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A Study of Hazardous Air Pollutants at the Tidd PFBC Demonstration Plant

Topical Report

October 1994

Work Performed Under Contract No.: DE-FC21-89MC26042

For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

By
American Electric Power Service Corporation
Columbus, Ohio

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For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26507-0880

By
American Electric Power Service Corporation
Ohio Power Company
1 Riverside Plaza
Columbus, Ohio 43215

October 1994

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Clean Coal Technology (CCT) Program is a joint effort between government and industry to develop a new generation of coal utilization processes. In 1986, the Ohio Power Company, a subsidiary of American Electric Power (AEP), was awarded cofunding through the CCT program for the Tidd Pressurized Fluidized Bed Combustor (PFBC) Demonstration Plant located in Brilliant, Ohio. The Tidd PFBC unit began operation in 1990 and was later selected as a test site for an advanced particle filtration (APF) system designed for hot gas particulate removal. The APF system was sponsored by the DOE Morgantown Energy Technology Center (METC) through their Hot Gas Cleanup Research and Development Program.

A complementary goal of the DOE CCT and METC R&D programs has always been to demonstrate the environmental acceptability of these emerging technologies. The Clean Air Act Amendments of 1990 (CAAA) have focused that commitment toward evaluating the fate of hazardous air pollutants (HAPs) associated with advanced coal-based and hot gas cleanup technologies. Radian Corporation was contracted by AEP to perform this assessment of HAPs at the Tidd PFBC demonstration plant with funding from the DOE-METC Hot Gas Cleanup R&D program. The objective of this study is to assess the major input, process, and emission streams at Plant Tidd for the HAPs identified in Title III of the CAAA.

Site Description

The boiler at Plant Tidd is a bubbling bed, pressurized fluidized bed combustor (PFBC) rated at 70 MWe; 55 MW is produced by a steam turbine generator and 15 MW is produced by depressurizing the hot flue gas in a gas turbine generator. Total plant load during the test period was steady at 45 to 46 MW, which is representative of stable, long-term operation. A slurry of Pittsburgh No. 8 bituminous coal (3.4% sulfur) is fed to the PFBC unit along with dolomite sorbent to control SO₂ emissions. Particulate matter is controlled by primary and secondary cyclones in series with an electrostatic precipitator (ESP). Formation of NO_x is minimized because of relatively low combustion temperatures within the PFBC process.

An additional feature of the Plant Tidd facility is a demonstration-scale hot gas clean-up system. Treated gas from one of the seven cyclones is directed to a ceramic barrier, advanced particle filter (APF), and back-up cyclone. The treated gas is then returned to the process upstream of the ESP. The APF operated at approximately 1350°F during the test period. The ceramic candles were backpulsed approximately every 30 minutes to remove particulate matter captured on the outside of the candles.

Sampling Locations

Four flue gas stream locations were tested: ESP inlet, ESP outlet, APF inlet, and APF outlet. Other process streams sampled were raw coal, coal paste, sorbent, bed ash, cyclone ash, individual ESP hopper ash, APF ash, and service water.

Sample Collection

Radian's approach to meeting the test objectives utilized established sampling methods (where possible) and a sampling strategy consistent with that of the DOE-sponsored program, "Comprehensive Assessment of Air Toxics Emissions from Coal-Fired Utility Boilers," and the EPRI-sponsored Field Chemical Emissions Monitoring (FCEM) program. Samples were collected with the boiler operating at steady-state conditions and in triplicate over four days (April 12-15, 1994).

Quality Assurance and Quality Control

During sample collection, quality assurance audits were conducted by Radian's internal QA auditor. Radian's auditor also conducted a performance evaluation audit by submitting "double-blind" (identity and composition unknown) samples to the analytical laboratories. Quality control procedures involved the evaluation of results for field and laboratory blank samples, duplicate field samples, matrix-spiked and surrogate-spiked samples, and laboratory control samples.

Overall, QA/QC data associated with this program indicate that measurement data are acceptable and can be used with confidence. The QA/QC results indicate that the quality control mechanisms were effective in ensuring measurement data reliability within the expected limits of sampling and analytical error.

Plant Operating Conditions

During sample collection, operating conditions were continuously monitored using a computerized data acquisition system which logged process information as five-minute averages. In addition, ESP operating data (voltages and currents for each field) were logged hourly by the on-site Radian engineer. Overall, all processes were very stable, and the key operating parameters were within the targeted range during the entire test period. Continuous emission monitors were operated during the test period, providing data for sulfur dioxide, nitrogen oxides, opacity, and carbon monoxide at the ESP outlet location. These data indicate steady process operation and ESP performance.

Analytical Results

Samples were analyzed for trace elements, minor and major elements, anions, volatile organic compounds, dioxin/furan compounds, ammonia, cyanide, formaldehyde, and semivolatile organic compounds. The particle size distribution in the ESP inlet and outlet gas streams and collected ash from individual ESP hoppers was also determined. Analytical

results have been tabulated in detail as mean values with 95% confidence intervals. In the detailed data tabulations, some data have been identified with flags; for example, where background analyte levels in the sampling media exceeded 30% of the uncorrected sample result.

Data Analysis: Mass Balances, Removal Efficiencies, and Emission Factors

Emission factors, removal efficiencies, and other results rely on measurement data that are near the limit of detection or below it for many of the substances of interest. For that reason, uncertainty analyses and the calculation of confidence intervals were performed as part of this program. The method used to determine uncertainties in calculated results is based on "Measurement Uncertainty".¹

The following observations are results of the data analysis:

- Material balances were calculated for 26 elements. Sixteen of these elements met the target closure objectives of 70-130% for balance around the plant. Nineteen elements met a closure criteria of 50-150 percent. Closures could not be estimated for four species (antimony, cadmium, molybdenum, and silver) because they were not detected in several of the outlet ash streams.
- Use of the ICP-MS analytical technique to analyze vapor phase multi-metals train samples at the four gas locations provided superior detection limits and allowed quantification of vapor phase trace metals at low ng/Nm³ levels—below the detection limits of standard ICP-AES and GFAAS techniques.
- Removal efficiencies for non-volatile metals were generally greater than 95% across the ESP. Less than 10% removal was observed for volatile species such as chloride, fluoride, and mercury.
- The particulate removal efficiency of the APF system was measured at 99.99 percent. Removal efficiencies for most non-volatile metals was greater than 99.5% across the APF. Removals of less than 30% were measured for mercury, selenium, chloride and fluoride. Approximately 40% removal of SO₂ was measured across the APF system as well as some removal for ammonia (25%), cyanide (69%), and formaldehyde (94%).
- High resolution GC/MS analysis of the Modified Method 5 sampling train components provided detection limits for selected polycyclic aromatic hydrocarbons at 2 to 5 orders of magnitude lower than low resolution GC/MS. Quantification of PAHs at these lower levels provides a better estimate of emissions.
- Hexavalent chromium analyses conducted in an on-site laboratory provided measurable results slightly above blank levels. Compared to total chromium results for the ESP outlet stream, chromium (VI) was measured at 37% of the total chromium concentration; however, additional research and validation of this method for coal-fired power plant flue gas is needed.

- Emission factors have been calculated for the target trace species detected in the ESP outlet gas and are presented in Table ES-1.
- Particle size distribution (PSD) results for the ESP inlet and outlet flue gas measurements were consistent and repeatable. PSD results for ash collected from the four ESP hoppers show a progressive shift downward in the mean particle diameter through the ESP. The particle size range collected in the first and second ESP field hoppers is consistent with that of the ESP inlet gas particulate. The mean aerodynamic particle diameter at the ESP inlet was 3.5 μm with less than approximately 8% of the particles below 1 μm .

Recommendations and Considerations

Some technical issues have been identified during this study that may warrant further consideration. Among these are the following sampling, analytical and/or process related issues:

- Contamination of the APF outlet particulate phase samples with chromium, nickel, and molybdenum associated with the Inconel 800 components of the hot gas sampling system was observed;
- Improved detection limits are required for some trace elements in gas stream particulate and process solid samples to facilitate complete material characterizations and balance closures;
- Analysis of multiple reagent blanks is necessary to provide a more representative statistical value for background levels of target analytes in the sampling media when samples are analyzed by highly sensitive analytical techniques;
- Gas sampling methods for semi-volatile organic compounds should be studied to determine if benzoic acid, phthalate esters, and other related compounds are sampling artifacts associated with the reactivity of flue gas components on XAD-2 resin; and
- The hexavalent chromium sampling method has not been validated for application to flue gas from coal-fired combustion systems and should be thoroughly evaluated for sampling bias and precision.

References

1. American Society of Mechanical Engineers. *Measurement Uncertainty: Instruments and Apparatus*. PTC 19.1-1985 (reaffirmed 1990), pp 1-65. United Engineering Center, New York, NY. Published by the American National Standards Institute.

Table ES-1
Emission Factors

	lb/10 ¹² Btu	95% CI
Anions		
Chloride	83,000	4,000
Fluoride	5,600	270
Reduced Species		
Ammonia	140	7
Cyanide	610	29
Selected Elements^a		
Arsenic	1.2	0.06
Barium	0.92	0.04
Beryllium	0.26	0.0012
Cadmium	2.2	0.11
Chromium	4.6	0.22
Chromium (VI)	1.7	0.08
Copper	5.3	0.25
Lead	0.8	0.038
Manganese	8.5	0.41
Mercury	18	1
Molybdenum	0.31	0.015
Nickel	7.4	0.35
Selenium	49	2.3
Silver	0.5	0.024
Vanadium	1.2	0.06
Aldehydes		
Formaldehyde	5.1	0.24
Volatile Organic Species^{a,b}		
Benzene	6.6	0.32
Carbon Disulfide	1.0	0.05
PAHs by HRGC/MS^c		
Acenaphthylene	1.2x10 ⁻¹	5.8x10 ⁻³
2-Chloronaphthalene	1.2x10 ⁻³	5.7x10 ⁻⁵

Table ES-1 (Continued)

	lb/10 ¹² Btu	95% CI
PAHs by Method 8270^{c,d}		
Acetophenone	3.9 ^e	0.2
Benzoic Acid	160	8
Isophorone	21 ^e	1
Phenol	1.2 ^e	0.06
Dioxin/furan Species^{a,f}		
1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.4 x 10 ⁻⁶	3.1 x 10 ⁻⁶
Octachlorodibenzofuran	1.2 x 10 ⁻⁵	5.8 x 10 ⁻⁷
Total Heptachlorodibenzo-p-dioxin	1.4 x 10 ⁻⁵	6.7 x 10 ⁻⁷
Total Heptachlorodibenzofuran	4.5 x 10 ⁻⁶	2.1 x 10 ⁻⁷
Total Hexachlorodibenzofuran	1.4 x 10 ⁻⁵	6.7 x 10 ⁻⁷
Total Pentachlorodibenzofuran	4.3 x 10 ⁻⁶	2.1 x 10 ⁻⁷

^a Only those compounds with an average concentration above the detection limit are included.

^b Methylene chloride, toluene, and other halogenated hydrocarbons are not included because their presence is strongly suspected to be the result of contamination from common field and laboratory reagents.

^c Substances for which the reagent blank background levels were greater than or equal to 30% of the sample result are not included because their quantification is considered suspect.

^d Phthalate esters are not included because their presence is suspected to be either the result of resin contamination from plasticizers commonly found in the laboratory environment, or a sampling artifact.

^e Reported concentration is between the quantitation limit and the method detection limit. Results in this range are considered uncertain.

^f Results are less than five times the detection limit.

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1

INTRODUCTION

Background

The U.S. Department of Energy (DOE) Clean Coal Technology (CCT) Program focuses on developing a new generation of coal utilization processes. One objective of the program is to move the most promising of the advanced coal-based technologies into the commercial marketplace through a series of demonstrations cofunded by government and industry. The DOE-Morgantown Energy Technology Center (METC) Hot Gas Cleanup Research and Development Program examines advanced technologies for application to hot gas streams in coal combustion and gasification systems. One objective is to aid in designing hot gas cleanup technologies for second-generation pressurized-fluidized bed combustor (PFBC) units.

In the first round of CCT solicitations in 1986, the Ohio Power Company, a subsidiary of American Electric Power (AEP), was awarded funding for the Tidd PFBC demonstration plant in Brilliant, Ohio. The Tidd PFBC unit began operation in late 1990 and was later selected by the DOE-METC R&D program as a test facility for an advanced particle filtration (APF) system.

Because of continuing concern that the use of coal as an energy source could cause significant environmental impact, a complementary goal of the DOE CCT and METC R&D programs has always been to demonstrate the environmental acceptability of these projects. The Clean Air Act Amendments of 1990 (CAAA) added another focus to DOE's environmental protection commitment; evaluating the fate of hazardous air pollutants (HAPs) associated with the demonstration of advanced coal-based and hot gas cleanup technologies.

The study of HAPs at the Tidd PFBC demonstration plant was funded by the DOE Hot Gas Cleanup R&D program through AEP to assess the major input, process, and emission streams for the HAPs identified in Title III of the CAAA. Included in this assessment were the inlet and outlet gas and solid samples from the APF system and the electrostatic precipitator (ESP). The resulting data from this study are used to generate emission factors for the HAPs so that the environmental acceptability of commercialized PFBC technologies can be assessed.

Radian Corporation was selected to perform the HAPs assessment at the Tidd PFBC demonstration plant with the advanced particle filter in operation. This report presents the results of that assessment.

Objectives

The specific objectives of this project are:

- To collect and analyze representative solid, liquid, and gas samples of all specified input and output streams of the Tidd PFBC Plant, including the advanced particle filtration system, for selected hazardous air pollutants contained in Title III of the CAAA;
- To determine the removal efficiencies of the APF and ESP subsystems for selected pollutants;
- To calculate material balance closures for selected pollutants in specified subsystems of the power plant and for the entire plant;
- To determine the concentrations of the respective pollutants associated with the particulate and vapor-phase fractions of the specified flue gas streams;
- To determine hexavalent chromium stack emissions; and
- To provide data (emission factors) for use in comparing emissions and system data from Plant Tidd with similar studies on conventional coal-fired power plants.

Table 1-1 lists the chemical substances selected for analysis during this project.

Table 1-1
Target Analytes

Trace Elements			
Antimony	Cadmium	Manganese	Selenium
Arsenic	Chromium, total	Mercury	Silver
Barium	Cobalt	Molybdenum	Vanadium
Beryllium	Copper	Nickel	
Boron	Lead	Phosphorus	
Radionuclides			
Hexavalent Chromium			
Anions			
Chloride (HCl)			
Fluoride (HF)			
Sulfate			
Phosphate			
Reduced Species			
Ammonia			
Cyanide			
Dioxins/Furans			
Volatile Organics			
Benzene		Methyl Chloroform (1,1,1-Trichloroethane)	
Bromoform		Methyl Ethyl Ketone (2-Butanone)	
Carbon Disulfide		Methylene Chloride (Dichloromethane)	
Carbon Tetrachloride		Propylene Dichloride (1,2-Dichloropropane)	
Chlorobenzene		Styrene	
Chloroform		1,1,2,2-Tetrachloroethane	
1,4-Dichlorobenzene		Tetrachloroethene	
cis-1,3-Dichloropropene		Toluene	
trans-1,3-Dichloropropene		1,1,2-Trichloroethane	
Ethyl Benzene		Trichloroethene	
Ethyl Chloride (Chloroethane)		Vinyl Acetate	
Ethylene Dichloride (1,2-Dichloroethane)		Vinyl Chloride	
Ethylidene Dichloride (1,1-Dichloroethane)		Vinylidene Chloride (1,1-Dichloroethene)	
Formaldehyde		m,p-Xylene	
Methyl Bromide (Bromomethane)		o-Xylene	
Methyl Chloride (Chloromethane)			

Table 1-1 (Continued)

Semivolatile Organics		
Acenaphthene Acenaphthylene Acetophenone 4-Aminobiphenyl Aniline Anthracene Benzidine Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Benzoic Acid Benzyl Alcohol 4-Bromophenyl Phenyl Ether Butylbenzylphthalate 4-Chloro-3-Methylphenol p-Chloraniline bis(2-Chloroethoxy)methane bis(2-Chloroethyl)ether bis(2-Chloroisopropyl)ether 2-Chloronaphthalene 2-Chlorophenol 4-Chlorophenyl Phenyl Ether Chrysene bis(2-Ethylhexyl)phthalate Fluoranthene Fluorene Hexachlorobenzene Hexachlorobutadiene Hexachlorocyclopentadiene Hexachloroethane	Indeno(1,2,3-cd)pyrene Isophorone 2-Methylnaphthalene 2-Methylphenol (o-cresol) 4-Methylphenol (p-cresol) N-Nitrosodimethylamine N-Nitrosodiphenylamine N-Nitrosopropylamine Naphthalene 2-Nitroaniline 3-Nitroaniline 4-Nitroaniline Nitrobenzene Di-n-octylphthalate Dibenz(a,h)anthracene Dibenzofuran Dibutylphthalate 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 3,3-Dichlorobenzidine 2,4-Dichlorophenol Diethylphthalate p-Dimethylaminoazobenzene	2,4-Dimethylphenol Dimethylphthalate 4,6-Dinitro-2-methylphenol 2,4-Dinitrophenol 2,4-Dinitrotoluene 2,6-Dinitrotoluene 2-Nitrophenol 4-Nitrophenol Pentachloronitrobenzene Pentachlorophenol Phenanthrene Phenol Pyrene 1,2,4-Trichlorobenzene 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol
Additional Elements		
Aluminum Calcium Iron Magnesium Potassium Sodium Titanium		

Emission factors, removal efficiencies, and other results rely on measurement data that vary and which may be near or below the limit of detection for many of the substances of interest. This report includes uncertainty analysis and confidence intervals to assess the precision of the data.

Auditing

During the field sampling program conducted at Plant Tidd in April 1994, quality assurance (QA) audits were conducted by Radian Corporation's internal QA auditor. Radian's audit provided an objective, independent assessment of the sampling procedures, data gathering, and measurement activities to ensure the production of reliable and useful results. The audit provided a review of calibration documentation, documentation of QC data, completeness of data forms and notebooks, data review/validation procedures, sample logging procedures, and others. Included in this audit was the preparation and analysis of analytical standards as blind samples for assessing the potential bias associated with the analytical methods. The audit results and responses to the auditor's comments are provided in Section 4.

Project Organization

Figure 1-1 shows the organization of this project.

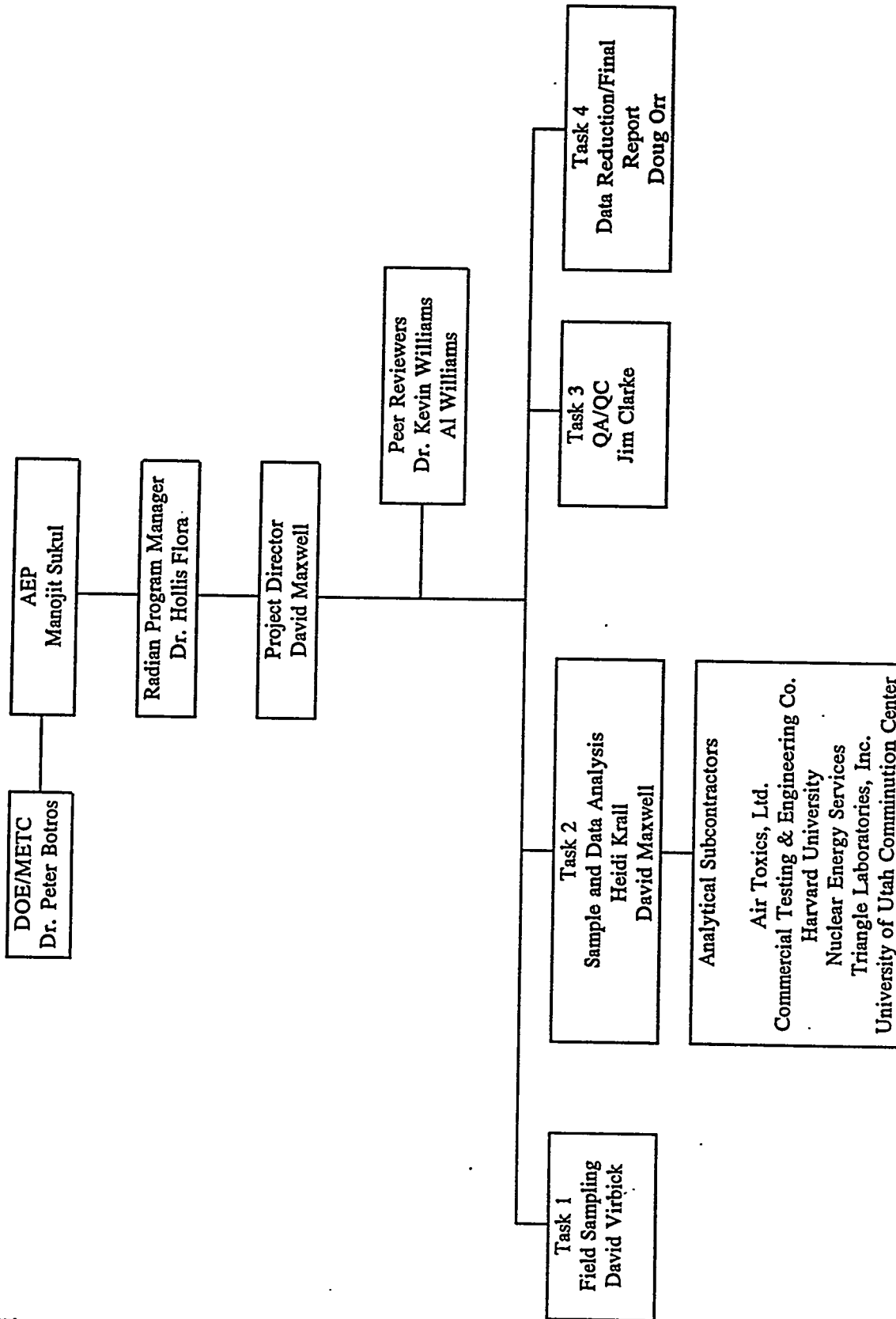


Figure 1-1
Project Organization

2

SITE DESCRIPTION

This section presents a description of the test site and sampling locations used during the test period. Deviations from the sampling locations described in the test plan are also discussed.

Site Description

Plant Tidd, located in Brilliant, Ohio, is operated by Ohio Power Company, a subsidiary of American Electric Power (AEP). The boiler at the Plant Tidd site is a bubbling-bed, pressurized fluidized bed combustor (PFBC) rated at 70 MWe full load. Total plant load during the test period was 45 to 46 MW; 37 MW was produced by a steam turbine generator and 8 MW was produced by depressurizing the hot flue gases through a gas turbine generator. The process operating conditions for the unit were selected by AEP and represent typical long-term operating conditions for the process. A simple schematic of the unit is shown in Figure 2-1.

Crushed coal (Pittsburgh No. 8, bituminous) is combined with water from a nearby river to produce a coal paste which was approximately 25 weight percent moisture. The paste is fed to the combustion chambers along with crushed dolomite. The material is fluidized by high velocity combustion air in the water-cooled boiler. Mean bed temperatures in the combustion chambers were controlled at approximately 1500°F during the test period. As the coal is combusted, the calcium carbonate in the dolomite or limestone is calcined to form quick lime which then reacts with the sulfur dioxide and oxygen in the combustion gases to form solid calcium sulfate. This reaction removes sulfur dioxide from the combustion gases, thus controlling SO₂ emissions. Test data from this program show approximately 90% removal of sulfur dioxide in the combustor. Formation of nitrogen oxides (NO_x) is minimized because of the relatively low combustion temperature of the PFBC process.

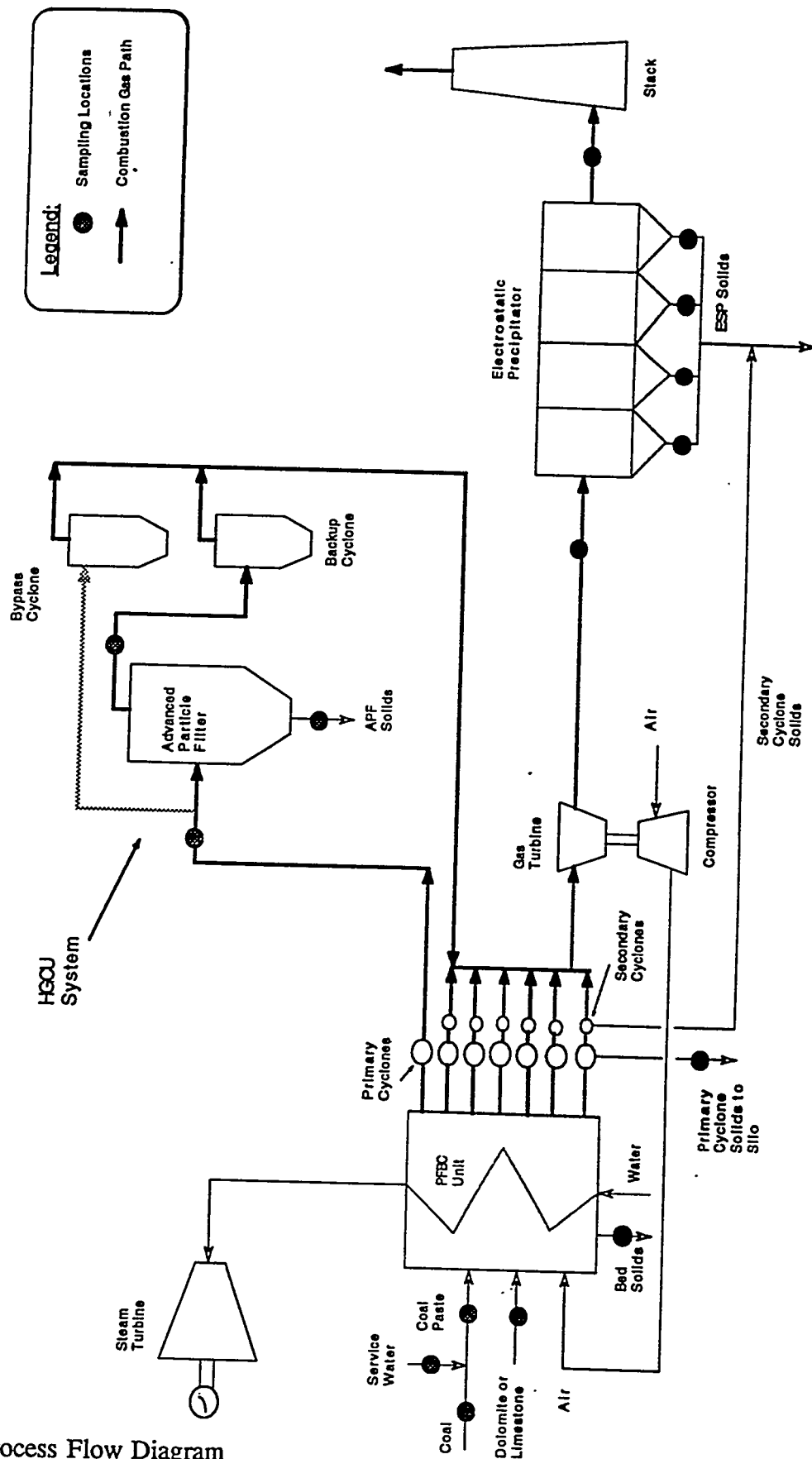


Figure 2-1
Plant Tidd Process Flow Diagram

After releasing heat to the in-bed, water-cooled boiler tubes, the particulate-laden combustion gases flow into seven parallel, two-stage cyclones. These cyclones remove approximately 93% of the entrained solids (primarily sulfated lime, unreacted lime, ash, and unburned carbon) from the gases. The combustion gases then flow to the ASEA Stal GT-35P gas turbine where they are expanded and then exit through the turbine exhaust gas economizer. Final particulate removal from the gases is achieved in an electrostatic precipitator (ESP) before the gases are released to the atmosphere.

Bed ash, which comprises about 45% of the total ash produced, is removed from the bottom of the combustor periodically through a lock hopper system. Solids collected by the primary cyclone are transported to a storage silo using a pressurized pneumatic transport system. Secondary cyclone solids are combined with the material collected in the ESP. All solids are transported by truck off site for disposal.

Hot Gas Cleanup

A research feature of the Plant Tidd facility is a demonstration-scale hot gas cleanup (HGCU) system, as shown in Figure 2-1. Treated gas from one of the seven cyclone systems (approximately one-seventh of the total gas flow from the combustor) is diverted to a ceramic barrier, advanced particle filter (APF) and back-up cyclone, and directed back to the outlet header of the secondary cyclones. The APF uses Schumacher silicon carbide candles in a cluster/ plenum arrangement developed by Westinghouse Corporation to filter the gas. Tempering air was added to the system during the test period to control ash bridging within the APF system, reducing the APF inlet gas temperature from 1500°F to approximately 1350°F.

Each candle element in the APF is a porous ceramic cylinder which is closed on the bottom and open at the top. Hot, particulate-laden gas flows through the outer surface of the candles and the clean gas exits through the inner cylinder of the candles. The candle clusters are back-pulsed sequentially on a continuous cycle by nine pulse injectors to remove particulate matter captured on the outside of the candles. The pulse cycle during the test period was

approximately every 30 minutes. Entrained solids removed in the APF system are collected and transported by truck off site for disposal.

Sampling Locations

Process streams that were sampled during the test are listed in Table 2-1 along with a brief description of the planned sampling location and any deviations from the planned location. Solid, liquid, and gas stream sampling locations are illustrated in Figure 2-1. Ports at the APF inlet and outlet and ESP outlet were located a sufficient distance from flow disturbances to allow collection of representative samples. Samples were collected from single 4-inch diameter horizontal ports at the APF inlet and outlet. Two 4-inch diameter ports (one horizontal and one vertical port 90 degrees apart) were available at the ESP outlet. The five 4-inch diameter horizontal ports at the ESP inlet were located less than 8 duct diameters downstream of a bend in the duct; therefore, this sample location was considered nonideal. Velocity and particulate loading measurements at the ESP inlet may not be representative because of the proximity of sample ports to this flow disturbance.

Solid and liquid stream samples were collected at intervals that accounted for the residence times within the system so that solid and liquid samples corresponded to gas sampling periods. The inlet air to the PFBC unit was not sampled because this stream was not considered a major source of any HAP substance measured in this study. The procedures for collecting, preserving, and analyzing samples are presented in Appendix A. Tables 2-2 and 2-3 present an overview of the types of analyses performed on these process streams.

All streams were sampled from the planned locations, with the exception of the sorbent and APF ash streams. A different sample location was used for the sorbent because the gear box on the autosampler at the East sorbent injector became jammed on the first day of testing. An alternate location at the diversion gate upstream of the East and West silos was used to collect sorbent samples on Day 2 and Day 3. This change did not adversely affect sample representativeness. Once on site, the crew identified an improved sampling location for the

Table 2-1
Sampling Locations at Plant Tidd

Process Stream	Sampling Location
Coal ^a	Solid automatic sampler on feed belt to crusher.
Coal Paste	Paddle belt feeder to storage tank.
Sorbent (Dolomite)	Automatic sampler on east sorbent injector (planned). Diversion gate upstream of both the East and West sorbent silos (actual).
Bed Ash	Bed ash collector before ash conveyor.
ESP Ash	ESP Hoppers 11 and 12; Hoppers 13 and 14 sampled on last day.
Primary Cyclone Ash	Automatic samplers on ash storage silo.
APF Ash	Sampled upon loading into disposal trucks (planned). Bottom of APF ash collector (actual).
Service Water	Tap on low pressure service water header.
APF Inlet Gas	Single 4-inch-diameter port on APF inlet duct.
APF Outlet Gas	Single 4-inch-diameter port on APF outlet duct.
ESP Inlet Gas	Five 4-inch-diameter ports on ESP inlet duct.
ESP Outlet Gas	Two 4-inch-diameter ports on ESP outlet duct.

^a Raw coal samples were collected as a backup to the coal paste sample.

Table 2-2
Analyses Performed for Solid and Liquid Streams

Analysis	Coal ^a	Coal Paste	Sorbent (Dolomite)	Service Water	Bed Ash	ESP Ash	Primary Cyclone Ash	APF Ash
Metals		✓	✓	✓	✓	✓	✓	✓
Anions		✓	✓	✓	✓	✓	✓	✓
Semivolatile Organics					✓	✓	✓	✓
Particle Size Distribution						✓		
Ultimate/Proximate		✓						
Radionuclides		✓			✓	✓	✓	✓
Carbon					✓	✓	✓	✓
Dioxins/Furans						✓	✓	✓
Moisture		✓						

^a Raw coal samples, collected as alternate feedstock samples, were not analyzed.

Table 2-3
Analyses Performed for Gas Streams

Analysis	APF Inlet Gas	APF Outlet Gas	ESP Inlet Gas	ESP Outlet Gas
Particulate Loading	✓	✓	✓	✓
Metals ^a	✓	✓	✓	✓
Anions ^a	✓	✓	✓	✓
Ammonia/Cyanide	✓	✓	✓	✓
Formaldehyde	✓	✓	✓	✓
Volatile Organics	✓	✓	✓	✓
Semivolatile Organics ^a	✓	✓	✓	✓
Dioxins/Furans ^b	✓	✓	✓	✓
Particle Size Distribution			✓	✓
Hexavalent Chromium ^a				✓

^a Particulate and vapor phases analyzed separately.

