species				
Ash	100	-- [a]	100	-- [a]
Aluminum	100	24	89	24
Iron	71	17	85	33
Sodium	68	14	102	23
Sulfur	99	11	97	13
Titanium	103	31	81	23
Target Species				
Arsenic	112	36	111	41
Barium	47	16	105	32
Beryllium	87	40	100	24
Cadmium	NC	--	NC	--
Chloride	64	25	113	49
Chromium	53	15	83	32
Cobalt	65	13	89	29
Copper	40	25	55	16
Fluoride	128	120	96	38
Lead	130	90	70	22
Manganese	80	75	110	19
Mercury	71	27	90	31
Molybdenum	NC	--	NC	--
Nickel	78	180	65	40
Phosphorus	57	36	54	22
Selenium	82	30	90	38
Vanadium	65	14	97	24

[a] Ash balance was forced to close by assuming an 80:20 fly ash to bottom ash ratio.
CI= Confidence Interval.
NC = Not calculated because substance was not detected in the coal.

of the 15 target elements detected in the coal had closures that met the project goal, indicating that, in general, representative samples were obtained. Barium, chlorine, chromium, cobalt, copper, phosphorus, and vanadium all show closures outside the project goal. The fact that none of the 95% confidence intervals for these elements contain 100% indicates that imprecision is not responsible for the poor closures. The low closures may indicate an analytical bias in one or more of the process streams.

For the OFA/LNB test, 12 of the 15 target elements detected in the coal had closures within the desired range of 70 to 130%. The closures for copper, nickel, and phosphorus were below 70%. For copper and phosphorus, this may indicate a bias in one or more of the process streams. For nickel, because the 95% confidence interval contains 100%, imprecision may be partly responsible for the low mean closure.

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EXAMPLE CALCULATIONS

This section presents selected examples of the calculations used to develop the results shown in Section 3. Specifically, the calculation of stream flow rates, mean concentration values and confidence intervals, and emission factors are presented.

Stream Flow Rates

Appendix F contains information about the stream flow rates measured at Site 16 during the sampling period. Coal flow rates were obtained directly from plant meters, and flue gas flow rates were measured during sampling. Neither the bottom ash nor the ESP collected ash flow rates could be measured directly. These rates were calculated from other available data.

For the OFA test, the particulate loading measured in the ESP inlet gas is not considered accurate. The measured loadings showed approximately 40-50% of the coal ash appearing in the ESP inlet gas. For this type of boiler, a split closer to 80:20 (fly ash to bottom ash) would be expected. The 80% fly ash figure was later confirmed by another contractor (SRI) and again by Radian during the OFA/LNB test. It is now suspected that during the OFA sampling, ESP inlet particulate matter was lost through the nozzle between sampling and recovery. The sampling probe was modified for the OFA/LNB test to prevent this from occurring.

The bottom ash and fly ash rates were calculated from the coal ash rate, assuming an 80:20 fly ash to bottom ash ratio. For example, for Run 1 on March 3, 1991, the following data were collected:

Coal Flow Rate = 330,000 lb/hr (dry)
Coal Ash Content = 12% (dry)

The bottom ash and fly ash flow rates were calculated as:

Fly Ash Rate = (0.80)(0.12)(330,000 lb/hr)
= 31,700 lb/hr

Bottom Ash Rate = (0.20)(0.12)(330,000 lb/hr)
= 7,920 lb/hr

For the OFA/LNB test, the particulate loadings measured at the ESP inlet are considered valid. Therefore, a different approach was taken in calculating the ash flow rates. The ESP collected ash rate was calculated as the difference between the ESP inlet particulate matter rate and the stack particulate matter rate. The bottom ash rate was calculated as the difference between the coal ash rate and the ESP inlet particulate matter rate (adjusted for loss on ignition, LOI). For example, for Run 2 on May 19, 1993, the following data were obtained:

Coal Flow Rate = 313,000 lb/hr (dry)
Coal Ash Content = 9.47% (dry)
Stack Ash Rate = 427 lb/hr
ESP Inlet Ash Rate = 22,920 lb/hr
ESP Inlet Ash LOI = 5.19%

The bottom ash and collected fly ash flow rates were calculated as:

Bottom Ash Rate = (0.0947)(313,000 lb/hr) - (1-0.0519)(22,920 lb/hr)
= 7,920 lb/hr

Fly Ash Rate = 22,920 lb/hr - 427 lb/hr
= 22,500 lb/hr

Means and Confidence Intervals for Stream Concentrations

The mean concentrations and 95% confidence intervals (CIs) about the mean were calculated for each target substance in the streams sampled. The means were calculated according to the conventions listed in Section 3. The equations used to calculate the 95% confidence intervals are presented in Appendix E. Example calculations for chromium in the stack gas during the OFA/LNB test follow here; these results were shown in Table 3-8.

The concentration data (in $\mu g/Nm^3$) given for chromium in Table 3-8 are:

	Run 2	Run 3	Run 4
Solid Phase	20	27	23
Vapor Phase	1.0	0.77	1.1
Total	21	28	24

The mean is calculated from the individual run totals:

$$\text{Mean} = (21 + 28 + 24)/3$$

$$= 24$$

The sample standard deviation of the individual run totals is calculated:

$$S_p = \sqrt{\left[(21-24)^2 + (28-24)^2 + (24-24)^2\right] /2} \qquad \text{(eq. 1)}$$

$$= 3.5$$

The standard deviation of the average is calculated according to Equation 6 in Appendix E for N = 3:

$$S_{\bar{p}} = 3.5/\sqrt{3} \qquad \text{(eq. 2)}$$

$$= 2.0$$

The bias error is found by root-sum-squaring the product of the bias error and the sensitivity from each run (see Equation 2 in Appendix E). According to the conventions listed in Section 3, no bias error is assigned to values above detection limits, whereas a bias error of one-half the detection limit is assigned to values below detection limits. The sensitivity of the mean to each run in this case is 1/3.

$$\beta_r = \sqrt{(1/3 \times 0)^2 + (1/3 \times 0)^2 + (1/3 \times 0)^2} \qquad \text{(eq. 3)}$$

$$= 0$$

The total uncertainty in the result is found from Equation 1 in Appendix E:

$$U_r = \sqrt{\beta_r^2 + \left(t \times S_{\bar{p}}\right)^2} \qquad \text{(eq. 4)}$$

$$= \sqrt{0^2 + (4.303 \times 2.0)^2}$$

$$= 8.6$$

Thus, the result is reported as 24 ± 8.6 $\mu g/Nm^3$.

Unit Energy Emission Factors

In addition to the gas-phase concentrations, unit-energy-based emission factors were developed for each target substance. These values were determined by calculating the mass flow rate of a substance in the flue gas (mean concentration times mean flow rate) and dividing by the mean heat input to the boiler during testing. The mean heat input is the product of the mean coal flow rate and the mean higher heating value (HHV) of the coal.

For example, note the calculation of the emission factor for chromium during the OFA/LNB test. The mean coal flow rate is 315,000 lb/hr on a dry basis. The mean HHV of the coal is 13,800 Btu/lb on a dry basis. Multiplying the coal flow rate by the HHV gives a mean heat input of 4.3×10^9 Btu/hr. The mean chromium mass flow through the stack (the product of the mean concentration, 24 $\mu g/Nm^3$, and the mean gas flow rate, 1,710,000 Nm^3/hr) is 4.1×10^7 $\mu g/hr$ or 0.090 lb/hr. When the mean mass flow rate is divided by the mean heat input, an emission factor of 21 $lb/10^{12}$ Btu is obtained, as shown in Table 3-9.

The 95% confidence intervals for emission factors were calculated according to the equations presented in Appendix E. For each parameter (flue gas flow rate, concentration, coal flow rate, and HHV) the mean, standard deviation, number of points, and bias estimates were used to calculate the combined uncertainty in the mean emission factors.

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GLOSSARY

Btu	British Thermal Unit
CAAA	Clean Air Act Amendments of 1990
CI	Confidence Interval
CV	Coefficient of Variation
CVAAS	Cold Vapor Atomic Absorption Spectrophotometry
DGA	Double Gold Amalgamation
DQO	Data Quality Objective
dscfm	Dry Standard Cubic Feet per Minute (1 atm, 68° F)
ESP	Electrostatic Precipitator
GFAAS	Graphite Furnace Atomic Absorption Spectrophotometry
HGAAS	Hydride Generation Atomic Absorption Spectrophotometry
HHV	Higher Heating Value
IC	Ion Chromatography
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
INAA	Instrumental Neutron Activation Analysis
ISE	Ion Selective Electrode
LNB	Low NO_x Burners
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Megawatt or Microwave
NC	Not Calculated
ND	Not Detected (below detection limit)
NIST	National Institute of Standards and Technology (formerly National Bureau of Standards, NBS)
Nm^3	Dry Normal Cubic Meter (0° C, 1 atm)
OFA	Overfire Air
PAH	Polynuclear Aromatic Hydrocarbon
POM	Polycyclic Organic Matter
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference

APPENDIX A: SAMPLE COLLECTION, PREPARATION, AND ANALYSIS

This appendix presents the methods used to collect and analyze each type of sample. Difference between the methods used during the OFA and OFA/LNB tests are noted where appropriate. Detailed method tables are included.

Multi-Metals Sampling Trains

Multi-metals samples were collected according to the procedure described in Section 3.1 of 40 CFR, Part 266, Appendix IX, "Methodology for the Determination of Metals Emissions from Hazardous Waste Incineration and Similar Combustion Processes," with modifications as noted here. This method provides for the collection of a flue gas sample at isokinetic conditions while traversing the duct according to EPA Method 1. Particulate matter is collected on a filter (which is also used to determine particulate loading) and the vapor-phase species are absorbed in an impinger train consisting of:

- Two impingers containing 5% HNO_3/10% H_2O_2, which are analyzed for all metals of interest; and
- Two impingers containing 4% $KMnO_4$/10% H_2SO_4, which are analyzed for mercury only.

The multi-metals method specifies that HNO_3/H_2O_2 impinger solutions be evaporated to near dryness prior to analysis. However, due to concern over the possible loss of volatile metals, this procedure was not followed. Instead, the impinger solutions were analyzed as recovered to avoid any loss of volatile metals.

Stack

Samples were collected at the stack according to the method. A Method 5 type train was used, with particulate matter captured on an out-of-stack quartz filter maintained at 250°F during sampling. The glass-lined probe was also maintained at 250°F. After sampling, the glass nozzle and probe liner were rinsed first with acetone, then with 0.1 N nitric acid according to the multi-metals method.

ESP Inlet

The multi-metals method specifies that particulate matter be collected according to the extractive Method 5. However, the high particulate loading at the ESP inlet precluded the use of a Method 5 filter. Instead, particulate matter was collected with an in situ quartz thimble (Method 17) at the ESP inlet. A Teflon® transfer line connected the thimble holder to the impinger train.

A single train was used to sample both the A- and B-side ducts. After sampling, the glass nozzle and the thimble holder were rinsed first with acetone, then with 0.1 N nitric acid according to the multi-metals method. The Teflon® transfer line was rinsed with 0.1 N nitric acid.

As was discussed in Section 5, it is suspected that particulate was lost through the nozzle during the OFA test. To prevent this from occurring during the OFA/LNB test, a cyclone precutter was added to the train ahead of the thimble. The solids collected in the cyclone were added to those collected in the thimble. The precutter was rinsed with acetone.

Anions Sampling Trains

Anions samples were collected using a Radian procedure designed for collection of HCl, HF, and SO_2. Particulate matter is captured on a filter and the acid gases are absorbed in an impinger train consisting of two impingers containing a solution of 0.013% Na_2CO_3, 0.013% $NaHCO_3$, and 6% H_2O_2.

Stack

An out-of-stack Method 5 glass filter was used at the stack. The filter and glass-lined probe were maintained at 250°F during sampling. The samples were collected isokinetically at a single point within the stack. After sampling, the glass nozzle and probe liner were rinsed with fresh anions impinger solution.

ESP Inlet

An in situ Method 17 glass thimble was used to collect anions samples at the ESP inlet. A Teflon® transfer line connected the filter holder to the impinger train. Samples were collected isokinetically at a single point. During sample recovery, the nozzle, thimble holder, and the transfer line were rinsed with fresh anions impinger solution.

For the OFA/LNB test, a cyclone precutter was added to the train ahead of the thimble to prevent the loss of particulate. The precutter was rinsed with fresh anions impinger solution during recovery.

Semivolatiles Sampling Trains (MM5)

Samples were collected according to SW-846 Method 0010, "Modified Method 5 (MM5) Sampling Train for Semivolatile Principal Organic Hazardous Compounds." Particulate matter is collected on a filter and vapor-phase compounds are captured in a chilled XAD resin cartridge. Samples are collected isokinetically while traversing the duct according to EPA Method 1.

Stack

Samples were collected according to the method using an out-of-stack quartz filter maintained at 250° F. The glass-lined probe was also maintained at 250° F. The glass nozzle and probe liner were rinsed with methylene chloride during sample recovery.

ESP Inlet

Particulate collection was the same as for the multi-metals train at the ESP inlet. An in situ quartz thimble was used, and a Teflon® transfer line connected the thimble holder to the train holding the XAD cartridge. A single train was used to sample both the A- and B-side ESP inlet ducts. The nozzle, thimble holder, and transfer line were rinsed with methylene chloride during sample recovery.

For the OFA/LNB test, a cyclone precutter was added to the train ahead of the thimble to prevent the loss of particulate. The precutter was rinsed with methylene chloride during recovery.

Volatile Organic Sampling Train (VOST)

Samples for volatile organic compounds were collected according to SW-846 Method 0030 "Volatile Organic Sampling Train (VOST)." Volatile organics are captured by a pair of sorbent resin traps in series and maintained at 20° C. The first trap contains Tenax and the second trap contains Tenax followed by petroleum-based charcoal. Samples are collected at rate of 0.5 liters per minute from a fixed point in the duct. After sampling, the resin traps are sealed and returned to the laboratory for analysis.

For the OFA test, each sampling run included the collection of 1-L, 5-L, and 20-L samples. For the OFA/LNB test, each run included the collection of three 20-L samples.

Aldehyde Sampling Train

Aldehyde samples were collected according to SW-846 Method 0011, "Sampling for Formaldehyde Emissions from Stationary Sources." Aldehydes are absorbed in impingers containing a solution of 2,4-dinitrophenylhydrazine and HCl. A filter is used to prevent particulate matter from entering the impingers. Samples are collected isokinetically from a single point within the duct.

For convenience, the aldehydes impinger trains shared filters with the anions trains, because the particulate is not analyzed for aldehydes. After an anions sample was collected, the anions impinger train was disconnected and the aldehydes impinger train was attached. Therefore, the particulate capture was identical to that previously described for the anions trains. No aldehydes samples were collected at the ESP inlet during the OFA/LNB test.

Chromium (VI) Sampling Train (OFA/LNB Test)

Samples for chromium (VI) were collected at the stack during the OFA/LNB test according to the procedure described in Section 3.2 of 40 CFR, Part 266, Appendix IX, "Determination of Hexavalent Chromium Emissions from Stationary Sources." The method uses a probe/impinger train equipped with a recirculation line to continuously pump the impinger solution to the tip of the probe during sampling. No filter is used; particulate is allowed to enter the impinger train. The impinger solution consists of a KOH solution designed to maintain the pH above 8.5 to prevent reduction of Cr(VI).

The method calls for a 0.1 N KOH solution. However, the method was not designed to contend with the high levels of CO_2 and SO_2 typically found in power plant stack gas. Therefore, the method was modified by using a 10 N KOH solution to guarantee a pH of 8.5 or greater during sampling.

After recovery of the KOH solution, all train components were rinsed with 0.1 N nitric acid, as per the method. The analysis of this rinse is necessary only if total chromium results are desired. Nitric acid rinses were held for possible analysis in the future.

Mercury Speciation Train (OFA/LNB Test)

The Frontier Geosciences mercury speciation train was used to collect samples at the stack during the OFA/LNB test. The solid sorbent technique was developed by Nicholas Bloom, now with Frontier Geosciences, Inc., but formerly with Brooks Rand, Ltd. A quartz-lined probe was inserted into the stack, and flue gas was extracted non-isokinetically from a single point at a rate of 0.5 liters per minute. The flue gas then passed through a series of four solid adsorbent cartridges which were used to trap the various vapor-phase mercury species. The cartridges were maintained at approximately 110°C in a heated jacket outside the duct. The first two cartridges contained KCl-impregnated soda lime which is designed to capture ionic inorganic mercury species (Hg^{2+}) as well as monomethyl mercury species (such as CH_3HgCl). The third and fourth cartridges contained iodated carbon, which is designed to capture elemental mercury. A glass wool plug ahead of the adsorbent cartridges prevented particulate from entering the adsorbents. This plug was not analyzed, because the single-point, non-isokinetic sampling does not provide representative particulate capture. Only vapor-phase species were determined.

The KCl/soda lime traps were dissolved in acetic acid solutions. Ionic and methyl mercury were determined by aqueous-phase ethylation, purging onto a carbotrap, cryogenic GC separation, and detection with cold vapor atomic fluorescence spectrometry (CVAFS). Methyl mercury was determined as methylethyl mercury, while inorganic ionic mercury was determined as diethyl mercury. Elemental mercury on iodated carbon traps was determined by digesting with a mixture of HNO_3/H_2SO_4 and BrCl, reducing with $SnCl_2$, purging and preconcentrating on gold, and detecting with CVAFS.

Impactor Sampling (OFA/LNB Test)

Size-fractionated particulate samples were collected at the stack using a University of Washington Mark 5 cascade impactor. Samples were collected isokinetically at a fixed point. Particulate on each impactor stage was collected on Kapton (polyamide) substrates, and a quartz fiber filter was used as the final filter. Prior to analysis, adjacent impactor stages were combined to provide three size fractions: approximately $<3\,\mu m$, $3\text{-}10\,\mu m$, and $>10\,\mu m$. Quartz final filters were microwave digested and analyzed by ICP-MS. Kapton substrates were rinsed and soaked in dilute nitric acid. The solids and nitric acid solution were then microwave digested and analyzed by ICP-MS.

Process Sample Collection

The details of sample collection at each location are listed below. Differences between the methods used for the OFA and OFA/LNB tests are noted where appropriate.

Coal

For the OFA test, a metal corer was used to collect samples from the clean-out ports at the bottom of each the coal bunkers. For the OFA/LNB test, samples were collected by opening a tap on each of the coal feeders, allowing the coal to fall into a plastic bucket, and subsampling the catch with a plastic scoop. For both tests, multiple grab samples were composited directly into a five-gallon plastic bucket and split with a riffler to provide two one-kilogram samples for analysis.

Bottom Ash and Bottom Ash Water

To obtain representative bottom ash samples, the bottom ash was sluiced prior to each test run and allowed to accumulate in the boiler bottom during the run. At the end of the run, the bottom ash was sluiced again. Wet bottom ash samples were collected from the discharge of the sluice pipe at the ash basin. For the OFA test, a polyethylene dipper was used to collect multiple grab samples. For the OFA/LNB test, a one-liter plastic graduated cylinder was used to traverse the discharge stream during sluicing to obtain one grab sample per minute during sluicing.

For both tests, the multiple grab samples were combined in a large container and the solids were allowed to settle. The bottom ash water was then siphoned off and filtered for collection. The bottom ash water samples collected during the OFA/LNB test were archived for possible analysis in the future.

ESP Ash

A metal sample thief was used to collect samples from the ESP hoppers. For the OFA test, multiple grab samples were collected from each of the 16 ESP hoppers during the gas sampling periods. A composite sample was generated by combining all hopper samples in equal proportions by volume. For the OFA/LNB test, the samples from each of the 16 hoppers were kept separate and archived for possible analysis in the future.

Sluice Supply Water

Grab samples of the water used for ash sluicing were collected at the recycle pond water intake immediately before sluicing. Single grab samples were collected for both the OFA and OFA/LNB tests. The samples collected during the OFA/LNB test were archived for possible analysis in the future.

Detailed Sample Collection/Preparation/Analysis Tables

Table A-1 lists the techniques used to collect, preserve, and handle the samples at Site 16. Analytical methods applied to coal samples are listed in Table A-2. Analytical methods for inorganic species in other samples are listed in Table A-3. The analytical methods applied to organic compounds are listed in Table A-4.

Table A-1
Sample Collection, Preservation, and Handling Techniques for Site 16

Stream	Collection Method	Fraction Description	Sample Handling and Preservation	Comments
Flue Gas Samples				
ESP Inlet Gas, Stack Gas	Specified in Section 3.1 of 40 CFR, Part 266, Appendix IX[a]	Metals Probe and Nozzle Rinse	Acetone portion dried and weighed; nitric acid portion sealed and kept at ambient temperature.	Digested probe and nozzle rinses combined with digested filters prior to analysis.
		Metals Filter or Thimble	Desiccated at room temperature to constant weight.	For ESP inlet, a 0.100 g subsample was digested and analyzed. For the stack, entire filter was digested and analyzed.
		Metals H_2O_2/HNO_3 Impingers	Sealed and kept at ambient temperature.	Analyzed for all target metals.
		Metals $KMnO_4/H_2SO_4$ Impingers	Sealed and kept at ambient temperature.	Analyzed for mercury only.
	Radian Method for Anions	Anions Train: Filter $Na_2CO_3/NaHCO_3/H_2O_2$ Impingers Probe and Nozzle Rinse	Sealed and kept at ambient temperature.	Analyzed for chloride, fluoride, and sulfate.
	SW 0030	VOST	Cooled to 4° C.	Analyzed for volatile organic compounds.
	SW 0010	MM5 - Filter or Thimble MM5 - XAD Resin MM5 - PNR/Condensate	Cooled to 4° C. Cooled to 4° C. Cooled to 4° C.	Analyzed for semivolatile organic compounds.
	SW 0011	Formaldehyde Impingers	Rinsed with $MeCl_2$; cooled to 4° C.	Analyzed for aldehydes.
	Specified in Section 3.2 of 40 CFR, Part 266, Appendix IX[b] (Method used for OFA/LNB test)	Chromium(VI) Impingers	pH >8.5 with KOH; cooled to 4° C.	Analyzed for chromium(VI).
Water Samples				
Bottom Ash Water	Decanted & Filtered	Metals	Nitric acid to pH <2; kept in sealed container.	Solids were allowed to settle before decanting the water phase.
		Cl, F	Kept in sealed container.	
		Total P	Sulfuric acid to pH <2; kept in a sealed container.	

Table A-1 (Continued)

Stream	Collection Method	Fraction Description	Sample Handling and Preservation	Comments
Recycle Pond Water	Grab	Metals	Nitric acid to pH <2; kept in a sealed container.	One grab sample during each test run.
		Cl, F	Kept in sealed container.	
		Total P	Sulfuric acid to pH <2: kept in a sealed container.	
Solid Samples				
Coal	Grab/Composite	Ultimate, Proximate Mercury Metals Cl, F, P	Placed in sealed container in the field; air dried, ground prior to analysis.	Multiple grab samples collected during the test period were composited directly into buckets, riffled to reduce sample size.
Bottom Ash Solids	Grab/Composite	Metals Cl, F Total P Total S	Placed in sealed container in the field; dried at 105°C and ground prior to analysis.	Multiple grab samples taken during bottom ash sluicing were composited in a large plastic container. Solids were allowed to settle and the water was decanted.
ESP Hopper Ash	Grab/Composite	Metals Cl, F Total P Total S	Kept in sealed container; submitted "as collected."	Grab samples taken from individual hoppers. Composite samples analyzed for OFA test. Samples collected during OFA/LNB test were archived.

[a] 40 CFR, Part 266, Appendix IX, Section 3.1, "Methodology for the Determination of Metals Emissions from Hazardous Waste Incineration and Similar Combustion Processes," 1991.

[b] 40 CFR, Part 266, Appendix IX, Section 3.2, "Determination of Hexavalent Chromium Emissions from Stationary Sources," 1991.

Table A-2
Preparation Procedures and Chemical Analysis Methods Applied to Coal at Site 16

Component	Method Reference	Coal
Ultimate Analysis of Coal		
Ash	ASTM D3174	X,O
Carbon	ASTM D3178	X,O
Hydrogen	ASTM D3178	X,O
Nitrogen	ASTM D3179	X,O
Sulfur	ASTM D4239	X,O
Heating Value	ASTM D2015	X,O
Proximate Analysis of Coal		
Moisture	ASTM D3173	X,O
Ash	ASTM D3174	X,O
Volatiles	ASTM D3175	X,O
Fixed Carbon	Calculated	X,O
Target Elements by INAA		
Preparation - None		
Analysis by INAA		
Arsenic	Karr, Chapters 12 and 46	X,O
Barium	Karr, Chapters 12 and 46	X,O
Cadmium	Karr, Chapters 12 and 46	X,O
Chlorine	Karr, Chapters 12 and 46	X,O
Chromium	Karr, Chapters 12 and 46	X,O
Cobalt	Karr, Chapters 12 and 46	X,O
Copper	Karr, Chapters 12 and 46	X,O
Manganese	Karr, Chapters 12 and 46	X,O
Mercury	Karr, Chapters 12 and 46	X,O
Molybdenum	Karr, Chapters 12 and 46	X,O
Nickel	Karr, Chapters 12 and 46	X,O
Selenium	Karr, Chapters 12 and 46	X,O
Vanadium	Karr, Chapters 12 and 46	X,O

Table A-2 (Continued)

Component	Method Reference	Coal
Chlorine and Fluorine in Coal		
Preparation		
Oxygen Bomb Digestion	ASTM D2361/ASTM D3761	X,O
Analysis by Potentiometric Titration		
Chloride	SM 4500	X,O
Analysis by Ion Selective Electrode		
Fluoride	ASTM D3761	X,O
Total Phosphorus in Coal		
Preparation		
Ashing and Acid Digestion	ASTM D2795	X
Spectrophotometric Analysis		
Total Phosphorus	ASTM D2795	X
Be, Pb, P in Coal		
Preparation		
Ashing at 500° C/Acid Digestion	EPA 340.2	X,O
Analysis by ICP-AES		
Beryllium	SW 6010	X,O
Lead	SW 6010	O
Phosphorus	SW 6010	O
Analysis by GFAAS		
Lead	SW 7421	X
Arsenic and Selenium in Coal		
Preparation		
Oxygen Bomb Combustion/Acid Digestion	ASTM D3684	X
Analysis by GFAAS		
Arsenic	SW 7060	X
Selenium	SW 7740	X

Table A-2 (Continued)

Component	Method Reference	Coal
Mercury in Coal		
Preparation		
Double Gold Amalgamation	Karr, Chapter 14	X,O
Analysis by CVAAS		
Mercury	Karr, Chapter 14	X,O
Additional Inorganic Analytes in Coal		
Preparation - None		
Analysis by INAA		
Aluminum	Karr, Chapters 12 and 46	X,O
Antimony	Karr, Chapters 12 and 46	X,O
Iron	Karr, Chapters 12 and 46	X,O
Sodium	Karr, Chapters 12 and 46	X,O
Titanium	Karr, Chapters 12 and 46	X,O

Karr, C. Jr., (ed)., "Analytical Methods for Coal and Coal Products."

SW is EPA SW-846, "Test Methods for Evaluating Solid Waste".

SM is "Standard Methods for the Examination of Water and Wastewater," 16th Edition.
ASTM is American Society for Testing and Materials.

X = Procedure performed on samples from OFA test.

O = Procedure performed on samples from OFA/LNB test.

Table A-3
Preparation Procedures and Chemical Analysis Methods for Inorganic Chemical Components in Ashes, Water Samples, and Flue Gas at Site 16

Component	Method Reference	Ashes	Water Samples	Flue Gas Solids	Metals HNO_3/H_2O_2 Impingers	Metals $KMnO_4/H_2SO_4$ Impingers	Anions Impingers
Target Elements by ICP-AES							
Preparation							
Water Digestion	SW 3005		X		X,O		
MW Digestion for Filters	CEM-F			X,O			
MW Digestion for Solids	CEM-FA	X,O					
Analysis by ICP-AES							
Arsenic	SW 6010	O		O	O		
Barium	SW 6010	X,O	X	X,O	X,O		
Beryllium	SW 6010	X,O	X	X,O	X,O		
Cadmium	SW 6010	X,O	X	X,O	X,O		
Chromium	SW 6010	X,O	X	X,O	X,O		
Cobalt	SW 6010	X,O	X	X,O	X,O		
Copper	SW 6010	X,O	X	X,O	X,O		
Manganese	SW 6010	X,O	X	X,O	X,O		
Molybdenum	SW 6010	X,O	X	X,O	X,O		
Nickel	SW 6010	X,O	X	X,O	X,O		
Phosphorus	SW 6010	X,O		X,O	O		X
Selenium	SW 6010	O		O	O		
Vanadium	SW 6010	X,O	X	X,O	X,O		

Table A-3 (Continued)

Component	Method Reference	Ashes	Water Samples	Flue Gas Solids	Metals HNO_3/H_2O_2 Impingers	Metals $KMnO_4/H_2SO_4$ Impingers	Anions Impingers
Target Elements by GFAAS							
Preparation							
Water Digestion	CLP 3/90D-5		X		X,O		
MW Digestion for Filters	CEM-F			X,O			
MW Digestion for Solids	CEM-FA	X,O					
Analysis by GFAAS							
Arsenic	SW 7060	X,O		X,O	X,O		
Cadmium	SW 7131	X,O	X	X,O	X,O		
Chromium	SW 7191				O		
Nickel	EPA 249.2	O		O	O		
Lead	SW 7421	X,O	X	X,O	X,O		
Selenium	SW 7740	O		O	O		
Target Elements by HGAAS							
Preparation							
MW Digestion for Filters	CEM-F			X			
MW Digestion for Solids	CEM-FA	X					
Analysis by HGAAS							
Arsenic	SW 7061		X				
Selenium	SW 7741	X	X	X	X		

Table A-3 (Continued)

Component	Method Reference	Ashes	Water Samples	Flue Gas Solids	Metals HNO_3/H_2O_2 Impingers	Metals $KMnO_4/H_2SO_4$ Impingers	Anions Impingers
Mercury by CVAAS							
Preparation							
MW Digestion for Filters	CEM-F			X,O			
MW Digestion for Solids	CEM-FA	X,O					
Analysis by CVAAS							
Mercury	SW 7470	X,O	X	X,O	X,O	X,O	
Elements by ICP-MS in Size-Fractionated Particulate							
MW Digestion for Filters	CEM-F			O			
MW Digestion for Solids	CEM-FA			O			
Analysis by ICP-MS							
Antimony	SW 6020			O			
Arsenic	SW 6020			O			
Barium	SW 6020			O			
Beryllium	SW 6020			O			
Cadmium	SW 6020			O			
Chromium	SW 6020			O			
Cobalt	SW 6020			O			
Copper	SW 6020			O			
Lead	SW 6020			O			
Manganese	SW 6020			O			
Mercury	SW 6020			O			
Molybdenum	SW 6020			O			

Table A-3 (Continued)

Component	Method Reference	Ashes	Water Samples	Flue Gas Solids	Metals HNO_3/H_2O_2 Impingers	Metals $KMnO_4/H_2SO_4$ Impingers	Anions Impingers
Nickel	SW 6020			O			
Selenium	SW 6020			O			
Vanadium	SW 6020			O			
Acid-Forming Anions							
Preparation							
Aqueous Extraction of Solids (Cl,F)	Radian	X,O		X,O			
Sodium Hydroxide Fusion (F)	McQuaker and Gurney	X,O					
Chloride by IC	EPA 300.0	X,O	X	X,O			X,O
Chloride by Pot. Titr.	SM 407C	X,O					
Fluoride by ISE	EPA 340.2	X,O	X	X,O			X,O
Total P Spectrophotometry	EPA 365.3		X				
Elements by X-Ray Fluorescence							
Aluminum	ASTM D4326	X					
Calcium	ASTM D4326	X					
Iron	ASTM D4326	X					
Magnesium	ASTM D4326	X					
Potassium	ASTM D4326	X					
Silicon	ASTM D4326	X					
Sodium	ASTM D4326	X					
Titanium	ASTM D4326	X					

Table A-3 (Continued)

Component	Method Reference	Ashes	Water Samples	Flue Gas Solids	Metals HNO_3/H_2O_2 Impingers	Metals $KMnO_4/H_2SO_4$ Impingers	Anions Impingers
Total Sulfur Analysis							
Sulfur by Leco	ASTM D4239	X					
Additional Inorganic Analytes by ICP-AES							
Preparation							
Water Digestion	SW 3005		X		X,O		
MW Digestion for Filters	CEM-F			X,O			
MW Digestion for Solids	CEM-FA	X,O					
Analysis by ICP-AES							
Aluminum	SW 6010	X,O	X	X,O	X,O		
Antimony	SW 6010	X,O	X	X,O	X,O		
Iron	SW 6010	X,O	X	X,O	X,O		
Sodium	SW 6010	X,O	X	X,O	X,O		
Titanium	SW 6010	X,O	X	X,O	X,O		

ASTM is American Society for Testing and Materials.
EPA is EPA Methods for Chemical Analysis of Water and Wastes, 1983.
SW is EPA SW-846, "Test Methods for Evaluating Solid Waste", 3rd ed.
SW 6020 is a **proposed** method for metals analysis by inductively coupled plasma - mass spectrometry (ICP-MS).
CEM-FA CEM Corporation, Matthews, NC Procedure for microwave digestion of coal fly ash.
CEM-F CEM Corporation, Matthews, NC Procedure for microwave digestion of glass or quartz filters.
CLP is EPA Contract Laboratory Program SOW 3/90.
McQuaker, N. R., and M. Gurney. "Determination of Total Fluoride in Soil and Vegetation Using An Alkali Fusion-Selective Ion Electrode Technique", Analytical Chemistry, Vol. 49, No. 1, January 1977, pp. 53-56.
SM is "Standard Methods for the Examination of Water and Wastewater", 16th Edition.
X = Procedure performed on samples from OFA test.
O = Procedure performed on samples from OFA/LNB test.

Table A-4
Preparation Procedures and Chemical Analysis Methods Used to Measure Organic Compounds at Site 16

Component	Method Reference	Flue Gas	Ashes	Water Samples
Volatile Organic Compounds				
Sample Collection				
VOST	SW 0030	X,O		
Analysis by GC-MS				
Benzene	SW 8240	X,O		
Toluene	SW 8240	X,O		
Formaldehyde				
Sample Collection				
DNPH Impinger	SW 0011	X,O		
Analysis by HPLC				
Formaldehyde	TO5	X,O		
Polycyclic Organic Matter				
Sample Collection				
MM5	SW 0010	X,O		
Preparation				
Soxhlet Extraction	SW 3540	X,O	X	X
Analysis by GC-MS				
Semivolatile organics, including PAHs and other POM	SW 8270	X	X	X
Analysis by High Resolution GC-MS				
PAHs		O		

DNPH is 2,4-Dinitrophenylhydrazine.

SW is EPA SW-846, "Test Methods for Evaluating Solid Waste."

TO5 is "EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air," EPA 600/4/84/041.

X = Procedure performed on samples from OFA test.
O = Procedure performed on samples from OFA/LNB test.

APPENDIX B:
ANALYTICAL DATA USED IN CALCULATIONS

Key to Data Flags

Flag	Description
@	Concentration is less than five times the detection limit.
B	Detected in blank.
E	Estimated analyte result exceeds calibration range.
R	Detected in blank, corrected in sample result.
<	Less than the detection limit.
+	Blank level exceeds 50% of uncorrected result.

30-Oct-93

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
1-Chloronaphthalene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1-Chloronaphthalene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1-Chloronaphthalene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1-Chloronaphthalene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1-Chloronaphthalene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1-Chloronaphthalene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1-Chloronaphthalene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1-Chloronaphthalene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1-Naphthylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1-Naphthylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1-Naphthylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1-Naphthylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1-Naphthylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1-Naphthylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1-Naphthylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1-Naphthylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,1-Dichloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,1-Dichloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,1-Dichloroethene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,1-Dichloroethene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,1,1-Trichloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	0.000577 @	0.00103 @	0.00447			
1,1,1-Trichloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,1,2-Trichloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,1,2-Trichloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,1,2,2-Tetrachloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,1,2,2-Tetrachloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,2-Dichloropropane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,2-Dichloropropane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,2-Diphenylhydrazine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,2-Diphenylhydrazine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,2-Diphenylhydrazine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1,2-Diphenylhydrazine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,2-Diphenylhydrazine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,2-Diphenylhydrazine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,2-Diphenylhydrazine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2-Diphenylhydrazine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2,4-Trichlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,2,4-Trichlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,2,4-Trichlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
1,2,4-Trichlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,2,4-Trichlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,2,4-Trichlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,2,4-Trichlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2,4-Trichlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,4-Dichlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,4-Dichlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,4-Dichlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1,4-Dichlorobenzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,4-Dichlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,4-Dichlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,4-Dichlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,4-Dichlorobenzene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,4-Dichlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,4-Dichlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Butanone	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.00525	< 0.00543	< 0.00559			
2-Butanone	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.00580	< 0.00569	< 0.00542			
2-Chloronaphthalene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Chloronaphthalene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Chloronaphthalene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Chloronaphthalene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Chloronaphthalene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Chloronaphthalene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Chloronaphthalene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Chloronaphthalene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Methylnaphthalene	bottom ash	GCMS(8270)	ug/g	0.995 @		< 0.980	< 0.990	< 0.990	
2-Methylnaphthalene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Methylnaphthalene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Methylnaphthalene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Methylnaphthalene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Methylnaphthalene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Methylnaphthalene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Methylnaphthalene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Methylphenol(o-cresol)	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Methylphenol(o-cresol)	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Methylphenol(o-cresol)	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Methylphenol(o-cresol)	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Methylphenol(o-cresol)	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Methylphenol(o-cresol)	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
2-Methylphenol(o-cresol)	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Methylphenol(o-cresol)	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Naphthylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Naphthylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Naphthylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Naphthylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Naphthylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Naphthylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Naphthylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Naphthylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4-Dinitrophenol	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
2,4-Dinitrophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
2,4-Dinitrophenol	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
2,4-Dinitrophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
2,4-Dinitrophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
2,4-Dinitrophenol	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
2,4-Dinitrophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
2,4-Dinitrophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
2,4-Dinitrotoluene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,4-Dinitrotoluene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,4-Dinitrotoluene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,4-Dinitrotoluene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,4-Dinitrotoluene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,4-Dinitrotoluene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,4-Dinitrotoluene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4-Dinitrotoluene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4,5-Trichlorophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,4,5-Trichlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,4,5-Trichlorophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,4,5-Trichlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,4,5-Trichlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,4,5-Trichlorophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,4,5-Trichlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4,5-Trichlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4,6-Trichlorophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,4,6-Trichlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,4,6-Trichlorophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,4,6-Trichlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,4,6-Trichlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
2,4,6-Trichlorophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,4,6-Trichlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4,6-Trichlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
3-Methylcholanthrene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
3-Methylcholanthrene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
3-Methylcholanthrene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
3-Methylcholanthrene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
3-Methylcholanthrene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
3-Methylcholanthrene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
3-Methylcholanthrene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
3-Methylcholanthrene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
3,3'-Dichlorobenzidine	bottom ash	GCMS(8270)	ug/g	< 2.00		< 2.00	< 2.00	< 2.00	
3,3'-Dichlorobenzidine	bottom ash sluice water	GCMS(8270)	ug/L	< 21.0		< 21.0	< 22.0	< 22.0	
3,3'-Dichlorobenzidine	collected fly ash	GCMS(8270)	ug/g	< 2.00		< 2.00	< 1.90	< 2.00	
3,3'-Dichlorobenzidine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0199	< 0.0167	< 0.0173			
3,3'-Dichlorobenzidine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0116	< 0.00976	< 0.0101			
3,3'-Dichlorobenzidine	sluice water supply	GCMS(8270)	ug/L	< 21.0		< 21.0	< 21.0	< 21.0	
3,3'-Dichlorobenzidine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0106	< 0.0111	< 0.0107			
3,3'-Dichlorobenzidine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0106	< 0.0111	< 0.0107			
4-Aminobiphenyl	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
4-Aminobiphenyl	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
4-Aminobiphenyl	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
4-Aminobiphenyl	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
4-Aminobiphenyl	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
4-Aminobiphenyl	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
4-Aminobiphenyl	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Aminobiphenyl	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Bromophenyl phenyl ether	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
4-Bromophenyl phenyl ether	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
4-Bromophenyl phenyl ether	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
4-Bromophenyl phenyl ether	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
4-Bromophenyl phenyl ether	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
4-Bromophenyl phenyl ether	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
4-Bromophenyl phenyl ether	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Bromophenyl phenyl ether	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Chlorophenyl phenyl ether	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
4-Chlorophenyl phenyl ether	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
4-Chlorophenyl phenyl ether	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
4-Chlorophenyl phenyl ether	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
4-Chlorophenyl phenyl ether	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
4-Chlorophenyl phenyl ether	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
4-Chlorophenyl phenyl ether	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Chlorophenyl phenyl ether	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Methylphenol(p-cresol)	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
4-Methylphenol(p-cresol)	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
4-Methylphenol(p-cresol)	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
4-Methylphenol(p-cresol)	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
4-Methylphenol(p-cresol)	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
4-Methylphenol(p-cresol)	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
4-Methylphenol(p-cresol)	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Methylphenol(p-cresol)	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Nitrophenol	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
4-Nitrophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
4-Nitrophenol	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
4-Nitrophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
4-Nitrophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
4-Nitrophenol	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
4-Nitrophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
4-Nitrophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
7,12-Dimethylbenz(a)anthracene	bottom ash	GCMS(8270)	ug/g	< 2.50		< 2.40	< 2.50	< 2.50	
7,12-Dimethylbenz(a)anthracene	bottom ash sluice water	GCMS(8270)	ug/L	< 26.0		< 26.0	< 27.0	< 28.0	
7,12-Dimethylbenz(a)anthracene	collected fly ash	GCMS(8270)	ug/g	< 2.50		< 2.50	< 2.40	< 2.50	
7,12-Dimethylbenz(a)anthracene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0249	< 0.0209	< 0.0216			
7,12-Dimethylbenz(a)anthracene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0145	< 0.0122	< 0.0126			
7,12-Dimethylbenz(a)anthracene	sluice water supply	GCMS(8270)	ug/L	< 26.0		< 26.0	< 26.0	< 26.0	
7,12-Dimethylbenz(a)anthracene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0132	< 0.0139	< 0.0134			
7,12-Dimethylbenz(a)anthracene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0132	< 0.0139	< 0.0134			
Acenaphthene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Acenaphthene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Acenaphthene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Acenaphthene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Acenaphthene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Acenaphthene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Acenaphthene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acenaphthene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acenaphthylene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Acenaphthylene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Acenaphthylene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	

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Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Acenaphthylene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Acenaphthylene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00561	< 0.00488	< 0.00503			
Acenaphthylene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Acenaphthylene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acenaphthylene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acetaldehyde	high dust gas, vapor phase	HPLC	mg/Nm3	0.0647		< 0.00782		< 0.00833	
Acetaldehyde	stack gas, vapor phase	HPLC	mg/Nm3	0.00489 @		0.00810 @		< 0.00564	
Acetophenone	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Acetophenone	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Acetophenone	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Acetophenone	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Acetophenone	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Acetophenone	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Acetophenone	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acetophenone	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Acrolein	high dust gas, vapor phase	HPLC	mg/Nm3	0.0118 @		< 0.00944		< 0.0100	
Acrolein	stack gas, vapor phase	HPLC	mg/Nm3	< 0.00232		< 0.00615		< 0.00681	
Aluminum	bottom ash	XRF	mg/kg			143321	142157	146126	144750
Aluminum	bottom ash sluice water	ICP-AES	mg/L			0.248 @	0.283 @	0.261 @	< 0.200
Aluminum	coal	NAA	ug/g, dry			16477	16591	13681	13083
Aluminum	collected fly ash	XRF	mg/kg			142898	142580	147238	148349
Aluminum	high dust gas, particulates	ICP-AES	mg/kg			116328 R		115097 R	120181 R
Aluminum	high dust gas, solid phase	ICP-AES	mg/Nm3			774 R		594 R	657 R
Aluminum	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.0869		< 0.0933	< 0.0900
Aluminum	sluice water supply	ICP-AES	mg/L			0.670 @	0.706 @	0.699 @	0.657 @
Aluminum	stack gas, particulates	ICP-AES	mg/kg			91597 R		77159 R	87035 R
Aluminum	stack gas, solid phase	ICP-AES	mg/Nm3			11.8 R		26.9 R	22.6 R
Aluminum	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.0733		< 0.0768	< 0.0681
Aniline	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Aniline	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Aniline	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Aniline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Aniline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Aniline	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Aniline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Aniline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Anthracene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Anthracene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Anthracene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Anthracene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Anthracene	*high dust gas, vapor phase*	*GCMS(8270)*	*mg/Nm3*	< 0.00581	< 0.00488	< 0.00503			
Anthracene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Anthracene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Anthracene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Antimony	bottom ash	ICP-AES	mg/kg			< 100	< 100	< 100	< 100
Antimony	bottom ash sluice water	ICP-AES	mg/L			< 0.100	< 0.100	< 0.100	< 0.100
Antimony	coal	NAA	ug/g, dry			0.905	1.62	1.90	1.30
Antimony	collected fly ash	ICP-AES	mg/kg			< 100	< 100	< 100	< 100
Antimony	high dust gas, particulates	ICP-AES	mg/kg			< 88.1		< 104	< 107
Antimony	high dust gas, solid phase	ICP-AES	mg/Nm3			< 0.586		< 0.538	< 0.587
Antimony	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.0435		< 0.0466	< 0.0261
Antimony	sluice water supply	ICP-AES	mg/L			< 0.100	< 0.100	< 0.100	< 0.100
Antimony	stack gas, particulates	ICP-AES	mg/kg			< 135		< 83.0	< 113
Antimony	stack gas, solid phase	ICP-AES	mg/Nm3			< 0.0174		< 0.0290	< 0.0295
Antimony	stack gas, vapor phase	*ICP-AES*	*mg/Nm3*			< *0.0200*		< *0.0164*	< *0.0194*
Arsenic	bottom ash	GFAAS	mg/kg			81.3 @	87.0	30.0 @	45.0
Arsenic	bottom ash sluice water	HGAAS	mg/L			0.00680 @	< 0.0250	0.00810 @	0.00670 @
Arsenic	coal	NAA	ug/g, dry			13.3	24.0	18.9	18.8
Arsenic	collected fly ash	GFAAS	mg/kg			225	224	226	199
Arsenic	high dust gas, particulates	GFAAS	mg/kg			324 R		250 R	342 R
Arsenic	high dust gas, solid phase	GFAAS	mg/Nm3			2.15 R		1.29 R	1.87 R
Arsenic	high dust gas, vapor phase	GFAAS	mg/Nm3			< 0.00174		< 0.00187	< 0.00180
Arsenic	sluice water supply	HGAAS	mg/L			0.0160 @	< 0.0250	0.0160 @	0.0160 @
Arsenic	stack gas, particulates	GFAAS	mg/kg			553 R			581 R
Arsenic	stack gas, solid phase	GFAAS	mg/Nm3			0.0713 R			0.151 R
Arsenic	stack gas, vapor phase	GFAAS	mg/Nm3			< 0.00147		< 0.00154	< 0.00136
Ash	coal	Ultimate	%dry	11.5		9.05	8.67	10.3	10.0
Barium	bottom ash	ICP-AES	mg/kg			893	871	948	743
Barium	bottom ash sluice water	*ICP-AES*	*mg/L*			*0.0940*	*0.0950*	*0.106*	*0.0940*
Barium	coal	NAA	ug/g, dry			206	154	158	139
Barium	collected fly ash	ICP-AES	mg/kg			827	775	756	747
Barium	high dust gas, particulates	ICP-AES	mg/kg			1128 R		1030 R	1092 R
Barium	high dust gas, solid phase	ICP-AES	mg/Nm3			7.50 R		5.32 R	5.97 R
Barium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00435		< 0.00466	< 0.00450
Barium	sluice water supply	ICP-AES	mg/L			0.150	0.151	0.148	0.148
Barium	stack gas, particulates	ICP-AES	mg/kg			1267 R		925 R	1102 R
Barium	stack gas, solid phase	ICP-AES	mg/Nm3			0.163 R		0.323 R	0.287 R
Barium	*stack gas, vapor phase*	*ICP-AES*	*mg/Nm3*			< 0.00366		< 0.00384	< 0.00341

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Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Benzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	0.00105 @	0.00206 @	0.000671 @			
Benzene	stack gas, 20-L VOST	GCMS	mg/Nm3	0.00128 @	0.00330	0.000650 @			
Benzidine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzidine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzidine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzidine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzidine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzidine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzidine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzidine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(a)anthracene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzo(a)anthracene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzo(a)anthracene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzo(a)anthracene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzo(a)anthracene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzo(a)anthracene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzo(a)anthracene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(a)anthracene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(a)pyrene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzo(a)pyrene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzo(a)pyrene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzo(a)pyrene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzo(a)pyrene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzo(a)pyrene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzo(a)pyrene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(a)pyrene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(b)fluoranthene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzo(b)fluoranthene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzo(b)fluoranthene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzo(b)fluoranthene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzo(b)fluoranthene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzo(b)fluoranthene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzo(b)fluoranthene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(b)fluoranthene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(g,h,i)perylene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzo(g,h,i)perylene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzo(g,h,i)perylene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzo(g,h,i)perylene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzo(g,h,i)perylene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Benzo(g,h,i)perylene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzo(g,h,i)perylene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(g,h,i)perylene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(k)fluoranthene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzo(k)fluoranthene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzo(k)fluoranthene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzo(k)fluoranthene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzo(k)fluoranthene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzo(k)fluoranthene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzo(k)fluoranthene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzo(k)fluoranthene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Beryllium	bottom ash	ICP-AES	mg/kg			8.80 @	8.70 @	10.6	11.0
Beryllium	bottom ash sluice water	ICP-AES	mg/L			< 0.00200	< 0.00200	< 0.00200	< 0.00200
Beryllium	coal	ICP-AES	mg/kg, dry			1.73	1.06	1.54	1.01 @
Beryllium	collected fly ash	ICP-AES	mg/kg			10.2	10.2	13.1	14.2
Beryllium	high dust gas, particulates	ICP-AES	mg/kg			16.5 R		19.8 R	20.9 R
Beryllium	high dust gas, solid phase	ICP-AES	mg/Nm3			0.110 R		0.102 R	0.115 R
Beryllium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.000495		< 0.000523	< 0.000900
Beryllium	sluice water supply	ICP-AES	mg/L			< 0.00200	< 0.00200	< 0.00200	< 0.00200
Beryllium	stack gas, particulates	ICP-AES	mg/kg			16.8 R		15.7 R	19.7 R
Beryllium	stack gas, solid phase	ICP-AES	mg/Nm3			0.00217 R		0.00548 R	0.00514 R
Beryllium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.000733		< 0.000441	< 0.000389
bis(2-Chloroethyl)ether	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
bis(2-Chloroethyl)ether	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
bis(2-Chloroethyl)ether	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
bis(2-Chloroethyl)ether	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
bis(2-Chloroethyl)ether	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
bis(2-Chloroethyl)ether	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
bis(2-Chloroethyl)ether	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Chloroethyl)ether	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Ethylhexyl)phthalate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
bis(2-Ethylhexyl)phthalate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
bis(2-Ethylhexyl)phthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
bis(2-Ethylhexyl)phthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	0.0109 @	< 0.00863			
bis(2-Ethylhexyl)phthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	0.396	0.0438	0.00767 @			
bis(2-Ethylhexyl)phthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
bis(2-Ethylhexyl)phthalate	stack gas, solid phase	GCMS(8270)	mg/Nm3	0.0109 @	< 0.00555	< 0.00534			
bis(2-Ethylhexyl)phthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	0.00832 @			
Bromoform	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			

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Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Bromoform	stack gas, 20-L VOST	GCMS	mg/Nm3	*< 0.000580*	*< 0.000569*	*< 0.000542*			
Bromomethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	0.000682 @	0.00168 @	< 0.000559			
Bromomethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Butylbenzylphthalate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Butylbenzylphthalate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Butylbenzylphthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Butylbenzylphthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Butylbenzylphthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Butylbenzylphthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Butylbenzylphthalate	*stack gas, solid phase*	*GCMS(8270)*	*mg/Nm3*	*< 0.00530*	*< 0.00555*	*< 0.00534*			
Butylbenzylphthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Cadmium	bottom ash	GFAAS	mg/kg			< 1.00	< 1.00	< 1.00	< 1.00
Cadmium	bottom ash sluice water	GFAAS	mg/L			< 0.00100	< 0.00100	< 0.00100	0.00200 @
Cadmium	coal	GFAAS	mg/kg, dry			< 0.104	< 0.104	0.157 @	< 0.105
Cadmium	collected fly ash	GFAAS	mg/kg			< 1.00	< 1.00	< 1.00	< 1.00
Cadmium	high dust gas, particulates	GFAAS	mg/kg			0.994 @R		< 2.04 R	1.11 @R
Cadmium	high dust gas, solid phase	GFAAS	mg/Nm3			0.00662 @R		< 0.0105 R	0.00608 @R
Cadmium	high dust gas, vapor phase	GFAAS	mg/Nm3			< 0.000435		< 0.000466	< 0.000450
Cadmium	*sluice water supply*	GFAAS	mg/L			0.00140 @	0.00170 @	0.00140 @	0.00170 @
Cadmium	stack gas, particulates	GFAAS	mg/kg			2.65 @			3.20 @
Cadmium	stack gas, solid phase	GFAAS	mg/Nm3			0.000342 @			0.000833 @
Cadmium	stack gas, vapor phase	GFAAS	mg/Nm3			< 0.000366		< 0.000384	< 0.000341
Calcium	bottom ash	XRF	mg/kg			7433	7433	7504	5861
Calcium	*bottom ash sluice water*	ICP-AES	mg/L			16.0	16.1	17.0	16.1
Calcium	coal	NAA	ug/g, dry			2879	1783	2408	1296
Calcium	collected fly ash	XRF	mg/kg			11650	9863	6361	4646
Calcium	high dust gas, particulates	ICP-AES	mg/kg			9761 R		9898 R	4041 @R
Calcium	high dust gas, solid phase	ICP-AES	mg/Nm3			65.0 R		51.1 R	22.1 @R
Calcium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.435		< 0.466	< 0.450
Calcium	sluice water supply	ICP-AES	mg/L			21.1	21.4	20.6	20.8
Calcium	stack gas, particulates	ICP-AES	mg/kg			9398 R		5905 R	6471 R
Calcium	stack gas, solid phase	ICP-AES	mg/Nm3			1.21 R		2.06 R	1.68 R
Calcium	*stack gas, vapor phase*	ICP-AES	*mg/Nm3*			< 0.366		< 0.384	< 0.341
Carbon	coal	Ultimate	%dry	75.0		77.6	78.0	76.5	76.6
Carbon disulfide	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Carbon disulfide	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Carbon tetrachloride	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Carbon tetrachloride	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Chloride	bottom ash	Pot. Titr.	mg/kg			< 100	167 @	< 100	< 100

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Chloride	bottom ash sluice water	IC	mg/L			2.92	2.89	3.35	3.07
Chloride	coal	Pot. Titr.	mg/kg, dry			314 @	460 @	501 @	404 @
Chloride	collected fly ash	Pot. Titr.	mg/kg			< 100	< 100	< 100	< 100
Chloride	high dust gas, solid phase	IC	mg/Nm3			22.5 R		20.7 R	27.5 R
Chloride	high dust gas, vapor phase	IC	mg/Nm3			9.11		11.7	11.6
Chloride	sluice water supply	IC	mg/L			3.01	2.96	2.99	2.97
Chloride	stack gas, solid phase	IC	mg/Nm3			0.0126 R		0.0242 R	0.0572 R
Chloride	stack gas, vapor phase	IC	mg/Nm3			20.9		21.7	23.4
Chlorobenzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Chlorobenzene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Chloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Chloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Chloroform	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Chloroform	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Chloromethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Chloromethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Chromium	bottom ash	ICP-AES	mg/kg			98.3	100	116	125
Chromium	bottom ash sluice water	ICP-AES	mg/L			< 0.0100	< 0.0100	< 0.0100	< 0.0100
Chromium	coal	NAA	ug/g, dry			25.6	20.0	20.9	18.8
Chromium	collected fly ash	ICP-AES	mg/kg			903	131	105	111
Chromium	high dust gas, particulates	ICP-AES	mg/kg			161 R		162 R	169 R
Chromium	high dust gas, solid phase	ICP-AES	mg/Nm3			1.07 R		0.837 R	0.925 R
Chromium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00435		< 0.00466	< 0.00450
Chromium	sluice water supply	ICP-AES	mg/L			< 0.0100	< 0.0100	< 0.0100	< 0.0100
Chromium	stack gas, particulates	ICP-AES	mg/kg			205 R		153 R	196 R
Chromium	stack gas, solid phase	ICP-AES	mg/Nm3			0.0264 R		0.0534 R	0.0511 R
Chromium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00366		< 0.00384	< 0.00341
Chrysene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Chrysene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Chrysene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Chrysene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Chrysene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Chrysene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Chrysene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Chrysene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
cis-1,3-Dichloropropene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
cis-1,3-Dichloropropene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Cobalt	bottom ash	ICP-AES	mg/kg			52.7	49.9 @	51.7	46.0 @
Cobalt	bottom ash sluice water	ICP-AES	mg/L			< 0.0100	< 0.0100	< 0.0100	< 0.0100

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Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Cobalt	coal	NAA	ug/g, dry			8.93	6.84	8.26	7.82
Cobalt	collected fly ash	ICP-AES	mg/kg			60.6	57.3	49.8 @	54.0
Cobalt	high dust gas, particulates	ICP-AES	mg/kg			62.3		62.8	66.6
Cobalt	high dust gas, solid phase	ICP-AES	mg/Nm3			0.415		0.324	0.364
Cobalt	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00248		< 0.00262	< 0.00189
Cobalt	sluice water supply	ICP-AES	mg/L			< 0.0100	< 0.0100	< 0.0100	< 0.0100
Cobalt	stack gas, particulates	ICP-AES	mg/kg			59.0 @		48.9	59.5
Cobalt	stack gas, solid phase	ICP-AES	mg/Nm3			0.00761 @		0.0171	0.0155
Cobalt	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00167		< 0.00220	< 0.00194
Copper	bottom ash	ICP-AES	mg/kg			95.2 @	93.3 @	97.5 @	97.9 @
Copper	bottom ash sluice water	ICP-AES	mg/L			< 0.0200	< 0.0200	< 0.0200	< 0.0200
Copper	coal	ICP-AES	mg/kg, dry			55.5	31.6	29.2	30.6
Copper	collected fly ash	ICP-AES	mg/kg			161	146	158	170
Copper	high dust gas, particulates	ICP-AES	mg/kg			196 R		223 R	233 R
Copper	high dust gas, solid phase	ICP-AES	mg/Nm3			1.31 R		1.15 R	1.27 R
Copper	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00869		< 0.00933	< 0.00900
Copper	sluice water supply	ICP-AES	mg/L			0.0340 @	0.0330 @	0.0350 @	0.0350 @
Copper	stack gas, particulates	ICP-AES	mg/kg			209 R		170 R	226 R
Copper	stack gas, solid phase	ICP-AES	mg/Nm3			0.0270 R		0.0593 R	0.0589 R
Copper	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00733		< 0.00768	< 0.00681
Dibenzofuran	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Dibenzofuran	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Dibenzofuran	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Dibenzofuran	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dibenzofuran	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Dibenzofuran	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dibenzofuran	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibenzofuran	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibenz(a,h)anthracene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Dibenz(a,h)anthracene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Dibenz(a,h)anthracene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Dibenz(a,h)anthracene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dibenz(a,h)anthracene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Dibenz(a,h)anthracene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dibenz(a,h)anthracene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibenz(a,h)anthracene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibenz(a,j)acridine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Dibenz(a,j)acridine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Dibenz(a,j)acridine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Dibenz(a,j)acridine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dibenz(a,j)acridine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Dibenz(a,j)acridine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dibenz(a,j)acridine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibenz(a,j)acridine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibutylphthalate	bottom ash	GCMS(8270)	ug/g	< 0.980 B		< 0.980 B	< 0.990	< 0.990	
Dibutylphthalate	bottom ash sluice water	GCMS(8270)	ug/L	20.1 @		20.4 @	31.5 @	77.2	
Dibutylphthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Dibutylphthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dibutylphthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	0.266	0.0303	< 0.00503			
Dibutylphthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dibutylphthalate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dibutylphthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dimethylphthalate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Dimethylphthalate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Dimethylphthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Dimethylphthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dimethylphthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Dimethylphthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dimethylphthalate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dimethylphthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Diphenylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Diphenylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Diphenylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Diphenylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Diphenylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Diphenylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Diphenylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Diphenylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Ethyl benzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Ethyl benzene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Fixed carbon	coal	Proximate	%dry	53.9		55.3	55.6	54.4	54.7
Fluoranthene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Fluoranthene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Fluoranthene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Fluoranthene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Fluoranthene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Fluoranthene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Fluoranthene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Fluoranthene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Fluorene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Fluorene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Fluorene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Fluorene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Fluorene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< *0.00581*	< *0.00488*	< *0.00503*			
Fluorene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Fluorene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Fluorene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< *0.00530*	< *0.00555*	< *0.00534*			
Fluoride	bottom ash	ISE	mg/kg			< 17.0	< 17.0	< 17.0	< 17.0
Fluoride	bottom ash sluice water	ISE	mg/L			0.123 @	0.122 @	0.139 @	0.135 @
Fluoride	*coal*	*ISE*	*mg/kg, dry*			72.9	96.8	37.5 @	101
Fluoride	collected fly ash	ISE	mg/kg			51.6	61.1	55.4	61.2
Fluoride	high dust gas, solid phase	ISE	mg/Nm3			1.06 R		1.41 R	1.39 R
Fluoride	*high dust gas, vapor phase*	*ISE*	*mg/Nm3*			1.68 R		2.23 R	1.65 R
Fluoride	sluice water supply	ISE	mg/L			0.179 @	0.173 @	0.175 @	0.170 @
Fluoride	stack gas, solid phase	ISE	mg/Nm3			0.466 R		0.379 R	0.486 R
Fluoride	*stack gas, vapor phase*	ISE	mg/Nm3			7.15 R		6.74 R	6.81 R
Formaldehyde	high dust gas, vapor phase	HPLC	mg/Nm3	0.0135 @R		< 0.00647 R		< 0.00689	
Formaldehyde	stack gas, vapor phase	HPLC	mg/Nm3	0.00274 @R		< 0.00422		< 0.00467	
Heating value	*coal*	Proximate	Btu/lb, dry	13385		13948	13992	13733	13740
Hexachlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Hexachlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Hexachlorobenzene	*collected fly ash*	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Hexachlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Hexachlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Hexachlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Hexachlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachlorobutadiene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Hexachlorobutadiene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Hexachlorobutadiene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Hexachlorobutadiene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Hexachlorobutadiene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Hexachlorobutadiene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Hexachlorobutadiene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachlorobutadiene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachlorocyclopentadiene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0 990	
Hexachlorocyclopentadiene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Hexachlorocyclopentadiene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Hexachlorocyclopentadiene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Hexachlorocyclopentadiene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Hexachlorocyclopentadiene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Hexachlorocyclopentadiene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachlorocyclopentadiene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachloroethane	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Hexachloroethane	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Hexachloroethane	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Hexachloroethane	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Hexachloroethane	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Hexachloroethane	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Hexachloroethane	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hexachloroethane	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Hydrogen	coal	Ultimate	%dry	4.72		5.04	4.95	4.85	4.96
Indeno(1,2,3-cd)pyrene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Indeno(1,2,3-cd)pyrene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Indeno(1,2,3-cd)pyrene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Indeno(1,2,3-cd)pyrene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Indeno(1,2,3-cd)pyrene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Indeno(1,2,3-cd)pyrene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Indeno(1,2,3-cd)pyrene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Indeno(1,2,3-cd)pyrene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Iron	bottom ash	XRF	mg/kg			93864	96172	95333	87499
Iron	bottom ash sluice water	ICP-AES	mg/L			0.293	0.377	0.296	0.140 @
Iron	coal	NAA	ug/g, dry			14512	9497	12890	11356
Iron	collected fly ash	XRF	mg/kg			97291	97291	90856	88059
Iron	high dust gas, particulates	ICP-AES	mg/kg			79782 R		73463 R	82430 R
Iron	high dust gas, solid phase	ICP-AES	mg/Nm3			531 R		379 R	451 R
Iron	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.0174		< 0.0187	0.0206 @
Iron	sluice water supply	ICP-AES	mg/L			0.805	0.850	0.788	0.768
Iron	stack gas, particulates	ICP-AES	mg/kg			69896 R		60304 R	64137 R
Iron	stack gas, solid phase	ICP-AES	mg/Nm3			9.02 R		21.1 R	16.7 R
Iron	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.0147		< 0.0154	< 0.0136
Isophorone	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Isophorone	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Isophorone	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Isophorone	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Isophorone	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Isophorone	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Isophorone	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Isophorone	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Lead	bottom ash	GFAAS	mg/kg			21.5	21.4	20.7	19.2
Lead	bottom ash sluice water	GFAAS	mg/L			< 0.00300	< 0.00300	0.00310 @	< 0.00300
Lead	coal	GFAAS	mg/kg, dry			4.80	4.16	5.64	4.94
Lead	collected fly ash	GFAAS	mg/kg			40.2	78.7	90.0	95.1
Lead	high dust gas, particulates	GFAAS	mg/kg			40.0 R		101 R	96.1 R
Lead	high dust gas, solid phase	GFAAS	mg/Nm3			0.266 R		0.523 R	0.526 R
Lead	high dust gas, vapor phase	GFAAS	mg/Nm3			< 0.00130		0.000864 @	0.00260 @
Lead	sluice water supply	GFAAS	mg/L			< 0.00300	0.00690 @	0.00340 @	0.00610 @
Lead	stack gas, particulates	GFAAS	mg/kg			326 R			139 R
Lead	stack gas, solid phase	GFAAS	mg/Nm3			0.0420 R			0.0360 R
Lead	stack gas, vapor phase	GFAAS	mg/Nm3			< 0.00110		< 0.00115	< 0.00102
Manganese	bottom ash	ICP-AES	mg/kg			140	142	131	101
Manganese	bottom ash sluice water	ICP-AES	mg/L			0.0500	0.0510	0.0570	0.0500
Manganese	coal	NAA	ug/g, dry			13.6	16.7	15.6	22.1
Manganese	collected fly ash	ICP-AES	mg/kg			230	130	93.0	96.8
Manganese	high dust gas, particulates	ICP-AES	mg/kg			147 R		116 R	124 R
Manganese	high dust gas, solid phase	ICP-AES	mg/Nm3			0.980 R		0.601 R	0.679 R
Manganese	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00435		< 0.00466	< 0.00450
Manganese	sluice water supply	ICP-AES	mg/L			0.0920	0.0930	0.0870	0.0900
Manganese	stack gas, particulates	ICP-AES	mg/kg			152 R		104 R	116 R
Manganese	stack gas, solid phase	ICP-AES	mg/Nm3			0.0196 R		0.0363 R	0.0301 R
Manganese	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00366		< 0.00384	< 0.00341
Mercury	bottom ash	DGA/CVAAS	ug/g			< 0.0200		< 0.0200	< 0.0200
Mercury	*bottom ash sluice water*	CVAAS	mg/L			< 0.000200	< 0.000200	< 0.000200	< 0.000200
Mercury	coal	DGA/CVAAS	ug/g, dry			0.188	0.448	0.125	0.147
Mercury	collected fly ash	DGA/CVAAS	ug/g			0.240	0.270	0.210	0.250
Mercury	*high dust gas, particulates*	CVAAS	*mg/kg*			0.536 @R		0.00961 @	1.06 R
Mercury	high dust gas, solid phase	CVAAS	mg/Nm3			0.00357 @R		0.0000496 @	0.00562 R
Mercury	high dust gas, vapor phase	CVAAS	mg/Nm3			0.00297		0.00437	0.00443
Mercury	*sluice water supply*	CVAAS	mg/L			< 0.000200	< 0.000200	< 0.000200	< 0.000200
Mercury	stack gas, particulates	CVAAS	mg/kg			0.984 @R		1.53 R	1.41 R
Mercury	stack gas, solid phase	CVAAS	mg/Nm3			0.000127 @R		0.000536 R	0.000366 R
Mercury	*stack gas, vapor phase*	CVAAS	mg/Nm3			0.00663		0.00718	0.00757
Methylene chloride	high dust gas, 20-L VOST	GCMS	mg/Nm3	0.00131 @	< 0.000543	0.00341			
Methylene chloride	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000560	0.00250 @	0.0103			
Moisture	coal	Ultimate	%	5.51		4.12	3.94	4.27	4.82

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Molybdenum	bottom ash	ICP-AES	mg/kg			< 200	< 200	< 200	< 200
Molybdenum	*bottom ash sluice water*	*ICP-AES*	*mg/L*			*< 0.0500*	*< 0.0500*	*< 0.0500*	*< 0.0500*
Molybdenum	coal	NAA	ug/g, dry			3.79	5.47	5.19	< 1.39
Molybdenum	collected fly ash	ICP-AES	mg/kg			< 200	< 200	< 200	< 200
Molybdenum	*high dust gas, particulates*	*ICP-AES*	*mg/kg*			*< 43.2 R*		*< 51.0 R*	*< 52.5 R*
Molybdenum	high dust gas, solid phase	ICP-AES	mg/Nm3			< 0.287 R		< 0.263 R	< 0.287 R
Molybdenum	*high dust gas, vapor phase*	ICP-AES	mg/Nm3			< 0.0217		< 0.0233	< 0.0225
Molybdenum	sluice water supply	ICP-AES	mg/L			< 0.0500	< 0.0500	< 0.0500	< 0.0500
Molybdenum	stack gas, particulates	ICP-AES	mg/kg			< 67.5 R		< 41.5 R	59.8 @R
Molybdenum	stack gas, solid phase	ICP-AES	mg/Nm3			< 0.00871 R		< 0.0145 R	0.0155 @R
Molybdenum	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.0183		< 0.0192	< 0.0170
m,p-Xylene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
m,p-Xylene	*stack gas, 20-L VOST*	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Naphthalene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Naphthalene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Naphthalene	*collected fly ash*	*GCMS(8270)*	*ug/g*	*< 0.990*		*< 0.990*	*< 0.970*	*< 1.00*	
Naphthalene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Naphthalene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Naphthalene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Naphthalene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Naphthalene	*stack gas, vapor phase*	*GCMS(8270)*	*mg/Nm3*	*< 0.00530*	*< 0.00555*	< 0.00534			
Nickel	bottom ash	ICP-AES	mg/kg			103	104	96.9 @	98.9 @
Nickel	bottom ash sluice water	ICP-AES	mg/L			< 0.0200	< 0.0200	< 0.0200	< 0.0200
Nickel	*coal*	*NAA*	*ug/g, dry*			*27.7*	*23.3*	*27.0*	*25.3*
Nickel	collected fly ash	ICP-AES	mg/kg			529	115	99.1 @	100
Nickel	high dust gas, particulates	ICP-AES	mg/kg			*122 R*		*105 R*	*116 R*
Nickel	high dust gas, solid phase	ICP-AES	mg/Nm3			0.813 R		0.544 R	0.634 R
Nickel	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00869		< 0.00933	< 0.00900
Nickel	sluice water supply	ICP-AES	mg/L			< 0.0200	< 0.0200	0.0250 @	< 0.0200
Nickel	stack gas, particulates	ICP-AES	mg/kg			138 R		96.6 R	125 R
Nickel	stack gas, solid phase	ICP-AES	mg/Nm3			0.0178 R		0.0337 R	0.0325 R
Nickel	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00733		< 0.00768	< 0.00681
Nitrobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Nitrobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Nitrobenzene	*collected fly ash*	*GCMS(8270)*	*ug/g*	*< 0.990*		*< 0.990*	*< 0.970*	*< 1.00*	
Nitrobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Nitrobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Nitrobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Nitrobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Nitrobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Nitrogen	coal	Ultimate	%dry	1.59		1.52	1.52	1.53	1.45
N-Nitrosodimethylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
N-Nitrosodimethylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
N-Nitrosodimethylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
N-Nitrosodimethylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
N-Nitrosodimethylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
N-Nitrosodimethylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
N-Nitrosodimethylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosodimethylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosodiphenylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
N-Nitrosodiphenylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
N-Nitrosodiphenylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
N-Nitrosodiphenylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
N-Nitrosodiphenylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
N-Nitrosodiphenylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
N-Nitrosodiphenylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosodiphenylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Oxygen	coal	Ultimate	%dry	5.41		5.17	5.41	5.20	5.34
o-Xylene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
o-Xylene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
p-Dimethylaminoazobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
p-Dimethylaminoazobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
p-Dimethylaminoazobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
p-Dimethylaminoazobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
p-Dimethylaminoazobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
p-Dimethylaminoazobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
p-Dimethylaminoazobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
p-Dimethylaminoazobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pentachloronitrobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Pentachloronitrobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Pentachloronitrobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Pentachloronitrobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Pentachloronitrobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Pentachloronitrobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Pentachloronitrobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pentachloronitrobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pentachlorophenol	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
Pentachlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Pentachlorophenol	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
Pentachlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
Pentachlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
Pentachlorophenol	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
Pentachlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
Pentachlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
Phenanthrene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Phenanthrene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Phenanthrene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Phenanthrene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Phenanthrene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Phenanthrene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Phenanthrene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phenanthrene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Phenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Phenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Phenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Phenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Phenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Phenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	0.0138 @	< 0.00534			
Phosphate as P	bottom ash sluice water	Spectrophot.	mg/L			< 0.0500	< 0.0500	< 0.0500	< 0.0500
Phosphate as P	sluice water supply	Spectrophot.	mg/L			0.0535 @	0.0535 @	0.0519 @	0.0542 @
Phosphorus	bottom ash	XRF	mg/kg			1266	1309	1353	742
Phosphorus	coal	ASTM D2795	mg/kg, dry			209	189	256	267
Phosphorus	collected fly ash	XRF	mg/kg			1920	1833	1527	873
Phosphorus	high dust gas, particulates	ICP-AES	mg/kg			1395		769 @	872 @
Phosphorus	high dust gas, solid phase	ICP-AES	mg/Nm3			9.28		3.97 @	4.77 @
Phosphorus	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.141		< 0.137	< 0.116
Phosphorus	stack gas, particulates	ICP-AES	mg/kg			1256 @		936 @	1217 @
Phosphorus	stack gas, solid phase	ICP-AES	mg/Nm3			0.162 @		0.327 @	0.317 @
Phosphorus	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.0963		< 0.111	< 0.120
Pyrene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Pyrene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Pyrene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Pyrene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Pyrene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Pyrene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	

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Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Pyrene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pyrene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Selenium	bottom ash	HGAAS	mg/kg			< 5.00	< 5.00	< 5.00	< 5.00
Selenium	bottom ash sluice water	HGAAS	mg/L			< 0.00500	< 0.0250	< 0.00500	< 0.00500
Selenium	coal	NAA	ug/g, dry			3.88	3.84	3.24	4.21
Selenium	collected fly ash	HGAAS	mg/kg			25.0	12.8 @	11.1 @	14.9 @
Selenium	high dust gas, particulates	HGAAS	mg/kg			47.0		104	104
Selenium	high dust gas, solid phase	HGAAS	mg/Nm3			0.313		0.539	0.566
Selenium	high dust gas, vapor phase	HGAAS	mg/Nm3			< 0.00124		< 0.00131	0.00175 @
Selenium	sluice water supply	HGAAS	mg/L			< 0.00500	< 0.00500	< 0.00500	< 0.00500
Selenium	stack gas, particulates	HGAAS	mg/kg			61.0			130
Selenium	stack gas, solid phase	HGAAS	mg/Nm3			0.00787			0.0339
Selenium	stack gas, vapor phase	HGAAS	mg/Nm3			0.129		0.128	0.116
Sodium	bottom ash	XRF	mg/kg			1706	1410	1855	1855
Sodium	bottom ash sluice water	ICP-AES	mg/L			5.52	5.55	7.05	6.79
Sodium	coal	NAA	ug/g, dry			288	358	266	260
Sodium	collected fly ash	XRF	mg/kg			2077	2003	1780	1706
Sodium	high dust gas, particulates	ICP-AES	mg/kg			3627 @R		3407 @R	< 1050 R
Sodium	high dust gas, solid phase	ICP-AES	mg/Nm3			24.1 @R		17.6 @R	< 5.74 R
Sodium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.435		< 0.466	< 0.450
Sodium	sluice water supply	ICP-AES	mg/L			9.01	9.06	8.84	10.1
Sodium	stack gas, particulates	ICP-AES	mg/kg			2523 @R		1920 @R	2240 @R
Sodium	stack gas, solid phase	ICP-AES	mg/Nm3			6.325 @R		0.670 @R	0.583 @R
Sodium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.366		< 0.384	< 0.341
Styrene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Styrene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Sulfate	bottom ash sluice water	IC	mg/L			35.1	35.6	43.5	42.4
Sulfate	high dust gas, solid phase	IC	mg/Nm3			117 R		110 R	145 R
Sulfate	high dust gas, vapor phase	IC	mg/Nm3			4695		4598	4336
Sulfate	sluice water supply	IC	mg/L			64.8	64.3	69.8	70.5
Sulfate	stack gas, solid phase	IC	mg/Nm3			8.19 R		15.0 R	14.3 R
Sulfate	stack gas, vapor phase	IC	mg/Nm3			4141		3992	4066
Sulfur	bottom ash	Leco	%			< 0.00500	< 0.00500	0.0603	0.0694
Sulfur	coal	Ultimate	%dry	1.78		1.58	1.41	1.59	1.56
Sulfur	collected fly ash	Leco	%			0.197	0.224	0.197	0.220
Tetrachloroethene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Tetrachloroethene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Titanium	bottom ash	XRF	mg/kg			8153	7554	7434	10312
Titanium	bottom ash sluice water	ICP-AES	mg/L			< 0.0500	< 0.0500	< 0.0500	< 0.0500

Table B-1: Site 16 OFA Data USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Titanium	coal	NAA	ug/g, dry			915	1099	694	714
Titanium	collected fly ash	XRF	mg/kg			7794	8153	7854	8213
Titanium	high dust gas, particulates	ICP-AES	mg/kg			7128 R		6927 R	7474 R
Titanium	high dust gas, solid phase	ICP-AES	mg/Nm3			47.4 R		35.8 R	40.9 R
Titanium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.0217		< 0.0233	< 0.0225
Titanium	sluice water supply	ICP-AES	mg/L			< 0.0500	< 0.0500	< 0.0500	< 0.0500
Titanium	stack gas, particulates	ICP-AES	mg/kg			4706		3908	4960
Titanium	stack gas, solid phase	ICP-AES	mg/Nm3			0.607		1.37	1.29
Titanium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.0183		< 0.0192	< 0.0170
Toluene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Toluene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
trans-1,3-Dichloropropene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
trans-1,3-Dichloropropene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Trichloroethene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Trichloroethene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Vanadium	bottom ash	ICP-AES	mg/kg			213	211	213	205
Vanadium	bottom ash sluice water	ICP-AES	mg/L			< 0.0200	< 0.0200	< 0.0200	< 0.0200
Vanadium	coal	NAA	ug/g, dry			35.5	39.6	41.3	34.8
Vanadium	collected fly ash	ICP-AES	mg/kg			243	242	239	250
Vanadium	high dust gas, particulates	ICP-AES	mg/kg			303 R		298 R	315 R
Vanadium	high dust gas, solid phase	ICP-AES	mg/Nm3			2.02 R		1.54 R	1.72 R
Vanadium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00869		< 0.00933	< 0.00900
Vanadium	sluice water supply	ICP-AES	mg/L			< 0.0200	< 0.0200	< 0.0200	< 0.0200
Vanadium	stack gas, particulates	ICP-AES	mg/kg			390 R		295 R	383 R
Vanadium	stack gas, solid phase	ICP-AES	mg/Nm3			0.0504 R		0.103 R	0.0996 R
Vanadium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00733		< 0.00768	< 0.00681
Vinyl acetate	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.00525	< 0.00543	< 0.00559			
Vinyl acetate	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.00580	< 0.00569	< 0.00542			
Vinyl chloride	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Vinyl chloride	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Volatiles	coal	Proximate	%dry	34.7		35.6	35.8	35.3	35.3

Table B–2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
1,1–Dichloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,1–Dichloroethene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,1,1–Trichloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,1,2–Trichloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,1,2,2–Tetrachloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,2–Dichlorobenzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,2–Dichloropropane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,4–Dichlorobenzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
2–Butanone	Stack gas, VOST	GCMS	ug/Nm3	< 2.94		< 2.94	< 2.89
5–methyl chrysene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00127		< 0.000345	< 0.00485
5–methyl chrysene	Stack gas	HRGCMS	ug/Nm3	0.000280		< 0.000168	< 0.000978
7H–dibenzo[c,g]carbazole	ESP inlet gas	HRGCMS	ug/Nm3	< 0.0186		< 0.0147	< 0.0781
7H–dibenzo[c,g]carbazole	Stack gas	HRGCMS	ug/Nm3	< 0.00511		< 0.00520	< 0.0180
Acenaphthene	ESP inlet gas	HRGCMS	ug/Nm3	0.00628		0.00485	0.0331
Acenaphthene	Stack gas	HRGCMS	ug/Nm3	0.0178		0.00772	0.00254
Acenaphthylene	ESP inlet gas	HRGCMS	ug/Nm3	0.00241		0.00518	0.00582
Acenaphthylene	Stack gas	HRGCMS	ug/Nm3	0.00414		0.00268	0.00364
Acetaldehyde	Stack gas, vapor phase	HPLC	ug/Nm3	5.84 +		2.40 +	6.54 +
Aluminum	Bottom ash	ICP–AES	mg/kg, dry	108216	131791	122000	131000
Aluminum	Coal	NAA	mg/kg, dry	11965	11229	15393	14873
Aluminum	ESP inlet gas, particulate	ICP–AES	mg/kg	125126	122244	129353	131737
Aluminum	ESP inlet gas, solid phase	ICP–AES	ug/Nm3	647443	632533	737965	762468
Aluminum	ESP inlet gas, vapor phase	ICP–AES	ug/Nm3	7.42 @		31.0 @	27.7 @
Aluminum	Stack gas, particulate	ICP–AES	mg/kg	100789		98132	84195
Aluminum	Stack gas, solid phase	ICP–AES	ug/Nm3	11543		16616	11207
Aluminum	Stack gas, vapor phase	ICP–AES	ug/Nm3	14.2 @		7.51 @	19.9 @
Anthracene	ESP inlet gas	HRGCMS	ug/Nm3	0.00444		0.00459	0.00581
Anthracene	Stack gas	HRGCMS	ug/Nm3	0.00691		0.00136	0.00442
Antimony	Bottom ash	ICP–AES	mg/kg, dry	< 18.9	< 19.0	22.6 @	< 18.3
Antimony	Coal	NAA	mg/kg, dry	1.33	1.40	1.78	1.28
Antimony	ESP inlet gas, particulate	ICP–AES	mg/kg	< 15.1	< 15.0	< 14.9	< 15.0
Antimony	ESP inlet gas, solid phase	ICP–AES	ug/Nm3	< 78.3	< 77.8	< 85.1	< 86.6
Antimony	ESP inlet gas, vapor phase	ICP–AES	ug/Nm3	< 5.04		< 5.08	< 5.28
Antimony	Stack gas, particulate	ICP–AES	mg/kg	20.9 @		16.9	19.3

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Antimony	Stack gas, solid phase	ICP-AES	ug/Nm3	2.39 @		2.86	2.57
Antimony	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 4.35		< 3.35	< 4.97
Antimony	Stack gas, <4 um	ICP-MS	ug/Nm3	0.785		0.690	0.656
Antimony	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.472		0.396	0.363
Antimony	Stack gas, >9 um	ICP-MS	ug/Nm3	0.735		1.14	0.766
Antimony	Stack particulate, <4 um	ICP-MS	mg/kg	83.0		87.4	93.6
Antimony	Stack particulate, 4-9 um	ICP-MS	mg/kg	43.5		44.1	41.7
Antimony	Stack particulate, >9 um	ICP-MS	mg/kg	16.7		20.6	18.5
Arsenic	Bottom ash	GFAAS	mg/kg, dry	5.01	4.15 @	59.8	5.65
Arsenic	Coal	NAA	mg/kg, dry	23.4	42.7	22.1	23.9
Arsenic	ESP inlet gas, particulate	GFAAS	mg/kg	245	214	372	324
Arsenic	ESP inlet gas, solid phase	GFAAS	ug/Nm3	1269	1110	2123	1877
Arsenic	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	< 0.137		< 0.138	0.802
Arsenic	Stack gas, particulate	GFAAS	mg/kg	935		624	1134
Arsenic	Stack gas, solid phase	GFAAS	ug/Nm3	107		106	151
Arsenic	Stack gas, vapor phase	GFAAS	ug/Nm3	2.03		1.06	2.13
Arsenic	Stack gas, <4 um	ICP-MS	ug/Nm3	13.1		14.4	12.2
Arsenic	Stack gas, 4-9 um	ICP-MS	ug/Nm3	7.52		7.13	6.46
Arsenic	Stack gas, >9 um	ICP-MS	ug/Nm3	13.5		22.7	16.9
Arsenic	Stack particulate, <4 um	ICP-MS	mg/kg	1387		1826	1739
Arsenic	Stack particulate, 4-9 um	ICP-MS	mg/kg	692		794	744
Arsenic	Stack particulate, >9 um	ICP-MS	mg/kg	308		410	407
Ash	Coal	Ultimate	%, dry	9.47	9.20	9.97	8.93
Barium	Bottom ash	ICP-AES	mg/kg, dry	831	1026	947	988
Barium	Coal	NAA	mg/kg, dry	94.5	100	117	86.0
Barium	ESP inlet gas, particulate	ICP-AES	mg/kg	1070	1042	1085	1088
Barium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	5535	5392	6188	6296
Barium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.111		0.663 @	0.109
Barium	Stack gas, particulate	ICP-AES	mg/kg	1265		1135	1099
Barium	Stack gas, solid phase	ICP-AES	ug/Nm3	145		192	146
Barium	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.112 @		< 0.0740	0.323 @
Barium	Stack gas, <4 um	ICP-MS	ug/Nm3	19.4		14.8	15.0
Barium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	19.6		15.2	14.8
Barium	Stack gas, >9 um	ICP-MS	ug/Nm3	52.4		76.4	54.9

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Barium	Stack particulate, <4 um	ICP-MS	mg/kg	2047		1876	2137
Barium	Stack particulate, 4-9 um	ICP-MS	mg/kg	1806		1692	1700
Barium	Stack particulate, >9 um	ICP-MS	mg/kg	1192		1381	1324
Benzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.521	0.877 @
Benzo[a]pyrene	ESP inlet gas	HRGCMS	ug/Nm3	0.0229		< 0.00357	< 0.00678
Benzo[a]pyrene	Stack gas	HRGCMS	ug/Nm3	0.00283		< 0.00253	< 0.00477
Benzo[b,j&k]fluoranthenes	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00848		0.000699	< 0.0316
Benzo[b,j&k]fluoranthenes	Stack gas	HRGCMS	ug/Nm3	0.00373		0.000588	0.000782
Benzo[ghi]perylene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00272		< 0.00371	< 0.0407
Benzo[ghi]perylene	Stack gas	HRGCMS	ug/Nm3	< 0.00361		< 0.00184	< 0.00193
Benz[a]anthracene	ESP inlet gas	HRGCMS	ug/Nm3	0.00114		0.00197	< 0.0149
Benz[a]anthracene	Stack gas	HRGCMS	ug/Nm3	0.0228		0.000633	0.000770
Beryllium	Bottom ash	ICP-AES	mg/kg, dry	19.7	20.8	22.9	23.1
Beryllium	Coal	ICP-AES	mg/kg, dry	1.90	2.10	2.40	2.40
Beryllium	ESP inlet gas, particulate	ICP-AES	mg/kg	21.3	18.0	23.7	22.8
Beryllium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	110	93.3	135	132
Beryllium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.116		0.213 @	0.238 @
Beryllium	Stack gas, particulate	ICP-AES	mg/kg	23.0		24.8	25.5
Beryllium	Stack gas, solid phase	ICP-AES	ug/Nm3	2.64		4.21	3.39
Beryllium	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.278 @		0.101 @	< 0.114
Beryllium	Stack gas, <4 um	ICP-MS	ug/Nm3	0.227		0.259	0.204
Beryllium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.417		0.368	0.341
Beryllium	Stack gas, >9 um	ICP-MS	ug/Nm3	0.958		1.38	1.18
Beryllium	Stack particulate, <4 um	ICP-MS	mg/kg	24.0		32.7	29.1
Beryllium	Stack particulate, 4-9 um	ICP-MS	mg/kg	38.3		41.0	39.2
Beryllium	Stack particulate, >9 um	ICP-MS	mg/kg	21.8		24.9	28.4
Bromoform	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Bromomethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		1.89 @	< 0.578
Cadmium	Bottom ash	GFAAS	mg/kg, dry	< 0.998	< 1.00	< 0.922	< 0.963
Cadmium	Coal	NAA	mg/kg, dry	< 2.61	< 2.62	< 2.61	< 2.58
Cadmium	ESP inlet gas, particulate	GFAAS	mg/kg	1.34 @		6.22	3.18 @
Cadmium	ESP inlet gas, solid phase	GFAAS	ug/Nm3	6.94 @		35.5	18.4 @
Cadmium	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	0.0715 @		0.179	1.31
Cadmium	Stack gas, particulate	GFAAS	mg/kg	25.2 @		27.9 @	36.3

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Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Cadmium	Stack gas, solid phase	GFAAS	ug/Nm3	2.89 @		4.73 @	4.83
Cadmium	Stack gas, vapor phase	GFAAS	ug/Nm3	< 0.0581		< 0.0447	< 0.0663
Cadmium	Stack gas, <4 um	ICP-MS	ug/Nm3	0.0604		0.0454	0.0607
Cadmium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.0454		0.0657	0.0316
Cadmium	Stack gas, >9 um	ICP-MS	ug/Nm3	0.142		0.284	0.0703
Cadmium	Stack particulate, <4 um	ICP-MS	mg/kg	6.38		5.75	8.67
Cadmium	Stack particulate, 4-9 um	ICP-MS	mg/kg	4.18		7.31	3.64
Cadmium	Stack particulate, >9 um	ICP-MS	mg/kg	3.24		5.14	1.70
Calcium	Bottom ash	ICP-AES	mg/kg, dry	4008 @	5573	4560 @	5130
Calcium	Coal	NAA	mg/kg, dry	1812	1509	1698	6287
Calcium	ESP inlet gas, particulate	ICP-AES	mg/kg	5570	5541	5602	5619
Calcium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	28822	28671	31960	32520
Calcium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 31.5		31.0	27.0
Calcium	Stack gas, particulate	ICP-AES	mg/kg	6778		6118	6201
Calcium	Stack gas, solid phase	ICP-AES	ug/Nm3	776		1036	825
Calcium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 27.2		< 21.0	< 31.1
Carbon	Coal	Ultimate	%, dry	77.3	77.3	76.7	77.6
Carbon Disulfide	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	0.611 @
Carbon Tetrachloride	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Chloride	Bottom ash	Pot. Titr.	mg/kg, dry	< 100.0	< 99.8	< 98.2	< 99.8
Chloride	Coal	Pot. Titr.	mg/kg, dry	432 @	346 @	276 @	311 @
Chloride	ESP inlet gas, particulate	IC	mg/kg	2011		2777	1970
Chloride	ESP inlet gas, solid phase	IC	ug/Nm3	10380		15863	11190
Chloride	ESP inlet gas, vapor phase	IC	ug/Nm3	14439		10354	13967
Chloride	Stack gas, particulate	IC	mg/kg	3455		1350	1502
Chloride	Stack gas, solid phase	IC	ug/Nm3	399		229	200
Chloride	Stack gas, vapor phase	IC	ug/Nm3	16950		17009	18910
Chlorobenzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Chloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Chloroform	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Chloromethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Chromium	Bottom ash	ICP-AES	mg/kg, dry	102	109	113	113
Chromium	Coal	NAA	mg/kg, dry	14.7	16.2	21.0	15.2
Chromium	ESP inlet gas, particulate	ICP-AES	mg/kg	146	128	166	141

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Chromium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	757	664	948	814
Chromium	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	1.26		3.01	3.54
Chromium	Stack gas, particulate	ICP-AES	mg/kg	170		157	173
Chromium	Stack gas, solid phase	ICP-AES	ug/Nm3	19.5		26.6	23.0
Chromium	Stack gas, vapor phase	GFAAS	ug/Nm3	0.962		0.768	1.06
Chromium	Stack gas, <4 um	ICP-MS	ug/Nm3	3.72		3.89	3.01
Chromium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	4.14		3.57	3.22
Chromium	Stack gas, >9 um	ICP-MS	ug/Nm3	10.6		12.6	15.2
Chromium	Stack particulate, <4 um	ICP-MS	mg/kg	393		493	429
Chromium	Stack particulate, 4-9 um	ICP-MS	mg/kg	381		397	371
Chromium	Stack particulate, >9 um	ICP-MS	mg/kg	242		228	367
Chromium(VI)	Stack gas	BIF Cr6	ug/Nm3	6.77 R+		2.61 @R+	9.32 R
Chrysene	ESP inlet gas	HRGCMS	ug/Nm3	0.00546		0.00169	0.00627
Chrysene	Stack gas	HRGCMS	ug/Nm3	0.00357		0.00162	0.000905
cis-1,3-Dichloropropene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Cobalt	Bottom ash	ICP-AES	mg/kg, dry	61.6 @	57.4 @	57.0 @	82.8 @
Cobalt	Coal	NAA	mg/kg, dry	5.95	6.27	6.84	5.45
Cobalt	ESP inlet gas, particulate	ICP-AES	mg/kg	37.8 @	42.6 @	59.1 @	55.8 @
Cobalt	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	196 @	220 @	337 @	323 @
Cobalt	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.715		< 0.719	< 0.747
Cobalt	*Stack gas, particulate*	ICP-AES	mg/kg	55.5		52.8	53.9
Cobalt	Stack gas, solid phase	ICP-AES	ug/Nm3	6.36		8.93	7.18
Cobalt	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.617		< 0.475	< 0.704
Cobalt	Stack gas, <4 um	ICP-MS	ug/Nm3	0.527		0.539	0.407
Cobalt	Stack gas, 4-9 um	ICP-MS	ug/Nm3	1.06		0.875	0.815
Cobalt	Stack gas, >9 um	ICP-MS	ug/Nm3	2.53		3.25	2.93
Cobalt	Stack particulate, <4 um	ICP-MS	mg/kg	55.8		68.3	58.1
Cobalt	Stack particulate, 4-9 um	ICP-MS	mg/kg	97.9		97.4	93.8
Cobalt	*Stack particulate, >9 um*	ICP-MS	mg/kg	57.6		58.8	70.8
Copper	Bottom ash	ICP-AES	mg/kg, dry	120	128	132	144
Copper	Coal	NAA	mg/kg, dry	28.8	34.1	32.5	40.0
Copper	ESP inlet gas, particulate	ICP-AES	mg/kg	189	193	223	196
Copper	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	976	1001	1272	1132
Copper	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.799		1.12	0.585

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Copper	Stack gas, particulate	ICP-AES	mg/kg	252		253	252
Copper	Stack gas, solid phase	ICP-AES	ug/Nm3	28.9		42.8	33.5
Copper	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.689		< 0.531	< 0.787
Copper	Stack gas, <4 um	ICP-MS	ug/Nm3	3.98		3.15	2.49
Copper	Stack gas, 4-9 um	ICP-MS	ug/Nm3	7.65		3.64	3.51
Copper	Stack gas, >9 um	ICP-MS	ug/Nm3	72.6		34.1	17.7
Copper	Stack particulate, <4 um	ICP-MS	mg/kg	421		399	356
Copper	Stack particulate, 4-9 um	ICP-MS	mg/kg	704		405	404
Copper	Stack particulate, >9 um	ICP-MS	mg/kg	1654		616	427
Dibenzo[a,e]pyrene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00232		< 0.00146	< 0.0116
Dibenzo[a,e]pyrene	Stack gas	HRGCMS	ug/Nm3	< 0.00231		< 0.000953	< 0.00342
Dibenzo[a,h]pyrene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00329		< 0.00269	< 0.0581
Dibenzo[a,h]pyrene	Stack gas	HRGCMS	ug/Nm3	< 0.00368		< 0.000765	< 0.00344
Dibenzo[a,i]pyrene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00424		< 0.00255	< 0.0181
Dibenzo[a,i]pyrene	Stack gas	HRGCMS	ug/Nm3	< 0.00331		< 0.00110	< 0.00491
Dibenz[a,h]acridine	ESP inlet gas	HRGCMS	ug/Nm3	< 0.0106		< 0.00271	< 0.0320
Dibenz[a,h]acridine	Stack gas	HRGCMS	ug/Nm3	< 0.00183		< 0.00157	< 0.00180
Dibenz[a,h]anthracene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00153		< 0.000868	< 0.0527
Dibenz[a,h]anthracene	Stack gas	HRGCMS	ug/Nm3	< 0.00148		< 0.000893	< 0.00433
Dibenz[a,i]acridine	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00798		< 0.00296	< 0.0218
Dibenz[a,i]acridine	Stack gas	HRGCMS	ug/Nm3	< 0.00482		< 0.00155	< 0.00114
Ethyl Benzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Fixed Carbon	Coal	Proximate	%, dry	58.2	58.1	57.7	58.9
Fluoranthene	ESP inlet gas	HRGCMS	ug/Nm3	0.0240		0.00608	0.00852
Fluoranthene	Stack gas	HRGCMS	ug/Nm3	0.0259		0.00447	0.00493
Fluorene	ESP inlet gas	HRGCMS	ug/Nm3	0.0149		0.00492	0.00609
Fluorene	Stack gas	HRGCMS	ug/Nm3	0.0236		0.00474	0.00587
Fluoride	Bottom ash	ISE	mg/kg, dry	30.6 @	29.9 @	17.4 @	22.6 @
Fluoride	Coal	ISE	mg/kg, dry	114	81.9	80.9	78.6
Fluoride	ESP inlet gas, particulate	ISE	mg/kg	132		314	225
Fluoride	ESP inlet gas, solid phase	ISE	ug/Nm3	682		1793	1276
Fluoride	ESP inlet gas, vapor phase	ISE	ug/Nm3	5239		3961	4466
Fluoride	Stack gas, particulate	ISE	mg/kg	847		379	576
Fluoride	Stack gas, solid phase	ISE	ug/Nm3	97.8		64.4	76.8

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Fluoride	Stack gas, vapor phase	ISE	ug/Nm3	5520		5704	6123
Formaldehyde	Stack gas, vapor phase	HPLC	ug/Nm3	2.72 +		0.544 +	1.37 +
HHV	Coal	Proximate	Btu/lb, dry	13728	13779	13730	13889
Hydrogen	Coal	Ultimate	%, dry	4.93	4.97	4.65	4.94
Indeno[1,2,3-cd]pyrene	ESP inlet gas	HRGCMS	ug/Nm3	< 0.00172		< 0.00314	< 0.0212
Indeno[1,2,3-cd]pyrene	Stack gas	HRGCMS	ug/Nm3	< 0.00311		0.000738	< 0.00284
Iron	Bottom ash	ICP-AES	mg/kg, dry	102204	113682	112000	117000
Iron	Coal	NAA	mg/kg, dry	14100	10369	10145	9522
Iron	ESP inlet gas, particulate	ICP-AES	mg/kg	94551	98196	90746	92914
Iron	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	489237	508100	517711	537771
Iron	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	6.87 @		35.5 @	22.2 @
Iron	Stack gas, particulate	ICP-AES	mg/kg	85013		74112	76884
Iron	Stack gas, solid phase	ICP-AES	ug/Nm3	9737		12549	10234
Iron	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 4.35		< 3.35	< 4.97
Lead	Bottom ash	GFAAS	mg/kg, dry	13.7	13.7	15.0	14.1
Lead	Coal	ICP-AES	mg/kg, dry	8.00	7.00	8.00	6.00
Lead	ESP inlet gas, particulate	GFAAS	mg/kg	56.1		66.1	61.5
Lead	ESP inlet gas, solid phase	GFAAS	ug/Nm3	290		377	356
Lead	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	2.10		2.14 @	5.18 @
Lead	Stack gas, particulate	GFAAS	mg/kg	91.1		90.7	102
Lead	Stack gas, solid phase	GFAAS	ug/Nm3	10.4		15.4	13.6
Lead	Stack gas, vapor phase	GFAAS	ug/Nm3	0.308 @		< 0.154	< 0.228
Lead	Stack gas, <4 um	ICP-MS	ug/Nm3	3.02		1.61	1.54
Lead	Stack gas, 4-9 um	ICP-MS	ug/Nm3	2.94		1.81	1.44
Lead	Stack gas, >9 um	ICP-MS	ug/Nm3	5.13		6.35	3.80
Lead	Stack particulate, <4 um	ICP-MS	mg/kg	320		204	220
Lead	Stack particulate, 4-9 um	ICP-MS	mg/kg	271		201	165
Lead	Stack particulate, >9 um	ICP-MS	mg/kg	117		115	91.6
Manganese	Bottom ash	ICP-AES	mg/kg, dry	160	171	148	146
Manganese	Coal	NAA	mg/kg, dry	14.4	13.4	13.9	14.5
Manganese	ESP inlet gas, particulate	ICP-AES	mg/kg	181	185	149	151
Manganese	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	935	959	851	872
Manganese	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	0.572		1.04	1.81
Manganese	Stack gas, particulate	ICP-AES	mg/kg	194		155	166

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Manganese	Stack gas, solid phase	ICP-AES	ug/Nm3	22.2		26.2	22.0
Manganese	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.528		0.135 @	0.240 @
Manganese	Stack gas, <4 um	ICP-MS	ug/Nm3	1.90		1.81	1.24
Manganese	Stack gas, 4-9 um	ICP-MS	ug/Nm3	3.27		2.23	2.09
Manganese	Stack gas, >9 um	ICP-MS	ug/Nm3	10.3		15.4	9.18
Manganese	Stack particulate, <4 um	ICP-MS	mg/kg	201		230	177
Manganese	Stack particulate, 4-9 um	ICP-MS	mg/kg	301		248	241
Manganese	Stack particulate, >9 um	ICP-MS	mg/kg	234		279	221
Mercury	Bottom ash	CVAAS	mg/kg, dry	< 0.0120	< 0.0121	< 0.0120	< 0.0120
Mercury	Coal	DGA/CVAAS	mg/kg, dry	0.160	0.110	0.150	0.110
Mercury	ESP inlet gas, particulate	CVAAS	mg/kg	0.626	0.782	0.836	0.898
Mercury	ESP inlet gas, solid phase	CVAAS	ug/Nm3	3.24	4.04	4.77	5.20
Mercury	ESP inlet gas, vapor phase	CVAAS	ug/Nm3	5.18		6.90	6.81
Mercury	Stack gas, particulate	CVAAS	mg/kg	2.52		0.710	1.31
Mercury	Stack gas, solid phase	CVAAS	ug/Nm3	0.289		0.120	0.174
Mercury	Stack gas, vapor phase	CVAAS	ug/Nm3	4.41		5.26	6.37
Mercury	Stack gas, <4 um	ICP-MS	ug/Nm3	0.0246		0.0219	0.00834
Mercury	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.0350		0.0200	0.0101
Mercury	Stack gas, >9 um	ICP-MS	ug/Nm3	0.107		0.310	0.0660
Mercury	Stack particulate, <4 um	ICP-MS	mg/kg	2.60		2.77	1.19
Mercury	Stack particulate, 4-9 um	ICP-MS	mg/kg	3.22		2.23	1.16
Mercury	Stack particulate, >9 um	ICP-MS	mg/kg	2.43		5.60	1.59
Mercury (0)	Stack gas, vapor phase	Bloom	ug/Nm3	4.07		3.44	3.28
Mercury (II)	Stack gas, vapor phase	Bloom	ug/Nm3	2.40		3.30	2.11
Methyl Mercury	Stack gas, vapor phase	Bloom	ug/Nm3	0.161		0.965	0.201
Methylene Chloride	Stack gas, VOST	GCMS	ug/Nm3	6.93 @B		1.07 @B	39.7 B
Moisture	Coal	Ultimate	%	4.32	4.69	4.04	3.02
Molybdenum	Bottom ash	ICP-AES	mg/kg, dry	< 12.9	< 13.0	27.4 @	38.7 @
Molybdenum	Coal	NAA	mg/kg, dry	3.19	3.34	5.02	< 3.61
Molybdenum	ESP inlet gas, particulate	ICP-AES	mg/kg	< 10.5	< 10.4	18.9 @	21.4 @
Molybdenum	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	< 54.3	< 53.9	108 @	124 @
Molybdenum	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.967		< 0.973	< 1.01
Molybdenum	Stack gas, particulate	ICP-AES	mg/kg	115		87.0	106
Molybdenum	Stack gas, solid phase	ICP-AES	ug/Nm3	13.2		14.7	14.1

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Molybdenum	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.835		< 0.642	< 0.953
Molybdenum	Stack gas, <4 um	ICP-MS	ug/Nm3	2.23		2.22	2.06
Molybdenum	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.700		0.560	0.484
Molybdenum	Stack gas, >9 um	ICP-MS	ug/Nm3	1.15		1.60	1.20
Molybdenum	Stack particulate, <4 um	ICP-MS	mg/kg	236		281	294
Molybdenum	Stack particulate, 4-9 um	ICP-MS	mg/kg	64.4		62.3	55.7
Molybdenum	Stack particulate, >9 um	ICP-MS	mg/kg	26.2		28.9	29.0
m,p-Xylene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.571
Nickel	Bottom ash	GFAAS	mg/kg, dry	80.1	85.2	81.7	83.0
Nickel	Coal	NAA	mg/kg, dry	20.6	18.8	18.9	11.7
Nickel	ESP inlet gas, particulate	GFAAS	mg/kg	123	106	118	117
Nickel	ESP inlet gas, solid phase	GFAAS	ug/Nm3	637	550	676	676
Nickel	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	0.609 @		1.81 @	2.41 @
Nickel	Stack gas, particulate	GFAAS	mg/kg	144		124	140
Nickel	Stack gas, solid phase	GFAAS	ug/Nm3	16.5		20.9	18.7
Nickel	Stack gas, vapor phase	GFAAS	ug/Nm3	0.816 @		0.503 @	0.642 @
Nickel	Stack gas, <4 um	ICP-MS	ug/Nm3	1.61		1.54	1.22
Nickel	Stack gas, 4-9 um	ICP-MS	ug/Nm3	2.55		1.96	1.92
Nickel	Stack gas, >9 um	ICP-MS	ug/Nm3	6.38		7.60	8.95
Nickel	Stack particulate, <4 um	ICP-MS	mg/kg	170		195	174
Nickel	Stack particulate, 4-9 um	ICP-MS	mg/kg	235		219	221
Nickel	Stack particulate, >9 um	ICP-MS	mg/kg	145		138	216
Nitrogen	Coal	Ultimate	%, dry	1.50	1.51	1.61	1.64
Oxygen	Coal	Ultimate	%, dry	5.01	5.41	5.36	5.29
o-Xylene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Percent moisture	Bottom ash	Gravimetric	%	0.200	0.600	0	0
Phenanthrene	ESP inlet gas	HRGCMS	ug/Nm3	0.0763		0.0224	0.0214
Phenanthrene	Stack gas	HRGCMS	ug/Nm3	0.104		0.0247	0.0253
Phosphorus	Bottom ash	ICP-AES	mg/kg, dry	527 @	674 @	542 @	535 @
Phosphorus	Coal	ICP-AES	mg/kg, dry	170	140	140	110
Phosphorus	ESP inlet gas, particulate	ICP-AES	mg/kg	917	769	777	731
Phosphorus	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	4746	3977	4433	4228
Phosphorus	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 177		< 178	< 185
Phosphorus	Stack gas, particulate	ICP-AES	mg/kg	1683		1289	1598

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Phosphorus	Stack gas, solid phase	ICP-AES	ug/Nm3	193		218	213
Phosphorus	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 152		< 117	< 174
Pyrene	ESP inlet gas	HRGCMS	ug/Nm3	0.0148		0.00493	0.00924
Pyrene	Stack gas	HRGCMS	ug/Nm3	0.0309		0.00361	0.00231
Selenium	Bottom ash	GFAAS	mg/kg, dry	< 1.16	< 1.17	< 1.07	< 1.12
Selenium	Coal	NAA	mg/kg, dry	3.36	3.53	4.00	3.60
Selenium	ESP inlet gas, particulate	GFAAS	mg/kg	17.4		17.9	16.9
Selenium	ESP inlet gas, solid phase	GFAAS	ug/Nm3	89.8		102	97.6
Selenium	ESP inlet gas, vapor phase	GFAAS	ug/Nm3	3.53		2.20 @	2.12 @
Selenium	Stack gas, particulate	GFAAS	mg/kg	123		96.5	119
Selenium	Stack gas, solid phase	GFAAS	ug/Nm3	14.1		16.3	15.9
Selenium	Stack gas, vapor phase	GFAAS	ug/Nm3	108		124	213
Selenium	Stack gas, <4 um	ICP-MS	ug/Nm3	0.963		1.05	0.946
Selenium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	0.580		0.326	0.369
Selenium	Stack gas, >9 um	ICP-MS	ug/Nm3	2.76		5.53	5.14
Selenium	Stack particulate, <4 um	ICP-MS	mg/kg	102		133	135
Selenium	Stack particulate, 4-9 um	ICP-MS	mg/kg	53.3		36.3	42.5
Selenium	Stack particulate, >9 um	ICP-MS	mg/kg	62.7		100	124
Sodium	Bottom ash	ICP-AES	mg/kg, dry	3397	3481	3320	3980
Sodium	Coal	NAA	mg/kg, dry	310	304	386	317
Sodium	ESP inlet gas, particulate	ICP-AES	mg/kg	3713	2956	3194	3323
Sodium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	19214	15295	18222	19235
Sodium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	17.7 @		80.7 @	59.2 @
Sodium	Stack gas, particulate	ICP-AES	mg/kg	3681		4291	3504
Sodium	Stack gas, solid phase	ICP-AES	ug/Nm3	422		727	466
Sodium	Stack gas, vapor phase	ICP-AES	ug/Nm3	70.4		14.7 @	22.8 @
Styrene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Sulfate	ESP inlet gas, particulate	IC	mg/kg	12222		2191	23465
Sulfate	ESP inlet gas, solid phase	IC	ug/Nm3	63085		12520	133269
Sulfate	ESP inlet gas, vapor phase	IC	ug/Nm3	4829957		4840293	4714625
Sulfate	Stack gas, particulate	IC	mg/kg	113068		93141	130542
Sulfate	Stack gas, solid phase	IC	ug/Nm3	13064		15823	17396
Sulfate	Stack gas, vapor phase	IC	ug/Nm3	4022447		3986056	4146332
Sulfur	Bottom ash	Leco	%, dry	< 0.00501	0.0145 @	0.0164 @	< 0.00500

Table B-2: Site 16 OFA/LNB Data USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Sulfur	Coal	Ultimate	%, dry	1.82	1.60	1.67	1.61
Tetrachloroethene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Titanium	Bottom ash	ICP-AES	mg/kg, dry	6670	6974	6794	6942
Titanium	Coal	NAA	mg/kg, dry	739	724	978	802
Titanium	ESP inlet gas, particulate	ICP-AES	mg/kg	6821	6774	6925	6866
Titanium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	35296	35049	39509	39741
Titanium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.210		1.09	0.382
Titanium	Stack gas, particulate	ICP-AES	mg/kg	6632		6056	6327
Titanium	Stack gas, solid phase	ICP-AES	ug/Nm3	760		1025	842
Titanium	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.305 @		< 0.140	< 0.207
Toluene	Stack gas, VOST	GCMS	ug/Nm3	0.719 @		0.789 @B	0.911 @B
trans-1,3-Dichloropropene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Trichloroethene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Vanadium	Bottom ash	ICP-AES	mg/kg, dry	200	229	224	258
Vanadium	Coal	NAA	mg/kg, dry	23.0	22.6	29.8	25.1
Vanadium	ESP inlet gas, particulate	ICP-AES	mg/kg	233	234	287	264
Vanadium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	1206	1213	1635	1531
Vanadium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.504		0.466	< 0.528
Vanadium	Stack gas, particulate	ICP-AES	mg/kg	345		328	355
Vanadium	Stack gas, solid phase	ICP-AES	ug/Nm3	39.5		55.6	47.3
Vanadium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.435		< 0.335	< 0.497
Vanadium	Stack gas, <4 um	ICP-MS	ug/Nm3	5.80		6.04	5.10
Vanadium	Stack gas, 4-9 um	ICP-MS	ug/Nm3	6.89		5.76	5.55
Vanadium	Stack gas, >9 um	ICP-MS	ug/Nm3	15.2		19.5	17.7
Vanadium	Stack particulate, <4 um	ICP-MS	mg/kg	614		765	729
Vanadium	Stack particulate, 4-9 um	ICP-MS	mg/kg	634		641	638
Vanadium	Stack particulate, >9 um	ICP-MS	mg/kg	347		352	428
Vinyl Acetate	Stack gas, VOST	GCMS	ug/Nm3	< 2.94		< 2.94	< 2.89
Vinyl Chloride	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Volatiles	Coal	Proximate	%, dry	32.3	32.7	32.3	32.1

APPENDIX C:
ANALYTICAL DATA NOT USED IN CALCULATIONS

30-Oct-93

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
1,1-Dichloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,1-Dichloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,1-Dichloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,1-Dichloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,1-Dichloroethene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,1-Dichloroethene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,1-Dichloroethene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,1-Dichloroethene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,1,1-Trichloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,1,1-Trichloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	0.00770 @			
1,1,1-Trichloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,1,1-Trichloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,1,2-Trichloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,1,2-Trichloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,1,2-Trichloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,1,2-Trichloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,1,2,2-Tetrachloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,1,2,2-Tetrachloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,1,2,2-Tetrachloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,1,2,2-Tetrachloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,2-Dichlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,2-Dichlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,2-Dichlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1,2-Dichlorobenzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,2-Dichlorobenzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,2-Dichlorobenzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,2-Dichlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,2-Dichlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,2-Dichlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,2-Dichlorobenzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,2-Dichlorobenzene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,2-Dichlorobenzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,2-Dichlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2-Dichlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2-Dichloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,2-Dichloroethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,2-Dichloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,2-Dichloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,2-Dichloroethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
1,2-Dichloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,2-Dichloropropane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,2-Dichloropropane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,2-Dichloropropane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,2-Dichloropropane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,2,4,5-Tetrachlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,2,4,5-Tetrachlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,2,4,5-Tetrachlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1,2,4,5-Tetrachlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,2,4,5-Tetrachlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,2,4,5-Tetrachlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,2,4,5-Tetrachlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,2,4,5-Tetrachlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,3-Dichlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
1,3-Dichlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
1,3-Dichlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
1,3-Dichlorobenzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,3-Dichlorobenzene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
1,3-Dichlorobenzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,3-Dichlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
1,3-Dichlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
1,3-Dichlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
1,3-Dichlorobenzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,3-Dichlorobenzene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
1,3-Dichlorobenzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
1,3-Dichlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,3-Dichlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
1,4-Dichlorobenzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
1,4-Dichlorobenzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
1,4-Dichlorobenzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
1,4-Dichlorobenzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
2-Butanone	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.0887	< 0.139	< 0.105			
2-Butanone	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.0202	< 0.0211	< 0.0226			
2-Butanone	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.115	< 0.114	< 0.110			
2-Butanone	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.0231	< 0.0227	< 0.0218			
2-Chlorophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Chlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Chlorophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Chlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
2-Chlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Chlorophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Chlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Chlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Hexanone	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.0887	< 0.139	< 0.105			
2-Hexanone	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.00525	< 0.00543	< 0.00559			
2-Hexanone	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.0202	< 0.0211	< 0.0226			
2-Hexanone	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.115	< 0.114	< 0.110			
2-Hexanone	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.00580	< 0.00569	< 0.00542			
2-Hexanone	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.0231	< 0.0227	< 0.0218			
2-Nitroaniline	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
2-Nitroaniline	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
2-Nitroaniline	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
2-Nitroaniline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
2-Nitroaniline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
2-Nitroaniline	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
2-Nitroaniline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
2-Nitroaniline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
2-Nitrophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Nitrophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Nitrophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Nitrophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Nitrophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Nitrophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Nitrophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Nitrophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Picoline	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2-Picoline	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2-Picoline	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2-Picoline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2-Picoline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2-Picoline	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2-Picoline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2-Picoline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,3,4,6-Tetrachlorophenol	bottom ash	GCMS(8270)	ug/g	< 2.00		< 2.00	< 2.00	< 2.00	
2,3,4,6-Tetrachlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 21.0		< 21.0	< 22.0	< 22.0	
2,3,4,6-Tetrachlorophenol	collected fly ash	GCMS(8270)	ug/g	< 2.00		< 2.00	< 1.90	< 2.00	
2,3,4,6-Tetrachlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0199	< 0.0167	< 0.0173			
2,3,4,6-Tetrachlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0116	< 0.00976	< 0.0101			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
2,3,4,6-Tetrachlorophenol	sluice water supply	GCMS(8270)	ug/L	< 21.0		< 21.0	< 21.0	< 21.0	
2,3,4,6-Tetrachlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0106	< 0.0111	< 0.0107			
2,3,4,6-Tetrachlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0106	< 0.0111	< 0.0107			
2,4-Dichlorophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,4-Dichlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,4-Dichlorophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,4-Dichlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,4-Dichlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,4-Dichlorophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,4-Dichlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4-Dichlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4-Dimethylphenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,4-Dimethylphenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,4-Dimethylphenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,4-Dimethylphenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,4-Dimethylphenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,4-Dimethylphenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,4-Dimethylphenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,4-Dimethylphenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,6-Dichlorophenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,6-Dichlorophenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,6-Dichlorophenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,6-Dichlorophenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,6-Dichlorophenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,6-Dichlorophenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,6-Dichlorophenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,6-Dichlorophenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,6-Dinitrotoluene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
2,6-Dinitrotoluene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
2,6-Dinitrotoluene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
2,6-Dinitrotoluene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
2,6-Dinitrotoluene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
2,6-Dinitrotoluene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
2,6-Dinitrotoluene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
2,6-Dinitrotoluene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
3-Nitroaniline	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
3-Nitroaniline	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
3-Nitroaniline	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
3-Nitroaniline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			

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Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
3-Nitroaniline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
3-Nitroaniline	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
3-Nitroaniline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
3-Nitroaniline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
4-Chloro-3-methylphenol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
4-Chloro-3-methylphenol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
4-Chloro-3-methylphenol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
4-Chloro-3-methylphenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
4-Chloro-3-methylphenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
4-Chloro-3-methylphenol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
4-Chloro-3-methylphenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Chloro-3-methylphenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
4-Methyl-2-pentanone	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.0887	< 0.139	< 0.105			
4-Methyl-2-pentanone	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.00525	< 0.00543	< 0.00559			
4-Methyl-2-pentanone	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.0202	< 0.0211	< 0.0226			
4-Methyl-2-pentanone	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.115	< 0.114	< 0.110			
4-Methyl-2-pentanone	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.00580	< 0.00569	< 0.00542			
4-Methyl-2-pentanone	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.0231	< 0.0227	< 0.0218			
4-Nitroaniline	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
4-Nitroaniline	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
4-Nitroaniline	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
4-Nitroaniline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
4-Nitroaniline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
4-Nitroaniline	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
4-Nitroaniline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
4-Nitroaniline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
4,6-Dinitro-2-methylphenol	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
4,6-Dinitro-2-methylphenol	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
4,6-Dinitro-2-methylphenol	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
4,6-Dinitro-2-methylphenol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
4,6-Dinitro-2-methylphenol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0290	< 0.0244	< 0.0251			
4,6-Dinitro-2-methylphenol	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
4,6-Dinitro-2-methylphenol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
4,6-Dinitro-2-methylphenol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
Acetone	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.0887	< 0.139	< 0.105			
Acetone	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.00525	< 0.00543	< 0.00559			
Acetone	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.0202	< 0.0211	< 0.0226			
Acetone	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.115	< 0.114	< 0.110			
Acetone	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.00580	< 0.00569	< 0.00542			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Acetone	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.0231	< 0.0227	< 0.0218			
Aluminum	bottom ash	ICP-AES	mg/kg			129000	128000	126000	112000
Aluminum	bottom ash	NAA	ug/g					133440	
Aluminum	coal	ICP-AES	mg/kg, dry			9856	8120	11073	7628
Aluminum	collected fly ash	ICP-AES	mg/kg			108000	101000	97100	93900
Aluminum	collected fly ash	NAA	ug/g					118440	
Aluminum	high dust gas, particulates	NAA	ug/g					42942 R	
Aluminum	stack gas, particulates	NAA	ug/g					28068 R	
Antimony	bottom ash	NAA	ug/g					1.99	
Antimony	coal	ICP-AES	mg/kg, dry			< 10.4	< 10.4	< 10.4	< 10.5
Antimony	collected fly ash	NAA	ug/g					7.73	
Antimony	high dust gas, particulates	NAA	ug/g					6.86 R	
Antimony	stack gas, particulates	NAA	ug/g					6.25 R	
Arsenic	bottom ash	NAA	ug/g					31.1	
Arsenic	coal	GFAAS	mg/kg, dry			31.8	24.3	33.6	34.0
Arsenic	collected fly ash	NAA	ug/g					170	
Arsenic	high dust gas, particulates	NAA	ug/g					142 R	
Arsenic	stack gas, particulates	NAA	ug/g					149	
Barium	bottom ash	NAA	ug/g					612	
Barium	bottom ash	XRF	mg/kg				1164	1164	
Barium	coal	ICP-AES	mg/kg, dry			102	89.2	166	106
Barium	collected fly ash	NAA	ug/g					1449	
Barium	collected fly ash	XRF	mg/kg			1075		1343	
Barium	high dust gas, particulates	NAA	ug/g					595 R	
Barium	stack gas, particulates	NAA	ug/g					497 R	
Benzaldehyde	high dust gas, vapor phase	HPLC	mg/Nm3	0.0313 @		< 0.0151		< 0.0161	
Benzaldehyde	stack gas, vapor phase	HPLC	mg/Nm3	< 0.00371		< 0.00984		< 0.0109	
Benzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Benzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Benzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Benzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	0.00862 @	< 0.00218			
Benzoic acid	bottom ash	GCMS(8270)	ug/g	< 4.90		< 4.90	< 4.90	< 5.00	
Benzoic acid	bottom ash sluice water	GCMS(8270)	ug/L	< 52.0		< 53.0	< 54.0	< 56.0	
Benzoic acid	collected fly ash	GCMS(8270)	ug/g	< 5.00		< 4.90	< 4.80	< 5.00	
Benzoic acid	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0498	< 0.0419	< 0.0432			
Benzoic acid	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	0.106 @	0.0400 @	< 0.0251			
Benzoic acid	sluice water supply	GCMS(8270)	ug/L	< 52.0		< 52.0	< 53.0	< 52.0	
Benzoic acid	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.0265	< 0.0278	< 0.0267			
Benzoic acid	stack gas, vapor phase	GCMS(8270)	mg/Nm3	0.105 @	0.0983 @	0.168			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Benzyl alcohol	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Benzyl alcohol	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Benzyl alcohol	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Benzyl alcohol	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Benzyl alcohol	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Benzyl alcohol	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Benzyl alcohol	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Benzyl alcohol	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Chloroethoxy)methane	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
bis(2-Chloroethoxy)methane	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
bis(2-Chloroethoxy)methane	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
bis(2-Chloroethoxy)methane	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
bis(2-Chloroethoxy)methane	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
bis(2-Chloroethoxy)methane	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
bis(2-Chloroethoxy)methane	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Chloroethoxy)methane	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Chloroisopropyl)ether	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
bis(2-Chloroisopropyl)ether	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
bis(2-Chloroisopropyl)ether	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
bis(2-Chloroisopropyl)ether	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
bis(2-Chloroisopropyl)ether	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
bis(2-Chloroisopropyl)ether	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
bis(2-Chloroisopropyl)ether	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
bis(2-Chloroisopropyl)ether	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Boron	bottom ash sluice water	ICP-AES	mg/L			< 0.600	< 0.600	< 0.600	< 0.600
Boron	high dust gas, vapor phase	ICP-AES	mg/Nm3			0.538 @		0.600 @	0.624 @
Boron	sluice water supply	ICP-AES	mg/L			< 0.600	< 0.600	< 0.600	< 0.600
Boron	stack gas, vapor phase	ICP-AES	mg/Nm3			0.837 @		0.805 @	0.883 @
Bromine	bottom ash	NAA	ug/g					< 3.93	
Bromine	coal	NAA	ug/g, dry			3.52	4.92	7.79	5.16
Bromine	collected fly ash	NAA	ug/g					6.58	
Bromine	high dust gas, particulates	NAA	ug/g					34.0	
Bromine	stack gas, particulates	NAA	ug/g					3.90 R	
Bromodichloromethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Bromodichloromethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Bromodichloromethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Bromodichloromethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Bromodichloromethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Bromodichloromethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Bromoform	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Bromoform	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Bromoform	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Bromoform	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Bromomethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Bromomethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Bromomethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Bromomethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Cadmium	bottom ash	ICP-AES	mg/kg			< 5.00	< 5.00	< 5.00	< 5.00
Cadmium	bottom ash	NAA	ug/g					< 100	
Cadmium	bottom ash sluice water	ICP-AES	mg/L			< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cadmium	coal	NAA	ug/g, dry			< 2.49	< 3.28	< 2.88	< 2.59
Cadmium	collected fly ash	ICP-AES	mg/kg			< 5.00	< 5.00	< 5.00	< 5.00
Cadmium	collected fly ash	NAA	ug/g					< 22.9	
Cadmium	high dust gas, particulates	ICP-AES	mg/kg			< 4.41 R		< 5.10 R	< 5.25 R
Cadmium	high dust gas, particulates	NAA	ug/g					< 25.4	
Cadmium	high dust gas, solid phase	ICP-AES	mg/Nm3			< 0.0293 R		< 0.0263 R	< 0.0287 R
Cadmium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00217		< 0.00233	< 0.00225
Cadmium	sluice water supply	ICP-AES	mg/L			< 0.00500	< 0.00500	< 0.00500	< 0.00500
Cadmium	stack gas, particulates	ICP-AES	mg/kg			< 6.75		< 4.15	< 5.67
Cadmium	stack gas, particulates	NAA	ug/g					< 4.30	
Cadmium	stack gas, solid phase	ICP-AES	mg/Nm3			< 0.000871		< 0.00145	< 0.00147
Cadmium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.000834		< 0.00192	< 0.00170
Calcium	bottom ash	ICP-AES	mg/kg			7330	7260	5980	3700 @
Calcium	bottom ash	NAA	ug/g					< 10000	
Calcium	coal	ICP-AES	mg/kg, dry			844	1011	1254	961
Calcium	collected fly ash	ICP-AES	mg/kg			7520	7650	4460 @	4570 @
Calcium	collected fly ash	NAA	ug/g					< 12653	
Calcium	high dust gas, particulates	NAA	ug/g					< 13589 R	
Calcium	stack gas, particulates	NAA	ug/g					2171 R	
Carbon disulfide	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Carbon disulfide	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Carbon disulfide	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Carbon disulfide	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Carbon tetrachloride	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Carbon tetrachloride	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Carbon tetrachloride	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Carbon tetrachloride	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Cerium	bottom ash	NAA	ug/g					94.4	

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Cerium	coal	NAA	ug/g, dry			28.9	23.3	21.4	21.9
Cerium	collected fly ash	NAA	ug/g					161	
Cerium	high dust gas, particulates	NAA	ug/g					82.0 R	
Cerium	stack gas, particulates	NAA	ug/g					47.8 R	
Cesium	bottom ash	NAA	ug/g					6.51	
Cesium	coal	NAA	ug/g, dry			1.30	1.01	1.07	0.943
Cesium	collected fly ash	NAA	ug/g					12.5	
Cesium	high dust gas, particulates	NAA	ug/g					3.73 R	
Cesium	stack gas, particulates	NAA	ug/g					2.76 R	
Chloride	collected fly ash	IC	mg/kg			9.16 @			
Chlorine	bottom ash	NAA	ug/g					< 411	
Chlorine	coal	NAA	ug/g, dry			< 95.6	365	574	402
Chlorine	collected fly ash	NAA	ug/g					< 324	
Chlorine	high dust gas, particulates	NAA	ug/g					1957 R	
Chlorine	stack gas, particulates	NAA	ug/g					< 97.2	
Chlorobenzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Chlorobenzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Chlorobenzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Chlorobenzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Chloroethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Chloroethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Chloroethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Chloroethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Chloroform	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Chloroform	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Chloroform	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Chloroform	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Chloromethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Chloromethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Chloromethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Chloromethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Chromium	bottom ash	NAA	ug/g					93.8	
Chromium	coal	ICP-AES	mg/kg, dry			23.2	31.9	48.1	19.5
Chromium	collected fly ash	NAA	ug/g					136	
Chromium	high dust gas, particulates	NAA	ug/g					33.8 R	
Chromium	stack gas, particulates	NAA	ug/g					204 R	
cis-1,2-Dichloroethene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
cis-1,2-Dichloroethene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
cis-1,2-Dichloroethene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
cis-1,2-Dichloroethene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
cis-1,2-Dichloroethene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
cis-1,2-Dichloroethene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
cis-1,3-Dichloropropene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
cis-1,3-Dichloropropene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
cis-1,3-Dichloropropene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
cis-1,3-Dichloropropene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Cobalt	bottom ash	NAA	ug/g					29.9	
Cobalt	coal	ICP-AES	mg/kg, dry			6.51	4.62 @	6.41	3.96 @
Cobalt	collected fly ash	NAA	ug/g					61.9	
Cobalt	high dust gas, particulates	NAA	ug/g					27.8 R	
Cobalt	stack gas, particulates	NAA	ug/g					21.0 R	
Copper	bottom ash	NAA	ug/g					< 438	
Copper	coal	NAA	ug/g, dry			80.0	80.8	57.2	< 53.9
Copper	collected fly ash	NAA	ug/g					< 364	
Copper	high dust gas, particulates	NAA	ug/g					< 558	
Copper	stack gas, particulates	NAA	ug/g					< 112	
Dibromochloromethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Dibromochloromethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Dibromochloromethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Dibromochloromethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Dibromochloromethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
Dibromochloromethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Diethylphthalate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Diethylphthalate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Diethylphthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Diethylphthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Diethylphthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Diethylphthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Diethylphthalate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Diethylphthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dimethylphenethylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Dimethylphenethylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Dimethylphenethylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Dimethylphenethylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Dimethylphenethylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Dimethylphenethylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Dimethylphenethylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Dimethylphenethylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Di-n-octylphthalate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Di-n-octylphthalate	*bottom ash sluice water*	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Di-n-octylphthalate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Di-n-octylphthalate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Di-n-octylphthalate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Di-n-octylphthalate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Di-n-octylphthalate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Di-n-octylphthalate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Ethyl benzene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Ethyl benzene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Ethyl benzene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Ethyl benzene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Ethyl methanesulfonate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Ethyl methanesulfonate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Ethyl methanesulfonate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Ethyl methanesulfonate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Ethyl methanesulfonate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Ethyl methanesulfonate	sluice water supply	GCMS(8270)	ug/L	< 10.0		*< 10.0*	*< 11.0*	*< 10.0*	
Ethyl methanesulfonate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Ethyl methanesulfonate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Europium	bottom ash	NAA	ug/g					*2.11*	
Europium	coal	NAA	ug/g, dry			0.537	0.349	0.397	0.408
Europium	collected fly ash	NAA	ug/g					1.95	
Europium	high dust gas, particulates	NAA	ug/g					*0.668 R*	
Europium	stack gas, particulates	NAA	ug/g					0.393 R	
Gold	coal	NAA	ug/g, dry			< 0.00104	< 0.00104	< 0.00104	< 0.00105
Hafnium	bottom ash	NAA	*ug/g*					5.04	
Hafnium	coal	NAA	ug/g, dry			1.20	0.775	0.788	0.728
Hafnium	collected fly ash	NAA	ug/g					8.71	
Hafnium	high dust gas, particulates	NAA	ug/g					*2.57 R*	
Hafnium	stack gas, particulates	NAA	ug/g					1.54 R	
Iodine	bottom ash	NAA	ug/g					< 10.6	
Iodine	*coal*	NAA	ug/g, dry			< 2.26	< 2.18	1.77	< 1.78
Iodine	collected fly ash	NAA	ug/g					< 9.36	
Iodine	high dust gas, particulates	NAA	ug/g					< 14.4	
Iodine	*stack gas, particulates*	*NAA*	*ug/g*					< 2.63	
Iron	bottom ash	ICP-AES	mg/kg			90500	90600	91600	82600
Iron	bottom ash	NAA	ug/g					62080	
Iron	coal	ICP-AES	mg/kg, dry			8605	5705	8211	6304

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Iron	collected fly ash	ICP-AES	mg/kg			79600	77600	68100	69900
Iron	collected fly ash	NAA	ug/g					90531	
Iron	high dust gas, particulates	NAA	ug/g					36211 R	
Iron	stack gas, particulates	NAA	ug/g					26496 R	
Lanthanum	bottom ash	NAA	ug/g					105	
Lanthanum	coal	NAA	ug/g, dry			10.8	13.9	9.50	10.1
Lanthanum	collected fly ash	NAA	ug/g					90.1	
Lanthanum	high dust gas, particulates	NAA	ug/g					51.1	
Lanthanum	stack gas, particulates	NAA	ug/g					17.4 R	
Lutetium	bottom ash	NAA	ug/g					0.693	
Lutetium	coal	NAA	ug/g, dry			0.196	0.153	0 150	0.145
Lutetium	collected fly ash	NAA	ug/g					1.12	
Lutetium	high dust gas, particulates	NAA	ug/g					0 592 R	
Lutetium	stack gas, particulates	NAA	ug/g					0.301 R	
Magnesium	bottom ash	ICP-AES	mg/kg			4500 @	4480 @	4130 @	3270 @
Magnesium	bottom ash	NAA	ug/g					7395	
Magnesium	bottom ash	XRF	mg/kg			4885	4945	4885	4583
Magnesium	bottom ash sluice water	ICP-AES	mg/L			2.82 @	2.87 @	3.02 @	2.86 @
Magnesium	coal	ICP-AES	mg/kg, dry			365 @	323 @	594	374 @
Magnesium	coal	NAA	ug/g, dry			670	688	584	519
Magnesium	collected fly ash	ICP-AES	mg/kg			3670 @	2940 @	2900 @	2800 @
Magnesium	collected fly ash	NAA	ug/g					6591	
Magnesium	collected fly ash	XRF	mg/kg			5488	5246	5126	4583
Magnesium	high dust gas, particulates	ICP-AES	mg/kg			4744 R		4745 @R	3359 @R
Magnesium	high dust gas, particulates	NAA	ug/g					2827 R	
Magnesium	high dust gas, solid phase	ICP-AES	mg/Nm3			31.6 R		24.5 @R	18.4 @R
Magnesium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.435		< 0.466	< 0 450
Magnesium	sluice water supply	ICP-AES	mg/L			3.56 @	3.61 @	3.44 @	3.46 @
Magnesium	stack gas, particulates	ICP-AES	mg/kg			3669 @R		2915 @R	3453 @R
Magnesium	stack gas, particulates	NAA	ug/g					1642 R	
Magnesium	stack gas, solid phase	ICP-AES	mg/Nm3			0.473 @R		1.02 @R	0 898 @R
Magnesium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.366		< 0.384	< 0.341
Manganese	bottom ash	NAA	ug/g					124	
Manganese	bottom ash	XRF	mg/kg			792	792	792	720
Manganese	coal	ICP-AES	mg/kg, dry			12.2	12.4	21.0	13.8
Manganese	collected fly ash	NAA	ug/g					102	
Manganese	collected fly ash	XRF	mg/kg			864	792	720	792
Manganese	high dust gas, particulates	NAA	ug/g					46.1 R	
Manganese	stack gas, particulates	NAA	ug/g					40.6 R	