^b Solid- and vapor-phase fractions were combined prior to analysis for all streams except APF outlet.

APF ash. Instead of sampling from the disposal trucks, as planned, a sample point was identified at the bottom of the APF ash collection system.

3

RESULTS

This section summarizes the results of the stream characterization for the Tidd PFBC demonstration plant. Sampling, preparation, and analytical methods are described in Appendix A. Detailed analytical data for each individual sample can be found in Appendix B.

Sampling Schedule

Samples were collected during the week of April 11, 1994. Figures 3-1 and 3-2 show the gas stream sample times for the ESP and APF systems, respectively. Figure 3-3 shows the sample collection periods for solid and liquid process streams. Three valid sample sets for each stream were obtained.

Every attempt was made to collect inlet and outlet gas samples for a given sample type over the same time period so that results would provide a meaningful comparison. All ESP inlet and outlet gas samples were collected simultaneously as shown in Figure 3-1. Run 1 multi-metals and anions train samples at the APF inlet were invalidated because of particulate breakthrough across the filter; these samples were recollected later in the test period. The higher than expected particulate loadings at the APF inlet caused delays in gas sample collection; therefore, the test period was extended one day to allow for collection of all three PAH, dioxin/furan, and volatile organic trains.

Data Treatment

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

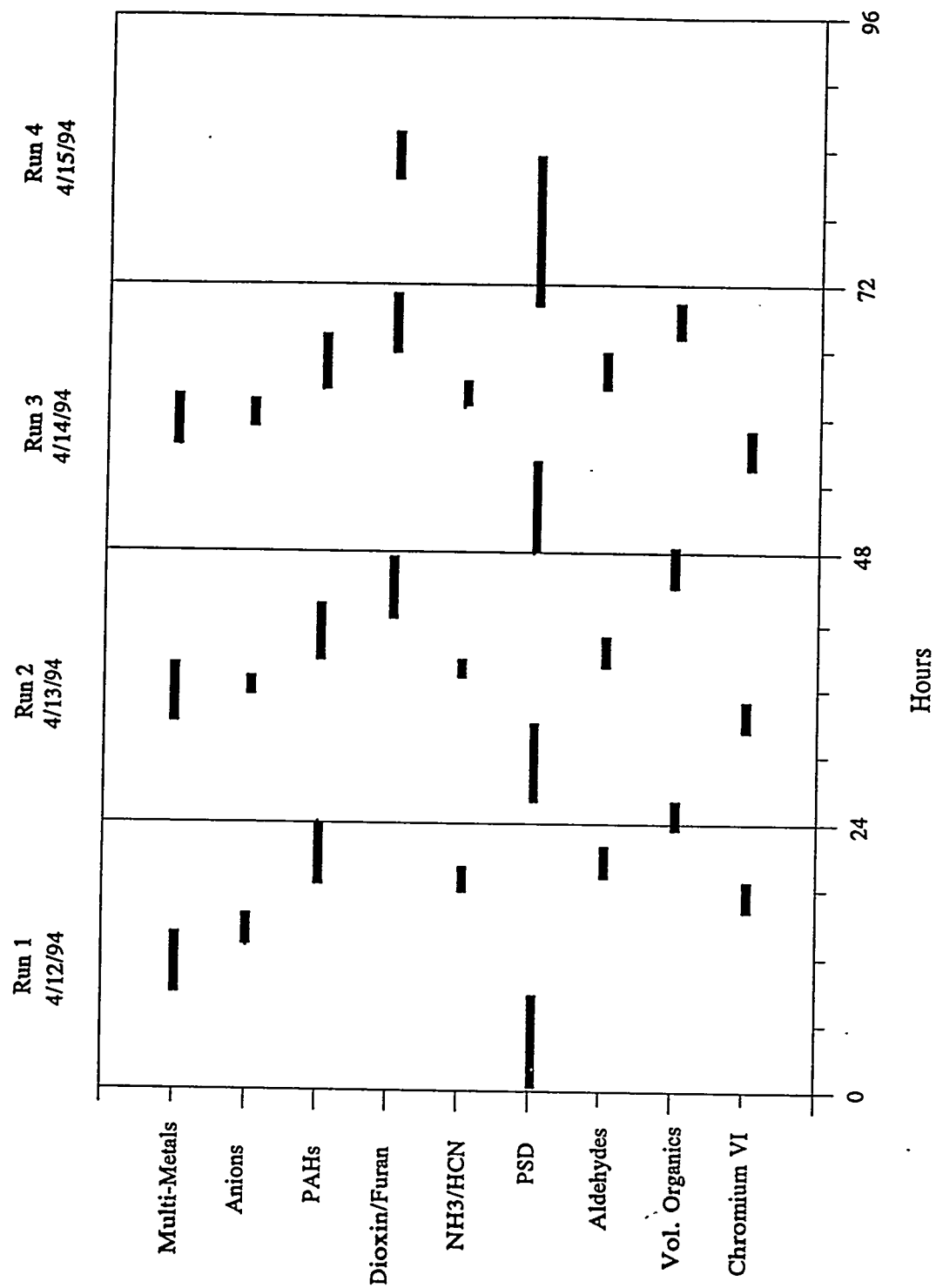


Figure 3-1
ESP Inlet and Outlet Sampling Schedule

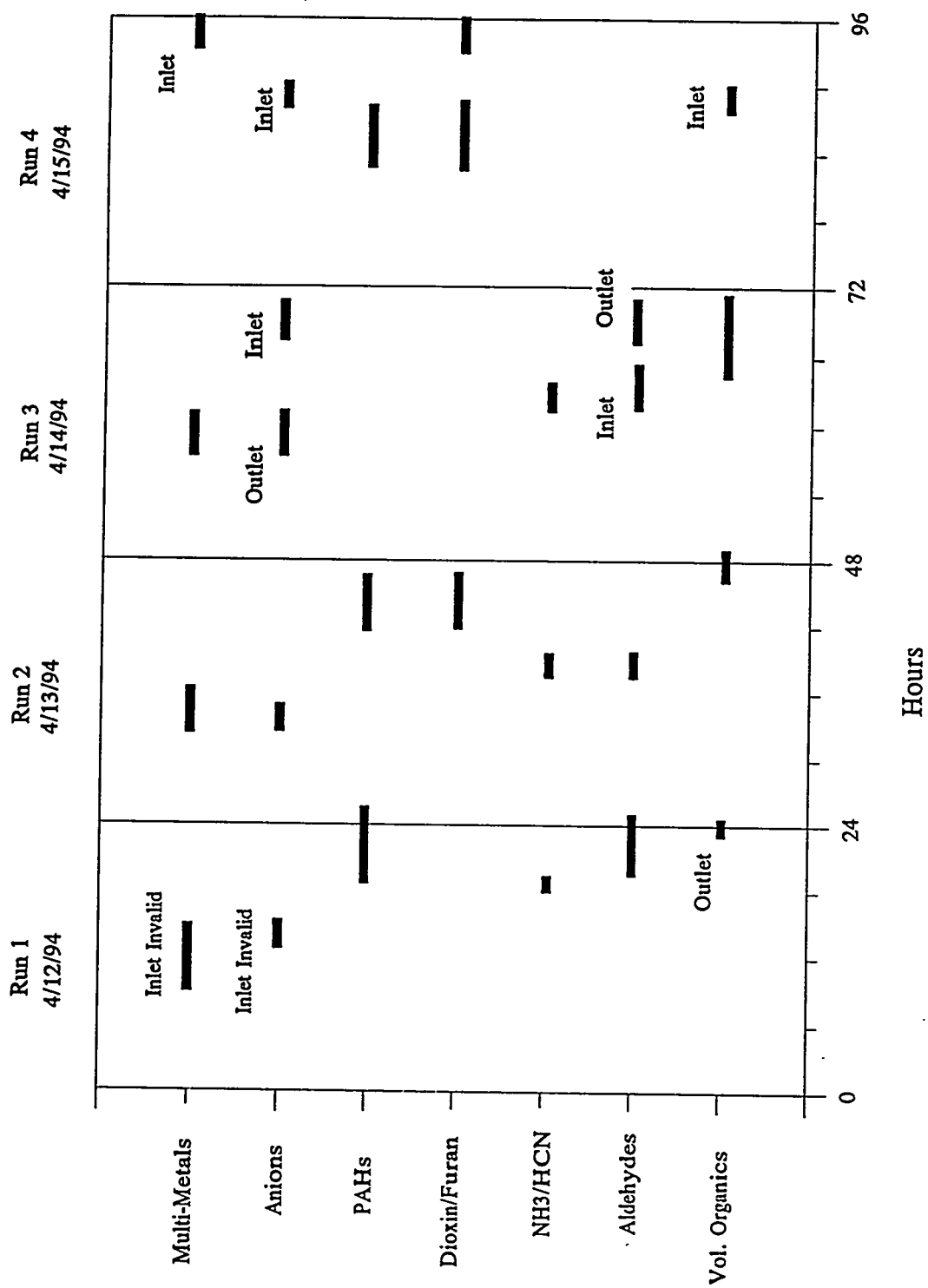


Figure 3-2
APF Inlet and Outlet Sampling Schedule

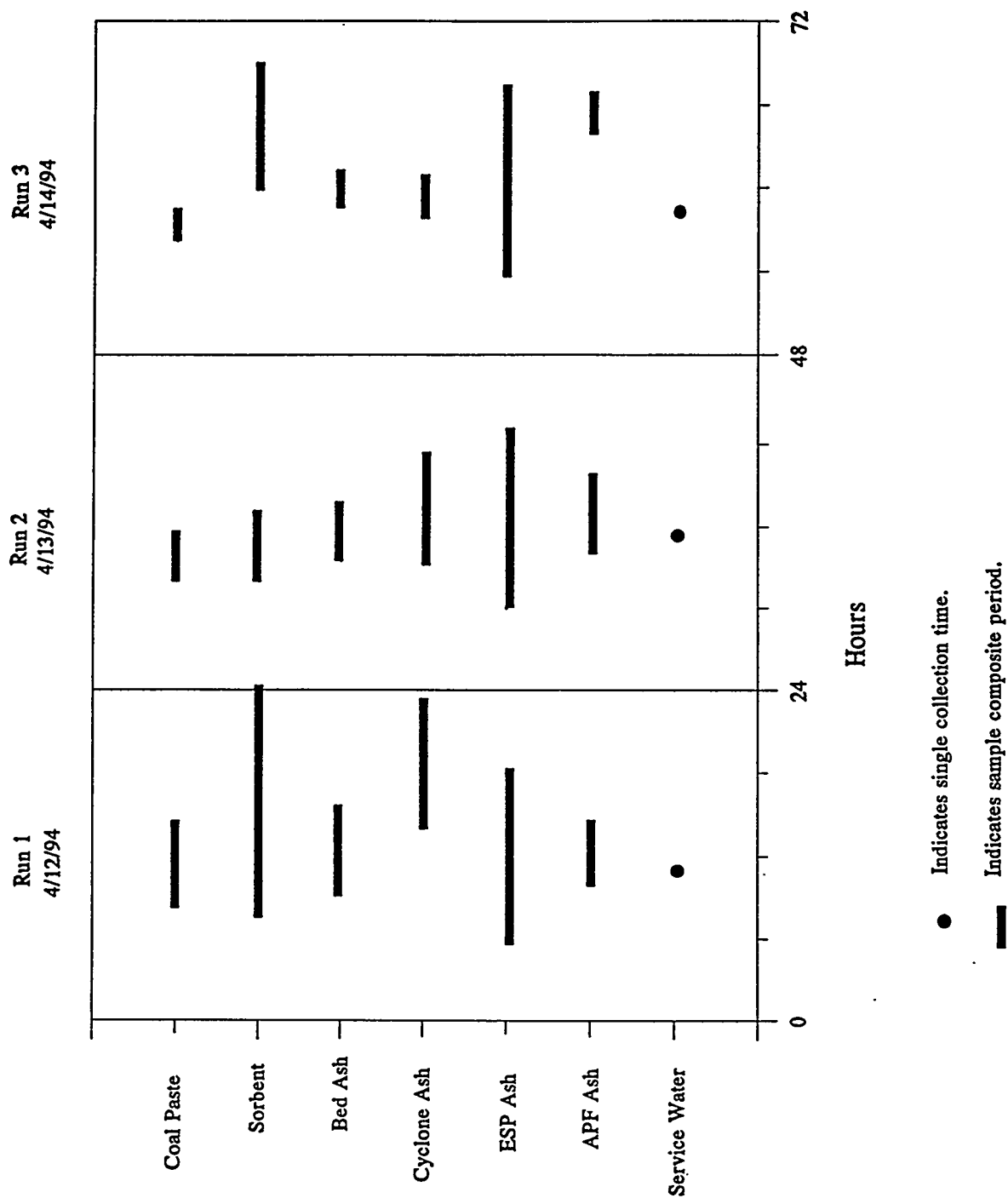


Figure 3-3
Sample Times for Solid and Liquid Process Streams

To determine the total concentration for gas streams within a 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:

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 detection limits.

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 inorganic constituents of interest other than HF, HCl, NH₃, HCN, 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. The opposite is generally true for organic species. 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 selenium concentration in the ESP inlet gas for Run 1 is calculated as follows:

Selenium in the solid phase = 52 $\mu\text{g}/\text{Nm}^3$

Selenium in the vapor phase = 20 $\mu\text{g}/\text{Nm}^3$

Total selenium in the ESP inlet gas = 72 $\mu\text{g}/\text{Nm}^3$

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

For example, the total silver concentration in the ESP inlet gas for Run 1 is calculated as follows:

$$\text{Silver in the solid phase} = \text{ND}(2.1) \mu\text{g}/\text{Nm}^3$$

$$\text{Silver in the vapor phase} = \text{ND}(1.6) \mu\text{g}/\text{Nm}^3$$

$$\text{Total silver in the ESP inlet gas} = \text{ND}(2.1) \mu\text{g}/\text{Nm}^3$$

- For Case 3, multiple conventions have been established, depending on the group of substances being considered.

For metals train results, if the substance is not detected in the solid phase and detected in the vapor phase at levels below the detection limit of the solid phase, the total concentration is reported as the detection limit of the solid phase and total is flagged to note that the substance was detected at low levels in the vapor phase.

For example, the total antimony concentration in the ESP inlet gas for Run 1 is calculated as follows:

$$\text{Antimony in the solid phase} = \text{ND}(3.2) \mu\text{g}/\text{Nm}^3$$

$$\text{Antimony in the vapor phase} = 0.016 \mu\text{g}/\text{Nm}^3$$

$$\text{Total antimony in the ESP inlet gas} = \text{ND}(3.2) \mu\text{g}/\text{Nm}^3$$

For metals train results, if the substance is not detected in the vapor phase and detected in the solid phase, the vapor-phase component is considered to be equal to zero.

For example, the total lead concentration in the ESP inlet gas for Run 1 is calculated as follows:

$$\text{Lead in the solid phase} = 76 \mu\text{g}/\text{Nm}^3$$

Lead in the vapor phase = ND(0.005) $\mu\text{g}/\text{Nm}^3$

Total lead in the ESP inlet gas = 76 $\mu\text{g}/\text{Nm}^3$

For semivolatile organic compounds, if the substance is not detected in the solid phase and detected in the vapor phase, the reported total is the concentration in the vapor phase.

For example, the total 2-chloronaphthalene concentration in the APF inlet gas for Run 1 is (refer to Table 3-15) calculated as follows:

2-chloronaphthalene in the solid phase = ND(0.09) ng/Nm^3

2-chloronaphthalene in the vapor phase = 5.9 ng/Nm^3

Total 2-chloronaphthalene in the ESP inlet gas = 5.9 ng/Nm^3

Historical test data for conventional power systems has indicated that HCl, HF, and mercury are present primarily in the vapor phase (although mercury is sometimes also detected in the solid phase). One would also expect that semivolatile organic compounds would be primarily associated with the vapor phase. For Case 2, 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 included values both above and below the detection limit, one-half the detection limit was used to calculate the mean. For example:

<u>Analytical Values</u>	<u>Calculation</u>	<u>Mean Value</u>
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 limit obtained; therefore, the reported mean is ND(4).

<u>Analytical Values</u>	<u>Calculation</u>	<u>Mean Value</u>
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 the 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.

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

Coal and Dolomite

Tables 3-1 and 3-2 show the analytical results for the coal paste and sorbent samples, 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 when QA/QC audit results indicated significant problems with precision or bias for a particular technique. Additional information regarding selection of data is provided in Section 4. For each substance, a mean 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

Table 3-1
Coal Paste Composition ($\mu\text{g/g}$, dry unless noted)

Substance	Analytical Method	Run 1	Run 2	Run 3	Mean	95% CI
Date		4/12/94	4/13/94	4/14/94		
Gross Load (MW)	DAS	46	46	45		
Coal Paste Rate (lb/hr, dry)	DAS	33,750	33,570	33,020	33,500	940
Coal Paste Solids (wt%)	Gravimetric	75.0	74.6	75.1	74.9	0.7
HHV (Btu/lb, dry)	Proximate	12,900	12,700	12,600	12,700	380
Ash (wt%, dry)	Ultimate	11.2	11.8	14.1	12	4
Sulfur (wt%, dry)	Ultimate	3.1	3.4	3.6	3.4	0.6
Major Species						
Aluminum	INAA	14,800	15,300	16,800	15,600	2,600
Calcium	ICP-AES	1,100	1,400	1,400	1,300	430
Iron	INAA	20,200	17,200	23,200	20,200	7,500
Magnesium	ICP-AES	840	820	910	860	120
Potassium	INAA	5,040	4,310	3,540	4,300	1,900
Sodium	INAA	310	407	297	340	150
Titanium	ICP-AES	680	680	720	690	60
Target Species						
Antimony	INAA	0.44	0.47	0.52	0.48	0.10
Arsenic	INAA	38	50	48	45	17
Barium	ICP-AES	49	51	61	54	16
Beryllium	ICP-AES	1.7	1.5	1.6	1.6	0.3
Boron	ICP-AES	79	83	ND (3.0)	55	114
Cadmium	GFAAS	0.080	0.060	0.19	0.11	0.17
Chlorine	SIE	990	1,300	1,200	1,200	390
Chromium	ICP-AES	15	17	17	16	3
Cobalt	INAA	3.7	3.9	4.2	3.9	0.6
Copper	ICP-AES	6.8	6.7	7.4	7.0	0.9
Fluorine	SIE	120	99	120	110	30
Lead	GFAAS	6.0	6.0	7.0	6.3	1.4
Manganese	INAA	22	26	29	26	9
Mercury	CVAAS	0.16	0.16	0.13	0.15	0.04
Molybdenum	INAA	1.2	0.30	ND (0.51)	0.58	1.3
Nickel	INAA	12	8	18	13	12
Phosphorus	ICP-AES	90	97	100	96	13
Selenium	INAA	1.6	1.8	1.9	1.8	0.4
Silver	INAA	0.80	0.44	0.64	0.63	0
Vanadium	INAA	25	21	26	24	6

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

Results

Table 3-2
Sorbent Composition ($\mu\text{g/g}$, as fired unless noted)

Substance	Analytical Method	Run 1	Run 2	Run 3	Mean	95% CI
Date		4/12/94	4/13/94	4/14/94		
Flow Rate (lb/hr, as fired)	DAS	18,000	21,000	19,000	19,300	3,800
Major Species						
Aluminum	ICP-AES	659	662	632	651	41
Calcium	ICP-AES	193,000	192,000	193,000	193,000	1,400
Iron	ICP-AES	2,130	2,430	2,160	2,240	410
Magnesium	ICP-AES	106,000	106,000	106,000	106,000	0
Potassium	ICP-AES	240	218	255	238	46
Sodium	ICP-AES	194	198	202	198	10
Titanium	ICP-AES	7.49	10.9	9.65	9.35	4.29
Sulfate	IC	6,420	6,370	6,460	6,420	110
Target Species						
Antimony	ICP-AES	ND (4.9)	ND (5.5)	ND (5.5)	ND (5.5)	—
Arsenic	GFAAS	2.2	2.1	1.2	1.9	1.3
Barium	ICP-AES	3.5	3.5	3.4	3.5	0.09
Beryllium	ICP-AES	0.049	ND (0.031)	ND (0.031)	ND (0.031)	—
Boron	ICP-AES	33	31	34	33	3
Cadmium	GFAAS	0.14	0.17	0.093	0.14	0.10
Chloride	SIE	370	340	250	320	160
Chromium	ICP-AES	2.8	2.9	2.9	2.8	0.1
Cobalt	ICP-AES	0.46	ND (0.5)	ND (0.50)	ND (0.5)	—
Copper	ICP-AES	ND (0.42)	ND (0.47)	ND (0.47)	ND (0.47)	—
Fluoride	SIE	300	210	140	210	200
Lead	GFAAS	7.3	6.2	7.2	6.9	.2
Manganese	ICP-AES	72	73	72	72	1
Mercury	CVAAS	ND (0.012)	ND (0.012)	ND (0.012)	ND (0.012)	—
Molybdenum	ICP-AES	1.4	1.3	1.6	1.5	0.4
Nickel	ICP-AES	20	17	1	12	26
Phosphorus	ICP-AES	ND(6.1)	ND(6.8)	ND(6.8)	ND(6.8)	—
Selenium	GFAAS	0.90	0.48	0.98	0.79	0.68
Silver	ICP-AES	ND (0.37)	ND (0.41)	ND (0.41)	ND (0.41)	—
Vanadium	ICP-AES	4.8	4.9	5.2	4.9	0.5

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

arsenic concentration in the coal paste was between 28 and 62 $\mu\text{g/g}$. Calculation of this confidence interval is discussed in Section 5.

For those substance which could not be quantified, the notation "ND(x)" is used. This means "not detected at a concentration of x." The detection limit can vary according to sample size, sample preparation, and analytical method. All of the target species were detected in the coal paste. Levels of the target species were generally much lower in the sorbent, with the exception of fluoride, manganese and molybdenum.

Ash Streams

Tables 3-3 and 3-4 show the mean compositions of inorganic and organic species in the bed ash, cyclone ash, APF ash, and ESP ash. The ESP ash sample represents ash collected from the first two hoppers of the ESP. Composite samples were prepared by combining ESP ash collected from Hopper 1 with ash from Hopper 2 in a ratio of 90:10, respectively.

The compositions of the ash streams illustrate the differences and similarities between solid byproducts produced by conventional pulverized coal (PC) and PFBC combustion. The bed ash from the PFBC system is a dense, coarse material consisting primarily of sulfated lime, unreacted lime, magnesite, and char, making it very different from PC byproducts. Trace metals, which can either volatilize in the combustion process or volatilize/recondense on the fine particulate matter, are present at relatively low levels in the bed material compared to the other ash streams. The cyclone ash is comparable to fly ash from a PC unit, with the exception that it contains a significant amount of spent sorbent material. The ESP and APF ashes are very similar to the ash produced in a conventional PC boiler (i.e., higher levels of aluminum, potassium, sodium, and titanium). These ashes contain smaller amounts of spent dolomite and a greater percentage of the fine coal ash particulate; therefore, concentrations of trace metals are highest in these two streams due to the volatilization/condensation mechanism associated with the fine particulate. This is particularly evident for beryllium and lead where the concentrations in the ESP ash are 12 to 17 times higher than the concentration in the bed ash. Concentrations of major coal elements such as aluminum and titanium are

Table 3-3
Ash Stream Compositions - Inorganic Species ($\mu\text{g/g}$ unless noted)

Substance	Analytical Method	Bed Ash		Cyclone Ash		APF Ash		ESP Ash	
		Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Flow Rate (lb/hr)		9,300	2,100	10,300	3,290	313	61	775	76
Major Species									
Aluminum	ICP-AES	8,990	7,650	31,900	2,800	54,800	5,380	60,400	10,100
Calcium	ICP-AES	164,000	8,600	124,000	8,960	87,500	7,430	89,700	15,000
Iron	ICP-AES	15,300	13,700	50,200	1,940	28,700	1,250	27,400	2,500
Magnesium	ICP-AES	125,000	18,000	70,300	1,490	46,500	4,770	45,600	5,800
Potassium	ICP-AES	1,010	1,000	6,350	960	12,600	1,030	15,400	1,320
Sodium	ICP-AES	219	65	963	217	2,100	240	2,600	90
Titanium	ICP-AES	485	390	1,670	170	2,920	370	3,760	360
Carbon (wt%)	Ultimate	3.5	0.5	5.3	0.4	0.1	0.1	0.23	0.48
Sulfur (wt%)	Ultimate	7.8	0.8	3.9	0.3	16	2.3	9.2	20
Target Species									
Antimony	ICP-AES	ND (54)	--	ND (40)	--	ND (50)	--	ND (59)	--
Arsenic	GFAAS	71	27	93	16	270	71	380	62
Barium	ICP-AES	34	25	150	16	200	31	220	29
Beryllium	ICP-AES	0.65	0.49	3.8	1.2	6.5	2.1	8.0	2.4
Boron	ICP-AES	96	16	110	29	310	630	60	130
Cadmium	GFAAS	ND (1.6)	--	0.35	0.21	1.6	0.1	1.9	0.2
Chloride	SIE	890	380	360	110	110	380	ND (78)	--
Chromium	ICP-AES	19	6	44	4	74	8	94	10
Cobalt	ICP-AES	13	5	13	5	16	7	22	6
Copper	ICP-AES	ND (4.6)	--	ND (3.7)	--	ND(4.2)	--	6.5	12

Table 3-3 (Continued)

Substance	Analytical Method	Bed Ash		Cyclone Ash		APF Ash		ESP Ash	
		Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Fluoride ^a	SIE	100	14	110	93	ND (12)	--	110	91
Lead	GFAAS	5.0	3.2	19	6	69	19	84	48
Manganese	ICP-AES	100	32	110	7	100	5	110	9
Mercury	CVAAS	ND (0.010)	--	ND (0.012)	--	ND (0.012)	--	ND (0.012)	--
Molybdenum	ICP-AES	ND (3.5)	--	ND (2.8)	--	ND (3.3)	--	ND (3.8)	--
Nickel	ICP-AES	ND (11)	--	14	36	29	29	50	38
Phosphorus	ICP-AES	ND(70)	--	ND(71)	--	ND(71)	--	ND(71)	--
Selenium	GFAAS	4.6	1.4	4.0	7.6	ND (0.99)	--	4.9	1.2
Silver	ICP-AES	ND (4.1)	--	ND (3.3)	--	ND (3.8)	--	ND (4.4)	--
Vanadium	ICP-AES	20	10	55	12	87	13	120	17

^a QA/QC results and material balance evaluations indicate that ash stream results are likely biased low.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

Table 3-4
Ash Stream Compositions - Organic Species ($\mu\text{g/g}$, unless noted)

Substance	Bed Ash		Cyclone Ash		APF Ash		ESP Ash	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Flow Rate (lb/hr)	9,300	2,100	10,300	3,290	313	61	775	76
Semivolatile Organic Species								
bis(2-Ethylhexyl)phthalate	ND(0.05)	--	ND(0.05)	--	ND(0.05)	--	0.34	0.91
Dioxin and Furan Species ($\mu\text{g/g}$)								
1,2,3,4,6,7,8-HpCDD	NS	--	ND(0.9)	--	ND(0.6)	--	1.4	1.0
2,3,4,6,7,8-HxCDF	NS	--	ND(0.4)	--	0.3	0.3	ND(0.8)	--
Total HpCDD	NS	--	ND(0.9)	--	ND(0.6)	--	2.3	1.0
Total HxCDF	NS	--	ND(0.7)	--	ND(0.4)	--	5.8	1.8
Total HxCDF	NS	--	ND(0.4)	--	0.3	0.3	ND(0.8)	--
Total PeCDD	NS	--	ND(0.7)	--	ND(0.4)	--	4.6	1.5
Total TCDD	NS	--	ND(0.4)	--	ND(0.3)	--	3.2	0.9

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

HpCDD = Heptachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

PeCDD = Pentachlorodibenzo-p-dioxin.

TCDD = Tetrachlorodibenzo-p-dioxin.

generally five to seven times higher in the ESP ash than in the bed ash. Enrichment factors for ash streams relative to the ash in the coal/dolomite feed were not calculated as part of this study. The coal ash content and trace species composition shown in Table 3-1 can be used in conjunction with the ash stream elemental compositions shown in Table 3-3 to calculate enrichment factors for each ash stream. It is also interesting to note the difference in the carbon content of the various ash streams. The bed ash and cyclone ash contain roughly 4% to 5% carbon, whereas the APF ash and ESP ash contain about 0.1% to 0.2% carbon.

None of the target semivolatile organic compounds were present in the ash stream at levels above the detection limits, with the exception of bis(2-ethylhexyl)phthalate in the ESP ash. Levels of this compound in the three ESP ash samples ranged from 0.06 $\mu\text{g/g}$ to 0.75 $\mu\text{g/g}$. Phthalate esters are typical plasticizers commonly attributed to plastic bottles, bags, etc., used in the field laboratory environment. Although all samples for organic compound analyses were collected in glass jars, the presence of this phthalate compound is most likely due to contamination.

Results for dioxin and furan compounds indicate that none of the target compounds were detected in the cyclone ash samples. 2,3,4,6,7,8-hexachlorodibenzofuran and total hexachlorodibenzofuran were detected in all three APF ash samples at a mean concentration of 0.3 pg/g (picograms/gram). 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, total heptachlorodibenzo-p-dioxin, total hexachlorodibenzo-p-dioxin, total pentachlorodibenzo-p-dioxin, and total trichlorodibenzo-p-dioxin were detected in all three ESP ash samples at concentrations in the range of 1.4 to 5.8 pg/g.

Service Water

Characterization data for the plant service water are shown in Table 3-5. Levels of target inorganic species indicate that the service water does not contribute significant amounts of these species to the process.

Table 3-5
Service Water Composition ($\mu\text{g/mL}$ unless noted)

Substance	Analytical Method	Run 1	Run 2	Run 3	Mean	95% CI
Date		4/12/94	4/13/94	4/14/94		
Flow Rate (lb/hr)	DAS	11,250	11,430	10,980	11,220	570
Flow Rate (L/hr)	DAS	5,100	5,200	5,000	5,100	250
Major Species						
Aluminum	ICP-AES	1.3	2.2	1.9	1.8	1.2
Calcium	ICP-AES	24	26	22	24	5
Iron	ICP-AES	3.0	4.7	4.5	4.1	2.3
Magnesium	ICP-AES	6.3	6.7	5.8	6.2	1.2
Potassium	ICP-AES	1.6	1.8	1.8	1.7	0.3
Sodium	ICP-AES	10	11	10	10	1
Sulfate	IC	59	58	47	55	17
Phosphorus	ICP-AES	ND(0.06)	ND(0.06)	ND(0.06)	ND(0.06)	--
Total phosphate (as P)	Colorimetry	ND(0.02)	ND(0.02)	0.03	ND(0.02)	--
Target Species						
Antimony	ICP-AES	ND(0.076)	ND(0.076)	ND(0.076)	ND(0.076)	--
Arsenic	GFAAS	ND(0.00065)	0.0011	0.0017	0.0011	0.0017
Barium	ICP-AES	0.049	0.069	0.066	0.061	0.027
Beryllium	ICP-AES	0.0016	0.00054	0.0046	0.0022	0.0052
Boron	ICP-AES	0.043	0.041	0.042	0.042	0.002
Cadmium	GFAAS	ND(0.00027)	ND(0.00027)	ND(0.00027)	ND(0.00027)	--
Chloride	IC	12	12	12	12	1
Chromium	ICP-AES	ND(0.0052)	ND(0.0052)	0.00788	ND(0.0052)	--
Cobalt	ICP-AES	0.0071	0.0046	ND(0.0041)	0.0046	0.0063
Copper	ICP-AES	0.013	0.017	0.021	0.017	0.010
Lead	GFAAS	0.0063	0.012	0.013	0.010	0.009
Manganese	ICP-AES	0.29	0.44	0.43	0.39	0.21
Mercury	CVAAS	ND(0.00003)	ND(0.00003)	ND(0.00003)	ND(0.00003)	--
Molybdenum	ICP-AES	ND(0.0074)	ND(0.0074)	0.00739	ND(0.0074)	--
Nickel	ICP-AES	ND(0.014)	ND(0.014)	0.0145	ND(0.014)	--
Selenium	GFAAS	ND(0.0018)	ND(0.0018)	ND(0.0018)	ND(0.0018)	--
Silver	ICP-AES	ND(0.0052)	ND(0.0052)	ND(0.0052)	ND(0.0052)	--
Titanium	ICP-AES	0.014	0.023	0.025	0.021	0.015
Vanadium	ICP-AES	0.0053	ND(0.0045)	0.0076	0.0051	0.0066

ESP Inlet and Outlet Gas

Inorganic Species

Tables 3-6 and 3-7 show the concentrations of the target inorganic analytes in the ESP inlet and outlet gas streams, respectively. The data are presented as solid and vapor-phase compositions, along with the mean concentrations and confidence intervals of the combined phases. Although the data are presented as solid- and vapor-phase concentrations, it is important to note that the Method 29 multi-metals train has not been validated by EPA for determination of phase splits. For ease of interpretation, researchers typically assume that the material collected on the filter represents the solid-phase composition, while the material collected in the impinger solutions represent vapor-phase composition. It is possible for extremely fine particulate matter to penetrate the pores of the filter and be collected in the nitric acid/hydrogen peroxide impinger solution. The gas flow rate data represent the average of the flow rate measurements obtained from all the trains which were traversed in the duct for a given run.