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Mercury	bottom ash	CVAAS	mg/kg			< 0.0450	< 0.0450	< 0.0450	< 0.0450
Mercury	bottom ash	NAA	ug/g					< 0.701	
Mercury	coal	CVAAS	mg/kg, dry			< 0.0469	< 0.0468	< 0.0470	< 0.0473
Mercury	coal	NAA	ug/g, dry			0.175	< 0.228	0.237	< 0.179
Mercury	collected fly ash	CVAAS	mg/kg			0.254	0.272	0.248	0.248
Mercury	collected fly ash	NAA	ug/g					< 3.16	
Mercury	high dust gas, particulates	NAA	ug/g					< 3.61	
Mercury	stack gas, particulates	NAA	ug/g					< 0.704	
Methyl methanesulfonate	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Methyl methanesulfonate	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Methyl methanesulfonate	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Methyl methanesulfonate	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Methyl methanesulfonate	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Methyl methanesulfonate	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Methyl methanesulfonate	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Methyl methanesulfonate	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Methylene chloride	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Methylene chloride	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	0.00589 @			
Methylene chloride	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	0.208			
Methylene chloride	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	0.125	0.0392			
Molybdenum	bottom ash	NAA	ug/g					< 12.4	
Molybdenum	coal	ICP-AES	mg/kg, dry			< 5.21	< 5.21	6.08 @	< 5.25
Molybdenum	collected fly ash	NAA	ug/g					< 12.5	
Molybdenum	high dust gas, particulates	NAA	ug/g					< 58.4 R	
Molybdenum	stack gas, particulates	NAA	ug/g					10.7 R	
m,p-Xylene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
m,p-Xylene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
m,p-Xylene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
m,p-Xylene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Neodymium	bottom ash	NAA	ug/g					5.75	
Neodymium	coal	NAA	ug/g, dry			21.2	15.1	14.6	13.9
Neodymium	collected fly ash	NAA	ug/g					131	
Neodymium	high dust gas, particulates	NAA	ug/g					43.6	
Neodymium	stack gas, particulates	NAA	ug/g					20.3 R	
Nickel	bottom ash	NAA	ug/g					191	
Nickel	coal	ICP-AES	mg/kg, dry			22.8	37.9	62.8	18.2
Nickel	collected fly ash	NAA	ug/g					< 159	
Nickel	high dust gas, particulates	NAA	ug/g					52.3 R	
Nickel	stack gas, particulates	NAA	ug/g					126	

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
N-Nitroso-di-n-butylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
N-Nitroso-di-n-butylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
N-Nitroso-di-n-butylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
N-Nitroso-di-n-butylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
N-Nitroso-di-n-butylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
N-Nitroso-di-n-butylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
N-Nitroso-di-n-butylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitroso-di-n-butylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosodipropylamine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
N-Nitrosodipropylamine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
N-Nitrosodipropylamine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
N-Nitrosodipropylamine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
N-Nitrosodipropylamine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
N-Nitrosodipropylamine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
N-Nitrosodipropylamine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosodipropylamine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosopiperidine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
N-Nitrosopiperidine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
N-Nitrosopiperidine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
N-Nitrosopiperidine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
N-Nitrosopiperidine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
N-Nitrosopiperidine	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
N-Nitrosopiperidine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
N-Nitrosopiperidine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
o-Xylene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
o-Xylene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
o-Xylene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
o-Xylene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
p-Chloroaniline	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
p-Chloroaniline	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
p-Chloroaniline	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
p-Chloroaniline	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
p-Chloroaniline	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
p-Chloroaniline	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
p-Chloroaniline	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
p-Chloroaniline	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pentachlorobenzene	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Pentachlorobenzene	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Pentachlorobenzene	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Pentachlorobenzene	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Pentachlorobenzene	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Pentachlorobenzene	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Pentachlorobenzene	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pentachlorobenzene	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phenacetin	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Phenacetin	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Phenacetin	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Phenacetin	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Phenacetin	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Phenacetin	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Phenacetin	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phenacetin	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Phosphate	collected fly ash	Spectrophot.	mg/kg			< 160			
Phosphate	high dust gas, solid phase	Spectrophot.	mg/Nm3			0.862 @		0.914	1.14
Phosphate	stack gas, solid phase	Spectrophot.	mg/Nm3			< 0.0375		< 0.0402	< 0.0573
Phosphorus	bottom ash	ICP-AES	mg/kg			< 300	< 300	< 300	< 300
Phosphorus	coal	ICP-AES	mg/kg, dry			< 31.3	< 31.2	< 31.3	< 31.5
Phosphorus	coal	ICP-AES	mg/kg, dry			30.2 @	38.0	4.90 @	10.7
Phosphorus	collected fly ash	ICP-AES	mg/kg			765 @	764 @	< 300	< 300
Potassium	bottom ash	ICP-AES	mg/kg			18400	18230	19100	19100
Potassium	bottom ash	NAA	ug/g					< 31691	
Potassium	bottom ash	XRF	mg/kg			19508	19342	11539	19425
Potassium	bottom ash sluice water	ICP-AES	mg/L			< 3.00	< 3.00	3.02 @	< 3.00
Potassium	coal	ICP-AES	mg/kg, dry			1241 @	1040 @	1964	1261 @
Potassium	coal	NAA	ug/g, dry			2463	2400	1833	2046
Potassium	collected fly ash	ICP-AES	mg/kg			16200	15500	17300	17200
Potassium	collected fly ash	NAA	ug/g					28764	
Potassium	collected fly ash	XRF	mg/kg			20671	20505	22829	21667
Potassium	high dust gas, particulates	ICP-AES	mg/kg			17544 R		18920 R	19531 R
Potassium	high dust gas, particulates	NAA	ug/g					< 42562	
Potassium	high dust gas, solid phase	ICP-AES	mg/Nm3			117 R		97.7 R	107 R
Potassium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 1.30		< 1.40	< 0.568
Potassium	sluice water supply	ICP-AES	mg/L			3.54 @	3.39 @	3.53 @	3.27 @
Potassium	stack gas, particulates	ICP-AES	mg/kg			14773 @R		12441 @R	14808 @R
Potassium	stack gas, particulates	NAA	ug/g					< 6173	
Potassium	stack gas, solid phase	ICP-AES	mg/Nm3			1.91 @R		4.35 @R	3.85 @R
Potassium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.500		< 0.661	< 1.02
Pronamide	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Pronamide	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Pronamide	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Pronamide	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Pronamide	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Pronamide	sluice water supply	GCMS(8270)	ug/L	< 10.0		< 10.0	< 11.0	< 10.0	
Pronamide	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pronamide	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pyridine	bottom ash	GCMS(8270)	ug/g	< 0.980		< 0.980	< 0.990	< 0.990	
Pyridine	bottom ash sluice water	GCMS(8270)	ug/L	< 10.0		< 11.0	< 11.0	< 11.0	
Pyridine	collected fly ash	GCMS(8270)	ug/g	< 0.990		< 0.990	< 0.970	< 1.00	
Pyridine	high dust gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00997	< 0.00837	< 0.00863			
Pyridine	high dust gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00581	< 0.00488	< 0.00503			
Pyridine	sluice water supply	GCMS(8270)	ug/L	*< 10.0*		*< 10.0*	*< 11.0*	*< 10.0*	
Pyridine	stack gas, solid phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Pyridine	stack gas, vapor phase	GCMS(8270)	mg/Nm3	< 0.00530	< 0.00555	< 0.00534			
Rubidium	bottom ash	NAA	ug/g					85.6	
Rubidium	coal	NAA	ug/g, dry			17.7	13.2	14.3	12.1
Rubidium	collected fly ash	NAA	ug/g					137	
Rubidium	*high dust gas, particulates*	NAA	*ug/g*					48.5 R	
Rubidium	stack gas, particulates	NAA	ug/g					31.7 R	
Samarium	bottom ash	NAA	ug/g					11.8	
Samarium	*coal*	*NAA*	*ug/g, dry*			1.74	2.22	1.83	1.71
Samarium	collected fly ash	NAA	ug/g					13.2	
Samarium	high dust gas, particulates	NAA	ug/g					8.13 R	
Samarium	*stack gas, particulates*	NAA	*ug/g*					4.44 R	
Scandium	bottom ash	NAA	ug/g					22.4	
Scandium	coal	NAA	ug/g, dry			5.70	4.45	5.12	4.36
Scandium	*collected fly ash*	NAA	ug/g					41.7	
Scandium	high dust gas, particulates	NAA	ug/g					17.6 R	
Scandium	stack gas, particulates	NAA	ug/g					10.2 R	
Selenium	*bottom ash*	NAA	ug/g					< 2.39	
Selenium	coal	HGAAS	mg/kg, dry			1.56 @	1.46 @	1.57 @	2.00 @
Selenium	collected fly ash	NAA	ug/g					16.4	
Selenium	high dust gas, particulates	NAA	ug/g					29.4	
Selenium	stack gas, particulates	NAA	ug/g					41.7	
Silicon	bottom ash	ICP-AES	mg/kg			190000	189000	192000	195000
Silicon	bottom ash	XRF	mg/kg			242599	238158	243113	239888
Silicon	bottom ash sluice water	ICP-AES	mg/L			3.57 @	3.65 @	3.73 @	3.46 @
Silicon	collected fly ash	ICP-AES	mg/kg			149200	153000	209000	202200

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Silicon	collected fly ash	XRF	mg/kg			236990	236335	243861	248114
Silicon	high dust gas, particulates	ICP-AES	mg/kg			274275 R		259754 R	279978 R
Silicon	high dust gas, solid phase	ICP-AES	mg/Nm3			1825 R		1341 R	1532 R
Silicon	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.435		< 0.466	< 0.450
Silicon	sluice water supply	ICP-AES	mg/L			3.91 @	4.01 @	3.85 @	3.87 @
Silicon	stack gas, particulates	ICP-AES	mg/kg			370983 R			333978 R
Silicon	stack gas, solid phase	ICP-AES	mg/Nm3			47.9 R			86.9 R
Silicon	stack gas, vapor phase	ICP-AES	mg/Nm3			0.794 @		0.457 @	0.705 @
Silver	bottom ash	ICP-AES	mg/kg			< 40.0	< 40.0	< 40.0	< 40.0
Silver	bottom ash	NAA	ug/g					< 3.82	
Silver	bottom ash sluice water	ICP-AES	mg/L			< 0.0100	< 0.0100	< 0.0100	< 0.0100
Silver	coal	ICP-AES	mg/kg, dry			< 1.04	< 1.04	< 1.04	< 1.05
Silver	coal	NAA	ug/g, dry			< 0.935	< 0.732	< 0.845	< 0.797
Silver	collected fly ash	ICP-AES	mg/kg			< 40.0	< 40.0	< 40.0	< 40.0
Silver	collected fly ash	NAA	ug/g					< 7.97	
Silver	high dust gas, particulates	ICP-AES	mg/kg			< 8.81		< 10.4	< 10.7
Silver	high dust gas, particulates	NAA	ug/g					< 2.49	
Silver	high dust gas, solid phase	ICP-AES	mg/Nm3			< 0.0586		< 0.0538	< 0.0587
Silver	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00435		< 0.00466	< 0.00450
Silver	sluice water supply	ICP-AES	mg/L			0.0110 @	< 0.0100	< 0.0100	< 0.0100
Silver	stack gas, particulates	ICP-AES	mg/kg			< 13.5		< 8.30	< 11.3
Silver	stack gas, particulates	NAA	ug/g					< 2.19	
Silver	stack gas, solid phase	ICP-AES	mg/Nm3			< 0.00174		< 0.00290	< 0.00295
Silver	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00167		< 0.00384	< 0.00341
Sodium	bottom ash	ICP-AES	mg/kg			2370 @	2580 @	2400 @	2220 @
Sodium	bottom ash	NAA	ug/g					2464	
Sodium	coal	ICP-AES	mg/kg, dry			260 @	223 @	306 @	255 @
Sodium	collected fly ash	ICP-AES	mg/kg			2320 @	2352 @	2190 @	2280 @
Sodium	collected fly ash	NAA	ug/g					2475	
Sodium	high dust gas, particulates	NAA	ug/g					< 51694 R	
Sodium	stack gas, particulates	NAA	ug/g					386 R	
Strontium	bottom ash	ICP-AES	mg/kg			1000	956	840	582
Strontium	bottom ash	NAA	ug/g					454	
Strontium	bottom ash	XRF	mg/kg			3721	3467	3636	3636
Strontium	bottom ash sluice water	ICP-AES	mg/L			0.168	0.170	0.200	0.182
Strontium	coal	ICP-AES	mg/kg, dry			98.7	96.7	99.2	80.8
Strontium	coal	NAA	ug/g, dry			89.7	88.4	85.8	116
Strontium	collected fly ash	ICP-AES	mg/kg			915	858	624	625
Strontium	collected fly ash	NAA	ug/g					1339	

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Strontium	collected fly ash	XRF	mg/kg			3636	3805	2960	2875
Strontium	high dust gas, particulates	ICP-AES	mg/kg			1135 R		893 R	1000 R
Strontium	high dust gas, particulates	NAA	ug/g					355 R	
Strontium	high dust gas, solid phase	ICP-AES	mg/Nm3			7.55 R		4.61 R	5 47 R
Strontium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.00130		< 0.000785	< 0.00135
Strontium	sluice water supply	ICP-AES	mg/L			0.266	0.268	2.66	0.267
Strontium	stack gas, particulates	ICP-AES	mg/kg			1081 R		756 R	862 R
Strontium	stack gas, particulates	NAA	ug/g					256 R	
Strontium	stack gas, solid phase	ICP-AES	mg/Nm3			0.140 R		0.264 R	0.224 R
Strontium	stack gas, vapor phase	ICP-AES	mg/Nm3			< 0.00110		< 0.000661	< 0 00102
Styrene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0 0139	< 0.0105			
Styrene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Styrene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Styrene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Sulfate	collected fly ash	IC	mg/kg			4650			
Sulfur	bottom ash	XRF	mg/kg			*120*	*120*	*120*	*120*
Sulfur	collected fly ash	XRF	mg/kg			841	360	120	120
Tantalum	bottom ash	NAA	ug/g					1.54	
Tantalum	coal	NAA	ug/g, dry			0.436	0.233	0.185	0.256
Tantalum	collected fly ash	NAA	ug/g					2.79	
Tantalum	high dust gas, particulates	NAA	ug/g					1.05	
Tantalum	stack gas, particulates	NAA	ug/g					0.685	
Terbium	bottom ash	NAA	ug/g					1.23	
Terbium	coal	NAA	ug/g, dry			0.381	0.282	0.263	0.287
Terbium	collected fly ash	NAA	ug/g					2.56	
Terbium	high dust gas, particulates	NAA	ug/g					1.24 R	
Terbium	stack gas, particulates	NAA	ug/g					0.618 R	
Tetrachloroethene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Tetrachloroethene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Tetrachloroethene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Tetrachloroethene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Thallium	bottom ash	ICP-AES	mg/kg			< 100	< 100	< 100	< 100
Thallium	bottom ash sluice water	ICP-AES	mg/L			< 0.100	< 0.100	< 0.100	< 0.100
Thallium	coal	ICP-AES	mg/kg, dry			< 10.4	< 10.4	< 10.4	< 10.5
Thallium	collected fly ash	ICP-AES	mg/kg			< 100	< 100	< 100	< 100
Thallium	high dust gas, particulates	ICP-AES	mg/kg			< 88.1 R		< 104 R	< 107 R
Thallium	high dust gas, solid phase	ICP-AES	mg/Nm3			< 0.586 R		< 0.538 R	< 0.587 R
Thallium	high dust gas, vapor phase	ICP-AES	mg/Nm3			< 0.0435		< 0.0466	< 0.0450
Thallium	sluice water supply	ICP-AES	mg/L			< 0.100	< 0.100	< 0.100	< 0.100

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Thallium	stack gas, particulates	ICP-AES	mg/kg			< 135		< 83.0	< 113
Thallium	stack gas, solid phase	ICP-AES	mg/Nm3			< 0.0174		< 0.0290	< 0.0295
Thallium	stack gas, *vapor phase*	ICP-AES	mg/Nm3			< 0.0366		< 0.0384	< 0.0341
Thorium	bottom ash	NAA	ug/g					18.4	
Thorium	coal	NAA	ug/g, dry			4.43	3.30	3.42	3.09
Thorium	collected fly ash	NAA	ug/g					28.1	
Thorium	high dust gas, particulates	NAA	ug/g					13.9 R	
Thorium	stack gas, particulates	NAA	ug/g					7.93 R	
Tin	bottom ash	NAA	ug/g					< 10.0	
Tin	coal	NAA	ug/g, dry			< 15.6	< 15.6	< 15.7	< 15.8
Tin	collected fly ash	NAA	ug/g					< 10.0	
Tin	high dust gas, particulates	NAA	ug/g					< 10.0	
Tin	stack gas, particulates	NAA	ug/g					< 10.0	
Titanium	bottom ash	ICP-AES	mg/kg			7220	7210	7130	7120
Titanium	bottom ash	NAA	ug/g					8179	
Titanium	coal	ICP-AES	mg/kg, dry			617	469	601	429
Titanium	collected fly ash	ICP-AES	mg/kg			6550	6640	6420	6420
Titanium	collected fly ash	NAA	ug/g					6055	
Titanium	*high dust gas, particulates*	NAA	ug/g					3924	
Titanium	stack gas, particulates	NAA	ug/g					1751 R	
Toluene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Toluene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Toluene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Toluene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
trans-1,2-Dichloroethene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
trans-1,2-Dichloroethene	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
trans-1,2-Dichloroethene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
trans-1,2-Dichloroethene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
trans-1,2-Dichloroethene	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	< 0.000569	< 0.000542			
trans-1,2-Dichloroethene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
trans-1,3-Dichloropropene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
trans-1,3-Dichloropropene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
trans-1,3-Dichloropropene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
trans-1,3-Dichloropropene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Trichloroethene	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Trichloroethene	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Trichloroethene	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Trichloroethene	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Trichlorofluoromethane	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Trichlorofluoromethane	high dust gas, 20-L VOST	GCMS	mg/Nm3	< 0.000525	< 0.000543	< 0.000559			
Trichlorofluoromethane	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Trichlorofluoromethane	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Trichlorofluoromethane	stack gas, 20-L VOST	GCMS	mg/Nm3	< 0.000580	0.000910 @	< 0.000542			
Trichlorofluoromethane	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	0.00295 @	< 0.00218			
Tungsten	bottom ash	NAA	ug/g					< 5.00	
Tungsten	coal	NAA	ug/g, dry			< 10.4	< 10.4	< 10.4	< 10.5
Tungsten	collected fly ash	NAA	ug/g					< 1.50	
Tungsten	high dust gas, particulates	NAA	ug/g					< 1.50	
Tungsten	stack gas, particulates	NAA	ug/g					< 1.50	
Uranium	bottom ash	NAA	ug/g					8.21	
Uranium	coal	NAA	ug/g, dry			1.57	1.72	1.84	1.48
Uranium	collected fly ash	NAA	ug/g					9.49	
Uranium	high dust gas, particulates	NAA	ug/g					5.15	
Uranium	stack gas, particulates	NAA	ug/g					4.27 R	
Vanadium	bottom ash	NAA	ug/g					223	
Vanadium	coal	ICP-AES	mg/kg, dry			25.2	21.4	28.5	20.8
Vanadium	collected fly ash	NAA	ug/g					257	
Vanadium	high dust gas, particulates	NAA	ug/g					152	
Vanadium	stack gas, particulates	NAA	ug/g					110 R	
Vinyl acetate	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.0887	< 0.139	< 0.105			
Vinyl acetate	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.0202	< 0.0211	< 0.0226			
Vinyl acetate	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.115	< 0.114	< 0.110			
Vinyl acetate	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.0231	< 0.0227	< 0.0218			
Vinyl chloride	high dust gas, 1-L VOST	GCMS	mg/Nm3	< 0.00887	< 0.0139	< 0.0105			
Vinyl chloride	high dust gas, 5-L VOST	GCMS	mg/Nm3	< 0.00202	< 0.00211	< 0.00226			
Vinyl chloride	stack gas, 1-L VOST	GCMS	mg/Nm3	< 0.0115	< 0.0114	< 0.0110			
Vinyl chloride	stack gas, 5-L VOST	GCMS	mg/Nm3	< 0.00231	< 0.00227	< 0.00218			
Ytterbium	bottom ash	NAA	ug/g					< 1.02	
Ytterbium	coal	NAA	ug/g, dry			< 0.457	0.479	1.34	0.541
Ytterbium	collected fly ash	NAA	ug/g					5.82	
Ytterbium	high dust gas, particulates	NAA	ug/g					3.74 R	
Ytterbium	stack gas, particulates	NAA	ug/g					1.85 R	
Zinc	bottom ash	ICP-AES	mg/kg			32.6 @	29.9 @	28.3 @	24.3 @
Zinc	bottom ash	NAA	ug/g					37.7	
Zinc	bottom ash sluice water	ICP-AES	mg/L			< 0.0200	< 0.0200	< 0.0200	0.0230 @
Zinc	coal	ICP-AES	mg/kg, dry			15.4	9.75 @	14.7	14.9
Zinc	coal	NAA	ug/g, dry			23.2	15.7	19.0	13.8
Zinc	collected fly ash	ICP-AES	mg/kg			90.5 @	86.1 @	86.1 @	97.0 @

Table C-1: Site 16 OFA Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 1	Run 2	Run 3	Run 3D	Run 4	Run 5
Zinc	collected fly ash	NAA	ug/g					107	
Zinc	high dust gas, particulates	ICP-AES	mg/kg			131 R		137 R	138 R
Zinc	high dust gas, particulates	NAA	ug/g					50.4 R	
Zinc	high dust gas, solid phase	ICP-AES	mg/Nm3			0.871 R		0.705 R	0.754 R
Zinc	high dust gas, vapor phase	ICP-AES	mg/Nm3			0.431		0.371	1.43
Zinc	sluice water supply	ICP-AES	mg/L			0.0430 @	0.0360 @	0.0410 @	0.0370 @
Zinc	stack gas, particulates	ICP-AES	mg/kg			237 R		197 R	268 R
Zinc	stack gas, particulates	NAA	ug/g					57.2 R	
Zinc	stack gas, solid phase	ICP-AES	mg/Nm3			0.0305 R		0.0687 R	0.0698 R
Zinc	stack gas, vapor phase	ICP-AES	mg/Nm3			0.696		0.243	< 0.00681
Zirconium	bottom ash	NAA	ug/g					189	
Zirconium	coal	NAA	ug/g, dry			76.0	< 50.3	66.7	63.3
Zirconium	collected fly ash	NAA	ug/g					< 376	
Zirconium	high dust gas, particulates	NAA	ug/g					175 R	
Zirconium	stack gas, particulates	NAA	ug/g					< 116	

30-Oct-93 Table C-2: Site 16 OFA/LNB Data NOT USED in Calculations 1

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
1,2-Dichloroethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
1,3-Dichlorobenzene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
2-Hexanone	Stack gas, VOST	GCMS	ug/Nm3	< 2.94		< 2.94	< 2.89
4-Methyl-2-Pentanone	Stack gas, VOST	GCMS	ug/Nm3	< 2.94		< 2.94	< 2.89
Acetone	Stack gas, VOST	GCMS	ug/Nm3	3.13 @		< 2.94	< 2.89
Arsenic	Bottom ash	ICP-AES	mg/kg, dry	< 159	< 160	< 147	< 154
Arsenic	ESP inlet gas, particulate	ICP-AES	mg/kg	85.8 @	83.6 @	197	164 @
Arsenic	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	444 @	432 @	1124	947 @
Arsenic	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 4.83		< 4.87	< 5.06
Arsenic	Stack gas, particulate	ICP-AES	mg/kg	508		452	592
Arsenic	Stack gas, solid phase	ICP-AES	ug/Nm3	58.2		76.5	78.8
Arsenic	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 4.17		< 3.21	< 4.76
Boron	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	628		708	842
Boron	Stack gas, vapor phase	ICP-AES	ug/Nm3	733		467	820
Bromine	Coal	NAA	mg/kg, dry	5.73	5.59	4.22	4.95
Bromodichloromethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Cadmium	Bottom ash	ICP-AES	mg/kg, dry	< 2.90	4.03 @	3.28 @	2.98 @
Cadmium	ESP inlet gas, particulate	ICP-AES	mg/kg	< 2.93	< 2.91	4.21 @	< 2.89
Cadmium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	< 15.1	< 15.0	24.0 @	< 16.8
Cadmium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	0.382 @		< 0.360	0.176
Cadmium	Stack gas, particulate	ICP-AES	mg/kg	12.8		15.8	18.7
Cadmium	Stack gas, solid phase	ICP-AES	ug/Nm3	1.47		2.68	2.49
Cadmium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.308		< 0.237	< 0.352
Cerium	Coal	NAA	mg/kg, dry	17.1	15.1	23.3	16.1
Cesium	Coal	NAA	mg/kg, dry	1.37	1.11	2.05	1.03
Chlorine	Coal	NAA	mg/kg, dry	473	448	417	320
Chromium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 0.525		1.51 @	1.86 @
Chromium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.454		< 0.349	0.725 @
Dibromochloromethane	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Europium	Coal	NAA	mg/kg, dry	0.328	0.315	0.490	0.348
Hafnium	Coal	NAA	mg/kg, dry	0.699	0.681	1.09	0.728
Iodine	Coal	NAA	mg/kg, dry	0.233	0.214	0.147	0.170
Lanthanum	Coal	NAA	mg/kg, dry	9.74	9.71	12.4	8.46
Lead	Bottom ash	ICP-AES	mg/kg, dry	6.11 @	20.0	9.84 @	3.85 @

Table C-2: Site 16 OFA/LNB Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Lead	ESP inlet gas, particulate	ICP-AES	mg/kg	61.7 @	68.6 @	57.4 @	63.0 @
Lead	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	319 @	355 @	328 @	364 @
Lead	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 5.67		< 5.71	< 5.94
Lead	Stack gas, particulate	ICP-AES	mg/kg	154		120	145
Lead	Stack gas, solid phase	ICP-AES	ug/Nm3	17.7		20.3	19.4
Lead	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 4.90		< 3.77	< 5.59
Lutetium	Coal	NAA	mg/kg, dry	0.148	0.146	0.138	0.138
Magnesium	Bottom ash	ICP-AES	mg/kg, dry	3788	5724	4230	4960
Magnesium	Coal	NAA	mg/kg, dry	538	484	623	685
Magnesium	ESP inlet gas, particulate	ICP-AES	mg/kg	4601	4349	4687	4950
Magnesium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	23809	22502	26737	28650
Magnesium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 4.83		< 4.87	2.30
Magnesium	Stack gas, particulate	ICP-AES	mg/kg	4703		4393	3832
Magnesium	Stack gas, solid phase	ICP-AES	ug/Nm3	539		744	510
Magnesium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 4.17		< 3.21	< 4.76
Mercury	Coal	NAA	mg/kg, dry	0.100	0.0861	0.171	0.116
Neodymium	Coal	NAA	mg/kg, dry	11.1	11.6	18.2	16.8
Nickel	Bottom ash	ICP-AES	mg/kg, dry	88.9	88.5	82.8	84.1
Nickel	ESP inlet gas, particulate	ICP-AES	mg/kg	113	96.6	104	106
Nickel	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	585	500	596	612
Nickel	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 2.08		< 2.09	1.40
Nickel	Stack gas, particulate	ICP-AES	mg/kg	108		96.3	103
Nickel	Stack gas, solid phase	ICP-AES	ug/Nm3	12.3		16.3	13.7
Nickel	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 1.80		< 1.38	< 2.05
Potassium	Bottom ash	ICP-AES	mg/kg, dry	21242	25352	24100	26400
Potassium	Coal	NAA	mg/kg, dry	823	860	1650	739
Potassium	ESP inlet gas, particulate	ICP-AES	mg/kg	19980	20541	21990	21058
Potassium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	103382	106286	125454	121879
Potassium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 77.8		< 78.3	< 81.3
Potassium	Stack gas, particulate	ICP-AES	mg/kg	20713		21556	18629
Potassium	Stack gas, solid phase	ICP-AES	ug/Nm3	2372		3650	2480
Potassium	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 67.1		< 51.7	< 76.6
Rubidium	Coal	NAA	mg/kg, dry	21.8	16.8	25.1	15.0
Samarium	Coal	NAA	mg/kg, dry	1.74	1.78	2.22	1.68

Table C-2: Site 16 OFA/LNB Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Scandium	Coal	NAA	mg/kg, dry	3.58	3.45	4.94	3.54
Selenium	Bottom ash	ICP-AES	mg/kg, dry	< 43.9	< 44.1	44.7 @	< 42.4
Selenium	ESP inlet gas, particulate	ICP-AES	mg/kg	< 178	< 176	< 175	< 176
Selenium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	< 919	< 913	< 999	< 1017
Selenium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 8.83		< 8.89	< 9.23
Selenium	Stack gas, particulate	ICP-AES	mg/kg	160 @		89.3 @	68.8 @
Selenium	Stack gas, solid phase	ICP-AES	ug/Nm3	18.4 @		15.1 @	9.16 @
Selenium	Stack gas, vapor phase	ICP-AES	ug/Nm3	126		122	224
Silicon	Bottom ash	ICP-AES	mg/kg, dry	211423	217304	220000	215000
Silicon	ESP inlet gas, particulate	ICP-AES	mg/kg	297679	241483	270647	247505
Silicon	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	1540288	1249511	1544049	1432516
Silicon	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	609		428	441 @
Silicon	Stack gas, vapor phase	ICP-AES	ug/Nm3	354		402	541
Silver	Bottom ash	ICP-AES	mg/kg, dry	< 1.79	< 1.80	< 1.66	< 1.73
Silver	Coal	NAA	mg/kg, dry	0.201	0.180	0.227	0.262
Silver	ESP inlet gas, particulate	ICP-AES	mg/kg	< 1.82	< 1.80	< 1.79	< 1.80
Silver	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	< 9.40	< 9.33	< 10.2	< 10.4
Silver	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 1.03		0.796	< 1.08
Silver	Stack gas, particulate	ICP-AES	mg/kg	2.27 @		2.65	2.26 @
Silver	Stack gas, solid phase	ICP-AES	ug/Nm3	0.260 @		0.448	0.300 @
Silver	Stack gas, vapor phase	ICP-AES	ug/Nm3	< 0.889		< 0.684	< 1.01
Strontium	Bottom ash	ICP-AES	mg/kg, dry	680	880	778	822
Strontium	Coal	NAA	mg/kg, dry	189	107	72.6	97.2
Strontium	ESP inlet gas, particulate	ICP-AES	mg/kg	941	921	935	945
Strontium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	4871	4765	5336	5470
Strontium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	0.109 @		0.536	0.282 @
Strontium	Stack gas, particulate	ICP-AES	mg/kg	1052		951	910
Strontium	Stack gas, solid phase	ICP-AES	ug/Nm3	120		161	121
Strontium	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.223		0.0978 @	0.108 @
Tantalum	Coal	NAA	mg/kg, dry	0.171	0.167	0.214	0.189
Terbium	Coal	NAA	mg/kg, dry	0.187	0.189	0.284	0.160
Thallium	Bottom ash	ICP-AES	mg/kg, dry	< 68.8	< 69.1	< 63.6	< 66.5
Thallium	ESP inlet gas, particulate	ICP-AES	mg/kg	< 20.2	< 20.0	< 19.9	< 20.0
Thallium	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	< 104	< 104	< 114	< 116

30-Oct-93

Table C-2: Site 16 OFA/LNB Data NOT USED in Calculations

Substance	Stream	Method	UOM	Run 2	Run 2D	Run 3	Run 4
Thallium	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	< 3.57		10.9 @	< 3.74
Thallium	Stack gas, particulate	ICP-AES	mg/kg	< 5.84		< 4.11	< 5.04
Thallium	Stack gas, solid phase	ICP-AES	ug/Nm3	< 0.669		< 0.695	< 0.671
Thallium	Stack gas, vapor phase	ICP-AES	ug/Nm3	4.75 @		2.60 @	5.92 @
Thorium	Coal	NAA	mg/kg, dry	2.30	2.43	3.75	2.45
Tin	Coal	NAA	mg/kg, dry	< 10.5	< 10.5	< 10.4	< 10.3
trans-1,2-Dichloroethene	Stack gas, VOST	GCMS	ug/Nm3	< 0.588		< 0.588	< 0.578
Trichlorofluoromethane	Stack gas, VOST	GCMS	ug/Nm3	4.96		5.31 @	23.3
Tungsten	Coal	NAA	mg/kg, dry	< 5.23	< 5.25	< 5.21	< 5.16
Uranium	Coal	NAA	mg/kg, dry	1.94	1.63	1.87	1.68
Ytterbium	Coal	NAA	mg/kg, dry	0.304	0.327	0.326	0.563
Zinc	Bottom ash	ICP-AES	mg/kg, dry	51.1 @	51.6 @	78.9 @	47.9 @
Zinc	Coal	NAA	mg/kg, dry	17.5	16.5	16.8	14.4
Zinc	ESP inlet gas, particulate	ICP-AES	mg/kg	102	99.2	115	102
Zinc	ESP inlet gas, solid phase	ICP-AES	ug/Nm3	527	513	656	589
Zinc	ESP inlet gas, vapor phase	ICP-AES	ug/Nm3	5.91		16.5	10.8
Zinc	Stack gas, particulate	ICP-AES	mg/kg	245		228	323
Zinc	Stack gas, solid phase	ICP-AES	ug/Nm3	28.0		38.6	42.9
Zinc	Stack gas, vapor phase	ICP-AES	ug/Nm3	0.929 @		0.216 @	< 0.311
Zirconium	Coal	NAA	mg/kg, dry	40.3	89.0	49.0	66.7

APPENDIX D:
ADDITIONAL OVERFIRE AIR TEST RESULTS

This appendix discusses additional results from the OFA test. Specifically, the arsenic, chromium, and mercury speciation results, and the analytical results for size-fractionated particulate matter samples are presented and discussed. These results are not considered valid for the following reasons:

- Arsenic speciation: The spike results showed that As(III) was oxidized to As(V) during sample recovery, preservation, or analysis. This procedure was not used for the OFA/LNB test.
- Chromium speciation: The spike results showed that Cr(VI) was reduced by the flue gas during sample collection, probably to Cr(III). This procedure was not used for the OFA/LNB test; instead, the EPA Cr(VI) method was selected.
- Mercury speciation: The procedure used for the OFA test has since been shown to be invalid. The technique has been changed significantly, and an improved method was used for the OFA/LNB test.
- Size-fractionated particulate matter samples: INAA has been shown to give poor results for this type of sample; therefore, ICP-MS was selected as the technique to analyze the samples collected during the OFA/LNB test.

Each of these topics is discussed in detail below.

Arsenic Speciation

Special stack gas samples were collected during the OFA test to determine the oxidation state of arsenic present in the stack gas and to verify the sampling and analytical methods applied. Studies by EPRI have shown that As(III) and As(V) concentrations can be determined in aqueous samples by adjusting the sample pH during analysis by hydride generation atomic absorption spectrophotometry (HGAAS). This analytical approach was applied to the impinger and extraction solutions for vapor- and particulate-phase samples collected for this test.

Sampling and Analytical Method

Stack gas samples were collected isokinetically at a single point in the stack representative of the overall gas velocity obtained from previous velocity profiles. Three EPA Method 5 samples were collected simultaneously from separate ports to provide triplicate samples for each sampling period. Teflon®-coated fiber filters were used to collect the particulate phase, and an impinger solution of nitric acid and hydrogen peroxide was used to collect vapor-phase arsenic.

Two sets of triplicate samples were collected to determine the concentration of As(III) and As(V) in the stack gas. Two additional sets of triplicate samples were collected using filters previously spiked with two different levels of As(III) and As(V). The purpose of analyzing these samples was to determine the recovery of As(III) and (V) after exposure to flue gas. One set was spiked with aqueous As(III) and (V) solutions to provide 3 μg of arsenic at each oxidation state. A second set was spiked with 15 μg each. Additional filters were spiked at the same levels but not exposed to flue gas. These filters were analyzed to determine spike recoveries without interference from the sample matrix.

The solids present in the sampling probe and nozzle were recovered by rinsing with a solution of 0.1 N sodium hydroxide (reducing-agent free). The filter was recovered from the hot box apparatus and placed in a covered Petri dish and sealed with Teflon® tape. Impinger solutions were transferred to polyethylene bottles. After the sample was recovered, the probe and nozzle rinse samples and impinger solutions were refrigerated at 4° C; the filters were placed in a freezer at approximately -20° C. Samples were shipped to the laboratory on ice by overnight express and refrigerated on arrival.

On the analysis date, the filters were combined with the corresponding probe and nozzle rinse samples and sonicated to solubilize the arsenic in the filtered solids. The leachates were analyzed by HGAAS. As(III) was analyzed directly at an adjusted pH of 6. Total arsenic was determined from the same sample with the pH adjusted to less than one. The concentration of As(V) was determined by subtracting the As(III) values from the total As value.

Arsenic Results and Discussion

Table D-1 shows the arsenic test results for the unspiked samples. Total arsenic averaged 108 μg/Nm^3 and corresponded well with the 112 μg/Nm^3 result obtained by analyzing the multi-metals train samples collected on the two preceding days. However, the test results for As(III) and As(V) are considered suspect because of the poor spike recovery obtained in the analysis of the spiked blank filters. The analytical results from these control samples are presented in Table D-2. The average spike recovery for the As(III) spikes on blank filters was less than 3 percent. The recovery of As(V) on the same filters exceeded 175%, demonstrating the oxidation of As(III) to As(V). Total

Table D-1
Speciation of Arsenic in Stack Particulates - OFA Test

Run No.	Collection Date	Arsenic Concentration (μg/Nm^3)		
		As(III)[a]	As(V)[a]	Total As
1-1	3/7/91	3.25	131	134
1-2	3/7/91	3.14	114	117
1-3	3/7/91	2.63	97.7	100
4-1	3/8/91	3.26	107	111
4-2	3/8/91	2.71	96.7	99.4
4-3	3/8/91	2.52	81.4	83.9
Average		2.92[a]	105[a]	108
95% CI		0.35	18	18

[a] As(III) and As(V) data are suspect because of the very low recovery of As(III) spikes and the very high recoveries of As(V). The conversion of As(III) to As(V) is evident in both sets of control samples.

Table D-2
Arsenic Speciation Control Sample Results - OFA Test

Sample No.	Arsenic(III) Spike Amount (μg)	Arsenic(III) Spike Recovery (%)	Arsenic(V)[a] Spike Amount (μg)	Arsenic(V)[a] Spike Recovery (%)	Total Arsenic Spike Amount (μg)	Total Arsenic Spike Recovery (%)
3 μg Spiked Filters[b]						
1	3	4.7	3	156	6	80.0
2	3	4.3	3	163	6	83.3
3	3	4.3	3	156	6	80.0
4	3	ND(2.0)	3	186	6	93.8
5	3	ND(2.0)	3	192	6	96.8
6	3	ND(2.0)	3	197	6	99.3
Mean	3	2.7	3	175	6	88.9
15 μg Spiked Filters[b]						
1	15	3.7	15	196	30	99.9
2	15	3.9	15	186	30	95.1
3	15	ND(0.4)	15	180	30	90.7
4	15	ND(0.4)	15	195	30	98.0
5	15	ND(0.4)	15	189	30	94.9
6	15	ND(0.4)	15	194	30	97.6
Mean	15	1.4	15	190	30	96.0

[a] Arsenic (V) determined indirectly by subtracting As(III) from total As.
[b] Arsenic species spiked onto blank filters. No flue gas sample was collected.

ND = Not detected. Value in parentheses is based on the detection limit.

arsenic recoveries averaged 88.9% and 96.0% for the 3 μg and 15 μg spikes, respectively. The results for the spiked sample filters are not shown because the spike levels were much too low, compared with the native arsenic concentration in the stack gas, rendering them meaningless.

Because nitric acid/peroxide impinger solutions were not amenable to analysis by HGAAS or speciation, they were analyzed for total arsenic by graphite furnace atomic absorption spectroscopy. Arsenic was not detected in these impinger solutions at a limit of detection of 1.2 $\mu g/Nm^3$.

A problem experienced with the sample sparger in the hydride generation unit during the analysis of As(III) may have contributed to the low As(III) results obtained during this test. However, a review of the QC check samples run during analysis tends to discredit the significance of this equipment problem, and Radian assumes that the poor recovery of As(III) is the result of oxidation to the more stable As(V) valence state. The high recovery of As(V) also supports this assumption.

Greater attention to sample handling, preservation, and preparation techniques will be necessary to maintain the oxidation state of the samples up to the time of analysis. An EPRI study of arsenic speciation in natural waters and sediments suggests that samples should be quick-frozen in liquid nitrogen and maintained at -80° C until analysis. Future sampling efforts should implement this preservation technique.

Chromium Speciation

Stack gas samples were collected during the OFA test to determine chromium concentrations in the +6 oxidation state. A modified version of California's Air Resources Board (CARB) Method 425 was used at this site. This method has been undergoing field application studies for detecting and quantifying Cr(VI) emissions in flue gas at several coal-fired generating stations. The method validation test results at this site are presented in this section.

Sampling and Analytical Methods

Three individual sampling trains were used to simultaneously collect triplicate sample sets from three sampling points of average flue gas velocity. Samples were collected isokinetically with Teflon®-coated filters used to separate the particulate material from the vapor phase. Unspiked filters and filters spiked with Cr(VI) were used to determine the efficacy of the sampling and analytical procedure. Instead of sodium hydroxide impingers being used to collect vapor-phase Cr(VI), impingers containing nitric acid/hydrogen peroxide solution were used to collect total vapor-phase chromium. Previous experience with impinger collection techniques for Cr(VI) in the presence of SO_2 have been unsuccessful.

Five sample sets were collected over a two-day period. Two sample sets (one each day) were collected on unspiked filters for determining the baseline Cr(VI) concentration in the particulate phase. The other sample sets were collected on filters pre-spiked with potassium dichromate solution to a level of 7.6 micrograms of Cr(VI). Additional filters were spiked at 1.25 μg, 6.25 μg, and 25 μg of Cr(VI) for spike recovery tests and sample degradation studies.

Particulate material was recovered from the sampling trains by rinsing the probe and nozzle with a solution of 0.1 N sodium hydroxide (reducing agent free). The particulate filters were recovered and immediately placed into the probe and nozzle rinse samples. The total volume was then adjusted to 100 mL and quantified gravimetrically. The samples were well mixed for approximately 30 minutes to extract Cr(VI) from the particulate material. Filtered aliquots of the extracts were then reacted with diphenylcarbazide reagent to produce a colored Cr(VI) complex suitable for spectrophotometric analysis.

Blank and pre-spiked filters not subjected to flue gas were extracted and analyzed alongside the samples to determine extraction efficiency and background corrections. To determine potential holding times for the samples, 18 pre-spiked filters of each spiking level (1.25, 6.25, and 25 μg) were collected for a time-related degradation study. Six filters of each Cr(VI) level were analyzed after one day, one week, and one month of storage under ambient conditions.

Chromium (VI) Results and Discussion

Table D-3 shows the results of Cr(VI) analyses for the spiked and unspiked filters used to sample the flue gas particulate material. Each series of three runs represents three samples obtained simultaneously using three stack sampling trains. The Series 1 runs provide an estimate of the Cr(VI) particulate material on the first day of sampling. The filters used contained no spike. The mean (± 95% confidence interval) particulate matter Cr(VI) concentration was 5.4 ± 1.9 $\mu g/Nm^3$. The Series 4 runs found the mean flue gas particulate matter Cr(VI) concentration to be 3.0 ± 4.5 $\mu g/Nm^3$. The mean particulate-phase total chromium concentration in the stack gas, as measured by the multi-metals train, was 44 ± 37 $\mu g/Nm^3$. These results show that about 10% of the particulate-phase total chromium was attributed Cr(VI).

Table D-3 also shows the detailed results for the spiked filters exposed to flue gas. The Series 2 results were obtained when the particulate filter was spiked with the medium spike before sampling on March 7. The Series 3 and Series 5 filters were obtained in the same way, except the sampling was performed on March 8. Because the daily flue gas particulate matter Cr(VI) values differ, the daily values were used to calculate expected filter Cr(VI) weights for spiked filters on the corresponding days. Comparison of the expected quantity of Cr(VI) on the filter with the measured Cr(VI) by the candidate method shows that, in every case, the measured Cr(VI) was less than the expected value. The mean recovery was 30 ± 38 percent.

Table D-3
Cr(VI) Measurement in Stack Particulate - OFA Test

		Filter Preparation			Cr(VI) Expected on Filter				
Run No.	Collection Date	Cr(VI) Spike[a]	Flue Gas Sampled (Nm^3)	Cr(VI) Measured on Filter (μg)	Spike (μg)	Flue Gas (μg)	Total (μg)	Cr(VI) Concentration ($\mu g/Nm^3$)	Spike Recovery (%)
1-1	3/7/91	None	1.57	8.1				5.2	
1-2	3/7/91	None	1.58	7.5				4.7	
1-3	3/7/91	None	1.55	9.6				6.2	
4-1	3/7/91	None	1.56	5.0				3.2	
4-2	3/7/91	None	1.60	NA				NA	
4-2	3/7/91	None	1.57	4.3				2.7	
Mean								4.4	
95% CI								1.8	
2-1	3/7/91	Medium	1.52	9.4	7.6	8.2	15.8		16
2-2	3/7/91	Medium	1.56	6.2	7.6	8.4	16.0		-29
2-3	3/7/91	Medium	1.57	3.7	7.6	8.4	16.0		-62
3-1	3/8/91	Medium	1.55	7.7	7.6	4.6	12.2		41
3-2	3/8/91	Medium	1.59	11.5	7.6	4.7	12.3		89
3-3	3/8/91	Medium	1.56	11.6	7.6	4.6	12.2		92
5-1	3/8/91	Medium	1.30	7.0	7.6	3.9	11.5		41
5-2	3/8/91	Medium	1.53	7.4	7.6	4.5	12.1		38
5-3	3/8/91	Medium	1.30	7.4	7.6	3.9	11.5		46
Mean									30
95% CI									38

[a] Spikes were made to filter before sampling.

NA = Not Analyzed.

Table D-4 shows the results of the sample degradation study. Cr(VI) was spiked onto the blank filters at low, medium, and high levels. The results indicate the variability in the spiking and analysis at each of the three spiking levels. The results also show that there is no significant difference in the amount of Cr(VI) on the filters after one day after one month of storage. Filters spiked at the same time as the medium-level spiked filters in this test were used to conduct flue gas testing at Site 16. The results in Table D-4 show that the best estimate of the amount of Cr(VI) on these medium-spiked filters is 7.6 μg.

Chromium (VI) (as potassium dichromate) spiked onto clean, Teflon®-coated filters, can easily be extracted and analyzed with close to 100% recovery at a level comparable to the amount of Cr(VI) detected in the particulate matter collected on unspiked filters from the flue gas at this site. However, when spiked filters are exposed to a large quantity of flue gas, the recoveries of these medium-level spikes are highly variable. The high degree of variability and the poor spike recoveries associated with pre-spiked sample results have been the primary concern when evaluating the data from this and other test sites. The low recoveries suggest that the Cr(VI) collected on the filter is being reduced to Cr(III) during sampling.

Mercury Speciation

Samples of stack gas were collected during the OFA test to characterize the forms of mercury being emitted from a coal-fired utility boiler and to validate the sampling and analytical methods applied. Elemental mercury (Hg^0), inorganic ionic mercury (Hg^{2+}), and methyl mercury (compounds such as CH_3HgCl) were the targeted species. The analysis was conducted by Brooks Rand, Ltd. in Seattle, Washington. This technique, developed by EPRI contractor Nicholas Bloom (formerly with Brooks Rand), was in the early stages of development when the OFA test was conducted.

Sampling and Analytical Methods

Four stack gas samples were collected non-isokinetically from a single port with a special impinger train. A Teflon® tube was inserted into the stack port and directed towards the gas stream for sample collection. The sampling train was designed for in-stack filtration of particulates from the gas stream before bubbling the gas through a solution of 1.0 N potassium chloride (KCl) and on through a series of iodated-charcoal sorbent tubes. The purpose of the KCl impinger solution is to collect water-soluble forms of mercury such as CH_3Hg and Hg^{2+}, and the charcoal sorbent is used to collect elemental mercury.

Three Teflon® filters and one ashed, quartz-fiber filter were used in an effort to compare the effects of the filtering media on sample recovery and analysis. Three Teflon® impingers, each with approximately 100 mL of 1.0 N KCl solution, were placed in an ice bath during sample collection, and three iodated-charcoal sorbent tubes followed in

Table D-4
Cr(VI) Spiked Filter Degradation Results - OFA Test

	Cr(VI) Measured on Filter (μg)		
Target Cr(VI) Level[a]	**One Day**	**One Week**	**One Month**
Low (1.25 μg)	0.91	0.94	1.18
	0.89	0.89	1.14
	0.84	0.85	0.87
	0.91	0.75	1.21
	0.91	0.89	1.18
	0.84	0.99	1.18
	0.88 ± 0.04[b]	0.89 ± 0.09	1.13 ± 0.13
Medium (6.25 μg)	7.91	7.69	7.11
	7.84	7.83	8.10
	7.42	8.01	7.07
	7.42	--	7.68
	7.69	--	7.98
	7.34	--	7.41
	7.60 ± 0.25	7.84 ± 0.40	7.56 ± 0.46
High (25 μg)	27.4	28.6	29.1
	26.1	27.1	29.3
	27.7	28.4	28.0
	27.9	29.2	29.5
	27.4	28.8	28.2
	28.2	28.6	29.4
	27.4 ± 0.8	28.4 ± 0.8	28.9 ± 0.7

[a] Cr(VI) spiked onto a blank filter. No flue gas sample was collected.

[b] Mean ± 95% CI.

series to complete each sampling train. All connecting pieces of the sampling train were made of Teflon®.

Impinger samples were combined in Teflon® bottles and refrigerated immediately after collection. Filters were placed in separate sealed containers and also refrigerated. Charcoal sorbent tubes were left connected with the ends capped and refrigerated after collection. All samples were packed on ice and sent by next day air to the laboratory. At the laboratory, the impinger samples were preserved with the addition of 10 mL/L of HCl and the filters were transferred to a freezer.

Aqueous (impinger) samples were first analyzed for ionic mercury by the direct reduction of a small aliquot with $SnCl_2$, purging onto gold, and analysis by cold vapor atomic fluorescence spectroscopy (CVAFS). The remaining sample was then divided into aliquots for methyl mercury extraction and total mercury analysis.

For the methyl mercury extractions, one sample was extracted in triplicate and the others were performed in duplicate. Approximately 40-mL aliquots were accurately weighed into Teflon® bottles, the volume was brought to exactly 60 mL with deionized water, and the samples were extracted by shaking overnight with 40 mL of methylene chloride. The methylene chloride layer was then separated, and 50 mL of deionized water was added. The methylene chloride was removed by boiling off at 60° C and then sparging with nitrogen. The methyl mercury, thus transferred to pure water, was analyzed by aqueous-phase ethylation, cryogenic gas chromatography, and CVAFS detection.

The remaining aliquots of impinger samples were cold oxidized with BrCl and analyzed for total mercury by the techniques described for ionic mercury analysis.

The filters were pre-digested in 5 mL of 6N HCl for 24 hours and then diluted to 18.2 mL in Teflon® vials. A small aliquot (100 μL) of this digestate was analyzed for ionic mercury and another aliquot (25 μL) for methyl mercury by the methods previously described. The remainder of the sample was then cold oxidized with BrCl (0.5 mL/18.2 mL). A 1-mL aliquot of this digestate was analyzed for total mercury by the method described above.

The iodated-charcoal sorbent media was recovered from the tubes and placed into 18.2-mL Teflon® vials with 5 mL of 7:3 HNO_3/H_2SO_4. The samples were digested for three hours at 70° C in sealed containers, cooled, and diluted to 18.2 mL. Aliquots of these digestates were analyzed for total mercury, as described above.

Mercury Results and Discussion

Table D-5 presents the stack gas mercury concentrations determined by the Brooks Rand sampling system. For comparison, the results from the multi-metals train samples

Table D-5
Speciation of Mercury in Stack Gas - OFA Test

	Mercury Concentration, $\mu g/Nm^3$						
Component	**Run 6a 3/7/91**	**Run 6b 3/7/91**	**Run 7a 3/8/91**	**Run 7b 3/8/91**	**Mean**	**95% CI**	**Percent of Vapor Hg**
Brooks Rand Sampling Train							
Particulate Phase	0.021	0.008	0.011	0.025	0.016	0.013	--
Vapor Phase	0.59	2.7	1.5	1.7	1.6	1.4	--
Ionic Inorganic Hg	ND(0.02)	0.24	0.90	1.1	0.56	0.83	35%
Elemental Hg	0.57	2.5	0.56	0.55	1.0	1.5	65%
Methyl Hg	0.018	0.002	0.005	0.008	0.008	0.011	0.5%
Total	0.61	2.7	1.5	1.7	1.6	1.4	--

	Run 3 3/5/91	**Run 4 3/6/91**	**Run 5 3/6/91**	**Mean**	**95% CI**	**Percent of Vapor Hg**
Multi-Metals Train						
Particulate Phase	0.13	0.54	0.37	0.35	0.51	--
Vapor Phase	6.6	7.2	7.6	7.1	1.2	--
Ionic Hg[a]	5.3	6.6	6.6	6.2	1.9	87%
Elemental Hg[b]	1.3	0.60	0.96	0.95	0.87	13%
Total	6.7	7.7	7.9	7.5	1.6	--

[a] Mercury captured in the HNO_3/H_2O_2 impingers.

[b] Mercury captured in the $H_2SO_4/KMnO_4$ impingers.

collected during the preceding two days are also provided. The mean total mercury concentrations are 1.6 ± 1.4 $\mu g/Nm^3$ for the Brooks Rand train and 7.5 ± 1.6 $\mu g/Nm^3$ for the multi-metals train. The multi-metals results agree much better with the coal measurements (71 ± 27 percent material balance closure), suggesting that the Brooks Rand results are biased very low.

The mercury speciation technique used for the OFA test was declared invalid by Nicholas Bloom in a communication to EPRI on July 7, 1993. The main problem with the system was the loss of mercury by condensation in the Teflon® tubing ahead of the KCl impingers. Also, some analytical interferences were presented by the KCl solution.

A much improved sampling system was used for the OFA/LNB test, the results of which were discussed in Section 3. The improvements included using heated quartz tubing ahead of the mercury traps (to prevent condensation) and a KCl/soda lime solid sorbent to replace the KCl impingers.

Size-Fractionated Particulate Matter Samples

Particulate matter samples were collected with particle sizing devices at both the ESP inlet and the stack during the OFA test. Specific size fractions were analyzed for metals by INAA.

Sampling and Analysis Methods

Stack particulate matter fractions were collected with a University of Washington Mark 5 cascade impactor to provide four particle size fractions: <0.8, 0.8-1.8, 1.8-12, and >12 μm. The samples were collected isokinetically at a fixed point in the stack. Because of the low particulate loading at the stack, samples collected over three days (March 5-7, 1991) were combined to produce a single set of four fractions for analysis.

At the ESP inlet, size-fractionated particulate matter was collected using an Anderson High Capacity Stack Sampler in four approximate particle sizes: <2, 2-7, 7-13, and >13 μm. The samples were collected isokinetically at a fixed point in the ESP inlet duct. Three sets of ESP inlet samples were submitted for analysis.

Following collection, the samples were desiccated and weighed until a constant weight was obtained. The samples were then analyzed as-collected using INAA. For those samples collected on a substrate, the entire substrate was placed in the analysis vial. Blank Kapton (polyamide) films, quartz filters, and glass fiber thimbles were analyzed so that the background concentrations of metals in these substrates could be subtracted from the sample values. All the results were corrected for the blank results for the substrates.

Size Fraction Results and Discussion

Table D-6 presents the results for the stack particulate matter, and Tables D-7, D-8, and D-9 show the results for the ESP inlet particulate matter. High background concentrations of aluminum, arsenic, barium, calcium, chromium, and manganese were observed in the blank glass fiber thimbles; therefore, those blank corrections were the most significant.

For the major elements such as aluminum, calcium, iron, and titanium and the non-volatile trace elements such as barium, cobalt, manganese, nickel, and vanadium, relatively constant levels are expected in all of the size fractions. These elements should appear in the particulate matter at levels approximately equal to their concentrations in the ash fraction of the coal. However, many anomalous results can be seen in Tables D-6 through D-9.

Two ash standards were analyzed in the same batch as the samples. Ash masses of roughly 10 mg and 100 mg were chosen to approximate the masses of particulate matter found in the samples. As shown in Table D-10, the recoveries were, in general, poor. Of the 13 elements with a certified value, only one element (titanium) had a recovery in the acceptable range of 75-125% for both sample sizes. In addition, there is no consistent pattern in the recoveries. Many of the elements show high recoveries in one sample but low recoveries in the other.

The analysis of particulate matter samples by INAA was attempted for one other test site in the FCEM project, with similar findings. As a result, INAA is not considered a reliable technique for accurately determining the composition of small quantities of particulate matter. A different procedure, microwave digestion followed by ICP-MS, was used successfully to analyze the samples collected during the OFA/LNB test.

Table D-6
Elemental Analysis of Stack Particulate Matter Fractions - OFA Test
Samples Collected March 5-7, 1993

Sample No.	**UWST4**	**UWST3**	**UWST2**	**UWST1**
Sample ID	Stage 4	Stage 3	Stage 2	Stage 1
dP50 Size Range	<0.8 μm	0.8-1.8 μm	1.8-12 μm	>12 μm
Substrate	Quartz Filter	Kapton	Kapton	Quartz Filter
Mass Collected, g	0.012	0.008	0.046	0.088
% of Total Mass, g	8	5	30	57
Mass Analyzed, g	0.012	0.008	0.046	0.088
Gas Volume, Nm^3	0.9057	0.9057	0.9057	0.9057

Elemental Conc., mg/kg				
Aluminum	150,000	180,000	41,000	43,000
Calcium	8,300	20,000	7,600	7,500
Iron	130,000	200,000	50,000	67,000
Titanium	11,000	15,000	3,300	2,700
Arsenic	3,000	ND(12)	390	130
Barium	3,500	3,800	1,100	2,200
Cadmium	ND(130)	ND(110)	ND(28)	ND(18)
Chromium	660	1,100	280	270
Cobalt	130	210	59	44
Copper	2,500	1,600	330	410
Manganese	320	190	50	65
Mercury	ND(8)	ND(63)	1	ND(1.1)
Molybdenum	NC	3,000	ND(10)	NC
Nickel	320	640	120	210
Selenium	830	930	150	140
Vanadium	1,200	1,100	220	100

Table D-7
Elemental Analysis of ESP Inlet Particulate Matter Fractions - OFA Test
Samples Collected March 5, 1991

Sample No.	**12**	**11**	**10**	**9**
Sample ID	Stage 4	Stage 3	Stage 2	Stage 1
dP50 Size Range	<2.1 μm	2.1-7.5 μm	7.5-14 μm	>14 μm
Substrate	Glass Thimble	None	None	None
Mass Collected, g	0.1288	0.32	0.461	3.492
% of Total Mass, g	3	7	11	79
Mass Analyzed, g	0.1288	0.1226	0.1906	0.4399
Gas Volume, Nm^3	0.6465	0.6465	0.6455	0.6465
Elemental Conc., mg/kg				
Aluminum	NC	160,000	160,000	130,000
Calcium	93,000	18,000	13,000	8,900
Iron	24,000	100,000	89,000	69,000
Titanium	ND(1,400)	11,000	9,800	7,200
Arsenic	1,600	660	280	63
Barium	540,000	1,700	1,300	750
Cadmium	ND(220)	ND(34)	ND(24)	ND(12)
Chromium	600	500	240	110
Cobalt	23	110	82	38
Copper	ND(6,400)	690	740	ND(370)
Manganese	34	240	190	130
Mercury	9.3	ND(3.4)	ND(2.4)	ND(1.2)
Molybdenum	110	180	56	ND(6.3)
Nickel	ND(640)	130	61	26
Selenium	480	28	19	23
Vanadium	570	630	430	220

Table D-8
Elemental Analysis of ESP Inlet Particulate Matter Fractions - OFA Test
Sample Collected March 6, 1991

Sample No.	**16**	**15**	**14**	**13**
Sample ID	Stage 4	Stage 3	Stage 2	Stage 1
dP50 Size Range	<2.1 μm	2.1-7.3 μm	7.3-13 μm	>13 μm
Substrate	Glass Thimble	None	None	None
Mass Collected, g	0.1288	0.269	0.263	2.155
% of Total Mass, g	1	10	10	79
Mass Analyzed, g	0.1288	0.1995	0.2232	0.4978
Gas Volume, Nm^3	0.4935	0.4935	0.4935	0.4935

Elemental Conc., mg/kg				
Aluminum	NC	150,000	140,000	126,000
Calcium	ND(19,000)	15,000	17,000	8,400
Iron	1,000,000	93,000	99,000	84,000
Titanium	12,000	9,700	8,400	6,500
Arsenic	2,000	480	280	60
Barium	140,000	1,600	1,500	1,000
Cadmium	ND(370)	ND(25)	ND(22)	ND(18)
Chromium	4,000	370	260	120
Cobalt	2,500	89	84	49
Copper	ND(4,900)	600	760	310
Manganese	110	250	210	130
Mercury	7	ND(2.4)	ND(2.2)	ND(1.8)
Molybdenum	1,200	97	65	ND(9.3)
Nickel	64,000	110	72	ND(39)
Selenium	5,500	26	29	11
Vanadium	760	560	380	200

Table D-9
Elemental Analysis of ESP Inlet Particulate Matter Fractions - OFA Test
Samples Collected on March 7, 1991

Sample No.	**484**	**483**	**482**	**481**
Sample ID	Stage 4	Stage 3	Stage 2	Stage 1
dP50 Size Range	<2.0 μm	2.0-7.0 μm	7.0-13 μm	>13 μm
Substrate	Glass Thimble	None	None	None
Mass Collected, g	0.0646	0.499	0.553	3.871
% of Total Mass, g	1	10	11	78
Mass Analyzed, g	0.0646	0.1563	0.201	0.5022
Gas Volume, Nm^3	0.7764	0.7764	0.7764	0.7764

Elemental Conc., mg/kg				
Aluminum	NC	150,000	150,000	150,000
Calcium	260,000	13,000	14,000	8,000
Iron	87,000	130,000	120,000	93,000
Titanium	ND(28,000)	10,000	8,900	6,500
Arsenic	5,300	760	420	88
Barium	1,200,000	2,600	1,800	960
Cadmium	ND(450)	ND(36)	ND(29)	ND(20)
Chromium	1,500	580	270	120
Cobalt	88	140	120	50
Copper	ND(13,000)	980	780	ND(590)
Manganese	34	ND(9.0)	160	120
Mercury	NC	ND(3.8)	ND(3.1)	ND(2.1)
Molybdenum	670	88	42	ND(7.5)
Nickel	ND(1,300)	640	310	ND(150)
Selenium	2,000	26	17	6.7
Vanadium	1,500	640	450	260

Table D-10
INAA Analysis of Standard Reference Material (SRM) Ash

Element	Reference Value (mg/kg)	0.096g Sample Recovery (%)	0.1013g Sample Recovery (%)
Aluminum	146,000	139	115
Calcium	18,600	149	38
Iron	55,700	149	48
Titanium	13,700	123	99
Arsenic	56.9	113	48
Barium	711	201	61
Cadmium	3.06	ND	ND
Chromium	183	158	47
Cobalt	49.8	153	53
Copper	157	ND	ND
Manganese	381	95	73
Nickel	117	ND	42
Vanadium	375	137	116

APPENDIX E: UNCERTAINTY FORMULAS

An error propagation analysis was performed on calculated results to determine the contribution of process, sampling, and analytical variability, and measurement bias, to the overall uncertainty in the result. This uncertainty was determined by propagating the bias and precision error of individual parameters through the calculation of the results. This uncertainty does not represent the total uncertainty in the result since many important bias errors are unknown and have been assigned a value of zero for this analysis. Also, this uncertainty is only for the period of time that the measurements were taken.

This method is based on ANSI/ASME PTC 19.1-1985, "Measurement Uncertainty."

Nomenclature

r = Calculated result;
S_{pi} = Sample standard deviation of parameter i;
θ_i = Sensitivity of the result to parameter i;
β_{pi} = Bias error estimate for parameter i;
v_i = Degrees of freedom in parameter i;
v_r = Degrees of freedom in result;
S_r = Precision component of result uncertainty;
β_r = Bias component of result uncertainty;
t = Student "t" factor (two-tailed distribution at 95% confidence);
U_r = Uncertainty in r; and
N_i = Number of measurements of parameter i.

For a result, r, the uncertainty in r is calculated as:

$$U_r = \sqrt{\beta_r^2 + (S_r * t)^2} \qquad \text{(eq. 1)}$$

The components are calculated by combining the errors in the parameters used in the result calculation.

$$\beta_r = \sqrt{\sum_{i=1}^{j} (\theta_i * \beta_{\overline{pi}})^2} \qquad \text{(eq. 2)}$$

$$S_r = \sqrt{\sum_{i=1}^{j} (\theta_i * S_{\overline{pi}})^2} \qquad \text{(eq. 3)}$$

The sensitivity of the result to each parameter is found from a Taylor series estimation method:

$$\theta_i = \frac{\partial r}{\partial pi} \qquad \text{(eq. 4)}$$

Or using a perturbation method (useful in computer applications):

$$\theta_i = \frac{r(P_i + \Delta P_i) - r(P_i)}{\Delta P_i} \qquad \text{(eq. 5)}$$

Equation 5 was applied to the calculations in this report. The perturbation selected for each parameter was the larger of the normalized standard deviation, $S_{\overline{pi}}$, or the bias, β_{pi}.

The standard deviation of the average for each parameter is calculated as:

$$S_{\overline{pi}} = \frac{S_{pi}}{\sqrt{N}} \qquad \text{(eq. 6)}$$

The degrees of freedom for each parameter is found from

$$v_i = N_i - 1 \qquad \text{(eq. 7)}$$

and the degrees of freedom for the result is found by weighing the sensitivity and precision error in each parameter.

$$v_r = \frac{S_r^4}{\sum_{i=1}^{j} \left[\frac{(S_{\overline{pi}} \times \theta_i)^4}{v_i} \right]} \qquad \text{(eq. 8)}$$

The student "t" in Equation 1 is associated with the degrees of freedom in the result.

The precision error terms are easily generated from the collected data. The bias error terms are more difficult to quantify. The following conventions were used for this report:

- 5% bias on coal and ash flow rates.
- No bias in gas flow rates.
- No bias in analytical results if the result is greater than the detection limit. One-half of the detection limit is used for both the parameter value and its bias in calculations if the result is below the detection limit.

Assignment of the flow rate bias values is based on engineering judgment. No bias is assigned to the analytical results (above the detection limit) or gas flow rate since a good estimate for magnitude of these terms is unknown. These bias terms may be very large (relative to the mean values of the parameters) and may represent a large amount of unaccounted uncertainty in each result. Analytical bias near the instrument detection limit may be especially large. The uncertainty values calculated for this report are, therefore, subject to these limitations.

The calculations assume that the population distribution of each measurement is normal and that the samples collected reflect the true population. Also, the uncertainty calculated is only for the average value over the sampling period. The uncertainty does not represent long-term process variations. In other words, the calculated uncertainty does not include a term to reflect the fact that the sampled system may not have been operating (and emitting) at conditions equivalent to the average conditions for that system over a longer period.

Improvements in bias estimates will be made as more data are collected and the QA/QC database is expanded. Spike and standard recoveries can be used to estimate analytical bias. Also, as the analytical methods improve, accuracy will improve, resulting in the true bias of the analytical results being closer to the zero bias now assigned. Accounting for long-term system variability will require repeated sampling trips to the same location.

APPENDIX F: QA/QC RESULTS

Table F.1-1

SUMMARY OF BLANK SAMPLE RESULTS FOR SITE 16

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Semivolatile Organics				
Lab Blanks (MM5)	1	0		
Field Blanks (MM5)	2			
Dibutylphthalate		2	0.83-106 ug	10 ug
Diethylphthalate		1	1.81 ug	10 ug
Bis(2-Ethylhexyl) phthalate		2	1.53-2.44 ug	10 ug
Naphthalene		1	2.05 ug	10 ug
Trip Blanks	2			
Dibutylphthalate		1	13.8 ug	10 ug
Diethylphthalate		1	3.32 ug	10 ug
Bis(2-Ethylhexyl) phthalate		2	1.64-26.3 ug	10 ug
Naphthalene		1	1.82 ug	10 ug
Semivolatile Organics (Solids)				
Lab Blanks	1			
Dibutylphthalate		1	0.104 ug/g	1 ug
Semivolatile Organics (Waters)				
Lab Blanks	1	0		
Field Blanks	1	0		
VOST				
Lab Blanks	4	0		
Field Blank - ESP Inlet	3			
Trichlorofluoromethane		1	25 ng	10 ng
Methylene Chloride		1	26 ng	10 ng
Field Blanks - Stack	3			
Trichlorofluoromethane		1	23 ng	10 ng
Methylene Chloride		1	410 ng	10 ng

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Aldehydes				
Lab Blanks	1			
Formaldehyde		1	1.32 ug	0.48 ug
Field Blanks	1			
Formaldehyde		1	5.4 ug	2.4 ug
Trip Blanks	1			
Formaldehyde		1	3.06 ug	0.95 ug
Chloride				
Lab Blanks (Solids)	1	0		
Lab Blanks (Filters)	1	0		
Lab Blanks (Impingers)	1	0		
Lab Blanks (Waters)	1	0		
Field Blanks (Filters)	1	1	4.34 ug	
Trip Blanks (Filters)	1	1	3.75 ug	
Field Blanks (Impingers)	1	0		
Trip Blanks (Impingers)	1	1	0.0864 mg/L	0.036 mg/L
Field Blanks (Waters)	1	0		
Fluoride				
Lab Blanks (Solids)				
Lab Blanks (Filters)				
Lab Blanks (Impingers)	1	0		
Lab Blanks (Waters)	1	0		
Field Blanks (Filters)				
Trip Blanks (Filters)				
Field Blanks (Impingers)	1	0		
Trip Blanks (Impingers)	1	0		
Field Blanks (Waters)	1	0		

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Phosphate				
Lab Blanks (Solids)	1	0		
Lab Blanks (Filters)	1	0		
Lab Blanks (Impingers)	1	0		
Lab Blanks (Waters)	1	0		
Field Blanks (Filters)	1	0		
Trip Blanks (Filters)	2	0		
Field Blanks (Impingers)	1	1	0.228 mg/L	0.30 mg/L
Trip Blanks (Impingers)	1	0		
Field Blanks (Waters)	1	0		
Sulfate				
Lab Blanks (Solids)	1	0		
Lab Blanks (Filters)	1	0		
Lab Blanks (Impingers)	1	0		
Lab Blanks (Waters)	1	1		
Field Blanks (Filters)	1	1	0.0421 mg	0.0035 mg
Trip Blanks (Filters)	2	2	0.0398-0.052 mg	0.008 mg
Field Blanks (Impingers)	1	1	2.04 mg/L	2.4 mg/L
Trip Blanks (Impingers)	1	0		
Field Blanks (Waters)	1	0		
Metals (ICP) - Coal				
Lab Blanks				
Aluminum	1	1	3.65 mg/kg	20 mg/kg
Barium	1	1	0.01 mg/kg	1.0 mg/kg
Calcium	1	1	2.32 mg/kg	100 mg/kg
Chromium	1	1	0.500 mg/kg	1.0 mg/kg
Cobalt	1	1	0.17 mg/kg	1.0 mg/kg
Copper	1	1	0.18 mg/kg	2.0 mg/kg
Iron	1	1	3.91 mg/kg	4.0 mg/kg
Magnesium	1	1	1.04 mg/kg	100 mg/kg
Manganese	1	1	0.07 mg/kg	1.0 mg/kg

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Coal (Cont'd)				
Molybdenum	1	1	6.95 mg/kg	5.0 mg/kg
Nickel	1	1	0.92 mg/kg	2.0 mg/kg
Potassium	1	1	1.53 mg/kg	300 mg/kg
Sodium	1	1	4.90 mg/kg	100 mg/kg
Titanium	1	1	0.47 mg/kg	5.0 mg/kg
Thallium	1	1	0.27 mg/kg	10 mg/kg
Vanadium	1	1	0.99 mg/kg	2.0 mg/kg
Zinc	1	1	0.80 mg/kg	2.0 mg/kg
Metals (GFAAS, HGAAS, CVAAS) - Coal				
Arsenic	1	0		
Cadmium	1	0		
Lead	1	0		
Mercury	1	0		
Selenium	1	0		
Metals (ICP) - Filters				
Field Blanks	1			
Aluminum		1	232 ug	20 ug
Barium		1	6.75 ug	1.0 ug
Calcium		1	101 ug	100 ug
Chromium		1	2.13 ug	1.0 ug
Copper		1	0.986 ug	2.0 ug
Iron		1	35 ug	4.0 ug
Magnesium		1	16.6 ug	100 ug
Manganese		1	1.28 ug	1.0 ug
Molybdenum		1	29.2 ug	5.0 ug
Nickel		1	2.10 ug	2.0 ug
Potassium		1	17.0 ug	300 ug
Sodium		1	110 ug	100 ug
Titanium		1	2.3 ug	0.30 ug

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Filters (Cont'd)				
Vanadium		1	0.900 ug	2.0 ug
Zinc		1	3.74 ug	2.0 ug
Metals (GFAAS, HGAAS, CVAAS) - Filters				
Field Blanks	1			
Arsenic		1	0.16 ug	0.40 ug
Cadmium		0		
Lead		1	0.56 ug	0.30 ug
Mercury		1	0.0082 ug	0.018 ug
Selenium		0		
Metals (ICP) - Filters				
Trip Blanks	1			
Aluminum		1	230 ug	20 ug
Barium		1	6.27 ug	1.0 ug
Calcium		1	114 ug	100 ug
Chromium		1	2.06 ug	1.0 ug
Copper		1	1.3 ug	2.0 ug
Iron		1	32.4 ug	4.0 ug
Magnesium		1	14.9 ug	100 ug
Manganese		1	1.17 ug	1.0 ug
Molybdenum		1	29.6 ug	5.0 ug
Nickel		1	1.95 ug	2.0 ug
Silicon		1	330000 ug	1000 ug
Sodium		1	105 ug	300 ug
Strontium		1	2.27 ug	0.3 ug
Vanadium		1	0.931 ug	2.0 ug
Zinc		1	3.03 ug	2.0 ug

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (GFAAS, HGAAS, CVAAS) - Filters				
Trip Blanks	1			
Arsenic		1	0.13 ug	0.4 ug
Cadmium		0		
Lead		1	0.57 ug	0.030 ug
Mercury		1	0.0424 ug	0.018 ug
Selenium		0		
Metals (ICP) - Probe and Nozzle Rinse				
Field Blanks	1			
Aluminum		1	6.51 ug	20 ug
Barium		1	1.46 ug	1.0 ug
Calcium		1	17.7 ug	100 ug
Chromium		1	0.53 ug	1.0 ug
Cobalt		1	0.129 ug	1.0 ug
Copper		1	0.3 ug	2.0 ug
Iron		1	30.8 ug	4.0 ug
Magnesium		1	4.47 ug	100 ug
Manganese		1	0.139 ug	1.0 ug
Molybdenum		1	0.894 ug	5.0 ug
Nickel		1	0.700 ug	2.0 ug
Silicon		1	18500 ug	1000 ug
Sodium		1	71 ug	300 ug
Strontium		1	0.692 ug	0.3 ug
Vanadium		1	0.128 ug	2.0 ug
Zinc		1	1.22 ug	2.0 ug
Metals (GFAAS, HGAAS, CVAAS) - Probe and Nozzle Rinse				
Field Blanks	1			
Arsenic		1	0.63 ug	0.4 ug
Cadmium		0	0.100 ug	0.1 ug

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (GFAAS, HGAAS, CVAAS) - Probe and Nozzle Rinse (Cont'd)				
Lead		1	0.50 ug	0.3 ug
Mercury		0		
Selenium		0		
Metals (ICP) - Probe and Nozzle Rinse				
Trip Blanks	1			
Barium		1	0.0652 ug	1.0 ug
Beryllium		1	0.149 ug	0.2 ug
Calcium		1	25.1 ug	100 ug
Chromium		1	0.179 ug	1.0 ug
Copper		1	0.34 ug	2.0 ug
Iron		1	2.58 ug	4.0 ug
Magnesium		1	7.16 ug	100 ug
Manganese		1	0.142 ug	1 ug
Silicon		1	19000 ug	1000 ug
Sodium		1	48.2 ug	100 ug
Strontium		1	0.235 ug	0.3 ug
Thallium		1	0.903 ug	10 ug
Zinc		1	0.905 ug	2.0 ug
Metals (GFAAS, HGAAS, CVAAS) - Probe and Nozzle Rinse				
Trip Blanks	1			
Arsenic		1	0.14 ug	0.4 ug
Cadmium		1	0.17 ug	0.1 ug
Lead		0		
Mercury		1	0.0302 ug	0.009 ug
Selenium		0		

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Impinger Solutions				
Field Blanks	2			
Aluminum		2	0.213-0.228 mg/L	0.2 mg/L
Antimony		2	0.001-0.042 mg/L	0.1 mg/L
Barium		2	0.003-0.006 mg/L	0.01 mg/L
Calcium		2	0.145-0.154 mg/L	1.0 mg/L
Chromium		2	0.003-0.005 mg/L	0.01 mg/L
Cobalt		1	0.006 mg/L	0.01 mg/L
Copper		2	0.004-0.007 mg/L	0.02 mg/L
Iron		2	0.058-0.063 mg/L	0.04 mg/L
Magnesium		2	0.005-0.039 mg/L	1.0 mg/L
Manganese		2	0.017-0.025 mg/L	0.01 mg/L
Molybdenum		2	0.054 mg/L	0.05 mg/L
Nickel		2	0.016-0.017 mg/L	0.02 mg/L
Potassium		2	0.124-0.30 mg/L	3.0 mg/L
Silicon		2	0.578-0.975 mg/L	1.0 mg/L
Silver		2	0.001 mg/L	0.01 mg/L
Sodium		2	0.35-0.564 mg/L	1.0 mg/L
Strontium		2	0.009-0.0012 mg/L	0.003 mg/L
Thallium		2	0.049-0.064 mg/L	0.1 mg/L
Vanadium		2	0.006-0.008 mg/L	0.02 mg/L
Zinc		2	46-47.6 mg/L	0.02 mg/L
Metals (GFAAS, HGAAS, CVAAS) - Impinger Solutions				
Field Blanks	2			
Arsenic		2	0.0010-0.0011 mg/L	0.004 mg/L
Cadmium		2	0.0007-0.0009 mg/L	0.001 mg/L
Lead		2	0.0068-0.0122 mg/L	0.003 mg/L
Mercury		0		
Selenium		0		

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Impinger Solutions				
Trip Blanks	1			
Aluminum		1	0.206 mg/L	0.2 mg/L
Barium		1	0.005 mg/L	0.01 mg/L
Calcium		1	0.039 mg/L	1.0 mg/L
Chromium		1	0.005 mg/L	0.01 mg/L
Copper		1	0.015 mg/L	0.02 mg/L
Iron		1	0.027 mg/L	0.04 mg/L
Magnesium		1	0.016 mg/L	1.0 mg/L
Manganese		1	0.02 mg/L	0.01 mg/L
Molybdenum		1	0.059 mg/L	0.05 mg/L
Nickel		1	0.022 mg/L	0.02 mg/L
Potassium		1	0.244 mg/L	3.0 mg/L
Silicon		1	0.152 mg/L	1.0 mg/L
Sodium		1	0.197 mg/L	1.0 mg/L
Strontium		1	0.0009 mg/L	0.003 mg/L
Thallium		1	0.081 mg/L	0.1 mg/L
Vanadium		1	0.007 mg/L	0.02 mg/L
Zinc		1	53.7 mg/L	0.02 mg/L
Metals (GFAAS, HGAAS, CVAAS) - Impinger Solutions				
Trip Blanks	1			
Arsenic		1	0.0001 mg/L	0.004 mg/L
Cadmium		1	0.0014 mg/L	0.001 mg/L
Lead		1	0.015 mg/L	0.003 mg/L
Mercury		0		
Selenium		0		
Metals (ICP) - Impinger Solutions				
Lab Blanks	1			
Antimony		1	0.005 mg/L	0.1 mg/L
Calcium		1	0.036 mg/L	1.0 mg/L
Cobalt		1	0.002 mg/L	0.01 mg/L

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Impinger Solutions (Cont'd)				
Copper		1	0.002 mg/L	0.02 mg/L
Magnesium		1	0.001 mg/L	1.0 mg/L
Silicon		1	0.055 mg/L	1.0 mg/L
Zinc		1	0.015 mg/L	0.02 mg/L
Metals (GFAAS, HGAAS, CVAAS) - Impinger Solutions				
Lab Blanks	1			
Arsenic		1	0.005 mg/L	0.004 mg/L
Cadmium		1	0.006 mg/L	0.001 mg/L
Lead		1	0.0049 mg/L	0.003 mg/L
Mercury		0		
Selenium		0		
Metals (ICP) - Solid Samples				
Lab Blanks	1			
Beryllium		1	2.4 mg/kg	2.0 mg/kg
Chromium		1	20.7 mg/kg	10 mg/kg
Molybdenum		1	58 mg/kg	50 mg/ kg
Silicon		1	159000 mg/kg	10000 mg/kg
Silver			56.4 mg/kg	40 mg/kg
Metals (ICP) - Water Samples				
Lab Blanks	1			
Antimony		1	0.035 mg/L	0.10 mg/L
Cobalt		1	0.002 mg/L	0.01 mg/L
Copper		1	0.001 mg/L	0.02 mg/L
Magnesium		1	0.001 mg/L	0.01 mg/L
Manganese		1	0.037 mg/L	0.05 mg/L
Sodium		1	0.198 mg/L	1 mg/L

Table F.1-1

(Continued)

Analyte Grouping	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected	Method Detection Limits
Metals (ICP) - Water Samples (Cont'd)				
Vanadium		1	0.004 mg/L	0.02 mg/L
Zinc		1	0.001 mg/L	0.001 mg/L
Metals (GFAAS, HGAAS, CVAAS) - Water Samples				
Lab Blanks	1			
Arsenic		0		
Cadmium		0		
Metals (GFAAS, HGAAS, CVAAS) - Water Samples (Cont'd)				
Lead		0		
Mercury		0		
Selenium		0		

Table F.1-2

SUMMARY OF QUALITY CONTROL CHECK SAMPLE RESULTS FOR SITE 16

Parameter	No. QCCS	Avg. % Rec.	Std. Dev.	No. Below Limits	No. Above Limits
Semi-Volatile Organics:					
Acenaphthene	2	66	2.8	0	0
4-Chloro-3-methylphenol	2	78	0.71	0	0
2-Chlorophenol	2	84	0.71	0	0
1,4-Dichlorobenzene	2	86	0.71	0	0
2,4-Dinitrotoluene	2	68	3.5	0	0
N-Nitrosodipropylamine	2	80	0.71	0	0
4-Nitrophenol	2	74	2.8	0	0
Pentachlorophenol	2	114	0	0	0
Phenol	2	78	2.1	0	0
Pyrene	2	82	0.71	0	0
1,2,4-Trichlorobenzene	2	94	0	0	0
Volatile Organics (VOST):					
Chloromethane	2	52	0.7	0	0
Vinyl Chloride	2	71	5.6	0	0
Bromomethane	2	76	3.5	0	0
Chloromethane	2	81	1.4	0	0
Trichlorofluoromethane	2	80	4.9	0	0
1,1-Dichloroethene	2	80	3.5	0	0
Carbon Disulfide	2	93	4.2	0	0
Acetone	2	94	21.9	0	0
Methylene Chloride	2	83	2.8	0	0
trans-1,2-Dichloroethene	2	82	2.1	0	0
1,1-Dichloroethane	2	90	6.4	0	0
Vinyl Acetate	2	69	53.7	0	0
2-Butanone	2	103	15.6	0	0
Chloroform	2	93	7.1	0	0
1,1,1-Trichloroethane	2	78	0.7	0	0
Carbon Tetrachloride	2	78	6.4	0	0
Benzene	2	90	14.1	0	0
1,2-Dichloroethane	2	116	14.1	0	0
Trichloroethene	2	105	19.8	0	0

Table F.1-2

(Continued)

Parameter	No. QCCS	Avg. % Rec.	Std. Dev.	No. Below Limits	No. Above Limits
Volatile Organics (VOST) (Cont'd):					
1,2-Dichloropropane	2	106	13.4	0	0
Bromodichloromethane	2	100	2.1	0	0
trans-1,3-Dichloroprypene	2	105	9.9	0	0
4-Methyl-2-Pentanone	2	74	5.6	0	0
Toluene	2	96	2.1	0	0
cis-1,3-Dichloropropane	2	82	11.3	0	0
1,1,2-Trichloroethane	2	121	14.1	0	0
Tetrachloroethene	2	80	13.4	0	0
2-Hexanone	2	102	1.41	0	0
Dibromochloromethane	2	102	0.7	0	0
Chlorobenzene	2	94	1.4	0	0
Ethyl Benzene	2	86	2.1	0	0
m,p-Xylene	2	87	2.8	0	0
o-Xylene	2	104	9.2	0	0
Styrene	2	120	4.2	0	0
Bromoform	2	120	2.1	0	0
1,1,2,2-Tetrachloroethane	2	94	36.1	0	0
1,3-Dichlorobenzene	2	96	7.1	0	0
1,4-Dichlorobenzene	2	96	9.2	0	0
1,2-Dichlorobenzene	2	93	2.8	0	0
Anions:					
Fluoride - Aqueous	1	98	-	0	0
Fluoride - Solids	3	111	11.3		
Phosphate - Aqueous	1	105	-		
Phosphate - Solids	1	101	-		
Metals (Predigestion Spike into Reagent Water):					
Aluminum	5	92	1.6	0	0
Antimony	5	84	15.5	1	0
Barium	5	95	3.7	0	0
Beryllium	5	89	4.3	0	0

Table F.1-2

(Continued)

Parameter	No. QCCS	Avg. % Rec.	Std. Dev.	No. Below Limits	No. Above Limits
Metals (Predigestion Spike into Reagent Water) (Cont'd):					
Calcium	5	94	3.3	0	0
Chromium	5	94	4.4	0	0
Cobalt	5	94	4.2	0	0
Copper	5	95	5.2	0	0
Iron	5	93	3.4	0	0
Magnesium	5	90	2.2	0	0
Manganese	5	92	4.1	0	0
Molybdenum	5	107	26.3	0	1
Nickel	5	93	6.1	0	0
Potassium	5	92	6.8	0	0
Silicon	5	708	1038	0	1
Silver	5	31	33.6	3	0
Sodium	5	94	3.2	0	0
Strontium	5	95	3.0	0	0
Thallium	5	79	44.6	0	0
Titanium	4	89	4.1	0	0
Vanadium	5	93	4.1	0	0
Zinc	5	89	6.0	0	0
Metals by GFAAS and HGAAS (Predigestion Spike into Reagent Water):					
Arsenic	4	98	16.4	1	0
Cadmium	5	100	26.0	1	1
Lead	5	111	13.0	0	1
Selenium	2	79	17.0	1	0
Metals-ICAPES (NBS Fly Ash 1633A):					
Aluminum	2	91	1.1	0	0
Barium	2	82	3.7	0	0
Beryllium	2	91	4.4	0	0
Calcium	2	90	3.3	0	0
Chromium	2	93	6.4	0	0
Cobalt	2	108	8.3	0	0

Table F.1-2

(Continued)

Parameter	No. QCCS	Avg. % Rec.	Std. Dev.	No. Below Limits	No. Above Limits
Metals-ICAPES (NBS Fly Ash 1633A) (Cont'd):					
Copper	2	91	4.4	0	0
Iron	2	91	0	0	0
Magnesium	2	86	3.5	0	0
Manganese	2	88	0	0	0
Molybdenum	1	266	-	0	1
Nickel	2	94	0	0	0
Silicon	1	166	24.8	0	2
Sodium	2	92	5.4	0	0
Strontium	2	89	6.7	0	0
Titanium	2	95	1.0	0	0
Vanadium	2	92	1.1	0	0
Zinc	2	88	1.1	0	0
Metals -GFAAS, HGAAS, and CVAAS (NBS Fly Ash 1633A)					
Arsenic	1	143	-	1	1
Cadmium	1	150	-	1	1
Mercury	1	69	-	1	0
Lead	1	131	-	0	1
Selenium	2	83	14.4	0	0
Metals-ICAPES (NBS Coal 1632A):					
Aluminum	2	62	36.5	2	0
Barium	2	56	25.6	2	0
Beryllium	2	62	40.4	1	0
Calcium	2	107	29.5	0	1
Cobalt	1	114	-	0	0
Iron	2	78	14.2	1	0
Manganese	2	76	7.9	1	0
Nickel	2	260	116	0	1
Potassium	2	76	11.9	1	0
Sodium	2	92	16.4	0	0
Thallium	1	100	-	0	0

Table F.1-2

(Continued)

Parameter	No. QCCS	Avg. % Rec.	Std. Dev.	No. Below Limits	No. Above Limits
Metals-ICAPES (NBS Coal 1632A): (Cont'd)					
Titanium	1	88	-	0	0
Strontium	1	46	-	1	0
Zinc	1	87	-	0	0
Metals -GFAAS (NBS Coal 1633A)					
Arsenic	2	288	144	0	2
Lead	2	58	17.2	2	1
Selenium	2	62	9.7	2	0

Table F.1-3

SUMMARY OF SPIKED SAMPLE RESULTS FOR SITE 16

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Semivolatile Organics - Bottom Ash:					
Acenaphthene	2	64	7.8	0	0
4-Chloro-3-methylphenol	2	82	3.6	0	0
2-Chlorophenol	2	82	6.1	0	0
1,4-Dichlorobenzene	2	88	6.8	0	0
2,4-Dinitrotoluene	2	68	4.4	0	0
N-Nitrosodipropylamine	2	80	6.2	0	0
4-Nitrophenol	2	63	0	0	0
Pentachlorophenol	2	96	5.2	0	0
Phenol	2	84	3.6	0	0
Pyrene	2	125	11.2	0	0
1,2,4-Trichlorobenzene	2	94	3.2	0	0
Anions:					
Chloride - Solids	4	94	4.8	0	0
Chloride - Water	1	100	-	0	0
Fluoride - Gas	1	103	-	0	0
Fluoride - Solids	5	77	23.2	2	0
Fluoride - Waters	2	100	11.3	0	0
Phosphate - Waters	1	105	-	0	0
Phosphate - Solids	1	76	-	0	0
Metals by ICP in ESP Inlet Gas (Impinger Solutions):					
Aluminum	2	92	0	0	0
Antimony	2	86	1.2	0	0
Barium	2	94	1.1	0	0
Beryllium	2	96	1.0	0	0
Boron	2	90	1.1	0	0
Calcium	2	96	0	0	0
Chromium	2	92	0	0	0
Cobalt	2	92	1.1	0	0
Copper	2	91	0	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by ICP in ESP Inlet Gas (Impinger Solutions): (Cont'd)					
Iron	2	96	0	0	0
Magnesium	2	90	1.1	0	0
Manganese	2	91	1.1	0	0
Molybdenum	2	94	1.2	0	0
Nickel	2	94	1.1	0	0
Potassium	2	86	1.2	0	0
Silicon	2	98	1.0	0	0
Silver	2	86	1.2	0	0
Sodium	2	92	0	0	0
Strontium	2	95	2.1	0	0
Thallium	2	93	3.2	0	0
Titanium	2	94	1.1	0	0
Vanadium	2	92	0	0	0
Zinc	2	40	100	2	0
Metals by GFAAS, HGAAS, and CVAAS in Impinger Solutions:					
Arsenic	2	74	1.3	1	0
Cadmium	2	106	7.5	0	0
Lead	2	74	1.3	2	0
Mercury	2	98	0	0	0
Selenium	2	70	5.1	2	0
Metals by ICP in Stack Gas (Probe and Nozzle Rinse):					
Antimony	2	84	2.4	0	0
Barium	2	94	1.0	0	0
Beryllium	2	86	0	0	0
Chromium	2	95	1.0	0	0
Cobalt	2	96	2.1	0	0
Copper	2	92	61.10	0	0
Manganese	2	91	0	0	0
Molybdenum	2	95	0	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by ICP in Stack Gas (Probe and Nozzle Rinse) (Cont'd):					
Nickel	2	92	4.3	0	0
Silver	2	0	NC	2	0
Strontium	2	93	2.2	0	0
Thallium	2	91	2.2	0	0
Titanium	2	92	1.1	0	0
Vanadium	2	94	0	0	0
Zinc	2	86	0	0	0
Metals by GFAAS in Stack Gas (Probe and Nozzle Rinse):					
Selenium	2	72	62.80	2	0
Metals by ICP in ESP Inlet Gas (Filter):					
Aluminum	2	63	15.9	2	0
Antimony	2	80	11.2	0	0
Barium	2	80	6.2	0	0
Beryllium	2	74	4.0	1	0
Calcium	2	88	4.5	0	0
Chromium	2	83	2.4	0	0
Cobalt	2	85	2.4	0	0
Copper	2	84	3.6	0	0
Iron	2	72	4.1	2	0
Magnesium	2	77	7.8	1	0
Manganese	2	84	6.0	0	0
Molybdenum	2	79	25	0	0
Nickel	2	82	1.2	0	0
Potassium	2	86	2.3	0	0
Silver	2	11	18.2	2	0
Sodium	2	90	5.6	0	0
Strontium	2	68	10.4	2	0
Thallium	2	82	11.0	0	0
Titanium	2	78	2.6	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by ICP in ESP Inlet Gas (Filter): (Cont'd)					
Vanadium	2	83	2.4	0	0
Zinc	2	80	2.5	0	0
Metals by GFAAS, HGAAS, and CVAAS in ESP Inlet Gas (Filter):					
Arsenic	2	71	2.8	2	0
Cadmium	2	91	2.2	0	0
Lead	2	92	1.1	0	0
Mercury	2	310	2.9	0	2
Selenium	2	92	13.0	0	0
Metals by ICP in Coal:					
Aluminum	4	106	50	1	1
Antimony	4	92	5.0	0	0
Barium	4	102	7.5	0	0
Beryllium	4	84	5.4	0	0
Calcium	4	119	20.2	0	2
Chromium	4	86	14.6	1	0
Cobalt	4	94	3.9	0	0
Copper	4	98	33.1	2	1
Iron	4	52.5	49	2	0
Magnesium	4	83	13.4	1	0
Manganese	4	95	2.6	0	0
Molybdenum	4	95	2.9	0	0
Nickel	4	88	19.9	1	0
Potassium	4	99	9.0	0	0
Silver	4	12.6	7.4	4	0
Sodium	4	94	2.1	0	0
Strontium	4	109	9.1	0	0
Thallium	4	97	7.6	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by ICP in Coal: (Cont'd)					
Vanadium	4	97	4.2	0	0
Zinc	4	88	3.3	0	0
Metals by GFAAS, HGAAS, and CVAAS in Coal:					
Arsenic	4	108	8.3	0	0
Cadmium	4	99	12.3	0	0
Lead	4	116	32.3	0	2
Mercury	4	57	21.5	2	0
Selenium	4	110	15.9	0	1
Metals by ICP in Fly Ash:					
Aluminum	2	57	21.1	2	0
Antimony	2	68	10.4	2	0
Barium	2	80	7.5	0	0
Beryllium	2	80	0	0	0
Calcium	2	75	8.0	1	0
Chromium	2	86	0	0	0
Cobalt	2	90	1.1	0	0
Copper	2	90	0	0	0
Iron	2	82	4.9	0	0
Magnesium	2	61	9.8	2	0
Manganese	2	82	2.4	0	0
Molybdenum	2	84	3.6	0	0
Nickel	2	88	1.1	0	0
Potassium	2	92	1.1	0	0
Silver	2	25	20	2	0
Sodium	2	80	2.5	0	0
Strontium	2	68	14.7	2	0
Thallium	2	96	1.0	0	0
Vanadium	2	88	0	0	0
Zinc	2	85	5.9	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by GFAAS, HGAAS, and CVAAS in Fly Ash:					
Arsenic	2	89	11.2	0	0
Cadmium	2	150	5.3	0	2
Lead	2	67	20.9	2	0
Mercury	2	97	2.1	0	0
Selenium	2	88	0	0	0
Metals by ICP in Bottom Ash Sluice Water:					
Aluminum	2	97	0	0	0
Antimony	2	92	0	0	0
Barium	2	97	1.0	0	0
Beryllium	2	96	0	0	0
Boron	2	96	1.0	0	0
Calcium	2	98	6.1	0	0
Chromium	2	94	1.1	0	0
Cobalt	2	94	0	0	0
Copper	2	94	0	0	0
Iron	2	96	1.1	0	0
Magnesium	2	94	1.1	0	0
Manganese	2	94	1.1	0	0
Molybdenum	2	92	1.1	0	0
Nickel	2	94	1.1	0	0
Potassium	2	94	1.1	0	0
Silicon	2	105	1.9	0	0
Silver	2	93	0	0	0
Sodium	2	97	21	0	0
Strontium	2	96	1.0	0	0
Thallium	2	96	0	0	0
Vanadium	2	93	0	0	0
Zinc	2	92	1.1	0	0

Table F.1-3

(Continued)

Compound	No. of Spikes	% Recovery	Mean RPD (Std. Dev.)	No. Below Limits	No. Above Limits
Metals by ICP in Sluice Water Supply:					
Aluminum	2	99	1.0	0	0
Antimony	2	90	1.1	0	0
Barium	2	96	1.0	0	0
Beryllium	2	96	1.1	0	0
Boron	2	96	0	0	0
Calcium	2	98	5.1	0	0
Chromium	2	94	1.1	0	0
Cobalt	2	94	1.1	0	0
Copper	2	94	1.1	0	0
Iron	2	95	1.1	0	0
Magnesium	2	95	0	0	0
Manganese	2	94	1.1	0	0
Molybdenum	2	92	1.1	0	0
Nickel	2	96	1.0	0	0
Potassium	2	102	1.0	0	0
Silicon	2	108	1.0	0	0
Silver	2	92	1.1	0	0
Sodium	2	97	0	0	0
Strontium	2	96	0	0	0
Thallium	2	94	3.3	0	0
Vanadium	2	93	2.2	0	0
Zinc	2	92	1.1	0	0

Table F.1-4

SUMMARY OF SURROGATE RECOVERIES FOR VOLATILE ORGANIC ANALYSES

Site 16	No. of Analyses	Mean % Rec.	Std. Dev.	No. Below Limits	No. Above Limits	QC Limits %
ESP Inlet Gas (VOST):						
1,4-Bromofluorobenzene	9	103	11.9	0	0	50-150
1,2-Dichloroethane-d14	9	92	13.4	0	0	50-150
Toluene-d8	9	104	6.2	0	0	50-150
Stack Gas (VOST):						
1,4-Bromofluorobenzene	9	110	15.1	0	1	50-150
1,2-Dichloroethane-d14	9	94	6.6	0	0	50-150
Toluene-d8	9	109	10.6	0	0	50-150
VOST Field Blanks (ESP Inlet):						
1,4-Bromofluorobenzene	3	100	16.2	0	0	50-150
1,2-Dichloroethane-d14	3	90	6.4	0	0	50-150
Toluene-d8	3	105	8.2	0	0	50-150
VOST Field Blanks (Stack):						
1,4-Bromofluorobenzene	3	118	11.2	0	0	50-150
1,2-Dichloroethane-d14	3	94	6.1	0	0	50-150
Toluene-d8	3	109	8.5	0	0	50-150
VOST Lab Blanks:						
1,4-Bromofluorobenzene	4	110	13.6	0	0	50-150
1,2-Dichloroethane-d14	4	92	3.3	0	0	50-150
Toluene-d8	4	110	8.3	0	0	50-150

Table F.1-5

SUMMARY OF SURROGATE RECOVERIES FOR SEMIVOLATILE ORGANIC ANALYSES

Site 16	No. of Analyses	Mean % Rec.	Std. Dev.	No. Below Limits	No. Above Limits	QC Limits %
Gas:						
2-Fluorobiphenyl	12	88	23.2	1	0	30-115
2-Fluorophenol	12	70	23.2	1	0	25-121
Nitrobenzene-d5	12	80	22.5	1	0	23-120
Phenol-d5	12	80	21.7	1	0	24-114
Terphenyl-d14	12	91	31.0	1	0	18-137
2,4,6-Tribromophenol	12	109	32.7	1	4	19-122
Solids:						
2-Fluorobiphenyl	8	102	2.6	0	0	30-115
2-Fluorophenol	8	86	3.4	0	0	25-121
Nitrobenzene-d5	8	92	2.2	0	0	23-120
Phenol-d5	8	91	4.6	0	0	24-114
Terphenyl-d14	8	94	21.4	0	0	18-137
2,4,6-Tribromophenol	8	70	5.2	0	0	19-122
Waters:						
2-Fluorobiphenyl	12	67	7.3	0	0	43-116
2-Fluorophenol	12	65	4.1	0	0	21-100
Nitrobenzene-d5	12	86	5.0	0	0	35-114
Phenol-d5	12	85	2.7	0	0	10-94
Terphenyl-d14	12	130	14.2	0	2	33-141
2,4,6-Tribromophenol	12	81	13.8	0	0	10-123

Table F.1-5

(Continued)

Site 16	No. of Analyses	Mean % Rec.	Std. Dev.	No. Below Limits	No. Above Limits	QC Limits %
Field Blanks - Gas Samples:						
2-Fluorobiphenyl	2	92	1.4	0	0	30-115
2-Fluorophenol	2	51	46.7	1	0	25-121
Nitrobenzene-d5	2	98	3.5	0	0	23-120
Phenol-d5	2	58	54.4	1	0	24-114
Terphenyl-d14	2	89	1.4	0	0	18-137
2,4,6-Tribromophenol	2	64	2.8	0	0	19-122
Trip Blanks - Gas Samples:						
2-Fluorobiphenyl	2	99	8.5	0	0	30-115
2-Fluorophenol	2	72	2.1	0	0	25-121
Nitrobenzene-d5	2	80	6.4	0	0	23-120
Phenol-d5	2	86	6.4	0	0	24-114
Terphenyl-d14	2	96	3.5	0	0	18-137
2,4,6-Tribromophenol	2	85	41.0	0	0	19-122
Lab Blanks - Gas Samples						
2-Fluorobiphenyl	3	99	1.2	0	0	43-116
2-Fluorophenol	3	78	1.2	0	0	21-100
Nitrobenzene-d5	3	84	1.5	0	0	35-114
Phenol-d5	3	89	2.9	0	0	10-94
Terphenyl-d14	3	98	2.1	0	0	33-141
2,4,6-Tribromophenol	3	117	5.3	0	0	10-123

Table F.1-5

(Continued)

Site 16	No. of Analyses	Mean % Rec.	Std. Dev.	No. Below Limits	No. Above Limits	QC Limits %
Lab Blanks - Solid Samples						
2-Fluorobiphenyl	3	101	6.1	0	0	43-116
2-Fluorophenol	3	77	3.1	0	0	21-100
Nitrobenzene-d5	3	95	0.6	0	0	35-114
Phenol-d5	3	94	3.1	0	0	10-94
Terphenyl-d14	3	123	12.6	0	0	33-141
2,4,6-Tribromophenol	3	83	7.6	0	0	10-123
Field Blanks - Water Samples						
2-Fluorobiphenyl	1	80	NC	0	0	43-116
2-Fluorophenol	1	68	NC	0	0	21-100
Nitrobenzene-d5	1	98	NC	0	0	35-114
Phenol-d5	1	88	NC	0	0	10-94
Terphenyl-d14	1	157	NC	0	1	33-141
2,4,6-Tribromophenol	1	66	NC	0	0	10-123
Lab Blanks - Water Samples:						
2-Fluorobiphenyl	1	67	NC	0	0	43-116
2-Fluorophenol	1	66	NC	0	0	21-100
Nitrobenzene-d5	1	70	NC	0	0	35-114
Phenol-d5	1	73	NC	0	0	10-94
Terphenyl-d14	1	90	NC	0	0	33-141
2,4,6-Tribromophenol	1	98	NC	0	0	10-123

Table F.1-6

SUMMARY OF DUPLICATE SAMPLE RESULTS

Site 16	No. of Pairs	Mean	RPD %
Chloride, Phosphate, and Total Phosphorus in Coal (mg/kg):			
Chloride	1	414.7	13.1
Phosphate	1	<30	0
Total Phosphorus	1	42.7	28.9
Chloride, Fluoride, and Total Sulfur in Bottom Ash (mg/kg):			
Chloride	1	<134	>50
Fluoride	1	14.8	23.6
Total Sulfur	1	<0.005	NC
Chloride, Fluoride, and Total Sulfur in Fly Ash (mg/kg):			
Chloride	1	<100	NC
Fluoride	1	84.4	11.2
Total Sulfur	1	0.211	12.8
ICAPES Metals in ESP Inlet Gas Samples:			
Aluminum	1	69450	1.6
Antimony	1	<50	0
Barium	1	555	1.8
Beryllium	1	10.25	2.9
Calcium	1	19550	1.5
Chromium	1	130	0.8
Cobalt	1	31.7	3.8
Copper	1	111.5	1.8
Iron	1	39450	1.8
Magnesium	1	8255	1.6
Manganese	1	65.55	0.5
Molybdenum	1	50.85	0.2
Nickel	1	60.65	1.5
Potassium	1	13850	2.2

Table F.1-6

(Continued)

Site 16	No. of Pairs	Mean	RPD %
ICAPES Metals in ESP Inlet Gas Samples: (Cont'd)			
Silver	1	<5	0
Sodium	1	48800	1.6
Strontium	1	487	2.0
Thallium	1	9.665	NC
Titanium	1	3605	1.9
Vanadium	1	151	2.6
Zinc	1	95.2	0.1
Arsenic and Lead by AAS in ESP Inlet Gas Samples:			
Arsenic	1	164	0
Cadmium	1	0.625	8.0
Lead	1	51.3	5.1
Mercury	1	0.55	18.2
Selenium	1	49.3	2.8
ICAPES Metals in Coal (mg/kg):			
Aluminum	1	9583	2.8
Antimony	1	<10	0
Barium	1	99.6	3.7
Beryllium	1	1.676	2.5
Calcium	1	814	1.3
Chromium	1	21.48	6.8
Cobalt	1	6.438	6.3
Copper	1	47.48	23.9
Iron	1	8252	0.2
Magnesium	1	355.6	2.9
Manganese	1	11.75	0.9
Molybdenum	1	2.305	34.9
Nickel	1	22.95	9.6
Potassium	1	1220	5.4
Silver	1	<1	0
Sodium	1	251.4	1.6

Table F.1-6

(Continued)

Site 16	No. of Pairs	Mean	RPD %
ICAPES Metals in Coal (mg/kg): (Cont'd)			
Strontium	1	1.552	NC
Titanium	1	600	2.8
Vanadium	1	24.52	0
Zinc	1	614.38	6.3
Metals by AAS and CVASS in Coal (mg/kg):			
Arsenic	1	31	1.9
Cadmium	1	<0.1	0
Mercury	1		
Lead	1	4.6	2.2
Selenium	1	1.4	6.9
ICAPES Metals in Bottom Ash (mg/kg):			
Aluminum	1	128500	0.8
Antimony	1	<100	NC
Barium	1	882	2.5
Beryllium	1	11.2	0.9
Calcium	1	7295	1.0
Chromium	1	120	1.7
Cobalt	1	51.3	5.4
Copper	1	94.2	2.1
Iron	1	90550	0.1
Magnesium	1	4490	0.4
Manganese	1	141	1.4
Molybdenum	1	<200	NC
Nickel	1	103.5	1.0
Potassium	1	18315	1.0
Silicon	1	348500	0.3
Silver	1	<40	NC
Sodium	1	2475	8.5
Strontium	1	978	4.5
Thallium	1	<100	NC
Titanium	1	7215	0.1

Table F.1-6

(Continued)

Site 16	No. of Pairs	Mean	RPD %
ICAPES Metals in Bottom Ash (mg/kg): (Cont'd)			
Vanadium	1	212	1.0
Zinc	1	31.25	8.6
Arsenic and Lead by AAS in Bottom Ash (mg/kg):			
Arsenic	1	84.15	6.8
Cadmium	1	<1	NC
Lead	1	21.4	0.5
Mercury	1	<0.045	NC
Selenium	1	<5	NC
ICAPES Metals in Fly Ash (mg/kg):			
Aluminum	1	104500	6.7
Antimony	1	<100	Nc
Barium	1	801	6.5
Beryllium	1	12.6	0
Calcium	1	7585	1.7
Chromium	1	491	157
Cobalt	1	58.95	5.6
Copper	1	153.5	9.8
Iron	1	78600	2.5
Magnesium	1	3305	22.1
Manganese	1	180	55.5
Molybdenum	1	<200	NC
Nickel	1	322	129
Potassium	1	15850	4.4
Silicon	1	310100	1.2
Silver	1	<40	NC
Sodium	1	2336	1.4
Strontium	1	886	6.4
Titanium	1	6595	1.4
Vanadium	1	242	0.4
Zinc	1	88.3	5.0

Table F.1-6

(Continued)

Site 16	No. of Pairs	Mean	RPD %
Metals by AAS and CVASS in Fly Ash (mg/kg):			
Arsenic	1	224	0.4
Cadmium	1	<1	27.0
Mercury	1	0.263	6.8
Lead	1	59.4	64.8
Selenium	1	18.9	64.6
ICAPES Metals in Bottom Ash Sluice Water (mg/L):			
Aluminum	1	0.266	13.2
Antimony	1	<0.1	NC
Barium	1	0.094	1.1
Beryllium	1	0.0007	0
Boron	1	0.1125	6.2
Calcium	1	16.0	0.6
Chromium	1	0.002	NC
Cobalt	1	0.003	NC
Copper	1	0.006	0
Iron	1	0.335	25.1
Magnesium	1	2.84	1.7
Manganese	1	0.05	2.0
Molybdenum	1	<0.05	NC
Nickel	1	0.008	NC
Potassium	1	2.24	2.2
Silicon	1	3.61	2.2
Silver	1	0.002	NC
Sodium	1	5.535	0.54
Strontium	1	0.169	1.1
Titanium	1	<0.1	NC
Vanadium	1	0.003	0
Zinc	1	0.014	NC

Table F.1-6

(Continued)

Site 16	No. of Pairs	Mean	RPD %
ICAPES Metals in Sluice Water Supply (mg/L):			
Aluminum	1	0.688	5.2
Antimony	1	<0.1	NC
Barium	1	0.150	0.7
Beryllium	1	0.0011	NC
Boron	1	0.160	NC
Calcium	1	21.25	1.4
Chromium	1	0.004	0
Cobalt	1	0.008	NC
Copper	1	0.034	NC
Iron	1	0.828	5.4
Magnesium	1	3.58	1.4
Manganese	1	0.092	1.1
Molybdenum	1	<0.05	0
Nickel	1	0.013	NC
Potassium	1	3.46	4.3
Silicon	1	3.96	4.3
Silver	1	0.006	NC
Sodium	1	9.04	0.1
Strontium	1	0.267	0.8
Titanium	1	<0.1	0
Vanadium	1	0.007	NC
Zinc	1	0.02	NC

Table F.1-7

RESULTS OF SITE 16 PERFORMANCE EVALUATION SAMPLE - FLY ASH 1633a ANALYZED BY ICP/AAS AND NEUTRON ACTIVATION

		ICP/AAS		NAA		XRF	
Parameter	Certified Value ug/G	Result ug/g	Rec. %	Result ug/g	Rec. %	Result %	Rec. %
Aluminum	14.3%	12.0%	84	1.33%	90	14.3	102
Antimony	6.8	<100	-	6.199	90		
Barium	0.15%	0.115%	77	0.1839%	122	0.161	107
Beryllium	12	11.0	92	NA	-		
Calcium	1.11%	0.913%	82	1.49%	134	1.06	95
Chromium	196	450	229	182	90		
Cobalt	46	54.8	119	53.1	115		
Copper	118	115	97	<418	-		
Iron	9.4%	8.28%	88	9.58%	102	9.81	104
Magnesium	0.455%	0.336%	76	0.6572%	144	0.452	100
Manganese	179	186	104	160	89	0.079	440
Nickel	127	256	202	162	140		
Potassium	1.88%	1.66%	88	2.53%	134	1.88	100
Silicon	22.85%	34.8%	153	NA	-	23.2	101
Sodium	0.17%	0.156%	92	0.184%	108	0.11	65
Strontium	830	664	80	1021	123	0.27	320
Titanium	0.8%	0.772%	96	0.7259%	90	0.82	103
Vanadium	297	277	93	288	90		
Zinc	220	192	87	202	92		
Arsenic	145	214	148	157	108		
Cadmium	1.00	<1	-	<24.9	-		
Mercury	0.16	0.104	65	<3.6	-		
Lead	72.4	88.2	122	NA	-		
Selenium	10.3	<5	-	10.9	106		

Table F.1-8

SITE 16 PERFORMANCE EVALUATION SAMPLE - FLY ASH 1633a SAMPLE ASPIRATED INTO IMPINGER TRAIN

Parameter	Certified Value ug/G	ICP/AAS Blank Corrected Result ug/g	ICP/AAS Blank Corrected Rec. %	ICP/AAS Not Blank Corrected Result ug/g	ICP/AAS Not Blank Corrected Rec. %
Aluminum	14.3%	9.70%	68	9.93%	69
Antimony	6.8				
Barium	0.15%	940	63	1021	68
Beryllium	12	9.61	80	9.6	80
Calcium	1.11%	8552	77	9723	88
Chromium	196	169	86	195	100
Cobalt	46	38.7	84	40.0	87
Copper	118	107.5	91	120.1	102
Iron	9.4%	6.2%	66	6.26%	67
Magnesium	0.455%	0.310%	68	0.3303%	73
Manganese	179	136	76	150	84
Molybdenum	29	27	93	324	1117
Nickel	127	103.6	82	131	103
Potassium	1.88%	1.36%	72	1.37%	73
Silicon	22.85				
Silver					
Sodium	0.17%	0.46	271	0.64%	376
Strontium	830	683	82	713	86
Titanium	0.8%	0.548%	69	0.548%	69
Vanadium	297	234	79	244	82
Zinc	220	228	104	277	126
Arsenic	145	209	144	217	150
Cadmium	1.00	1.98	198	2.97	297

Table F.1-9

RESULTS OF SITE 16 PERFORMANCE EVALUATION SAMPLE - COAL 1632A NEUTRON ACTIVATION ANALYSIS

		PE Sample			LAB QC	
Parameter	Certified Value	Result	Rec. %	Certified Value	Result	Rec. %
Aluminum	8550	8572	100	29500	29121	99
Antimony	0.24	0.277	115	0.600	0.612	102
Barium	67.5	97.8	145	120	117	98
Beryllium						
Calcium	2040	1962	96	2410	2355	98
Chromium	11	12.8	117	34.3	33.5	98
Cobalt	2.29	2.57	112	6.7	6.55	98
Copper	6.28	55.1	878			
Iron	7590	8423	111	11100	10847	98
Magnesium	383	381	99	1150	1096	95
Manganese	12.4	12.35	100	28.0	26.7	95
Molybdenum	0.9	<1.15		3.85	4.02	104
Nickel	6.1	<15.8		19.4	<25	NC
Potassium	748	1017	136	4110	3918	95
Silicon						
Silver						
Sodium	515	526	102	828	844	102
Strontium	102	95.1	93.2	85	83.1	98
Titanium	454	519	114	1630	1554	95
Vanadium	14	15.5	111	44.0	41.9	95
Zinc	11.89	9.25	78	28.0	27.4	98
Arsenic	3.72	3.9	105	9.3	9.48	102
Cadmium	0.057	<3.2		0.17	<0.25	NC
Mercury				0.13	<0.25	
Lead						
Selenium	1.29	1.64	127	2.6	2.54	98

Table F.1-10

SITE 16 PERFORMANCE EVALUATION SAMPLE - EPA TRACE ELEMENTS IN WATER

Parameter	Certified Value mg/L	Result mg/L	Rec. %
Aluminum	0.500	0.511	102
Beryllium	0.100	0.0973	97
Chromium	0.100	0.098	98
Cobalt	0.100	0.097	97
Copper	0.100	0.093	93
Iron	0.100	0.113	113
Manganese	0.100	0.094	94
Nickel	0.100	0.100	100
Vanadium	0.250	0.233	93
Zinc	0.100	0.098	98
Arsenic	0.100	0.092	92
Cadmium	0.025	0.028	112
Mercury	0.005	0.0055	110
Lead	0.102	0.102	102
Selenium	0.025	0.022	88

Table F2–1. Summary of Field Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H–315	Acetaldehyde	HPLC	3.9	ug/mL	0.1 ug/sample	Stack gas, impingers
H–315	Formaldehyde	HPLC	17.0	ug/mL	0.1 ug/sample	Stack gas, impingers
H–111/H–109/H–125	5–methyl chrysene	HRGC/HRMS	7.6	ng	7.6	ESP inlet gas
H–111/H–109/H–125	7H–dibenzo[c,g]carbazole	HRGC/HRMS	41.7	ng	41.7	ESP inlet gas
H–111/H–109/H–125	Acenaphthene	HRGC/HRMS	469.0	ng	--	ESP inlet gas
H–111/H–109/H–125	Acenaphthylene	HRGC/HRMS	32.2	ng	--	ESP inlet gas
H–111/H–109/H–125	Anthracene	HRGC/HRMS	19.7	ng	19.7	ESP inlet gas
H–111/H–109/H–125	Benzo[a]pyrene	HRGC/HRMS	22.4	ng	22.4	ESP inlet gas
H–111/H–109/H–125	Benzo[b,j&k]fluoranthenes	HRGC/HRMS	13.8	ng	--	ESP inlet gas
H–111/H–109/H–125	Benzo[ghi]perylene	HRGC/HRMS	25.1	ng	--	ESP inlet gas
H–111/H–109/H–125	Benz[a]anthracene	HRGC/HRMS	13.2	ng	13.2	ESP inlet gas
H–111/H–109/H–125	Chrysene	HRGC/HRMS	11.7	ng	--	ESP inlet gas
H–111/H–109/H–125	Dibenzo[a,e]pyrene	HRGC/HRMS	11.6	ng	11.6	ESP inlet gas
H–111/H–109/H–125	Dibenzo[a,h]pyrene	HRGC/HRMS	30.2	ng	30.2	ESP inlet gas
H–111/H–109/H–125	Dibenzo[a,i]pyrene	HRGC/HRMS	8.5	ng	8.5	ESP inlet gas
H–111/H–109/H–125	Dibenz[a,h]acridine	HRGC/HRMS	8.4	ng	8.4	ESP inlet gas
H–111/H–109/H–125	Dibenz[a,h]anthracene	HRGC/HRMS	8.2	ng	8.2	ESP inlet gas
H–111/H–109/H–125	Dibenz[a,i]acridine	HRGC/HRMS	15.3	ng	15.3	ESP inlet gas
H–111/H–109/H–125	Fluoranthene	HRGC/HRMS	27.4	ng	--	ESP inlet gas
H–111/H–109/H–125	Fluorene	HRGC/HRMS	35.4	ng	--	ESP inlet gas
H–111/H–109/H–125	Indeno[1,2,3–cd]pyrene	HRGC/HRMS	7.4	ng	--	ESP inlet gas
H–111/H–109/H–125	Phenanthrene	HRGC/HRMS	119.9	ng	--	ESP inlet gas
H–111/H–109/H–125	Pyrene	HRGC/HRMS	46.1	ng	--	ESP inlet gas
H311	Aluminum	ICP analysis by SW6010	2060.0	ug	8.3	ESP inlet gas, th/PCR
H311	Antimony	ICP analysis by SW6010	ND	ug	1.5	ESP inlet gas, th/PCR
H311	Arsenic	ICP analysis by SW6010	ND	ug	3.4	ESP inlet gas, th/PCR
H311	Barium	ICP analysis by SW6010	15.0	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Beryllium	BIF ICP for Metals Trains	0.4	ug	0.2	ESP inlet gas, th/PCR
H311	Cadmium	BIF ICP for Metals Trains	0.1	ug	0.3	ESP inlet gas, th/PCR
H311	Calcium	ICP analysis by SW6010	159.0	ug	26.0	ESP inlet gas, th/PCR
H311	Chromium	ICP analysis by SW6010	6.0	ug	0.5	ESP inlet gas, th/PCR
H311/H303 COMP	Cobalt	BIF ICP for Metals Trains	2.7	ug	2.1	ESP inlet gas, th/PCR
H311/H303 COMP	Copper	BIF ICP for Metals Trains	4.1	ug	1.0	ESP inlet gas, th/PCR
H311	Iron	ICP analysis by SW6010	1130.0	ug	34.0	ESP inlet gas, th/PCR
H311	Lead	BIF ICP for Metals Trains	ND	ug	2.5	ESP inlet gas, th/PCR
H311/H303 COMP	Magnesium	BIF ICP for Metals Trains	92.6	ug	10.8	ESP inlet gas, th/PCR
H311	Manganese	ICP analysis by SW6010	6.6	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Mercury	Mercury, cold vapor SW7471	0.0	ug	0.0	ESP inlet gas, th/PCR
H311/H303 COMP	Molybdenum	BIF ICP for Metals Trains	0.0	ug	1.0	ESP inlet gas, th/PCR
H311	Nickel	BIF ICP for Metals Trains	4.1	ug	1.1	ESP inlet gas, th/PCR

Table F2-1. Summary of Field Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H311	Phosphorus	BIF ICP for Metals Trains	50.4	ug	7.3	ESP inlet gas, th/PCR
H311/H303 COMP	Potassium	BIF ICP for Metals Trains	240.0	ug	140.0	ESP inlet gas, th/PCR
H311/H303 COMP	Selenium	BIF ICP for Metals Trains	ND	ug	17.6	ESP inlet gas, th/PCR
H311/H303 COMP	Selenium	BIF Se for Metals Trains	0.3	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Silicon	BIF ICP for Metals Trains	4360.0	ug	44.0	ESP inlet gas, th/PCR
H311	Silver	BIF ICP for Metals Trains	ND	ug	0.2	ESP inlet gas, th/PCR
H311/H303 COMP	Sodium	BIF ICP for Metals Trains	53.7	ug	10.4	ESP inlet gas, th/PCR
H311	Strontium	ICP analysis by SW6010	14.4	ug	0.1	ESP inlet gas, th/PCR
H311	Thallium	ICP analysis by SW6010	2.3	ug	2.0	ESP inlet gas, th/PCR
H311	Titanium	ICP analysis by SW6010	91.2	ug	0.5	ESP inlet gas, th/PCR
H311/H303 COMP	Vanadium	BIF ICP for Metals Trains	3.4	ug	1.7	ESP inlet gas, th/PCR
H311	Zinc	ICP analysis by SW6010	3.6	ug	0.7	ESP inlet gas, th/PCR
H-123,H-117 COMP	Chloride	Chloride, by IC EPA300	278.0	ug/sam	3.3	Stack gas, filt+PNR
H-123,H-117 COMP	Fluoride	Fluoride by EPA 340.2	15.1	ug/sam	3.3	Stack gas, filt+PNR
H-123,H-117 COMP	Sulfate	Sulfate on filters	438.0	ug/sam	9.9	Stack gas, filt+PNR
H311/H303 COMP	Arsenic	BIF As for Metals Trains	4.1	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Cadmium	BIF Cd for Metals Trains	0.2	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Lead	BIF Pb for Metals Trains	0.5	ug	0.1	ESP inlet gas, th/PCR
H311/H303 COMP	Nickel	BIF Ni for Metals Trains	4.3	ug	0.1	ESP inlet gas, th/PCR
H-243	1,1-Dichloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,1-Dichloroethene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,1,1-Trichloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,1,2-Trichloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,1,2,2-Tetrachloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,2-Dichlorobenzene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,2-Dichloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,2-Dichloropropane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,3-Dichlorobenzene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	1,4-Dichlorobenzene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	2-Butanone	GCMS	<50	ng	50	Stack Gas, 20L VOST
H-243	2-Hexanone	GCMS	<50	ng	50	Stack Gas, 20L VOST
H-243	4-Methyl-2-Pentanone	GCMS	<50	ng	50	Stack Gas, 20L VOST
H-243	Acetone	GCMS	150.0	ng	50	Stack Gas, 20L VOST
H-243	Benzene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Bromodichloromethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Bromoform	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Bromomethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Carbon Disulfide	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Carbon Tetrachloride	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Chlorobenzene	GCMS	<10	ng	10	Stack Gas, 20L VOST

Table F2-1. Summary of Field Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H-243	Chloroethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Chloroform	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Chloromethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	cis-1,3-Dichloropropene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Dibromochloromethane	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Ethyl Benzene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Methylene Chloride	GCMS	2700.0	ng	10	Stack Gas, 20L VOST
H-243	m,p-Xylene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	o-Xylene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Styrene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Tetrachloroethene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Toluene	GCMS	11.0	ng	10	Stack Gas, 20L VOST
H-243	trans-1,2-Dichloroethene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	trans-1,3-Dichloropropene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Trichloroethene	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-243	Trichlorofluoromethane	GCMS	55.0	ng	10	Stack Gas, 20L VOST
H-243	Vinyl Acetate	GCMS	<50	ng	50	Stack Gas, 20L VOST
H-243	Vinyl Chloride	GCMS	<10	ng	10	Stack Gas, 20L VOST
H-310	Mercury	Mercury,HNO3/H2O2 Impinger	ND	mg/L	0.00024	ESP inlet gas, HCl rinse
H-308	Aluminum	ICP analysis by SW6010	0.07890	mg/L	0.02800	ESP inlet gas, imps 1&2
H-308	Antimony	ICP analysis by SW6010	ND	mg/L	0.02400	ESP inlet gas, imps 1&2
H-308	Arsenic	ICP analysis by SW6010	ND	mg/L	0.02300	ESP inlet gas, imps 1&2
H-308	Arsenic	Arsenic by SW7060	ND	mg/L	0.00065	ESP inlet gas, imps 1&2
H-308	Barium	ICP analysis by SW6010	0.00156	mg/L	0.00053	ESP inlet gas, imps 1&2
H-308	Beryllium	ICP analysis by SW6010	0.00021	mg/L	0.00055	ESP inlet gas, imps 1&2
H-308	Boron	ICP analysis by SW6010	0.02840	mg/L	0.01500	ESP inlet gas, imps 1&2
H-308	Cadmium	Cadmium by SW7131	ND	mg/L	0.00032	ESP inlet gas, imps 1&2
H-308	Cadmium	ICP analysis by SW6010	0.00078	mg/L	0.00170	ESP inlet gas, imps 1&2
H-308	Calcium	ICP analysis by SW6010	0.03420	mg/L	0.15000	ESP inlet gas, imps 1&2
H-308	Chromium	Chromium by GF - SW7191	0.00640	mg/L	0.00072	ESP inlet gas, imps 1&2
H-308	Chromium	ICP analysis by SW6010	0.00403	mg/L	0.00250	ESP inlet gas, imps 1&2
H-308	Cobalt	ICP analysis by SW6010	0.00000	mg/L	0.00340	ESP inlet gas, imps 1&2
H-308	Copper	ICP analysis by SW6010	ND	mg/L	0.00380	ESP inlet gas, imps 1&2
H-308	Iron	ICP analysis by SW6010	0.01250	mg/L	0.02400	ESP inlet gas, imps 1&2
H-308	Lead	ICP analysis by SW6010	ND	mg/L	0.02700	ESP inlet gas, imps 1&2
H-308	Lead	Lead by SW7421	0.00670	mg/L	0.00110	ESP inlet gas, imps 1&2
H-308	Magnesium	ICP analysis by SW6010	0.00916	mg/L	0.02300	ESP inlet gas, imps 1&2
H-308	Manganese	ICP analysis by SW6010	0.00252	mg/L	0.00039	ESP inlet gas, imps 1&2
H-308	Mercury	Mercury,HNO3/H2O2 Impinger	ND	mg/L	0.00024	ESP inlet gas, imps 1&2
H-308	Molybdenum	ICP analysis by SW6010	ND	mg/L	0.00460	ESP inlet gas, imps 1&2

Table F2-1. Summary of Field Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H-308	Nickel	ICP analysis by SW6010	ND	mg/L	0.00990	ESP inlet gas, imps 1&2
H-308	Nickel	Nickel by GF, EPA 249.2	0.02690	mg/L	0.00180	ESP inlet gas, imps 1&2
H-308	Phosphorus	ICP analysis by SW6010	0.10000	mg/L	0.84000	ESP inlet gas, imps 1&2
H-308	Potassium	ICP analysis by SW6010	0.08330	mg/L	0.37000	ESP inlet gas, imps 1&2
H-308	Selenium	Selenium by SW7740	ND	mg/L	0.00140	ESP inlet gas, imps 1&2
H-308	Selenium	ICP analysis by SW6010	ND	mg/L	0.04200	ESP inlet gas, imps 1&2
H-308	Silicon	ICP analysis by SW6010	1.60000	mg/L	0.27000	ESP inlet gas, imps 1&2
H-308	Silver	ICP analysis by SW6010	ND	mg/L	0.00490	ESP inlet gas, imps 1&2
H-308	Sodium	ICP analysis by SW6010	0.06200	mg/L	0.04000	ESP inlet gas, imps 1&2
H-308	Strontium	ICP analysis by SW6010	0.00035	mg/L	0.00017	ESP inlet gas, imps 1&2
H-308	Thallium	ICP analysis by SW6010	0.00668	mg/L	0.01700	ESP inlet gas, imps 1&2
H-308	Titanium	ICP analysis by SW6010	ND	mg/L	0.00100	ESP inlet gas, imps 1&2
H-308	Vanadium	ICP analysis by SW6010	ND	mg/L	0.00240	ESP inlet gas, imps 1&2
H-308	Zinc	ICP analysis by SW6010	0.00458	mg/L	0.00150	ESP inlet gas, imps 1&2
H-309	Mercury	Mercury, cold vapor SW7470	ND	mg/L	0.00005	ESP inlet gas, imps 3,4,5
H-304	Aluminum	ICP analysis by SW6010	0.02210	mg/L	0.02800	ESP inlet gas, TL rinse
H-304	Antimony	ICP analysis by SW6010	ND	mg/L	0.02400	ESP inlet gas, TL rinse
H-304	Arsenic	Arsenic by SW7060	ND	mg/L	0.00065	ESP inlet gas, TL rinse
H-304	Arsenic	ICP analysis by SW6010	0.02000	mg/L	0.02300	ESP inlet gas, TL rinse
H-304	Barium	ICP analysis by SW6010	0.00078	mg/L	0.00053	ESP inlet gas, TL rinse
H-304	Beryllium	ICP analysis by SW6010	0.00038	mg/L	0.00055	ESP inlet gas, TL rinse
H-304	Boron	ICP analysis by SW6010	0.04980	mg/L	0.01500	ESP inlet gas, TL rinse
H-304	Cadmium	Cadmium by SW7131	0.00331	mg/L	0.00024	ESP inlet gas, TL rinse
H-304	Cadmium	ICP analysis by SW6010	0.00061	mg/L	0.00170	ESP inlet gas, TL rinse
H-304	Calcium	ICP analysis by SW6010	0.08740	mg/L	0.15000	ESP inlet gas, TL rinse
H-304	Chromium	ICP analysis by SW6010	0.00435	mg/L	0.00250	ESP inlet gas, TL rinse
H-304	Chromium	Chromium by GF -- SW7191	0.00640	mg/L	0.00072	ESP inlet gas, TL rinse
H-304	Cobalt	ICP analysis by SW6010	ND	mg/L	0.00340	ESP inlet gas, TL rinse
H-304	Copper	ICP analysis by SW6010	0.00514	mg/L	0.00380	ESP inlet gas, TL rinse
H-304	Iron	ICP analysis by SW6010	0.08360	mg/L	0.00600	ESP inlet gas, TL rinse
H-304	Lead	ICP analysis by SW6010	ND	mg/L	0.02700	ESP inlet gas, TL rinse
H-304	Lead	Lead by SW7421	0.04860	mg/L	0.00110	ESP inlet gas, TL rinse
H-304	Magnesium	ICP analysis by SW6010	0.02720	mg/L	0.02300	ESP inlet gas, TL rinse
H-304	Manganese	ICP analysis by SW6010	0.00174	mg/L	0.00039	ESP inlet gas, TL rinse
H-304	Mercury	Mercury, cold vapor SW7470	0.00000	mg/L	0.00005	ESP inlet gas, TL rinse
H-304	Molybdenum	ICP analysis by SW6010	0.00343	mg/L	0.00460	ESP inlet gas, TL rinse
H-304	Nickel	Nickel by GF, EPA 249.2	0.00190	mg/L	0.00182	ESP inlet gas, TL rinse
H-304	Nickel	ICP analysis by SW6010	ND	mg/L	0.00990	ESP inlet gas, TL rinse
H-304	Phosphorus	ICP analysis by SW6010	0.26200	mg/L	0.84000	ESP inlet gas, TL rinse
H-304	Potassium	ICP analysis by SW6010	ND	mg/L	0.37000	ESP inlet gas, TL rinse

Table F2-1. Summary of Field Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H-304	Selenium	Selenium by SW7740	0.00690	mg/L	0.00144	ESP inlet gas, TL rinse
H-304	Selenium	ICP analysis by SW6010	0.03500	mg/L	0.04200	ESP inlet gas, TL rinse
H-304	Silicon	ICP analysis by SW6010	0.33100	mg/L	0.02700	ESP inlet gas, TL rinse
H-304	Silver	ICP analysis by SW6010	0.00423	mg/L	0.00490	ESP inlet gas, TL rinse
H-304	Sodium	ICP analysis by SW6010	0.41800	mg/L	0.04000	ESP inlet gas, TL rinse
H-304	Strontium	ICP analysis by SW6010	0.00132	mg/L	0.00017	ESP inlet gas, TL rinse
H-304	Thallium	ICP analysis by SW6010	ND	mg/L	0.01700	ESP inlet gas, TL rinse
H-304	Titanium	ICP analysis by SW6010	0.00052	mg/L	0.00100	ESP inlet gas, TL rinse
H-304	Vanadium	ICP analysis by SW6010	ND	mg/L	0.00240	ESP inlet gas, TL rinse
H-304	Zinc	ICP analysis by SW6010	0.04	mg/L	0.00150	ESP inlet gas, TL rinse
H-122	Chloride	Chloride, by IC EPA300	1.28	mg/L	0.02	Stack gas, anion imps
H-122	Fluoride	Fluoride by EPA 340.2	0.09	mg/L	0.02	Stack gas, anion imps
H-122	Sulfate	Sulfate, EPA 300.0	1.73	mg/L	0.06	Stack gas, anion imps
H383	Mercury (0)	Bloom	1.9	ng/trap	2.1	Stack Gas
H383	Mercury (II)	Bloom	12.4	ng/trap	7.6	Stack Gas
H383	Methyl Mercury	Bloom	1.9	ng/trap	0.9	Stack Gas
H383	Total Mercury	Bloom	16.2	ng/trap	8.0	Stack Gas