The solid-phase multi-metals train data from the ESP outlet have been corrected for the background levels associated with the quartz filters. At the ESP inlet, filtered gas particulate matter was analyzed separately from the filter media, so background corrections were not necessary. Vapor-phase data have been corrected for the background levels present in the nitric acid/hydrogen peroxide impinger reagent due to the lower detection limits provided by ICP-MS and the significance of the background levels compared to the samples.

Reported solid-phase concentrations for antimony, barium, beryllium, chromium, cobalt, copper, manganese, molybdenum, nickel, silver, vanadium, and all major species were determined by ICP-AES. Arsenic, cadmium, lead, and selenium were determined by GFAAS. Mercury was determined by CVAAS. Chloride and sulfate were determined by IC, while fluoride was determined by SIE.

Table 3-6
ESP Inlet Gas Composition - Inorganic Species ($\mu\text{g}/\text{Nm}^3$ unless noted)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95%CI
Date	4/12/94	4/13/94	4/14/94	4/15/94	4/12/94	4/13/94	4/14/94	4/15/94		
Gas Flow Rate (dscfm) ^a	153,000	151,000	153,000	146,000					151,000	5,300
Gas Flow Rate (Nm^3/hr) ^a	242,000	240,000	242,000	231,000					239,000	8,500
Particulate Matter (lb/hr)	778	809	800						796	39
Particulate Matter (mg/Nm^3)	1,460	1,530	1,500						1,500	96
Major Species										
Aluminum	72,600	55,900	73,500	NS	36	43	66	NS	67,400	24,600
Calcium	107,000	87,900	114,000	NS	180	260	370	NS	103,000	33,000
Iron	32,500	27,900	34,100	NS	31	30	370	NS	31,500	8,200
Magnesium	54,400	44,900	57,600	NS	26	27	58	NS	52,300	16,500
Phosphorus	30	26	30	NS	ND(19)	ND(19)	ND(17)	NS	28	6
Potassium	18,000	13,100	17,800	NS	ND(250)	ND(250)	ND(230)	NS	16,300	6,870
Sodium	3,390	2,460	3,090	NS	207	294	250	NS	3,230	1,060
Sulfate	9,441,000	9,151,000	9,260,000	NS	795,000	756,000	784,000	NS	10,100,000	411,000
Titanium	4,430	3,360	4,340	NS	1.2	1.6	3.0	NS	4,040	1,480
Target Species										
Ammonia	NS	NS	NS	NS	160	95	120	NS	130	87
Antimony	ND(3.2)	ND(2.9)	ND(76)	NS	0.016	0.016	0.017	NS	ND(76) ^b	--
Arsenic	450	380	420	NS	0.34	0.26	0.36	NS	420	87
Barium	260	190	270	NS	ND(0.005)	ND(0.005)	ND(0.005)	NS	240	110
Beryllium	10	6.8	8.7	NS	ND(0.005)	ND(0.005)	0.026	NS	8.6	4.2
Boron	1.2	2.5	4.4	NS	200	210	190	NS	200	23

Table 3-6 (Continued)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95%CI
Cadmium	3.7	2.3	2.3	NS	1.1	0.22	0.15	NS	3.2	3.3
Chloride	1,600	1,800	860	NS	68,000	67000	74,000	NS	71,000	7,200
Chromium (multi-metals)	150	100	120	NS	3.8	0.76	26	NS	130	60
Cobalt	22	20	26	NS	0.019	0.019	1.1	NS	23	9
Copper	11	17	ND(6.7)	NS	0.63	0.23	2.4	NS	11	19
Cyanide	NS	NS	NS	NS	870	610	390	NS	630	590
Fluoride	4,100	3,200	2,300	NS	7,000	6,300	6,400	NS	9,800	3,100
Lead	76	70	75	NS	ND(0.005)	ND(0.005)	ND(0.005)	NS	73	8
Manganese	130	150	140	NS	1.2	1.2	3.3	NS	140	22
Mercury(total)	0.079	0.050	0.072	NS	15	16	15	NS	16	2
Mercury (nitric impingers)	--	--	--	NS	12	14	13	NS	--	--
Mercury (permanganate impingers)	--	--	--	NS	3.4	2.1	1.7	NS	--	--
Molybdenum	ND(1.6)	ND(3.4)	ND(1.2)	NS	0.14	ND(0.008)	3.3	NS	ND(3.4) ^b	--
Nickel	50	43	49	NS	0.15	0.20	29	NS	57	45
Selenium	52	43	41	NS	20	14	17	NS	62	21
Silver	ND(2.1)	0.45	ND(5.7)	NS	ND(1.6)	ND(1.6)	ND(1.4)	NS	ND(5.7)	--
Vanadium	130	100	130	NS	1.5	0.83	0.94	NS	120	42

^a Assumed equal to the measured ESP outlet gas flow rate. Measured ESP inlet flow rate are considered non-representative because of the non-ideal sampling location.

^b Substance detected in the vapor phase at low levels. Reported value is an upper limit.
CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

Table 3-7
ESP Outlet Gas Composition - Inorganic Species ($\mu\text{g}/\text{Nm}^3$ unless noted)

Substance	Solid Phase				Vapor Phase				Total	
Date	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
	4/12/94	4/13/94	4/14/94	4/15/94	4/12/94	4/13/94	4/14/94	4/15/94		
Gas Flow Rate (dscfm)	153,000	151,000	153,000	146,000					151,000	5,300
Gas Flow Rate (Nm^3/hr)	242,000	240,000	242,000	231,000					239,000	8,500
Particulate Matter (lb/hr)	33	4.4	29						22	38
Particulate Matter (mg/Nm^3)	61	8.2	54						41	72
Major Species										
Aluminum	140	56	29	NS	38	42	53	NS	120	126
Calcium	270	227	152	NS	213	256	342	NS	490	14
Iron	220	705	92	NS	42	48	61	NS	392	793
Magnesium	110	94	61	NS	25	16	30	NS	114	55
Phosphorus	3.4	3.8	3.1	NS	ND(16)	ND(19)	ND(16)	NS	3.4	0.8
Potassium	39	24	18	NS	ND(210)	ND(250)	ND(210)	NS	27	26
Sodium	77	48	36	NS	287	310	338	NS	360	23
Sulfate	450	4,940	198	NS	780,000	746,000	-- ^b	NS	766,000	188,000
Titanium	16	5.9	4.0	NS	1.2	1.6	1.8	NS	10	16
Target Species										
Ammonia	NS	NS	NS	NS	94	130	93	NS	110	54
Antimony	ND(2.0)	ND(2.1)	ND(2.0)	NS	0.013	0.017	0.023	NS	ND(2.1) ^a	--
Arsenic	0.78	1.1	0.63	NS	0.16	0.24	0.26	NS	1.0	0.5
Barium	1.9	0.19	0.11	NS	ND(0.004)	ND(0.005)	ND(0.004)	NS	0.74	7.5
Beryllium	0.01	ND(0.012)	ND(0.011)	NS	ND(0.004)	ND(0.005)	0.048	NS	0.021	0.17
Boron	NA	NA	NA	NS	170	160	160	NS	170	19

Table 3-7 (Continued)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
Cadmium	0.67	0.27	0.38	NS	ND(0.005)	0.55	3.5	NS	1.8	4.5
Chloride	1.3	1.2	3.8	NS	66,000	66,000	69,000	NS	67,000	5,200
Chromium (multi-metals)	1.7	1.8	0.8	NS	1.4	0.89	4.7	NS	3.7	3.7
Cobalt	ND(0.19)	ND(0.19)	ND(0.18)	NS	0.020	0.048	0.065	NS	ND(0.19)*	--
Copper	1.6	2.3	0.71	NS	0.46	2.2	4.9	NS	4.1	4.4
Cyanide	NS	NS	NS	NS	810	370	300	NS	490	680
Fluoride	ND(0.12)	0.13	ND(0.12)	NS	5,100	4,100	4,300	NS	4,500	1,400
Lead	1.4	ND(0.027)	ND(0.13)	NS	ND(0.004)	ND(0.005)	0.53	NS	0.65	3.8
Manganese	2.4	7.4	1.0	NS	ND(0.006)	1.0	8.7	NS	6.9	9.8
Mercury (total)	0.0042	0.0045	ND(0.0082)	NS	15	15	14	NS	15	1
Mercury (nitric impingers)	--	--	--	NS	13	14	12	NS	--	--
Mercury (permanganate impingers)	--	--	--	NS	1.8	1.6	1.9	NS	--	--
Molybdenum	0.32	ND(0.13)	0.37	NS	ND(0.007)	ND(0.008)	0.071	NS	0.25	0.57
Nickel	0.98	8.8	1.3	NS	0.72	1.3	4.9	NS	6.0	11
Selenium	19	19	19	NS	13	19	30	NS	39	21
Silver	ND(0.15)	1.0	ND(0.15)	NS	ND(1.3)	ND(1.6)	ND(1.3)	NS	0.40	1.4
Vanadium	0.24	0.18	0.14	NS	0.67	0.85	1.0	NS	1.0	0.33

^a Substance detected in vapor phase at low levels. Reported concentration is an upper limit.

^b Value considered suspect. Data were not used in the calculation of the mean total concentration.

CI = Confidence interval.

NA = Not analyzed.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

QA/QC audit sample results for the following target species did not meet the 75%-125% recovery objective for the filtered particulate matter audit sample: cadmium (919%), cobalt (51%), manganese (69%), molybdenum (129%), and selenium (175%). However, matrix spike results for these elements in the samples indicate good analytical precision and accuracy. These results indicate a potential bias in the reported particulate-phase ESP outlet results for these substances. Refer to Section 4 for a detailed discussion of QA/QC results.

Reported vapor-phase concentrations for the target species were determined by ICP-MS, with the exception of boron (ICP-AES), mercury (CVAAS), and silver (ICP-AES). Other techniques such as GFAAS and ICP-AES were also used for many of the species; however, the ICP-MS data were selected based on their superior detection limits and performance. In most cases, the levels of target species in the vapor phase at the ESP outlet were below detection limits for GFAAS and ICP-AES methods; therefore, the use of the ICP-MS technique provided a means to accurately quantify the very low levels found in the gas streams. All major metal species were determined by ICP-AES.

Boron, chloride, fluoride, mercury and selenium were quantified in the vapor phase at both the ESP inlet and outlet locations because of their high volatility at the temperatures within the ESP (approximately 350°F). Levels of vapor-phase mercury in the nitric acid/hydrogen peroxide and potassium permanganate impinger solutions were similar at both locations. Approximately 10-15% of the total vapor-phase mercury was found in the permanganate impinger solutions, which is believed to capture the elemental species of mercury (Hg^0). Conversely, the nitric acid/hydrogen peroxide impinger solution contained 85-90% of the vapor-phase mercury and is believed to capture ionic mercury species. Essentially 100% of the mercury entering the system exits in the ESP outlet gas. For chloride, fluoride, and selenium, these percentages are somewhat smaller: 80%, 30%, and 24%, respectively. Ammonia and cyanide were quantified in both the ESP inlet and outlet gas at levels well above detection limits.

QA/QC results for ICP-MS analysis of the nitric acid impinger solutions indicate that vapor-phase results for antimony, selenium, and nickel may be biased slightly low based on

recovery data for the audit samples (recoveries in the 60-70% range were reported). Matrix-spiked sample results indicate acceptable analytical accuracy for all species except selenium. Major species such as aluminum, calcium, iron, magnesium, sodium, and titanium were detected in the vapor-phase fractions at similar levels at both locations after background corrections were applied. QA/QC audit sample results for calcium, potassium, and sodium indicate a high bias in the ICP-AES method used to measure these species in this matrix near the detection limit. Recovery results for the nitric acid/hydrogen peroxide impinger audit sample indicate recoveries of 151% (calcium), 1420% (potassium), and 321% (sodium). Thus, sample results for these elements may be biased high.

Organic Species

Tables 3-8 and 3-9 show the concentrations of the target organic species in the ESP inlet gas. Tables 3-10 and 3-11 show results for organic species in the ESP outlet gas. Since the number of volatile and semivolatile organic compounds analyzed was quite large and very few compounds were detected, only those species which were present at levels above the detection limit in one or more samples are reported. PAH species measured by Method 8270, which were present at levels between the detection limit and the quantitation limit, are flagged with a "J" symbol. Results in this range are considered uncertain. The quantitation limit was defined by the laboratory as one-half of the lowest point on the linear calibration range. The lowest point on the linear range was 20 $\mu\text{g/mL}$ for all species; therefore, the quantitation limit was defined as 10 $\mu\text{g/mL}$. The detection limits for each species were calculated using an area of 10,000 for all analytes which were not found in the samples. The reported detection limits are the average detection limits achievable over time for a given instrument type and are determined by statistical evaluation of the background noise associated with the samples. Complete results for substances which were not detected are provided in Appendix B.

The following volatile organic compounds were detected in VOST samples collected at the ESP inlet: 1,2-dichloroethane, benzene, carbon disulfide, chloromethane, methylene chloride, and toluene. None of these substances were detected in the reagent blanks which

Table 3-8
ESP Inlet Gas Composition - VOST and Method 23 Species ($\mu\text{g}/\text{Nm}^3$ unless noted)

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
Date	4/12/94	4/13/94	4/14/94	4/15/94			
Gas Flow Rate (dscfm)	153,000	151,000	153,000	146,000	152,000	5,300	
Gas Flow Rate (Nm^3/hr)	242,000	240,000	242,000	231,000	241,000	8,500	
VOST							
1,2-Dichloroethane	2.0	ND(0.5)	ND(0.6)	NS	0.84	2.4	ND(0.5)
Benzene	6.5	11	6.7	NS	8.0	6.0	ND(0.5)
Carbon Disulfide	0.83	1.3	1.0	NS	1.0	0.59	ND(0.5)
Chloromethane	1.3 ^b	1.4 ^b	1.1 ^b	NS	1.3 ^b	0.34	ND(0.5)
Methylene Chloride	ND(0.8)	14 ^b	3.5 ^b	NS	6.0 ^b	18	ND(0.5)
Toluene	ND(0.8)	1.8 ^b	1.1 ^b	NS	1.1 ^b	1.7	ND(0.5)
Dioxin/Furan (pg/Nm^3)							
1,2,3,4,6,7,8-HpCDD	NS	6.4	3.3 E	6.4	5.3	4.5	ND(2.8)
1,2,3,4,6,7,8-HpCDF	NS	0.32 E	1.6 E	2.0	1.3	2.2	ND(1.4)
1,2,3,4,7,8-HxCDD	NS	ND(4.1)	ND(2.7)	ND(4.4)	ND(4.4)	--	ND(2.8)
1,2,3,4,7,8-HxCDF	NS	6.4 E	1.6 E	2.0 B	3.3	6.6	1.4 E
1,2,3,6,7,8-HxCDF	NS	2.2	ND(1.7)	ND(2.0)	ND(2.0)	--	ND(1.0)
1,2,3,7,8-PeCDF	NS	0.96 E	ND(0.99)	ND(1.7)	ND(1.7)	--	ND(1.0)
2,3,4,6,7,8-HxCDF	NS	3.2 E,B	3.3 E,B	2.9 B	3.1	0.40	2.1
2,3,7,8-TCDF	NS	ND(1.7)	1.7 E	ND(1.5)	ND(1.7)	--	ND(1.0)
OCDD	NS	57	34	43	44	28	3.4 E
OCDF	NS	8.4	ND(4.3)	5.2	5.2	7.7	ND(3.4)

Table 3-8 (Continued)

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
Total HpCDD	NS	6.4	3.6	11	6.8	8.6	ND(2.8)
Total HpCDF	NS	2.6 E	3.3 E	2.6	2.8	0.98	ND(1.7)
Total HxCDD	NS	1.6 E	2.4	2.5 E	2.2	1.2	ND(2.1)
Total HxCDF	NS	7.2 B	6.5 E,B	6.3	6.7	1.1	2.1
Total PeCDD	NS	3.2	2.0 E	2.2	2.4	1.7	ND(1.4)
Total PeCDF	NS	5.4	0.98 E	2.2	2.8	5.6	ND(1.0)
Total TCDD	NS	ND(1.7)	1.6	1.7 E	ND(1.7)	--	ND(1.4)
Total TCDF	NS	ND(1.7)	1.6 E	ND(1.5)	ND(1.7)	--	ND(1.0)
Aldehydes							
Formaldehyde	8.7	4.5	3.0	NS	5.4	7.4	ND

^a Calculated based on the mean level in the reagent blank divided by the mean gas sample volume.

^b Levels in the field blanks are $\geq 30\%$ of the sample value.

E indicates the substance was detected in the reagent blanks at $\geq 30\%$ of the sample value.

B indicates value is an estimated upper limit.

CI = Confidence interval

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

HpCDD = Heptachlorodibenzo-p-dioxin.

HpCDF = Heptachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

PeCDD = Pentachlorodibenzo-p-dioxin.

PeCDF = Pentachlorodibenzofuran.

TCDD = Tetrachlorodibenzo-p-dioxin.

TCDF = Tetrachlorodibenzofuran.

OCDD = Octachlorodibenzo-p-dioxin.

OCDF = Octachlorodibenzofuran.

Table 3-9
Results for Semivolatile Organic Species at the ESP Inlet

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
PAHs by HRGC/MS (ng/Nm ³)								
Acenaphthene	1.8 B	3.5 B	2.2 B	35 B	12 B	7.9 B	21 B	35
Acenaphthylene	0.53 B	0.54 B	0.45 B	6.5	19	43	23	46
Anthracene	1.1 B	0.90 B	0.47 B	11	1.1 B	0.94 B	5.1 B	15
Benzo(a)anthracene	1.6 B	0.37 B	1.0 B	0.86	0.32 B	0.63	1.6 B	2.2
Benzo(a)pyrene	2.2 B	0.62 B	1.1 B	1.3	0.37 B	0.56 B	2.1 B	3.2
Benzo(b)fluoranthene	5.0 B	0.98 B	2.8 B	2.4	1.1 B	1.5 B	4.6 B	6.6
Benzo(g,h,i)perylene	5.2 B	2.9 B	5.3 B	2.5 B	1.4 B	1.4 B	6.3 B	4.3
Benzo(k)fluoranthene	1.7 B	0.29 B	1.3 B	0.93	0.32 B	0.45 B	1.7 B	2.5
2-Chloronaphthalene	0.064	0.12	0.058	0.59	1.1	1.9	1.3	1.6
Chrysene	3.5 B	1.6 B	2.2 B	2.3	1.4	1.5	4.2 B	3.6
Dibenz(a,h)anthracene	0.64 B	ND(0.51)	3.4	0.45 B	ND(0.23)	0.41 B	1.7 B	4.2
Fluoranthene	7.4 B	4.4 B	3.7 B	18	10 B	11	18 B	16
Fluorene	4.1 B	3.3 B	2.9 B	10 B	6.8 B	7.4 B	12 B	6.0
Indeno(1,2,3-cd)pyrene	2.5 B	0.75 B	2.7 B	1.4	0.56 B	0.78 B	2.9 B	3.5
2-Methylnaphthalene	16 B	14 B	13 B	46 B	32 B	43 B	55 B	19
Naphthalene	140 B	370 B	150 B	180 B	200 B	73 B	370 B	440
Phenanthrene	24 B	13 B	15 B	68	32 B	27 B	59 B	69
Pyrene	5.0 B	9.9 B	4.1 B	16	3.5 B	4.0 B	14 B	17

Table 3-9 (Continued)

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
Semivolatile Organic Compounds by 8270 ($\mu\text{g}/\text{Nm}^3$)								
Acetophenone	ND(2.9)	ND(2.3)	ND(2.6)	4.1 J	4.7 J	2.5 J	3.8 J	2.9
Benzoic acid	ND(11)	ND(9.0)	ND(9.8)	120 E	220 d	120 d	150 d	140
Butylbenzylphthalate	ND(1.4)	ND(1.2)	ND(1.3)	0.70 J	ND(0.44)	ND(0.48)	ND(0.48)	--
Di-n-butylphthalate	110 d	5.1 J,B	2.3 J,B	11 B	2.0 J,B	29	52 d,J,B	150
Di-n-octylphthalate	ND(0.69)	ND(0.56)	ND(0.64)	ND(0.30)	0.19 J	ND(0.70)	ND(0.70)	--
Diethylphthalate	ND(1.5)	ND(1.2)	ND(1.3)	0.77 J	0.97 J	ND(0.35)	0.64 J	0.78
bis(2-Ethylhexyl)phthalate	8.5 B	4.7 J,B	5.5 J,B	470 d	9.0	1.2 J,B	170 d,J,B	670
Hexachlorobenzene	ND(3.8)	ND(3.3)	ND(3.4)	34	ND(1.3)	ND(1.4)	12	47
Isophorone	ND(1.7)	ND(1.5)	ND(1.6)	ND(0.39)	6.8 J	11	6.1 J	14
Naphthalene	5.3 J,B	ND(0.92)	ND(1.0)	0.67 J,B	0.73 J,B	ND(0.34)	2.3 J,B	8.0
4-Nitrophenol	ND(12)	ND(10)	ND(11)	ND(1.7)	0.47	ND(2.0)	ND(1.4)	--
Phenol	ND(2.4)	ND(2.0)	ND(2.2)	2.8 J	3.0 J	1.7 J	2.5 J	1.8

B indicates the substance was detected in the reagent blank at levels greater than or equal to 30% of the sample value.

J indicates that the concentration was less than the quantitation limit of the method but above the detection limit.

d indicates that the undiluted sample exceeded the calibration range of the instrument; result shown is for the diluted sample.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

Table 3-10
ESP Outlet Gas Composition - VOST and Method 23 Species

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
Date	4/12/94	4/13/94	4/14/94	4/15/94			
Gas Flow Rate (dscfm)	153,000	151,000	153,000	146,000	152,000	5,300	
Gas Flow Rate (Nm ³ /hr)	242,000	240,000	242,000	231,000	241,000	8,500	
VOST (µg/Nm ³)							
Bromodichloromethane	0.6	ND(0.5)	ND(0.5)	NS	ND(0.5)	--	ND(2.5)
Bromoform	ND(0.5)	ND(0.5)	ND(0.5)	NS	ND(0.5)	--	ND(2.5)
Bromomethane	0.7	ND(0.5)	ND(0.5)	NS	ND(0.5)	--	ND(0.5)
Chloroethane	1.1	ND(0.5)	ND(0.5)	NS	ND(0.5)	--	ND(0.5)
Chloroform	ND(0.5)	0.5	ND(0.5)	NS	ND(0.5)	--	ND(0.5)
1,1,1-Trichloroethane	0.7	0.60	37	NS	13	52	ND(0.5)
1,2-Dichloroethane	16	2.5	2.5	NS	7.0	20	ND(0.5)
Benzene	3.8	5.4	6.8	NS	5.4	3.7	ND(0.5)
Carbon Disulfide	1.0	0.7	0.74	NS	0.83	0.42	ND(0.5)
Chloromethane	6.7	ND(0.5)	3.7	NS	3.5	8.0	ND(0.5)
Methylene Chloride	2.1 ^b	0.82 ^b	5.8 ^b	NS	2.9 ^b	6.4	ND(0.5)
Toluene	0.95 ^b	1.7 ^b	0.89 ^b	NS	1.2 ^b	1.1	ND(0.5)
Dioxin/Furan (pg/Nm ³)							
1,2,3,4,6,7,8-HpCDD	NS	5.3	11	1.9 E	5.9	11	ND(2.8)
1,2,3,4,6,7,8-HpCDF	NS	ND(1.6)	7.3 E	7.5 E	5.2	9.5	ND(1.4)
1,2,3,4,7,8-HxCDD	NS	ND(3.1)	ND(3.9)	ND(3.6)	ND(3.9)	--	ND(2.8)
1,2,3,4,7,8-HxCDF	NS	1.9 E	1.5 E,B	10	4.5	12	1.4 E
1,2,3,4,7,8,9-HpCDF	NS	ND(2.8)	ND(3.9)	ND(4.0)	ND(4.01)	--	ND(2.4)
1,2,3,6,7,8-HxCDD	NS	ND(2.5)	ND(3.2)	ND(2.9)	ND(3.2)	--	ND(2.1)
1,2,3,6,7,8-HxCDF	NS	ND(1.2)	ND(1.8)	2.4	ND(1.77)	--	ND(1.0)

Table 3-10 (Continued)

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
1,2,3,7,8-PeCDF	NS	ND(1.2)	ND(1.8)	2.3 E	ND(1.77)	--	ND(1.0)
2,3,4,6,7,8-HxCDF	NS	2.9 E,B	3.9 B	4.0 B	3.58	1.6	2.1
2,3,4,7,8-PeCDF	NS	ND(1.2)	ND(1.8)	1.5 E	ND(1.77)	--	ND(1.0)
2,3,7,8-TCDF	NS	ND(1.2)	ND(1.6)	1.8	ND(1.59)	--	ND(1.0)
OCDD	NS	48	110	30 E	62	100	3.4 E
OCDF	NS	6.1	20	ND(6.2)	9.90	23	ND(3.4)
Total HpCDD	NS	11	20	3.9	11	20	ND(2.8)
Total HpCDF	NS	ND(1.9)	7.5	2.4	3.60	8.6	ND(1.7)
Total HxCDD	NS	ND(2.8)	2.9 E	ND(3.3)	ND(3.28)	--	ND(2.1)
Total HxCDF	NS	6.3 E,B	6.4 B	22	11	22	2.1
Total PeCDD	NS	1.3 E	ND(2.8)	ND(1.8)	ND(2.83)	--	ND(1.4)
Total PeCDF	NS	ND(1.2)	3.2	6.7	3.49	7.5	ND(1.0)
Total TCDD	NS	ND(1.2)	8.0E-07	ND(1.5)	ND(1.46)	--	ND(1.4)
Total TCDF	NS	ND(6.2E-07)	ND(1.6)	1.8	ND(1.59)	--	ND(1.0)
Aldehydes ($\mu\text{g}/\text{Nm}^3$)							
Formaldehyde	5.1	3.5	3.6	NS	4.1	2.3	ND

^a Calculated based on the mean level in the reagent blank divided by the mean gas sample volume.

^b Levels in the field blanks are $\geq 30\%$ of the sample value.

B indicates the substance was detected in the reagent blanks at $\geq 30\%$ of the sample value.

E indicates value is an estimated upper limit.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

HpCDD = Heptachlorodibenzo-p-dioxin.

HpCDF = Heptachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

PeCDD = Pentachlorodibenzo-p-dioxin.

PeCDF = Pentachlorodibenzofuran.

TCDD = Tetrachlorodibenzo-p-dioxin.

TCDF = Tetrachlorodibenzofuran.

OCDD = Octachlorodibenzo-p-dioxin.

OCDF = Octachlorodibenzofuran.

Table 3-11
Results for Semivolatile Organic Species at the ESP Outlet

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
PAHs by HRGC/MS (ng/Nm ³)								
Acenaphthene	1.9 B	2.6 B	0.92 B	15 B	23 B	180	75 B	230
Acenaphthylene	0.54 B	0.75 B	0.24 B	84 B	4.4	210	98	250
Anthracene	1.1 B	1.6 B	0.33 B	1.0 B	0.82 B	1.5 B	2.1 B	0.71
Benzo(a)anthracene	0.33 B	0.15 B	0.26 B	0.61 B	0.46 B	0.87	0.89 B	0.66
Benzo(a)pyrene	0.48 B	0.17 B	0.16 B	1.3	0.62 B	NR	0.90 B	2.0
Benzo(b)fluoranthene	0.83 B	0.56 B	0.50 B	1.7	1.4 B	1.1 B	2.0 B	1.1
Benzo(g,h,i)perylene	2.2 B	0.86 B	1.2 B	1.6 B	1.6 B	180	62 B	250
Benzo(k)fluoranthene	0.25 B	0.14 B	0.13 B	0.70	0.44 B	0.59	0.75 B	0.46
2-Chloronaphthalene	ND(0.019)	ND(0.024)	ND(0.10)	1.9	0.72	0.32	0.97	2.0
Chrysene	0.56	0.51 B	0.94 B	1.6	0.72 B	0.98	1.8 B	1.2
Dibenz(a,h)anthracene	ND(0.066)	ND(0.037)	ND(0.24)	0.54 B	ND(0.65)	0.35 B	ND(0.65)	--
Fluoranthene	4.2 B	5.6 B	2.0 B	12	5.0 B	6.4 B	12 B	9.9
Fluorene	5.6 B	11 B	2.3 B	8.4 B	5.0 B	7.9 B	13 B	7.2
Indeno(1,2,3-cd)pyrene	0.79 B	0.36 B	0.33 B	0.92 B	0.69 B	5.7	2.9 B	6.8
2-Methylnaphthalene	10 B	14 B	5.3 B	110 B	59 B	61 B	85 B	67
Naphthalene	15 B	19 B	17 B	94 B	170 B	62 B	130 B	150
Phenanthrene	33 B	48 B	11 B	35 B	22 B	25 B	58 B	48
Pyrene	2.1 B	2.6 B	1.5 B	2.0 B	3.0 B	1.2 B	4.1 B	3.7

Table 3-11 (Continued)

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
Semivolatile Organic Compounds by 8270 ($\mu\text{g}/\text{Nm}^3$)								
Acetophenone	ND(1.6)	ND(1.7)	ND(2.4)	3.0 J	2.7 J	3.8 J	3.1 J	1.4
Benzoic acid	ND(6.2)	ND(6.4)	ND(11)	110 d	150 d	140 d	130 d	43
Dibenzofuran	ND(0.72)	ND(0.72)	ND(1.1)	0.079 J	ND(0.30)	ND(1.5)	ND(1.5)	--
Di-n-butylphthalate	ND(0.39)	2.4 J, B	32	19	6.3 B	14	25	48
Diethylphthalate	ND(0.85)	ND(0.86)	ND(1.2)	3.3 J	ND(0.30)	ND(1.4)	ND(3.3)	--
bis(2-Ethylhexyl)phthalate	1.4 J, B	ND(0.61)	0.64 J, B	22	1.6 J, B	14	13 J, B	27
Isophorone	ND(1.0)	ND(1.0)	ND(1.4)	20	ND(0.39)	31	17	39
Naphthalene	ND(0.65)	ND(0.67)	ND(0.94)	0.78 J, B	0.44 J, B	0.92 J, B	0.71 J, B	0.61
Phenol	ND(1.3)	ND(1.4)	ND(2.0)	1.2 J	1.2 J	ND(0.74)	0.95 J	1.2

B indicates the substance was detected in the reagent blank at levels greater than or equal to 30% of the sample value.

J indicates that the concentration was less than the quantitation limit of the method but above the detection limit.

d indicates that the undiluted sample result exceeded the calibration range of the instrument; results are shown for the diluted samples.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NR = Not reported. Internal standard was not detected; therefore, substance could not be quantified.

are used to assess background levels in the sampling media; however; chloromethane, methylene chloride, and toluene were detected in the field blank samples, indicating potential field contamination for these three substances. The presence of toluene and methylene chloride are not unexpected, since these solvents are routinely used to rinse probes after sample collection and were present at all four gas sampling locations. 1,2-dichloroethane and carbon disulfide were present at levels which were less than five times the detection limit ($0.5 \mu\text{g}/\text{Nm}^3$); therefore, the presence of these species in the ESP inlet gas is uncertain. Benzene was not present in the reagent blank and was the only species consistently detected in the samples at levels greater than five times the detection limit; therefore, it is considered a process-generated compound. Mean benzene concentrations were $8 \mu\text{g}/\text{Nm}^3$ at the ESP inlet and $5.4 \mu\text{g}/\text{Nm}^3$ at the ESP outlet.

A similar set of volatile organic compounds were detected at the ESP outlet in one or more samples: bromodichloromethane, bromoethane, chloroethane, 1,1,1-trichloroethane, 1,2-dichloroethane, benzene, carbon disulfide, chloromethane, methylene chloride, and toluene. Bromodichloromethane, bromoethane, and chloroethane were detected at levels less than five times the detection limit in only one of the three samples and are not considered to be present in the ESP outlet gas. The presence of chloromethane, methylene chloride, and toluene is due to field contamination. 1,1,1-trichloroethane levels were less than five times the detection limit in two of the three samples; therefore, its presence in the ESP outlet gas is uncertain. The presence of the halogenated hydrocarbon species in the ESP inlet and outlet gas is attributed to an unknown source of solvents or refrigerants in the field environment and they are not considered to be process-generated compounds.

Method 23 results for dioxin and furan compounds and congeners indicate some species were detected in both the ESP inlet and outlet gas at pg/Nm^3 levels (near the detection limit). For many of the compounds detected, background levels associated with the reagent blank were similar to the levels found in the samples (refer to Section 4 for a detailed discussion of the blank results for organic compounds); these results are flagged with the "B" symbol.

Compounds or congeners detected in one or more ESP outlet samples, but not detected in the reagent blank include: 1,2,3,4,6,7,8-heptachlorodibenzofuran, octachlorodibenzofuran, total

heptachlorodibenzo-p-dioxin, total heptachlorodibenzofuran, total hexachlorodibenzofuran, and total pentachlorodibenzofuran.