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
BLK93-682	Aluminum	ICP analysis by SW6010		mg/kg	73	Laboratory QC
BLK93682	Antimony	ICP analysis by SW6010		mg/kg	19	Laboratory QC
BLK93-682	Arsenic	ICP analysis by SW6010		mg/kg	160	Laboratory QC
BLK931164	Arsenic	Arsenic by SW7060		mg/kg	0.933	Laboratory QC
BLK93-682	Barium	ICP analysis by SW6010	0.39 J	mg/kg	0.8	Laboratory QC
BLK93-682	Barium	ICP analysis by SW6010		mg/kg	0.8	Laboratory QC
BLK93-682	Beryllium	ICP analysis by SW6010	0.12 J	mg/kg	0.6	Laboratory QC
BLK93638	Beryllium	ICP analysis by SW6010	0.00 J	mg/kg	0.06	Laboratory QC
BLK93638	Beryllium	ICP analysis by SW6010	0.01 J	mg/kg	0.06	Laboratory QC
BLK93-682	Beryllium	ICP analysis by SW6010		mg/kg	0.6	Laboratory QC
BLK93682	Cadmium	ICP analysis by SW6010	3.39	mg/kg	2.9	Laboratory QC
BLK93638	Cadmium	ICP analysis by SW6010	0.00 J	mg/kg	0.29	Laboratory QC
BLK93638	Cadmium	ICP analysis by SW6010	0.02 J	mg/kg	0.29	Laboratory QC
BLK93682	Cadmium	Cadmium by SW7131		mg/kg	1	Laboratory QC
BLK93-682	Calcium	ICP analysis by SW6010		mg/kg	250	Laboratory QC
BLK93-682	Calcium	ICP analysis by SW6010	18.3 J	mg/kg	250	Laboratory QC
BLK93629	Chloride	Chloride, potentiometric		mg/kg	100	Laboratory QC
BLK93525	Chloride	Chloride by SM 4500 Cl B	ND	mg/kg	100	Laboratory QC
BLK93-682	Chromium	ICP analysis by SW6010		mg/kg	5.5	Laboratory QC
BLK93-682	Chromium	ICP analysis by SW6010	3.12 J	mg/kg	5.5	Laboratory QC
BLK93638	Cobalt	ICP analysis by SW6010	0.39 J	mg/kg	0.52	Laboratory QC
BLK93638	Cobalt	ICP analysis by SW6010	0.86	mg/kg	0.52	Laboratory QC
BLK93682	Cobalt	ICP analysis by SW6010	6.33	mg/kg	5.2	Laboratory QC
BLK93638	Copper	ICP analysis by SW6010	0.88	mg/kg	0.25	Laboratory QC
BLK93638	Copper	ICP analysis by SW6010	0.76	mg/kg	0.25	Laboratory QC
BLK93682	Copper	ICP analysis by SW6010	3.53	mg/kg	2.5	Laboratory QC
BLK93840	Fluoride	Fluoride by EPA 340.2	18.3	mg/kg	10	Laboratory QC
BLK93539	Fluoride	Fluoride by EPA 340.2	0.02	mg/kg	0.02	Laboratory QC
BLK93840	Fluoride	Fluoride by EPA 340.2	19.4	mg/kg	10	Laboratory QC
BLK93-682	Iron	ICP analysis by SW6010	93 J	mg/kg	330	Laboratory QC
BLK93-682	Iron	ICP analysis by SW6010		mg/kg	330	Laboratory QC
BLK93682	Lead	Lead by SW7421	0.1 J	mg/kg	1.1	Laboratory QC
BLK93-682	Lead	ICP analysis by SW6010		mg/kg	3.4	Laboratory QC
BLK93638	Lead	ICP analysis by SW6010		mg/kg	2.5	Laboratory QC
BLK93-682	Lead	ICP analysis by SW6010	10.2	mg/kg	3.4	Laboratory QC
BLK93-682	Magnesium	ICP analysis by SW6010		mg/kg	26	Laboratory QC
BLK93638	Magnesium	ICP analysis by SW6010	2.47 J	mg/kg	2.7	Laboratory QC
BLK93-682	Magnesium	ICP analysis by SW6010	2.4 J	mg/kg	26	Laboratory QC
BLK93638	Magnesium	ICP analysis by SW6010	0.59 J	mg/kg	2.7	Laboratory QC
BLK93-682	Manganese	ICP analysis by SW6010	0.14 J	mg/kg	1.4	Laboratory QC
BLK93-682	Manganese	ICP analysis by SW6010	1.88	mg/kg	1.4	Laboratory QC
BLK93649	Mercury	Mercury, cold vapor SW7471		mg/kg	0.012	Laboratory QC
BLK93682	Molybdenum	ICP analysis by SW6010		mg/kg	2.6	Laboratory QC
BLK93638	Molybdenum	ICP analysis by SW6010		mg/kg	0.26	Laboratory QC
BLK93682	Nickel	ICP analysis by SW6010	10 J	mg/kg	11	Laboratory QC
BLK93638	Nickel	ICP analysis by SW6010	0.84 J	mg/kg	1.1	Laboratory QC
BLK93638	Nickel	ICP analysis by SW6010		mg/kg	1.1	Laboratory QC
BLK93682	Nickel	Nickel by GF, EPA 249.2		mg/kg	1.17	Laboratory QC
BLK93-682	Phosphorus	ICP analysis by SW6010		mg/kg	140	Laboratory QC
BLK93682	Potassium	ICP analysis by SW6010	308 J	mg/kg	350	Laboratory QC
BLK93638	Potassium	ICP analysis by SW6010	8.68 J	mg/kg	35	Laboratory QC
BLK93638	Potassium	ICP analysis by SW6010		mg/kg	35	Laboratory QC
BLK93638	Selenium	ICP analysis by SW6010		mg/kg	4.4	Laboratory QC
BLK93682	Selenium	ICP analysis by SW6010	3.81 J	mg/kg	44	Laboratory QC
BLK93682	Selenium	Selenium by SW7740		mg/kg	1.16	Laboratory QC
BLK93638	Silicon	ICP analysis by SW6010	1310 Q	mg/kg	11	Laboratory QC
BLK93682	Silicon	ICP analysis by SW6010	2630 Q	mg/kg	110	Laboratory QC
BLK93638	Silicon	ICP analysis by SW6010	3130 Q	mg/kg	11	Laboratory QC
BLK93638	Silver	ICP analysis by SW6010		mg/kg	0.18	Laboratory QC
BLK93682	Silver	ICP analysis by SW6010		mg/kg	1.8	Laboratory QC
BLK93638	Sodium	ICP analysis by SW6010	7.89	mg/kg	2.6	Laboratory QC
BLK93638	Sodium	ICP analysis by SW6010	8.86	mg/kg	2.6	Laboratory QC
BLK93-682	Sodium	ICP analysis by SW6010	4.14 J	mg/kg	21	Laboratory QC
BLK93-682	Sodium	ICP analysis by SW6010		mg/kg	21	Laboratory QC
BLK93-682	Strontium	ICP analysis by SW6010		mg/kg	0.6	Laboratory QC
BLK93-682	Strontium	ICP analysis by SW6010	0.23 J	mg/kg	0.6	Laboratory QC
BLK93-682	Thallium	ICP analysis by SW6010	41.9 J	mg/kg	120	Laboratory QC
BLK93-682	Thallium	ICP analysis by SW6010	6.62 J	mg/kg	120	Laboratory QC
BLK93682	Thallium	ICP analysis by SW6010	33.8 J	mg/kg	69	Laboratory QC
BLK93-682	Titanium	ICP analysis by SW6010		mg/kg	3.5	Laboratory QC

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
BLK93682	Titanium	ICP analysis by SW6010	0.92 J	mg/kg	1.8	Laboratory QC
BLK93-682	Titanium	ICP analysis by SW6010	6.07	mg/kg	3.5	Laboratory QC
BLK93638	Vanadium	ICP analysis by SW6010	0.24 J	mg/kg	0.43	Laboratory QC
BLK93682	Vanadium	ICP analysis by SW6010	2.2 J	mg/kg	4.3	Laboratory QC
BLK93638	Vanadium	ICP analysis by SW6010	0.12 J	mg/kg	0.43	Laboratory QC
BLK93-682	Zinc	ICP analysis by SW6010		mg/kg	19	Laboratory QC
BLK93-682	Zinc	ICP analysis by SW6010	9.77 J	mg/kg	19	Laboratory QC
BLK93-376	Aluminum	ICP analysis by SW6010	0.00 J	mg/L	0.028	Laboratory QC
BLK93716	Aluminum	ICP analysis by SW6010	0.00 J	mg/L	0.028	Laboratory QC
BLK93716	Antimony	ICP analysis by SW6010	0.00 J	mg/L	0.024	Laboratory QC
BLK93-376	Antimony	ICP analysis by SW6010		mg/L	0.024	Laboratory QC
BLK93-376	Arsenic	ICP analysis by SW6010		mg/L	0.023	Laboratory QC
BLK93716	Arsenic	ICP analysis by SW6010	0.00 J	mg/L	0.023	Laboratory QC
BLK93642	Arsenic	Arsenic by SW7060		mg/L	0.00065	Laboratory QC
BLK93-379	Arsenic	Arsenic by SW7060		mg/L	0.00065	Laboratory QC
BLK93716	Barium	ICP analysis by SW6010	0.00 J	mg/L	0.00053	Laboratory QC
BLK93-376	Barium	ICP analysis by SW6010		mg/L	0.00053	Laboratory QC
BLK93-376	Beryllium	ICP analysis by SW6010	0.00 J	mg/L	0.00055	Laboratory QC
BLK93716	Beryllium	ICP analysis by SW6010	0.00 J	mg/L	0.00055	Laboratory QC
BLK93716	Boron	ICP analysis by SW6010	0.02	mg/L	0.015	Laboratory QC
BLK93-376	Boron	ICP analysis by SW6010	ND	mg/L	0.015	Laboratory QC
BLK93-376	Cadmium	ICP analysis by SW6010	0.00	mg/L	0.0017	Laboratory QC
BLK93642	Cadmium	Cadmium by SW7131		mg/L	0.00024	Laboratory QC
BLK93716	Cadmium	ICP analysis by SW6010	0.00 J	mg/L	0.0017	Laboratory QC
BLK93379	Cadmium	Cadmium by SW7131	ND	mg/L	0.00032	Laboratory QC
BLK93716	Calcium	ICP analysis by SW6010	0.05 J	mg/L	0.15	Laboratory QC
BLK93-376	Calcium	ICP analysis by SW6010		mg/L	0.15	Laboratory QC
BLK93624	Chloride	Chloride, by IC EPA300		mg/L	0.02	Laboratory QC
BLK93744	Chloride	Chloride, by IC EPA300		mg/L	0.02	Laboratory QC
BLK93746	Chloride	Chloride, by IC EPA300		mg/L	0.02	Laboratory QC
BLK93566	Chloride	Chloride, by IC EPA300	ND	mg/L	0.02	Laboratory QC
BLK93-376	Chromium	ICP analysis by SW6010		mg/L	0.0025	Laboratory QC
BLK93-379	Chromium	Chromium by GF - SW7191	0.00	mg/L	0.00072	Laboratory QC
BLK93716	Chromium	ICP analysis by SW6010		mg/L	0.0025	Laboratory QC
BLK93642	Chromium	Chromium by GF - SW7191	0.00 J	mg/L	0.00072	Laboratory QC
BLK93716	Cobalt	ICP analysis by SW6010		mg/L	0.0034	Laboratory QC
BLK93-376	Cobalt	ICP analysis by SW6010		mg/L	0.0034	Laboratory QC
BLK93-376	Copper	ICP analysis by SW6010		mg/L	0.0038	Laboratory QC
BLK93716	Copper	ICP analysis by SW6010	0.00	mg/L	0.0038	Laboratory QC
BLK93725	Fluoride	Fluoride by EPA 340.2	0.02	Bmg/L	0.02	Laboratory QC
BLK93634	Fluoride	Fluoride by EPA 340.2	0.01 J	mg/L	0.02	Laboratory QC
BLK93635	Fluoride	Fluoride by EPA 340.2	0.01 J	mg/L	0.02	Laboratory QC
Lab Blank	Fluoride	Fluoride by EPA 340.2	0.01 J	mg/L	0.02	Laboratory QC
Lab Blank	Fluoride	Fluoride by EPA 340.2	0.02	mg/L	0.02	Laboratory QC
BLK93539	Fluoride	Fluoride by EPA 340.2	0.03	mg/L	0.02	Laboratory QC
BLK93716	Iron	ICP analysis by SW6010	0.01	mg/L	0.006	Laboratory QC
BLK93-431	Iron	ICP analysis by SW6010	0.01 J	mg/L	0.024	Laboratory QC
BLK93482	Lead	Lead by SW7421	0.00	mg/L	0.0011	Laboratory QC
BLK93482	Lead	Lead by SW7421	0.00	mg/L	0.0011	Laboratory QC
BLK93-376	Lead	ICP analysis by SW6010		mg/L	0.027	Laboratory QC
BLK93-642	Lead	Lead by SW7421	0.00 J	mg/L	0.0011	Laboratory QC
BLK93607	Lead	Lead by SW7421		mg/L	0.0011	Laboratory QC
BLK93716	Lead	ICP analysis by SW6010		mg/L	0.027	Laboratory QC
BLK93-376	Magnesium	ICP analysis by SW6010		mg/L	0.023	Laboratory QC
BLK93716	Magnesium	ICP analysis by SW6010		mg/L	0.023	Laboratory QC
BLK93716	Manganese	ICP analysis by SW6010		mg/L	0.00039	Laboratory QC
BLK93-376	Manganese	ICP analysis by SW6010	0.00	mg/L	0.00039	Laboratory QC
BLK93722	Mercury	Mercury, cold vapor SW7470		mg/L	0.00004	Laboratory QC
BLK93596	Mercury	Mercury, cold vapor SW7470		mg/L	0.00004	Laboratory QC
BLK93587	Mercury	Mercury,HNO3/H2O2 Impinger		mg/L	0.00004	Laboratory QC
BLK93647	Mercury	Mercury, cold vapor SW7470		mg/L	0.00004	Laboratory QC
BLK93587	Mercury	Mercury, cold vapor SW7470		mg/L	0.00004	Laboratory QC
BLK93716	Molybdenum	ICP analysis by SW6010	0.00 J	mg/L	0.0046	Laboratory QC
BLK93-376	Molybdenum	ICP analysis by SW6010		mg/L	0.0046	Laboratory QC
BLK93-376	Nickel	ICP analysis by SW6010		mg/L	0.0099	Laboratory QC
BLK93379	Nickel	Nickel by GF, EPA 249.2	0.00 J	mg/L	0.0018	Laboratory QC
BLK93642	Nickel	Nickel by GF, EPA 249.2	0.00 J	mg/L	0.00182	Laboratory QC
BLK93716	Nickel	ICP analysis by SW6010		mg/L	0.0099	Laboratory QC
BLK93-431	Phosphorus	ICP analysis by SW6010		mg/L	0.84	Laboratory QC

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
BLK93782	Phosphorus	ICP analysis by SW6010	0.25 J	mg/L	0.84	Laboratory QC
BLK93716	Potassium	ICP analysis by SW6010		mg/L	0.37	Laboratory QC
BLK93-376	Potassium	ICP analysis by SW6010		mg/L	0.37	Laboratory QC
BLK93-376	Selenium	ICP analysis by SW6010		mg/L	0.042	Laboratory QC
BLK93716	Selenium	ICP analysis by SW6010	0.01 J	mg/L	0.042	Laboratory QC
BLK93642	Selenium	Selenium by SW7740		mg/L	0.00144	Laboratory QC
BLK93482	Selenium	Selenium by SW7740		mg/L	0.0014	Laboratory QC
BLK93-376	Silicon	ICP analysis by SW6010	0.02 J	mg/L	0.27	Laboratory QC
BLK93716	Silicon	ICP analysis by SW6010	0.05	mg/L	0.027	Laboratory QC
BLK93-376	Silver	ICP analysis by SW6010		mg/L	0.0049	Laboratory QC
BLK93716	Silver	ICP analysis by SW6010	0.00 J	mg/L	0.0049	Laboratory QC
BLK93716	Sodium	ICP analysis by SW6010	0.01 J	mg/L	0.04	Laboratory QC
BLK93-376	Sodium	ICP analysis by SW6010	0.01 J	mg/L	0.04	Laboratory QC
BLK93716	Strontium	ICP analysis by SW6010	0.00	mg/L	0.00017	Laboratory QC
BLK93-376	Strontium	ICP analysis by SW6010	ND	mg/L	0.00017	Laboratory QC
BLK93624	Sulfate	Sulfate, EPA 300.0		mg/L	0.06	Laboratory QC
BLK93744	Sulfate	Sulfate on filters	0	mg/L	0.06	Laboratory QC
BLK93566	Sulfate	Sulfate, EPA 300.0	ND	mg/L	0.06	Laboratory QC
BLK93625	Sulfate	Sulfate, EPA 300.0		mg/L	0.06	Laboratory QC
BLK93716	Thallium	ICP analysis by SW6010		mg/L	0.017	Laboratory QC
BLK93-376	Thallium	ICP analysis by SW6010	0.03	mg/L	0.017	Laboratory QC
BLK93716	Titanium	ICP analysis by SW6010		mg/L	0.001	Laboratory QC
BLK93-376	Titanium	ICP analysis by SW6010		mg/L	0.001	Laboratory QC
BLK93716	Vanadium	ICP analysis by SW6010		mg/L	0.0024	Laboratory QC
BLK93-376	Vanadium	ICP analysis by SW6010		mg/L	0.0024	Laboratory QC
BLK93-376	Zinc	ICP analysis by SW6010	0.00 J	mg/L	0.0015	Laboratory QC
BLK93716	Zinc	ICP analysis by SW6010	0.00 J	mg/L	0.0015	Laboratory QC
BLK93-638	Aluminum	ICP analysis by SW6010		ug	8.3	Laboratory QC
BLK93-638	Antimony	ICP analysis by SW6010		ug	1.5	Laboratory QC
BLK93638	Arsenic	BIF As for Metals Trains	0.65	ug	0.093	Laboratory QC
BLK93-638	Arsenic	ICP analysis by SW6010		ug	3.4	Laboratory QC
BLK93-638	Barium	ICP analysis by SW6010	0.09	ug	0.092	Laboratory QC
BLK93-638	Beryllium	ICP analysis by SW6010	0.03 J	ug	0.068	Laboratory QC
BLK93638	Cadmium	BIF Cd for Metals Trains		ug	0.1	Laboratory QC
BLK93-638	Calcium	ICP analysis by SW6010	4.53 J	ug	26	Laboratory QC
BLK93-638	Chromium	ICP analysis by SW6010	0.42 J	ug	0.47	Laboratory QC
BLK93-638	Iron	ICP analysis by SW6010	3.06 J	ug	34	Laboratory QC
BLK93638	Lead	BIF Pb for Metals Trains		ug	0.11	Laboratory QC
BLK93-638	Lead	ICP analysis by SW6010	0.25 J	ug	3.1	Laboratory QC
BLK93-638	Magnesium	ICP analysis by SW6010	1.67 J	ug	2.3	Laboratory QC
BLK93-638	Manganese	ICP analysis by SW6010	0.15	ug	0.13	Laboratory QC
BLK93648	Mercury	Mercury, cold vapor SW7471		ug	0.0096	Laboratory QC
BLK93-638	Nickel	BIF NI for Metals Trains		ug	0.117	Laboratory QC
BLK93-638	Nickel	BIF NI for Metals Trains	0.02 J	ug	0.117	Laboratory QC
BLK93-638	Phosphorus	ICP analysis by SW6010		ug	7.3	Laboratory QC
BLK93638	Phosphorus	BIF ICP for Metals Trains		ug	7.29	Laboratory QC
BLK93638	Selenium	BIF Se for Metals Trains		ug	0.12	Laboratory QC
BLK93-638	Sodium	ICP analysis by SW6010	13.1	ug	4.6	Laboratory QC
BLK93-638	Strontium	ICP analysis by SW6010	0.06	ug	0.05	Laboratory QC
BLK93-638	Thallium	ICP analysis by SW6010	2.77	ug	2	Laboratory QC
BLK93-638	Titanium	ICP analysis by SW6010	0.71	ug	0.47	Laboratory QC
BLK93-638	Titanium	ICP analysis by SW6010	0.71	ug	0.47	Laboratory QC
BLK93-638	Zinc	ICP analysis by SW6010	0.54 J	ug	0.67	Laboratory QC
Method Blank	Hexavalent chromium	Cr(VI) by BIF METHOD	ND	ug/L	0.024	Laboratory QC
BLK93-381	Hexavalent chromium	Cr(VI) by BIF METHOD	ND	ug/L	0.024	Laboratory QC
Method Blank	Chloride	Chloride, by IC EPA300	ND	ug/samp	0.02	Laboratory QC
Lab Blank	Sulfate	Sulfate on filters	ND	ug/samp	0.06	Laboratory QC
BLK93794	Sulfur	Total sulfur		% Sulfur	0.005	Laboratory QC
Method Blank	Antimony	ICP-MS	0.05	ug	0.0004	Method Blank
Method Blank	Arsenic	ICP-MS	1.3	ug	0.0054	Method Blank
Method Blank	Barium	ICP-MS	0.14	ug	0.0021	Method Blank
Method Blank	Beryllium	ICP-MS	0.4	ug	0.0028	Method Blank
Method Blank	Cadmium	ICP-MS	0.03 @	ug	0.0012	Method Blank
Method Blank	Chromium	ICP-MS	4.59	ug	0.0014	Method Blank
Method Blank	Cobalt	ICP-MS	0.13	ug	0.0005	Method Blank
Method Blank	Copper	ICP-MS	0.7	ug	0.0016	Method Blank

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
Method Blank	Lead	ICP-MS	0.01 @	ug	0.0009	Method Blank
Method Blank	Manganese	ICP-MS	0.09	ug	0.0004	Method Blank
Method Blank	Mercury	ICP-MS	0.14 @	ug	0.0049	Method Blank
Method Blank	Molybdenum	ICP-MS	0.18	ug	0.0024	Method Blank
Method Blank	Nickel	ICP-MS	0.52	ug	0.0049	Method Blank
Method Blank	Selenium	ICP-MS	1.6	ug	0.009	Method Blank
Method Blank	Vanadium	ICP-MS	2.84	ug	0.002	Method Blank
Method Blank	Antimony	ICP-MS	0.02	ug	0.0003	Method Blank Dup
Method Blank	Arsenic	ICP-MS	0.97	ug	0.0037	Method Blank Dup
Method Blank	Barium	ICP-MS	0.15	ug	0.0017	Method Blank Dup
Method Blank	Beryllium	ICP-MS	0.34	ug	0.0024	Method Blank Dup
Method Blank	Cadmium	ICP-MS	0.00	ug	0.0005	Method Blank Dup
Method Blank	Chromium	ICP-MS	3.71	ug	0.0108	Method Blank Dup
Method Blank	Cobalt	ICP-MS	0.11	ug	0.0006	Method Blank Dup
Method Blank	Copper	ICP-MS	0.62	ug	0.0016	Method Blank Dup
Method Blank	Lead	ICP-MS	0.00	ug	0.0009	Method Blank Dup
Method Blank	Manganese	ICP-MS	0.01 @	ug	0.0004	Method Blank Dup
Method Blank	Mercury	ICP-MS	0.02	ug	0.0029	Method Blank Dup
Method Blank	Molybdenum	ICP-MS	0.05 @	ug	0.0018	Method Blank Dup
Method Blank	Nickel	ICP-MS	0.22 @	ug	0.0052	Method Blank Dup
Method Blank	Selenium	ICP-MS	1.09	ug	0.02	Method Blank Dup
Method Blank	Vanadium	ICP-MS	2.07	ug	0.0026	Method Blank Dup
Lab Blank	5-methyl chrysene	HRGC/HRMS	1.29	ng	--	MM5 lab blnk
Lab Blank	7H-dibenzo[c,g]carbazole	HRGC/HRMS	21.1	ng	21.1714	MM5 lab blnk
Lab Blank	Acenaphthene	HRGC/HRMS	1.55	ng	--	MM5 lab blnk
Lab Blank	Acenaphthylene	HRGC/HRMS	2.06	ng	--	MM5 lab blnk
Lab Blank	Anthracene	HRGC/HRMS	0.96	ng	--	MM5 lab blnk
Lab Blank	Benzo[a]pyrene	HRGC/HRMS	5.59	ng	5.59659	MM5 lab blnk
Lab Blank	Benzo[b,j&k]fluoranthenes	HRGC/HRMS	3.47	ng	--	MM5 lab blnk
Lab Blank	Benzo[ghi]perylene	HRGC/HRMS	2.47	ng	--	MM5 lab blnk
Lab Blank	Benz[a]anthracene	HRGC/HRMS	1.55	ng	--	MM5 lab blnk
Lab Blank	Chrysene	HRGC/HRMS	2.15	ng	--	MM5 lab blnk
Lab Blank	Dibenzo[a,e]pyrene	HRGC/HRMS	1.04	ng	--	MM5 lab blnk
Lab Blank	Dibenzo[a,h]pyrene	HRGC/HRMS	12.5	ng	12.5022	MM5 lab blnk
Lab Blank	Dibenzo[a,i]pyrene	HRGC/HRMS	2.96	ng	2.96588	MM5 lab blnk
Lab Blank	Dibenz[a,h]acridine	HRGC/HRMS	3.42	ng	--	MM5 lab blnk
Lab Blank	Dibenz[a,h]anthracene	HRGC/HRMS	3.42	ng	--	MM5 lab blnk
Lab Blank	Dibenz[a,i]acridine	HRGC/HRMS	9.12	ng	--	MM5 lab blnk
Lab Blank	Fluoranthene	HRGC/HRMS	3.37	ng	--	MM5 lab blnk
Lab Blank	Fluorene	HRGC/HRMS	2.43	ng	--	MM5 lab blnk
Lab Blank	Indeno[1,2,3-cd]pyrene	HRGC/HRMS	2.70	ng	--	MM5 lab blnk
Lab Blank	Phenanthrene	HRGC/HRMS	7.40	ng	--	MM5 lab blnk
Lab Blank	Pyrene	HRGC/HRMS	2.64	ng	--	MM5 lab blnk
Lab Blank	Acetaldehyde	HPLC	0.11	ug/mL	0.1 ug/sam	Stack gas, impingers
Lab Blank	Formaldehyde	HPLC	0.13 @	ug/mL	0.1 ug/sam	Stack gas, impingers
VOST Lab Blar	1,1-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,1-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,1,1-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,1,2-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,1,2,2-Tetrachloroethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,2-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,2-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,2-Dichloropropane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,3-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,4-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	2-Butanone	GCMS	50	ng	50	VOST Lab Blank1
VOST Lab Blar	2-Hexanone	GCMS	50	ng	50	VOST Lab Blank1
VOST Lab Blar	4-Methyl-2-Pentanone	GCMS	50	ng	50	VOST Lab Blank1
VOST Lab Blar	Acetone	GCMS	50	ng	50	VOST Lab Blank1
VOST Lab Blar	Benzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Bromodichloromethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Bromoform	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Bromomethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Carbon Disulfide	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Carbon Tetrachloride	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Chlorobenzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Chloroethane	GCMS	10	ng	10	VOST Lab Blank1

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
VOST Lab Blar	Chloroform	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Chloromethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	cis-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Dibromochloromethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Ethyl Benzene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Methylene Chloride	GCMS	11	ng	10	VOST Lab Blank1
VOST Lab Blar	m,p-Xylene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	o-Xylene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Styrene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Tetrachloroethene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Toluene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	trans-1,2-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	trans-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Trichloroethene	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Trichlorofluoromethane	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	Vinyl Acetate	GCMS	50	ng	50	VOST Lab Blank1
VOST Lab Blar	Vinyl Chloride	GCMS	10	ng	10	VOST Lab Blank1
VOST Lab Blar	1,1-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,1-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,1,1-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,1,2-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,1,2,2-Tetrachloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,2-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,2-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,2-Dichloropropane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,3-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,4-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	2-Butanone	GCMS	50	ng	50	VOST Lab Blank2
VOST Lab Blar	2-Hexanone	GCMS	50	ng	50	VOST Lab Blank2
VOST Lab Blar	4-Methyl-2-Pentanone	GCMS	50	ng	50	VOST Lab Blank2
VOST Lab Blar	Acetone	GCMS	50	ng	50	VOST Lab Blank2
VOST Lab Blar	Benzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Bromodichloromethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Bromoform	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Bromomethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Carbon Disulfide	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Carbon Tetrachloride	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Chlorobenzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Chloroethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Chloroform	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Chloromethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	cis-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Dibromochloromethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Ethyl Benzene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Methylene Chloride	GCMS	13	ng	10	VOST Lab Blank2
VOST Lab Blar	m,p-Xylene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	o-Xylene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Styrene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Tetrachloroethene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Toluene	GCMS	13	ng	10	VOST Lab Blank2
VOST Lab Blar	trans-1,2-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	trans-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Trichloroethene	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Trichlorofluoromethane	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	Vinyl Acetate	GCMS	50	ng	50	VOST Lab Blank2
VOST Lab Blar	Vinyl Chloride	GCMS	10	ng	10	VOST Lab Blank2
VOST Lab Blar	1,1-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,1-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,1,1-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,1,2-Trichloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,1,2,2-Tetrachloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,2-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,2-Dichloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,2-Dichloropropane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,3-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	1,4-Dichlorobenzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	2-Butanone	GCMS	50	ng	50	VOST Lab Blank3
VOST Lab Blar	2-Hexanone	GCMS	50	ng	50	VOST Lab Blank3
VOST Lab Blar	4-Methyl-2-Pentanone	GCMS	50	ng	50	VOST Lab Blank3
VOST Lab Blar	Acetone	GCMS	50	ng	50	VOST Lab Blank3

Table F2-2. Summary of Laboratory Method Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
VOST Lab Blar	Benzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Bromodichloromethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Bromoform	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Bromomethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Carbon Disulfide	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Carbon Tetrachloride	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Chlorobenzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Chloroethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Chloroform	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Chloromethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	cis-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Dibromochloromethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Ethyl Benzene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Methylene Chloride	GCMS	12	ng	10	VOST Lab Blank3
VOST Lab Blar	m,p-Xylene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	o-Xylene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Styrene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Tetrachloroethene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Toluene	GCMS	11	ng	10	VOST Lab Blank3
VOST Lab Blar	trans-1,2-Dichloroethene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	trans-1,3-Dichloropropene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Trichloroethene	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Trichlorofluoromethane	GCMS	10	ng	10	VOST Lab Blank3
VOST Lab Blar	Vinyl Acetate	GCMS	50	ng	50	VOST Lab Blank3
VOST Lab Blar	Vinyl Chloride	GCMS	10	ng	10	VOST Lab Blank3

Table F2–3. Summary of Reagent Blank Results

Sample ID	Analyte	Method		Result	Units	Det Lin	Sample
M–FF Blank	Antimony	ICP–MS		0.29	ug	0.00	Final Filter Blank 1
M–FF Blank	Arsenic	ICP–MS		1.68	ug	0.00	Final Filter Blank 1
M–FF Blank	Barium	ICP–MS		27.25	ug	0.02	Final Filter Blank 1
M–FF Blank	Beryllium	ICP–MS		0.63	ug	0.00	Final Filter Blank 1
M–FF Blank	Cadmium	ICP–MS		0.17	ug	0.00	Final Filter Blank 1
M–FF Blank	Chromium	ICP–MS		9.9	ug	0.00	Final Filter Blank 1
M–FF Blank	Cobalt	ICP–MS		0.49	ug	0.00	Final Filter Blank 1
M–FF Blank	Copper	ICP–MS		1.73	ug	0.00	Final Filter Blank 1
M–FF Blank	Lead	ICP–MS		1.24	ug	0.00	Final Filter Blank 1
M–FF Blank	Manganese	ICP–MS		2.69	ug	0.00	Final Filter Blank 1
M–FF Blank	Mercury	ICP–MS		0.15 @	ug	0.00	Final Filter Blank 1
M–FF Blank	Molybdenum	ICP–MS		36.3	ug	0.03	Final Filter Blank 1
M–FF Blank	Nickel	ICP–MS		2.37	ug	0.00	Final Filter Blank 1
M–FF Blank	Selenium	ICP–MS		12.01	ug	0.01	Final Filter Blank 1
M–FF Blank	Vanadium	ICP–MS		4.51	ug	0.00	Final Filter Blank 1
N–FF Blank	Antimony	ICP–MS		0.18	ug	0.00	Final Filter Blank 2
N–FF Blank	Arsenic	ICP–MS		0.9	ug	0.00	Final Filter Blank 2
N–FF Blank	Barium	ICP–MS		25.85	ug	0.02	Final Filter Blank 2
N–FF Blank	Beryllium	ICP–MS		0.32	ug	0.00	Final Filter Blank 2
N–FF Blank	Cadmium	ICP–MS		0.03 @	ug	0.00	Final Filter Blank 2
N–FF Blank	Chromium	ICP–MS		3.59	ug	0.01	Final Filter Blank 2
N–FF Blank	Cobalt	ICP–MS		0.4	ug	0.00	Final Filter Blank 2
N–FF Blank	Copper	ICP–MS		0.89	ug	0.00	Final Filter Blank 2
N–FF Blank	Lead	ICP–MS		1.34	ug	0.00	Final Filter Blank 2
N–FF Blank	Manganese	ICP–MS		1.6	ug	0.00	Final Filter Blank 2
N–FF Blank	Mercury	ICP–MS		0.12 @	ug	0.00	Final Filter Blank 2
N–FF Blank	Molybdenum	ICP–MS		29.93	ug	0.02	Final Filter Blank 2
N–FF Blank	Nickel	ICP–MS		0.5	ug	0.00	Final Filter Blank 2
N–FF Blank	Selenium	ICP–MS		0.65 @	ug	0.03	Final Filter Blank 2
N–FF Blank	Vanadium	ICP–MS		1.66	ug	0.00	Final Filter Blank 2
H–138	Hexavalent chromium	Cr(VI) by BIF METHOD		40.2	ug/L	2.4	Reag blnk, KOH imps
H–137	Hexavalent chromium	Cr(VI) by BIF METHOD		42	ug/L	2.4	Reag blnk, KOH imps
H–139	Hexavalent chromium	Cr(VI) by BIF METHOD		37.9	ug/L	2.4	Reag blnk, KOH imps
H–370	Acetaldehyde	HPLC		0.1	ug/mL	0.1 ug/	Stack gas, impingers
H–339	Acetaldehyde	HPLC		0.0484	ug/mL	0.1 ug/	Stack gas, impingers
H–339	Formaldehyde	HPLC		0.0184	ug/mL	0.1 ug/	Stack gas, impingers
H–370	Formaldehyde	HPLC		0.02	ug/mL	0.1 ug/	Stack gas, impingers
H–QB1	Aluminum	ICP analysis by SW6010		286	B ug	7.33	Stack gas, qtz filt blnk 1
H–QB1	Antimony	BIF ICP for Metals Trains		5.91	ug	1.54	Stack gas, qtz filt blnk 1
H–QB1	Arsenic	BIF As for Metals Trains		0.34	ug	0.09	Stack gas, qtz filt blnk 1
H–QB1	Arsenic	ICP analysis by SW6010	ND		ug	1.58	Stack gas, qtz filt blnk 1
H–QB1	Barium	ICP analysis by SW6010		5.36	ug	0.05	Stack gas, qtz filt blnk 1
H–QB1	Beryllium	ICP analysis by SW6010	ND		B ug	0.05	Stack gas, qtz filt blnk 1
H–QB1	Cadmium	ICP analysis by SW6010	ND		B ug	0.28	Stack gas, qtz filt blnk 1
H–QB1	Cadmium	BIF Cd for Metals Trains	ND		ug	0.04	Stack gas, qtz filt blnk 1
H–QB1	Calcium	ICP analysis by SW6010		168	B ug	23.8	Stack gas, qtz filt blnk 1
H–QB1	Chromium	ICP analysis by SW6010		2.45	B ug	0.27	Stack gas, qtz filt blnk 1
H–QB1	Chromium	BIF Cr for Metals Trains		2.77	B ug	0.05	Stack gas, qtz filt blnk 1
H–QB1	Cobalt	ICP analysis by SW6010	ND		B ug	0.52	Stack gas, qtz filt blnk 1
H–QB1	Copper	ICP analysis by SW6010		1.42	B ug	0.24	Stack gas, qtz filt blnk 1
H–QB1	Iron	ICP analysis by SW6010		35.9	B ug	31.1	Stack gas, qtz filt blnk 1
H–QB1	Lead	BIF Pb for Metals Trains		0.33	ug	0.11	Stack gas, qtz filt blnk 1
H–QB1	Lead	ICP analysis by SW6010		17.4	ug	2.47	Stack gas, qtz filt blnk 1
H–QB1	Magnesium	ICP analysis by SW6010		19.6	ug	2.73	Stack gas, qtz filt blnk 1
H–QB1	Manganese	ICP analysis by SW6010		1.36	B ug	0.01	Stack gas, qtz filt blnk 1
H–QB1	Mercury	Mercury, cold vapor SW7471		0.19	B ug	0.04	Stack gas, qtz filt blnk 1
H–QB1	Molybdenum	BIF ICP for Metals Trains		28.7	Bug	0.29	Stack gas, qtz filt blnk 1

Table F2–3. Summary of Reagent Blank Results

Sample ID	Analyte	Method		Result	Units	Det Lin	Sample
H–QB1	Nickel	ICP analysis by SW6010		1.47	B ug	1.09	Stack gas, qtz filt blnk 1
H–QB1	Nickel	BIF Ni for Metals Trains		1.16	ug	0.11	Stack gas, qtz filt blnk 1
H–QB1	Phosphorus	BIF ICP for Metals Trains	ND		ug	7.29	Stack gas, qtz filt blnk 1
H–QB1	Potassium	ICP analysis by SW6010	ND		B ug	34.6	Stack gas, qtz filt blnk 1
H–QB1	Selenium	ICP analysis by SW6010	ND		B ug	4.42	Stack gas, qtz filt blnk 1
H–QB1	Selenium	BIF Se for Metals Trains	ND		ug	0.11	Stack gas, qtz filt blnk 1
H–QB1	Silver	ICP analysis by SW6010	ND		B ug	0.18	Stack gas, qtz filt blnk 1
H–QB1	Sodium	ICP analysis by SW6010		86.4	B ug	2.59	Stack gas, qtz filt blnk 1
H–QB1	Strontium	ICP analysis by SW6010		2.73	B ug	0.05	Stack gas, qtz filt blnk 1
H–QB1	Thallium	ICP analysis by SW6010	ND		B ug	6.94	Stack gas, qtz filt blnk 1
H–QB1	Titanium	BIF ICP for Metals Trains		2.79	Bug	0.47	Stack gas, qtz filt blnk 1
H–QB1	Vanadium	ICP analysis by SW6010		0.88	B ug	0.43	Stack gas, qtz filt blnk 1
H–QB1	Zinc	ICP analysis by SW6010		7	B ug	0.29	Stack gas, qtz filt blnk 1
H–QB2	Aluminum	ICP analysis by SW6010		286	B ug	7.33	Stack gas, qtz filt blnk 2
H–QB2	Antimony	BIF ICP for Metals Trains		4.92	ug	1.54	Stack gas, qtz filt blnk 2
H–QB2	Arsenic	ICP analysis by SW6010	ND		ug	1.58	Stack gas, qtz filt blnk 2
H–QB2	Arsenic	BIF As for Metals Trains		0.17	ug	0.09	Stack gas, qtz filt blnk 2
H–QB2	Barium	ICP analysis by SW6010		4.39	ug	0.05	Stack gas, qtz filt blnk 2
H–QB2	Beryllium	ICP analysis by SW6010	ND		B ug	0.05	Stack gas, qtz filt blnk 2
H–QB2	Cadmium	ICP analysis by SW6010	ND		B ug	0.28	Stack gas, qtz filt blnk 2
H–QB2	Cadmium	BIF Cd for Metals Trains	ND		ug	0.04	Stack gas, qtz filt blnk 2
H–QB2	Calcium	ICP analysis by SW6010		146	B ug	23.8	Stack gas, qtz filt blnk 2
H–QB2	Chromium	BIF Cr for Metals Trains		2.96	B ug	0.05	Stack gas, qtz filt blnk 2
H–QB2	Chromium	ICP analysis by SW6010		3.06	B ug	0.27	Stack gas, qtz filt blnk 2
H–QB2	Cobalt	ICP analysis by SW6010	ND		B ug	0.52	Stack gas, qtz filt blnk 2
H–QB2	Copper	ICP analysis by SW6010		1.66	B ug	0.24	Stack gas, qtz filt blnk 2
H–QB2	Iron	ICP analysis by SW6010		38.8	B ug	31.1	Stack gas, qtz filt blnk 2
H–QB2	Lead	BIF Pb for Metals Trains		0.25	ug	0.11	Stack gas, qtz filt blnk 2
H–QB2	Lead	ICP analysis by SW6010		15.2	ug	2.47	Stack gas, qtz filt blnk 2
H–QB2	Magnesium	ICP analysis by SW6010		21.5	ug	2.73	Stack gas, qtz filt blnk 2
H–QB2	Manganese	ICP analysis by SW6010		1.38	B ug	0.01	Stack gas, qtz filt blnk 2
H–QB2	Mercury	Mercury, cold vapor SW7471		0.122	B ug	0.00	Stack gas, qtz filt blnk 2
H–QB2	Molybdenum	BIF ICP for Metals Trains		28.5	Bug	0.29	Stack gas, qtz filt blnk 2
H–QB2	Nickel	ICP analysis by SW6010		1.38	B ug	1.09	Stack gas, qtz filt blnk 2
H–QB2	Nickel	BIF Ni for Metals Trains		1.4	ug	0.11	Stack gas, qtz filt blnk 2
H–QB2	Phosphorus	BIF ICP for Metals Trains	ND		ug	7.29	Stack gas, qtz filt blnk 2
H–QB2	Potassium	ICP analysis by SW6010		74.3	B ug	34.6	Stack gas, qtz filt blnk 2
H–QB2	Selenium	ICP analysis by SW6010	ND		B ug	4.42	Stack gas, qtz filt blnk 2
H–QB2	Selenium	BIF Se for Metals Trains		0.17	R ug	0.11	Stack gas, qtz filt blnk 2
H–QB2	Silver	ICP analysis by SW6010	ND		B ug	0.18	Stack gas, qtz filt blnk 2
H–QB2	Sodium	ICP analysis by SW6010		99.4	B ug	2.59	Stack gas, qtz filt blnk 2
H–QB2	Strontium	ICP analysis by SW6010		2.73	B ug	0.05	Stack gas, qtz filt blnk 2
H–QB2	Thallium	ICP analysis by SW6010	ND		B ug	6.94	Stack gas, qtz filt blnk 2
H–QB2	Titanium	BIF ICP for Metals Trains		2.81	Bug	0.47	Stack gas, qtz filt blnk 2
H–QB2	Vanadium	ICP analysis by SW6010		0.961	B ug	0.43	Stack gas, qtz filt blnk 2
H–QB2	Zinc	ICP analysis by SW6010		3.21	B ug	0.29	Stack gas, qtz filt blnk 2
H–QB3	Aluminum	ICP analysis by SW6010		286	B ug	7.33	Stack gas, qtz filt blnk 3
H–QB3	Antimony	BIF ICP for Metals Trains		5.45	ug	1.54	Stack gas, qtz filt blnk 3
H–QB3	Arsenic	ICP analysis by SW6010	ND		ug	1.58	Stack gas, qtz filt blnk 3
H–QB3	Arsenic	BIF As for Metals Trains		0.44	ug	0.09	Stack gas, qtz filt blnk 3
H–QB3	Barium	ICP analysis by SW6010		4.47	ug	0.05	Stack gas, qtz filt blnk 3
H–QB3	Beryllium	ICP analysis by SW6010	ND		B ug	0.05	Stack gas, qtz filt blnk 3
H–QB3	Cadmium	ICP analysis by SW6010	ND		B ug	0.28	Stack gas, qtz filt blnk 3
H–QB3	Cadmium	BIF Cd for Metals Trains	ND		ug	0.04	Stack gas, qtz filt blnk 3
H–QB3	Calcium	ICP analysis by SW6010		149	B ug	23.8	Stack gas, qtz filt blnk 3
H–QB3	Chromium	BIF Cr for Metals Trains		3.54	B ug	0.05	Stack gas, qtz filt blnk 3
H–QB3	Chromium	ICP analysis by SW6010		3.46	B ug	0.27	Stack gas, qtz filt blnk 3
H–QB3	Cobalt	ICP analysis by SW6010	ND		B ug	0.52	Stack gas, qtz filt blnk 3

Table F2-3. Summary of Reagent Blank Results

Sample ID	Analyte	Method		Result	Units	Det Lin	Sample
H-QB3	Copper	ICP analysis by SW6010		1.51	B ug	0.24	Stack gas, qtz filt blnk 3
H-QB3	Iron	ICP analysis by SW6010		37.6	B ug	31.1	Stack gas, qtz filt blnk 3
H-QB3	Lead	BIF Pb for Metals Trains		0.29	ug	0.11	Stack gas, qtz filt blnk 3
H-QB3	Lead	ICP analysis by SW6010		16.4	ug	2.47	Stack gas, qtz filt blnk 3
H-QB3	Magnesium	ICP analysis by SW6010		22.4	ug	2.73	Stack gas, qtz filt blnk 3
H-QB3	Manganese	ICP analysis by SW6010		1.42	B ug	0.01	Stack gas, qtz filt blnk 3
H-QB3	Mercury	Mercury, cold vapor SW7471		0.122	B ug	0.00	Stack gas, qtz filt blnk 3
H-QB3	*Molybdenum*	BIF *ICP for Metals Trains*		28.3	Bug	0.29	Stack gas, qtz filt blnk 3
H-QB3	Nickel	BIF Ni for Metals Trains		1.48	ug	0.11	Stack gas, qtz filt blnk 3
H-QB3	Nickel	ICP analysis by SW6010	ND		B ug	1.09	Stack gas, qtz filt blnk 3
H-QB3	Phosphorus	BIF ICP for Metals Trains	ND		ug	7.29	Stack gas, qtz filt blnk 3
H-QB3	Potassium	ICP analysis by SW6010	ND		B ug	34.6	Stack gas, qtz filt blnk 3
H-QB3	Selenium	ICP analysis by SW6010	ND		B ug	4.42	Stack gas, qtz filt blnk 3
H-QB3	Selenium	BIF Se for Metals Trains	ND		ug	0.11	Stack gas, qtz filt blnk 3
H-QB3	Silver	ICP analysis by SW6010	ND		B ug	0.18	Stack gas, qtz filt blnk 3
H-QB3	Sodium	ICP analysis by SW6010		115	B ug	2.59	Stack gas, qtz filt blnk 3
H-QB3	Strontium	ICP analysis by SW6010		2.76	B ug	0.05	Stack gas, qtz filt blnk 3
H-QB3	Thallium	ICP analysis by SW6010	ND		B ug	6.94	Stack gas, qtz filt blnk 3
H-QB3	*Titanium*	*BIF ICP for Metals Trains*		3.35	*Bug*	*0.47*	Stack gas, qtz filt blnk 3
H-QB3	Vanadium	ICP analysis by SW6010		0.939	B ug	0.43	Stack gas, qtz filt blnk 3
H-QB3	Zinc	ICP analysis by SW6010		3.33	B ug	0.29	Stack gas, qtz filt blnk 3

Table F2-4. Summary of Trip Blank Results

Sample ID	Analyte	Method	Result	Units	Det Lim	Sample
H330-I-11	Antimony	ICP-MS	0.04 @	ug	0.0013	Kapton Trip Blank 2
H394-L-11	Antimony	ICP-MS	0.01 @	ug	0.0013	Kapton Trip Blank 1
H330-I-11	Arsenic	ICP-MS	1.53	ug	0.0058	Kapton Trip Blank 2
H394-L-11	Arsenic	ICP-MS	1.32	ug	0.0058	Kapton Trip Blank 1
H330-I-11	Barium	ICP-MS	0.21 @	ug	0.0212	Kapton Trip Blank 2
H394-L-11	Barium	ICP-MS	0.18 @	ug	0.0212	Kapton Trip Blank 1
H330-I-11	Beryllium	ICP-MS	0.39	ug	0.0042	Kapton Trip Blank 2
H394-L-11	Beryllium	ICP-MS	0.6	ug	0.0042	Kapton Trip Blank 1
H330-I-11	Cadmium	ICP-MS	0.06	ug	0.029	Kapton Trip Blank 2
H394-L-11	Cadmium	ICP-MS	0.04 @	ug	0.0029	Kapton Trip Blank 1
H330-I-11	Chromium	ICP-MS	4.05	ug	0.0118	Kapton Trip Blank 2
H394-L-11	Chromium	ICP-MS	4.28	ug	0.0118	Kapton Trip Blank 1
H330-I-11	Cobalt	ICP-MS	0.17 @	ug	0.0073	Kapton Trip Blank 2
H394-L-11	Cobalt	ICP-MS	0.25 @	ug	0.0073	Kapton Trip Blank 1
H394-L-11	Copper	ICP-MS	1.04	ug	0.0018	Kapton Trip Blank 1
H330-I-11	Copper	ICP-MS	0.94	ug	0.0018	Kapton Trip Blank 2
H330-I-11	Lead	ICP-MS	0.04	ug	0.03	Kapton Trip Blank 2
H394-L-11	Lead	ICP-MS	0.08 @	ug	0.003	Kapton Trip Blank 1
H330-I-11	Manganese	ICP-MS	0.04	ug	0.012	Kapton Trip Blank 2
H394-L-11	Manganese	ICP-MS	0.03 @	ug	0.0012	Kapton Trip Blank 1
H330-I-11	Mercury	ICP-MS	0.17 @	ug	0.0051	Kapton Trip Blank 2
H394-L-11	Mercury	ICP-MS	0.2 @	ug	0.0051	Kapton Trip Blank 1
H394-L-11	Molybdenum	ICP-MS	0.14 @	ug	0.0372	Kapton Trip Blank 1
H330-I-11	Molybdenum	ICP-MS	0.1 @	ug	0.0372	Kapton Trip Blank 2
H330-I-11	Nickel	ICP-MS	0.12 @	ug	0.0065	Kapton Trip Blank 2
H394-L-11	Nickel	ICP-MS	0.54	ug	0.0065	Kapton Trip Blank 1
H330-I-11	Selenium	ICP-MS	1.6 @	ug	0.0387	Kapton Trip Blank 2
H394-L-11	Selenium	ICP-MS	2.44	ug	0.0387	Kapton Trip Blank 1
H330-I-11	Vanadium	ICP-MS	2.1	ug	0.0026	Kapton Trip Blank 2
H394-L-11	Vanadium	ICP-MS	2.35	ug	0.0026	Kapton Trip Blank 1
H-368	Acetaldehyde	HPLC	< 0.01	ug/m	0.1 ug/sa	Stack gas, impingers
H-368	Formaldehyde	HPLC	0.015 @	ug/m	0.1 ug/sa	Stack gas, impingers

Table F.2–5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Aluminum	ICPES	94
Aluminum	ICPES	97
Aluminum	ICPES	87
Aluminum	ICPES	83
Aluminum	ICPES	98
Aluminum	ICPES	95
Aluminum	ICPES	98
Aluminum	ICPES	97
Antimony	ICPES	96
Antimony	ICPES	98
Antimony	ICPES	94
Antimony	ICPES	92
Antimony	ICPES	91
Antimony	ICPES	91
Antimony	ICPES	88
Antimony	ICPES	94
Antimony	ICPES	91
Antimony	ICPES	95
Arsenic	ICPES	21
Arsenic	ICPES	96
Arsenic	ICPES	94
Arsenic	ICPES	96
Arsenic	ICPES	32
Arsenic	ICPES	97
Arsenic	ICPES	43
Arsenic	ICPES	33
Barium	ICPES	95
Barium	ICPES	98
Barium	ICPES	93
Barium	ICPES	97
Barium	ICPES	96
Barium	ICPES	97
Barium	ICPES	99
Barium	ICPES	97
Beryllium	ICPES	99
Beryllium	ICPES	87
Beryllium	ICPES	89
Beryllium	ICPES	96
Beryllium	ICPES	95
Beryllium	ICPES	89
Beryllium	ICPES	80
Beryllium	ICPES	88
Beryllium	ICPES	81
Beryllium	ICPES	99
Boron	ICPES	97
Boron	ICPES	99
Boron	ICPES	96
Boron	ICPES	97
Cadmium	ICPES	76
Cadmium	ICPES	95
Cadmium	ICPES	85

Table F.2–5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Cadmium	ICPES	79
Cadmium	ICPES	68
Cadmium	ICPES	94
Cadmium	ICPES	95
Cadmium	ICPES	92
Calcium	ICPES	103
Calcium	ICPES	94
Calcium	ICPES	100
Calcium	ICPES	93
Calcium	ICPES	85
Calcium	ICPES	102
Calcium	ICPES	99
Calcium	ICPES	89
Chromium	ICPES	95
Chromium	ICPES	96
Chromium	ICPES	91
Chromium	ICPES	91
Chromium	ICPES	93
Chromium	ICPES	94
Chromium	ICPES	96
Chromium	ICPES	91
Cobalt	ICPES	94
Cobalt	ICPES	95
Cobalt	ICPES	81
Cobalt	ICPES	88
Cobalt	ICPES	80
Cobalt	ICPES	93
Cobalt	ICPES	88
Cobalt	ICPES	95
Copper	ICPES	93
Copper	ICPES	91
Copper	ICPES	95
Copper	ICPES	96
Copper	ICPES	91
Copper	ICPES	94
Copper	ICPES	92
Copper	ICPES	96
Iron	ICPES	96
Iron	ICPES	94
Iron	ICPES	97
Iron	ICPES	95
Iron	ICPES	92
Iron	ICPES	96
Iron	ICPES	100
Iron	ICPES	99
Lead	ICPES	80
Lead	ICPES	89
Lead	ICPES	95
Lead	ICPES	96
Lead	ICPES	97
Lead	ICPES	98

Table F.2–5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Lead	ICPES	89
Lead	ICPES	75
Lead	ICPES	87
Lead	ICPES	86
Magnesium	ICPES	95
Magnesium	ICPES	98
Magnesium	ICPES	94
Magnesium	ICPES	95
Magnesium	ICPES	87
Magnesium	ICPES	82
Magnesium	ICPES	86
Magnesium	ICPES	98
Magnesium	ICPES	95
Magnesium	ICPES	89
Manganese	ICPES	94
Manganese	ICPES	95
Manganese	ICPES	96
Manganese	ICPES	94
Manganese	ICPES	92
Manganese	ICPES	93
Manganese	ICPES	94
Manganese	ICPES	96
Molybdenum	ICPES	96
Molybdenum	ICPES	91
Molybdenum	ICPES	91
Molybdenum	ICPES	96
Molybdenum	ICPES	82
Molybdenum	ICPES	92
Molybdenum	ICPES	92
Molybdenum	ICPES	81
Nickel	ICPES	91
Nickel	ICPES	83
Nickel	ICPES	96
Nickel	ICPES	90
Nickel	ICPES	80
Nickel	ICPES	96
Nickel	ICPES	95
Nickel	ICPES	94
Phosphorus	ICPES	91
Phosphorus	ICPES	112
Phosphorus	ICPES	85
Phosphorus	ICPES	110
Phosphorus	ICPES	96
Phosphorus	ICPES	83
Phosphorus	ICPES	109
Phosphorus	ICPES	93
Phosphorus	ICPES	87
Phosphorus	ICPES	86
Potassium	ICPES	91
Potassium	ICPES	94
Potassium	ICPES	95

Table F.2-5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Potassium	ICPES	94
Potassium	ICPES	92
Potassium	ICPES	91
Potassium	ICPES	93
Potassium	ICPES	94
Selenium	ICPES	5
Selenium	ICPES	174
Selenium	ICPES	94
Selenium	ICPES	99
Selenium	ICPES	94
Selenium	ICPES	95
Selenium	ICPES	43
Selenium	ICPES	209
Silicon	ICPES	98
Silicon	ICPES	99
Silicon	ICPES	90
Silicon	ICPES	102
Silicon	ICPES	95
Silicon	ICPES	84
Silicon	ICPES	98
Silicon	ICPES	98
Silver	ICPES	64
Silver	ICPES	43
Silver	ICPES	93
Silver	ICPES	94
Silver	ICPES	62
Silver	ICPES	94
Silver	ICPES	26
Silver	ICPES	94
Sodium	ICPES	94
Sodium	ICPES	95
Sodium	ICPES	97
Sodium	ICPES	95
Sodium	ICPES	99
Sodium	ICPES	97
Sodium	ICPES	97
Sodium	ICPES	99
Sodium	ICPES	97
Sodium	ICPES	94
Strontium	ICPES	97
Strontium	ICPES	98
Strontium	ICPES	97
Strontium	ICPES	92
Strontium	ICPES	94
Strontium	ICPES	97
Strontium	ICPES	95
Strontium	ICPES	93
Thallium	ICPES	96
Thallium	ICPES	94
Thallium	ICPES	91
Thallium	ICPES	97

Table F.2–5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Thallium	ICPES	91
Thallium	ICPES	101
Thallium	ICPES	88
Thallium	ICPES	92
Thallium	ICPES	96
Thallium	ICPES	85
Titanium	ICPES	96.4
Titanium	ICPES	92
Titanium	ICPES	90
Titanium	ICPES	96
Vanadium	ICPES	92
Vanadium	ICPES	94
Vanadium	ICPES	96
Vanadium	ICPES	86
Vanadium	ICPES	92
Vanadium	ICPES	88
Vanadium	ICPES	93
Vanadium	ICPES	96
Zinc	ICPES	92
Zinc	ICPES	95
Zinc	ICPES	89
Zinc	ICPES	96
Zinc	ICPES	93
Zinc	ICPES	89
Zinc	ICPES	91
Zinc	ICPES	94
Arsenic	GFAAS	97
Arsenic	GFAAS	106
Arsenic	GFAAS	99
Arsenic	GFAAS	109
Arsenic	GFAAS	102
Arsenic	GFAAS	95
Arsenic	GFAAS	99
Arsenic	GFAAS	98
Cadmium	GFAAS	112
Cadmium	GFAAS	121
Cadmium	GFAAS	99
Cadmium	GFAAS	102
Cadmium	GFAAS	122
Cadmium	GFAAS	103
Cadmium	GFAAS	114
Cadmium	GFAAS	100
Chromium	GFAAS	98
Chromium	GFAAS	102
Chromium	GFAAS	98
Chromium	GFAAS	98
Chromium	GFAAS	96
Chromium	GFAAS	98
Lead	GFAAS	93
Lead	GFAAS	105

Table F.2–5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Lead	GFAAS	91
Lead	GFAAS	129
Lead	GFAAS	104
Lead	GFAAS	98
Lead	GFAAS	92
Lead	GFAAS	93
Lead	GFAAS	107
Lead	GFAAS	104
Nickel	GFAAS	99
Nickel	GFAAS	101
Nickel	GFAAS	96
Nickel	GFAAS	101
Nickel	GFAAS	101
Nickel	GFAAS	108
Nickel	GFAAS	91
Nickel	GFAAS	92
Nickel	GFAAS	103
Selenium	GFAAS	95
Selenium	GFAAS	89
Selenium	GFAAS	89
Selenium	GFAAS	89
Selenium	GFAAS	89
Selenium	GFAAS	98
Selenium	GFAAS	90
Selenium	GFAAS	90
Selenium	GFAAS	94
Selenium	GFAAS	94
Mercury	CVAAS	93
Mercury	CVAAS	94
Mercury	CVAAS	111
Mercury	CVAAS	112
Mercury	CVAAS	111
Mercury	CVAAS	98
Mercury	CVAAS	132
Mercury	CVAAS	104
Mercury	CVAAS	100
Mercury	CVAAS	125
Mercury	CVAAS	107
Mercury	CVAAS	104
Fluoride	EPA 340.2	91
Fluoride	EPA 340.2	97
Fluoride	EPA 340.2	88
Fluoride	EPA 340.2	95
Fluoride	EPA 340.2	90
Fluoride	EPA 340.2	91
Fluoride	EPA 340.2	90
Fluoride	EPA 340.2	93
Fluoride	EPA 340.2	86
Fluoride	EPA 340.2	91
Fluoride	EPA 340.2	98

Table F.2-5. Laboratory Control Sample Recovery Data for Metals and Anions

Analyte	Method code	Recovery (%)
Fluoride	EPA 340.2	95
Fluoride	EPA 340.2	97
Fluoride	EPA 340.2	71
Fluoride	EPA 340.2	92
Fluoride	EPA 340.2	94
Fluoride	EPA 340.2	93
Fluoride	EPA 340.2	73
Hexavalent chromium	Cr(VI) by BIF METHOD	98
Hexavalent chromium	Cr(VI) by BIF METHOD	92
Chloride	Potentiometric	100
Chloride	Potentiometric	100
Chloride	Ion Chromatography	103
Chloride	Ion Chromatography	100
Chloride	Ion Chromatography	98
Chloride	Ion Chromatography	102
Chloride	Ion Chromatography	102
Chloride	Ion Chromatography	90
Chloride	Ion Chromatography	99
Chloride	Ion Chromatography	101
Chloride	SM 4500 Cl B	93
Chloride	SM 4500 Cl B	99
Sulfur	Total sulfur	95
Sulfur	Total sulfur	92
Sulfate	Sulfate, EPA 300.0	97
Sulfate	Sulfate, EPA 300.0	97
Sulfate	Sulfate, EPA 300.0	96
Sulfate	Sulfate, EPA 300.0	96
Sulfate	Sulfate, EPA 300.0	96
Sulfate	Sulfate, EPA 300.0	96
Sulfate	Sulfate, EPA 300.0	95
Sulfate	Sulfate, EPA 300.0	96

Table F.2-5. Laboratory Control Sample Recovery Data for Metals and Anions

Summary	Method	No. of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)
Aluminum	ICPES	8	94	83	98
Antimony	ICPES	10	93	88	98
Arsenic	ICPES	8	64	21	97
Barium	ICPES	8	97	93	99
Beryllium	ICPES	10	90	80	99
Boron	ICPES	4	97	96	99
Cadmium	ICPES	8	86	68	95
Calcium	ICPES	8	96	85	103
Chromium	ICPES	8	93	91	96
Cobalt	ICPES	8	89	80	95
Copper	ICPES	8	94	91	96
Iron	ICPES	8	96	92	100
Lead	ICPES	10	89	75	98
Magnesium	ICPES	10	92	82	98
Manganese	ICPES	8	94	92	96
Molybdenum	ICPES	8	90	81	96
Nickel	ICPES	8	91	80	96
Phosphorus	ICPES	10	95	83	112
Potassium	ICPES	8	93	91	95
Selenium	ICPES	8	102	5	209
Silicon	ICPES	8	96	84	102
Silver	ICPES	8	71	26	94
Sodium	ICPES	10	96	94	99
Strontium	ICPES	8	95	92	98
Thallium	ICPES	10	93	85	101
Titanium	ICPES	4	94	90	96
Vanadium	ICPES	8	92	86	96
Zinc	ICPES	8	92	89	96
Arsenic	AAS	8	101	95	109
Cadmium	AAS	8	109	99	122
Chromium	AAS	6	98	96	102
Lead	AAS	10	102	91	129
Mercury	AAS	12	108	93	132
Nickel	AAS	9	99	91	108
Selenium	AAS	10	92	89	98
Chloride	IC/Pot.	12	99	90	103
Fluoride	340.2	18	90	71	98
Hexavalent chromium	Cr (IV)	2	95	92	98
Sulfate	IC	8	96	95	97
Sulfur	Elem. Analyzer	2	94	92	95

Table F2–6. ICPMS Laboratory Control Sample Recovery Data for Metals

Analyte	LCS (% Rec)	LCSD (% Rec)	Mean (% Rec)	RPD (% Rec)
Antimony	110	111	110	0.5
Arsenic	95	93	94	1.5
Barium	101	103	102	1.8
Beryllium	96	93	95	4.0
Cadmium	98	97	97	1.4
Chromium	97	101	99	3.8
Cobalt	103	99	101	3.9
Copper	91	92	92	0.8
Lead	103	97	100	5.5
Manganese	100	102	101	2.2
Mercury	NA	NA	NA	NA
Molybdenum	104	95	99	8.2
Nickel	90	95	92	4.8
Selenium	94	94	94	0.7
Vanadium	108	106	107	1.2

Table F2-7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H-294 MSD	Aluminum	ICP analysis by SW6010	Bottom ash	2D	80	64	72	22.2
H-294 MSD	Antimony	ICP analysis by SW6010	Bottom ash	2D	84	102	93	19.4
H-294 MSD	Arsenic	Arsenic by SW7060	Bottom ash	2D	106	104	105	1.9
H-294 MSD	Barium	ICP analysis by SW6010	Bottom ash	2D	82	94	88	13.6
H-294 MSD	Beryllium	ICP analysis by SW6010	Bottom ash	2D	87	84	86	3.5
H-294 MSD	Cadmium	Cadmium by SW7131	Bottom ash	2D	105	94	100	11.1
H-294 MSD	Cadmium	Cadmium by SW7131	Bottom ash	2D	106	104	105	1.9
H-294 MSD	Calcium	ICP analysis by SW6010	Bottom ash	2D	102	82	92	21.7
H-294 MSD	Chloride	Chloride, potentiometric	Bottom ash	2D	99	97.7	98	1.3
H-294 MSD	Chromium	ICP analysis by SW6010	Bottom ash	2D	91	90	91	1.1
H-294 MSD	Cobalt	ICP analysis by SW6010	Bottom ash	2D	89	91	90	2.2
H-294 MSD	Copper	ICP analysis by SW6010	Bottom ash	2D	92	91	92	1.1
H-294 MSD	Fluoride	Fluoride by EPA 340.2	Bottom ash	2D	71	29	50	84.0
H-294 MSD	Fluoride	Fluoride by EPA 340.2	Bottom ash	2D	88	81	85	8.3
H-294 MSD	Iron	ICP analysis by SW6010	Bottom ash	2D	103	91	97	12.4
H-294 MSD	Lead	Lead by SW7421	Bottom ash	2D	98	96	97	2.1
H-294 MSD	Magnesium	ICP analysis by SW6010	Bottom ash	2D	102	69	86	38.6
H-294 MSD	Manganese	ICP analysis by SW6010	Bottom ash	2D	91	90	91	1.1
H-294 MSD	Mercury	Mercury, cold vapor SW7471	Bottom ash	2D	97	97	97	0.0
H-294 MSD	Molybdenum	ICP analysis by SW6010	Bottom ash	2D	102	103	103	1.0
H-294 MSD	Nickel	Nickel by GF, EPA 249.2	Bottom ash	2D	89	91	90	2.2
H-294 MSD	Phosphorus	ICP analysis by SW6010	Bottom ash	2D	95	95	95	0.0
H-294 MSD	Potassium	ICP analysis by SW6010	Bottom ash	2D	89	85	87	4.6
H-294 MSD	Selenium	Selenium by SW7740	Bottom ash	2D	84	88	86	4.7
H-294 MSD	Silicon	ICP analysis by SW6010	Bottom ash	2D	83	82	83	1.2
H-294 MSD	Silver	ICP analysis by SW6010	Bottom ash	2D	43	61	52	34.6
H-294 MSD	Sodium	ICP analysis by SW6010	Bottom ash	2D	98	88	93	10.8
H-294 MSD	Strontium	ICP analysis by SW6010	Bottom ash	2D	80	77	79	3.8
H-294 MSD	Thallium	ICP analysis by SW6010	Bottom ash	2D	91	88	90	3.4
H-294 MSD	Vanadium	ICP analysis by SW6010	Bottom ash	2D	91	92	92	1.1
H-294 MSD	Zinc	ICP analysis by SW6010	Bottom ash	2D	86	85	86	1.2
H201/202 MSD	Chloride	Chloride by SM 4500 Cl B	Coal	2	95	97	96	2.1
H201/202 MSD	Fluoride	Fluoride by EPA 340.2	Coal	2	91	82.2	87	10.2
H201/202 MSD	Fluoride	Fluoride by EPA 340.2	Coal	2	49	60	55	20.2
H201/202 MSD	Fluoride	Fluoride by EPA 340.2	Coal	2	66	69	68	4.4
H302/H217/H218 C	Aluminum	ICP analysis by SW6010	Stack gas, filt+PNR	3	84	90	87	6.9
H-213 MSD	Aluminum	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	90.4	90	0.4

Table F2-7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H-244 MSD	Aluminum	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	93	92.1	93	1.0
H-213 MSD	Aluminum	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	88.1	89	2.1
H-244 MSD	Aluminum	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.2	92	0.9
H113/H249 D MSD	Aluminum	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	101	100	101	1.0
H-244 MSD	Antimony	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	87	87.4	87	0.5
H-244 MSD	Antimony	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	95	88	92	7.7
H113/H249 D MSD	Antimony	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	96	95	96	1.0
H-213 MSD	Antimony	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	87.5	88	1.7
H-213 MSD	Antimony	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	89.1	90	1.0
H302/H217/H218 C	Antimony	ICP analysis by SW6010	Stack gas, filt+PNR	3	80	82	81	2.5
H-213 MSD	Arsenic	Arsenic by SW7060	Stack gas, imps 1&2	2	93	94.2	94	1.3
H113/H249 D MSD	Arsenic	BIF As for Metals Trains	ESP inlet gas, th/PCR	2	100	95	98	5.1
H302/H217/H218 C	Arsenic	BIF As for Metals Trains	Stack gas, filt+PNR	3	94	96	95	2.1
H-244 MSD	Arsenic	Arsenic by SW7060	ESP inlet gas, imps 1&2	2	95	95	95	0.0
H302/H217/H218 C	Barium	ICP analysis by SW6010	Stack gas, filt+PNR	3	73	90	82	20.9
H113/H249 D MSD	Barium	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	109	107	108	1.9
H-213 MSD	Barium	ICP analysis by SW6010	Stack gas, imps 1&2	2	85	87.2	86	2.6
H-213 MSD	Barium	ICP analysis by SW6010	Stack gas, imps 1&2	2	83	84.4	84	1.7
H-244 MSD	Barium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.2	92	0.9
H-244 MSD	Barium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	90.5	91	0.6
H302/H217/H218 C	Beryllium	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	90	90	90	0.0
H-244 MSD	Beryllium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	96	95.4	96	0.6
H-244 MSD	Beryllium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	94	94.5	94	0.5
H-213 MSD	Beryllium	ICP analysis by SW6010	Stack gas, imps 1&2	2	95	95	95	0.0
H113/H249 D MSD	Beryllium	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	89	89	89	0.0
H-213 MSD	Beryllium	ICP analysis by SW6010	Stack gas, imps 1&2	2	95	93.3	94	1.8
H-244 MSD	Boron	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	84	80.2	82	4.6
H-244 MSD	Boron	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	82	80.9	81	1.4
H-213 MSD	Boron	ICP analysis by SW6010	Stack gas, imps 1&2	2	83	73	78	12.8
H-213 MSD	Boron	ICP analysis by SW6010	Stack gas, imps 1&2	2	80	59	70	30.2
H302/H217/H218 C	Cadmium	BIF Cd for Metals Trains	Stack gas, filt+PNR	3	98	97	98	1.0
H-360 MS	Cadmium	Cadmium by SW7131	ESP inlet gas, imps 1&2	4	108	109	109	0.9
H113/H249 D MSD	Cadmium	BIF Cd for Metals Trains	ESP inlet gas, th/PCR	2	109	116	113	6.2
H-213 MSD	Cadmium	Cadmium by SW7131	Stack gas, imps 1&2	2	109	112	111	2.7
H113/H249 D MSD	Calcium	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	93	92	93	1.1
H-244 MSD	Calcium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	98	96.9	97	1.1
H-244 MSD	Calcium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	99	98	99	1.0
H-213 MSD	Calcium	ICP analysis by SW6010	Stack gas, imps 1&2	2	96	94	95	2.1
H-213 MSD	Calcium	ICP analysis by SW6010	Stack gas, imps 1&2	2	96	96.4	96	0.4

Table F2-7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H302/H217/H218 C	Calcium	ICP analysis by SW6010	Stack gas, filt+PNR	3	85	86	86	1.2
H-298,H-274,H-22	Chloride	Chloride, by IC EPA300	ESP inlet gas, th/PCR/TLR	3	100	100	100	0.0
H-210,H-209,H-16	Chloride	Chloride, by IC EPA300	ESP inlet gas, th/PCR/TLR	2	114	103	109	10.1
H-230,H-193 COMP	Chloride	Chloride, by IC EPA300	Stack gas, filt+PNR	2	108	106	107	1.9
H-199 MSD	Chloride	Chloride, by IC EPA300	Stack gas, anion imps	2	94	95.3	95	1.4
H-208 MSD	Chloride	Chloride, by IC EPA300	ESP inlet gas, anion imps	2	100	90	95	10.5
H-244 MSD	Chromium	Chromium by GF - SW7191	ESP inlet gas, imps 1&2	2	110	106	108	3.7
H-213 MSD	Chromium	Chromium by GF - SW7191	Stack gas, imps 1&2	2	104	96.8	100	7.2
H-137 MSD	Chromium (VI)	Cr(VI) by BIF METHOD	Reag blnk, KOH imps	RB	111	105	108	5.6
H-364 MSD	Chromium (VI)	Cr(VI) by BIF METHOD	Stack gas, KOH imps	3	90	100	95	10.5
H-213 MSD	Cobalt	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	89.3	89	0.3
H-213 MSD	Cobalt	ICP analysis by SW6010	Stack gas, imps 1&2	2	88	87.5	88	0.6
H-244 MSD	Cobalt	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	89.9	90	1.2
H113/H249 D MSD	Cobalt	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	94	92	93	2.2
H-244 MSD	Cobalt	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	89	88.4	89	0.7
H302/H217/H218 C	Cobalt	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	88	88	88	0.0
H-213 MSD	Copper	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	87.8	88	1.4
H113/H249 D MSD	Copper	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	94	94	94	0.0
H-244 MSD	Copper	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	90	89.5	90	0.6
H-213 MSD	Copper	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	89.8	90	0.2
H302/H217/H218 C	Copper	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	101	99	100	2.0
H-244 MSD	Copper	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	90	91	1.1
H-208 MSD	Fluoride	Fluoride by EPA 340.2	ESP inlet gas, anion imps	2	93	98.1	96	5.3
H-208 MSD	Fluoride	Fluoride by EPA 340.2	ESP inlet gas, anion imps	2	102	94.1	98	8.1
H-230,H-193 COMP	Fluoride	Fluoride by EPA 340.2	Stack gas, filt+PNR	2	85	88.9	87	4.5
H-210,H-209,H-16	Fluoride	Fluoride by EPA 340.2	ESP inlet gas, th/PCR/TLR	2	90	93	92	3.3
H-199 MSD	Fluoride	Fluoride by EPA 340.2	Stack gas, anion imps	2	96	93.5	95	2.6
H302/H217/H218 C	Iron	ICP analysis by SW6010	Stack gas, filt+PNR	3	74	79	77	6.5
H113/H249 D MSD	Iron	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	92	88	90	4.4
H-213 MSD	Iron	ICP analysis by SW6010	Stack gas, imps 1&2	2	97	96.4	97	0.6
H-244 MSD	Iron	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	99	98.8	99	0.2
H-244 MSD	Lead	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	89	90.6	90	1.8
H-244 MSD	Lead	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	90	87.6	89	2.7
H-244 MSD	Lead	Lead by SW7421	ESP inlet gas, imps 1&2	2	97	95.6	96	1.5
H302/H217/H218 C	Lead	BIF Pb for Metals Trains	Stack gas, filt+PNR	3	108	105	107	2.8
H-360 MSD	Lead	Lead by SW7421	ESP inlet gas, imps 1&2	4	65	109	87	50.6
H-213 MSD	Lead	Lead by SW7421	Stack gas, imps 1&2	2	102	100	101	2.0
H113/H249 D MSD	Lead	BIF Pb for Metals Trains	ESP inlet gas, th/PCR	2	98	95	97	3.1
H-213 MSD	Magnesium	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	87.8	88	1.4

Table F2-7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H-244 MSD	Magnesium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	93	91.6	92	1.5
H302/H217/H218 C	Magnesium	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	94	94	94	0.0
H-213 MSD	Magnesium	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	90	90	0.0
H113/H249 D MSD	Magnesium	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	94	94	94	0.0
H-244 MSD	Magnesium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	90.7	91	1.4
H-244 MSD	Manganese	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	89.8	90	1.3
H-244 MSD	Manganese	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	90	88.5	89	1.7
H302/H217/H218 C	Manganese	ICP analysis by SW6010	Stack gas, filt+PNR	3	82	84	83	2.4
H113/H249 D MSD	Manganese	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	92	90	91	2.2
H-213 MSD	Manganese	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	89.6	89	0.7
H-213 MSD	Manganese	ICP analysis by SW6010	Stack gas, imps 1&2	2	88	87.2	88	0.9
H302/H217/H218 C	Mercury	Mercury, cold vapor SW7471	Stack gas, filt+PNR	3	112	126	119	11.8
H-245 MSD	Mercury	Mercury, cold vapor SW7470	ESP inlet gas, imps 3,4,5	2	50	50	50	0.0
H-214 MSD	Mercury	Mercury, cold vapor SW7470	Stack gas, imps 3,4,5	2	62	69	66	10.7
H-244 MSD	Mercury	Mercury,HNO3/H2O2 Impinger	ESP inlet gas, imps 1&2	2	104	106	105	1.9
H113/H249 D MSD	Mercury	Mercury, cold vapor SW7471	ESP inlet gas, th/PCR	2	130	132	131	1.5
H-214 MSD	Mercury	Mercury, cold vapor SW7470	Stack gas, imps 3,4,5	2	54	51	53	5.7
H-245 MSD	Mercury	Mercury, cold vapor SW7470	ESP inlet gas, imps 3,4,5	2	83	71	77	15.6
H-213 MSD	Mercury	Mercury, cold vapor SW7470	Stack gas, imps 1&2	2	78	85	82	8.6
H-215 MSD	Mercury	Mercury,HNO3/H2O2 Impinger	Stack gas, HCl rinse	2	80	84	82	4.9
H-250 MSD	Mercury	Mercury, cold vapor SW7470	ESP inlet gas, TL rinse	3	110	111	111	0.9
H-247 MSD	Mercury	Mercury,HNO3/H2O2 Impinger	ESP inlet gas, HCL rinse	2	82	72	77	13.0
H-213 MSD	Molybdenum	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	91.5	91	0.5
H-244 MSD	Molybdenum	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.9	92	0.1
H-213 MSD	Molybdenum	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	90.4	90	0.4
H-244 MSD	Molybdenum	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.3	92	0.8
H302/H217/H218 C	Molybdenum	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	89	86	88	3.4
H113/H249 D MSD	Molybdenum	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	93	93	93	0.0
H-244 MSD	Nickel	Nickel by GF, EPA 249.2	ESP inlet gas, imps 1&2	2	96	94.6	95	1.5
H-213 MSD	Nickel	Nickel by GF, EPA 249.2	Stack gas, imps 1&2	2	89	86.8	88	2.5
H392 A MSD	Nickel	BIF NI for Metals Trains	Stack gas, filter blank A	RB	82	85	84	3.6
H113/H249 D MSD	Nickel	BIF NI for Metals Trains	ESP inlet gas, th/PCR	2	110	103	107	6.6
H113/H249 D MSD	Nickel	BIF NI for Metals Trains	ESP inlet gas, th/PCR	2	91	90	91	1.1
H302/H217/H218 C	Nickel	BIF NI for Metals Trains	Stack gas, filt+PNR	3	96	80	88	18.2
H-313 MSD	Phosphorus	ICP analysis by SW6010	ESP inlet gas, TL rinse	4	109	100	105	8.6
H113/H249 D MSD	Phosphorus	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	85	84	85	1.2
H-244 MSD	Phosphorus	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	114	113	114	0.9
H-213 MSD	Phosphorus	ICP analysis by SW6010	Stack gas, imps 1&2	2	112	112	112	0.0
H113/H249 D MSD	Phosphorus	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	90	90	90	0.0

Table F2-7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H302/H217/H218 C	Phosphorus	ICP analysis by SW6010	Stack gas, filt+PNR	3	79	79	79	0.0
H-213 MSD	Potassium	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	88.7	89	0.3
H-244 MSD	Potassium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	93	90.7	92	2.5
H302/H217/H218 C	Potassium	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	103	100	102	3.0
H-213 MSD	Potassium	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	86.9	88	2.4
H-244 MSD	Potassium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	93	90.9	92	2.3
H113/H249 D MSD	Potassium	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	102	102	102	0.0
H-213 MSD	Selenium	ICP analysis by SW6010	Stack gas, imps 1&2	2	119	119	119	0.0
H-244 MSD	Selenium	Selenium by SW7740	ESP inlet gas, imps 1&2	2	76	79	78	3.9
H302/H217/H218 C	Selenium	BIF Se for Metals Trains	Stack gas, filt+PNR	3	142	67	105	71.8
H113/H249 D MSD	Selenium	BIF Se for Metals Trains	ESP inlet gas, th/PCR	2	79	80	80	1.3
H302/H217/H218 C	Selenium	BIF Se for Metals Trains	Stack gas, filt+PNR	3	137	135	136	1.5
H113/H249 D MSD	Silicon	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	54	50	52	7.7
H-213 MSD	Silicon	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	83	87	9.2
H-244 MSD	Silicon	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	89	84.9	87	4.7
H-244 MSD	Silicon	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	89.4	90	1.8
H-213 MSD	Silicon	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	89.7	90	1.4
H113/H249 D MSD	Silver	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	51	52	52	1.9
H-213 MSD	Silver	ICP analysis by SW6010	Stack gas, imps 1&2	2	86	84.7	85	1.5
H-244 MSD	Silver	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	88	87.9	88	0.1
H-213 MSD	Silver	ICP analysis by SW6010	Stack gas, imps 1&2	2	87	87.2	87	0.2
H302/H217/H218 C	Silver	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	59	62	61	5.0
H-244 MSD	Silver	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	87	87	87	0.0
H-213 MSD	Sodium	ICP analysis by SW6010	Stack gas, imps 1&2	2	89	87.8	88	1.4
H113/H249 D MSD	Sodium	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	98	99	99	1.0
H302/H217/H218 C	Sodium	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	101	100	101	1.0
H-213 MSD	Sodium	ICP analysis by SW6010	Stack gas, imps 1&2	2	90	90.3	90	0.3
H-244 MSD	Sodium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	95	94	95	1.1
H-244 MSD	Sodium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	95	93.8	94	1.3
H113/H249 D MSD	Strontium	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	105	103	104	1.9
H-244 MSD	Strontium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.5	92	0.5
H-213 MSD	Strontium	ICP analysis by SW6010	Stack gas, imps 1&2	2	92	92.3	92	0.3
H-213 MSD	Strontium	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	90.2	91	0.9
H302/H217/H218 C	Strontium	ICP analysis by SW6010	Stack gas, filt+PNR	3	76	91	84	18.0
H-244 MSD	Strontium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	93	92.3	93	0.8
H-208 MSD	Sulfate	Sulfate, EPA 300.0	ESP inlet gas, anion imps	2	99	101	100	2.0
H-210,H-209,H-16	Sulfate	Sulfate on filters	ESP inlet gas, th/PCR/TLR	2	111	98	105	12.4
H-230,H-193 COMP	Sulfate	Sulfate on filters	Stack gas, filt+PNR	2	119	123	121	3.3
H-199 MSD	Sulfate	Sulfate, EPA 300.0	Stack gas, anion imps	2	107	96.2	102	10.6

Table F2–7. Matrix Spike Recovery Data for Metals and Anions

Sample ID	Analyte	Method	Sample	Run	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H–208 MSD	Sulfate	Sulfate, EPA 300.0	ESP inlet gas, anion imps	2	75	84.8	80	12.3
H–199 MSD	Sulfate	Sulfate, EPA 300.0	Stack gas, anion imps	2	118	74	96	45.8
H302/H217/H218 C	Thallium	ICP analysis by SW6010	Stack gas, filt+PNR	3	85	90	88	5.7
H113/H249 D MSD	Thallium	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	90	89	90	1.1
H–213 MSD	Thallium	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	85.2	88	6.6
H–213 MSD	Thallium	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	87.7	89	3.7
H–244 MSD	Thallium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	88	91.9	90	4.3
H–244 MSD	Thallium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	92.2	92	1.3
H–213 MSD	Titanium	BIF ICP for Metals Trains	Stack gas, imps 1&2	2	90.3	90.8	91	0.6
H–213 MSD	Titanium	BIF ICP for Metals Trains	Stack gas, imps 1&2	2	89.9	88.7	89	1.3
H–244 MSD	Titanium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91.7	90.9	91	0.9
H–244 MSD	Titanium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	90.6	90	90	0.7
H–244 MSD	Vanadium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	92	91.4	92	0.7
H–213 MSD	Vanadium	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	91.1	91	0.1
H113/H249 D MSD	Vanadium	BIF ICP for Metals Trains	ESP inlet gas, th/PCR	2	96	95	96	1.0
H–213 MSD	Vanadium	ICP analysis by SW6010	Stack gas, imps 1&2	2	91	89.1	90	2.1
H–244 MSD	Vanadium	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	91	90.3	91	0.8
H302/H217/H218 C	Vanadium	BIF ICP for Metals Trains	Stack gas, filt+PNR	3	98	96	97	2.1
H–213 MSD	Zinc	ICP analysis by SW6010	Stack gas, imps 1&2	2	86	84.8	85	1.4
H–213 MSD	Zinc	ICP analysis by SW6010	Stack gas, imps 1&2	2	87	87.2	87	0.2
H302/H217/H218 C	Zinc	ICP analysis by SW6010	Stack gas, filt+PNR	3	74	74	74	0.0
H113/H249 D MSD	Zinc	ICP analysis by SW6010	ESP inlet gas, th/PCR	2	87	86	87	1.2
H–244 MSD	Zinc	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	88	86.7	87	1.5
H–244 MSD	Zinc	ICP analysis by SW6010	ESP inlet gas, imps 1&2	2	89	87.8	88	1.4

Table F2-7. Matrix Spike Recovery Data for Metals and Anions
Summary of Matrix Spike Recovery Data for Bottom Ash Samples

Analyte	No. of MSD Pairs	Mean (% Rec)	Min (% Rec)	Max (% Rec)	RPD (%)
Aluminum	1	72	64	80	22.2
Antimony	1	93	84	102	19.4
Arsenic	1	105	104	106	1.9
Barium	1	88	82	94	13.6
Beryllium	1	86	84	87	3.5
Cadmium	2	102	94	106	6.5
Calcium	1	92	82	102	21.7
Chromium	1	91	90	91	1.1
Cobalt	1	90	89	91	2.2
Copper	1	92	91	92	1.1
Iron	1	97	91	103	12.4
Lead	1	97	96	98	2.1
Magnesium	1	86	69	102	38.6
Manganese	1	91	90	91	1.1
Mercury	1	97	97	97	0.0
Molybdenum	1	103	102	103	1.0
Nickel	1	90	89	91	2.2
Phosphorus	1	95	95	95	0.0
Potassium	1	87	85	89	4.6
Selenium	1	86	84	88	4.7
Silicon	1	83	82	83	1.2
Silver	1	52	43	61	34.6
Sodium	1	93	88	98	10.8
Strontium	1	79	77	80	3.8
Thallium	1	90	88	91	3.4
Vanadium	1	92	91	92	1.1
Zinc	1	86	85	86	1.2
Chloride	1	98	98	99	1.3
Fluoride	2	67	29	88	46.1

Summary of Matrix Spike Recovery Data for Coal Samples

Analyte	No. of MSD Pairs	Mean (% Rec)	Min (% Rec)	Max (% Rec)	RPD (%)
Chloride	1	96	95	97	2.1
Fluoride	3	70	49	91	11.6

Table F2-7. Matrix Spike Recovery Data for Metals and Anions
Summary of Matrix Spike Recovery Data for Gas Samples

Analyte	No. of MSD Pairs	Mean (% Rec)	Min (% Rec)	Max (% Rec)	RPD (%)
Aluminum	6	92	84	101	2.1
Antimony	6	89	80	96	2.4
Arsenic	4	95	93	100	2.1
Barium	6	90	73	109	4.7
Beryllium	6	93	89	96	0.5
Boron	4	78	59	84	12.3
Cadmium	4	107	97	116	2.7
Calcium	6	94	85	99	1.2
Chromium	2	104	97	110	5.4
Cobalt	6	90	88	94	0.8
Copper	6	92	88	101	0.9
Iron	4	91	74	99	3.0
Lead	7	95	65	109	9.2
Magnesium	6	92	88	94	0.7
Manganese	6	88	82	92	1.5
Mercury	11	86	50	132	6.8
Molybdenum	6	91	86	93	0.9
Nickel	6	92	80	110	5.6
Phosphorus	6	97	79	114	1.8
Potassium	6	94	87	103	1.7
Selenium	5	103	67	142	15.7
Silicon	5	81	50	91	5.0
Silver	6	77	51	88	1.5
Sodium	6	94	88	101	1.0
Strontium	6	92	76	105	3.7
Thallium	6	89	85	92	3.8
Titanium	4	90	89	92	0.9
Vanadium	6	93	89	98	1.1
Zinc	6	85	74	89	0.9
Chloride	5	101	90	114	4.8
Fluoride	5	93	85	102	4.8
Sulfate	6	101	74	123	14.4
Chromium (VI)	2	102	90	111	8.0

Table F2-8. Coal Standard Reference Material Analysis Results for Metals

Sample ID	Analyte	Method	Meas'd (mg/kg)	Ref Value (mg/kg)	Recov (% Rec)	Dup Recov (% Rec)	RPD (% Rec)
NBS 1632A	Aluminum	NAA	28159	29500	95		
NBS 1632A	Antimony	NAA	0.6	0.6	101		
NBS 1632A	Arsenic	NAA	9.3	9.3	100		
NBS 1632A	Barium	NAA	117	120	97		
NBS 1632A	Bromine	NAA	42	41	103		
NBS 1632A	Calcium	NAA	2353	2410	98		
NBS 1632A	Cerium	NAA	30	29	102		
NBS 1632A	Cesium	NAA	2.3	2.3	99		
NBS 1632A	Chlorine	NAA	722	756	95		
NBS 1632A	Chromium	NAA	33.8	34.3	99		
NBS 1632A	Cobalt	NAA	7.1	6.7	106		
NBS 1632A	Copper	NAA	18.6	16.5	113		
NBS 1632A	Europium	NAA	0.6	0.52	110		
NBS 1632A	Hafnium	NAA	2	1.62	104		
NBS 1632A	Iodine	NAA	1.7	1.8	95		
NBS 1632A	Iron	NAA	11390	11100	103		
NBS 1632A	Lanthanum	NAA	16	15	104		
NBS 1632A	Lutetium	NAA	0.18	0.17	104		
NBS 1632A	Magnesium	NAA	1098	1150	95		
NBS 1632A	Manganese	NAA	27	28	95		
NBS 1632A	Molybdenum	NAA	4.02	3.85	104		
NBS 1632A	Neodymium	NAA	14	12	115		
NBS 1632A	Nickel	NAA	21.0	19.4	108		
NBS 1632A	Potassium	NAA	4175	4110	102		
NBS 1632A	Rubidium	NAA	31	30	104		
NBS 1632A	Samarium	NAA	2.4	2.4	101		
NBS 1632A	Scandium	NAA	6.5	6.3	103		
NBS 1632A	Selenium	NAA	2.6	2.6	101		
NBS 1632A	Sodium	NAA	790	828	95		
NBS 1632A	Strontium	NAA	79	85	93		
NBS 1632A	Tantalum	NAA	0.41	0.42	97		
NBS 1632A	Terbium	NAA	0.308	0.311	99		
NBS 1632A	Thorium	NAA	4.7	4.5	105		
NBS 1632A	Titanium	NAA	1556	1630	95		
NBS 1632A	Uranium	NAA	1.29	1.28	101		
NBS 1632A	Vanadium	NAA	42	44	95		
NBS 1632A	Ytterbium	NAA	1.15	1.08	107		
NBS 1632A	Zinc	NAA	28	28	98		
NBS 1632A	Zirconium	NAA	53	53	99		
SARM 20	Aluminum	NAA	58567	59600	98	96	2.3
SARM 20	Antimony	NAA	0.6	0.4	162	148	9.3
SARM 20	Arsenic	NAA	5.8	4.7	123	116	5.7
SARM 20	Barium	NAA	318	372	86		
SARM 20	Beryllium	ICP-AE	1.8	2.5	72		
SARM 20	Bromine	NAA	5	2	230	207	10.7
SARM 20	Calcium	NAA	21132	13400	158		
SARM 20	Cerium	NAA	89	87	102		

Table F2–8. Coal Standard Reference Material Analysis Results for Metals

Sample ID	Analyte	Method	Meas'd (mg/kg)	Ref Value (mg/kg)	Recov (% Rec)	Dup Recov (% Rec)	RPD (% Rec)
SARM 20	Cesium	NAA	2	2	96		
SARM 20	Chromium	NAA	71	67	106		
SARM 20	Cobalt	NAA	8.4	8.3	102		
SARM 20	Copper	NAA	44	18	244	256	4.9
SARM 20	Europium	NAA	1	1	122		
SARM 20	Hafnium	NAA	5.5	4.8	114		
SARM 20	Iron	NAA	8253	8180	101		
SARM 20	Lanthanum	NAA	46	43	107	110	2.9
SARM 20	Lead	ICP–AE	27	26	104		
SARM 20	Magnesium	NAA	3265	2600	126	119	5.4
SARM 20	Manganese	NAA	64	80	80	83	3.7
SARM 20	Mercury	NAA	0.44	0.25	176	149	16.7
SARM 20	Mercury	DGA/CV	0.25	0.25	100		
SARM 20	Nickel	NAA	25	25	99		
SARM 20	Phosphorus	ICP–AE	630	611	103		
SARM 20	Potassium	NAA	2128	1160	183		
SARM 20	Rubidium	NAA	13	10	127		
SARM 20	Samarium	NAA	5.5	6.3	87	88	0.8
SARM 20	Scandium	NAA	12	10	124		
SARM 20	Selenium	NAA	2.0	0.8	244		
SARM 20	Sodium	NAA	2005	2000	100	108	7.5
SARM 20	Strontium	NAA	282	330	85		
SARM 20	Tantalum	NAA	1.2	1.2	99		
SARM 20	Terbium	NAA	1.0	0.9	116		
SARM 20	Thorium	NAA	19	18	103		
SARM 20	Tin	NAA	20	4	500		
SARM 20	Titanium	NAA	3389	3780	90	87	3.0
SARM 20	Uranium	NAA	5	4	121	127	4.7
SARM 20	Vanadium	NAA	50	47	106	103	3.2
SARM 20	Ytterbium	NAA	0.3	2	15		
SARM 20	Zinc	NAA	52	17	306		
SARM 20	Zirconium	NAA	266	180	148		

Table F2-9. Ash Recovery Data for Metals by ICPES and AAS

Analyte	Method code	Result (mg/kg)	Ref Value (mg/kg)	Recovery (%)
Aluminum	ICPES	142000	143000	99
Aluminum	ICPES	141000	143000	99
Aluminum	ICPES	140000	143000	98
Aluminum	ICPES	139000	143000	97
Aluminum	ICPES	143000	143000	100
Aluminum	ICPES	139000	143000	97
Aluminum	ICPES	131000	143000	92
Aluminum	ICPES	141000	143000	99
Aluminum	ICPES	139000	143000	97
Aluminum	ICPES	141000	143000	99
Aluminum	ICPES	139000	143000	97
Aluminum	ICPES	140000	143000	98
Arsenic	GFAAS	181	145	125
Arsenic	GFAAS	188	145	130
Arsenic	GFAAS	183	145	126
Arsenic	GFAAS	184	145	127
Arsenic	ICPES	99.6	145	69
Arsenic	ICPES	121	145	83
Arsenic	ICPES	121	145	83
Arsenic	ICPES	110	145	76
Arsenic	ICPES	94.3	145	65
Arsenic	ICPES	99.6	145	69
Arsenic	ICPES	94.3	145	65
Arsenic	ICPES	110	145	76
Barium	ICPES	1270	1500	85
Barium	ICPES	1310	1500	87
Barium	ICPES	1310	1500	87
Barium	ICPES	1320	1500	88
Barium	ICPES	1320	1500	88
Barium	ICPES	1270	1500	85
Barium	ICPES	1280	1500	85
Barium	ICPES	1280	1500	85
Barium	ICPES	1330	1500	89
Barium	ICPES	1340	1500	89
Barium	ICPES	1340	1500	89
Barium	ICPES	1320	1500	88
Beryllium	ICPES	16.4	12	137
Beryllium	ICPES	16.3	12	136
Beryllium	ICPES	15.9	12	133
Beryllium	ICPES	16.2	12	135
Beryllium	ICPES	16.3	12	136
Beryllium	ICPES	16.4	12	137
Beryllium	ICPES	16.4	12	137
Beryllium	ICPES	16.4	12	137
Beryllium	ICPES	15.6	12	130
Beryllium	ICPES	15.8	12	132
Beryllium	ICPES	16.4	12	137
Beryllium	ICPES	15.9	12	133
Calcium	ICPES	10900	11100	98
Calcium	ICPES	10700	11100	96
Calcium	ICPES	10700	11100	96

Table F2–9. Ash Recovery Data for Metals by ICPES and AAS

Analyte	Method code	Result (mg/kg)	Ref Value (mg/kg)	Recovery (%)
Calcium	ICPES	10600	11100	95
Calcium	ICPES	9850	11100	89
Calcium	ICPES	10600	11100	95
Calcium	ICPES	11300	11100	102
Calcium	ICPES	10900	11100	98
Calcium	ICPES	10800	11100	97
Calcium	ICPES	11400	11100	103
Calcium	ICPES	10600	11100	95
Calcium	ICPES	10600	11100	95
Calcium	ICPES	10800	11100	97
Calcium	ICPES	10600	11100	95
Chromium	ICPES	179	196	91
Chromium	ICPES	183	196	93
Chromium	ICPES	185	196	94
Chromium	ICPES	185	196	94
Chromium	ICPES	179	196	91
Chromium	ICPES	181	196	92
Chromium	ICPES	177	196	90
Chromium	ICPES	181	196	92
Chromium	ICPES	183	196	93
Chromium	ICPES	180	196	92
Chromium	ICPES	181	196	92
Chromium	ICPES	178	196	91
Iron	ICPES	98400	94000	105
Iron	ICPES	91100	94000	97
Iron	ICPES	89500	94000	95
Iron	ICPES	92700	94000	99
Iron	ICPES	94600	94000	101
Iron	ICPES	96200	94000	102
Iron	ICPES	93100	94000	99
Iron	ICPES	89500	94000	95
Iron	ICPES	92000	94000	98
Iron	ICPES	94600	94000	101
Iron	ICPES	96200	94000	102
Iron	ICPES	94000	94000	100
Iron	ICPES	92000	94000	98
Iron	ICPES	99900	94000	106
Lead	GFAAS	59.6	72	83
Lead	GFAAS	58.7	72	82
Lead	ICPES	64.3	72	89
Lead	ICPES	44.7	72	62
Lead	ICPES	44.7	72	62
Lead	ICPES	64.3	72	89
Lead	ICPES	53.3	72	74
Lead	ICPES	43.3	72	60
Lead	ICPES	53.3	72	74
Lead	ICPES	43.3	72	60
Lead	GFAAS	51.6	72	72
Lead	GFAAS	51.6	72	72
Lead	GFAAS	49.5	72	69
Lead	GFAAS	53.3	72	74

Table F2–9. Ash Recovery Data for Metals by ICPES and AAS

Analyte	Method code	Result (mg/kg)	Ref Value (mg/kg)	Recovery (%)
Magnesium	ICPES	4160	4550	91
Magnesium	ICPES	4140	4550	91
Magnesium	ICPES	4250	4550	93
Magnesium	ICPES	4500	4550	99
Magnesium	ICPES	4240	4550	93
Magnesium	ICPES	4280	4550	94
Magnesium	ICPES	4280	4550	94
Magnesium	ICPES	4250	4550	93
Magnesium	ICPES	4240	4550	93
Magnesium	ICPES	4140	4550	91
Manganese	ICPES	174	179	97
Manganese	ICPES	180	179	101
Manganese	ICPES	174	179	97
Manganese	ICPES	172	179	96
Manganese	ICPES	175	179	98
Manganese	ICPES	176	179	98
Manganese	ICPES	174	179	97
Manganese	ICPES	180	179	101
Manganese	ICPES	175	179	98
Manganese	ICPES	173	179	97
Manganese	ICPES	172	179	96
Manganese	ICPES	167	179	93
Nickel	GFAAS	129	127	102
Nickel	GFAAS	131	127	103
Nickel	GFAAS	123	127	97
Nickel	GFAAS	124	127	98
Nickel	GFAAS	124	127	98
Nickel	GFAAS	132	127	104
Sodium	ICPES	2380	1700	140
Sodium	ICPES	2410	1700	142
Sodium	ICPES	2450	1700	144
Sodium	ICPES	2360	1700	139
Sodium	ICPES	2440	1700	144
Sodium	ICPES	2440	1700	144
Sodium	ICPES	2390	1700	141
Sodium	ICPES	2450	1700	144
Sodium	ICPES	2410	1700	142
Sodium	ICPES	2380	1700	140
Strontium	ICPES	793	830	96
Strontium	ICPES	804	830	97
Strontium	ICPES	793	830	96
Strontium	ICPES	799	830	96
Strontium	ICPES	799	830	96
Strontium	ICPES	799	830	96
Strontium	ICPES	804	830	97
Strontium	ICPES	809	830	97
Strontium	ICPES	801	830	97
Strontium	ICPES	808	830	97
Strontium	ICPES	808	830	97
Strontium	ICPES	760	830	92
Titanium	ICPES	7950	8000	99

Table F2–9. Ash Recovery Data for Metals by ICPES and AAS

Analyte	Method code	Result (mg/kg)	Ref Value (mg/kg)	Recovery (%)
Titanium	ICPES	8080	8000	101
Titanium	ICPES	7810	8000	98
Titanium	ICPES	8076	8000	101
Titanium	ICPES	7860	8000	98
Titanium	ICPES	8080	8000	101
Titanium	ICPES	7950	8000	99
Titanium	ICPES	7810	8000	98
Titanium	ICPES	7860	8000	98
Titanium	ICPES	7865	8000	98
Titanium	ICPES	7952	8000	99
Titanium	ICPES	7880	8000	99
Titanium	ICPES	7880	8000	99
Titanium	ICPES	7878	8000	98
Titanium	ICPES	7809	8000	98
Titanium	ICPES	7860	8000	98
Titanium	ICPES	7951	8000	99
Titanium	ICPES	7857	8000	98
Zinc	ICPES	197	220	90
Zinc	ICPES	189	220	86
Zinc	ICPES	193	220	88
Zinc	ICPES	193	220	88
Zinc	ICPES	197	220	90
Zinc	ICPES	189	220	86
Zinc	ICPES	196	220	89
Zinc	ICPES	193	220	88
Zinc	ICPES	193	220	88
Zinc	ICPES	186	220	85
Zinc	ICPES	196	220	89
Zinc	ICPES	187	220	85

Summary

	Method	No. of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)	Std Dev (% Rec)
Aluminum	ICPES	12	98	92	100	2.1
Arsenic	ICPES	8	73	65	83	7.5
Barium	ICPES	12	87	85	89	1.7
Beryllium	ICPES	12	135	130	137	2.4
Calcium	ICPES	14	97	89	103	3.3
Chromium	ICPES	12	92	90	94	1.3
Iron	ICPES	14	100	95	106	3.3
Lead	ICPES	8	71	60	89	12.4
Magnesium	ICPES	10	93	91	99	2.3
Manganese	ICPES	12	97	93	101	2.0
Sodium	ICPES	10	142	139	144	1.9
Strontium	ICPES	12	96	92	97	1.6
Titanium	ICPES	18	99	98	101	1.1
Zinc	ICPES	12	87	85	90	1.7
Arsenic	GFAAS	4	127	125	130	2.0
Lead	GFAAS	6	75	69	83	5.7
Nickel	GFAAS	6	100	97	104	3.1

Table F2-10. PSD Ash Recovery Data for Metals

Sample ID	Analyte	Method	Meas'd (mg/kg)	Ref Value (mg/kg)	Rec (%)	Dup Rec (%)	RPD (%)
NIST 1633a	Antimony	ICPMS	5.2	6.8	76	76	1.0
NIST 1633a	Arsenic	ICPMS	128.6	145	89	88	0.7
NIST 1633a	Beryllium	ICPMS	10.1	12	84	86	2.7
NIST 1633a	Cadmium	ICPMS	0.5	1	51	60	16.7
NIST 1633a	Chromium	ICPMS	193.4	196	99	89	9.8
NIST 1633a	Cobalt	ICPMS	33.5	46	73	68	7.3
NIST 1633a	Copper	ICPMS	120.6	118	102	94	8.3
NIST 1633a	Lead	ICPMS	64.5	72.4	89	88	0.7
NIST 1633a	Manganese	ICPMS	195.1	179	109	104	4.5
NIST 1633a	Mercury	ICPMS	0.3	0.16	179	133	29.7
NIST 1633a	Molybdenum	ICPMS	24.9	29	86	97	12.0
NIST 1633a	Nickel	ICPMS	94.3	127	74	69	6.8
NIST 1633a	Selenium	ICPMS	10.0	10.3	98	108	9.8
NIST 1633a	Vanadium	ICPMS	253.5	297	85	82	3.7

Table F2-11. Quartz Filter Spike Recovery Data for Metals

Sample ID	Analyte	Method	Sample	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
H-QB1	Aluminum	ICPES	Stack gas, qtz filt blnk 1	83	82	83	1.2
H-QB1	Aluminum	ICPES	Stack gas, qtz filt blnk 1	81		81	
H-QB1	Arsenic	ICPES	Stack gas, qtz filt blnk 1	75		75	
H-QB1	Arsenic	ICPES	Stack gas, qtz filt blnk 1	79	77	78	2.6
H-QB1	Barium	ICPES	Stack gas, qtz filt blnk 1	90	88	89	2.2
H-QB1	Barium	ICPES	Stack gas, qtz filt blnk 1	87		87	
H-QB1	Beryllium	ICPES	Stack gas, qtz filt blnk 1	86	85	86	1.2
H-QB1	Beryllium	ICPES	Stack gas, qtz filt blnk 1	83		83	
H-QB1	Cadmium	ICPES	Stack gas, qtz filt blnk 1	89		89	
H-QB1	Cadmium	ICPES	Stack gas, qtz filt blnk 1	72	91	82	23.3
H-QB1	Calcium	ICPES	Stack gas, qtz filt blnk 1	87		87	
H-QB1	Calcium	ICPES	Stack gas, qtz filt blnk 1	89	88	89	1.1
H-QB1	Chromium	ICPES	Stack gas, qtz filt blnk 1	86		86	
H-QB1	Chromium	ICPES	Stack gas, qtz filt blnk 1	88	88	88	0.0
H-QB1	Cobalt	ICPES	Stack gas, qtz filt blnk 1	84	85	85	1.2
H-QB1	Cobalt	ICPES	Stack gas, qtz filt blnk 1	83		83	
H-QB1	Copper	ICPES	Stack gas, qtz filt blnk 1	83		83	
H-QB1	Copper	ICPES	Stack gas, qtz filt blnk 1	86	85	86	1.2
H-QB1	Iron	ICPES	Stack gas, qtz filt blnk 1	84		84	
H-QB1	Iron	ICPES	Stack gas, qtz filt blnk 1	86	86	86	0.0
H-QB1	Lead	ICPES	Stack gas, qtz filt blnk 1	84	81	83	3.6
H-QB1	Lead	ICPES	Stack gas, qtz filt blnk 1	79		79	
H-QB1	Magnesium	ICPES	Stack gas, qtz filt blnk 1	83	82	83	1.2
H-QB1	Magnesium	ICPES	Stack gas, qtz filt blnk 1	81		81	
H-QB1	Manganese	ICPES	Stack gas, qtz filt blnk 1	85		85	
H-QB1	Manganese	ICPES	Stack gas, qtz filt blnk 1	87	87	87	0.0
H-QB3	Molybdenum	ICPES	Stack gas, qtz filt blnk 3	92	40	66	78.8
H-QB3	Molybdenum	ICPES	Stack gas, qtz filt blnk 3	40		40	
H-QB1	Nickel	ICPES	Stack gas, qtz filt blnk 1	84		84	
H-QB1	Nickel	ICPES	Stack gas, qtz filt blnk 1	87	86	87	1.2
H-QB3	Phosphorus	ICPES	Stack gas, qtz filt blnk 3	99		99	
H-QB3	Phosphorus	ICPES	Stack gas, qtz filt blnk 3	101	99	100	2.0
H-QB1	Potassium	ICPES	Stack gas, qtz filt blnk 1	85		85	
H-QB1	Potassium	ICPES	Stack gas, qtz filt blnk 1	87	87	87	0.0

H-QB1	Selenium	ICPES	Stack gas, qtz filt blnk 1	166		166	
H-QB1	Selenium	ICPES	Stack gas, qtz filt blnk 1	102	170	136	50.0
H-QB1	Silver	ICPES	Stack gas, qtz filt blnk 1	55		55	
H-QB1	Silver	ICPES	Stack gas, qtz filt blnk 1	55	56	56	1.8
H-QB1	Sodium	ICPES	Stack gas, qtz filt blnk 1	85	85	85	0.0
H-QB1	Sodium	ICPES	Stack gas, qtz filt blnk 1	83		83	
H-QB1	Strontium	ICPES	Stack gas, qtz filt blnk 1	91	90	91	1.1
H-QB1	Strontium	ICPES	Stack gas, qtz filt blnk 1	88		88	
H-QB1	Thallium	ICPES	Stack gas, qtz filt blnk 1	76		76	
H-QB1	Thallium	ICPES	Stack gas, qtz filt blnk 1	74	77	76	4.0
H-QB1	Vanadium	ICPES	Stack gas, qtz filt blnk 1	89	89	89	0.0
H-QB1	Vanadium	ICPES	Stack gas, qtz filt blnk 1	87		87	
H-QB1	Zinc	ICPES	Stack gas, qtz filt blnk 1	78	78	78	0.0
H-QB1	Zinc	ICPES	Stack gas, qtz filt blnk 1	76		76	
H-QB3	Arsenic	GFAAS	Stack gas, qtz filt blnk 3	114	111	113	2.7
H-QB1	Cadmium	GFAAS	Stack gas, qtz filt blnk 1	107	105	106	1.9
H-QB3	Chromium	GFAAS	Stack gas, qtz filt blnk 3	98	88	93	10.8
H-QB1	Lead	GFAAS	Stack gas, qtz filt blnk 1	67	61	64	9.4
H-QB1	Lead	GFAAS	Stack gas, qtz filt blnk 1	62	62	62	0.0
H-QB3	Nickel	GFAAS	Stack gas, qtz filt blnk 3	110	106	108	3.7
H-QB2	Selenium	GFAAS	Stack gas, qtz filt blnk 2	76	24	50	104.0
H-QB2	Selenium	GFAAS	Stack gas, qtz filt blnk 2	33	28	31	16.4
H-QB2	Selenium	GFAAS	Stack gas, qtz filt blnk 2	52	24	38	73.7
H-QB1	Mercury	CVAAS	Stack gas, qtz filt blnk 1	45	46	46	2.2

Summary ICPES Analyte	No. of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)	Mean RPD (%)
Aluminum	2	82	81	83	1.2
Arsenic	2	77	75	79	2.6
Barium	2	88	87	90	2.2
Beryllium	2	84	83	86	1.2
Cadmium	2	85	72	91	23.3
Calcium	2	88	87	89	1.1
Chromium	2	87	86	88	0.0
Cobalt	2	84	83	85	1.2
Copper	2	84	83	86	1.2
Iron	2	85	84	86	0.0
Lead	2	81	79	84	3.6
Magnesium	2	82	81	83	1.2
Manganese	2	86	85	87	0.0
Molybdenum	2	53	40	92	78.8
Nickel	2	85	84	87	1.2
Phosphorus	2	100	99	101	2.0
Potassium	2	86	85	87	0.0
Selenium	2	151	102	170	50.0
Silver	2	55	55	56	1.8
Sodium	2	84	83	85	0.0
Strontium	2	89	88	91	1.1
Thallium	2	76	74	77	4.0
Vanadium	2	88	87	89	0.0
Zinc	2	77	76	78	0.0
AAS					
Arsenic	1	113	111	114	2.7
Cadmium	1	106	105	107	1.9
Chromium	1	93	88	98	10.8
Lead	2	63	61	67	4.7
Mercury	1	46	45	46	2.2
Nickel	1	108	106	110	3.7
Selenium	3	40	24	76	64.7

Table F2–12. Mercury Speciation Spike Recovery Data

Sample ID	Compound	Method	% Recovery
Method Spike	Mercury (0)	Bloom	88
Method Spike	Mercury (II)	Bloom	97
Method Spike	Methyl Mercury	Bloom	106
Method Spike	Mercury (II)	Bloom	94

Table F2-13. Coal Duplicate Sample Results for Metals

			Duplicate Sample Results		
		Sample ID:	H201/202	H225/226	RPD
Analyte	Method	Units	Meas'd	Meas'd	(%)
Aluminum	NAA	mg/kg, dry	11964.9	11228.6	6.3
Antimony	NAA	mg/kg, dry	1.3	1.4	5.1
Arsenic	NAA	mg/kg, dry	23.4	42.7	58.5
Barium	NAA	mg/kg, dry	94.5	100.1	5.8
Beryllium	ICP-AES	mg/kg, dry	1.9	2.1	10.0
Bromine	NAA	mg/kg, dry	5.7	5.6	2.4
Cadmium	NAA	mg/kg, dry	< 2.6	< 2.6	0.4
Calcium	NAA	mg/kg, dry	1811.9	1509.0	18.2
Cerium	NAA	mg/kg, dry	17.1	15.1	12.2
Cesium	NAA	mg/kg, dry	1.4	1.1	20.9
Chlorine	NAA	mg/kg, dry	473.2	448.0	5.5
Chromium	NAA	mg/kg, dry	14.7	16.2	10.2
Cobalt	NAA	mg/kg, dry	5.9	6.3	5.2
Copper	NAA	mg/kg, dry	28.8	34.1	17.0
Europium	NAA	mg/kg, dry	0.3	0.3	4.0
Hafnium	NAA	mg/kg, dry	0.7	0.7	2.6
Iodine	NAA	mg/kg, dry	0.2	0.2	8.8
Iron	NAA	mg/kg, dry	14100.1	10368.8	30.5
Lanthanum	NAA	mg/kg, dry	9.7	9.7	0.3
Lead	ICP-AES	mg/kg, dry	8.0	7.0	13.3
Lutetium	NAA	mg/kg, dry	0.1	0.1	1.1
Magnesium	NAA	mg/kg, dry	538.3	483.7	10.7
Manganese	NAA	mg/kg, dry	14.4	13.4	7.1
Mercury	DGA/CVAAS	mg/kg, dry	0.2	0.1	37.0
Mercury	NAA	mg/kg, dry	0.1	0.1	15.0
Molybdenum	NAA	mg/kg, dry	3.2	3.3	4.6
Neodymium	NAA	mg/kg, dry	11.1	11.6	4.3
Nickel	NAA	mg/kg, dry	20.6	18.8	9.2
Phosphorus	ICP-AES	mg/kg, dry	170.0	140.0	19.4
Potassium	NAA	mg/kg, dry	822.7	860.0	4.4
Rubidium	NAA	mg/kg, dry	21.8	16.8	26.1
Samarium	NAA	mg/kg, dry	1.7	1.8	2.0
Scandium	NAA	mg/kg, dry	3.6	3.5	3.7
Selenium	NAA	mg/kg, dry	3.4	3.5	4.9
Silver	NAA	mg/kg, dry	0.2	0.2	11.0
Sodium	NAA	mg/kg, dry	310.0	303.6	2.1
Strontium	NAA	mg/kg, dry	189.2	106.9	55.6
Tantalum	NAA	mg/kg, dry	0.2	0.2	2.4
Terbium	NAA	mg/kg, dry	0.2	0.2	0.7
Thorium	NAA	mg/kg, dry	2.3	2.4	5.3
Tin	NAA	mg/kg, dry	< 10.5	< 10.5	0.4
Titanium	NAA	mg/kg, dry	739.1	723.5	2.1
Tungsten	NAA	mg/kg, dry	< 5.2	< 5.2	0.4
Uranium	NAA	mg/kg, dry	1.9	1.6	17.1
Vanadium	NAA	mg/kg, dry	23.0	22.6	1.8
Ytterbium	NAA	mg/kg, dry	0.3	0.3	7.4

Table F2-13. Coal Duplicate Sample Results for Metals

			Duplicate Sample Results		
		Sample ID:	H201/202	H225/226	RPD
Analyte	Method	Units	Meas'd	Meas'd	(%)
Zinc	NAA	mg/kg, dry	17.5	16.5	6.0
Zirconium	NAA	mg/kg, dry	40.3	89.0	75.3
Moisture	Ultimate	%	4.3	4.7	8.2
Carbon	Ultimate	%, dry	77.3	77.3	0.1
Hydrogen	Ultimate	%, dry	4.9	5.0	0.8
Nitrogen	Ultimate	%, dry	1.5	1.5	0.7
Sulfur	Ultimate	%, dry	1.8	1.6	12.9
Ash	Ultimate	%, dry	9.5	9.2	2.9
Oxygen	Ultimate	%, dry	5.0	5.4	7.7
Volatiles	Proximate	%, dry	32.3	32.7	1.3
Fixed Carbon	Proximate	%, dry	58.2	58.1	0.3
HHV	Proximate	Btu/lb, dry	13728.0	13779.0	0.4

Table F2–14. Botton Ash Duplicate Sample Results for Metals

Analyte	Method	Run 2 Result (mg/kg)	Run 2D Result (mg/kg)	RPD (%)
Aluminum	ICPES	108000	131000	19.2
Antimony	ICPES	ND	ND	NC
Arsenic	GFAAS	5	4.13	19.1
Barium	ICPES	829	1020	20.7
Beryllium	ICPES	19.7	20.7	5.0
Cadmium	GFAAS	ND	0.478 J	NC
Calcium	ICPES	4000	5540	32.3
Chromium	ICPES	102	108	5.7
Cobalt	ICPES	61.5	57.1	7.4
Copper	ICPES	120	127	5.7
Iron	ICPES	102000	113000	10.2
Lead	ICPES	6.1	19.9	106.2
Magnesium	ICPES	3780	5690	40.3
Manganese	ICPES	160	170	6.1
Mercury	CVAAS	ND	ND	NC
Molybdenum	ICPES	2.74 J	10.9 J	NC
Nickel	ICPES	88.7	88	0.8
Phosphorus	ICPES	526	670	24.1
Potassium	ICPES	21200	25200	17.2
Selenium	ICPES	32 J	26 J	NC
Silicon	ICPES	211000	216000 B	2.3
Silver	ICPES	ND	ND	NC
Sodium	ICPES	3390	3460	2.0
Strontium	ICPES	679	875	25.2
Thallium	ICPES	4.34 J	ND	NC
Titanium	ICPES	6657	6932	4.0
Vanadium	ICPES	200	228	13.1
Zinc	ICPES	51	51.3	0.6

Table F2-15. SVOC Internal Standard Recovery Data

Sample ID	Compound	% Rec.
ESP Inlet Gas		
H-317/281/238/212/277/278	Acenaphthene-d10	14
H-111/H-109/H-125	Acenaphthene-d10	2
H-237/233/181/163/235/236	Acenaphthene-d10	17
H-417/418/419/306/291/352/353	Acenaphthene-d10	15
H-317/281/238/212/277/278	Acenaphthylene-d8	11
H-237/233/181/163/235/236	Acenaphthylene-d8	4
H-111/H-109/H-125	Acenaphthylene-d8	6
H-417/418/419/306/291/352/353	Acenaphthylene-d8	18
H-237/233/181/163/235/236	Anthracene-d10	6
H-111/H-109/H-125	Anthracene-d10	8
H-417/418/419/306/291/352/353	Anthracene-d10	22
H-317/281/238/212/277/278	Anthracene-d10	26
H-417/418/419/306/291/352/353	Benzo[a]pyrene-d12	4
H-111/H-109/H-125	Benzo[a]pyrene-d12	14
H-237/233/181/163/235/236	Benzo[a]pyrene-d12	3
H-317/281/238/212/277/278	Benzo[a]pyrene-d12	11
H-317/281/238/212/277/278	Benzo[b&k]fluoranthenes-d12	23
H-111/H-109/H-125	Benzo[b&k]fluoranthenes-d12	22
H-417/418/419/306/291/352/353	Benzo[b&k]fluoranthenes-d12	1
H-237/233/181/163/235/236	Benzo[b&k]fluoranthenes-d12	13
H-317/281/238/212/277/278	Benzo[ghi]perylene-d12	12
H-237/233/181/163/235/236	Benzo[ghi]perylene-d12	6
H-111/H-109/H-125	Benzo[ghi]perylene-d12	12
H-417/418/419/306/291/352/353	Benzo[ghi]perylene-d12	0
H-317/281/238/212/277/278	Benz[a]anthracene-d12	36
H-237/233/181/163/235/236	Benz[a]anthracene-d12	29
H-111/H-109/H-125	Benz[a]anthracene-d12	17
H-417/418/419/306/291/352/353	Benz[a]anthracene-d12	5
H-111/H-109/H-125	Chrysene-d12	17
H-317/281/238/212/277/278	Chrysene-d12	35
H-237/233/181/163/235/236	Chrysene-d12	37
H-417/418/419/306/291/352/353	Chrysene-d12	5
H-317/281/238/212/277/278	Dibenz[a,h]anthracene-d14	15
H-237/233/181/163/235/236	Dibenz[a,h]anthracene-d14	5
H-417/418/419/306/291/352/353	Dibenz[a,h]anthracene-d14	0
H-111/H-109/H-125	Dibenz[a,h]anthracene-d14	15
H-417/418/419/306/291/352/353	Fluoranthene-d10	17
H-317/281/238/212/277/278	Fluoranthene-d10	34
H-237/233/181/163/235/236	Fluoranthene-d10	49
H-111/H-109/H-125	Fluoranthene-d10	12
H-111/H-109/H-125	Fluorene-d10	3
H-417/418/419/306/291/352/353	Fluorene-d10	19
H-237/233/181/163/235/236	Fluorene-d10	22
H-317/281/238/212/277/278	Fluorene-d10	19
H-237/233/181/163/235/236	Indeno[1,2,3-cd]pyrene-d10	5
H-417/418/419/306/291/352/353	Indeno[1,2,3-cd]pyrene-d10	1
H-111/H-109/H-125	Indeno[1,2,3-cd]pyrene-d10	16
H-317/281/238/212/277/278	Indeno[1,2,3-cd]pyrene-d10	14
H-237/233/181/163/235/236	Phenanthrene-d10	41
H-417/418/419/306/291/352/353	Phenanthrene-d10	28
H-111/H-109/H-125	Phenanthrene-d10	7
H-317/281/238/212/277/278	Phenanthrene-d10	40

Table F2-15. SVOC Internal Standard Recovery Data

Sample ID	Compound	% Rec.
ESP Inlet Gas		
H-417/418/419/306/291/352/353	Pyrene-d10	19
H-317/281/238/212/277/278	Pyrene-d10	37
H-111/H-109/H-125	Pyrene-d10	13
H-237/233/181/163/235/236	Pyrene-d10	53
Stack Gas		
H-227/194/119/223/224	Acenaphthene-d10	68
H-388/314/292/354/355	Acenaphthene-d10	60
H-316/228/211/279/280	Acenaphthene-d10	62
H-227/194/119/223/224	Acenaphthylene-d8	2
H-316/228/211/279/280	Acenaphthylene-d8	48
H-388/314/292/354/355	Acenaphthylene-d8	37
H-388/314/292/354/355	Anthracene-d10	39
H-316/228/211/279/280	Anthracene-d10	46
H-227/194/119/223/224	Anthracene-d10	1
H-388/314/292/354/355	Benzo[a]pyrene-d12	22
H-316/228/211/279/280	Benzo[a]pyrene-d12	47
H-227/194/119/223/224	Benzo[a]pyrene-d12	0
H-316/228/211/279/280	Benzo[b&k]fluoranthenes-d12	66
H-388/314/292/354/355	Benzo[b&k]fluoranthenes-d12	51
H-227/194/119/223/224	Benzo[b&k]fluoranthenes-d12	32
H-227/194/119/223/224	Benzo[ghi]perylene-d12	18
H-388/314/292/354/355	Benzo[ghi]perylene-d12	23
H-316/228/211/279/280	Benzo[ghi]perylene-d12	31
H-388/314/292/354/355	Benz[a]anthracene-d12	74
H-227/194/119/223/224	Benz[a]anthracene-d12	3
H-316/228/211/279/280	Benz[a]anthracene-d12	81
H-388/314/292/354/355	Chrysene-d12	79
H-227/194/119/223/224	Chrysene-d12	74
H-316/228/211/279/280	Chrysene-d12	73
H-227/194/119/223/224	Dibenz[a,h]anthracene-d14	19
H-316/228/211/279/280	Dibenz[a,h]anthracene-d14	37
H-388/314/292/354/355	Dibenz[a,h]anthracene-d14	29
H-227/194/119/223/224	Fluoranthene-d10	43
H-388/314/292/354/355	Fluoranthene-d10	63
H-316/228/211/279/280	Fluoranthene-d10	53
H-388/314/292/354/355	Fluorene-d10	81
H-227/194/119/223/224	Fluorene-d10	97
H-316/228/211/279/280	Fluorene-d10	82
H-227/194/119/223/224	Indeno[1,2,3-cd]pyrene-d10	13
H-388/314/292/354/355	Indeno[1,2,3-cd]pyrene-d10	26
H-316/228/211/279/280	Indeno[1,2,3-cd]pyrene-d10	35
H-227/194/119/223/224	Phenanthrene-d10	44
H-316/228/211/279/280	Phenanthrene-d10	48
H-388/314/292/354/355	Phenanthrene-d10	55
H-227/194/119/223/224	Pyrene-d10	31
H-316/228/211/279/280	Pyrene-d10	59
H-388/314/292/354/355	Pyrene-d10	60
MM5 Trip Spike		
	Acenaphthene-d10	55
	Acenaphthylene-d8	57
	Anthracene-d10	60
	Benzo[a]pyrene-d12	87

Table F2-15. SVOC Internal Standard Recovery Data

Sample ID	Compound	% Rec.
ESP Inlet Gas		
	Benzo[b&k]fluoranthenes-d12	77
	Benzo[ghi]perylene-d12	82
	Benz[a]anthracene-d12	87
	Chrysene-d12	77
	Dibenz[a,h]anthracene-d14	89
	Fluoranthene-d10	72
	Fluorene-d10	79
	Indeno[1,2,3-cd]pyrene-d10	85
	Phenanthrene-d10	60
	Pyrene-d10	78
MM5 Lab Spike		
	Acenaphthene-d10	61
	Acenaphthylene-d8	58
	Anthracene-d10	54
	Benzo[a]pyrene-d12	71
	Benzo[b&k]fluoranthenes-d12	78
	Benzo[ghi]perylene-d12	77
	Benz[a]anthracene-d12	68
	Chrysene-d12	69
	Dibenz[a,h]anthracene-d14	80
	Fluoranthene-d10	84
	Fluorene-d10	67
	Indeno[1,2,3-cd]pyrene-d10	77
	Phenanthrene-d10	54
	Pyrene-d10	86
MM5 Lab Blank		
	Acenaphthene-d10	101
	Acenaphthylene-d8	111
	Anthracene-d10	106
	Benzo[a]pyrene-d12	88
	Benzo[b&k]fluoranthenes-d12	99
	Benzo[ghi]perylene-d12	58
	Benz[a]anthracene-d12	95
	Chrysene-d12	87
	Dibenz[a,h]anthracene-d14	58
	Fluoranthene-d10	83
	Fluorene-d10	79
	Indeno[1,2,3-cd]pyrene-d10	63
	Phenanthrene-d10	99
	Pyrene-d10	87

Summary for ESP and Stack Gas

	No. of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)	Std Dev (% Rec)
Acenaphthene-d10	7	34	2	68	27.8
Acenaphthylene-d8	7	18	2	48	17.8
Anthracene-d10	7	21	1	46	17.1
Benzo[a]pyrene-d12	7	15	0	47	16.1
Benzo[b&k]fluoranthenes-d12	7	30	1	66	22.5
Benzo[ghi]perylene-d12	7	14	0	31	10.3
Benz[a]anthracene-d12	7	35	3	81	31.4
Chrysene-d12	7	46	5	79	29.8
Dibenz[a,h]anthracene-d14	7	17	0	37	12.7
Fluoranthene-d10	7	39	12	63	18.7
Fluorene-d10	7	46	3	97	38.6
Indeno[1,2,3-cd]pyrene-d10	7	16	1	35	11.6
Phenanthrene-d10	7	38	7	55	15.5
Pyrene-d10	7	39	13	60	19.1

Table F2-16. SVOC Trip Spike and Lab Spike Recovery Data

Sample ID	Compound	% Rec.
MM5 Trip Spike		
	5-methyl chrysene	93
	7H-dibenzo[c,g]carbazole	70
	Acenaphthene	87
	Acenaphthylene	90
	Anthracene	95
	Benzo[a]pyrene	87
	Benzo[b,j&k]fluoranthenes	95
	Benzo[ghi]perylene	91
	Benz[a]anthracene	89
	Chrysene	103
	Dibenzo[a,e]pyrene	62
	Dibenzo[a,h]pyrene	23
	Dibenzo[a,i]pyrene	49
	Dibenz[a,h]acridine	91
	Dibenz[a,h]anthracene	91
	Dibenz[a,i]acridine	107
	Fluoranthene	92
	Fluorene	98
	Indeno[1,2,3-cd]pyrene	85
	Phenanthrene	117
	Pyrene	91
MM5 Lab Spike		
	5-methyl chrysene	83
	7H-dibenzo[c,g]carbazole	102
	Acenaphthene	100
	Acenaphthylene	94
	Anthracene	98
	Benzo[a]pyrene	89
	Benzo[b,j&k]fluoranthenes	84
	Benzo[ghi]perylene	72
	Benz[a]anthracene	81
	Chrysene	76
	Dibenzo[a,e]pyrene	87
	Dibenzo[a,h]pyrene	64
	Dibenzo[a,i]pyrene	79
	Dibenz[a,h]acridine	88
	Dibenz[a,h]anthracene	82
	Dibenz[a,i]acridine	97
	Fluoranthene	80
	Fluorene	96
	Indeno[1,2,3-cd]pyrene	85
	Phenanthrene	89
	Pyrene	84

Table F2-17. SVOC Surrogate Spike Recovery Data

Sample ID	Compound	% Rec.
ESP Inlet Gas		
H-237/233/181/163/235/236	Biphenyl-d10	102
H-111/H-109/H-125	Biphenyl-d10	530
H-317/281/238/212/277/278	Biphenyl-d10	153
H-417/418/419/306/291/352/353	Biphenyl-d10	128
H-237/233/181/163/235/236	Hexachlorobenzene-13C6	66
H-317/281/238/212/277/278	Hexachlorobenzene-13C6	108
H-111/H-109/H-125	Hexachlorobenzene-13C6	160
H-417/418/419/306/291/352/353	Hexachlorobenzene-13C6	115
H-111/H-109/H-125	Perylene-d12	92
H-237/233/181/163/235/236	Perylene-d12	42
H-317/281/238/212/277/278	Perylene-d12	19
H-417/418/419/306/291/352/353	Perylene-d12	0
Stack Gas		
H-227/194/119/223/224	Biphenyl-d10	918
H-388/314/292/354/355	Biphenyl-d10	146
H-316/228/211/279/280	Biphenyl-d10	138
H-388/314/292/354/355	Hexachlorobenzene-13C6	106
H-316/228/211/279/280	Hexachlorobenzene-13C6	87
H-227/194/119/223/224	Hexachlorobenzene-13C6	73
H-316/228/211/279/280	Perylene-d12	63
H-388/314/292/354/355	Perylene-d12	0
H-227/194/119/223/224	Perylene-d12	0
MM5 Trip Spike		
	Biphenyl-d10	125
	Hexachlorobenzene-13C6	95
	Perylene-d12	126
MM5 Lab Spike		
	Biphenyl-d10	137
	Hexachlorobenzene-13C6	118
	Perylene-d12	136
MM5 Lab Blank		
	Biphenyl-d10	116
	Hexachlorobenzene-13C6	102
	Perylene-d12	114

Summary for ESP and Stack Gas

	No. of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)	Std Dev (% Rec)
Biphenyl-d10	8	280	102	918	293.4
Hexachlorobenzene-13C6	8	101	66	160	29.5
Perylene-d12	8	43	0	126	47.4

Table F2–18. VOST Method Spike Recovery Data

Compound	MS (% Rec)	MSD (% Rec)	Mean (% Rec)	RPD (%)
Methylene Chloride	130	130	130	0.0
1,2–Dichloroethane	130	130	130	0.0
1,3–Dichlorobenzene	128	130	129	1.6
1,1,2,2–Tetrachloroethane	128	128	128	0.0
trans–1,2–Dichloroethene	128	128	128	0.0
1,2–Dichlorobenzene	127	127	127	0.0
Tetrachloroethene	126	125	126	0.8
Trichlorofluoromethane	126	125	126	0.8
Chloroform	126	123	125	2.4
Chlorobenzene	125	123	124	1.6
1,1–Dichloroethane	123	123	123	0.0
1,4–Dichlorobenzene	123	122	123	0.8
Ethyl Benzene	122	122	122	0.0
o–Xylene	122	121	122	0.8
Acetone	120	121	121	0.8
1,1–Dichloroethene	119	120	120	0.8
Styrene	119	120	120	0.8
4–Methyl–2–Pentanone	114	120	117	5.1
2–Butanone	108	119	114	9.7
Carbon Tetrachloride	103	116	110	11.9
Bromodichloromethane	103	116	110	11.9
Bromoform	102	114	108	11.1
1,1,2–Trichloroethane	100	111	106	10.4
1,1,1–Trichloroethane	99	107	103	7.8
Dibromochloromethane	99	105	102	5.9
Chloroethane	93	105	99	12.1
Trichloroethene	93	104	99	11.2
trans–1,3–Dichloropropene	92	103	98	11.3
cis–1,3–Dichloropropene	92	99	96	7.3
2–Hexanone	91	97	94	6.4
Benzene	89	95	92	6.5
1,2–Dichloropropane	89	95	92	6.5
Bromomethane	89	94	92	5.5
m,p–Xylene	86	92	89	6.7
Vinyl Chloride	70	91	81	26.1
Vinyl Acetate	50	88	69	55.1
Chloromethane	49	84	67	52.6
Carbon Disulfide	49	44	47	10.8
Toluene	142	137	140	3.6

Table F.2-19. VOST Surrogate Spike Recovery Data

Sample	Compound	% Recovery
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	92
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	105
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	106
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	115
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	128
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	105
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	120
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	123
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	126
Stack Gas, 20L VOST Sur	1,2-Dichloroethane-d4	128
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	100
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	83
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	82
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	96
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	96
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	85
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	113
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	85
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	117
Stack Gas, 20L VOST Sur	4-Bromofluorobenzene	109
Stack Gas, 20L VOST Sur	Toluene-d8	81
Stack Gas, 20L VOST Sur	Toluene-d8	87
Stack Gas, 20L VOST Sur	Toluene-d8	84
Stack Gas, 20L VOST Sur	Toluene-d8	92
Stack Gas, 20L VOST Sur	Toluene-d8	92
Stack Gas, 20L VOST Sur	Toluene-d8	86
Stack Gas, 20L VOST Sur	Toluene-d8	93
Stack Gas, 20L VOST Sur	Toluene-d8	82
Stack Gas, 20L VOST Sur	Toluene-d8	97
Stack Gas, 20L VOST Sur	Toluene-d8	80
VOST Lab Blank1 Sur	1,2-Dichloroethane-d4	93
VOST Lab Blank1 Sur	4-Bromofluorobenzene	78
VOST Lab Blank1 Sur	Toluene-d8	96
VOST Lab Blank2 Sur	1,2-Dichloroethane-d4	95
VOST Lab Blank2 Sur	4-Bromofluorobenzene	78
VOST Lab Blank2 Sur	Toluene-d8	96
VOST Lab Blank3 Sur	1,2-Dichloroethane-d4	128
VOST Lab Blank3 Sur	4-Bromofluorobenzene	99
VOST Lab Blank3 Sur	Toluene-d8	91
VOST Meth Spk1 Sur	1,2-Dichloroethane-d4	118
VOST Meth Spk1 Sur	4-Bromofluorobenzene	84
VOST Meth Spk1 Sur	Toluene-d8	115
VOST Meth Spk2 Sur	1,2-Dichloroethane-d4	96
VOST Meth Spk2 Sur	4-Bromofluorobenzene	84
VOST Meth Spk2 Sur	Toluene-d8	116

Summary		Number of Results	Mean (% Rec)	Min (% Rec)	Max (% Rec)
	1,2-Dichloroethane-d4	15	112	92	128
	4-Bromofluorobenzene	15	93	78	117
	Toluene-d8	15	93	80	116

Table F.2–20. Spike Recovery Data for Aldehydes in Gas Samples

Sample ID	Compound	Method	% Recovery
Stack gas, impingers LCS	Acetaldehyde	HPLC	100
Stack gas, impingers LCS	Formaldehyde	HPLC	89
Stack gas, impingers Trip Spike (H–369)	Formaldehyde	HPLC	83
Stack gas, impingers Trip Spike (H–369)	Acetaldehyde	HPLC	81
Stack gas, impingers Matrix Spike (H–307)	Acetaldehyde	HPLC	92
Stack gas, impingers Matrix Spike (H–307)	Formaldehyde	HPLC	90

APPENDIX G: PROCESS STREAM FLOW RATES AND FLUE GAS SAMPLING DATA

Table G-1
Process Stream Flows at Site 16 - OFA Test

Stream	Mean Flow Rate	Std. Dev.	Source
Coal (lb/hr, wet)	346,000	3,800	Measured[a]
Coal (lb/hr, dry)	330,000	3,900	Calculated[b]
Bottom Ash (lb/hr, dry)	6,770	790	Calculated[c]
ESP Hopper Ash (lb/hr, dry)	27,100	3,200	Calculated[c]
ESP Inlet Gas (dscfm)	1,290,000	28,000	Measured[d]
Stack Gas (dscfm)	1,110,000	61,000	Measured[d]

[a] Available from plant meters.