Data for semivolatile organic compounds at the ESP inlet and outlet are summarized in Tables 3-9 and 3-11, respectively. Samples were analyzed by standard GC/MS as specified in Method 8270 and by high resolution HRGC/MS as specified in CARB Method 29 for a selected subset of the species listed in Method 8270. The high resolution GC/MS technique provided detection limits which were three to four orders of magnitude lower than those obtained with the conventional GC/MS technique.

All of the 18 compounds analyzed by HRGC/MS were detected in the samples collected at the ESP inlet and outlet, with the exception of dibenz(a,h)anthracene at the ESP outlet. However, because of the extremely low detection limits for the HRGC/MS method, most substances were also detected in the reagent and field blanks at levels similar to those found in the samples. The "B" flag is used in Tables 3-9 and 3-11 to denote cases where the background levels in the blanks were greater than or equal to 30% of the levels found in the samples. Acenaphthylene and 2-chloronaphthalene were the only substances detected in the ESP inlet and outlet gas samples and not present in the blanks at significant levels. For those substances flagged with a "B" symbol, accurate quantification by HRGC/MS is not possible; however, the reported results do provide an indication of the maximum possible concentration of these substances present in the gas streams and, as such, should provide useful information for use in health risk assessments.

Six semivolatile organic compounds routinely detected in ESP inlet and outlet samples analyzed by conventional GC/MS include: acetophenone, benzoic acid, di-n-butylphthalate, diethylphthalate, bis(2-ethylhexyl)phthalate, hexachlorobenzene, isophorone, naphthalene, and phenol. The phthalate esters detected in these samples are typical plasticizers commonly attributed to plastic bottles, bags, etc. used in the field laboratory environment. Sample and blank concentrations are comparable; since phthalates are ubiquitous in the laboratory environment, their presence is most likely due to contamination. Although, acetophenone, isophorone, hexachlorobenzene, phenols, and benzene (discussed previously) are potential

products of coal devolatilization, their presence is more likely attributed to oxidation of the XAD resin. Concentrations of these substances (on the order of 1-6 $\mu\text{g}/\text{Nm}^3$) were also between the quantification limit and detection limits of the method, thus increasing the uncertainty in these results. Levels of naphthalene in the blanks were greater than 30% of the samples values.

Benzoic acid was measured in the ESP inlet and outlet gas samples at mean concentrations of 150 $\mu\text{g}/\text{Nm}^3$ and 130 $\mu\text{g}/\text{Nm}^3$, respectively.

Benzoic acid is not on the CAAA of 1990 list of 189 toxic substances, but it is noteworthy that all of the detected organic compounds are aromatic and share a common toluene, benzene, or substituted-benzene structure. Benzoic acid may be a degradation product of XAD resin in the acidic environment that exists while sampling flue gas streams with high moisture, SO_2 , and NO_x levels. However, Radian knows of no scientific studies that have been conducted to determine if this compound, and possibly other compounds, are generated as a sampling artifact.

APF Inlet and Outlet Gas

The elevated temperature (1350°F) and pressure (135 psig) at the APF inlet and outlet locations made it necessary to design a unique sampling system to extract gas samples at these locations. The capacity of the system was also designed to allow quantification of the extremely low particulate loadings in the APF outlet gas. Particulate matter was filtered outside the duct and filter temperatures were maintained at approximately 500-600°F. A detailed discussion of the APF sampling system is provided in Appendix A. Unlike the moveable, glass-lined probes used at the ESP inlet and outlet, the APF sampling system used a fixed probe made of Inconel 800 (a chromium/nickel alloy material). The fixed probe design did not allow the APF inlet and outlet ducts to be traversed; however, samples were collected at isokinetic sampling rates at a single point in the center of the duct. Since there are no significant flow disturbances at either location, evenly distributed gas flow would be expected within the duct at both the APF inlet and outlet locations. Therefore, the impact of

the fixed probe design is expected to be minimal. The use of the chromium/nickel alloy introduced the potential for chromium and nickel contamination in the sampling system; however, both the fixed probe and Inconel 800 material were necessary to meet the safety requirements for the plant and ensure safe operation of the system.

Laboratory tests were conducted at Radian before the on-site testing to evaluate the potential for chromium and nickel contamination from the APF sampling system. These tests consisted of heating a section of the Inconel 800 tubing to 1600°F in a muffle furnace and passing 100 dscf of ambient air through the tubing over a period of approximately two hours. The air was bubbled through a series of impingers containing the nitric acid/hydrogen peroxide reagent used in the metals train. The impinger solutions were subsequently analyzed for chromium, nickel, and iron by ICP-AES. Following these tests, the Inconel 800 tubing was examined and exfoliation on the surface of the tubing was noted. In addition, small flecks of this exfoliated material were also found in the impinger solutions. Chromium, nickel, and iron were detected in the impinger solutions when analyzed by ICP-AES and the presence of these species is attributed to the presence of the exfoliated material. Results of these laboratory tests indicated that chromium and nickel contamination may occur during field sampling at the APF locations and the contamination was expected to be significant at the APF outlet location because of the extremely low particulate loading.

As discussed later in this section, test data indicate abnormally high levels of chromium, molybdenum, and nickel in the particulate multi-metals train samples collected at the APF outlet. The presence of these elements is attributed to exfoliation of the Inconel 800 probe material. Levels of these species in the APF outlet particulate matter were 2-3 orders of magnitude higher than expected; therefore, these data should be considered nonrepresentative.

Inorganic Species

Tables 3-12 and 3-13 show the concentrations of the target inorganic analytes in the APF inlet and outlet gas streams, respectively. The analytical methods chosen for each substance were identical to those chosen for the ESP inlet and outlet gas streams.

The solid-phase multi-metals train data from the APF outlet have been corrected for the background levels associated with the quartz filters. Vapor-phase data have been corrected for the background levels present in the nitric impinger reagent. No corrections were necessary at the APF inlet since the particulate matter was analyzed separately from the ceramic filter media. The potential biases discussed above for the ESP inlet and outlet gas streams also apply to the APF gas stream results.

The measured particulate loadings at the APF inlet are approximately three times larger than those measured at the ESP inlet. This is the expected result, since unlike the ESP inlet gas, the gas fed to the APF system is not treated in a secondary cyclone. The levels of particulate-phase metals measured at the APF inlet are consistent with the higher particulate loading relative to the ESP inlet.

Concentrations of target species in the vapor phase at the APF inlet were generally higher than levels measured at the ESP inlet, presumably because of the increased volatility at the elevated temperatures of the APF gas stream (1350°F versus 350°F at the ESP locations). It is interesting to note that the distribution of mercury between the nitric acid/hydrogen peroxide and permanganate impinger solutions at the APF outlet is distinctly different than the distribution observed at the ESP locations and the APF inlet location. Approximately 1-2% of the total vapor-phase mercury was captured in the permanganate impinger solution at the APF outlet compared to 10-15% at the other three gas sampling locations. This indicates that the form of mercury may change as the gas passes through the APF system.

Table 3-12
APF Inlet Gas Composition - Inorganic Species ($\mu\text{g}/\text{Nm}^3$ unless noted)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
Date	4/12/94	4/13/94	4/14/94	4/15/94	4/12/94	4/13/94	4/14/94	4/15/94		
Gas Flow Rate (dscfm) ^a	21,800	21,600	21,800	20,800					21,500	760
Gas Flow Rate (Nm^3/hr) ^a	34,600	34,200	34,600	33,000					34,100	1,200
Particulate Matter (lb/hr)	274	359	290	327					312	60
Particulate Matter (mg/Nm^3)	3,590	4,760	3,810	4,500					4,170	880
Major Species										
Aluminum	NS	271,000	235,000	210,000	NS	1,190	395	263	239,000	78,100
Calcium	NS	474,000	356,000	323,000	NS	2,500	1,220	700	386,000	199,000
Iron	NS	153,000	120,000	114,000	NS	332	173	136	129,000	51,900
Magnesium	NS	249,000	187,000	170,000	NS	1,070	817	214	203,000	104,000
Phosphorus	NS	ND(310)	ND(260)	ND(240)	NS	ND(19)	ND(16)	ND(17)	ND(310)	--
Potassium	NS	62,600	54,000	44,300	NS	280	ND(220)	ND(230)	53,700	23,100
Sodium	NS	10,100	8,880	7,750	NS	123	135	148	9,100	2,930
Sulfate	NS	3,850,000	4,589,000	2,682,000	NS	954,000	811,000	791,000	4,560,000	2,450,000
Titanium	NS	14200	12,600	10,500	NS	63	19	13	12,500	4,530
Target Species										
Ammonia	NS	NS	NS	NS	250	180	170	NS	200	120
Antimony	NS	ND(270)	ND(220)	ND(190)	NS	0.085	2.8	0.043	0.96	3.9
Arsenic	NS	1,400	1,000	830	NS	7.9	2.2	ND(0.005)	1,100	750
Barium	NS	970	890	710	NS	4.8	1.5	2.3	860	330
Beryllium	NS	28	27	24	NS	0.23	0.063	0.053	27	5
Boron	NS	NA	NA	NA	NS	210	200	250	220 ^b	56

Table 3-12 (Continued)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
Cadmium	NS	6.9	8.2	5.0	NS	ND(0.006)	ND(0.006)	0.31	6.8	3.7
Chloride	NS	1100	5,300	1,100	NS	72,000	65,000	79,000	75,000	12,000
Chromium (multi-metals)	NS	490	400	620	NS	3.0	13	41	520	310
Cobalt	NS	88	73	48	NS	0.22	0.15	0.43	70	50
Copper	NS	95	63	170	NS	7.7	44	68	150	190
Cyanide	NS	NS	NS	NS	1,600	1,600	960	NA	1,400	920
Fluoride	NS	770	1,800	640	NS	6,900	6,000	7,200	7,800	310
Lead	NS	290	240	200	NS	2.9	1.1	1.2	240	120
Manganese	NS	520	440	380	NS	8.7	3.2	33	460	160
Mercury (total)	NS	ND(0.050)	ND(0.046)	ND(0.042)	NS	16	16	17	16	2
Mercury (nitric impingers)	NS	--	--	--	NS	16	15	16	--	--
Mercury (permanganate impingers)	NS	--	--	--	NS	0.30	0.53	0.28	--	--
Molybdenum	NS	ND(18)	ND(14)	66	NS	0.71	1.2	5.9	25	100
Nickel	NS	110	160	300	NS	19	25	58	220	300
Selenium	NS	54	49	51	NS	18	15	14	67	12
Silver	NS	ND(20)	ND(16)	ND(14)	NS	ND(1.6)	ND(1.4)	ND(1.4)	ND(20)	--
Vanadium	NS	450	380	330	NS	3.1	1.7	1.9	390	150

^a Assumed equal to 1/7th of the measured ESP outlet gas flow rates.^b Vapor phase only.

CI = Confidence interval.

NA = Not analyzed.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

Table 3-13
APF Outlet Gas Composition - Inorganic Species ($\mu\text{g}/\text{Nm}^3$ unless noted)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
Date	4/12/94	4/13/94	4/14/94	4/15/94	4/12/94	4/13/94	4/14/94	4/15/94		
Gas Flow Rate (dscfm) ^b	21,800	21,600	21,800	20,800					21,500	760
Gas Flow Rate (Nm^3/hr) ^b	34,600	34,200	34,600	33,000					34,100	1,200
Particulate Matter (lb/hr)	0.0056	0.024	0.014	0.049					0.023	0.030
Particulate Matter (mg/Nm^3)	0.074	0.31	0.18	0.68					0.31	0.42
Major Species										
Aluminum	0.87	4.8	2.4	NS	NS	55	59	53	58	10
Calcium	0.092	5.8	2.7	NS	NS	280	360	210	290	181
Iron	1.4	7.3	2.8	NS	NS	37	810	58	310	1,100
Magnesium	ND(0.53)	2.8	1.3	NS	NS	23	15	20	26	9
Phosphorus	ND(0.40)	ND(0.45)	ND(0.32)	NS	NS	ND(21)	ND(17)	ND(18)	ND(0.45)	--
Potassium	ND(2.4)	ND(2.7)	ND(2.0)	NS	NS	ND(280)	ND(230)	ND(250)	ND(2.7)	--
Sodium	ND(0.17)	1.4	ND(0.14)	NS	NS	360	410	260	359	190
Sulfate	38	84	52	NS	NS	532,000	470,000	474,000	492,000	85,426
Titanium	0.061	0.409	0.232	NS	NS	2.1	2.1	1.9	2.2	0.7
Target Species										
Ammonia	NS	NS	NS	NS	170	150	120	NS	150	55
Antimony	ND(0.33)	ND(0.36)	ND(0.26)	NS	NS	0.023	0.033	0.022	ND(0.36) ^a	--
Arsenic	0.21	0.36	0.27	NS	NS	3.9	4.1	3.0	3.9	1.7
Barium	0.091	0.017	0.0049	NS	NS	ND(0.006)	ND(0.005)	ND(0.005)	0.038	0.12
Beryllium	ND(0.0018)	ND(0.0020)	ND(0.0015)	NS	NS	0.028	0.013	0.018	0.020	0.019
Boron	NA	NA	NA	NS	NS	390	320	380	360 ^c	84

Table 3-13 (Continued)

Substance	Solid Phase				Vapor Phase				Total	
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Mean	95% CI
Cadmium	ND(0.0043)	ND(0.0048)	ND(0.0035)	NS	NS	ND(0.007)	ND(0.006)	ND(0.006)	ND(0.005)	--
Chloride	0.19	0.16	ND(0.11)	NS	NS	73,000	50,000	60,000	61,000	28,000
Chromium (multi-metals)	8.0 ^d	13 ^d	8.9 ^d	NS	NS	1.7	150	3.2	60	200
Cobalt	ND(0.030)	ND(0.033)	ND(0.024)	NS	NS	0.020	0.83	0.061	0.30	1.1
Copper	ND(0.028)	ND(0.031)	ND(0.022)	NS	NS	0.77	0.88	0.75	0.80	0.2
Cyanide	NS	NS	NS	NS	510	430	360	NS	430	190
Fluoride	0.046	0.22	0.12	NS	NS	9,400	8,900	8,500	8,900	1,200
Lead	0.019	0.035	0.033	NS	NS	ND(0.006)	ND(0.005)	ND(0.005)	0.029	0.022
Manganese	0.21	0.62	0.14	NS	NS	0.72	22	0.56	8.1	30
Mercury (total)	ND(0.00027)	ND(0.00030)	ND(0.00021)	NS	NS	16	14	14	15	2.6
Mercury (nitric impingers)	--	--	--	NS	NS	13	9.4	9.3	--	--
Mercury (permanganate impingers)	--	--	--	NS	NS	2.9	4.9	4.8	--	--
Molybdenum	3.4 ^d	6.5 ^d	2.9 ^d	NS	NS	3.4	3.4	7.7	9.1	6.1
Nickel	ND(0.26)	1.3 ^d	0.34 ^d	NS	NS	6.7	89	54	51	100
Selenium	ND(0.0044)	ND(0.0050)	ND(0.0036)	NS	NS	46	41	58	49	22
Silver	0.31	0.37	0.14	NS	NS	ND(1.8)	ND(1.5)	ND(1.6)	0.27	0.3
Vanadium	0.96	0.81	0.85	NS	NS	1.0	1.4	1.0	2.0	0.5

^a Detected in the vapor phase at low levels. Reported value is an upper limit.^b Assumed equal to 1/7th of the ESP outlet gas flow rate.^c Vapor phase only.^d Results indicate the presence of Iiconel 800 residue in the particulate matter. Data are considered biased high.

CI = Confidence interval.

NA = Not analyzed.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

Organic Species

Tables 3-14 and 3-15 show the concentrations of the target organic compounds in the APF inlet gas. Tables 3-16 and 3-17 show the results for organic compounds in the APF outlet gas. For volatile and semivolatile organic compounds, only those species which were present at levels above the detection limit in one or more samples are reported.

Levels of volatile organic compounds at the APF inlet and outlet were similar to the levels observed at the ESP locations. Methylene chloride and toluene are likely present due to field contamination. With the exception of carbon disulfide at the APF outlet (mean concentration = $25 \mu\text{g}/\text{Nm}^3$), most of these species were detected at levels less than five times the detection limit; therefore, their presence in the APF gas samples is uncertain. Benzene was quantified in two of the three APF inlet samples at levels greater than five times the detection limit. At the APF outlet, benzene was found at levels greater than five times the detection limit in only one of the three samples. Mean concentrations of benzene were 3.0 and $3.1 \mu\text{g}/\text{Nm}^3$ at the APF inlet and outlet, respectively.

Dioxin and furan results for the APF inlet indicate all of the species were present in the gas at levels which are 2 to 3 orders of magnitude greater than detection limits. Concentrations of the various dioxin/furan compounds or congeners ranged from $8.1 \text{ pg}/\text{Nm}^3$ for 2,3,7,8-tetrachlorodibenzo-p-dioxin to $2300 \text{ pg}/\text{Nm}^3$ for total pentachlorodibenzo-p-dioxin. Levels in the reagent blank were insignificant compared to the sample results at the APF inlet.

At the APF outlet, the front (filter) and back (resin) half of the Method 23 train were analyzed separately. None of the dioxin and furan species were detected in the front half sample. The results presented in Table 3-15 are the back half results only; the front half concentrations were assumed to be zero for the purpose of calculating a total concentration. Detection limits for the front-half samples can be found in Appendix B. Levels of dioxin/furan compounds and congeners at the APF outlet were much lower than those observed at the APF inlet. Mean concentrations for those species which were detected in the samples but not detected at significant levels in the reagent blanks (i.e., less than 30% of the

Table 3-14
APF Inlet Gas Composition - VOST and Method 23 Species

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
Date	4/12/94	4/13/94	4/14/94	4/15/94			
Gas Flow Rate (dscfm)	21,800	21,600	21,800	20,800	21,500	760	
Gas Flow Rate (Nm ³ /hr)	34,600	34,200	34,600	33,000	34,100	1,200	
VOST (µg/Nm ³)							
Benzene	NS	1.2	4.1	3.7	3.0	3.9	ND(0.5)
Carbon Disulfide	NS	1.8	5.2	4.1	3.7	4.3	ND(0.5)
Chloroethane	NS	ND(0.6)	ND(0.6)	19	6.5	27	ND(0.5)
Chloroform	NS	ND(0.6)	ND(0.6)	1.6	0.7	1.9	ND(0.5)
Chloromethane	NS	ND(0.5)	2.9	4.9	2.7	5.8	ND(0.5)
Methylene Chloride	NS	0.8 ^b	11 ^b	55	22 ^b	71	ND(0.5)
Toluene	NS	ND(0.6)	ND(0.6)	1.4 ^b	0.6 ^b	1.7	ND(0.5)
Dioxin/Furan (Method 23, pg/Nm ³)							
1,2,3,4,6,7,8-HpCDD	NS	460	650	270	460	470	ND(2.8)
1,2,3,4,6,7,8-HpCDF	NS	210	440	190	280	350	ND(1.4)
1,2,3,4,7,8-HxCDD	NS	110	170	51	110	150	ND(2.8)
1,2,3,4,7,8-HxCDF	NS	210	500	160	290	460	1.4 E
1,2,3,4,7,8,9-HpCDF	NS	49	67	39	52	35	ND(2.4)
1,2,3,6,7,8-HxCDD	NS	130	170	72	120	120	ND(2.1)
1,2,3,6,7,8-HxCDF	NS	76	160	53	95	140	ND(1.0)
1,2,3,7,8-PeCDD	NS	81	100	47	78	73	ND(1.4)
1,2,3,7,8-PeCDF	NS	65 E	93	230 E	130	230	ND(1.0)
1,2,3,7,8,9-HxCDD	NS	170	220	83	160	170	ND(2.1)

Table 3-14 (Continued)

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
1,2,3,7,8,9-HxCDF	NS	18	42	9.3	23	42	ND(1.7)
2,3,4,6,7,8-HxCDF	NS	90	160	53	100	140	2.1
2,3,4,7,8-PeCDF	NS	110 E	150	53	100	120	ND(1.0)
2,3,7,8-TCDD	NS	6.5 B	12	5.8	8.1	8.7	ND(1.4)
2,3,7,8-TCDF	NS	170	400	93	220	390	ND(1.0)
OCDD	NS	490	800	330	540	590	3.4 E
OCDF	NS	160	250	240	210	130	ND(3.4)
Total HpCDD	NS	940	1,400	560	970	1,000	ND(2.8)
Total HpCDF	NS	340	690	310	450	530	ND(1.7)
Total HxCDD	NS	1,900	2,400	1,100	1,800	1,600	ND(2.1)
Total HxCDF	NS	700	1,600	510	930	1,400	2.1
Total PeCDD	NS	2,600	3,000	1,400	2,300	2,100	ND(1.4)
Total PeCDF	NS	610	2,000	540	1,000	2,000	ND(1.0)
Total TCDD	NS	2,600	2,900	1,200	2,200	2,300	ND(1.4)
Total TCDF	NS	1,600	3,200	740	1,800	3,100	ND(1.0)
Aldehydes ($\mu\text{g}/\text{Nm}^3$)							
Formaldehyde	40	150	17	NS	68	170	

^a Calculated based on the mean of the levels in the reagent blanks divided by the mean gas sample volume for the three sample runs.

^b Levels in the field blanks are $\geq 30\%$ of the sample value.

E indicates value is an estimated upper limit.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

HpCDD = Heptachlorodibenzo-p-dioxin.

HpCDF = Heptachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

PeCDD = Pentachlorodibenzo-p-dioxin.

PeCDF = Pentachlorodibenzofuran.

TCDD = Tetrachlorodibenzo-p-dioxin.

TCDF = Tetrachlorodibenzofuran.

OCDD = Octachlorodibenzo-p-dioxin.

OCDF = Octachlorodibenzofuran.

Table 3-15
Results for Semivolatile Organic Species at the APF Inlet ($\mu\text{g}/\text{Nm}^3$)

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
PAHs by HR GC/MS (ng/Nm^3)								
Acenaphthene	0.87 B	0.96 B	1.4 B	21 B	44 B	10 B	26 B	43
Acenaphthylene	0.18 B	0.27 B	0.37 B	4.3	10	4.0	6.5 B	8.9
Anthracene	0.68 B	1.9 B	3.2	ND(0.96)	0.97 B	0.76 B	2.5 B	4.1
Benzo(a)anthracene	0.27 B	1.3	1.8	0.69	0.25 B	0.50 B	1.6 B	1.7
Benzo(a)pyrene	0.43 B	1.7	2.8	0.91	ND(0.42)	0.46 B	2.1 B	2.5
Benzo(b)fluoranthene	0.65 B	2.3	5.4	1.5 B	0.68 B	1.0 B	3.9 B	5.6
Benzo(g,h,i)perylene	2.4 B	8.3	12	6.1	0.99 B	1.2 B	10 B	5.6
Benzo(k)fluoranthene	0.22 B	0.65	3.1	0.91	0.19 B	0.31 B	1.8 B	3.5
2-Chloronaphthalene	ND(0.089)	ND(0.12)	ND(0.18)	5.9	4.5	7.3	5.9	3.5
Chrysene	1.5 B	3.1	6.5	0.87 B	0.52 B	0.92 B	4.4 B	6.5
Dibenz(a,h)anthracene	ND(0.25)	ND(1.2)	2.2	ND(1.1)	ND(0.23)	0.17 B	ND(1.1) B	--
Fluoranthene	3.1 B	8.5	14	7.3 B	8.3 B	5.7 B	16	12
Fluorene	3.3 B	6.3 B	10	5.9 B	8.7 B	10 B	15 B	14
Indeno(1,2,3-cd)pyrene	0.59 B	2.0	3.6	1.8	0.49 B	0.63 B	3.0 B	2.7
2-Methylnaphthalene	5.4 B	5.8 B	7.6 B	79 B	140	200	150 B	150
Naphthalene	17 B	17 B	24 B	700	150 B	190 B	370 B	760
Phenanthrene	17 B	27 B	46	26 B	43 B	41 B	67 B	56
Pyrene	3.2 B	7.2	10	4.0 B	3.5 B	2.8 B	10 B	7.3

Table 3-15
Results for Semivolatile Organic Species at the APF Inlet ($\mu\text{g}/\text{Nm}^3$)

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
Semivolatile Organic Compounds by 8270 ($\mu\text{g}/\text{Nm}^3$)								
Acetophenone	ND(2.8)	ND(2.7)	ND(2.9)	1.4 J	1.7 J	2.6 J	1.9 J	1.6
Benzoic acid	ND(10)	ND(10)	ND(11)	88	120 d	110	110	45
Di-n-butylphthalate	3.1 J,B	20	11	1.3 J,B	5.4 J,B	55	32 B	77
bis(2-Ethylhexyl)phthalate	1.2 J,B	ND(1.1)	ND(1.2)	1.1 J,B	ND(0.62)	1.5 J,B	1.4 B	2.5
2-Methylnaphthalene	ND(1.7)	ND(1.6)	ND(1.7)	ND(1.3)	ND(0.70)	0.082 J	ND(1.3)	--
Naphthalene	ND(1.1)	ND(1.1)	ND(1.1)	ND(0.81)	ND(0.45)	0.73 J,B	ND(0.81)	--
2-Nitrophenol	ND(5.1)	ND(5.1)	ND(5.3)	ND(3.8)	ND(2.7)	0.28 J	ND(3.8)	--
4-Nitrophenol	ND(12)	ND(12)	ND(13)	ND(8.5)	0.65 J	0.54 J	ND(8.5)	--
Phenol	ND(2.3)	ND(2.3)	ND(2.4)	ND(1.7)	ND(1.4)	0.66 J	ND(1.7)	--
Benzo(a)anthracene	ND(0.84)	0.82	ND(0.89)	ND(0.51)	ND(0.50)	ND(0.33)	ND(0.51)	--
bis(2-Chloroethoxy)methane	ND(2.5)	ND(2.5)	ND(2.5)	ND(2.6)	ND(1.9)	1.5	ND(0.70)	ND(1.9)

B indicates the substance was detected in the reagent blank at levels greater than or equal to 30% of the sample value.

J indicates that the concentration was less than the quantitation limit of the method but above the detection limit.

d indicates that the undiluted sample results exceeded the calibration range of the instrument. The sample was diluted and the results for the diluted samples are shown.

Table 3-16
APF Outlet Gas Composition - VOST and Method 23 Species

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
Date	4/12/94	4/13/94	4/14/94	4/15/94			
Gas Flow Rate (dscfm)	21,800	21,600	21,800	20,800	21,500	760	
Gas Flow Rate (Nm ³ /hr)	34,600	34,200	34,600	33,000	34,100	1,200	
VOST (µg/Nm ³)							
Chloroform	0.7	ND(0.5)	0.5	NS	ND(0.5)	--	ND(0.5)
Benzene	8.0	0.5	0.8	NS	3.1	7.7	ND(0.5)
Bromomethane	ND(0.4)	ND(0.5)	2.2	NS	0.89	2.9	ND(0.5)
Carbon Disulfide	21	31	23	NS	25	62	ND(0.5)
Chloromethane	5.1	ND(0.5)	2.3	NS	2.6	3.5	ND(0.5)
Methylene Chloride	1,500	280	330	NS	720	1,800	ND(0.5)
Toluene	2.6 ^b	ND(0.4)	0.6 ^b	NS	1.2 ^b	3.2	ND(0.5)
Dioxin/Furan (pg/Nm ³)							
1,2,3,4,6,7,8-HpCDD	NS	22	10	8.8	14	18	ND(2.8)
1,2,3,4,6,7,8-HpCDF	NS	17	13	11	14 B	7.8	ND(1.4)
1,2,3,4,7,8-HxCDD	NS	2.3 E	ND(5.6)	ND(7.1)	ND(7.1)	0.0	ND(2.8)
1,2,3,4,7,8-HxCDF	NS	24	15	9.1	16 B	19	1.4 E
1,2,3,4,7,8,9-HpCDF	NS	3.3 E	5.2	ND(7.1)	ND(7.1)	--	ND(2.4)
1,2,3,6,7,8-HxCDD	NS	5.7	ND(4.5)	ND(6.0)	ND(6.0)	--	ND(2.1)
1,2,3,6,7,8-HxCDF	NS	5.5	3.5	ND(3.0)	3.5	4.9	ND(1.0)
1,2,3,7,8-PeCDD	NS	2.7 E	ND(5.3)	ND(6.0)	ND(6.0)	--	ND(1.4)
1,2,3,7,8-PeCDF	NS	6.8	ND(3.0)	ND(3.0)	3.1	0.61	ND(1.0)
1,2,3,7,8,9-HxCDD	NS	5.7	5.3	ND(6.3)	ND(6.3)	--	ND(2.1)

Table 3-16 (Continued)

Substance	Run 1	Run 2	Run 3	Run 4	Mean	95% CI	Mean Blank Level ^a
1,2,3,7,8,9-HxCDF	NS	2.5	ND(3.4)	ND(4.1)	ND(4.1)	--	ND(1.7)
2,3,4,6,7,8-HxCDF	NS	6.0 B	3.8 B,E	3.4 E,B	4.4	3.5	2.1
2,3,4,7,8-PeCDF	NS	3.3 E	ND(3.0)	ND(3.0)	ND(3.0)	--	ND(1.0)
2,3,7,8-TCDD	NS	1.0 E	ND(3.4)	ND(3.0)	ND(3.4)	--	ND(1.4)
2,3,7,8-TCDF	NS	12	4.5	ND(1.1)	5.7	14	ND(1.0)
OCDD	NS	43 E	34 E	35	37	13	3.4 E
OCDF	NS	66	42	34 E	47	42	ND(3.4)
Total HpCDD	NS	22	10	8.8	14	18	ND(2.8)
Total HpCDF	NS	24	20	14	19	13	ND(1.7)
Total HxCDD	NS	46	3.8 E	5.2	18	59	ND(2.1)
Total HxCDF	NS	51	18	8.6 B	26	56	2.1
Total PeCDD	NS	41	11 E	ND(6.0)	19	50	ND(1.4)
Total PeCDF	NS	53	7.5 E	4.0	21	68	ND(1.0)
Total TCDD	NS	130	14	ND(3.0)	47	170	ND(1.4)
Total TCDF	NS	99	12	2.8	38	130	ND(1.0)
Aldehydes							
Formaldehyde	3.6	4.1	3.8	NS	3.9	0.6	

^a Calculated based on the mean level in the reagent blank divided by the mean gas sample volume.

^b Levels in the field blanks are $\geq 30\%$ of the sample value.

B indicates the substance was detected in the reagent blanks at $\geq 30\%$ of the sample value.

E indicates value is an estimated upper limit.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NS = Not sampled.

HpCDD = Heptachlorodibenzo-p-dioxin.

HpCDF = Heptachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

PeCDD = Pentachlorodibenzo-p-dioxin.

PeCDF = Pentachlorodibenzofuran.

TCDD = Tetrachlorodibenzo-p-dioxin.

TCDF = Tetrachlorodibenzofuran.

OCDD = Octachlorodibenzo-p-dioxin.

OCDF = Octachlorodibenzofuran.

Table 3-17
Results for Semivolatile Organic Species at the APF Outlet

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
PAHs by HR GC/MS (ng/Nm ³)								
Acenaphthene	0.1 B	0.080 B	0.28 B	70 B	9.5 B	31 B	37 B	76
Acenaphthylene	0.027 B	0.017 B	0.078 B	27	1.3 B	3.5 B	10 B	35
Anthracene	0.16 B	0.097 B	0.34 B	0.25 B	0.53 B	0.78 B	0.72 B	0.92
Benzo(a)anthracene	0.070	0.077	0.043 B	0.26 B	0.26 B	0.38 B	0.36 B	0.13
Benzo(a)pyrene	0.090	0.044 B	0.078 B	NR	0.28 B	0.31 B	0.27 B	0.39
Benzo(b)fluoranthene	0.15 B	0.17 B	0.11 B	0.80 B	0.71 B	0.87 B	0.93 B	0.13
Benzo(g,h,i)perylene	0.48	0.79	0.30	53	1.2 B	1.1 B	19 B	74
Benzo(k)fluoranthene	0.033 B	0.027 B	0.032 B	0.41 B	0.32 B	0.28 B	0.37 B	0.17
2-Chloronaphthalene	ND(0.028)	ND(0.015)	ND(0.019)	ND(0.070)	ND(0.13)	0.40	0.17	0.50
Chrysene	0.13 B	0.27	0.23	0.73 B	0.38 B	0.77 B	0.83 B	0.43
Dibenz(a,h)anthracene	ND(0.073)	ND(0.018)	ND(0.026)	0.41 B	ND(0.24)	0.23 B	0.25 B	0.33
Fluoranthene	0.61 B	0.37 B	1.0 B	4.7 B	3.9 B	7.2 B	5.9 B	5.1
Fluorene	0.71 B	0.47 B	1.7 B	6.0 B	3.8 B	9.2 B	7.3 B	8.2
Indeno(1,2,3-cd)pyrene	0.092 B	0.17	0.092 B	0.65 B	0.58 B	0.48 B	0.69 B	0.25
2-Methylnaphthalene	1.1 B	0.99 B	2.4 B	51 B	24 B	22 B	34 B	39
Naphthalene	2.9 B	2.8 B	3.2 B	140 B	380 B	380 B	300 B	350
Phenanthrene	3.4 B	3.1 B	8.3 B	24 B	19 B	39 B	32 B	33
Pyrene	1.1	0.30 B	0.63 B	1.1 B	1.8 B	3.4 B	2.8 B	2.7

Table 3-17 (Continued)

Substance	Particulate Phase			Vapor Phase			Total	
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3	Mean	95% CI
Semivolatile Organic Compounds by 8270 ($\mu\text{g}/\text{Nm}^3$)								
Acetophenone	ND(0.44)	ND(0.36)	ND(0.40)	2.0 J	1.6 J	2.8 J	2.1 J	1.5
Benzoic acid	ND(1.6)	ND(1.4)	ND(1.5)	130 d	110	23 d	84 d	140
Di-n-butylphthalate	18	1.2	10	3.7 J,B	1.0 J,B	100	45	150
bis(2-Ethylhexyl)phthalate	0.094 J,B	0.10 J,B	0.070 J,B	1.0 J,B	0.52 J,B	9.9	3.9	13
Isophorone	ND(0.26)	ND(0.22)	ND(0.25)	1.7 J	ND(0.38)	ND(0.40)	0.70 J	2.2
Phenol	ND(0.37)	ND(0.30)	ND(0.33)	1.3 J	0.65 J	1.2 J	1.0 J	0.85

B indicates the substance was detected in the reagent blank at levels greater than or equal to 30% of the sample.