[b] Calculated from wet coal flow rate and moisture content.

[c] Calculated assuming a 80:20 fly ash to bottom ash split of coal ash flow.

[d] Average of gas flows measured during multi-metals and semivolatiles sampling, when duct was traversed.

Table G-2
Process Stream Flows at Site 16 - OFA/LNB Test

Stream	Mean Flow Rate	Std. Dev.	Source
Coal (lb/hr, wet)	328,000	1,200	Measured[a]
Coal (lb/hr, dry)	315,000	2,100	Calculated[b]
Bottom Ash (lb/hr, dry)	7,060	1,800	Calculated[c]
ESP Hopper Ash (lb/hr, dry)	23,700	1,100	Calculated[d]
ESP Inlet Gas (dscfm)	1,250,000	18,000	Measured[e]
Stack Gas (dscfm)	1,080,000	7,600	Measured[e]

[a] Available from plant meters.

[b] Calculated from wet coal flow rate and moisture content.

[c] Calculated as the difference between coal ash rate and ESP inlet ash rate.

[d] Calculated as the difference between the ESP inlet ash rate and the stack ash rate.

[e] Average of gas flows measured during multi-metals and semivolatiles sampling, when duct was traversed.

OFA Test Flue Gas Sampling Data

MULTI-METALS

PARAMETER	INLET		STACK	
Date	3/5/91		3/5/91	
Dry Standard Meter Volume	55.312	DSCF	65.224	DSCF
Percent Flue Gas Moisture	6.34	%	6.33	%
Flue Gas Molecular Weight (wet)	29.19	g/g-mole	29.28	g/g-mole
Average Gas Velocity	78.47	ft/sec	84.17	ft/sec
Average Flue Gas Flow Rate	1,276,745	DSCFM	1,082,066	DSCFM
Adjusted Inlet Flue Gas Flow Rate	1,240,000	DSCFM		
Isokinetic Sampling Rate	101.7	%	99.6	%
Oxygen Concentration	7.5	%	9	%
Total Mass of Particulate Solids	5.6627	grams	0.2220	grams
Particulate Concentration	1.58	gr/DSCF	0.0525	gr/DSCF
Particulate Emissions	16,795	lb/hr	487	lb/hr
Impinger Volume (imp 1&2)	634.2	grams	630.3	grams
Impinger Volume (imp 3&4)	541.7	grams	553.4	grams

Date	3/6/91		3/6/91	
Dry Standard Meter Volume	55.602	DSCF	63.622	DSCF
Percent Flue Gas Moisture	6.17	%	6.86	%
Flue Gas Molecular Weight (wet)	29.00	g/g-mole	29.34	g/g-mole
Average Gas Velocity	82.62	ft/sec	83.95	ft/sec
Average Flue Gas Flow Rate	1,299,211	DSCFM	1,056,146	DSCFM
Adjusted Inlet Flue Gas Flow Rate	1,270,000	DSCFM		
Isokinetic Sampling Rate	100.4	%	99.5	%
Oxygen Concentration	7	%	8.5	%
Total Mass of Particulate Solids	4.4173	grams	0.5863	grams
Particulate Concentration	1.23	gr/DSCF	0.14	gr/DSCF
Particulate Emissions	13,348	lb/hr	1,288	lb/hr
Impinger Volume (imp 1&2)	684.3	grams	644.4	grams
Impinger Volume (imp 3&4)	525.4	grams	568.7	grams

Date	3/6/91		3/6/91	
Dry Standard Meter Volume	51.725	DSCF	65.539	DSCF
Percent Flue Gas Moisture	6.45	%	6.27	%
Flue Gas Molecular Weight (wet)	29.06	g/g-mole	29.42	g/g-mole
Average Gas Velocity	83.14	ft/sec	84.1	ft/sec
Average Flue Gas Flow Rate	1,307,402	DSCFM	1,058,476	DSCFM
Adjusted Inlet Flue Gas Flow Rate	1,270,000	DSCFM		
Isokinetic Sampling Rate	92.8	%	102.3	%
Oxygen Concentration	7.5	%	8.5	%
Total Mass of Particulate Solids	4.3543	grams	0.4498	grams
Particulate Concentration	1.30	gr/DSCF	0.11	gr/DSCF
Particulate Emissions	14,144	lb/hr	961	lb/hr
Impinger Volume (imp 1&2)	614.2	grams	589.3	grams
Impinger Volume (imp 3&4)	607	grams	558	grams

ANIONS

	INLET Dry Standard Meter Volume	STACK Dry Standard Meter Volume
3/3/91	58.787 DSCF	56.882 DSCF
3/5/91	59.168 DSCF	59.217 DSCF
3/6/91-1	60.846 DSCF	55.876 DSCF
3/6/91-2	58.317 DSCF	55.514 DSCF

	Filter Weight Gain	Filter Weight Gain
3/3/91	19.1000 gms	0.9849 gms
3/5/91	14.644 gms	0.3099 gms
3/6/91-1	18.41 gms	0.5078 gms
3/6/91-2	14.5758 gms	0.4202 gms

	Impinger volume	Impinger volume
3/3/91	605.5 g	502.1 g
3/5/91	732.9 g	501.6 g
3/6/91-1	730.8 g	545 g
3/6/91-2	595.7 g	583.9 g

ALDEHYDES

	Dry Standard Meter Volume	Dry Standard Meter Volume
3/3/91	11.559 DSCF	57.216 DSCF
3/5/91	14.055 DSCF	21.563 DSCF
3/6/91	13.202 DSCF	19.489 DSCF

MODIFIED METHOD 5

PARAMETER	INLET	STACK
Date	3/3/91	3/3/91
Dry Standard Meter Volume	65.275 DSCF	71.552 DSCF
Percent Flue Gas Moisture	6.34 %	6.17 %
Flue Gas Molecular Weight (wet)	29.07 g/g-mole	29.17 g/g-mole
Average Gas Velocity	80.68 ft/sec	90.98 ft/sec
Average Flue Gas Flow Rate	1,279,777 DSCFM	1,174,695 DSCFM
Adjusted Inlet Flue Gas Flow Rate	1,220,000 DSCFM	
Isokinetic Sampling Rate	86.0 %	100.6 %

PARAMETER	INLET	STACK
Date	3/4/91	3/4/91
Dry Standard Meter Volume	77.691 DSCF	68.259 DSCF
Percent Flue Gas Moisture	6.17 %	6.86 %
Flue Gas Molecular Weight (wet)	29.09 g/g-mole	29.18 g/g-mole
Average Gas Velocity	82.18 ft/sec	87.21 ft/sec
Average Flue Gas Flow Rate	1,300,588 DSCFM	
Adjusted Inlet Flue Gas Flow Rate	1,270,000 DSCFM	1,135,673 DSCFM
Isokinetic Sampling Rate	99.8 %	99.3 %

PARAMETER	INLET	STACK
Date	3/5/91	3/5/91
Dry Standard Meter Volume	75.358 DSCF	70.908 DSCF
Percent Flue Gas Moisture	6.34 %	6.27 %
Flue Gas Molecular Weight (wet)	29.07 g/g-mole	29.38 g/g-mole
Average Gas Velocity	78.63 ft/sec	83.98 ft/sec
Average Flue Gas Flow Rate	1,276,582 DSCFM	1,075,909 DSCFM
Adjusted Inlet Flue Gas Flow Rate	1,240,000 DSCFM	
Isokinetic Sampling Rate	98.6 %	107.3 %

VOST DATA

Run No.	Pair No.	Date	Start Time	Stop Time	Volume at Meter (l)	DGMCF	Meter Temp (deg F)	Probe Temp (deg F)	Bar. Pressure (in. Hg)	as Volume Collected (Std l)
ESP INLET	A	3/3/91	1936	1938	1.15	1.037	44	278	28.9	1.21
RUN NO.1	B	3/3/91	1951	2001	5.06	1.037	44	281	28.9	5.31
	C	3/3/91	2012	2052	19.45	1.037	43	271	28.9	20.45
ESP INLET	A	3/4/91	1705	1745	18.96	1.037	53	277	29.22	19.76
RUN NO.2	B	3/4/91	1815	1825	4.86	1.037	52	292	29.22	5.08
	C	3/4/91	1830	1832	0.74	1.037	51	276	29.22	0.77
ESP INLET	A	3/5/91	1718	1758	18.91	1.037	71	284	29.44	19.19
RUN NO.3	B	3/5/91	1806	1816	4.67	1.037	71	282	29.44	4.74
	C	3/5/91	1820	1822	1.00	1.037	70	286	29.44	1.02
Stack	A	3/3/91	1906	1946	20.02	0.962	66	304	28.65	18.51
RUN NO.1	B	3/3/91	2005	2015	5.03	0.962	66	307	28.65	4.65
	C	3/3/91	2043	2045	1.01	0.962	68	290	28.65	0.93
Stack	A	3/4/91	1653	1733	20.02	0.962	62	283	28.97	18.86
RUN NO.2	B	3/4/91	1822	1832	5.01	0.962	61	290	28.97	4.73
	C	3/4/91	1845	1847	1.00	0.962	61	270	28.97	0.94
Stack	A	3/5/91	1720	1800	19.98	1.038	78	267	29.1	19.80
RUN NO.3	B	3/5/91	1814	1824	5.03	1.038	84	268	29.1	4.93
	C	3/5/91	1834	1836	1.00	1.038	84	270	29.1	0.98

CHROME 6

	Run 1-1	Run 1-2	Run 1-3
Date	3/07/91	3/07/91	3/07/91
Sampling Port	South	West	North
Dry Standard Meter Volume	59.491 DSCF	60.010 DSCF	58.629 DSCF
Isokinetic Sampling Rate	95.5 %	95.9 %	94.7 %

	Run 2-1	Run 2-2	Run 2-3
Date	3/07/91	3/07/91	3/07/91
Sampling Port	South	North	West
Dry Standard Meter Volume	57.569 DSCF	59.104 DSCF	59.351 DSCF
Isokinetic Sampling Rate	98.1 %	102.3 %	100.4 %

	Run 3-1	Run 3-2	Run 3-3
Date	3/08/91	3/08/91	3/08/91
Sampling Port	South	North	West
Dry Standard Meter Volume	58.921 DSCF	60.273 DSCF	59.182 DSCF
Isokinetic Sampling Rate	94.7 %	98.7 %	97.1 %

	Run 4-1	Run 4-2	Run 4-3
Date	3/08/91	3/08/91	3/08/91
Sampling Port	West	South	North
Dry Standard Meter Volume	59.019 DSCF	60.782 DSCF	59.412 DSCF
Isokinetic Sampling Rate	95.0 %	96.7 %	95.8 %

	Run 5-1	Run 5-2	Run 5-3
Date	3/08/91	3/08/91	3/08/91
Sampling Port	North	South	West
Dry Standard Meter Volume	49.219 DSCF	57.884 DSCF	49.402 DSCF
Isokinetic Sampling Rate	98.5 %	107.6 %	91.9 %

ARSENIC

3/07/91	Run 1-1	Run 1-2	Run 1-3
Sampling Port	North	West	South
Dry Standard Meter Volume	60.784 DSCF	60.145 DSCF	57.676 DSCF
Isokinetic Sampling Rate	98.5 %	98.5 %	98.3 %

3/07/91	Run 2-1	Run 2-2	Run 2-3
Sampling Port	West	North	South
Dry Standard Meter Volume	56.952 DSCF	58.802 DSCF	24.966 DSCF
Isokinetic Sampling Rate	96.3 %	98.2 %	89.6 %

3/08/91	Run 3-1	Run 3-2	Run 3-3
Sampling Port	North	West	South
Dry Standard Meter Volume	59.844 DSCF	58.544 DSCF	59.314 DSCF
Isokinetic Sampling Rate	104.1 %	97.8 %	99.9 %

3/08/91	Run 4-1	Run 4-2	Run 4-3
Sampling Port	North	South	West
Dry Standard Meter Volume	58.395 DSCF	58.892 DSCF	61.011 DSCF
Isokinetic Sampling Rate	101.3 %	99.8 %	99.5 %

Mercury Data

Run No.	Date	Start Time	Stop Time	Volume at Meter (l)	DGMCF	Meter Temp (deg F)	Probe Temp (deg F)	Bar. Pressure (in. Hg)	as Volume Collected (Std l)
Stack Run 1	3/07/91	1302	1622	100.00	1.038	87	289	29.09	97.42
Stack Run 2	3/07/91	1716	2036	100.00	1.038	90	293	29.09	96.94
Stack Run 3	3/08/91	737	1103	100.00	1.038	77	293	29.17	99.54
Stack Run 4	3/08/91	1146	1506	100.00	1.038	79	297	29.17	99.19

OFA/LNB Test Flue Gas Sampling Data

Location ESP Inlet - Particulate/Metals

Run No.	1	2	3	4	Average
Date	05-18-93	05-19-93	05-20-93	05-21-93	-
Time Start	1258 CDT	0830 CDT	0725 CDT	0715 CDT	-
Time Finish	1639 CDT	1211 CDT	1106 CDT	1107 CDT	-
Operator	RLM	DHD	DHD	DHD	-
Initial Leak Rate	0.008	0.004	0.006	0.009	-
Final Leak Rate	0.017	0.012	0.018	0.012	-
Duct Dimensions (ft2)	425.7	425.7	425.7	425.7	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.008	1.008	1.008	1.008	1.008
Nozzle Diameter (inches)	0.1850	0.1850	0.1850	0.1810	-
Barometric Pressure ("Hg)	29.3	29.6	29.3	29.4	29.4
Static Pressure ("H2O)	-20.5	-19.5	-17.5	-19.5	-19.25
Meter Volume (acf)	127.573	122.975	121.984	119.711	123.061
Average square root of delta p	1.1868	1.1941	1.1819	1.1518	1.1787
Average delta H (" H2O)	1.27	1.23	1.17	1.13	1.20
Average Stack Temperature (F)	301	305	311	298	304
Average DGM Temp (F)	97.7	77.6	85.4	78.8	84.9
Test Duration (minutes)	216.0	216.0	216.0	216.0	216.0
Condensed Water (g)	208.8	203.8	176.9	177.2	191.7
Filter Weight Gain (g)		11.8018	12.8046	14.2535	12.9533
PNR Weight Gain (g)		4.6916	4.7940	3.5414	4.3423
Impinger Residue (g)					ERR
% CO2	10.0	12.8	12.2	12.2	11.8
% O2	7.8	6.0	6.0	6.0	6.5
% N2	82.2	81.2	81.8	81.8	81.8
Meter Volume (dscf)	119.612	120.808	116.912	116.525	118.464
Flue Gas Moisture (%)	7.6	7.4	6.7	6.7	7.1
Gas Molecular Weight (Wet) (g/g-mole	29.01	29.38	29.38	29.38	29.29
Absolute Stack Pressure (" Hg)	27.79	28.17	28.01	27.97	27.98
Absolute Stack Temperature (R)	761	765	771	758	764
Average Gas Velocity (f/sec)	82.81	82.42	82.13	79.45	81.70
Avg Flow Rate (acfm)	2,115,168	2,105,117	2,097,695	2,029,434	2,086,853
Avg Flow Rate (dscfm)	1,258,769	1,267,221	1,255,498	1,232,217	1,253,426
Isokinetic Sampling Rate (%)	100.34	100.67	98.33	104.32	100.92
Particulate Concentration (gr/dscf)	0.00E+00	2.11E+00	2.32E+00	2.36E+00	1.70E+00
Particulate Concentration (lbs/dscf)	0.00E+00	3.01E-04	3.32E-04	3.37E-04	2.42E-04
Particulate Emission (grams/sec)	0.00	2883.94	3150.34	3136.78	2292.77
Particulate Emission (lbs/hour)	0.00	22888.93	25003.26	24895.62	18196.95

Location ESP Inlet - Anions

Run No.	1	2	3	4	Average
Date	05-18-93	05-19-93	5-20-92	05-21-93	-
Time Start	1159 CDT	0750 CDT	0717 CDT	0705 CDT	-
Time Finish	1354 CDT	0950 CDT	0907 CDT	0900 CDT	-
Operator	LLR	LLR	LLR	LLR	-
Initial Leak Rate	0.000	0.004	0.003	0.002	-
Final Leak Rate	0.003	0.002	0.002	0.002	-
Duct Dimensions (ft2)	425.7	425.7	425.7	425.7	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.007	1.007	1.007	1.007	1.007
Nozzle Diameter (inches)	0.181	0.181	0.181	0.181	0.181
Barometric Pressure ("Hg)	29.30	29.60	29.30	29.40	29.40
Static Pressure ("H2O)	-20.50	-19.50	-17.50	-19.00	-19.13
Meter Volume (acf)	65.631	66.300	63.697	67.710	65.835
Average square root of delta p	1.2751	1.2247	1.3038	1.3416	1.2863
Average delta H (" H2O)	1.21	1.05	1.20	1.25	1.18
Average Stack Temperature (F)	308	297	300	296	300
Average DGM Temp (F)	91.3	69.1	73.5	66.5	75.1
Test Duration (minutes)	110.0	120.0	110.0	115.0	113.8
Condensed Water (g)	120.4	120.6	112.0	117.3	117.6
% CO2	10.0	12.8	12.2	12.2	11.8
% O2	7.8	6.0	6.0	6.0	6.5
% N2	82.2	81.2	81.8	81.8	81.8
Meter Volume (dscf)	62.174	66.085	62.357	67.400	64.504
Flue Gas Moisture (%)	8.4	7.9	7.8	7.6	7.9
Gas Molecular Weight (Wet) (g/g-mole	28.91	29.31	29.24	29.27	29.18
Absolute Stack Pressure (" Hg)	27.79	28.17	28.01	28.00	27.99
Absolute Stack Temperature (R)	768	757	760	756	760
Average Gas Velocity (f/sec)	89.50	84.23	90.17	92.53	89.11
Avg Flow Rate (acfm)	2,286,103	2,151,457	2,303,109	2,363,448	2276029.36
Avg Flow Rate (dscfm)	1,337,491	1,299,488	1,381,019	1,427,056	1361263.65
Isokinetic Sampling Rate (%)	100.70	100.98	97.81	97.86	99.34

Location ESP Inlet - MM5

Run No.	MM5-1	2	3	4	Average
Date	05-18-93	05-19-93	05-20-93	05-21-93	-
Time Start	1215 CDT	0750 CDT	0804 CDT	0755 CDT	-
Time Finish	1558 CDT	1133 CDT	1146 CDT	1159 CDT	-
Operator	DHD	DHD	DHD	DHD	-
Initial Leak Rate	0.008	0.009	0.010	0.003	-
Final Leak Rate	0.014	0.014	0.008	0.07	-
Duct Dimensions (ft2)	425.7	425.7	425.7	425.7	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.988	0.988	0.988	0.988	0.988
Nozzle Diameter (inches)	0.1970	0.1970	0.1970	0.1970	-
Barometric Pressure ("Hg)	29.3	29.6	29.3	29.4	29.4
Static Pressure ("H2O)	-20.5	-19.5	-17.5	-19.5	-19.25
Meter Volume (acf)	144.449	141.926	142.550	141.032	142.489
Average square root of delta p	1.2009	1.1913	1.1773	1.1726	1.1855
Average delta H (" H2O)	1.48	1.47	1.45	1.46	1.47
Average Stack Temperature (F)	310	308	305	298	305
Average DGM Temp (F)	99.9	78.0	94.2	83.5	88.9
Test Duration (minutes)	216.0	216.0	216.0	216.0	216.0
Condensed Water (g)	206.6	208.7	181.4	174.8	192.9
% CO2	10.0	12.8	12.2	12.2	11.8
% O2	7.8	6.0	6.0	6.0	6.5
% N2	82.2	81.2	81.8	81.8	81.8
Meter Volume (dscf)	132.291	136.640	131.890	133.497	133.579
Flue Gas Moisture (%)	6.9	6.7	6.1	5.8	6.4
Gas Molecular Weight (Wet) (g/g-mole	29.09	29.46	29.45	29.48	29.37
Absolute Stack Pressure (" Hg)	27.79	28.17	28.01	27.97	27.98
Absolute Stack Temperature (R)	770	768	765	758	765
Average Gas Velocity (f/sec)	84.14	82.32	81.43	80.75	82.16
Avg Flow Rate (acfm)	2,149,131	2,102,535	2,080,011	2,062,567	2,098,561
Avg Flow Rate (dscfm)	1,274,834	1,268,256	1,261,022	1,263,814	1,266,981
Isokinetic Sampling Rate (%)	96.64	100.33	97.40	98.37	98.19

Location Stack Outlet - Metals/Particulate

Run No.	1	2	3	4	Average
Date	05-18-93	05-19-93	05-20-93	05-21-93	-
Time Start	1325 CDT	0704 CDT	0703 CDT	0838 CDT	-
Time Finish	1852 CDT	1108 CDT	1041 CDT	1250 CDT	-
Operator	EBZ	TMP	TMP	EBZ	-
Initial Leak Rate	0.000	0.005	0.005	0.000	-
Final Leak Rate	0.002	0.005	0.000	0.005	-
Stack Diameter (ft)	21.0	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.017	1.017	0.994	0.994	1.006
Nozzle Diameter (inches)	0.1880	0.1880	0.1870	0.1870	-
Barometric Pressure ("Hg)	29.1	29.4	29.0	29.20	29.175
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	95.770	116.385	116.206	118.502	111.716
Average square root of delta p	1.2133	1.2032	1.2157	1.2209	1.2133
Average delta H (" H2O)	1.27	1.28	1.35	1.34	1.31
Average Stack Temperature (F)	314	302	308	308	308
Average DGM Temp (F)	92.2	83.9	84.0	79.2	84.8
Test Duration (minutes)	160.0	192.0	192.0	192.0	184.0
Condensed Water (g)	145.5	171.2	119.7	160.8	149.3
Filter Weight Gain (g)	0.2381	0.2395	0.3033	0.2416	0.2556
PNR Weight Gain (g)		0.1028	0.1838	0.1551	0.1472
Impinger Residue (g)					ERR
% CO2	9.6	10.8	11.0	11.0	10.6
% O2	8.0	8.8	8.0	8.0	8.2
% N2	82.4	80.4	81.0	81.0	81.2
Meter Volume (dscf)	90.873	113.272	109.027	112.955	106.532
Flue Gas Moisture (%)	7.0	6.7	4.9	6.3	6.2
Gas Molecular Weight (Wet) (g/g-mole	29.02	29.28	29.48	29.32	29.28
Absolute Stack Pressure (" Hg)	28.90	29.20	28.80	29.00	28.98
Absolute Stack Temperature (R)	774	762	768	768	768
Average Gas Velocity (f/sec)	83.68	81.56	83.02	83.31	82.89
Avg Flow Rate (acfm)	1,739,050	1,695,029	1,725,340	1,731,317	1,722,684
Avg Flow Rate (dscfm)	1,065,344	1,069,826	1,085,138	1,081,017	1,075,331
Isokinetic Sampling Rate (%)	95.81	99.10	95.05	98.85	97.20
Particulate Concentration (gr/dscf)	4.04E-02	4.66E-02	6.90E-02	5.42E-02	5.26E-02
Particulate Concentration (lbs/dscf)	5.78E-06	6.66E-06	9.85E-06	7.74E-06	7.51E-06
Particulate Emission (grams/sec)	46.53	53.89	80.81	63.29	61.13
Particulate Emission (lbs/hour)	369.30	427.72	641.40	502.28	485.17

Location Stack Outlet - Anions

Run No.	1	2	3	4	Average
Date	05-18-93	05-19-93	05-20-93	05-21-93	-
Time Start	1400 CDT	0720 CDT	0736 CDT	0847 CDT	-
Time Finish	1543 CDT	0906 CDT	0930 CDT	1022 CDT	-
Operator	EBZ	TMP	TMP	EBZ	-
Initial Leak Rate	0.002	0.003	0.005	0.000	-
Final Leak Rate	0.000	0.005	0.003	0.005	-
Stack Diameter (ft)	21.0	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.982	0.982	0.982	0.982	0.982
Nozzle Diameter (inches)	0.1840	0.1863	0.1850	0.1960	-
Barometric Pressure ("Hg)	29.1	29.4	29	29.2	29.18
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	68.220	64.531	67.991	63.537	66.070
Average square root of delta p	1.2247	1.1671	1.1571	1.2247	1.1934
Average delta H (" H2O)	1.23	1.20	1.17	1.37	1.24
Average Stack Temperature (F)	315	299	299	300	303
Average DGM Temp (F)	97.5	102.5	94.6	98.8	98.3
Test Duration (minutes)	103.0	106.0	114.0	95.0	104.5
Condensed Water (g)	102.6	104.2	93.0	78.2	94.5
% CO2	9.6	10.8	11.0	11.0	10.6
% O2	8.0	8.8	8.0	8.0	8.2
% N2	82.4	80.4	81.0	81.0	81.2
Meter Volume (dscf)	61.900	58.624	61.798	57.734	60.014
Flue Gas Moisture (%)	7.3	7.7	6.6	6.0	6.9
Gas Molecular Weight (Wet) (g/g-mole	29.00	29.14	29.28	29.35	29.19
Absolute Stack Pressure (" Hg)	28.90	29.20	28.80	29.00	28.98
Absolute Stack Temperature (R)	775	759	759	760	763
Average Gas Velocity (f/sec)	84.55	79.15	78.83	83.10	81.41
Avg Flow Rate (acfm)	1,757,064	1,644,963	1,638,137	1,726,897	1,691,765
Avg Flow Rate (dscfm)	1,072,683	1,029,808	1,023,959	1,092,591	1,054,760
Isokinetic Sampling Rate (%)	105.11	98.28	98.25	91.96	98.40

Location Stack Outlet - MM5

Run No.	1	2	3	4	Average
Date	05-18-93	05-19-93	05-20-93	05-21-93	-
Time Start	1229 CDT	0810 CDT	0807 CDT	0700 CDT	-
Time Finish	1720 CDT	1205 CDT	1223 CDT	1100 CDT	-
Operator	TMP	EBZ	EBZ	TMP	-
Initial Leak Rate	0.001	0.010	0.005	0.005	-
Final Leak Rate	0.005	0.000	0.000	0.000	-
Stack Diameter (ft)	21.0	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.994	0.994	1.017	1.017	1.006
Nozzle Diameter (inches)	0.1890	0.1853	0.1870	0.1850	-
Barometric Pressure ("Hg)	29.1	29.4	29.0	29.2	29.175
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	109.012	116.550	120.203	109.284	113.762
Average square root of delta p	1.2137	1.2230	1.2481	1.1966	1.2204
Average delta H (" H2O)	1.28	1.30	1.34	1.18	1.28
Average Stack Temperature (F)	317	308	303	297	306
Average DGM Temp (F)	96.0	89.4	78.3	70.6	83.6
Test Duration (minutes)	183.0	192.0	192.0	192.0	189.8
Condensed Water (g)	161.4	136.2	150.4	137.8	146.5
% CO2	9.6	10.8	11.0	11.0	10.6
% O2	8.0	8.8	8.0	8.0	8.2
% N2	82.4	80.4	81.0	81.0	81.2
Meter Volume (dscf)	100.398	109.765	116.626	108.260	108.762
Flue Gas Moisture (%)	7.1	5.5	5.7	5.7	6.0
Gas Molecular Weight (Wet) (g/g-mole	29.02	29.41	29.39	29.40	29.30
Absolute Stack Pressure (" Hg)	28.90	29.20	28.80	29.00	28.98
Absolute Stack Temperature (R)	777	768	763	757	766
Average Gas Velocity (f/sec)	83.89	83.06	85.09	80.97	83.25
Avg Flow Rate (acfm)	1,743,277	1,726,196	1,768,255	1,682,758	1,730,121
Avg Flow Rate (dscfm)	1,063,274	1,093,383	1,110,160	1,072,769	1,084,897
Isokinetic Sampling Rate (%)	91.75	96.72	99.38	97.54	96.35

Location Stack Outlet - Aldehyde

Run No.	1	2	3	4	Average
Date	05-19-93	05-20-93	05-21-93	05-21-93	-
Time Start	0933 CDT	1002 CDT	0650 CDT	1137 CDT	-
Time Finish	1121 CDT	1145 CDT	0829 CDT	1317 CDT	-
Operator	TMP	EBZ	EBZ	EBZ	-
Initial Leak Rate	0.005	0.002	0.000	0.005	-
Final Leak Rate	0.002	0.000	0.005	0.000	-
Stack Diameter (ft)	21.0	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.982	0.982	0.982	0.982	0.982
Nozzle Diameter (inches)	0.1863	0.1850	0.1960	0.1960	-
Barometric Pressure ("Hg)	29.4	29.0	29.2	29.2	29.2
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	65.175	62.510	64.580	70.283	65.637
Average square root of delta p	1.1771	1.1474	1.1704	1.2178	1.1782
Average delta H (" H2O)	1.22	1.16	1.43	1.54	1.34
Average Stack Temperature (F)	301	305	291	306	301
Average DGM Temp (F)	108.5	104.4	87.0	100.3	100.1
Test Duration (minutes)	108.0	103.0	99.0	100.0	102.5
Condensed Water (g)	96.2	74.6	86.9	83.1	85.2
% CO2	10.8	11.0	11.0	11.0	11.0
% O2	8.8	8.0	8.0	8.0	8.2
% N2	80.4	81.0	81.0	81.0	80.9
Meter Volume (dscf)	58.587	55.821	59.957	63.717	59.521
Flue Gas Moisture (%)	7.2	5.9	6.4	5.8	6.3
Gas Molecular Weight (Wet) (g/g-mole	29.21	29.36	29.31	29.38	29.32
Absolute Stack Pressure (" Hg)	29.20	28.80	29.00	29.00	29.00
Absolute Stack Temperature (R)	761	765	751	766	761
Average Gas Velocity (f/sec)	79.84	78.36	79.02	82.89	80.03
Avg Flow Rate (acfm)	1,659,219	1,628,373	1,642,080	1,722,625	1,663,074
Avg Flow Rate (dscfm)	1,042,327	1,017,546	1,046,693	1,084,477	1,047,761
Isokinetic Sampling Rate (%)	95.24	98.84	95.67	97.14	96.72

Location Stack Outlet - Chrome VI

Run No.	1	2	3	Average
Date	05-19-93	05-20-93	05-21-93	-
Time Start	1456 CDT	1332 CDT	1412 CDT	-
Time Finish	1652 CDT	1532 CDT	1600 CDT	-
Operator	TMP	TMP	TMP	-
Initial Leak Rate	0.005	0.001	0.005	-
Final Leak Rate	0.005	0.001	0.000	-
Stack Diameter (ft)	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.994	0.994	0.994	0.994
Nozzle Diameter (inches)	0.1870	0.1840	0.1870	-
Barometric Pressure ("Hg)	29.4	29.0	29.2	29.2
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	57.618	56.622	54.780	56.340
Average square root of delta p	1.2508	1.2134	1.1434	1.2025
Average delta H (" H2O)	1.42	1.25	1.17	1.28
Average Stack Temperature (F)	313	317	313	315
Average DGM Temp (F)	88.8	86.5	80.1	85.2
Test Duration (minutes)	96.0	96.0	96.0	96.0
Condensed Water (g)	92.0	98.0	91.0	93.7
% CO2	10.8	11.0	11.2	11.0
% O2	8.8	8.0	7.8	8.2
% N2	80.4	81.0	81.0	80.8
Meter Volume (dscf)	54.333	52.868	52.105	53.102
Flue Gas Moisture (%)	7.4	8.0	7.6	7.7
Gas Molecular Weight (Wet) (g/g-mole	29.19	29.11	29.18	29.16
Absolute Stack Pressure (" Hg)	29.20	28.80	29.00	29.00
Absolute Stack Temperature (R)	773	777	773	775
Average Gas Velocity (f/sec)	85.56	83.90	78.49	82.65
Avg Flow Rate (acfm)	1,778,061	1,743,646	1,631,193	1,717,633
Avg Flow Rate (dscfm)	1,096,755	1,047,988	996,825	1,047,189
Isokinetic Sampling Rate (%)	93.73	98.59	98.90	97.07

Plant Name: Site 16 – OFA/LNB Test
Location: Stack Outlet – VOST

Run No.	1–1	1–2	1–3	1–4	2–1	2–2	2–3	2–4
Date	05–18–93	05–18–93	05–18–93	05–18–93	05–19–93	05–19–93	05–19–93	05–19–93
Time Start	1245	1345	1533	1645	0710	0823	0930	1030
Time Finish	1325	1425	1613	1725	0750	0903	1010	1110
Operator	RVW	RVW	RVW	RVW	RVW	RVW	RVW	RVW
Dry Gas Meter Calibration (Yd)	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991
Barometric Pressure ("Hg)	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10
Initial Meter Volume (Liters)	0.000	0.000	1.500	22.000	45.000	66.000	80.000	3.000
Final Meter Volume (Liters)	20.250	19.965	21.550	44.020	65.060	86.020	100.030	23.610
Average delta H (" H2O)	1.20	1.20	1.00	1.20	1.30	1.20	1.20	1.20
Average Stack Temperature (F)	305	313	315	319	300	299	300	302
Average DGM Temp (F)	102.3	103.3	104.3	106.7	92.7	98.3	100.0	101.7
% CO2	9.6	9.6	9.6	9.6	10.8	10.8	10.8	10.8
% O2	8.0	8.0	8.0	8.0	8.8	8.8	8.8	8.8
% N2	82.4	82.4	82.4	82.4	80.4	80.4	80.4	80.4
Meter Volume (STD Liters, 68F)	18.383	18.092	18.128	19.834	18.532	18.303	18.258	18.731
Meter Volume (Nm3, 0C)	0.0171	0.0168	0.0168	0.0184	0.0172	0.0170	0.0170	0.0174
Flue Gas Moisture (%)	7.0	7.0	7.0	7.0	6.7	6.7	6.7	6.7
Gas MW (Wet) (g/g–mole)	29.03	29.03	29.03	29.03	29.27	29.27	29.27	29.27
Absolute Stack Temperature (R	765	773	775	779	760	759	760	762

Run No.	3–1	3–2	3–3	3–4	4–1	4–2	4–3	4–4	Average
Date	05–20–93	05–20–93	05–20–93	05–20–93	05–21–93	05–21–93	05–21–93	05–21–93	–
Time Start	0830	0935	1047	1155	0736	0841	0935	1033	–
Time Finish	0914	1021	1127	1239	0816	0921	1015	1117	–
Operator	RVW	RVW	RVW	RVW	RVW	RVW	RVW	RVW	–
Dry Gas Meter Calibration (Yd)	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991
Barometric Pressure ("Hg)	29.00	29.00	29.00	29.00	29.20	29.20	29.20	29.20	29.10
Initial Meter Volume (Liters)	24.000	47.000	71.000	92.000	25.500	46.000	67.000	88.000	–
Final Meter Volume (Liters)	46.350	70.000	91.130	114.320	45.890	66.120	87.040	110.330	–
Average delta H (" H2O)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.19
Average Stack Temperature (F)	300	302	305	305	293	297	300	300	303
Average DGM Temp (F)	89.7	95.7	98.0	99.0	76.3	86.0	91.3	93.0	96.1
% CO2	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	10.6
% O2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.2
% N2	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.2
Meter Volume (STD Liters, 68F)	20.684	21.056	18.352	20.312	19.474	18.874	18.619	20.682	19.145
Meter Volume (Nm3, 0C)	0.0192	0.0195	0.0170	0.0189	0.0181	0.0175	0.0173	0.0192	0.0178
Flue Gas Moisture (%)	4.9	4.9	4.9	4.9	6.3	6.3	6.3	6.3	6.2
Gas MW (Wet) (g/g–mole)	29.49	29.49	29.49	29.49	29.32	29.32	29.32	29.32	29.28
Absolute Stack Temperature (R	760	762	765	765	753	757	760	760	763

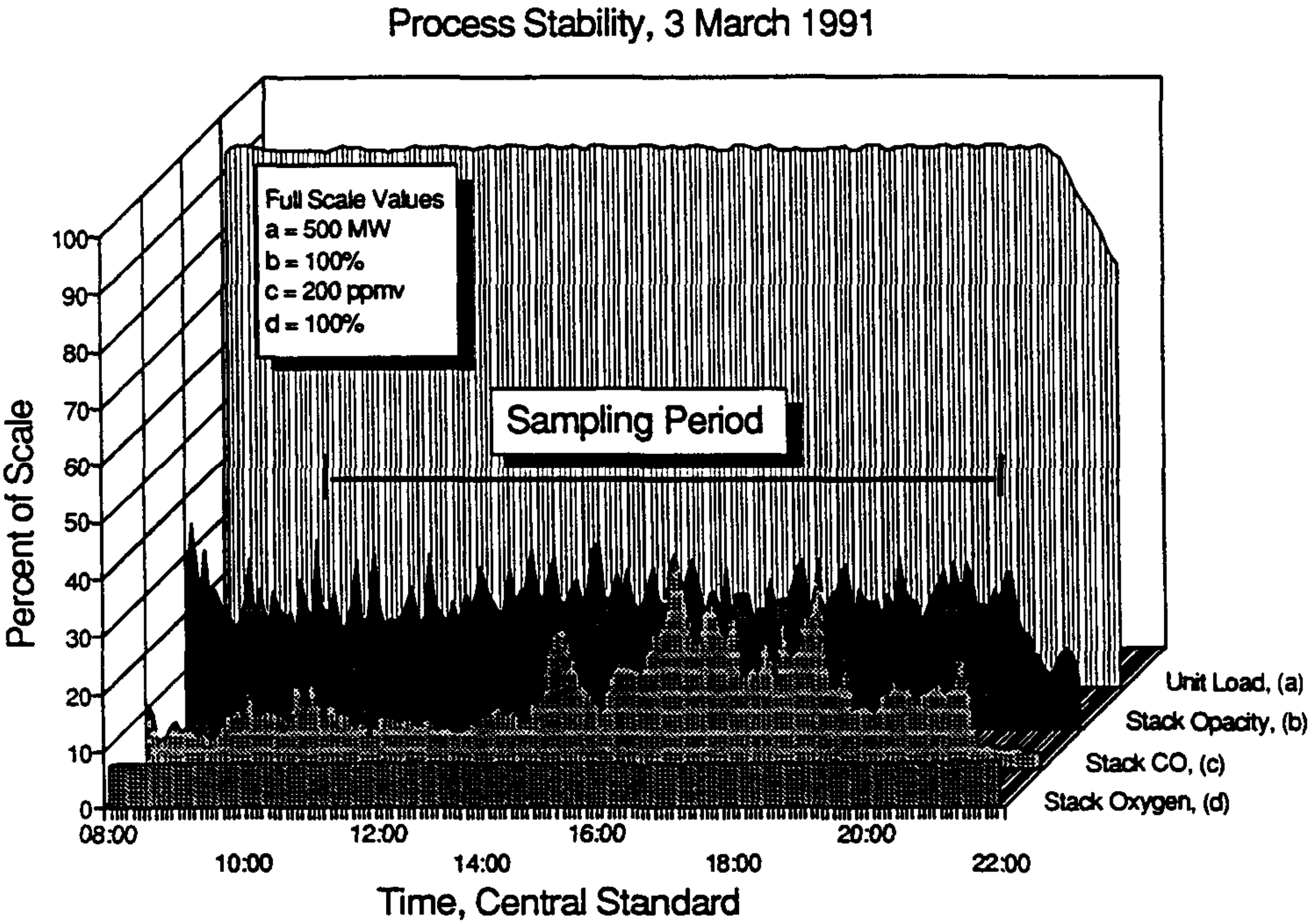
Plant Name: Site 16 – OFA/LNB Test
Location: Stack Outlet – Mercury Speciation

Run No.	1	2	3	4
Date	05–18–93	05–19–93	05–20–93	05–21–93
Time Start	1212	0815	1027	0915
Time Finish	1538	1334	1407	1259
Operator	RVW	RVW	RVW	RVW
Initial Flow (L/min)	0.500	0.451	0.500	0.500
Final Flow (L/min)	0.499	0.462	0.501	0.486
Sample Volume (Nm3)	0.0941	0.0964	0.0972	0.0983

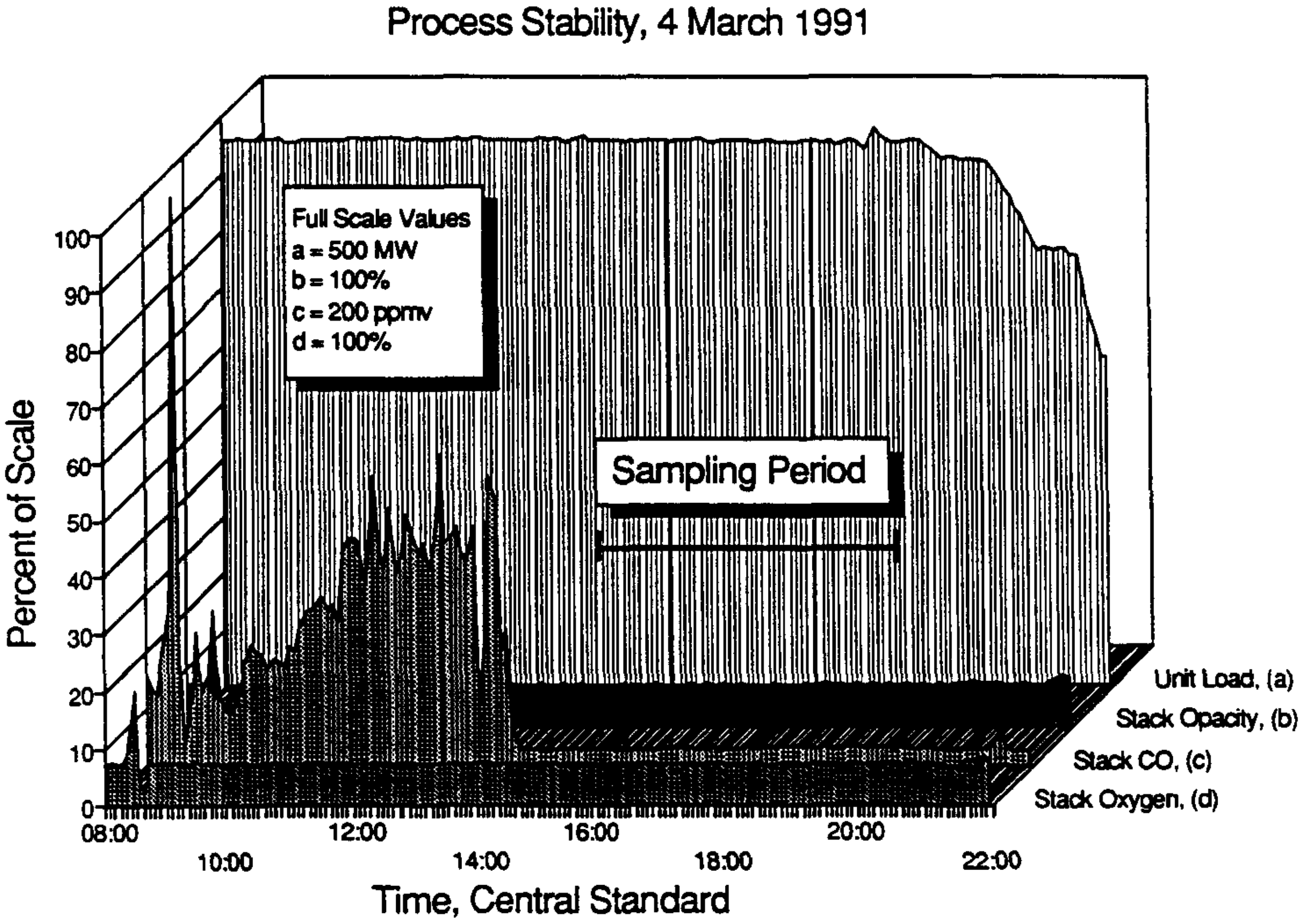
Location Stack Outlet - PSD

Run No.	1	2	3	4	5	6	Average
Date	05-18-93	05-19-93	05-19-93	05-20-93	05-20-93	05-21-93	-
Time Start	1145 CDT	0807 CDT	1100 CDT	0705 CDT	0832 CDT	0730 CDT	-
Time Finish	1910 CDT	0950 CDT	1435 CDT	0756 CDT	1210 CDT	1116 CDT	-
Operator	RVW/EBZ	EBZ	EBZ	EBZ	EBZ	EBZ	-
Initial Leak Rate	0.000	0.005	0.005	0.005	0.008	0.005	-
Final Leak Rate	NA	0.007	0.003				-
Stack Diameter (ft)	21.0	21.0	21.0	21.0	21.0	21.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.995	0.995	0.995	0.995	0.995	0.995	0.995
Nozzle Diameter (inches)	0.2430	0.1207	0.1910	0.1910	0.1910	0.1910	-
Barometric Pressure ("Hg)	29.1	29.4	29.4	29.0	29.0	29.2	29.2
Static Pressure ("H2O)	-2.7	-2.7	-2.7	-2.7	-2.7	-2.7	-2.7
Meter Volume (acf)	302.170	32.278	150.987	21.395	150.885	157.000	135.786
Average square root of delta p	1.2083	1.4491	1.4490	1.3962	1.4077	1.3941	1.3841
Average delta H (" H2O)	1.50	0.29	1.87	1.74	1.76	1.74	1.48
Average Stack Temperature (F)	315	306	304	303	303	296	304
Average DGM Temp (F)	103.3	85.8	92.7	70.0	85.2	79.5	86.1
Test Duration (minutes)	445.0	103.0	200.0	51.0	209.0	226.0	205.7
Condensed Water (g)	326.9	40.0	258.2	30.0	140.5	188.3	164.0
% CO2	9.6	10.8	10.8	11.0	11.0	11.0	10.7
% O2	8.0	8.8	8.8	8.0	8.0	8.0	8.3
% N2	82.4	80.4	80.4	81.0	81.0	81.0	81.0
Meter Volume (dscf)	275.133	30.551	141.678	20.646	141.547	149.859	126.569
Flue Gas Moisture (%)	5.3	5.8	7.9	6.4	4.5	5.6	5.9
Gas Molecular Weight (Wet) (g/g-mole	29.23	29.38	29.12	29.30	29.54	29.40	29.33
Absolute Stack Pressure (" Hg)	28.90	29.20	29.20	28.80	28.80	29.00	28.98
Absolute Stack Temperature (R)	775	766	764	763	763	756	764
Average Gas Velocity (f/sec)	83.11	98.33	98.60	95.31	95.76	94.27	94.23
Avg Flow Rate (acfm)	1,727,238	2,043,532	2,049,150	1,980,720	1,990,063	1,959,057	1,958,293
Avg Flow Rate (dscfm)	1,075,900	1,294,238	1,272,723	1,234,735	1,265,070	1,251,308	1,232,329
Isokinetic Sampling Rate (%)	61.81	99.92	96.91	57.08	93.21	92.26	83.53