J indicates that the concentration was less than the quantitation limit of the method but above the detection limit.

d indicates that the undiluted sample result exceeded the calibration range of the instrument; results are shown for the diluted sample.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

NR = Not reported. Internal standard was not detected; therefore, substance could not be quantified.

sample value) ranged from $3.5 \times 10^{-6} \mu\text{g}/\text{Nm}^3$ for 1,2,3,6,7,8-hexachlorodibenzofuran to $4.7 \times 10^{-5} \mu\text{g}/\text{Nm}^3$ octachlorodibenzofuran. The apparent reduction of dioxin/furan concentrations across the APF system may be due to condensation of these species on the particulate matter in the APF gas. Data for the APF and ESP ash (Table 3-4) indicate the presence of some dioxin/furan compounds at pg/g levels.

Results for semivolatile organic compounds measured in the APF inlet and outlet gas are presented in Tables 3-15 and 3-17, respectively. Results are very similar to those discussed above for the ESP inlet and outlet gas streams. The same compounds were detected at similar concentrations at both the ESP and APF locations. The discussion presented previously also applies to the results for the APF gas streams.

ESP System Control Efficiency

Table 3-18 presents the removal efficiencies for the ESP system, listed by species. The average particulate removal efficiency was calculated to be 97.2% based on the data collected during the three Method 29 train tests. Little or no removal is indicated for chloride (6%), mercury (4%) and SO_2 (2%). Modest removal was measured for cadmium (44%), copper (62%), fluoride (54%), selenium (37%), ammonia (16%), cyanide (21%), and formaldehyde (24%). Removal of other target species is much higher, ranging from 90% (nickel) to 99.8% (arsenic).

APF System Control Efficiency

Estimates of the APF system control efficiency are also shown in Table 3-18. Over 1300 dscf of gas was collected during each test run at the APF outlet to quantify the particulate loading. The mean measured particulate removal efficiency was 99.993 percent. Low removals are indicated for chloride (18%), fluoride (-15%), and mercury (9%). Modest removals were observed for molybdenum (63%), nickel (77%), selenium (27%), ammonia (25%), and cyanide (69%). Removals for major elements (Al, Ca, Ti, etc.) were comparable to the removal observed for particulate matter.

Table 3-18
ESP and APF Control Efficiencies

Substance	ESP		APF	
	Mean Removal (%)	95% CI	Mean Removal (%)	95% CI
Particulate	97.2	4.8	99.99	0.01
Antimony	NC	--	>65	--
Arsenic	99.8	0.1	99.6	0.2
Barium	99.7	3.1	99.996	0.014
Beryllium	99.8	4.0	>99.9	--
Boron	NC	--	NC	--
Cadmium	44	150	>99.9	--
Chloride (total)	6.0	7.7	18	39
HCl ^a	4	10	11	33
Chromium	97.2	2.2	89 ^b	40
Cobalt	>99.2	--	99.6	1.6
Copper	62	41	99.5	0.7
Fluoride (total)	54	13	-15	16
HF ^a	32	16	-33	25
Lead	99.1	5.1	99.99	0.01
Manganese	95.2	6.8	98.2 ^b	6.6
Mercury	4	40	9	39
Molybdenum	NC	43	63 ^b	82
Nickel	90	15	77 ^b	38
Selenium	37	29	27	26
Silver	NC	--	NC	--
Vanadium	99.2	0.2	99.5	0.2
Aluminum	99.8	0.2	99.98	0.01
Calcium	99.5	0.2	99.9	0.04
Iron	98.8	2.5	99.8	0.9
Magnesium	99.8	0.1	99.99	0.005
Potassium	99.8	0.1	>99.995	--
Sodium	88.9	3.5	96.2	1.8
Titanium	99.7	0.4	99.98	0.01
Ammonia	16	42	25	31
Cyanide	21	92	69	15
Formaldehyde	24	66	94	20
Sulfur (total)	92	--	89	4
SO ₂	2	--	42	11

^a Assumes that the vapor-phase concentration of the anion is present as HCl or HF.

^b May not be representative of actual APF performance.

NC = Not calculated. Substance was not detected in the inlet gas stream.

> indicates the reported removal efficiency is a lower limit. The substance was not detected in the device outlet gas. Detection limit was used to estimate a lower limit for the removal efficiency.

CI = Confidence interval.

The relatively low removal efficiencies for chromium, molybdenum, and nickel, relative to the total particulate removal, suggests either 1) a significant fraction of these elements exists in the vapor phase and is not removed; or 2) that contamination from the Inconel 800 sampling probe or elsewhere in the process equipment may have occurred within the APF outlet particulate matter. A comparison of the mean particulate-phase composition on a $\mu\text{g/g}$ basis at all four gas locations and collected ash from these systems is shown below:

	<u>ESP Inlet</u>	<u>ESP Ash</u>	<u>ESP Outlet</u>	<u>APF Inlet</u>	<u>APF Ash</u>	<u>APF Outlet</u>
Chromium ($\mu\text{g/g}$)	82	94	35	110	74	66,500
Molybdenum ($\mu\text{g/g}$)	<2	<3.8	6	7	<3.3	27,700
Nickel ($\mu\text{g/g}$)	32	29	270	130	50	2,600

The abnormally high concentrations of chromium, molybdenum, and nickel in the APF outlet particulate matter shown above strongly suggest that residue from the Inconel 800 components of the sampling system is present in the particulate matter. The particulate-phase concentrations of these species reported for the APF outlet should be considered biased high.

Examination of the data in Table 3-13 indicates high levels of chromium, cobalt, iron, manganese, and nickel (all potential components of the Inconel 800 or stainless steel components of the sampling system) in the vapor phase at the APF outlet, particularly for Run 2. However, elevated levels were not observed for those elements primarily associated with the fly ash component of the particulate matter (e.g., aluminum, antimony, arsenic, beryllium, calcium, copper, lead, magnesium, selenium, titanium, and vanadium). Since the filters used at the APF outlet have a pore size of about $0.45\ \mu\text{m}$, it is possible that any residue from the probe less than about $0.45\ \mu\text{m}$ diameter could have penetrated the filter at the APF outlet resulting in abnormally high levels of the metallic elements in the vapor phase. Since the PSD results of the ESP inlet and outlet ash indicate very little ash material in the less than $0.5\ \mu\text{m}$ diameter fraction, penetration of fly ash across the sampling system filters is expected to be minimal. Therefore, vapor-phase data for chromium, cobalt, iron, manganese, and nickel for Run 2 may not be representative of the actual vapor-phase

composition at the APF outlet. Calculated control efficiencies for chromium, manganese, molybdenum, and nickel may not be representative of actual APF performance.

If the ESP outlet particulate composition is used to estimate the particulate-phase removal of these species across the APF, values of 99.997% (chromium), 99.98% (nickel), and 99.993% (molybdenum) are obtained. These values are more consistent with the overall particulate removal measured across the APF system.

Data from the anions train indicate approximately 40% removal of SO_2 across the APF system, presumably because of reaction of the SO_2 with the sorbent material on the surface of the ceramic candles. The SO_2 measurements made during the three tests were consistent with the levels of SO_2 measured by the plant's CEM system at both the APF inlet and outlet; both data sets suggest SO_2 removal occurs across the APF unit.

Emission Factors

Table 3-19 provides calculated ESP outlet emissions factors for all of the target species. Emissions factors are presented on a $\text{lb}/10^{12}$ Btu heat input basis. Emissions factors for inorganic substances detected in the ESP outlet gas range from 83,000 lb/trillion Btu (chloride) to 0.31 lb/trillion Btu (molybdenum). The range of emission factors for organic species is 4.3×10^{-6} lb/trillion Btu (pentachlorodibenzofuran) to 6.6 lb/trillion Btu (benzene).

Particle Size Distribution Data

Particle size distributions (PSDs) were determined for the ash material collected at the ESP inlet, ESP outlet, and the each of the four ESP hoppers. PSDs for the gas stream particulate matter were determined using an "in-stack" cascade impactor which separated the entrained particulate matter into 11 fractions (10 impacted fractions and one filter fraction) according to aerodynamic particle size. ESP hopper ash samples were analyzed by laser diffraction to determine the physical diameter of the particles. Results from the laser diffraction analyses of the ESP hopper ash were converted from physical particle diameters to aerodynamic

Table 3-19
Emission Factors for ESP Outlet Gas (lb/10¹² Btu, unless noted)

Substance	Emission Factor	95% CI
Particulate (lb/10 ⁶ Btu)	0.051	0.09
Inorganic Species		
Ammonia	140	7
Antimony	ND(2.6)	--
Arsenic	1.2	0.06
Barium	0.92	0.044
Beryllium	0.026	0.0012
Boron	210	10
Cadmium	2.2	0.11
Chloride (total)	83,000	4,000
Chromium	4.6	0.22
Cobalt	ND(2.4)	--
Copper	5.3	0.25
Cyanide	610	29
Fluoride (total)	5600	270
Lead	0.80	0.038
Manganese	8.5	0.41
Mercury (total)	18	1
Molybdenum	0.31	0.015
Nickel	7.4	0.35
Selenium	49	2.3
Silver	0.50	0.024
Vanadium	1.2	0.06
Chromium (VI)	1.7	0.08
Organic Species		
Formaldehyde	5.1	0.24
1,1,2,2-Tetrachloroethane	ND(0.7)	--
1,1,2-Trichloroethane	ND(0.7)	--
1,1-Dichloroethane	ND(0.7)	--
1,1-Dichloroethene	ND(0.7)	--
1,2-Dichlorobenzene	ND(0.7)	--
1,2-Dichloropropane	ND(0.7)	--
1,3-Dichlorobenzene	ND(0.7)	--
1,4-Dichlorobenzene	ND(0.7)	--

Table 3-19 (Continued)

Substance	Emission Factor	95% CI
2-Butanone	ND(3.3)	--
2-Hexanone	ND(3.3)	--
4-Methyl-2-Pentanone	ND(3.3)	--
Acetone	ND(3.3)	--
Bromodichloromethane	ND(0.7)	--
Bromoform	ND(0.7)	--
Bromomethane	ND(0.7)	--
Carbon Tetrachloride	ND(0.7)	--
Chlorobenzene	ND(0.7)	--
Chloroethane	ND(0.7)	--
Chloroform	ND(0.7)	--
cis-1,3-Dichloropropene	ND(0.7)	--
Dibromochloromethane	ND(0.7)	--
Ethyl Benzene	ND(0.7)	--
m,p-Xylene	ND(0.7)	--
o-Xylene	ND(0.7)	--
Styrene	ND(0.7)	--
Tetrachloroethene	ND(0.7)	--
trans-1,2-Dichloroethene	ND(0.7)	--
trans-1,3-Dichloropropene	ND(0.7)	--
Trichloroethene	ND(0.7)	--
Trichlorofluoromethane	ND(0.7)	--
Vinyl Acetate	ND(3.3)	--
Vinyl Chloride	ND(0.7)	--
1,1,1-Trichloroethane	16 ^a	1
1,2-Dichloroethane	8.7 ^a	0.41
Benzene	6.6	0.32
Carbon Disulfide	1.0	0.05
Chloromethane	4.4 ^a	0.21
Methylene Chloride	3.6 ^a	0.17
Toluene	1.4 ^a	0.07

Table 3-19 (Continued)

Substance	Emission Factor	95% CI
1,2,3,4,6,7,8-HpCDD	7.3E-06 ^{b,c}	3.5E-07
1,2,3,4,6,7,8-HpCDF	6.4E-06 ^c	3.1E-07
1,2,3,4,7,8-HxCDD	ND(4.8E-6)	--
1,2,3,4,7,8-HxCDF	5.6E-06 ^{b,c}	2.7E-07
1,2,3,4,7,8,9-HpCDF	ND(5.0E-6)	--
1,2,3,6,7,8-HxCDD	ND(3.9E-6)	--
1,2,3,6,7,8-HxCDF	ND(2.2E-6)	--
1,2,3,7,8-PeCDD	ND(3.5E-6)	--
1,2,3,7,8-PeCDF	ND(2.2E-6)	--
1,2,3,7,8,9-HxCDD	ND(4.4E-6)	--
1,2,3,7,8,9-HxCDF	ND(3.5E-6)	--
2,3,4,6,7,8-HxCDF	4.4E-06 ^{b,c}	2.1E-07
2,3,4,7,8-PeCDF	ND(2.2E-6)	--
2,3,7,8-TCDD	ND(2.0E-6)	--
2,3,7,8-TCDF	ND(2.0E-6)	--
OCDD	7.7E-05 ^{b,c}	3.7E-06
OCDF	1.2E-05 ^c	5.8E-07
TOTAL HpCDD	1.4E-05 ^c	6.7E-07
TOTAL HpCDF	4.5E-06 ^c	2.1E-07
TOTAL HxCDD	ND(4.1E-6)	--
TOTAL HxCDF	1.4E-05 ^c	6.7E-07
TOTAL PeCDD	ND(3.5E-6)	--
TOTAL PeCDF	4.3E-06 ^c	2.1E-07
TOTAL TCDD	ND(1.8E-6)	--
TOTAL TCDF	ND(2.0E-6)	--

^a Methylene chloride, toluene, and other halogenated hydrocarbons are suspected to be present as a result of contamination.

^b Substance was detected in the reagent blank at greater than or equal to 30% of the sample result. Results are considered to be bias high. Quantification is suspect.

^c Substance was quantified at less than five times the detection limit.

CI = Confidence interval.

HpCDD = Heptachlorodibenzo-p-dioxin.

HpCDF = Heptachlorodibenzofuran.

HxCDD = Hexachlorodibenzo-p-dioxin.

HxCDF = Hexachlorodibenzofuran.

PeCDD = Pentachlorodibenzo-p-dioxin.

PeCDF = Pentachlorodibenzofuran.

TCDD = Tetrachlorodibenzo-p-dioxin.

TCDF = Tetrachlorodibenzofuran.

OCDD = Octachlorodibenzo-p-dioxin.

OCDF = Octachlorodibenzofuran.

particle diameters so that they could be compared to the cascade impactor results from the ESP inlet location. Physical and aerodynamic particle sizes are related by the following equation:

$$D_a = D_p / (\rho)^{0.5}$$

where

D_a = aerodynamic particle size (μm)

D_p = physical particle size (μm)

ρ = particle specific gravity (assumed to be 2.0)

In this case, the specific gravity of the material collected at the ESP outlet was assumed to be equal to 2.0. Specific gravity for typical fly ash can range from 2.0 to 2.8. The selection of this value does not have a significant impact on the ESP hopper PSD results.

Results for each of the three runs at the gas stream locations were combined to obtain the average PSD plots shown in Figures 3-4 and 3-5 for the ESP inlet and outlet, respectively. Similarly, the results for the samples collected from each of the four ESP hoppers were combined to obtain the average PSD plots shown in Figures 3-6 and 3-7. PSD plots for individual samples and hoppers are provided at the end of Appendix C along with the detailed PSD results. Weight gains from the initial precutter fraction of the impactor were not included in the PSD analysis, since these weight gains caused the total particulate loadings to become abnormally high. The large weight gains associated with right angle precutter fractions are believed to be caused by collection of large rust/ash particles from the walls of the sample ports as the impactors were inserted into the duct. Rust flakes and a reddish-brown discoloration were noted in the precutter fractions.

As expected, data for the ESP hoppers show a downward shift in the particle size distribution from the first to the last hopper (i.e., Hopper #1 to Hopper #4) since the largest particles are easily collected in the first field of the ESP. One would also expect that the PSD data for

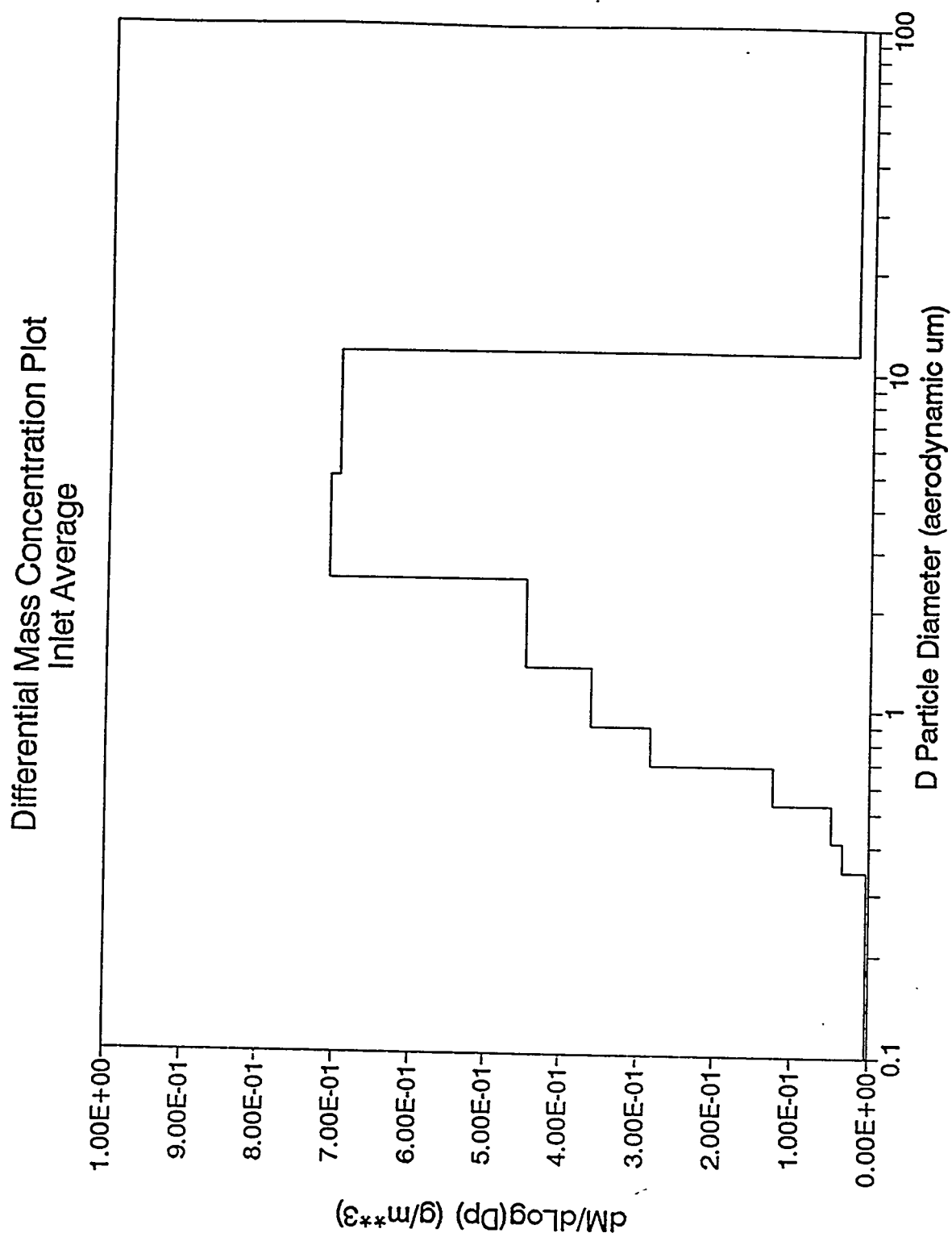


Figure 3-4
ESP Inlet PSD

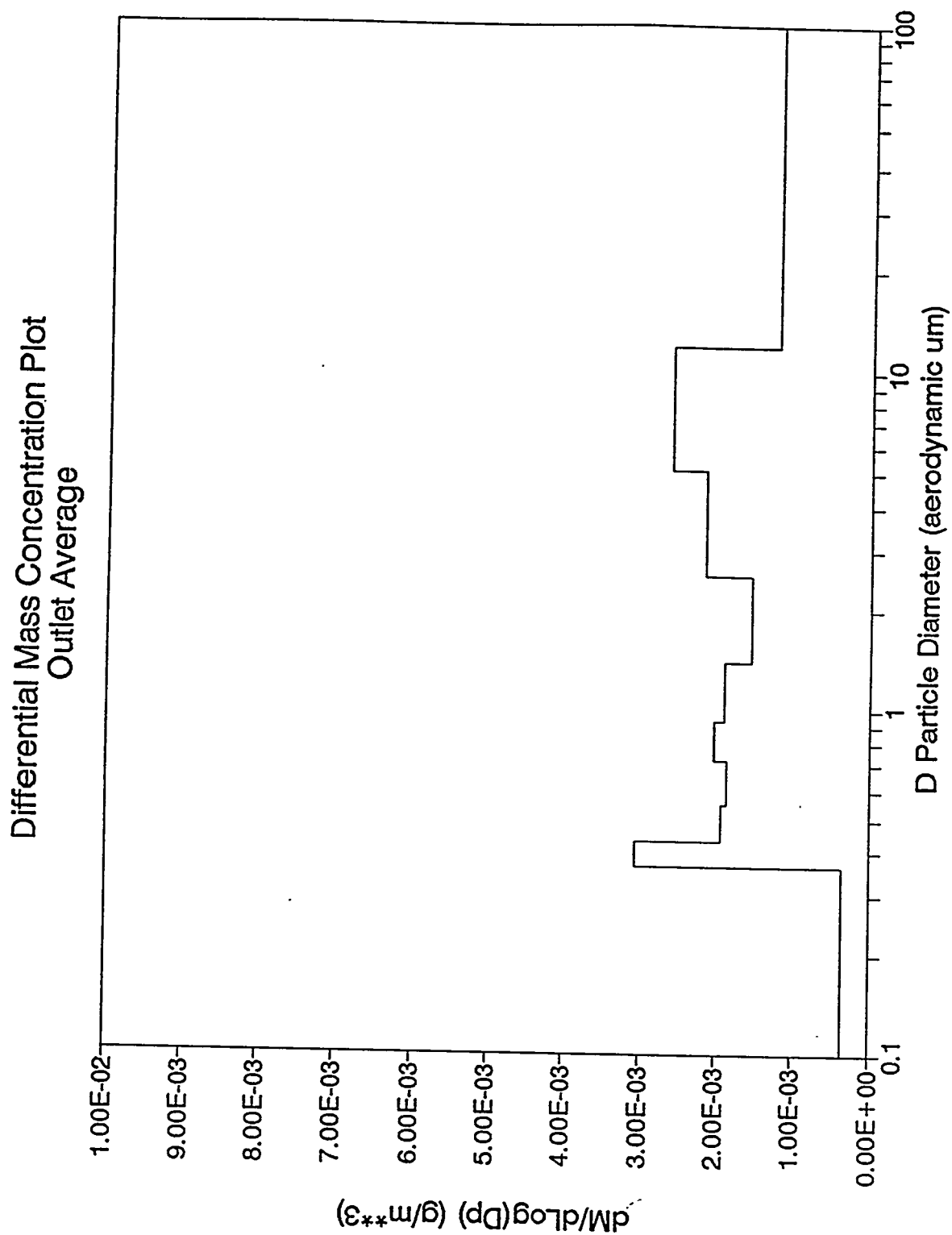


Figure 3-5
ESP Outlet PSD

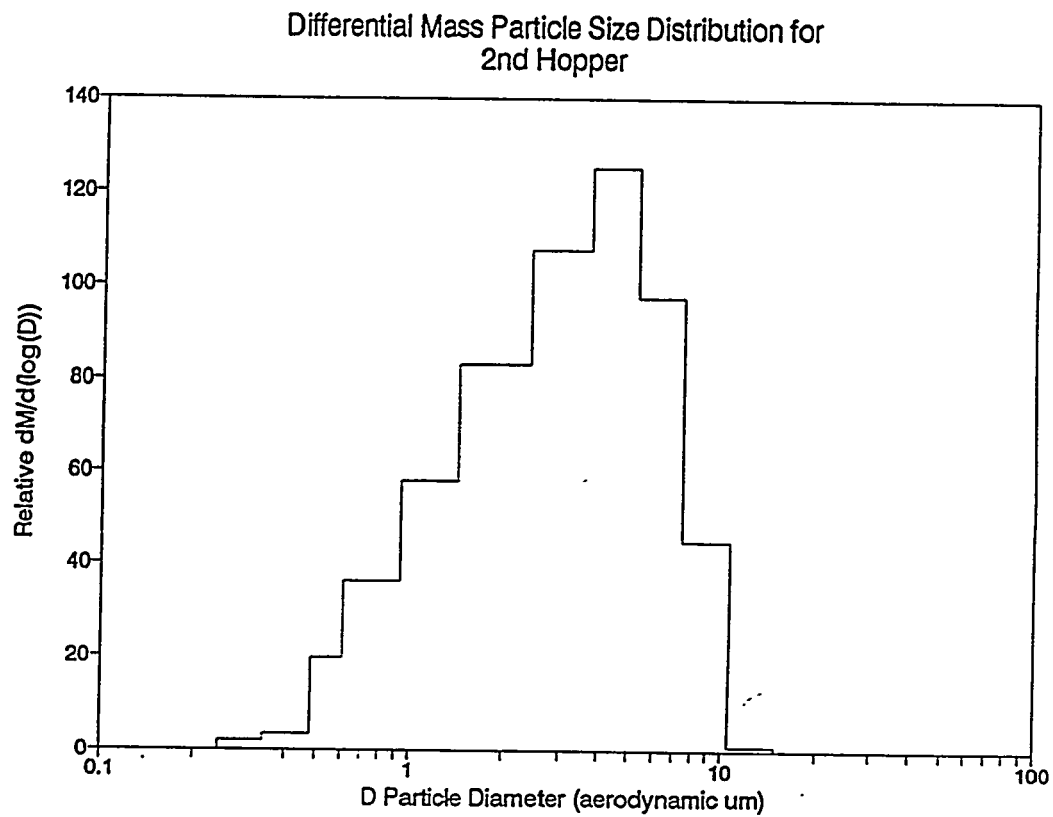
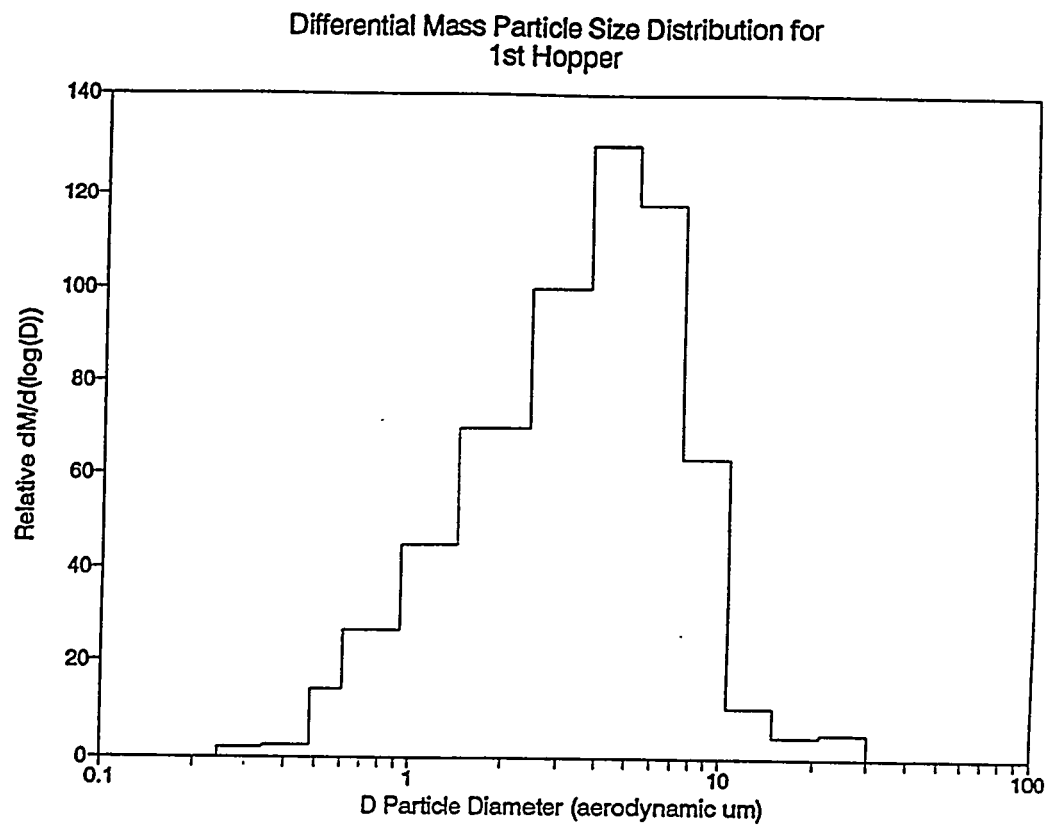


Figure 3-6
ESP Hoppers 1 and 2 PSD

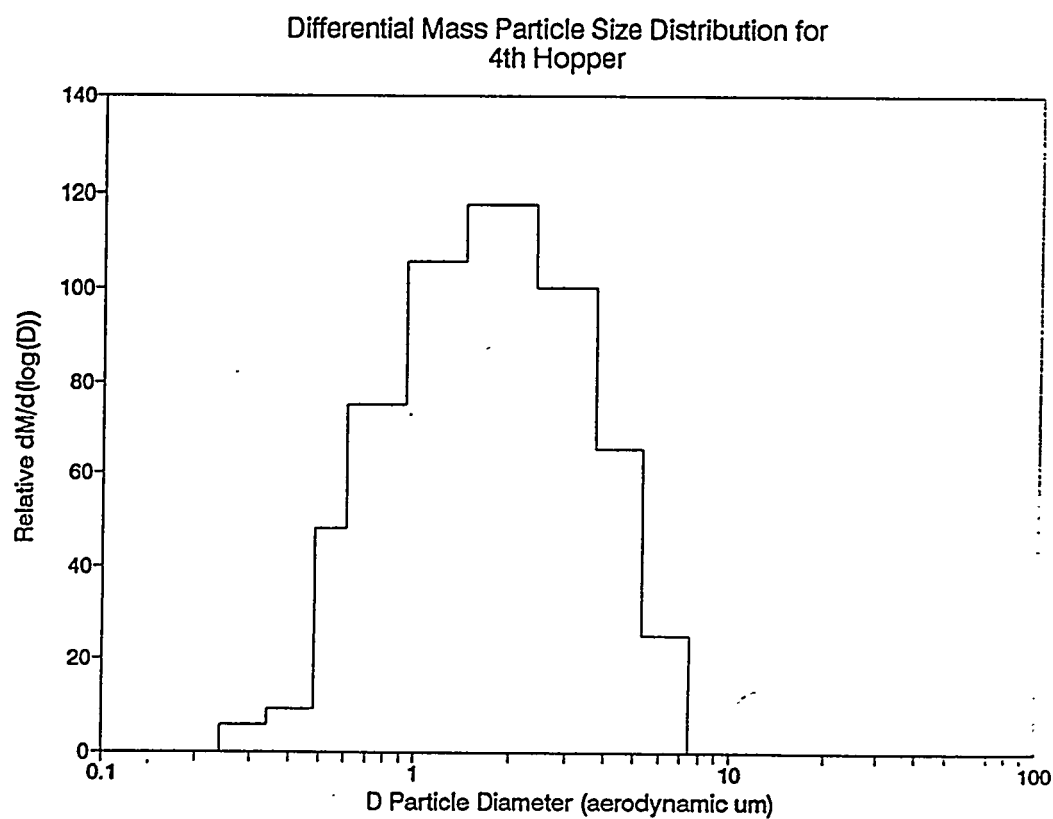
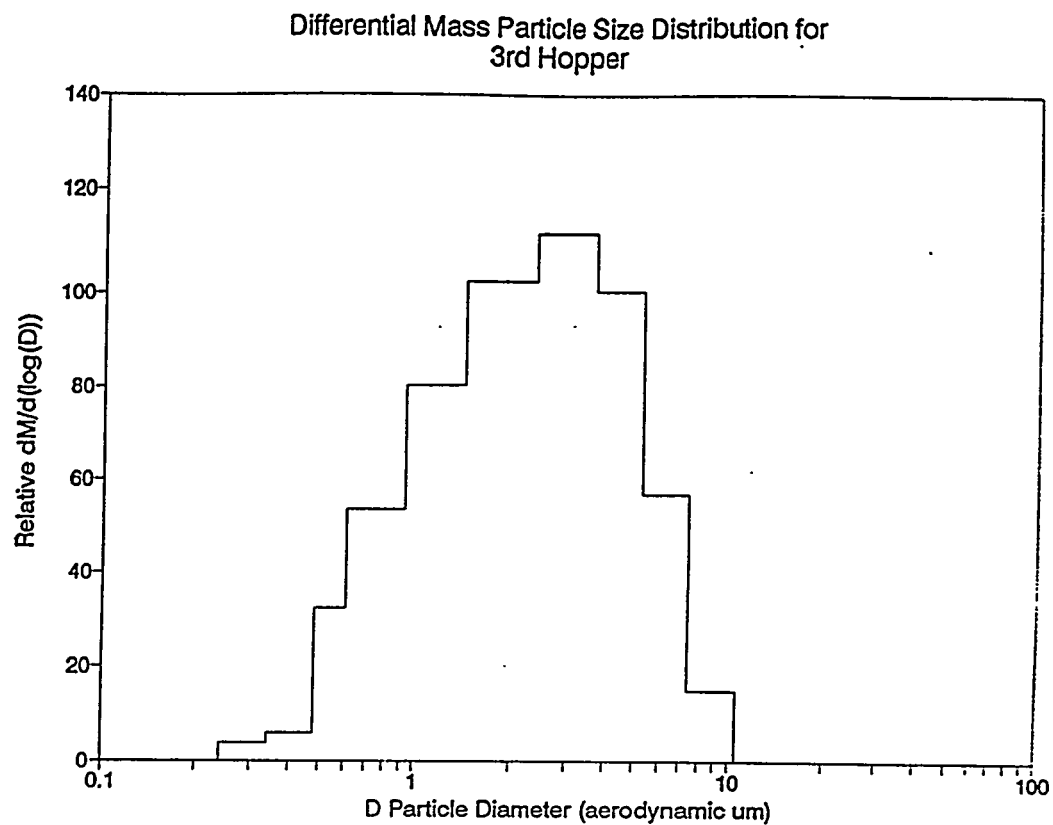


Figure 3-7
ESP Hoppers 3 and 4 PSD

the ESP inlet and the first ESP hopper to be similar, since these samples represent the same material. Comparison of the data shown in Figures 3-4 and 3-6 show that this is generally true. ESP inlet PSDs indicate particle diameters range from approximately 0.3 μm to 10 μm with a median diameter of about 3.5 μm . Data for ESP Hopper #1 indicate particle sizes in approximately the 0.2 μm to 30 μm range with a median diameter of about 3 μm . The lack of particles in the 10 μm to 30 μm range at the ESP inlet reflects the exclusion of the cyclone precutter fraction from the PSD analysis.

Radionuclide Data

Results of the radionuclide analyses performed on the coal and ash streams, expressed in activity units of picocuries per gram of sample, are summarized in Tables 3-20 and 3-21, respectively. The highest levels of radionuclides were found in the APF and ESP ash samples, both of which show very similar results. All of the ash results are consistent with the relative amount found in the coal (i.e., species with the largest levels in the coal also show the largest levels in the ash streams).

Chromium (VI) Measurements

Results for the chromium (VI) samples collected at the ESP outlet are shown in Table 3-22. Background levels in the reagent blank accounted for greater than 65% of the chromium (VI) detected in the samples; therefore, the data presented in Table 3-22 have been corrected for background contributions. The samples were analyzed on site by IC to determine chromium (VI) concentrations and, subsequently, analyzed by ICP-AES to determine the total chromium concentrations. Total chromium results for the nitric acid rinses indicated all of the chromium was accounted for in the impinger solutions. The mean chromium (VI) concentrations represent about 27% of the total chromium concentrations measured in the ESP outlet gas.

Experience has shown that measurement of hexavalent chromium can be very difficult in electric utility flue gas. A brief discussion of the technical implications of determination of

Table 3-20
Coal Radionuclide (pCi/g)

Substance	Run 1	Run 2	Run 3	Mean	95% CI
Date					
Actinium-228 @338 KeV	ND(0.01)	0.15	0.21	0.12	0.26
Actinium-228 @911 KeV	0.15	0.15	0.07	0.12	0.11
Actinium-228 @968 KeV	0.16	ND(0.02)	0.22	0.13	0.27
Bismuth-212 @727 KeV	0.48	ND(0.31)	0.11	ND(0.31)	--
Bismuth-214 @1120.4 KeV	0.02	0.09	0.39	0.17	0.50
Bismuth-214 @1764.7 KeV	0.28	0.05	0.01	0.11	0.17
Bismuth-214 @609.4 KeV	0.22	0.27	0.28	0.26	0.24
K-40 @1460 KeV	1.3	1.6	2.0	1.6	1.6
Lead-210 @46 KeV	0.88	0.09	0.49	0.49	0.54
Lead-212 @238 KeV	0.08	0.12	0.3	0.17	0.33
Lead-214 @295.2 KeV	0.17	0.23	0.14	0.18	0.18
Lead-214 @352.0 KeV	0.34	0.32	0.15	0.27	0.23
Radium-226 @186.0 KeV	0.19	0.62	ND(0.1)	0.27	0.75
Thallium-208 @583 KeV	0.04	0.05	0.04	0.04	0.04
Thallium-208 @860 KeV	ND(0.14)	0.1	0.05	0.09	0.15
Thorium-234 @63.3 KeV	0.02	ND(0.1)	0.61	0.23	0.83
Thorium-234 @92.6 KeV	ND(0.1)	0.22	ND(0.08)	0.10	0.25
Uranium-235 @143.8 KeV	0.01	0.04	ND(0.01)	0.02	0.05

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

Table 3-21
Ash Stream Radionuclide (pCi/g, unless noted)

Substance	Bed Ash		Cyclone Ash		APF Ash		ESP Ash	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Actinium-228 @338 KeV	0.23	0.20	0.68	0.27	1.1	0.80	1.2	0.14
Actinium-228 @911 KeV	0.06	0.10	0.56	0.10	1.1	0.90	0.99	0.26
Actinium-228 @968 KeV	0.05	0.09	0.60	0.53	0.62	0.52	1.1	0.56
Bismuth-212 @727 KeV	0.21	0.08	0.71	1.5	1.2	1.9	1.3	0.74
Bismuth-214 @1120.4 KeV	0.47	0.65	1.1	0.25	2.1	2.4	1.8	0.52
Bismuth-214 @1764.7 KeV	0.42	0.29	0.97	0.38	2.1	2.8	1.6	0.14
Bismuth-214 @609.4 KeV	0.59	0.32	0.99	0.06	1.9	1.2	1.8	0.25
K-40 @1460 KeV	1.0	0.26	6.6	1.9	14	12	11	1.4
Lead-210 @46 KeV	0.28	0.63	1.3	1.4	4.0	3.0	4.8	8.9
Lead-212 @238 KeV	0.19	0.29	0.63	0.09	1.8	1.8	0.97	0.07
Lead-214 @295.2 KeV	0.51	0.20	1.0	0.15	1.7	1.4	1.8	0.38
Lead-214 @352.0 KeV	0.59	0.17	1.1	0.25	2.2	1.8	1.9	0.29
Radium-226 @186.0 KeV	1.0	1.3	2.0	1.3	3.3	4.0	2.6	1.1
Thallium-208 @583 KeV	0.06	0.07	0.22	0.07	0.42	0.33	0.36	0.14
Thallium-208 @860 KeV	ND(0.28)	--	ND(0.44)	--	0.25	0.78	0.28	0.29
Thorium-234 @63.3 KeV	0.99	1.6	1.0	1.8	3.5	3.9	1.6	1.7
Thorium-234 @92.6 KeV	0.14	0.27	0.48	1.0	0.50	1.5	0.70	0.88
Uranium-235 @143.8 KeV	0.07	0.08	0.12	0.07	0.21	0.24	0.16	0.07

Table 3-22
Chromium (VI) and Total Chromium Results for the ESP Outlet ($\mu\text{g}/\text{Nm}^3$)

Substance	Method	Run 1 4/12/94	Run 2 4/13/94	Run 3 4/14/94	Mean	95% CI
Chromium (VI) (impinger)	IC	2.2 ^a	0.96 ^a	1.0 ^a	1.4	1.7
Total Chromium (impinger solution)	ICP-AES	5.1	ND(1.1)	9.8	5.2	11
Total Chromium (nitric acid rinse)	ICP-AES	ND(0.2)	ND(0.2)	ND(0.4)	ND(0.4)	--
Total Chromium (Method 29)	ICP-AES ICP/MS	3.1	2.7	5.5	3.7	3.7

^a Background concentrations in the reagent blank were $\geq 65\%$ of the sample values. Results have been corrected for background levels.

CI = Confidence interval.

ND = Not detected at the concentration in parentheses.

chromium (VI) in stack gas and, in particular, in combustion sources and utility sources is included here. Additional details regarding chromium (VI) sampling are included in Appendix A.

The chromium (VI) method depends on the solubility and stability of chromium (VI) in basic aqueous solution. The method calls for the use of a strong base in a solution contained in the impingers and recycled to the probe tip for early gas contact and flushing to the probe walls. The method is theoretically sound but has some limitations when applied to combustion sources in general and utility flue gases specifically.

As mentioned above, chromium (VI) is stable in a strong alkaline solution ($\text{pH} > \sim 9$), but all combustion gas streams contain large amounts of CO_2 (10-20%), which is an acid gas, and serves to lower the pH of the impinger solution. As a result, the pH may dip lower than desirable during sampling. As a further complication, utility flue gas contains significant levels of SO_2 (100 ppm or more). SO_2 is also an acid gas but is a reductant as well, so the impinger solution designed to absorb chromium (VI) also absorbs CO_2 and SO_2 . The result of this is a lowered pH and a solution which contains an oxidant [chromium (VI)] and a reductant ($\text{SO}_2/\text{HSO}_3^-$). As the pH falls, the redox couple becomes more favorable, and any chromium (VI) present may be reduced by $\text{SO}_2/\text{HSO}_3^-$ and not detected as chromium (VI).

4

DATA EVALUATION

Three methods were used to evaluate the quality of data obtained from the tests at Plant Tidd. First, the process data were examined to determine if the unit was operating at normal, steady-state conditions during the test periods. Second, the QA/QC protocol for sampling and analytical procedures (i.e., equipment calibration and leak checks, duplicate analyses, blanks, spikes, standards, etc.) was evaluated. In addition, QC sample results (presented in Appendix D) were compared with project objectives. Third, material balances were calculated for various systems within the plant. 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 During Testing

Process operating data were examined to ensure that operation was stable during the sampling periods. Measurements were available in five-minute intervals from the plant computerized data acquisition system. Table 4-1 shows the mean value and coefficient of variation (CV, standard deviation divided by the mean) for key process parameters associated with the combustor, ESP, and APF systems. In addition, process data trend plots are included in Appendix E.

The CVs were calculated to evaluate process stability. Steady combustor operation was maintained during each of the test runs, as indicated by the low CVs for the total load, the coal paste feed rate, the mean bed temperature, and the bed outlet oxygen levels (see Table 4-1). The sorbent feed rate (CVs of 18 to 24%) showed greater variability than the other combustor parameters. However, this amount of variability is typical of normal operation

Table 4-1
Summary of Process Monitoring Data

	Units of Measure	Run 1 04-12-94		Run 2 04-13-94		Run 3 04-14-94		Run 4 04-15-94	
		Mean	CV (%)	Mean	CV (%)	Mean	CV (%)	Mean	CV (%)
Combustor Parameters									
Total Load	MW	46	2.1	46	1.9	45	1.9	46	2.7
Steam Turbine Load	MW	38	2.2	37	2.1	37	2.1	38	2.5
Gas Turbine Load	MW	8.3	4.2	9.0	3.6	8.0	3.4	8.0	6.0
Coal Paste Feed Rate	10 ³ lb/hr ^a	45	1.5	45	1.5	44	1.8	45	2.2
Sorbent Feed Rate	10 ³ lb/hr ^a	18	18	21	21	19	19	18	24
Mean Bed Temperature	°F	1499	0.3	1497	0.3	1497	0.3	1497	0.3
Bed Level	inches	122	1.3	115	0.5	113	0.4	112	0.9
Bed Outlet Oxygen	% vol.	6.9	4.0	7.0	4.1	6.9	4.3	6.5	6.0
ESP Parameters									
ESP Outlet Opacity	%	10	7.5	10	4.3	10	8.6	11	6.0
ESP Outlet CO	ppmv	33	30	35	15	34	23	36	16
ESP Outlet SO ₂	ppmv	182	10	178	12	179	11	181	13
ESP Outlet NO _x	ppmv	143	9	145	10	138	10	137	10
ESP Outlet Oxygen	% vol.	7.0	1.7	7.0	2.2	7.0	2.8	6.6	2.7
ESP Outlet Temperature	°F	404	0.2	403	0.3	405	0.3	403	0.4
APF Parameters									
APF Inlet Temperature	°F	1352	0.8	1364	0.8	1347	1.7	1359	1.1
APF Outlet Temperature	°F	1322	0.6	1328	0.9	1329	1.8	1322	1.0
APF Differential Pressure	inches H ₂ O	116	5	117	5	116	6	118	6

^a Feed rate reported on an "as fired" basis.

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

since the sorbent feed system cycles between the east and west feeder systems approximately every 2 1/2 hours. The total load was controlled at approximately 46 MW throughout the test period which is representative of stable, long-term operation.

Stable ESP operations were also indicated by the low CVs for ESP outlet opacity. ESP outlet CO (CVs of 15 to 30%) and SO₂ levels (CVs of 10 to 13%) were typically more variable than other parameters. ESP outlet SO₂ levels increased for a short period each time the sorbent feed system switched from the east feeder to the west feeder. These fluctuations are typical of normal operation.

Data for APF system parameters indicate stable operation of this system during all test periods. APF differential pressure measurements indicate that the APF pulse-cleaning cycle was approximately 30 minutes during all tests. APF inlet gas temperatures were approximately 200°F cooler than design (1350°F versus 1550°F) because tempering air was added to the system during the test period. The cooler gas temperature and reduced load during the tests made it necessary to adjust the gas sampling rate through the gas cooling apparatus at both the APF inlet and outlet. Since the gas cooling system was designed for an inlet gas temperature of 1550°F and a unit load of 70 MW; a reduction in the gas sampling rate was necessary to ensure that an isokinetic sampling rate was maintained at these locations.

Sample Collection

Appendix A describes the sampling procedures used at Plant Tidd. Several factors indicate representative sample collection. First, the key components of the sampling equipment—pitot tubes, thermocouples, orifice meters, dry gas meters, and sampling nozzles—had been calibrated before use in the field; the calibrations are on file at Radian Corporation. Second, the sampling runs were well documented. Third, all flue gas samples (except one) were collected at rates between 90 and 110% of the isokinetic rates. Fourth, sufficient data were collected using standard sampling and analytical methods to ensure acceptable data completeness and the comparability of the measurements.

Following are some significant observations about sample collection:

- The multi-metals and anions samples collected at the APF inlet during Run 1 (4/12/94) were voided because of breakthrough of particulate matter across the thimble filter into the impinger solutions. The higher than expected particulate loading exceeded the capacity of the filter, resulting in filter gasket failure and particle penetration. During subsequent runs, additional filters were added in series to prevent breakthrough. The completeness objective of three valid runs was met despite this problem.
- The sampling systems at the APF inlet and outlet were designed to allow gas samples to cool only after the gas entered the recoverable quartz tubing portion of the sampling train. However, the quartz tubing broke repeatedly during the initial test runs because the quartz tube ball joint could not withstand the thermal stresses at 600°F. To solve this problem, the heat tracing tape was removed from the sample line downstream of the orifice meter to allow the gas to cool slightly. Skin temperatures at the header sample valves were typically 250-350°F after this modification. Because most of the quartz tubes were broken during the initial test, subsequent tests at the APF locations were conducted by connecting the Teflon® tubing directly to the sample valves. This modification should have no measurable effect on the results.

Analytical Quality Control Results

Quality control (QC) information obtained for the Tidd PFBC HAPs project is related to measurement precision, accuracy (which includes 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 QC 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. Table 4-2 summarizes the QC measures used as part of the data evaluation protocol and the characteristic information obtained. The absence of any of these types of quality QC checks 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 placing an estimate of confidence in the results.

Different QC checks provide different types of information, particularly pertaining to the sources of inaccuracy, imprecision, and blank effects, as shown in Table 4-2. As part of the Tidd PFBC HAPs project, measurement precision and accuracy are typically estimated from

Table 4-2
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	Similar to 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 organic compound analyses.
Method blank	Blank effects inherent in the analytical method, including reagents and equipment.
Reagent blank	Blank effects from reagents used.

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 programs are compared with data quality objectives (DQOs) established for this project.

The DQOs are not intended to be used as validation criteria but as empirical estimates of the precision and accuracy that would be expected from existing reference measurement methods that are 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 objectives are not necessarily unacceptable. Rather, 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 should be considered in light of the intended use of the data.

A summary of the types of QC data evaluated for this project is presented in Table 4-3. Appendix D presents detailed quality control sample results for blank samples (Table D-1), precision and accuracy measurements (Table D-2), and organic surrogate-spiked samples (Table D-3). In each table, the sample type, sample matrix, and sample stream are provided to identify the process samples directly related to the QC results. Most of the QC results met the project objectives.

Blank samples include laboratory method blanks, field blanks, and reagent/trip blanks. Laboratory method blank results are presented for samples where a digestion or other sample preparation technique is performed by the laboratory. Method blanks are performed with the preparation reagents only and the results indicate the potential level of contamination derived from the preparation method alone.

Field blanks are samples collected in the field that have undergone all preparation and handling steps with no exposure to samples. Typically this applies only to the gas samples where the sampling train is prepared, leak checked, and recovered with no sample gas introduced. Field blank results provide an indication of potential contamination from field

Table 4-3
Types of Quality Control Data

Analysis (Grouped by Source/Matrix)	Precision			Accuracy					Blank			
	Dup Field Samples	Dup Lab Analysis	Matrix or Media Spiked Dup	Lab Control Sample Dup	Matrix or Media Spike	Surrogate Spike	Lab Control Sample	Standard Reference Material	Field Blank	Trip Blank	Method Blank	Reagent Blank
Gas Streams												
Metals - Vapor Phase			✓	✓	✓		✓		✓		✓	✓
Metals - Solid Phase			✓	✓	✓		✓	✓	✓		✓	✓
Anions - Vapor Phase			✓	✓	✓		✓		✓		✓	✓
Anions - Solid Phase			✓	✓	✓		✓		✓		✓	✓
Chromium (VI)			✓		✓		✓		✓			✓
Total Chromium			✓		✓		✓		✓		✓	✓
Volatile Organics						✓	✓		✓	✓	✓	
Semivolatile Organics						✓			✓	✓		
Formaldehyde		✓			✓				✓		✓	✓
Ammonia			✓		✓		✓		✓		✓	✓
Cyanide			✓		✓		✓		✓		✓	✓
PAHs						✓			✓	✓	✓	
PCDD/PCDF						✓			✓			
Coal												
Metals	✓	✓						✓				
Radionuclides	✓											
Anions	✓	✓						✓				
Ultimate/Proximate	✓							✓				

Table 4-3 (Continued)

Analysis (Grouped by Source/Matrix)	Precision				Accuracy				Blank			
	Dup Field Samples	Dup Lab Analysis	Matrix or Media Spiked Dup	Lab Control Sample Dup	Matrix or Media Spike	Surrogate Spike	Lab Control Sample	Standard Reference Material	Field Blank	Trip Blank	Method Blank	Reagent Blank
Bed Ash and Fly Ash												
Metals	✓		✓		✓			✓			✓	
Anions	✓		✓		✓			✓			✓	
Radionuclides	✓											
Semivolatile Organics	✓		✓		✓	✓	✓				✓	
PCDD/PCDF	✓					✓					✓	
Carbon	✓											
Particle Size Dist.	✓											
Service Water												
Metals	✓		✓		✓		✓				✓	
Anions	✓		✓		✓		✓				✓	
Dolomite Sorbent												
Metals	✓		✓		✓		✓				✓	
Anions	✓		✓		✓		✓				✓	

reagents, sample recovery, airborne contaminants, and any analytical preparation method; however, the identification of any one contaminant source is not possible.

Reagent blanks are samples of the prepared reagents or sampling media used to collect field samples. Blank filters, XAD resin, prepared impinger solutions, and VOST tubes are all examples of reagent blanks. Reagent blank results help identify the amount of target analytes present in the samples due specifically to the reagent or sampling media itself.

Analytical precision measurements for inorganic analytes are derived from matrix spiked and/or standard sample results. Results of duplicate sample and duplicate matrix spike sample analyses are used to assess analytical precision. Table D-2 presents the results of these analyses. QC results that are outside the specified data quality objectives are flagged and indicate the potential for analytical bias or imprecision. Surrogate spike samples are limited to the analysis of organic compounds and are used to assess analytical accuracy (Table D-3).

A performance audit was conducted as an independent check to evaluate the data produced. The performance audit addressed the chemical analysis of the samples collected and the physical measurements supporting the field sampling effort. The laboratories conducting the analyses were given performance audit samples prepared by spiking representative sample matrices with target analytes at representative concentration levels. Results for the audit samples for the field and laboratory activities were compiled and discussed in an audit report submitted to the project team on July 15, 1994. Table 4-4 presents a summary of analytical results for the audit samples. A list of concerns was presented as a part of that report. The concerns, as stated in the report, are listed below followed by the response from the project team (in italics).

- Particulate matter collection efficiency in the QC audit sample at the ESP inlet was 50 percent.

Incomplete rinsing or recovery of solids deposited in the probe and/or filter losses during disassembly of the filter holder are likely contributors to low sample recovery. In this

Table 4-4
Analytical Results for Audit Samples

Lab ^a	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
Multi-Metals Trains								
Radian	AEP-QD02MMFD AEP-QD02MMAF	Filter Acetone PNR	Particulate Weight	gram	0.0601	0.1198	50	NS
Radian	AEP-QD02MMAF	Acetone PNR	Aluminum	µg/g	97,715	140,000	70 Q	75-125
	AEP-QD02MMNR	HNO ₃ PNR	Antimony	µg/g	ND	7	NA	75-125
	AEP-QD02MMFD	Filter	Arsenic	µg/g	180	145	124	75-125
			Barium	µg/g	854	1,500	57 Q	75-125
			Beryllium	µg/g	9.9	12	82	75-125
			Cadmium	µg/g	9.19	1	919 Q	75-125
			Calcium	µg/g	14,147	11,100	127 Q	75-125
			Chromium	µg/g	149	196	76	75-125
			Cobalt	µg/g	23.4	46	51 Q	75-125
			Copper	µg/g	123	118	104	75-125
			Iron	µg/g	46,995	94,000	50 Q	75-125
			Lead	µg/g	60.2	72.4	83	75-125
			Magnesium	µg/g	5,033	4,550	111	75-125
			Manganese	µg/g	131	190	69 Q	75-125
			Mercury	µg/g	0.192	0.16	120	75-125
			Molybdenum	µg/g	37.3	29	129 Q	75-125
			Nickel	µg/g	111	127	87	75-125
			Phosphorus	µg/g	ND	NA	NA	75-125
			Potassium	µg/g	13,463	18,800	72 Q	75-125
			Selenium	µg/g	18.1	10.3	175 Q	75-125
			Silver	µg/g	ND	NA	NA	75-125
			Sodium	µg/g	1,586	1,700	93	75-125
			Titanium	µg/g	5,808	8,000	73 Q	75-125
			Vanadium	µg/g	229	300	76	75-125
Radian	AEP-QD01MMHT	HNO ₃ Impingers	Aluminum	mg/L	0.0101	NA	NA	75-125
			Antimony	mg/L	0.183	0.20	91	75-125
			Arsenic	mg/L	1.85 ^a	2.00	92	75-125
			Barium	mg/L	0.190	0.20	95	75-125
			Beryllium	mg/L	0.210	0.20	105	75-125
			Boron	mg/L	0.0385	NA	NA	75-125
			Cadmium	mg/L	0.296 ^a	0.20	148 Q	75-125
			Calcium	mg/L	0.302	0.20	151 Q	75-125
			Chromium	mg/L	1.72	2.00	86	75-125
			Cobalt	mg/L	0.191	0.20	95	75-125
			Copper	mg/L	0.437	0.50	87	75-125
			Iron	mg/L	ND	NA	NA	75-125

Table 4-4 (Continued)

Lab	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
Radian	AEP-QD01MMHT	HNO ₃ Impingers	Lead	mg/L	1.91 ^a	2.00	95	75-125
			Magnesium	mg/L	0.186	0.20	93	75-125
			Manganese	mg/L	0.221	0.20	110	75-125
			Mercury	mg/L	4.36	5.00	87	75-125
			Molybdenum	mg/L	0.154	0.20	77	75-125
			Nickel	mg/L	0.444	0.50	89	75-125
			Phosphorus	mg/L	ND	NA	NA	75-125
			Potassium	mg/L	2.85	0.20	1,425 Q	75-125
			Selenium	mg/L	0.175 ^a	0.20	87	75-125
			Silver	mg/L	0.0269	0.20 ^b	NA ^b	75-125
			Sodium	mg/L	0.642	0.20	321 Q	75-125
			Titanium	mg/L	0.00294	NA	NA	75-125
			Vanadium	mg/L	0.443	0.5	89	75-125
Harvard ICP/MS	AEP-QD02MMHT	HNO ₃ Impingers	Antimony	µg/L	3.48	5.0	70 Q	75-125
			Arsenic	µg/L	8.97	10.0	90	75-125
			Barium	µg/L	10.66	10.0	107	75-125
			Beryllium	µg/L	11.45	10.0	114	75-125
			Cadmium	µg/L	9.40	10.0	94	75-125
			Chromium	µg/L	9.37	10.0	94	75-125
			Cobalt	µg/L	8.80	10.0	88	75-125
			Copper	µg/L	8.80	10.0	88	75-125
			Lead	µg/L	9.49	10.0	95	75-125
			Manganese	µg/L	9.23	10.0	92	75-125
			Mercury	µg/L	10.78	10.0	108	75-125
			Molybdenum	µg/L	5.26	5.0	105	75-125
			Nickel	µg/L	6.97	10.0	70 Q	75-125
			Selenium	µg/L	6.20	10.0	62 Q	75-125
			Vanadium	µg/L	9.41	10.0	94	75-125
Radian	AEP-QD01MMHI	KMnO ₄ Impingers	Mercury	mg/L	0.479	0.400	120	75-125
Anions Train								
Radian	AEP-QD01ANIT	Na ₂ CO ₃ /NaHCO ₃ Impingers	Chloride	mg/L	284	297	96	80-120
			Fluoride	mg/L	9.22	9.8	94	80-120
			Sulfate	mg/L	8,680	10,000	86	80-120

Table 4-4 (Continued)

Lab	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
Ammonia/Cyanide Train								
Radian	AEP-QD01NHIP	H ₂ SO ₄ Impinger	Ammonia	mg/L	1.31	0.27	485 Q	80-120
Radian	AEP-QD01NHIP	ZnOAc Impinger	Cyanide	mg/L	0.0257	0.10	26 Q	75-125
Chromium (VI) Trains								
Radian	AEP-QD01CRIP	KOH Impinger	Chromium(VI)	µg/L	19.35	16	121	75-125
Radian	AEP-QD01CRIP	KOH Impinger	Tot. Chrome	µg/L	22	16	138 Q	75-125
Service Water								
Radian	AEP-QD01SWMM	Service Water	Aluminum	mg/L	0.126	NA	NA	75-125
			Antimony	mg/L	1.06	0.99	107	75-125
			Arsenic	mg/L	0.870 ^a	1.00	87	75-125
			Barium	mg/L	0.0021	NA	NA	75-125
			Beryllium	mg/L	0.97	0.96	101	75-125
			Boron	mg/L	0.314	NA	NA	75-125
			Cadmium	mg/L	0.853 ^a	0.94	91	75-125
			Calcium	mg/L	1.12	1.00	112	75-125
			Chromium	mg/L	0.976	1.03	95	75-125
			Cobalt	mg/L	0.954	1.00	95	75-125
			Copper	mg/L	0.996	1.03	97	75-125
			Iron	mg/L	1.02	1.02	100	75-125
			Lead	mg/L	0.934 ^a	1.01	92	75-125
			Magnesium	mg/L	0.968	1.06	91	75-125
			Manganese	mg/L	0.978	1.02	96	75-125
			Molybdenum	mg/L	1.00	1.06	94	75-125
			Nickel	mg/L	0.979	1.02	96	75-125
			Phosphorus	mg/L	ND	NA	NA	75-125
			Potassium	mg/L	0.0968	NA	NA	75-125
			Selenium	mg/L	0.936 ^a	0.99	94	75-125
			Silver	mg/L	ND	NA	NA	75-125
			Sodium	mg/L	0.286	NA	NA	75-125
			Titanium	mg/L	0.936	1.01	93	75-125
			Vanadium	mg/L	0.966	1.01	96	75-125
Radian	AEP-QD02SWMM	Service Water	Mercury	mg/L	0.0724	0.08	90	75-125
Radian	AEP-QD01SWAN	Service Water	Chloride	mg/L	31.0	33.0	94	80-120
			Fluoride	mg/L	1.91	1.7	112	80-120
			Sulfate	mg/L	44.4	50.0	89	80-120
			Phosphate	mg/L	ND	NA	NA	80-120

Table 4-4 (Continued)

Lab	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
Dolomite Sorbent								
Radian	AEP-QD00SOAN	Sorbent	Aluminum	µg/g	60.4	1,193	5 Q	75-125
			Antimony	µg/g	ND	NA	NA	75-125
			Arsenic	µg/g	3.48 ^a	NA	NA	75-125
			Barium	µg/g	1.89	NA	NA	75-125
			Beryllium	µg/g	0.0108	NA	NA	75-125
			Boron	µg/g	ND	NA	NA	75-125
			Cadmium	µg/g	0.587	NA	NA	75-125
			Calcium	µg/g	191,000	215,000	89	75-125
			Chromium	µg/g	1.51	NA	NA	75-125
			Cobalt	µg/g	ND	NA	NA	75-125
			Copper	µg/g	0.900	NA	NA	75-125
			Iron	µg/g	1,400	1,960	71 Q	75-125
			Lead	µg/g	0.220 ^a	NA	NA	75-125
			Magnesium	µg/g	108,000	127,800	85	75-125
			Manganese	µg/g	161	232	69 Q	75-125
			Mercury	µg/g	ND	NA	NA	75-125
			Molybdenum	µg/g	0.0676	NA	NA	75-125
			Nickel	µg/g	0.0186	NA	NA	75-125
			Phosphorus	µg/g	ND	43	NA	75-125
			Potassium	µg/g	60.8	996	6 Q	75-125
			Selenium	µg/g	1.81 ^a	NA	NA	75-125
			Silver	µg/g	ND	NA	NA	75-125
			Sodium	µg/g	50.6	74	68 Q	75-125
			Titanium	µg/g	7.41	120	6 Q	75-125
			Vanadium	µg/g	3.63	NA	NA	75-125
			Chloride	µg/g	0	NA	NA	75-125
			Fluoride	µg/g	14.9	NA	NA	75-125
Coal Paste								
CT&E	AEP-QD00GCCM	Coal	Arsenic	µg/g	8.5	10.3	82	75-125
			Barium	µg/g	32	32.76	98	75-125
			Beryllium	µg/g	1.2	1.33	90	75-125
			Boron	µg/g	71	72.3	98	75-125
			Cadmium	µg/g	0.10/0.08	0.11	91	75-125
			Calcium	µg/g	900	861	104	75-125
			Chromium	µg/g	17	16.3	104	75-125
			Copper	µg/g	7.5	8.47	88	75-125

Table 4-4 (Continued)

Lab	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
CT&E	AEP-QD00GCCM	Coal	Lead	µg/g	7	6.00	117	75-125
			Magnesium	µg/g	470	420	112	75-125
			Mercury	µg/g	0.20	0.14	143 Q	75-125
			Molybdenum	µg/g	<3	2.19	NA	75-125
			Phosphorus	µg/g	38	NA	NA	75-125
			Selenium	µg/g	0.8	1.83	44 Q	75-125
			Titanium	µg/g	660	690	96	75-125
			Chloride	µg/g	1,230	860	143	75-125
			Fluoride	µg/g	70	58	121	75-125
			Carbon	%	72.33	72.08	100	75-125
			Hydrogen	%	4.76	4.96	96	75-125
			Nitrogen	%	1.43	1.39	103	75-125
			Sulfur	%	3.28	3.26	101	75-125
			Ash	%	11.94	11.56	103	75-125
			HHV	Btu/lb	12,923	12,888	100	75-125
NC State	AEP-QD00GCCM	Coal	Aluminum	µg/g	14,734	13,075	113	75-125
			Antimony	µg/g	0.543	0.64	85	75-125
			Arsenic	µg/g	18.97	10.33	184 Q	75-125
			Barium	µg/g	57.9	32.76	177 Q	75-125
			Cadmium	µg/g	2.087	0.11	1,897 Q	75-125
			Calcium	µg/g	1785	861	207 Q	75-125
			Chromium	µg/g	20.6	16.30	126 Q	75-125
			Cobalt	µg/g	5.75	5.50	104	75-125
			Copper	µg/g	12.2	8.47	144 Q	75-125
			Iron	µg/g	22,314	20,031	111	75-125
			Magnesium	µg/g	631	420	150 Q	75-125
			Manganese	µg/g	20.9	18.35	114	75-125
			Mercury	µg/g	0.058	0.14	41 Q	75-125
			Molybdenum	µg/g	0.628	2.19	29 Q	75-125
			Nickel	µg/g	16.2	14.07	115	75-125
			Potassium	µg/g	1,859	1,762	105	75-125
			Selenium	µg/g	1.96	1.83	107	75-125
			Silver	µg/g	0.303	NA	NA	75-125
			Sodium	µg/g	344	367	94	75-125
			Titanium	µg/g	1013	690	147 Q	75-125
			Vanadium	µg/g	35.8	31.01	115	75-125

Table 4-4 (Continued)

Lab	Sample ID	Matrix	Analyte	Units	Lab Result	Reference Value	Percent Recovery	Audit Objective
ESP Ash, APF Ash, Bed Ash, Cyclone Ash								
Radian	AEP-QD00FAMM	Ash	Aluminum	µg/g	107,000	140,000	76	75-125
			Antimony	µg/g	ND	7	NA	75-125
			Arsenic	µg/g	174 ^a	145	120	75-125
			Barium	µg/g	1,120	1,500	75	75-125
			Beryllium	µg/g	10.3	12	86	75-125
			Cadmium	µg/g	1.06 ^a	1.0	106	75-125
			Calcium	µg/g	8,090	11,100	73 Q	75-125
			Chromium	µg/g	171	196	87	75-125
			Cobalt	µg/g	44.4	46	96	75-125
			Copper	µg/g	88.8	118	75	75-125
			Iron	µg/g	78,200	94,000	83	75-125
			Lead	µg/g	71.0 ^a	72.4	78	75-125
			Magnesium	µg/g	3,020	4,550	66	75-125
			Manganese	µg/g	138	190	73 Q	75-125
			Mercury	µg/g	0.180	0.16	112	75-125
			Molybdenum	µg/g	20.7	29	71 Q	75-125
			Nickel	µg/g	110	127	87	75-125
			Phosphorus	µg/g	ND	NA	NA	75-125
			Potassium	µg/g	16,000	18,800	85	75-125
			Selenium	µg/g	11.7 ^a	10.3	114	75-125
			Silver	µg/g	0.147	NA	NA	75-125
			Sodium	µg/g	1,430	1,700	84	75-125
			Titanium	µg/g	726.0	8,000	91	75-125
			Vanadium	µg/g	269	300	90	75-125
Radian	AEP-QD00FAAN	Ash	Chloride	µg/g	0.0	NA	NA	80-120
			Fluoride	µg/g	38.2	NA	NA	80-120

^a Analytical result from GFAAS method.^b Silver precipitated in the solution during audit sample preparation; this result should be used for qualitative assessment only.