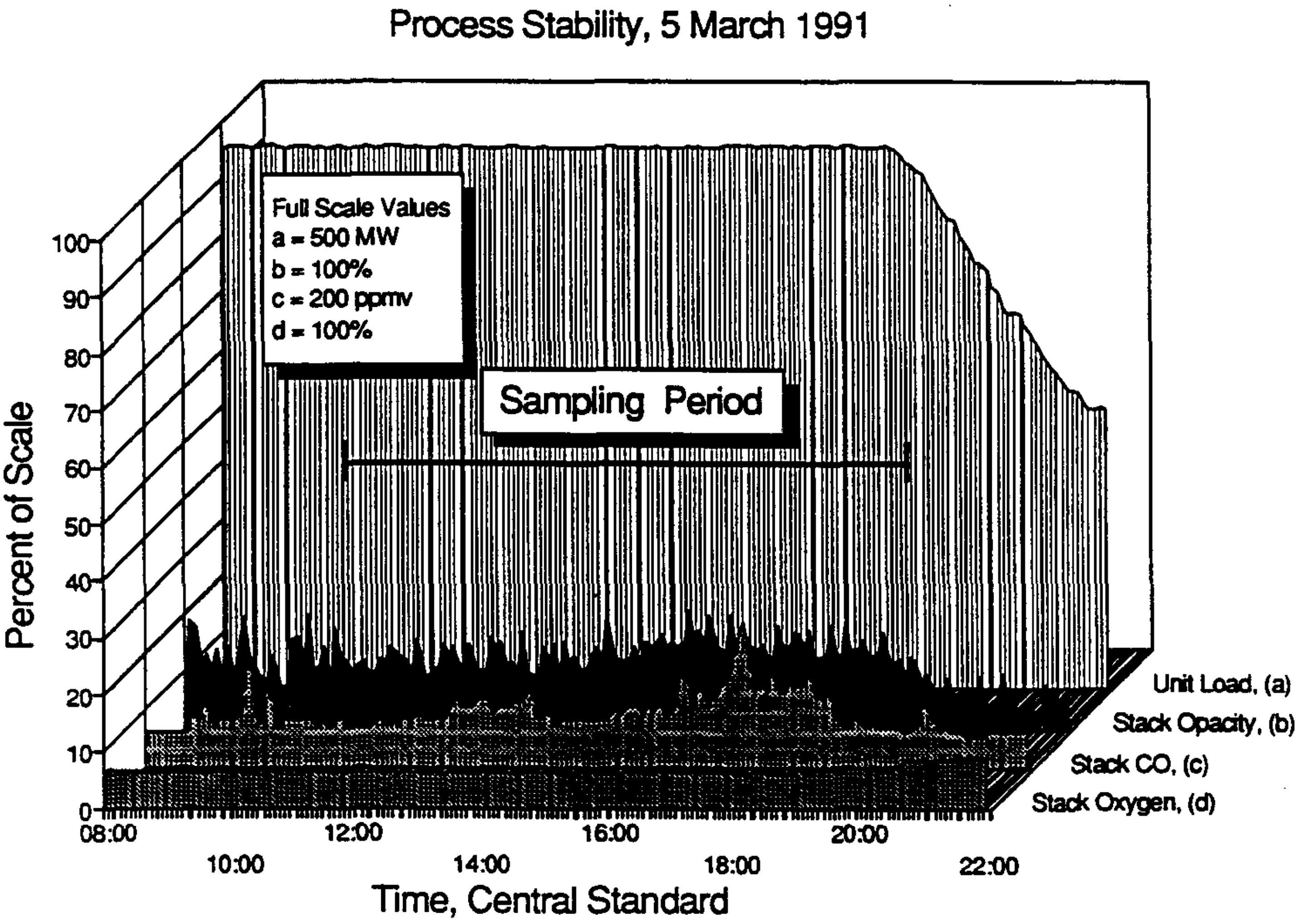
APPENDIX H: PROCESS DATA TREND PLOTS



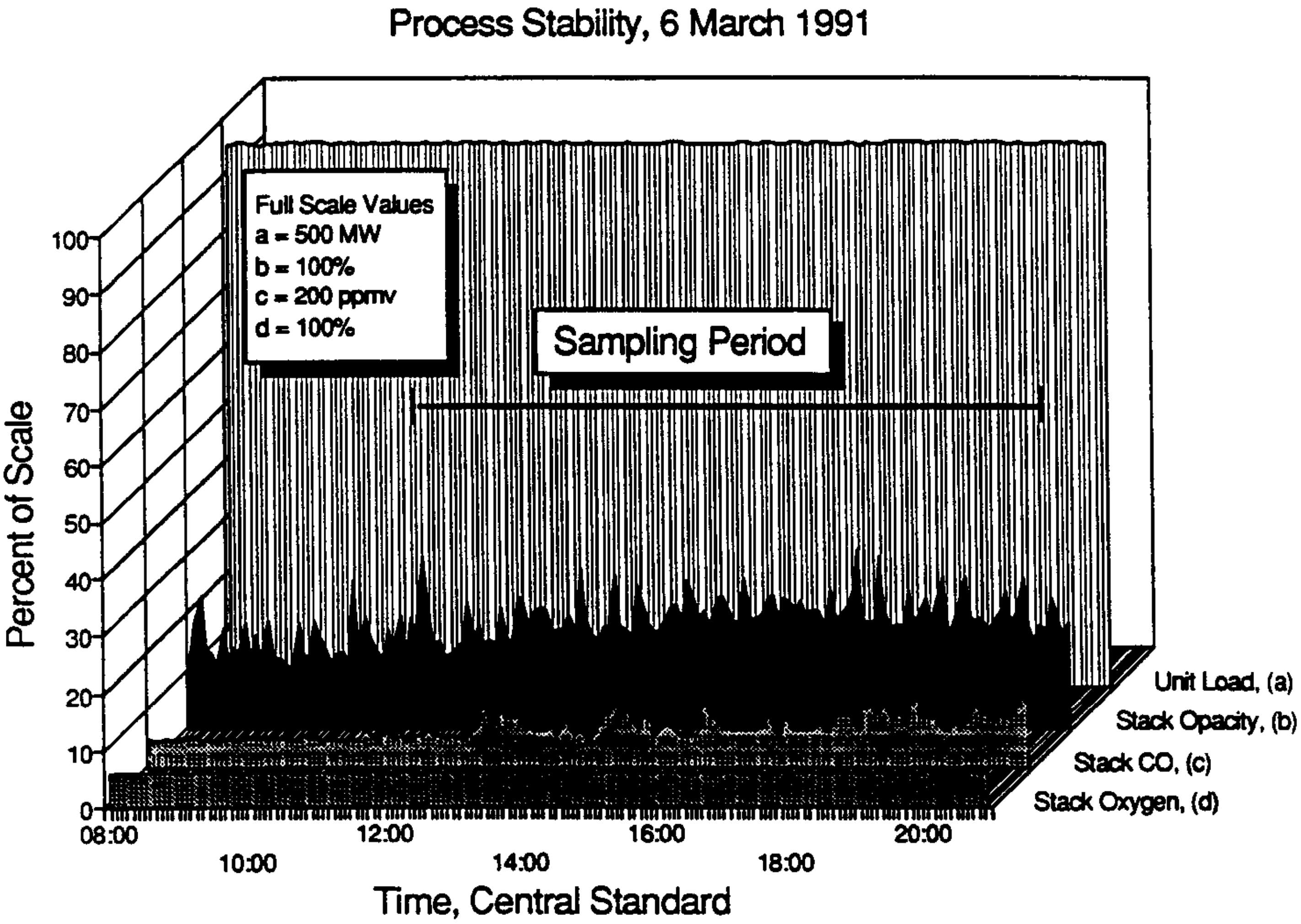
March 3rd Process Data



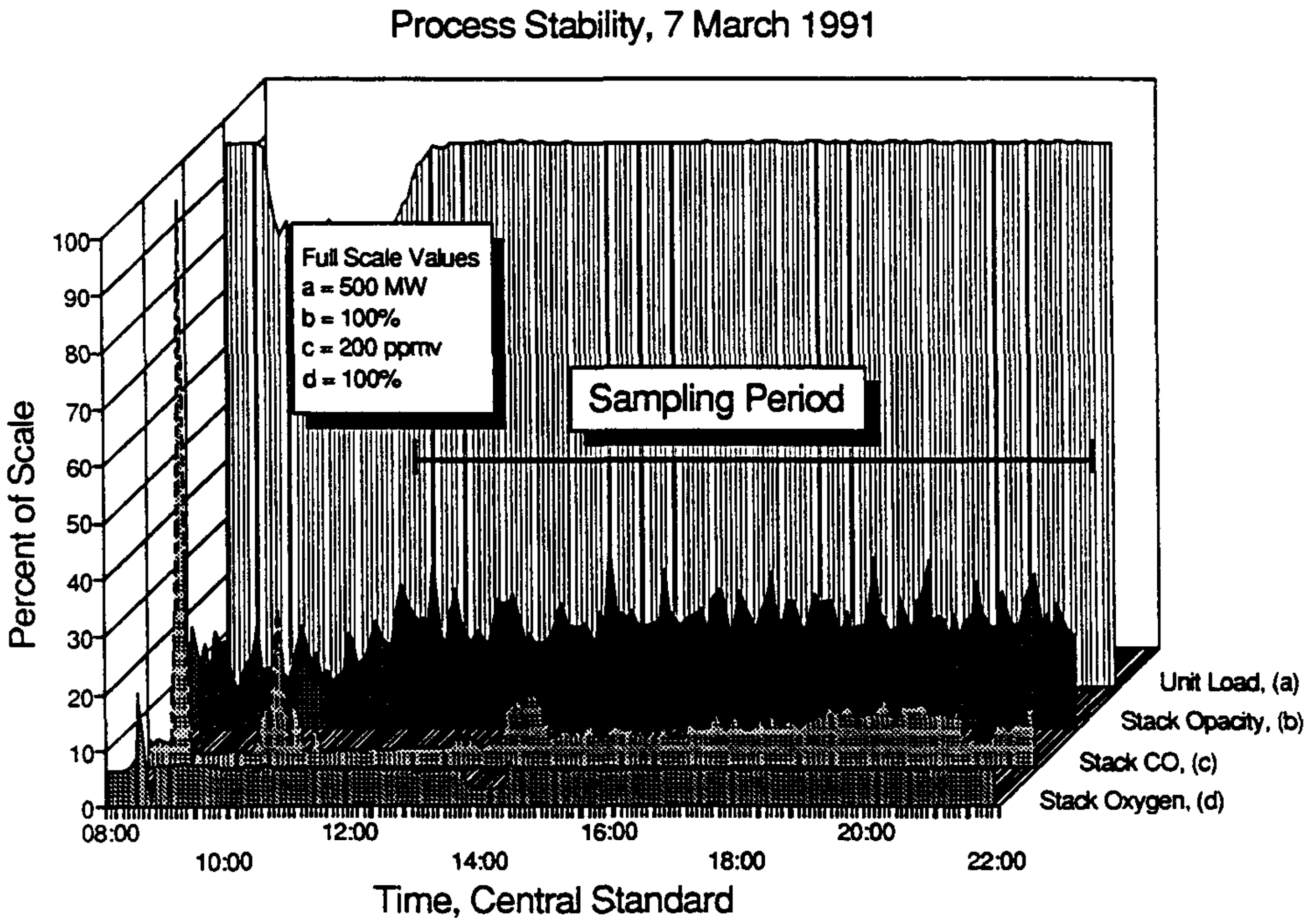
March 4th Process Data



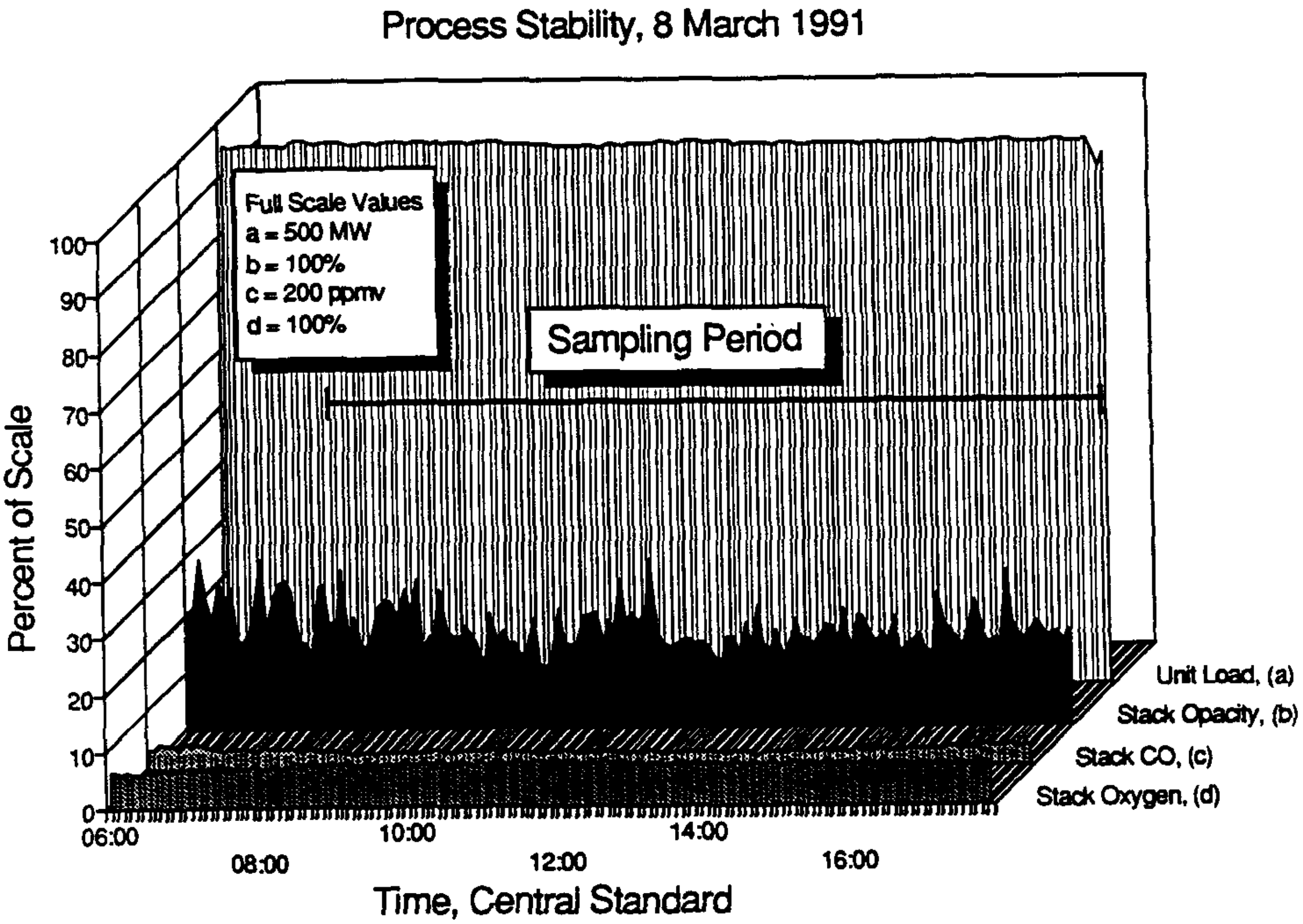
March 5th Process Data



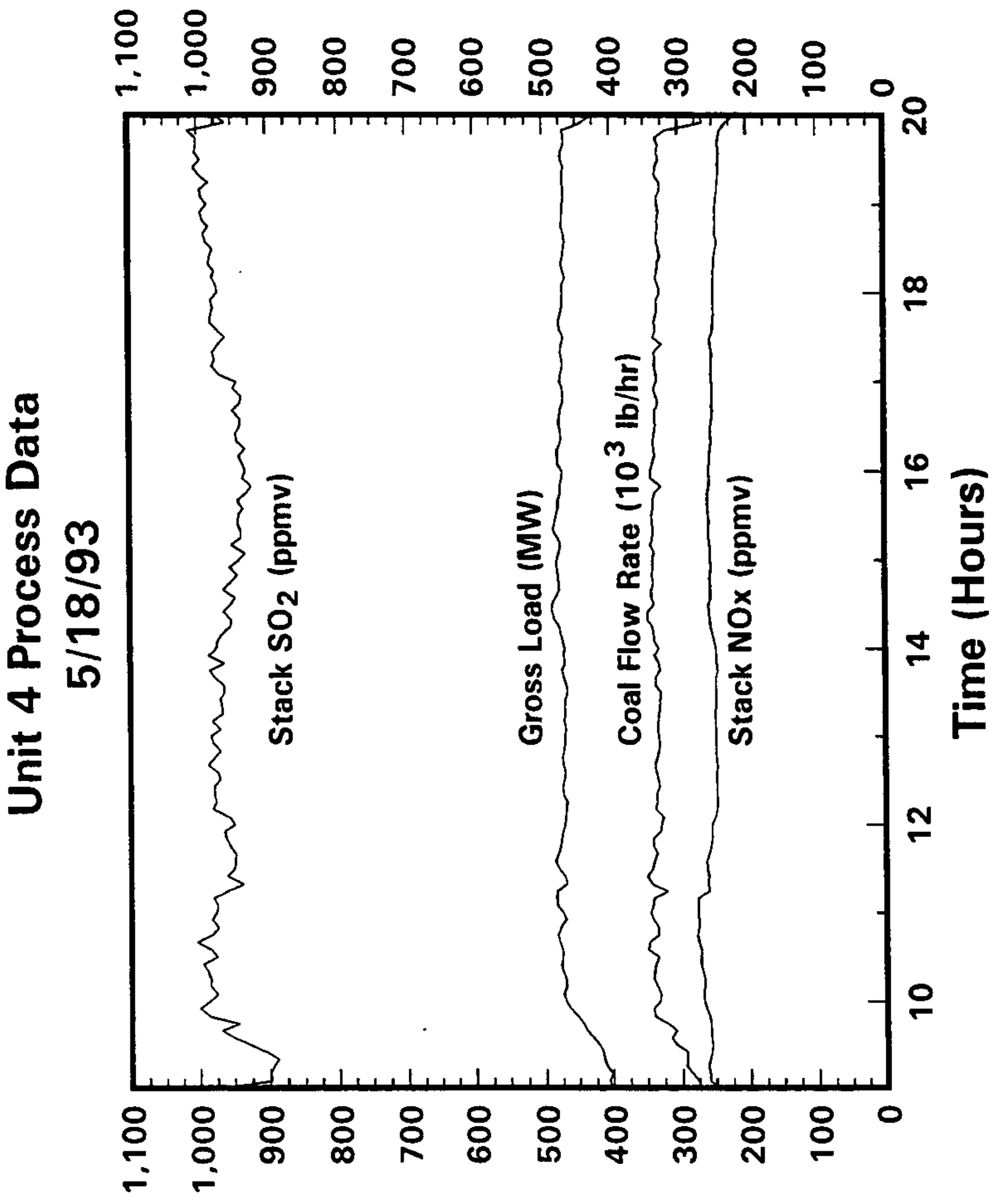
March 6th Process Data

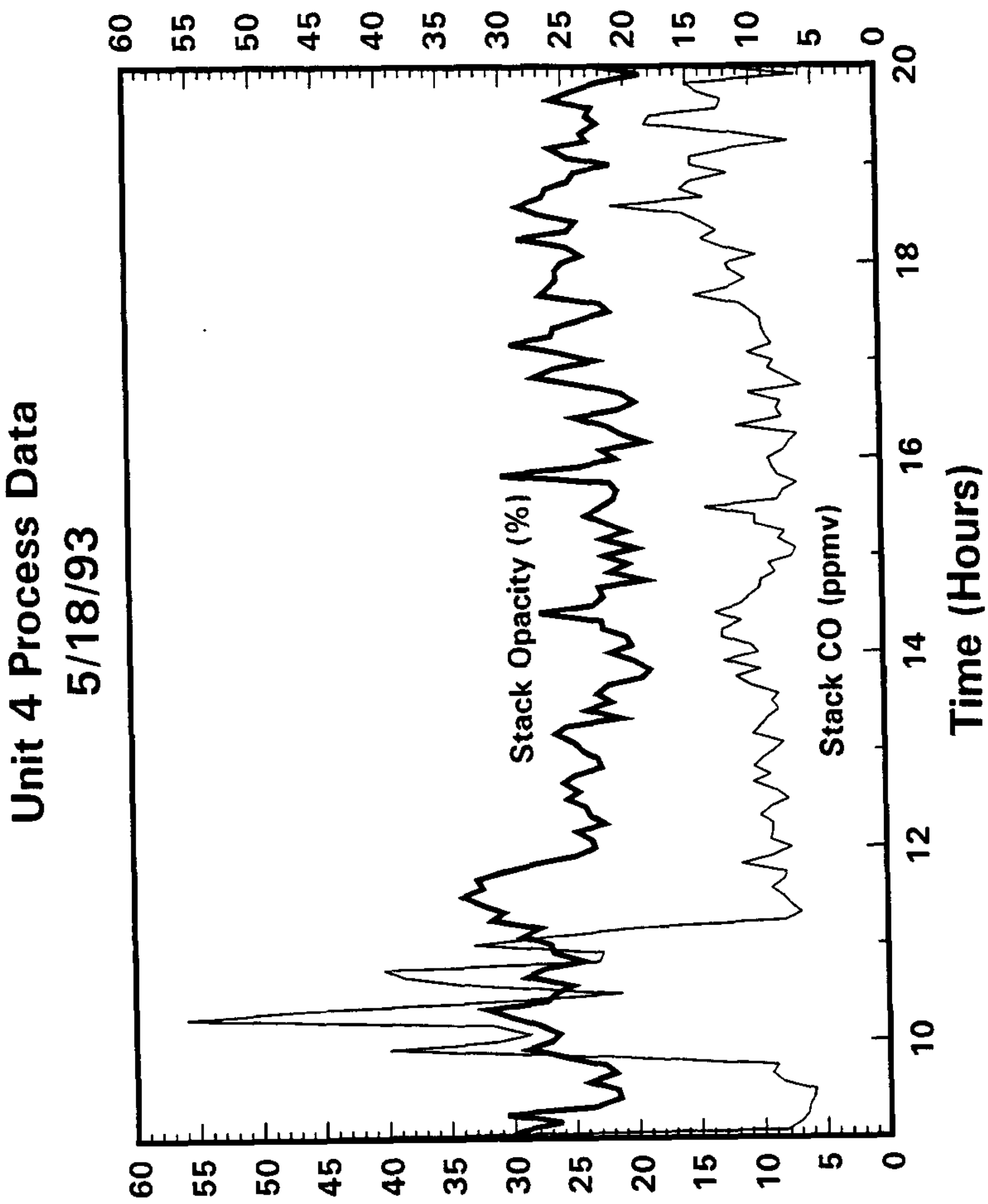


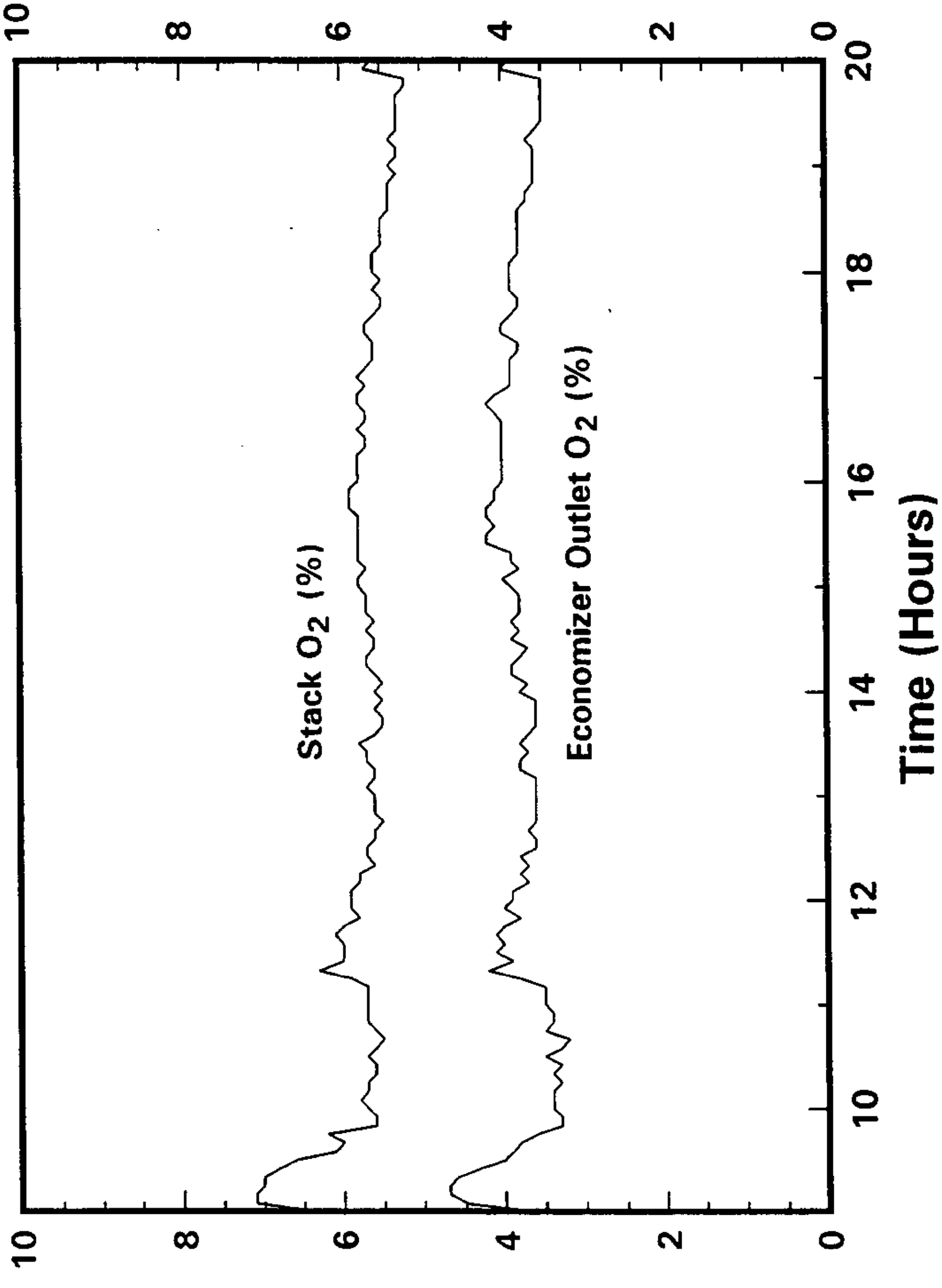
March 7th Process Data



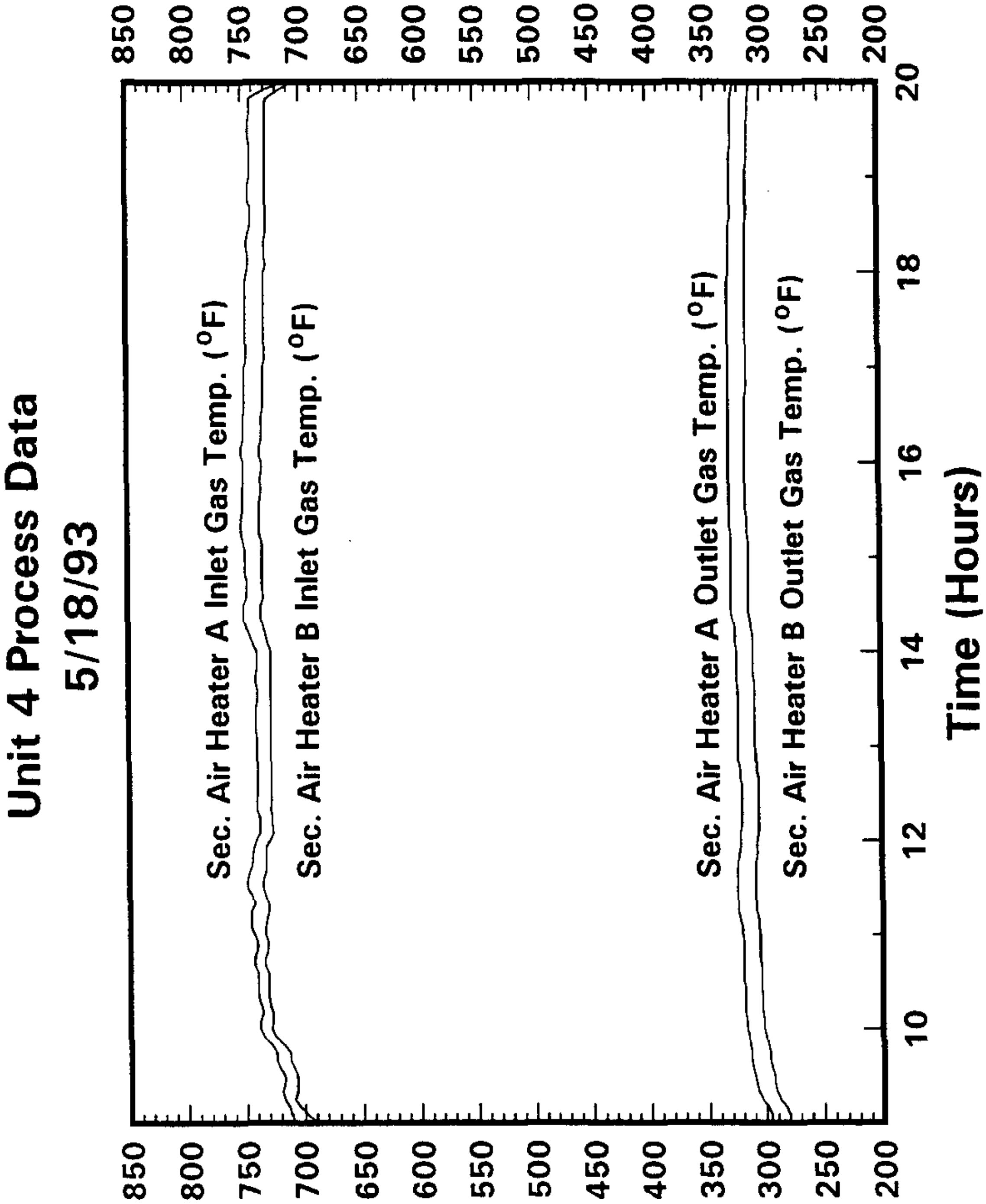
March 8th Process Data

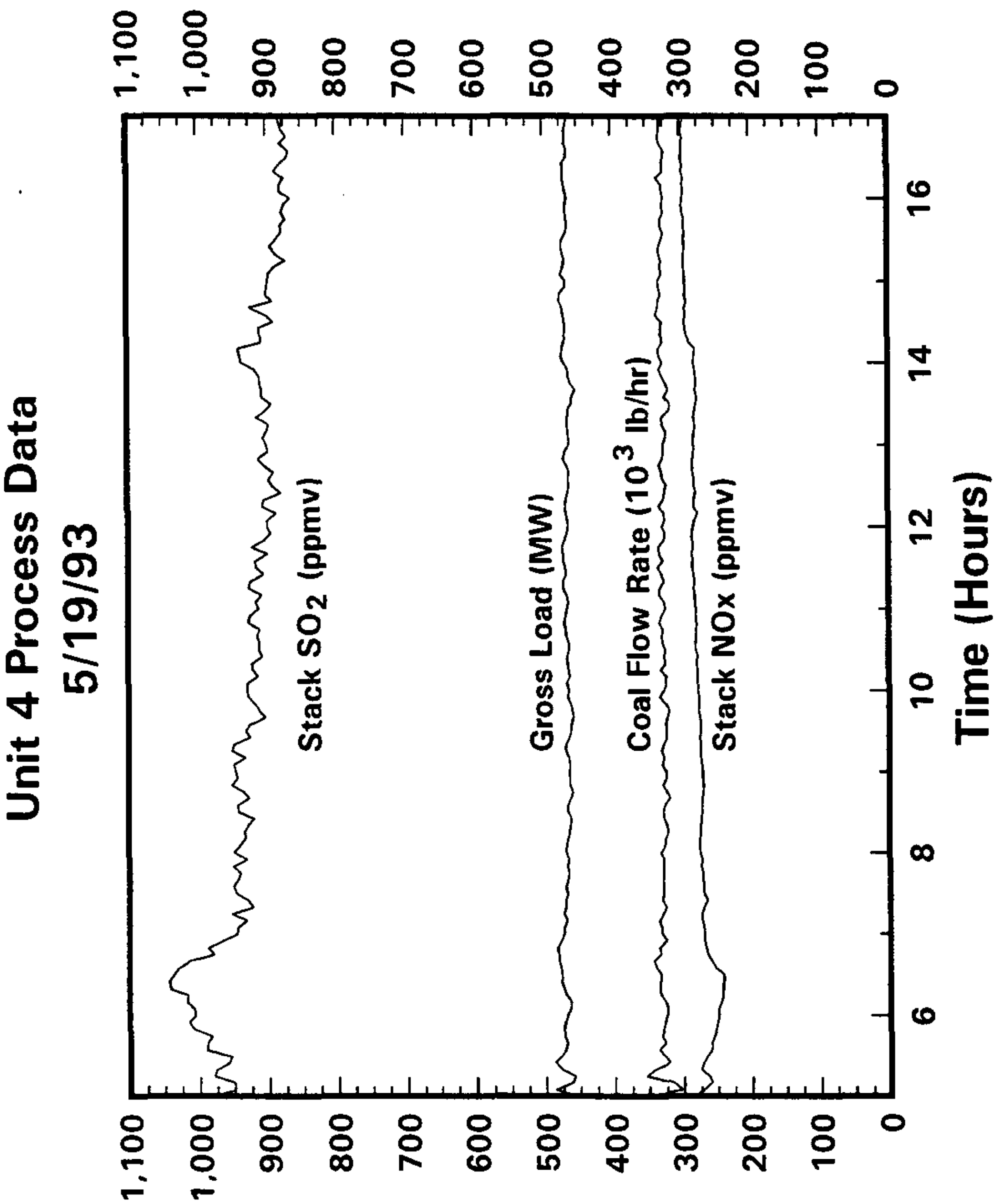

Unit 4 Process Data
5/18/93
Stack SO$_2$ (ppmv)
Gross Load (MW)
Coal Flow Rate (10^3 lb/hr)
Stack NOx (ppmv)
1,100
1,000
900
800
700
600
500
400
300
200
100
0
10
12
14
16
18
20
Time (Hours)

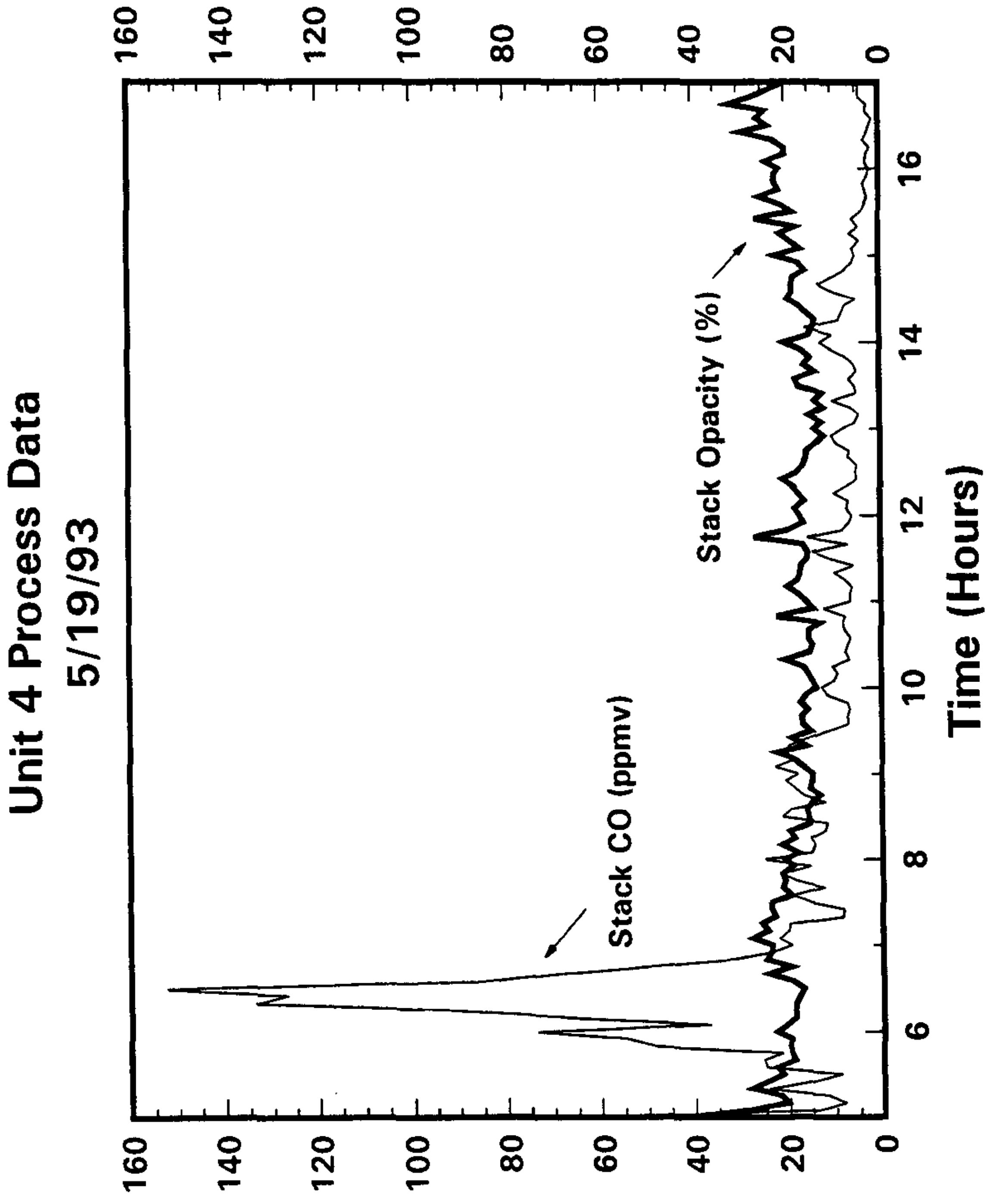

Unit 4 Process Data
5/18/93
Stack Opacity (%)
Stack CO (ppmv)
Time (Hours)
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
50
55
60

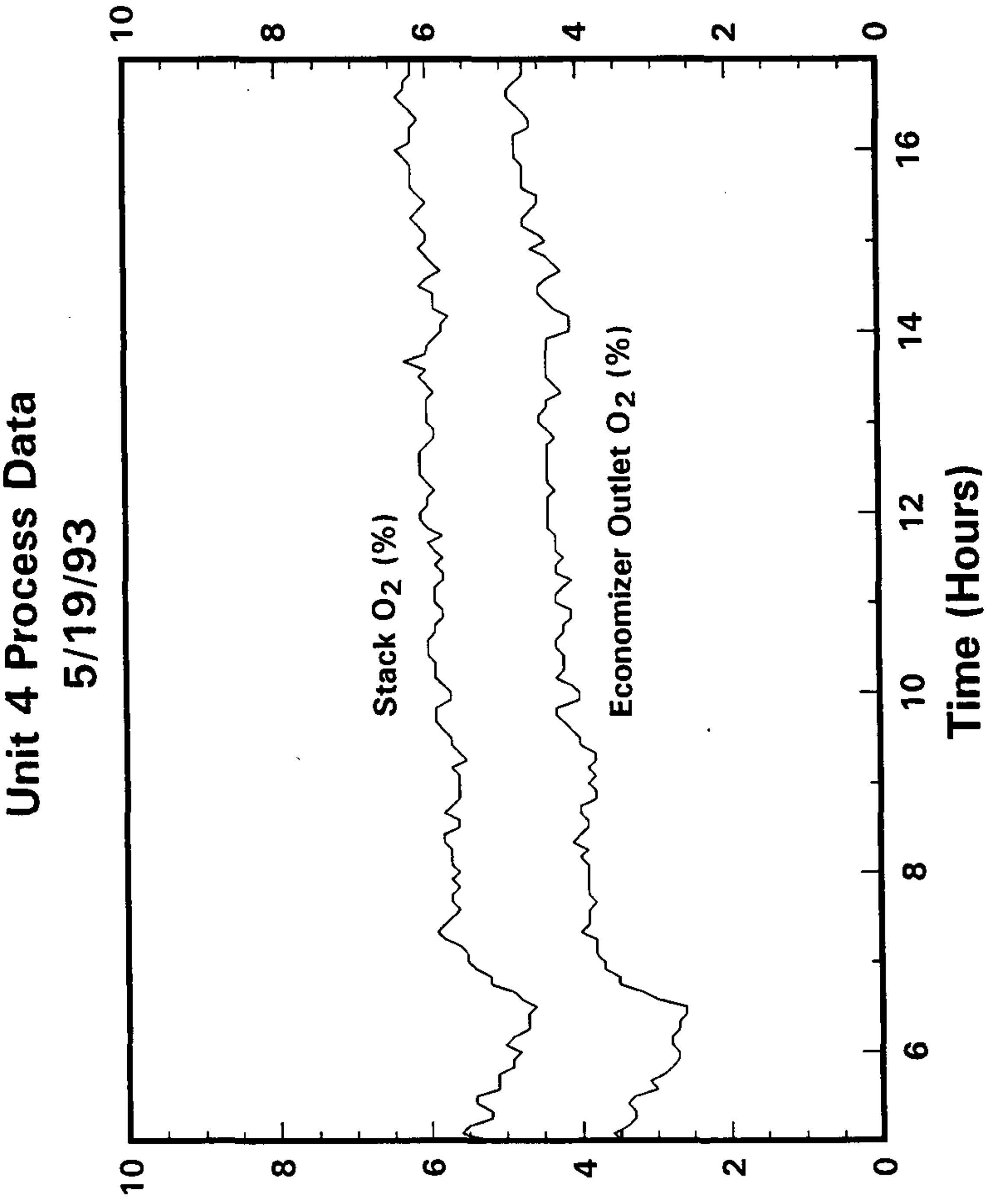


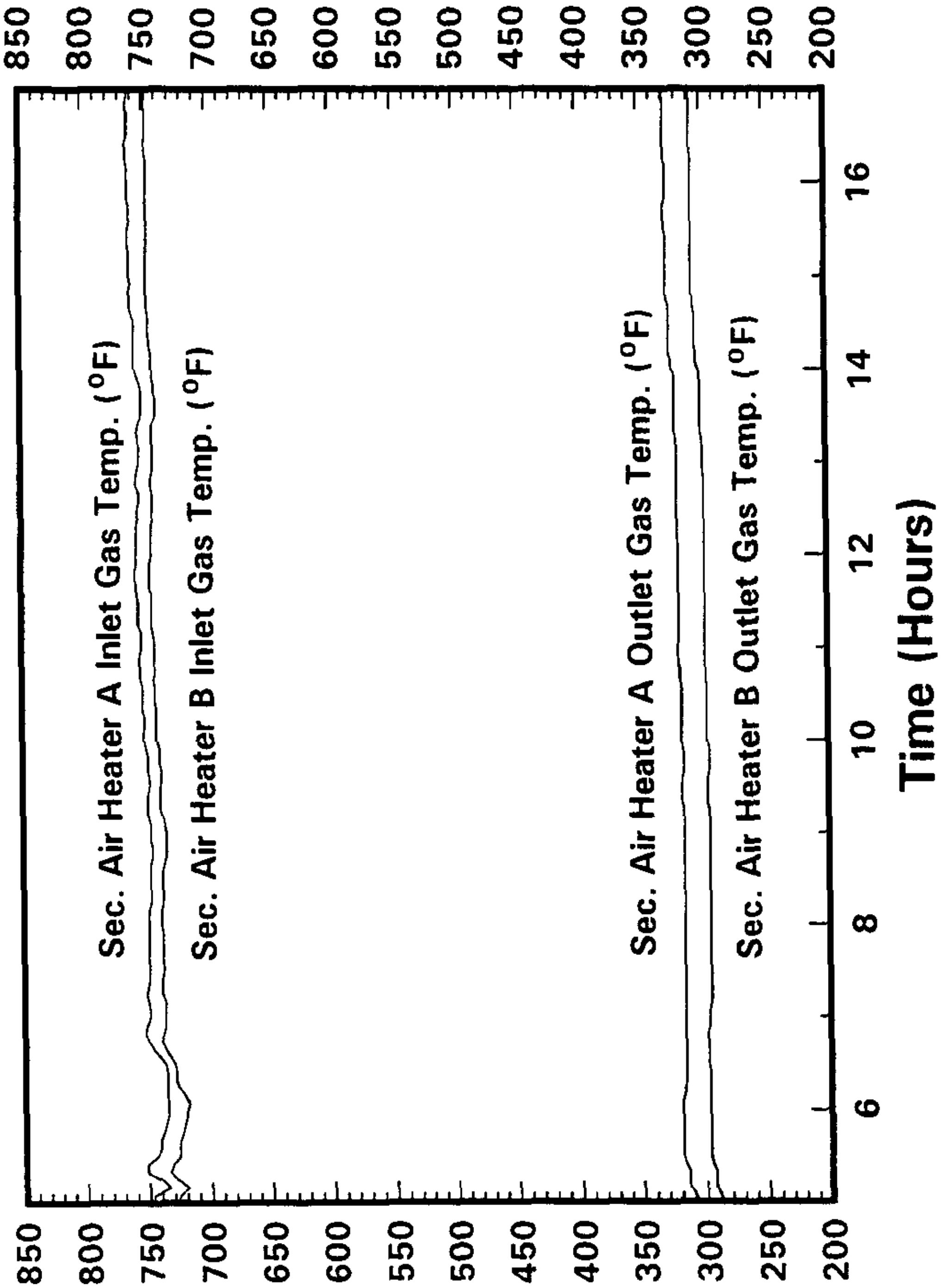
Unit 4 Process Data
5/18/93


Unit 4 Process Data
5/18/93
Sec. Air Heater A Inlet Gas Temp. (^oF)
Sec. Air Heater B Inlet Gas Temp. (^oF)
Sec. Air Heater A Outlet Gas Temp. (^oF)
Sec. Air Heater B Outlet Gas Temp. (^oF)
850
800
750
700
650
600
550
500
450
400
350
300
250
200
10
12
14
16
18
20
Time (Hours)


Unit 4 Process Data
5/19/93
Stack SO2 (ppmv)
Gross Load (MW)
Coal Flow Rate (10^3 lb/hr)
Stack NOx (ppmv)
Time (Hours)
6
8
10
12
14
16
0
100
200
300
400
500
600
700
800
900
1,000
1,100

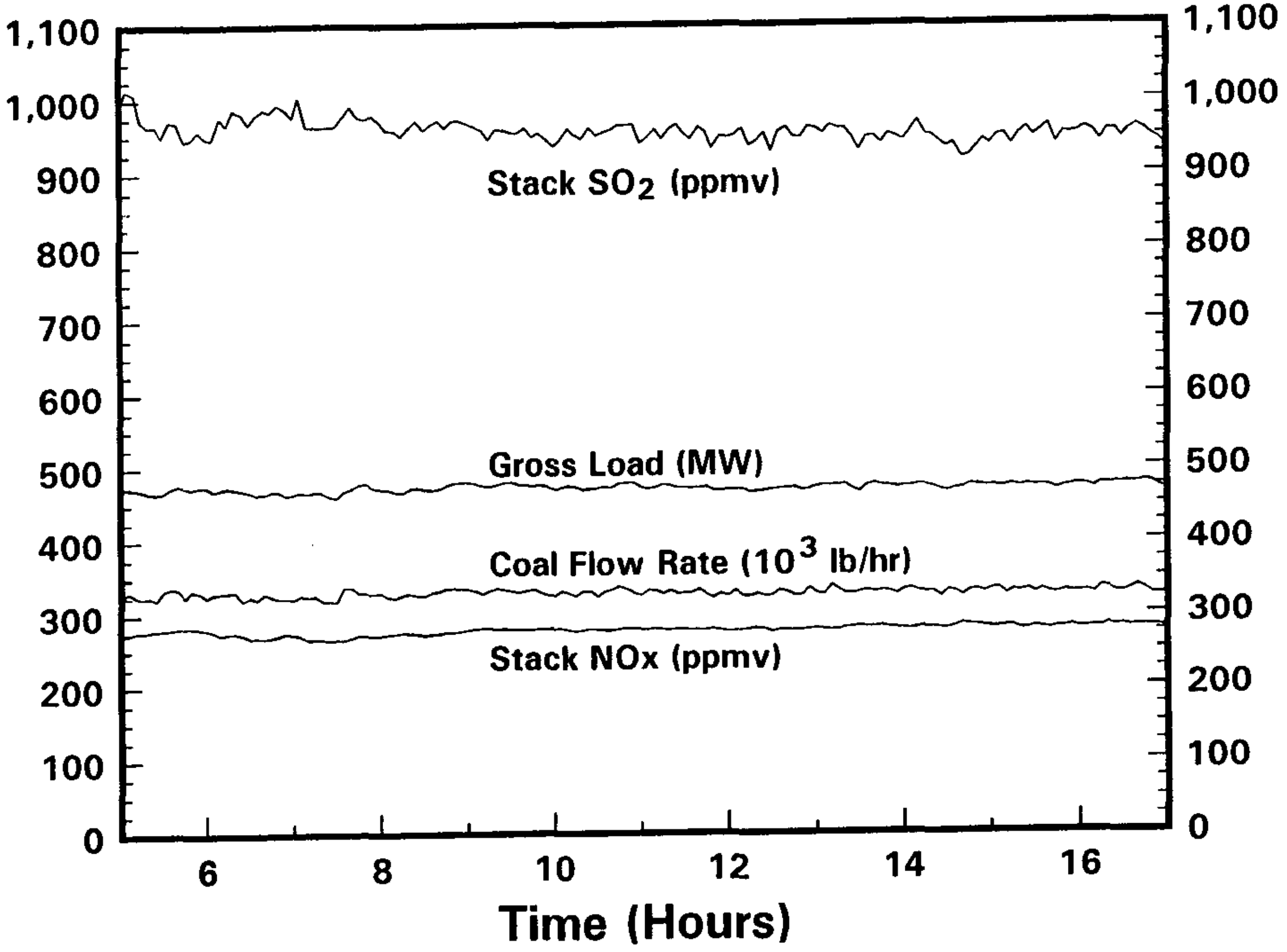

Unit 4 Process Data
5/19/93
Stack CO (ppmv)
Stack Opacity (%)
160
140
120
100
80
60
40
20
0
160
140
120
100
80
60
40
20
0
6
8
10
12
14
16
Time (Hours)

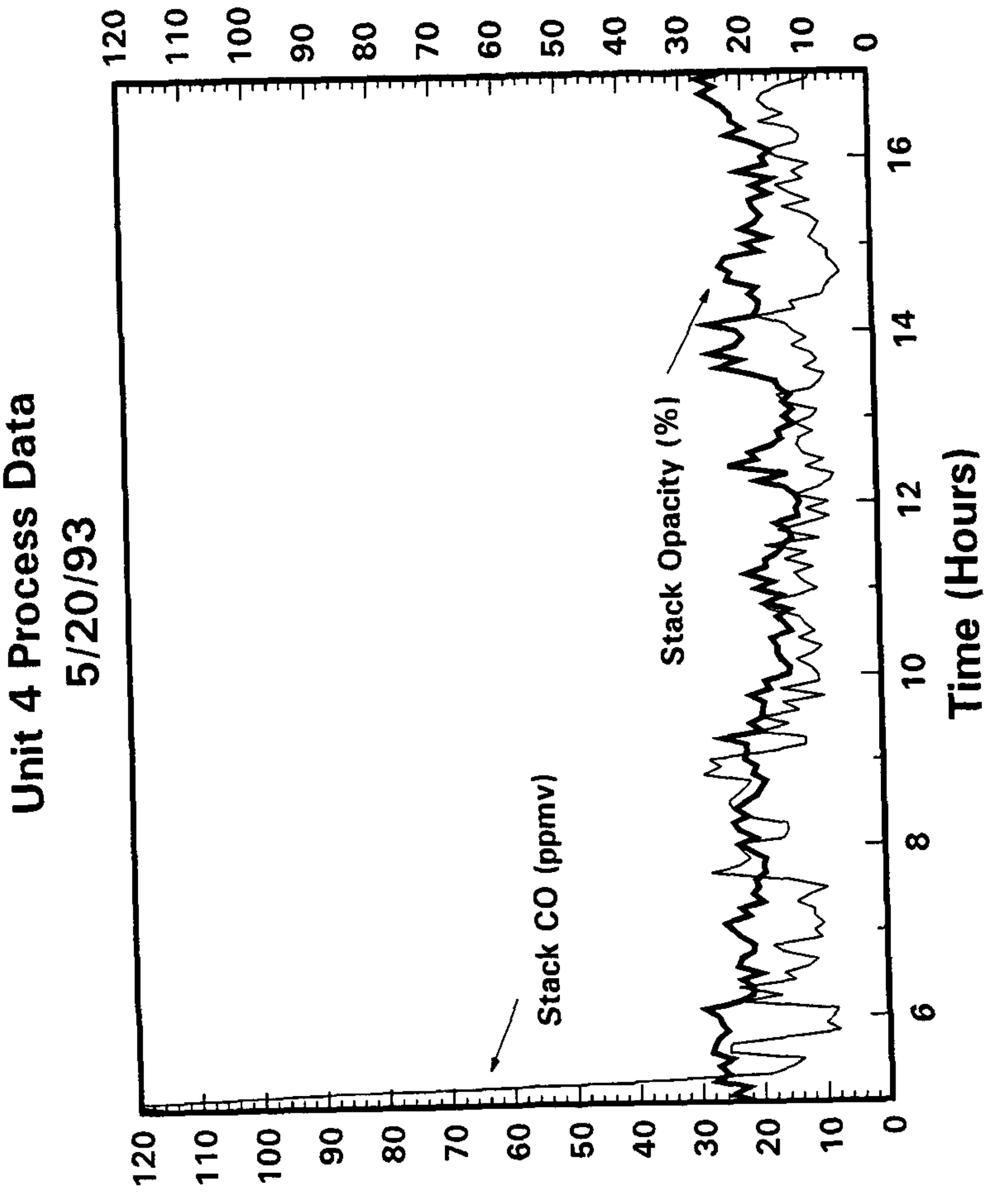

Unit 4 Process Data
5/19/93
Stack O_2 (%)
Economizer Outlet O_2 (%)
Time (Hours)
6
8
10
12
14
16
0
2
4
6
8
10
0
2
4
6
8
10

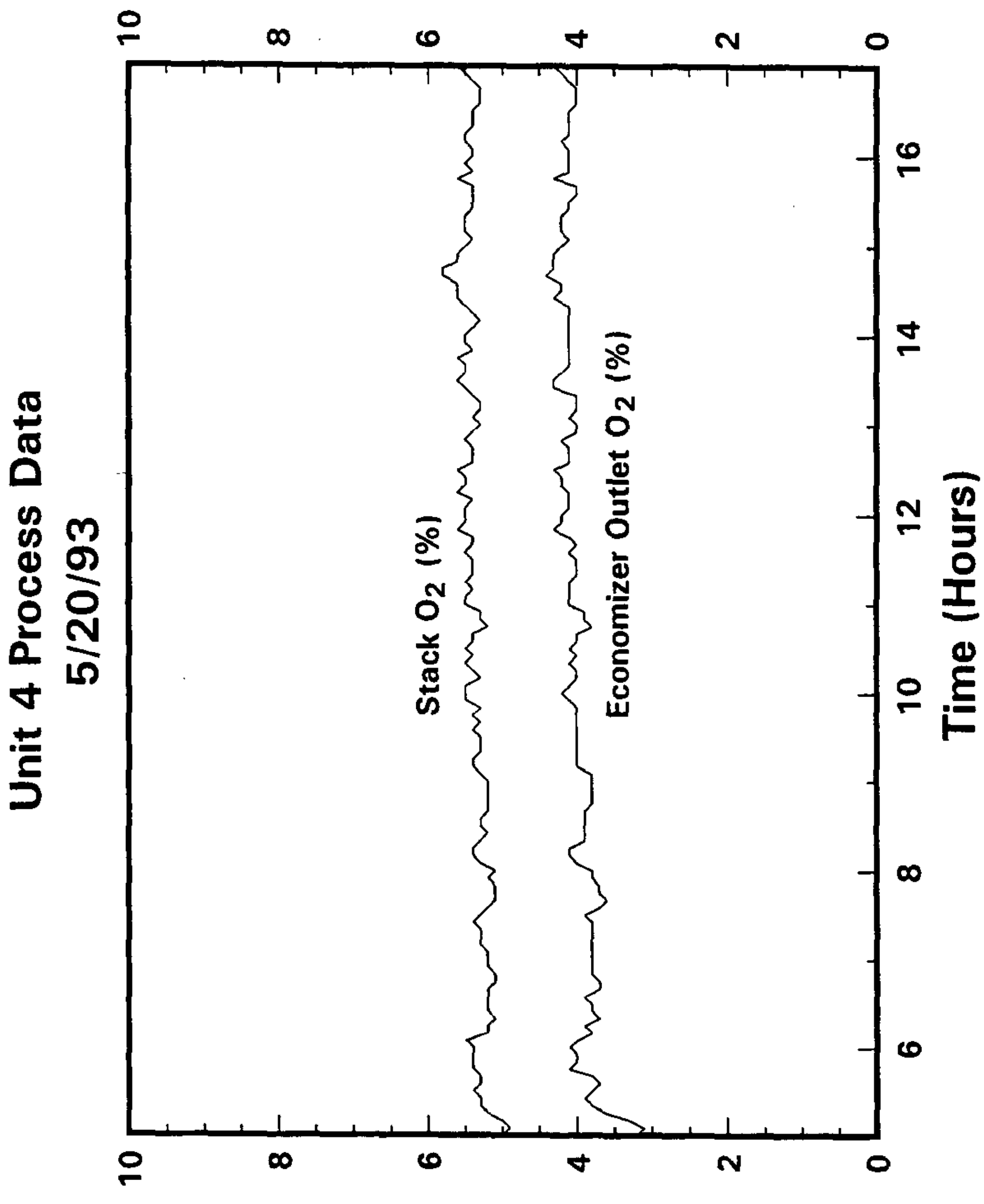


Unit 4 Process Data
5/19/93

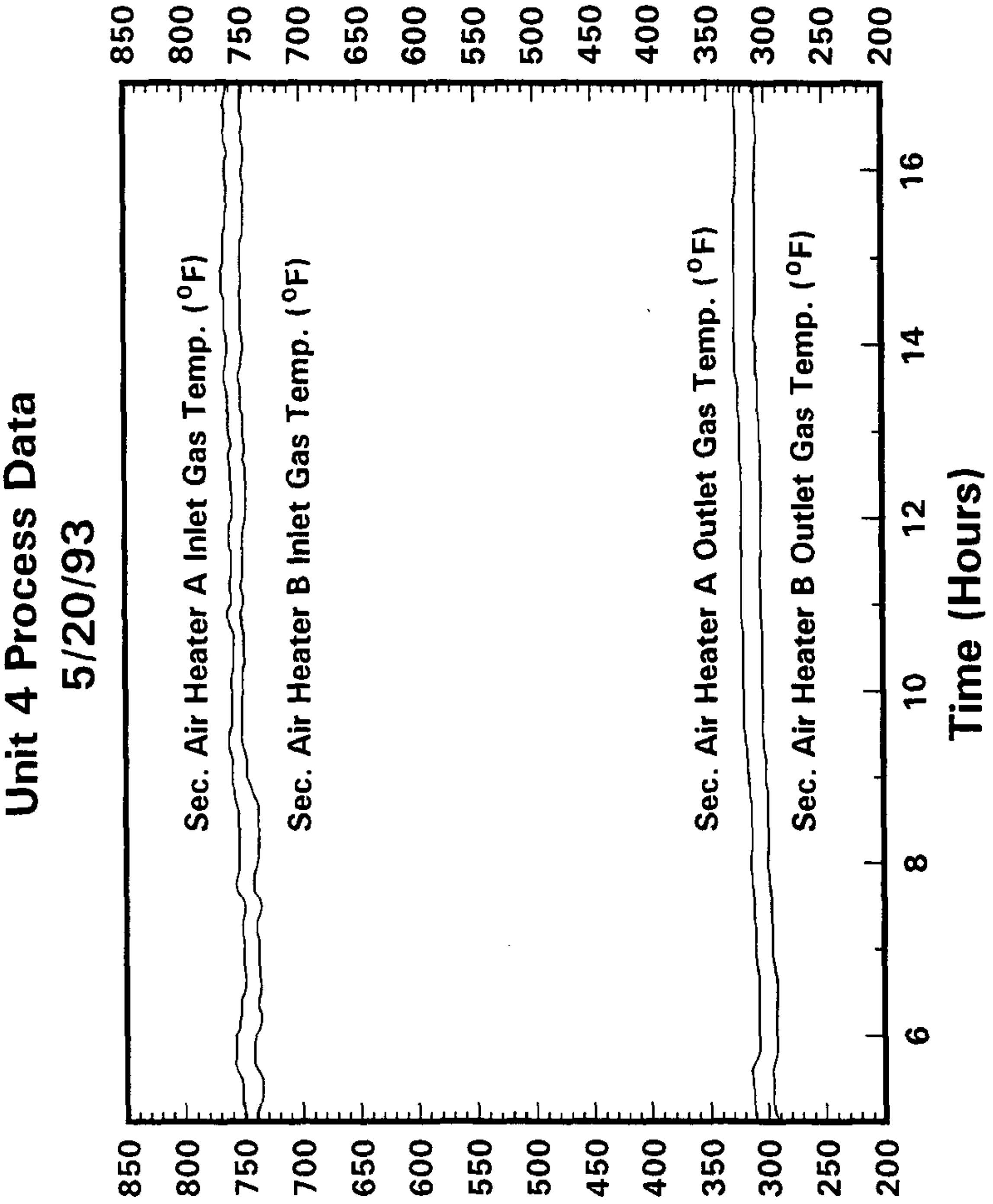
Unit 4 Process Data
5/20/93




Unit 4 Process Data
5/20/93
Stack CO (ppmv)
Stack Opacity (%)
Time (Hours)
6
8
10
12
14
16
0
10
20
30
40
50
60
70
80
90
100
110
120

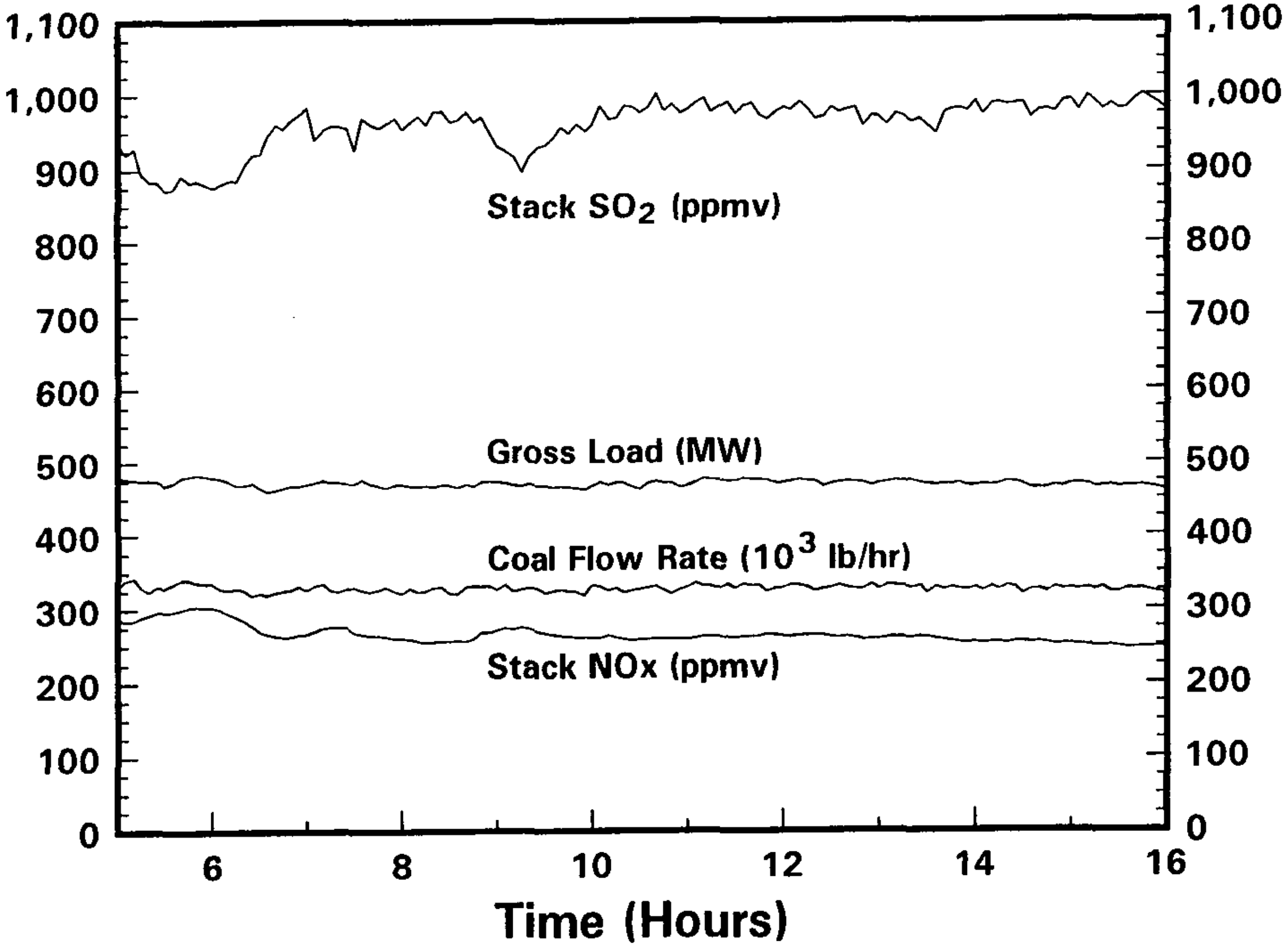


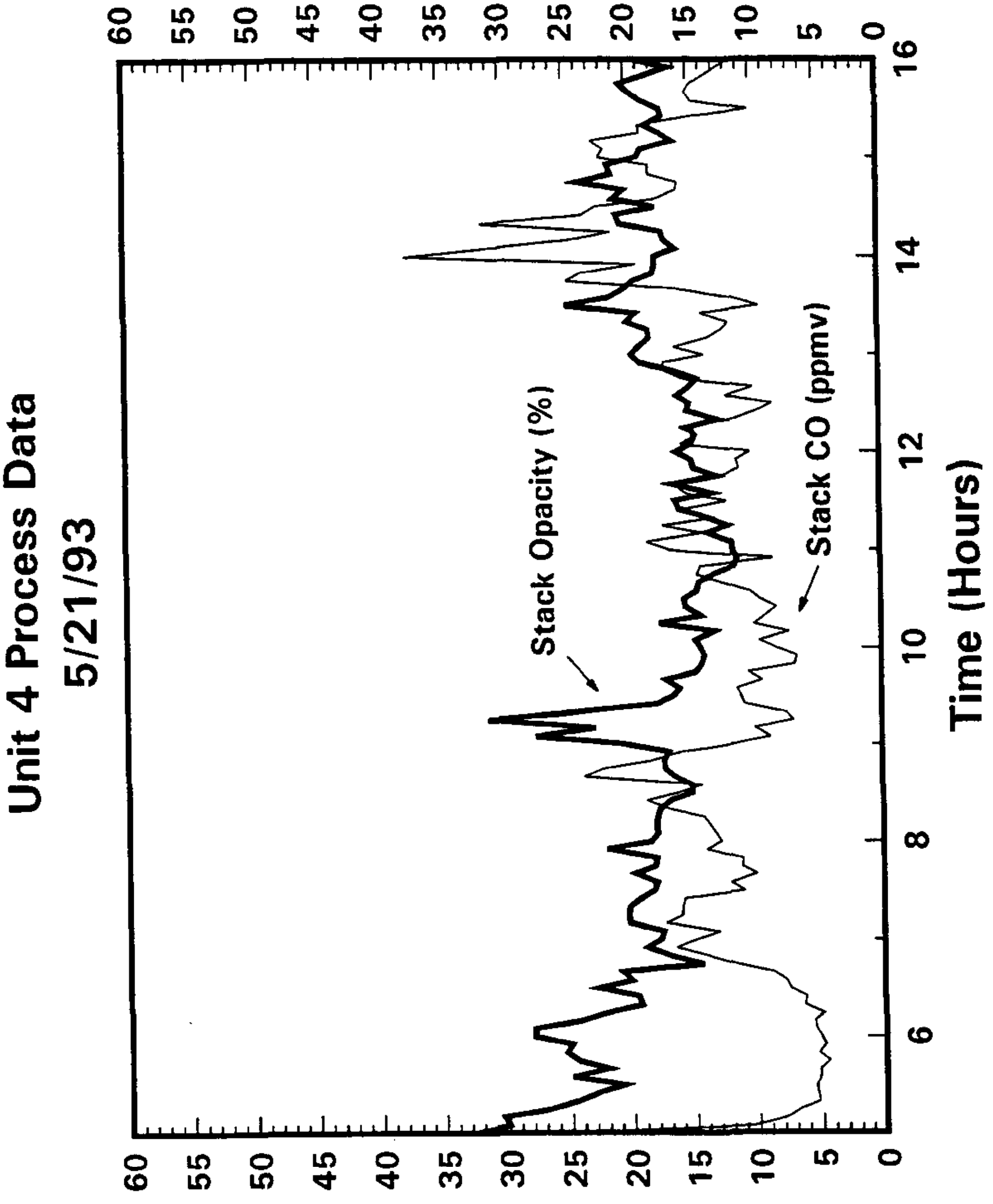
Unit 4 Process Data
5/20/93



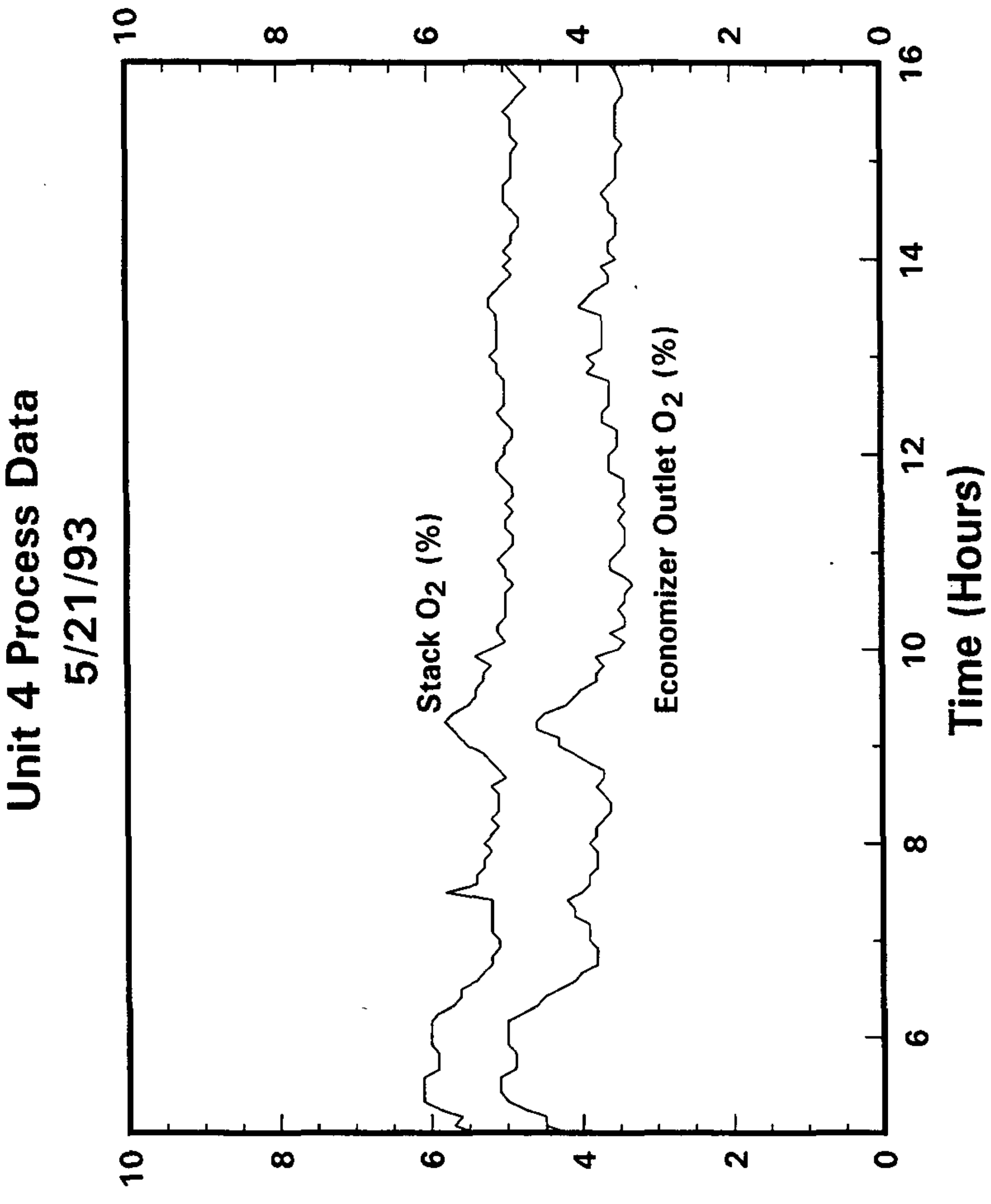
Unit 4 Process Data
5/20/93

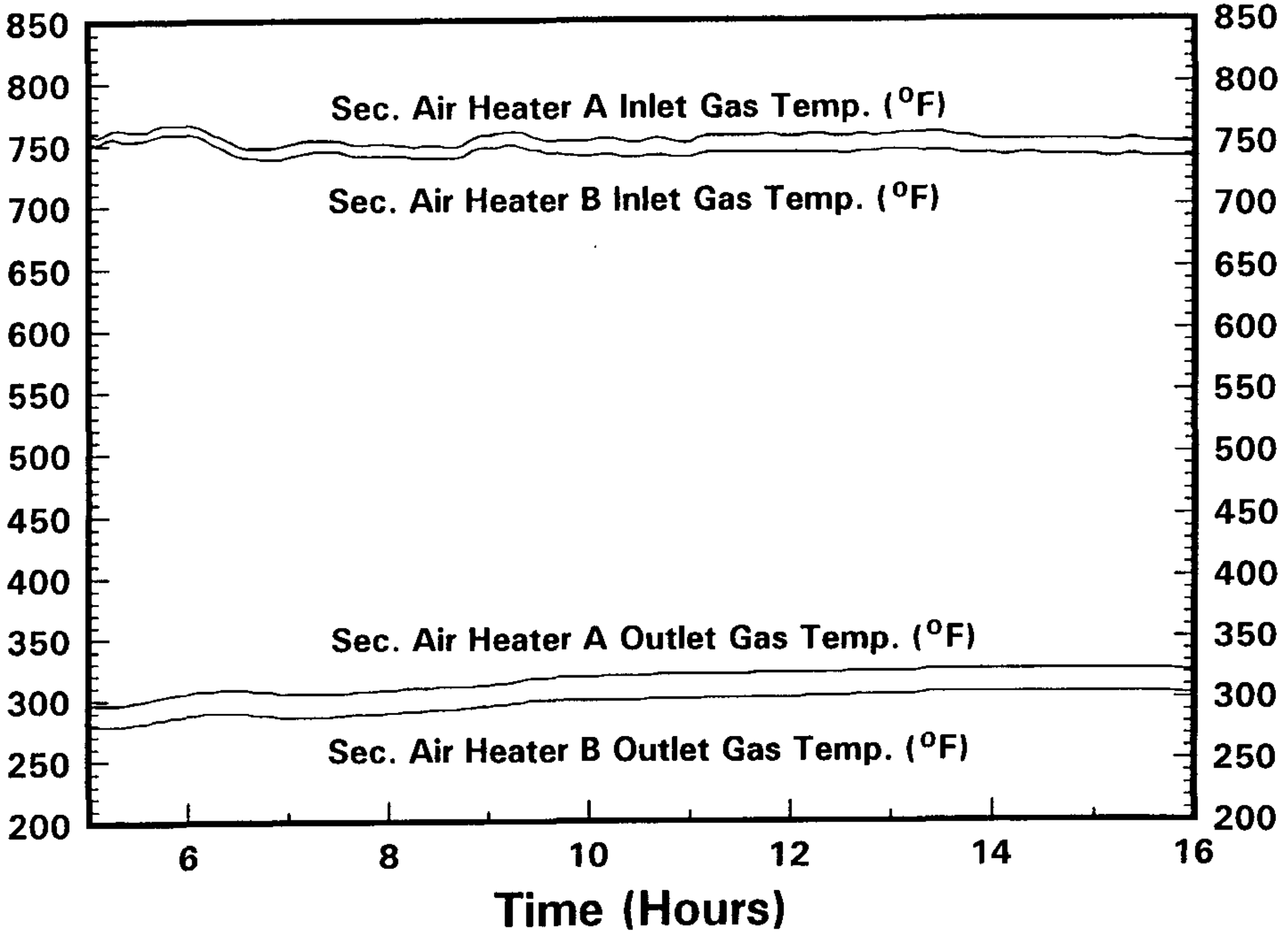
Unit 4 Process Data
5/21/93





Unit 4 Process Data
5/21/93


Unit 4 Process Data
5/21/93
Stack O$_2$ (%)
Economizer Outlet O$_2$ (%)
Time (Hours)
6
8
10
12
14
16
0
2
4
6
8
10
0
2
4
6
8
10



Unit 4 Process Data
5/21/93

APPENDIX I: BLANK CORRECTION DATA

For many of the substances of interest to this program, small traces are present in the reagents and filter media used for sampling and analysis. Therefore, some of the gas stream results in this report have been blank corrected. For the OFA test, blank corrections were routinely applied to the aldehydes, metals, and anions results. Tables I-1 through I-5 show the details of the blank corrections, including the ratio of the blank to the uncorrected result. If the uncorrected value was already below the detection limit, the result is not included in these tables. In many instances, the blank correction was a very small percentage of the result. Instances where the blank values exceed 50% of the measured values are denoted with a "B".

For the OFA/LNB test, only the chromium(VI) results were blank corrected. The details of these corrections are included in Table I-6.

Table I–1: Metals Solid Phase Blank Corrections – OFA Test*

Substance	Stream	Run	Method	Uncorr. ug	Blank, ug	DL, ug	% Blank
Arsenic	High dust gas	3	GFAAS	1,844	13	196	0.71
Arsenic	High dust gas	4	GFAAS	1,117	14	180	1.3
Arsenic	High dust gas	5	GFAAS	1,503	15	183	1.0
Arsenic	Stack gas	3	GFAAS	123	0.79	18	0.64
Arsenic	Stack gas	5	GFAAS	262	0.79	20	0.30
Barium	High dust gas	3	ICP–AES	6,656	276	50	4.1
Barium	High dust gas	4	ICP–AES	4,853	308	46	6.3
Barium	High dust gas	5	ICP–AES	5,071	321	47	6.3
Barium	Stack gas	3	ICP–AES	289	8.0	3.0	2.8
Barium	Stack gas	4	ICP–AES	550	8.0	4.9	1.4
Barium	Stack gas	5	ICP–AES	504	8.2	5.1	1.6
Beryllium	High dust gas	3	ICP–AES	96	2.2	10.0	2.3
Beryllium	High dust gas	4	ICP–AES	90	2.5	9.2	2.8
Beryllium	High dust gas	5	ICP–AES	94	2.6	9.3	2.8
Cadmium	High dust gas	3	GFAAS	6.5	0.85	5.0	13
Cadmium	High dust gas	5	GFAAS	5.7	0.98	4.7	17
Cadmium	Stack gas	3	GFAAS	0.69	0.10	0.30	15
Cadmium	Stack gas	5	GFAAS	1.5	0.10	0.51	6.5
Chromium	High dust gas	3	ICP–AES	1,301	393	50	30
Chromium	High dust gas	4	ICP–AES	1,153	438	46	38
Chromium	High dust gas	5	ICP–AES	1,192	457	47	38
Chromium	Stack gas	3	ICP–AES	48	2.6	3.0	5.4
Chromium	Stack gas	4	ICP–AES	92	2.6	4.9	2.8
Chromium	Stack gas	5	ICP–AES	91	2.7	5.1	2.9
Cobalt	Stack gas	3	ICP–AES	13	0.13	3.0	0.98
Cobalt	Stack gas	4	ICP–AES	29	0.13	4.9	0.45
Cobalt	Stack gas	5	ICP–AES	27	0.13	5.1	0.48
Copper	High dust gas	3	ICP–AES	1,117	6.3	100	0.56
Copper	High dust gas	4	ICP–AES	991	7.0	92	0.70
Copper	High dust gas	5	ICP–AES	1,019	7.3	93	0.71
Copper	Stack gas	3	ICP–AES	48	1.3	6.0	2.6
Copper	Stack gas	4	ICP–AES	101	1.2	9.7	1.2
Copper	Stack gas	5	ICP–AES	103	1.3	10	1.2
Lead	High dust gas	3	GFAAS	271	44	30	16
Lead	High dust gas	4	GFAAS	497	49	54	9.9
Lead	High dust gas	5	GFAAS	469	51	28	11
Lead	Stack gas	3	GFAAS	73	1.0	6.6	1.4
Lead	Stack gas	5	GFAAS	63	1.1	5.5	1.7
Manganese	High dust gas	3	ICP–AES	884	51	50	5.7
Manganese	High dust gas	4	ICP–AES	570	56	46	9.9
Manganese	High dust gas	5	ICP–AES	599	59	47	9.8
Manganese	Stack gas	3	ICP–AES	35	1.4	3.0	4.0
Manganese	Stack gas	4	ICP–AES	62	1.4	4.9	2.2
Manganese	Stack gas	5	ICP–AES	53	1.4	5.1	2.6
Mercury	High dust gas	3	CVAAS	3.5	0.44	0.90	13
Mercury	High dust gas	5	CVAAS	5.1	0.51	0.84	9.9
Mercury	Stack gas	3	CVAAS	0.23	0.0080	0.05	3.5
Mercury	Stack gas	4	CVAAS	0.91	0.0079	0.09	0.87
Mercury	Stack gas	5	CVAAS	0.64	0.0082	0.09	1.3
Molybdenum	High dust gas	3	ICP–AES	424	341	244	80 B
Molybdenum	High dust gas	4	ICP–AES	434	380	230	88 B
Molybdenum	High dust gas	5	ICP–AES	465	396	233	85 B
Molybdenum	Stack gas	3	ICP–AES	42	29	15	70 B
Molybdenum	Stack gas	4	ICP–AES	53	29	24	55 B
Molybdenum	Stack gas	5	ICP–AES	57	30	25	53 B
Nickel	High dust gas	3	ICP–AES	735	44	100	6.0
Nickel	High dust gas	4	ICP–AES	514	49	92	9.5
Nickel	High dust gas	5	ICP–AES	555	51	93	9.2
Nickel	Stack gas	3	ICP–AES	33	2.7	6.0	8.2
Nickel	Stack gas	4	ICP–AES	59	2.7	9.7	4.6
Nickel	Stack gas	5	ICP–AES	59	2.8	10	4.7
Vanadium	High dust gas	3	ICP–AES	1,723	7.8	100	0.45
Vanadium	High dust gas	4	ICP–AES	1,323	8.7	92	0.66
Vanadium	High dust gas	5	ICP–AES	1,380	9.1	93	0.66
Vanadium	Stack gas	3	ICP–AES	88	1.0	6.0	1.1
Vanadium	Stack gas	4	ICP–AES	174	0.99	9.7	0.57
Vanadium	Stack gas	5	ICP–AES	173	1.0	10	0.59

* Includes filter and probe/nozzle rinses

B indicates that blank correction exceeds 50% of uncorrected result.

Table I–2: Metals Vapor Phase Blank Coorections – OFA Test*

Substance	Stream	Run	Method	Uncorr. ug	Blank ug	DL, ug	Blank %
Cadmium	High dust gas	5	GFAAS	0.69	0.39	0.61	57 B
Cadmium	Stack Gas	3	GFAAS	0.85	0.39	0.63	46
Cadmium	Stack Gas	5	GFAAS	0.76	0.39	0.59	52 B
Copper	High dust gas	5	ICP–AES	13	2.7	12	21
Lead	High dust gas	3	GFAAS	3.1	4.7	1.9	152 B
Lead	High dust gas	5	GFAAS	8.3	4.7	1.8	57 B
Lead	Stack Gas	3	GFAAS	6.2	4.7	1.9	76 B
Lead	Stack Gas	4	GFAAS	2.6	4.7	1.9	181 B
Lead	Stack Gas	5	GFAAS	2.1	4.7	1.8	229 B
Manganese	High dust gas	3	ICP–AES	9.8	10	6.3	105 B
Manganese	High dust gas	4	ICP–AES	13	10	6.8	82 B
Manganese	High dust gas	5	ICP–AES	13	10	6.1	78 B
Manganese	Stack Gas	3	ICP–AES	10	10	6.3	103 B
Manganese	Stack Gas	4	ICP–AES	9.6	10	6.4	107 B
Manganese	Stack Gas	5	ICP–AES	10	10	5.9	99 B
Nickel	High dust gas	5	ICP–AES	14	7.9	12	58 B

* Results of all impingers combined.
B indicates that blank correction exceeds 50% of uncorrected result.

Table I–3: Anions Solid Phase Blank Corrections – OFA Test

Substance	Stream	Run	Method	Uncorr. mg	Blank mg	DL, mg	Blank %
Chloride	High dust gas	3	IC	27	1.9	0.0030	7.0
Chloride	High dust gas	4	IC	25	1.6	0.0029	6.3
Chloride	High dust gas	5	IC	27	1.9	0.0028	7.0
Chloride	Stack gas	3	IC	0.031	0.0044	0.0012	14
Chloride	Stack gas	4	IC	0.053	0.0044	0.0012	8.4
Chloride	Stack gas	5	IC	0.088	0.0043	0.0013	4.9
Fluoride	High dust gas	3	ISE	2.3	1.1	0.025	49
Fluoride	High dust gas	4	ISE	2.6	0.96	0.024	37
Fluoride	High dust gas	5	ISE	2.4	1.1	0.024	47
Fluoride	Stack gas	3	ISE	1.00	0.0031	0.010	0.32
Fluoride	Stack gas	4	ISE	0.76	0.0032	0.010	0.42
Fluoride	Stack gas	5	ISE	0.72	0.0031	0.011	0.43

Table I–4: **Anions Vapor Phase Blank Corrections – OFA Test**

Substance	Stream	Run	Method	Uncorr. ug	Blank, ug	DL, ug	Blank %
Fluoride	High dust gas	3	ISE	2624	8.1	73	0.31
Fluoride	High dust gas	4	ISE	3604	8.1	73	0.22
Fluoride	High dust gas	5	ISE	2551	8.1	60	0.32
Fluoride	Stack gas	3	ISE	11164	8.1	50	0.072
Fluoride	Stack gas	4	ISE	9919	8.1	55	0.081
Fluoride	Stack gas	5	ISE	9957	8.1	58	0.081

Table I–5: Aldehydes Blank Corrections – OFA Test

Substance	Stream	Run	Method	Uncorr. ug	Blank ug	DL, ug	Blank %
Formaldehyde	High dust gas	1	HPLC	9.5	5.4	2.4	57 B
Formaldehyde	High dust gas	3	HPLC	6.3	5.4	2.4	86 B
Formaldehyde	Stack gas	1	HPLC	9.5	5.4	2.4	57 B

B indicates that blank correction exceeds 50% of uncorrected result.

Table I–6: Chromium(VI) Blank Corrections – OFA/LNB Test

Substance	Stream	Run	Method	Uncorr. ug	Blank ug	DL, ug	Blank %
Chromium(VI)	Stack gas	2	BIF Cr6	22	12	0.95	55 B
Chromium(VI)	Stack gas	3	BIF Cr6	22	18	0.84	83 B
Chromium(VI)	Stack gas	4	BIF Cr6	25	12	0.70	48

B indicates that blank correction exceeds 50% of uncorrected result.