NA = Not applicable or not able to be calculated.

ND = Not detected.

NS = None specified.

Q = Outside of audit objective for recovery.

sample, the unrecovered mass was approximately 0.05 gram. At the ESP inlet where the recovered particulate mass for actual samples was approximately 5 grams, this amount of sample loss is not significant. However, at the ESP outlet where the recovered particulate mass was much lower, sample losses or incomplete particulate recovery may be more significant. Since a particulate audit sample was not collected by the sampling team at the ESP outlet, their recovery technique cannot be assessed.

- Ammonia QC audit sample recovery was 485% at 0.27 mg/L, outside the accuracy objective of 80-120 percent. Cyanide QC audit sample recovery was 26% at 0.10 mg/L, also outside the accuracy objective of 80-120 percent.

The ammonia audit sample was prepared in fresh impinger solution and required a five-fold dilution to reduce acidity prior to distillation and analysis. Since the audit sample concentration was prepared near the method detection limit, sample dilution lowered the concentration to a level where there is a greater degree of uncertainty in the analytical result. Actual field samples did not require dilution and the QC results for matrix spikes and matrix spike duplicates indicate excellent analytical precision and recovery.

The cyanide audit sample was prepared using an EPA water quality standard as the source material. An investigation of possible causes for low recovery revealed that a complex form of cyanide (iron ferricyanide) was used in the EPA standard which is susceptible to photodegradation. In the event the source material was exposed to sunlight prior to audit sample preparation, photodegradation may explain the low recovery, although there is no evidence to confirm this. In the laboratory, field samples were spiked with a cyanide salt solution (free cyanide) which more closely simulates the dissociation of HCN in solution. The recovery results for these matrix spike samples indicate excellent analytical precision and accuracy. However, firm conclusions regarding the accuracy of the cyanide analysis cannot be made based on the audit sample results.

- Eleven target metals (Al, Ba, Ca, Cd, Co, Fe, Mn, Mo, K, Se, and Ti) did not meet the recovery objective for the particulate matter audit sample.

Quartz filter blanks are analyzed along with the samples to determine the background metal concentrations contributed by the filter media. Blank results equilibrated to the tare weight of the sample filters are subtracted from the samples to determine the filtered particulate metal concentrations. In some cases, the result is the difference between two relatively high, or similarly low concentrations thereby increasing the uncertainty of the background-corrected result.

- Four target metals (Ca, Cd, K, and Na) did not meet the recovery objective for the vapor-phase metals impinger audit sample analyzed by ICP-AES and GFAAS.

Audit sample concentrations were near the ICP-AES detection limit for sodium and potassium. The reasons for high recovery of calcium and cadmium are unknown; however, the matrix spike recoveries for these elements were within the recovery objective

range. The metal concentrations in the audit sample prepared for ICP-AES and GFAAS analysis were between 200 and 5000 parts per billion (ppb). These concentrations were significantly higher than the actual sample concentrations, but were made that way to provide detectable concentrations for these techniques. Cadmium results by ICP/MS were selected for reporting since audit results for cadmium by ICP/MS met the data quality objectives.

- Three target metals (Sb, Ni, and Se) did not meet the recovery objective for the vapor-phase metals impinger audit sample submitted to Harvard for ICP/MS analysis.

The metal concentrations prepared in the audit sample for ICP/MS analysis were 5 and 10 ppb, much closer to the actual sample concentrations and therefore more representative of the technique's performance on the gas impinger samples. Antimony and nickel were recovered at 70%, slightly lower than the 80% recovery objective; however, matrix spike recoveries for these elements were within the desired range and demonstrate acceptable accuracy in the sample matrix.

The quantitation of selenium is subject to interferences from the argon plasma in ICP/MS. Low recovery (62%) is caused by incomplete resolution of the selenium mass peak at 79 atomic mass units (amu) from the much larger Ar-Ar mass peak at 80 amu. Selenium recovery in the matrix spike was also low at 71 percent. These results indicate that vapor-phase selenium results may be biased low.

- Six target metals (Al, Fe, Mn, K, Na, and Ti) did not meet the recovery objective for the dolomite sorbent audit sample.

Dolomite samples were digested with nitric acid and hydrogen peroxide by EPA Method SW-3050. This procedure is generally adequate for the digestion of calcium and magnesium, which accounts for 99% of the sample matrix. The amounts of major coal ash minerals (silica, alumina, titania, etc.) are relatively small and do not affect the material balances for these elements. The digestion procedure applied here does not use hydrofluoric acid (HF) which is required to dissolve the oxides of aluminum, silicon, titanium, and others that may be bound in the inert matrix. A mixed acid digestion which includes HF should be considered for future laboratory analyses if the level of inert substances is thought to be a significant contributor to the mass flow rates of these materials.

- Two target metals (Hg and Se) did not meet the recovery objective for the coal audit sample submitted to CT&E.

The coal audit sample selected for this project was taken from coal collected at the Ohio Power Cardinal Station as part of a recent round robin coal study sponsored by the Department of Energy.¹ This coal audit sample is not a standard reference material; however, it has been well characterized for all of the target analytes, and it is representative of the Pittsburgh #8 bituminous coal feedstock at Plant Tidd.

The variability inherent in coal mercury measurements was demonstrated in the DOE round robin study and has been the subject of studies sponsored by the Electric Power Research Institute (EPRI) and others.² Although the recovery of mercury by the double gold amalgamation technique was 143% of the mean value reported, it is within two standard deviations of the mean for all results reported in the round robin study. These results reflect the variability and uncertainty typically encountered with coal mercury determinations.

Selenium values by GFAAS were not selected for reporting as a result of the audit sample recovery. The INAA results for selenium were selected since the audit sample recovery by INAA was within the recovery objective at 107 percent.

- *Ten target metals (As, Ba, Ca, Cd, Cr, Cu, Mg, Hg, Mo and Ti) did not meet the recovery objective for the coal audit sample submitted to NC State.*

All elements not meeting the audit sample recovery objectives for INAA were analyzed by alternative analytical procedures. The results reported from the alternative procedures were within the recovery objectives and were reported in lieu of the INAA results with the exception of arsenic.

INAA results for arsenic were selected for reporting over those determined by GFAAS in spite of the apparent failure of INAA to meet the desired recovery objectives. Based on the audit sample recovery data, GFAAS results were initially selected for calculating material balance closures. However, the use of GFAAS arsenic values resulted in a closure of 213%, while a closure of 129% was obtained using INAA arsenic values. Since audit sample recovery results were used to select the most accurate data for reporting, the individual results used to determine the mean arsenic value of the coal audit sample were reviewed for consistency and accuracy. Twenty-two results for arsenic were averaged to obtain a mean concentration of 10.3 µg/g (CV = 0.33). The analytical methods used to measure arsenic in the round robin study included GFAAS, ICP/MS, INAA, and cold vapor atomic fluorescence (CVAF). Based on arsenic results obtained for an SRM coal sample analyzed with the round robin samples, ICP/MS results were the most accurate and consistent, followed by INAA results. The average arsenic result of the audit sample as determined by ICP/MS in the round robin study was 13.28 µg/g. The arsenic result by INAA in the audit sample was 18.97 µg/g or 143% of the ICP/MS average. Although this result still suggests a high analytical bias, supporting information indicates that the INAA result for arsenic is more accurate than the GFAAS result. It is also reasonable to expect that the direct analysis of coal by INAA would provide more complete quantitation of arsenic. This is based on the volatile nature of this element and the potential for losses during sample digestion for GFAAS analysis.

- *Three target metals (Ca, Mn, and Mo) did not meet the recovery objective for the fly ash audit sample.*

The recovery percentages for Ca, Mn, and Mo are 73%, 73%, and 71%, respectively. These are very close to the recovery objective of 75% and indicate a possible analytical

bias. Sample digestion is assumed complete based on the 91% recovery of titanium. Measurement results for Ca, Mn, and Mo may be biased slightly low in ash streams.

Detailed QC Results

Precision is a measure of the reproducibility of measurements under a given set of conditions. It reflects the distribution or scatter of the data and is expressed 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 agreement between a value generated by a specific procedure and the assumed or accepted known value and includes both bias and precision. Bias is the persistent positive or negative deviation of the method average value from the assumed or accepted known 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 the 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 concentration of the analyte in the sample before spiking, but it does provide an indication of a method's ability to accurately measure an analyte in a given sample matrix.

Representativeness expresses the degree to which the sampling data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is improved by making certain that sampling locations are properly selected and that a sufficient number of samples are collected.

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

standard techniques (wherever possible) to collect and analyze representative samples and by reporting analytical results in appropriate units. Data sets can be compared with confidence when the precision and accuracy are known.

Completeness is an expression of the number of valid measurements obtained compared with the number planned for a given study. The goal to generate three valid sample results for each measurement parameter was met.

A discussion of the overall measurement precision, accuracy, and blank effects is presented below for each set of analytes. The individual QC sample results used to assess these analytical measurements are presented in Appendix D. This assessment of data quality is limited to the analytical techniques used to determine the results selected for reporting.

Metals

Precision. The analysis of matrix spike/matrix spike duplicate (MS/MSD) samples, or analytical duplicate samples provided the basis for assessing analytical precision. The precision objective for metals in all samples was 20% RPD.

In general, good analytical precision is indicated for almost all of the target metals in all sample matrices. Noteworthy exceptions include cadmium in coal by GFAAS (22% RPD), calcium in dolomite (45% RPD), silver in ash (70% RPD), and selenium in both gas particulate- and vapor-phase samples by GFAAS. Poor analytical precision for these metals in these streams increases the uncertainty associated with the measured value.

Other metals failing to meet the precision objective include aluminum (71% RPD), calcium (34% RPD), and magnesium (63% RPD) in an acetone probe/nozzle rinse (PNR) sample, and phosphorus (43% RPD) in a filter sample. The impact of imprecise analytical measurements for these samples is less because they each represent only a fraction of the total gas particulate samples specific to the ESP.

Accuracy. Recovery data for matrix spikes, analytical spikes, and standard reference materials (SRMs) provided the basis for assessing analytical accuracy. For most of the analytical techniques, the accuracy objective was 75-125% spike, or standard recovery. Performance audit samples submitted to the laboratory as blind samples also served as indicators of analytical accuracy in the coal, dolomite sorbent, and ash matrices. Audit sample results not meeting program objectives were discussed earlier in this section.

Matrix spiked samples and performance audit samples were used to estimate the accuracy of the flue gas vapor-phase metals analyses. Six of the metals analyzed recorded audit sample recoveries outside the specified objective: antimony, calcium, nickel, potassium, selenium, and sodium. Only selenium failed to meet recovery objectives in both the audit and matrix spike samples.

Poor selenium recovery was experienced in the vapor-phase samples analyzed by GFAAS (4-61%) and ICP/MS (62-71%). In response to the poor recovery by direct GFAAS analysis, the method of standard additions (MSA) was used to reanalyze the impinger samples for selenium. The GFAAS-MSA result for selenium in the audit standard was 87% and the remaining sample results were in close agreement with the ICP/MS results. Based on this recovery data, ICP/MS results were selected for reporting, although they may be biased low.

Gas particulate-phase samples were characterized in two different batches depending on the particulate loading of the sample. Matrix spikes and a standard reference fly ash material (NIST 1633a) were used to estimate the accuracy of the particulate-phase metals analyses for the APF and ESP inlet samples. Six of the metals analyzed recorded spike recoveries outside the specified objective: aluminum, calcium, lead, magnesium, selenium, and silver. Matrix spike recoveries for all of these elements were in the range of 58-72% except silver (15-18%) and may indicate a low bias in the results.

The analytical accuracy of gas particulate samples analyzed in conjunction with filters (APF and ESP outlet) was estimated using analytical spikes and a standard reference fly ash

material aspirated onto a filter as an audit sample. The audit sample results were discussed earlier in this section. Analytical spike recoveries below the desired recovery range were experienced for aluminum, calcium, magnesium, selenium, silver, and titanium in an acetone PNR sample from the ESP inlet. Matrix spike recoveries for all target metals associated with filter samples met the recovery objective except for one phosphorus spike (153%).

Matrix spikes and SRMs were used to estimate the accuracy of the fly ash, bed ash, and dolomite sorbent metals analyses. In the ash matrices, matrix spike recoveries for aluminum (70%), calcium (73%), magnesium (64%), and silver (27%) did not meet the program objective. Fly ash SRM recovery results for calcium (73%), manganese (73%), and molybdenum (71%) were also reported slightly below the objective range. Matrix spike recoveries outside the program objectives were experienced in the dolomite sorbent for calcium (286%), cobalt (74%), and iron (74%).

All matrix spike and audit sample results for metals in service water were between 93 and 108%, well within the specified recovery range.

Blank Effects. The field blank impinger samples analyzed by ICP-AES, GFAAS, CVAAS, and ICP/MS showed no significant levels of field contamination when compared to the reagent blank analyses. Relative to the actual gas impinger samples, the background levels detected in the reagent blank are significant (greater than 30% of the sample result), especially at the trace levels detected by ICP/MS. Significant concentrations of calcium, iron, magnesium, manganese, and sodium were also detected by ICP-AES in the blanks. All sample results for vapor-phase metals have therefore been corrected to account for the background concentrations found in the reagents.

Filter media blanks were also analyzed to determine the levels of target metals present in the quartz filters. Significant levels of aluminum, barium, calcium, chromium, magnesium, molybdenum, and sodium were reported. Arsenic, cadmium, lead, mercury, and selenium were also detected in the filter media at levels more than five times the detection limit.

Background corrections were also performed for gas-particulate samples analyzed in the presence of filter media (APF and ESP outlet).

Anions

Precision. The precision of anion analyses in coal and ash samples was estimated using duplicate analyses. The precision estimates for chloride and sulfur in the ash and dolomite samples met the objective of 20% RPD, as did the precision estimates for chloride, fluoride, and sulfur in the coal. Analytical results for chloride, fluoride, and sulfate in the flue gas particulate- and vapor-phase samples, as well as the service water samples, all met the precision objectives. Precision estimates for fluoride in ash and dolomite were between 25 and 33% RPD, slightly outside the objective.

Accuracy. Matrix spikes were used to estimate the accuracy of anion analyses in ash and flue gas samples. All anions met the recovery objective for flue gas analysis accuracy. All anions in ash met the accuracy objective with the exception of fluoride. The recovery of fluoride in the ash was below the project objective (32% compared to 75-125%). A performance audit sample and a standard reference material were analyzed to provide accuracy estimates for coal. Chloride recovery was 143% and fluoride recovery was 121% in the performance audit sample (objective of 80-120%). For the standard reference materials, chloride recovery was 101% for NBS SRM 1632-b and 87% for a coal standard from a recent laboratory round-robin study. Fluoride recovery in the standard reference material was 110 percent.

No reference values were available for the dolomite sorbent audit sample; therefore, no estimate of accuracy was obtained. However, anions in the sorbent material are minor constituents that are not expected to play a major role in material balance calculations. For service water, a single matrix spike recovery of 62% for fluoride was the only result outside the expected range of recovery.

Low fluoride spike recoveries were experienced in many of the sample matrices analyzed. Fluoride results, particularly in ash samples, are likely biased low. An investigation into the possible causes has identified aluminum and iron as potential interferents with the specific ion electrode analysis method. This is particularly significant in the analysis of fluoride in ash samples which are prepared by fusion with sodium hydroxide. Separation of fluoride by distillation from the ash fusion matrix is suggested as a means to provide an interference-free analytical matrix.

Blank Effects. Field blank impinger solutions and probe/nozzle rinses were analyzed for chloride, fluoride, and sulfate. The concentrations of these anions were above reporting limits in many of the blanks but well below the levels observed in the samples. The levels of chloride, fluoride, and sulfate found in the field blank for the flue gas solid phase were 4%, 3%, and 2% of the concentrations in the samples, respectively; therefore, these data should not be affected by the blank levels. The field blank associated with the vapor-phase samples contained all of the anions at levels much lower than those found in the vapor-phase samples. The method blanks associated with the stack gas samples showed fluoride at levels less than five times the detection limit; much higher levels of fluoride were observed in the associated samples. Sulfur was also observed in the method blank associated with the sorbent samples at a level near the detection limit, but at a higher concentration than those observed in the samples. Therefore, the results for sulfur in the sorbent samples may be overestimated.

Chromium (VI) and Total Chromium

Precision. The precision of the chromium (VI) and total chromium analyses was assessed by matrix spike duplicate analyses. All results met the RPD objective of 20 percent.

Accuracy. The accuracy of the analyses was estimated using performance audit spike recoveries. Recovery of chromium (VI) was within the 75-125% objective, and recovery of total chromium was slightly outside the objective at 138 percent. Total chromium sample data may be slightly overestimated.

Blank Effects. Low concentrations of total chromium were reported in the field and reagent blanks, but none of the values were more than five times the expected detection limit. Chromium (VI) concentrations in the field and reagent blanks were significant when compared to the gas impinger samples. Background concentrations in the reagent blank accounted for over 65% of the chromium (VI) concentration measured in the samples. Chromium (VI) results were background corrected for reporting and emission factor calculations.

Volatile Organic Compounds

Precision. The precision of the volatile organic compounds measured for this project was not assessed.

Accuracy. The accuracy of the analyses was estimated using surrogate spike recoveries. Recovery of all surrogates (1,2-dichloroethane-d4, toluene-d8, and 4-bromofluorobenzene) was within the compound specific objective.

Blank Effects. The trip and method blanks show no results above the detection limit for the target compounds. Concentrations of chloromethane, methylene chloride, and toluene were reported in the field blank, but only methylene chloride is present at more than five times the expected detection limit. Methylene chloride and toluene are common contaminants from field laboratory operations. The range of results (48 to 230 ng) for methylene chloride suggests that no specific, consistent source of the contamination was present.

Semivolatile Organic Compounds

Precision. The precision of the semivolatile organic compounds measured for this project was not assessed.

Accuracy. The accuracy of the analyses was estimated using surrogate spike recoveries. All vapor-phase sample surrogate spikes were recovered within the accuracy expectations.

Recovery of several surrogates in the cyclone ash and gas particulate-phase samples were outside the compound specific objectives.

Blank Effects. The trip and method blanks show no results above the expected detection limit for the target compounds, except for a single naphthalene result of 4.77 μg . Concentrations of bis(2-ethylhexyl)phthalate and naphthalene were reported in the field blank, but only naphthalene is present at more than five times the expected detection limit. Reported results for naphthalene have the potential to be overestimated at low levels.

Polycyclic Aromatic Hydrocarbons (PAHs) by HRGC/MS

Precision. The precision of the PAH analytical results was not evaluated.

Accuracy. The accuracy of the PAH analytical results was evaluated using surrogate spike recoveries. All recoveries were within the project objective of 50-150 percent.

Blank Effects. Many low-level measurements were reported for the trip, field, and method blanks. Concentrations ranged from 0.13-309 ng for the compounds in the method blank and 0.19-129 ng for the compounds in the trip blank. Field blank results ranged from 0.06-1050 ng. For compounds found in the samples, the results have been flagged if trip blank results for PAHs exceed 30% of the sample value.

Formaldehyde

Precision. The precision of formaldehyde measurements was assessed from duplicate analyses. Results for formaldehyde at two different concentration levels was excellent, with both RPDs within 5 percent.

Accuracy. The accuracy of the analyses was estimated using matrix spike recoveries. Both spikes were recovered within the accuracy objective of 50-150 percent.

Blank Effects. The reagent and method blanks show no results above the expected detection limit for formaldehyde. Significant concentrations of formaldehyde were reported in the field blank, at more than ten times the expected detection limit. Reported results for formaldehyde in the APF outlet and ESP inlet and outlet gas streams have the potential to be overestimated at low levels.

Ammonia

Precision. The precision of ammonia measurements was assessed from matrix spike duplicate analyses. Results for ammonia met the 20% RPD objective.

Accuracy. The accuracy of the analyses was estimated using matrix spike recoveries and a performance audit sample. The audit sample recovery was 485% at a theoretical concentration of 0.27 mg/L. A laboratory flag was attached to the audit sample result stating that the acidity of the sample was so high that an unusually small sample aliquot was taken for analysis. Since it appears that the audit sample was not distilled and analyzed in exactly the same manner as routine field samples, no firm conclusions about the accuracy of ammonia analysis can be made based on the performance audit. Both matrix spikes were recovered within the accuracy objective of 80-120 percent.

Blank Effects. The field, reagent, and method blanks all show results above the expected detection limit for ammonia. None of these blank results is greater than five times the expected detection limit.

Cyanide

Precision. The precision of cyanide measurements was assessed from matrix spike duplicate analyses. Results for cyanide met the 20% RPD objective.

Accuracy. The accuracy of the analyses was estimated using matrix spike recoveries and a performance audit sample. Both matrix spikes were recovered within the accuracy objective

of 75-125 percent. The audit sample recovery was 26% of a prepared concentration of 0.1 mg/L. For the audit sample, an EPA water quality standard was used which may have degraded as discussed previously in this section. The EPA standard material was not analyzed, so no data are available to confirm the standard's theoretical value.

Blank Effects. The field, reagent, and method blanks all show results below the expected detection limit for cyanide.

Dioxins and Furans (PCDD/PCDF)

Precision. The precision of the PCDD/PCDF analyses was not assessed.

Accuracy. The accuracy of the analyses was estimated using surrogate spike recoveries. Nearly all spike recoveries were within the project objective. The four recoveries outside the objective were within 10% of the lower limit of the objective.

Blank Effects. Low concentrations of eight compounds in the method, trip, and field blanks associated with these samples were observed. All concentrations reported for the blank results were near the analytical detection limits. Sample concentrations, which were also near the detection limits of many compounds, may be slightly overestimated for these compounds.

Ultimate/Proximate

Precision. The precision of ultimate/proximate analyses was not assessed.

Accuracy. The accuracy of the ultimate/proximate analyses for coal was estimated using performance audit sample recoveries. All recoveries were within the accuracy objective of 75-125% recovery.

Blank Effects. Ultimate/proximate test parameters are generally not subject to blank or background assessments.

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.

Table 4-5 shows the results of the material balances around the entire plant, the ESP system and the APF system. 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 Tidd PFBC HAPs 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 error propagation analysis, which is discussed in Appendix G. Inlet streams and their associated flow rates for each material balance system are provided in Table 4-6. Flow rates are presented in units consistent with the reported stream concentrations to facilitate mass flow rate determinations. A brief description of the methods for determining flow rates is also provided in Table 4-6.

Entire Plant

As shown in Table 4-5, 10 of the 19 target elements have closures around the entire plant that meet the project goal. The target elements that do not meet the closure goal are copper (<37%), fluorine (58%), mercury (155%), nickel (<45%), and selenium (148%). Closures could not be determined for antimony, cadmium, molybdenum, and silver because these elements were not detected in the major outlet ash streams. Closures for the other major

Table 4-5
Material Balance Results

Substance	Entire Plant		ESP System		APF System	
	Closure (%)	95% CI	Closure (%)	95% CI	Closure (%)	95% CI
Target Species						
Antimony	NC	--	NC	--	NC	--
Arsenic	129	36	134	21	101	59
Barium	111	27	134	63	97	29
Beryllium	101	22	137	59	101	27
Boron	91	140	126	95	NC	--
Cadmium	NC	--	140	124	95	43
Chlorine	105	24	94	8	83	29
Chromium	122	21	107	51	70	36
Cobalt	119	49	137	44	97	55
Copper	<37	--	129	184	<12	--
Fluorine	58	22	47	13	120	16
Lead	95	3	167	97	120	44
Manganese	102	2	119	14	92	25
Mercury	155	33	96	9	91	13
Molybdenum	NC	--	NC	--	<92	--
Nickel	<45	--	138	95	77	80
Selenium	148	87	74	27	<79	--
Silver	NC	--	NC	--	NC	--
Vanadium	97	4	136	38	95	29
Other Species						
Aluminum	89	17	131	40	95	25
Calcium	78	0:1	128	35	94	42
Iron	96	27	128	27	93	30
Magnesium	99	0.1	127	33	95	42
Potassium	61	20	138	60	98	33
Sodium	99	25	128	42	93	30
Titanium	109	19	136	53	98	28

Closure goal for the Tidd PFBC HAPs project is 70-130 percent.

CI = Confidence interval.

Table 4-6
Material Balance Stream Flow Rates

Stream	Mean Flow Rate	95% CI	Units of Measure	How Calculated
Entire Plant				
Coal Paste (inlet)	15,170	430	kg/hr, dry	Five-minute averages from the plants data acquisition system and coal paste moisture determinations.
Sorbent (inlet)	8,620	1,020	kg/hr, as fired	Five-minute averages from the plants data acquisition system.
Bed Ash (outlet)	4,220	970	kg/hr, dry	Data from AEP bed ash generation test on 4/9/94. Test conditions: Coal paste = 45 KPPH (as fired), MW = 46, sorbent = 19.8 KPPH.
Cyclone Ash (outlet)	4,690	1,490	kg/hr, dry	Average of the cyclone ash rate determined from material balances for magnesium, titanium, and sodium.
APF Ash (outlet)	142	28	kg/hr, dry	Measured particulate loading data collected at the APF inlet and outlet.
ESP Ash (outlet)	352	35	kg/hr, dry	Measured particulate loading data collected at the ESP inlet and outlet.
ESP Outlet Gas (outlet)	238,700	8,500	Nm ³ /hr	Direct measurement at the ESP outlet location.
APF System				
APF Inlet Gas (inlet)	34,100	1,200	Nm ³ /hr	Assumed equal to 1/7th of the ESP outlet gas rate.
APF Outlet Gas (outlet)	34,100	1,200	Nm ³ /hr	Assumed equal to 1/7th of the ESP outlet gas rate.
APF Ash (outlet)	142	28	kg/hr, dry	Measured particulate loading data collected at the APF inlet and outlet.
ESP System				
ESP Inlet Gas (inlet)	264,900	44,400	Nm ³ /hr	Direct measurement at the ESP inlet location. ESP outlet rate used in the material balance.
ESP Outlet Gas (outlet)	238,700	8,500	Nm ³ /hr	Direct measurement at the ESP outlet location.
ESP Ash (outlet)	352	35	kg/hr, dry	Measured particulate loading data collected at the ESP inlet and outlet.

CI = Confidence interval.

species met the project goal, with the exception of potassium (61%). For mercury and selenium, the closures are slightly above the desired range and the wide 95% confidence intervals indicate that imprecision may be partially responsible for the high closures. For copper, fluorine, and nickel, the results may indicate an analytical bias in one or more of the process streams.

ESP System

Closures for the ESP system were typically in the 125-135% range, which is slightly outside the project goal. This indicates that the ESP ash rate, calculated from the measured particulate loadings at the ESP inlet and outlet, may be biased slightly high. Concentrations of antimony, molybdenum, and silver were below detection limits in one or more of the inlet or outlet streams; therefore, closures could not be calculated around the ESP.

APF System

All closures around the APF system met the project goal except copper (<12%). Closures could not be determined for antimony, boron, and silver because substances were not detected in the inlet and outlet streams. Again, the low closure for copper indicates an analytical bias in one or more of the process streams. The relatively wide 95% confidence intervals for most of the target and other major elements in the ESP and APF material balances reflect the inherent variability in the gas stream measurements.

Recommendations and Considerations

Some technical issues have been identified during this study that may warrant further consideration. Some significant sampling, analytical and/or process related issues are discussed below.

APF Outlet Particulate Contamination

Comparison of the composition of the APF outlet particulate matter with the composition of the ESP outlet, ESP inlet, and APF inlet particulate matter indicates high levels of chromium, nickel, and molybdenum. This suggests residue from the Inconel 800 probe material may be present in the collected particulate matter. The contribution from this residue becomes significant at the APF outlet where the particulate loading is 1-2 orders of magnitude lower than those measured at the ESP outlet.

Improved Detection Limits

The following elements were below the detection limits in the particulate phase at the ESP outlet and/or APF outlet: Antimony, cobalt, copper, chromium, molybdenum, and silver. In addition, the following elements were below detection limits in one or more of the ash streams: Antimony, cadmium, copper, molybdenum, nickel, and silver. Detection limits could be improved by application of the ICP-MS analytical technique for these substances with slight modifications of the sample preparation procedures.

Multiple Reagent Blanks

As part of this test program, single reagent blank samples were submitted for analysis to provide a qualitative assessment of background levels in the sampling media. In addition, two field blank samples were also collected and analyzed to enable assessment of contamination possibly introduced during sample preparation and recovery. Using conventional analytical techniques, this series of blank samples provides an adequate assessment of background analyte levels—usually below method detection limits. With the more sensitive analytical techniques, there are fewer results below the detection limit, so it is more difficult to differentiate between background and sample contributions. Multiple reagent blanks for multi-metals train filters and impinger solutions, and the filters and XAD-2 resin used in the MM5 sampling train for semivolatile organics could be analyzed to provide a more sound

statistical average for estimating background concentrations in the sampling media and performing reliable background corrections.

Gas Sampling Methods for Semivolatile Organic Compounds

The gas sampling method for semivolatile organic compounds should be studied to confirm the suspicion that benzoic acid and phthalate esters detected in the flue gas samples are sampling artifacts. The presence of benzoic acid, and other intermediate oxidation products of naphthalene could possibly arise from the reaction of flue gas components with the XAD-2 resin matrix. Sulfur and nitrogen oxides in the flue gas combine with condensed moisture in the resin traps to form acids. These acids may be contributing to the breakdown of the resin into the by-products detected most frequently in the vapor-phase sample fraction.

Hexavalent Chromium Sampling and Analysis

The hexavalent chromium sampling method has not been validated for application to flue gas from coal-fired combustion systems and should be thoroughly evaluated for sampling bias and precision. The analytical method is relatively sound, but the fate of Cr(VI) during sampling in a recirculating caustic impinger solution with constant exposure to CO₂ and SO₂ is not well defined. Multiple sampling trains should be used in parallel to obtain duplicate spiked and duplicate unspiked samples simultaneously from the same location in the process duct. Multiple samples providing spike recovery and duplicate sample results will provide an indication of method accuracy and precision.

References

1. Lawrence W. Rosendale and Matthew S. DeVito. Interlaboratory Variability and Accuracy of Coal Analyses in the U.S. Department of Energy Utility Air Toxics Assessment Program. CONSOL, Inc. Library, PA (1994).

2. J. Lengyel, Jr., M.S. DeVito, and R.A. Bilonick, "Interlaboratory and Intralaboratory Variability in the Analyses of Mercury in Coal," paper presented at the Air & Waste Management Association Annual Meeting. Cincinnati, OH (1994).

5

EXAMPLE CALCULATIONS

This section describes the methodology and sample calculations used to develop the results discussed in Section 3. Specifically, the calculation of stream flow rates, emission factors, mean values, and confidence intervals are presented.

Stream Flow Rates

Table 4-6 in Section 4 contains information about the stream flow rates used in the material balance calculations. Coal paste and sorbent feed rates were determined from five-minute averages from the plant's data acquisition system. The bed ash rate was determined from data supplied by the Plant Tidd personnel. This data was from a bed ash generation test conducted on April 9, 1994, during operating conditions very similar to those used during the air toxics test period (ash generation test conditions: 46 MW, coal paste rate = 45,000 lb/hr, sorbent rate = 19,800 lb/hr). Therefore, the bed ash rate is considered representative of plant operation during the air toxics tests. The APF and ESP ash rates were calculated using measured particulate loading data and gas flow rate data for each run as follows:

$$\text{Ash rate} = (\text{inlet loading} \times \text{inlet gas rate}) - (\text{outlet loading} \times \text{outlet gas rate})$$

For the ESP ash rate, the ESP inlet and outlet gas rates were assumed equal to the measured ESP outlet gas rate. The ESP outlet gas rate was selected because that sampling point is configured to minimize flow disturbances upstream and downstream of the sample ports, thus providing more reliable flow rate measurements. For the APF ash rate, the inlet and outlet gas rates were assumed equal to 1/7th of the measured ESP outlet gas flow rate. The

cyclone ash rate was determined by calculating overall plant material balances for magnesium, titanium and sodium as follows:

$$\text{Cyclone ash rate} = \frac{[(\text{coal rate} \times \text{concentration of element}) + (\text{sorbent rate} \times \text{concentration of element}) - (\text{ESP ash rate} \times \text{concentration of element}) - (\text{APF ash rate} \times \text{concentration of element}) - (\text{bed ash rate} \times \text{concentration of element}) - (\text{ESP outlet gas rate} \times \text{concentration of element})]}{\text{concentration of element in cyclone ash}}$$

These elements were selected on the basis of the superior quality of the analytical data for the coal, sorbent, and major ash streams, as indicated by QA/QC data. The final cyclone ash rate used in the material balance calculations was the average of the cyclone ash rates determined for each element.

The flow rates in the ESP inlet and outlet were measured directly during sampling. The flow rate of the APF inlet and outlet were assumed to be equal to 1/7th of the measured ESP outlet gas flow rates. This assumption was based on plant design information supplied by Plant Tidd personnel.

Means and Confidence Intervals for Stream Concentrations

The mean concentration and 95% confidence interval (CI) about the mean were calculated for each target substance in the coal, sorbent, ash streams, and gas streams. The means were calculated according to the conventions listed in Section 3. Equations used to calculate 95% confidence intervals are presented in Appendix G. Example calculations are presented here for arsenic in the ESP inlet gas; these results were shown in Table 3-6.

The concentration data (in $\mu\text{g}/\text{Nm}^3$) given for arsenic are:

	<u>Run 1</u>	<u>Run 2</u>	<u>Run 3</u>
Solid Phase	450	380	420
Vapor Phase	0.34	0.26	0.36
Total	450.3	380.3	420.4

The mean is calculated from the individual run totals:

$$\begin{aligned}\text{Mean} &= (450 + 380.3 + 420.4)/3 \\ &= 417\end{aligned}$$

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

$$\begin{aligned}S_p &= \sqrt{[(450.3-417)^2 + (380.3-417)^2 + (420.4-417)^2]/2} \\ &= 35.1\end{aligned}$$

The standard deviation of the mean is calculated according to Equation 6 in Appendix G for $N = 3$:

$$\begin{aligned}S_{\bar{p}} &= \frac{35.1}{\sqrt{3}} \\ &= 20.3\end{aligned}$$

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 G). 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 one-third.

$$\begin{aligned}\beta_r &= \sqrt{(1/3 \times 0)^2 + (1/3 \times 0)^2 + (1/3 \times 0)^2} \\ &= 0\end{aligned}$$

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

$$U_r = \sqrt{\beta_r^2 + (t \times S_{\bar{p}})^2}$$

$$= \sqrt{0^2 + (4.3 \times 20.3)^2}$$

$$= 87$$

Thus, the result is reported as $420 \pm 87 \mu\text{g}/\text{Nm}^3$.

Unit Energy Emission Factors

In addition to the gas-phase concentrations, unit-energy-based emission factors have been developed for each target substance. These values were determined by calculating the mass flow of a substance in the ESP outlet 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.

As an example, the calculation of the emission factor for arsenic is presented. The mean coal paste flow rate is 33,450 lb/hr on a dry basis. The mean HHV of the coal is 12,700 Btu/lb on a dry basis. Multiplying the coal flow rate by the HHV gives a mean heat input of 425 million Btu/hr. The mean arsenic mass flow through the stack (the product of the mean concentration, $1.0 \mu\text{g}/\text{Nm}^3$, and the mean gas flow rate, $239,000 \text{ Nm}^3/\text{hr}$) is 0.239 g/hr or 0.000526 lb/hr. When the mean mass flow rate is divided by the mean heat input, an emission factor of $1.2 \text{ lb}/10^{12} \text{ Btu}$ is obtained, as shown in Table 3-19.

The 95% confidence intervals for emission factors were calculated according to the equations presented in Appendix G. For each parameter (ESP outlet 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

AAS	Atomic absorption spectrophotometry
acfm	Actual cubic foot (feet) per minute
AEP	American Electric Power Service Corporation
APF	Advanced particle filter
AS	Analytical standard
ASTM	American Society for Testing and Materials
Btu	British thermal unit
CARB	California Air Resources Board
CEM	Continuous emission monitor
CEMS	Continuous emission monitoring system
CI	Confidence interval
C _p	Pitot tube coefficient
CT&E	Commercial Testing & Engineering
CVAAS	Cold vapor atomic absorption spectrophotometry
DAS	Data acquisition system
ΔP	"Delta P"; pressure drop; pressure difference (measured in inches of water column)
DGA	Double gold amalgamation
DL	Detection limit
DNPH	Dinitrophenylhydrazine
DQO	Data quality objective
dscfm	Dry standard (1 atm. 68°F) cubic foot (feet) per minute
EPA	U.S. Environmental Protection Agency
ESP	Electrostatic Precipitator
FPAs	Analytical services laboratory of Radian Corporation

GC/MS	Gas chromatography/mass spectrometry (low resolution)
GFAAS	Graphite furnace atomic absorption spectrophotometry
HAP	Hazardous Air Pollutant
HGCU	Hot Gas Clean Up (System)
HHV	Higher heating value
HRGC/MS	High-resolution gas chromatography/mass spectrometry
ICP-AES	Inductively coupled plasma-atomic emission spectrometry
ICP-MS	Inductively coupled plasma-mass spectrometry
INAA	Instrumental neutron activation analysis
IS	Internal standard
MS/MSD	Matrix spike/matrix spike duplicate
NA	Not applicable
NC	Not calculated
ND	Not detected (below detection limit)
Nm ³	Normal cubic meter(s): 1 m ³ @ 0°C and 1.0 atm (equivalent to 37.44 ft ³ @ 68°F and 1.0 atm)
NO _x	Nitrogen oxides
Orsat	Method of fixed-gas (O ₂ , CO ₂ , CO) analysis
PAH	Polycyclic aromatic hydrocarbon
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PFBC	Pressurized fluidized bed combustion
PNR	Probe and nozzle rinse
POM	Polycyclic organic matter
QA	Quality assurance
QC	Quality control
RPD	Relative percent difference
PSD	Particle size distribution
RS	Recovery standard
RSF	Relative sensitivity factor (used in mass spectrometry)

scf	Standard cubic foot (feet): 1 ft ³ @ 68°F and 1.0 atm (equivalent to 0.02671 m ³ @ 0°C and 1.0 atm)
scfm	Standard cubic foot (feet) per minute
SIE	Specific ion electrode
SVOC	Semivolatile organic compound; semivolatile organic chemical
SW-846	Publication number of "Test Methods for Evaluating Solid Waste"
SS	Surrogate spike
TCLP	Toxicity characteristic leaching procedure
Tenax	An organic resin used for sample collection
UV-Vis	Ultraviolet-visible
VOC	Volatile organic compound; volatile organic chemical
VOST	Volatile organic sampling train
XAD	An organic resin used for sample collection

APPENDICES

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APPENDIX A: SAMPLE COLLECTION, PRETREATMENT, AND ANALYTICAL PROCEDURES

This appendix describes in detail the procedures Radian used during the HAPs testing at Plant Tidd to collect, handle, and analyze each process stream sample. An overview of the gas, solid, and liquid sample collection and analysis performed for this project is presented in Tables A-1, A-2, and A-3. Where analyte groups such as "metals" or "semivolatile organics" are referenced, a complete list of the target analytes is provided in Tables A-4 through A-6.

Radian used established sampling and analytical methods wherever possible to provide comparable and useable data. Modifications or adaptations to these methods are noted and described appropriately. All deviations from the procedures outlined in the test plan are discussed.

Gas Streams

Gas stream samples were collected at the ESP inlet and outlet and APF inlet and outlet ducts. Samples from each of these streams were analyzed for particulate loading, metals, acid gases (anions), ammonia and cyanide, formaldehyde, volatile organics, semivolatile organics, and dioxins/furans. Particle size distribution (PSD) measurements were performed at the ESP inlet and outlet only, and samples for hexavalent chromium emissions were collected only at the ESP outlet.

Gas sampling at the APF inlet and outlet ducts required a fixed sampling probe because of the high process gas temperature and pressure. Consequently, the APF inlet and outlet gas

Table A-1
Field Sampling Completed for Gas Streams

Analysis	ESP Inlet	ESP Outlet	APF Inlet	APF Outlet	Field Blanks ^a	Media Blanks ^b	PE Audit Samples
Particulate Loading	3/3 ^c	3/3	3/3	3/3	2/2	1/1	1/1
Metals ^d	3/3	3/3	3/3	3/3	2/2	1/1	1/1
Anions ^d	3/3	3/3	3/3	3/3	2/2	1/1	1/1
Ammonia/Cyanide ^e	3/3	3/3	3/3	3/3	2/2	1/1	1/1
Formaldehyde ^e	3/3	3/3	3/3	3/3	2/2	1/1	--
Volatile Organics ^e	6/6 ^f	6/6 ^f	6/6 ^f	6/6 ^f	12/12 ^g	1/1	--
Semivolatile Organics ^d	3/3	3/3	3/3	3/3	2/2	1/1	--
Dioxins/Furans	3/3 ^h	3/3 ^h	3 ^h /3	3/3 ^d	2/2	1/1	--
Particle Size Distribution	3/3	3/3	--	--	--	1/1	--
Hexavalent Chromium ^h	--	3/3	--	--	1/1	1/1	1/1

^a A field blank is collected at the ESP inlet and at the APF inlet to assess the effect of sample handling at these two locations.

^b Media blanks refer to prepared reagents for impinger solutions, blank VOST tubes, XAD resin cartridges, and blank filters.

^c Samples planned/samples completed.

^d Both particulate and vapor phases analyzed, separately.

^e Vapor phase analysis only.

^f Two 20-L samples collected per run.

^g One field blank collected per location per run.

^h Particulate and vapor phases combined for single analysis.

Table A-2
Field Sampling Completed for Coal, Sorbent, and Service Water

Analysis	Raw Coal ^a	Coal Paste			Sorbent (Dolomite)			Service Water		
	Field Samples	Field Samples	Field Duplicates	PE Audit Samples	Field Samples	Field Duplicates	PE Audit Samples	Field Samples	Field Duplicates	PE Audit Samples
Ultimate/Proximate/HHV	1/1 ^b	3/3	1/1	1/1	--	--	--	--	--	--
Metals	1/1	3/3	1/1	1/1	3/3	1/1	1/1	3/3	1/1	1/1
Anions	1/1	3/3	1/1	1/1	3/3	1/1	1/1	3/3	1/1	1/1
Radionuclides	1/1	3/3	1/1	--	--	--	--	--	--	--
% Moisture	1/1	3/3	1/1	--	3/3	1/1	--	--	--	--

^a Raw coal samples held for possible analysis pending data quality assessment of coal paste results.

^b Samples planned/samples completed.

Table A-3
Field Sampling Completed for Ash Samples

Analysis	Bed Ash		Primary Cyclone Ash		ESP Ash (4 Hoppers)		APF Ash		QC Audit Samples
	Field Samples	Field Duplicates	Field Samples	Field Duplicates	Field Samples	Field Duplicates	Field Samples	Field Duplicates	
Metals	3/3 ^a	1/1	3/3	1/1	3/3 ^b	1/1	3/3	1/1	1/1
Anions	3/3	1/1	3/3	1/1	3/3 ^b	1/1	3/3	1/1	1/1
Radionuclides	3/3	1/1	3/3	1/1	3/3 ^b	1/1	3/3	1/1	--
Carbon	3/3	1/1	3/3	1/1	3/3 ^b	1/1	3/3	1/1	--
Semivolatile Organics	3/3	1/1	3/3	1/1	3/3 ^b	1/1	3/3	1/1	--
Dioxins/Furans	--	--	3/3	1/1	3/3 ^b	1/1	3/3	1/1	--
Particle Size Distribution	--	--	--	--	12/8 ^c	4/4	--	--	--

^a Samples planned/samples completed.

^b ESP fly ash composite samples.

^c ESP Fields 1 and 2 were sampled in triplicate; Fields 1-4 were sampled in duplicate during final run.

Table A-4
Analyte List for Inorganic Parameters

Trace Elements	Major Elements
Antimony ^a	Aluminum
Arsenic ^a	Calcium
Barium ^a	Iron
Beryllium ^a	Magnesium
Boron	Potassium
Cadmium ^a	Sodium
Hexavalent Chromium ^b	Titanium
Chromium, total ^a	Ultimate/Proximate Parameters
Cobalt ^a	Carbon
Copper ^a	Hydrogen
Lead ^a	Nitrogen
Manganese ^a	Sulfur
Mercury ^a	Ash
Molybdenum ^a	Volatile Matter
Nickel ^a	Fixed Carbon
Selenium ^a	
Silver	
Vanadium ^a	
Ionic Species	
Chloride (Cl ⁻)	
Fluoride (F ⁻)	
Phosphates (as Total P) ^c	
Sulfates (SO ₄ ⁻²)	
Ammonia	
Cyanide	

^a These elements were analyzed by ICP-MS in the gas impinger samples.

^b Hexavalent chromium in ESP outlet flue gas only.

^c Phosphorus is determined by ICP-AES in all samples except service water where phosphorus is measured as total phosphate.

Table A-5
Analyte List for Organic Parameters

Volatilic Organics ^a (Method 8240)	Semivolatile Organics (Method 8270/CARB 429 ^b)	
Benzene	Acenaphthene ^b	2,4-Dimethylphenol
Bromoform	Acenaphthylene ^b	Dimethylphthalate
Carbon Disulfide	Acetophenone	4,6-Dinitro-2-methylphenol
Carbon Tetrachloride	4-Aminobiphenyl	2,4-Dinitrophenol
Chlorobenzene	Aniline	2,4-Dinitrotoluene
Chloroform	Anthracene ^b	2,6-Dinitrotoluene
1,4-Dichlorobenzene	Benidine	bis(2-Ethylhexyl)phthalate
cis-1,3-Dichloropropene	Benzo(a)anthracene ^b	Fluoranthene ^b
trans-1,3-Dichloropropene	Benzo(a)pyrene ^b	Fluorene ^b
Ethyl Benzene	Benzo(b)fluoranthene ^b	Hexachlorobenzene
Ethyl Chloride (Chloroethane)	Benzo(g,h,i)perylene ^b	Hexachlorobutadiene
Ethylene Dichloride (1,2-Dichloroethane)	Benzo(k)fluoranthene ^b	Hexachlorocyclopentadiene
Ethylidene Dichloride (1,1-Dichloroethane)	Benzoic Acid	Hexachloroethane
Methyl Bromide (Bromomethane)	Benzyl Alcohol	Indeno(1,2,3-cd)pyrene ^b
Methyl Chloride (Chloromethane)	4-Bromophenyl Phenyl Ether	Isophorone
Methyl Chloroform (1,1,1-Trichloroethane)	Butylbenzylphthalate	2-Methylnaphthalene ^b
Methyl Ethyl Ketone (2-Butanone)	4-Chloro-3-Methylphenol	2-Methylphenol (o-cresol)
Methylene Chloride (Dichloromethane)	p-Chloroaniline	4-Methylphenol (p-cresol)
Propylene Dichloride (1,2-Dichloropropane)	bis(2-Chloroethoxy)methane	N-Nitrosodimethylamine
Styrene	bis(2-Chloroethyl)ether	N-Nitrosodiphenylamine
1,1,2,2-Tetrachloroethane	bis(2-Chloroisopropyl)ether	N-Nitrosopropylamine
Tetrachloroethene	2-Chloronaphthalene ^b	Naphthalene ^b
Toluene	2-Chlorophenol	2-Nitroaniline
1,1,2-Trichloroethane	4-Chlorophenyl Phenyl Ether	3-Nitroaniline
Trichloroethene	Chrysene ^b	4-Nitroaniline
Vinyl Acetate	Di-n-octylphthalate	Nitrobenzene
Vinyl Chloride	Dibenz(a,h)anthracene ^b	2-Nitrophenol
Vinylidene Chloride (1,1-Dichloroethene)	Dibenzofuran	4-Nitrophenol
m,p-Xylene	Dibutylphthalate	Pentachloronitrobenzene
o-Xylene	1,2-Dichlorobenzene	Pentachlorophenol
	1,3-Dichlorobenzene	Phenanthrene ^b
	1,4-Dichlorobenzene	Phenol
	3,3-Dichlorobenzidine	Pyrene ^b
	2,4-Dichlorophenol	1,2,4-Trichlorobenzene
	Diethylphthalate	2,4,5-Trichlorophenol
	p-Dimethylaminoazobenzene	2,4,6-Trichlorophenol

^a These are the volatile organic compounds detected by VOST (Method 8240) that are listed in the Clean Air Act list of hazardous air pollutants.

^b These semivolatile organic compounds were analyzed in the gas samples by CARB Method 429 using high resolution GC/MS.

Table A-6
List of Radionuclides

Gamma Emitters
Actinium-228 @ 338 KeV
Actinium-228 @ 911 KeV
Actinium-228 @ 968 KeV
Bismuth-212 @ 727 KeV
Bismuth-214 @ 609.4 KeV
Bismuth-214 @ 1120.4 KeV
Bismuth-214 @ 1764.7 KeV
Lead-210 @ 46 KeV
Lead-212 @ 238 KeV
Lead-214 @ 295.2 KeV
Lead-214 @ 352.0 KeV
Potassium-40 @ 1460 KeV
Radium-226 @ 186.0 KeV
Thallium-208 @ 583 KeV
Thallium-208 @ 860 KeV
Thorium-234 @ 63.3 KeV
Thorium-234 @ 92.6 KeV
Uranium-235 @ 143 KeV

sampling approach varied from the standard EPA Method 5¹ sampling approach used at the ESP inlet and outlet ducts. The difference, however, was limited to the collection of particulate matter. In the fixed probe system, hot-gas filters were used to collect particulate matter. Multiple gas samples were then collected for vapor-phase species from a header downstream of the filter. The Method 5 approach specifies a single filter for each independent sampling train.

A schematic of the fixed probe sampling system designed for the Plant Tidd APF unit is shown in Figure A-1. The system was designed to sample the process gas isokinetically at a single point in the center of the duct. Gas cooling was accomplished by thermal convection through the sample line. Sample gas was cooled from 1350°F to approximately 600°F to safely operate the isolation ball valve. A flow orifice and sample control valve downstream of the filter were used to maintain isokinetic sampling rates.

To keep volatile species from condensing in the sample line downstream of the filter, the filter holder and all downstream components were heat traced and kept at or above the temperature of the gas entering the filter holder. The system was designed to allow gas samples to cool only after the gas entered the recoverable quartz tubing portion of the sampling train. However, the quartz tubing broke repeatedly during the initial test runs because the ball joint could not withstand the thermal stresses at 600°F. To solve this problem, the heat tracing tape was removed from the sample line downstream of the orifice meter to allow the gas to cool slightly. Skin temperatures at the header sample valves were typically 250-350°F after this modification. Because most of the quartz tubes were broken during the initial test, subsequent tests at the APF inlet were conducted using Teflon® tubing instead of quartz. This modification is not judged to have any affect on the gas samples. The tubing that connects the impinger train to the fixed probe sample header was directly comparable to the sampling train components found downstream of the heated filter in the EPA Method 5 sampling train and was rinsed and recovered accordingly.

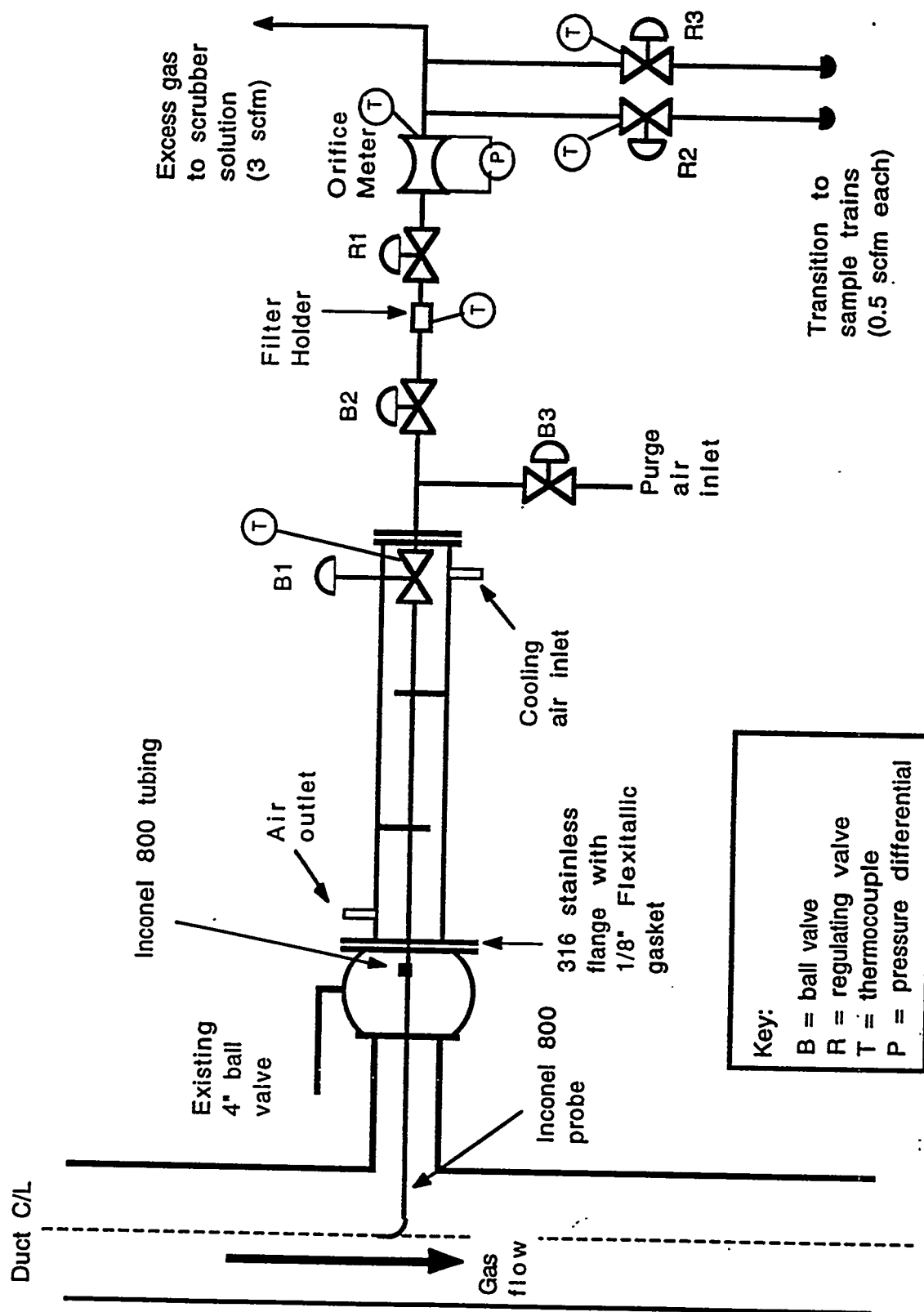


Figure A-1
APF High Pressure Sampling System

Particulate Loading

EPA Reference Method 5 was used to determine the particulate loading at the ESP inlet and outlet sampling locations. This method was performed in conjunction with the multi-metals sampling train to provide compatible particulate loading and particulate metals concentration data. Although not specified in Method 5 for determining particulate loading, quartz-fiber filters were used in place of glass-fiber filters to reduce background trace element contamination. Samples were collected isokinetically at multiple points across the duct as specified by EPA Reference Methods 1² and 2.³

At the APF inlet sampling location, the fixed probe system equipped with an allundum-ceramic thimble filter was used to collect isokinetic samples from a single point in the center of the duct. A 47 mm quartz-fiber filter in a high pressure Gelman filter holder was used in place of the allundum thimble at the APF outlet. Breakthrough of particulate occurred across the thimble filter during initial tests at the APF inlet because of the higher than expected particulate loading. To solve this problem, a second thimble filter assembly was installed in series and filters were changed out approximately every two hours to avoid exceeding the filter capacity. On Days 3 and 4, a third backup filter (high-pressure Gelman) was added downstream of the two thimble filters. The gas flow through the filter was determined by taking pressure differential readings and gas temperature readings across the flow orifice. The total gas flow through the filter was calculated using the orifice diameter, gas temperature and pressure at the orifice, and the sampling time.

Filters from both systems were recovered and weighed to determine the particulate mass collected. At the ESP sampling locations, particulate matter was also rinsed and recovered from the sampling nozzle and probe. Rinsing of the fixed high-pressure sampling probe was not feasible. Any wall losses or solids deposition inside the probe were assumed to be insignificant relative to the overall sample mass collected.

Particulate- and Vapor-Phase Metals

Collection of particulate- and vapor-phase metals was performed in conjunction with the particulate loading runs using the procedures detailed in EPA Draft Method 29.⁴ Method 29 is similar to Method 5 with a few sample train modifications. Method 29 requires replacement of the stainless steel nozzle and probe liner used in Method 5 with glass components. The particulate material was collected on quartz fiber filters, replacing the standard glass fiber filters normally used with Method 5.

At the APF inlet and outlet, the sampling probe was constructed of a high chromium-nickel alloy (Inconel 800) for strength and corrosion resistance at the high process temperature. The use of probe materials other than glass or quartz is a modification to Method 29 specific to the APF inlet and outlet sample locations.

Vapor-phase metals were collected in a series of impinger solutions. The first two impingers contained a dilute nitric acid and hydrogen peroxide ($\text{HNO}_3/\text{H}_2\text{O}_2$) solution. The third impinger was empty. The next two impingers contained acidic potassium permanganate ($\text{KMnO}_4/\text{H}_2\text{SO}_4$) solution for mercury collection. These impingers were followed by one dry impinger, and an impinger filled with silica gel. Approximately 90 to 100 dry standard cubic feet (dscf) of gas were collected isokinetically.

A description of the sampling train and sample fraction recovery for the multi-metals sampling train is presented in Table A-7. The sample fractions generated by the multi-metals sampling train and an overview of the sample handling process are shown in Figures A-2 through A-7. These particulate- and vapor-phase sample fractions were prepared and analyzed separately for the elements listed in Table A-4.

Particulate Phase. The filter samples were desiccated and weighed to a constant weight (defined as successive weight determinations within 0.5 mg at 6-hour intervals). For samples collected at the ESP, the acetone probe and nozzle rinses (PNR) were evaporated, desiccated, and also weighed to a constant weight. For the ESP outlet, the nitric acid PNR was added to

Table A-7
Description and Recovery of Method 29 (Multi-Metals) Sampling Train

Component	Contents	Recovery ^a	Container	Preparation & Analysis
Probe Nozzle Rinse and front half of filter holder rinse ^b	NA	Rinse probe, nozzle, and front half of filter holder with acetone into sample container.	500 mL amber glass bottle	See Figures A-2 and A-3
Probe Nozzle Rinse and front half of filter holder rinse ^b	NA	Rinse probe, nozzle, and front half of filter holder with 0.1 N HNO ₃ into sample container.	500 mL amber glass bottle	See Figures A-2 and A-3
Filter ^b	Tared quartz filter	Place filter in sample container.	Plastic petri dish	See Figures A-2 through A-4
Thimble ^c	Tared thimble ceramic	Place thimble in sample container.	Glass jar	See Figure A-5
Transfer Line Rinse ^d	NA	Rinse transfer line with 0.1 N HNO ₃ into sample container.	Combine transfer line rinse and Impingers 1 and 2 in a 1000 mL amber glass bottle	See Figure A-6
Impinger #1	5% nitric acid in 10% hydrogen peroxide (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with 0.1 N HNO ₃ into sample container.		
Impinger #2	5% nitric acid in 10% hydrogen peroxide (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with 0.1 N HNO ₃ into sample container.		
Impinger #3	Dry	Recover condensate, then rinse impinger and connecting glassware with 0.1 N HNO ₃ into sample container.		See Figure A-7
Impinger #4	4% potassium permanganate in 10% sulfuric acid (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with fresh KMnO ₄ solution into sample container.		
Impinger #5	4% potassium permanganate in 10% sulfuric acid (200 mL)	Recover impinger solution, then rinse impinger with fresh KMnO ₄ solution into sample container.		
Impinger #4 - Second Rinse	NA	Rinse impinger with 8N HCl into sample container. Not to exceed 25 mL HCl.		
Impinger #5 - Second Rinse	NA	Rinse impinger with 8N HCl into sample container. Not to exceed 25 mL HCl.	250 mL amber glass bottle	See Figure A-7
Impinger #6	Silica Gel (300 g)	Replace when exhausted.	None	None

NA = Not applicable.

^a All impingers were weighed prior to recovery to determine gas sample moisture content by EPA Reference Method 4.

^b ESP inlet and outlet and APF outlet.

^c APF inlet only.

^d Includes back half of filter holder at ESP inlet and outlet; and gas cooling system at APF inlet and outlet.

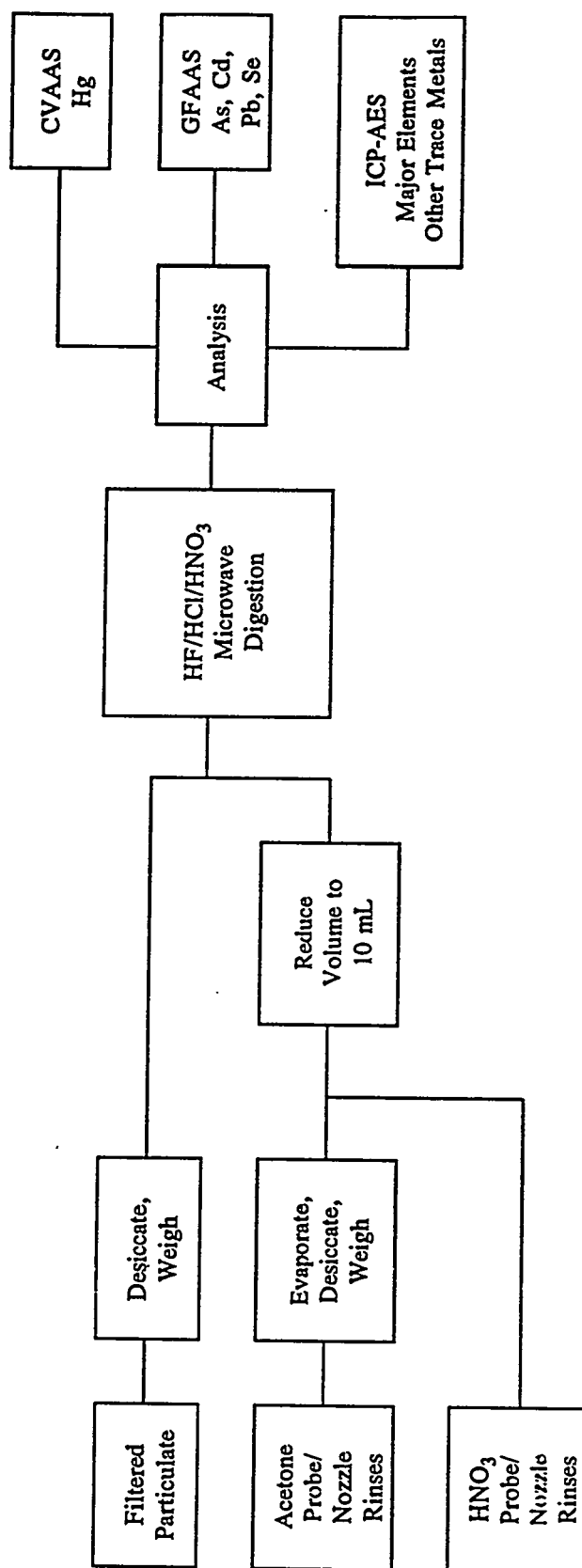


Figure A-2
Gas Particulate Sample Preparation and Analysis Plan for Metals (ESP Outlet)

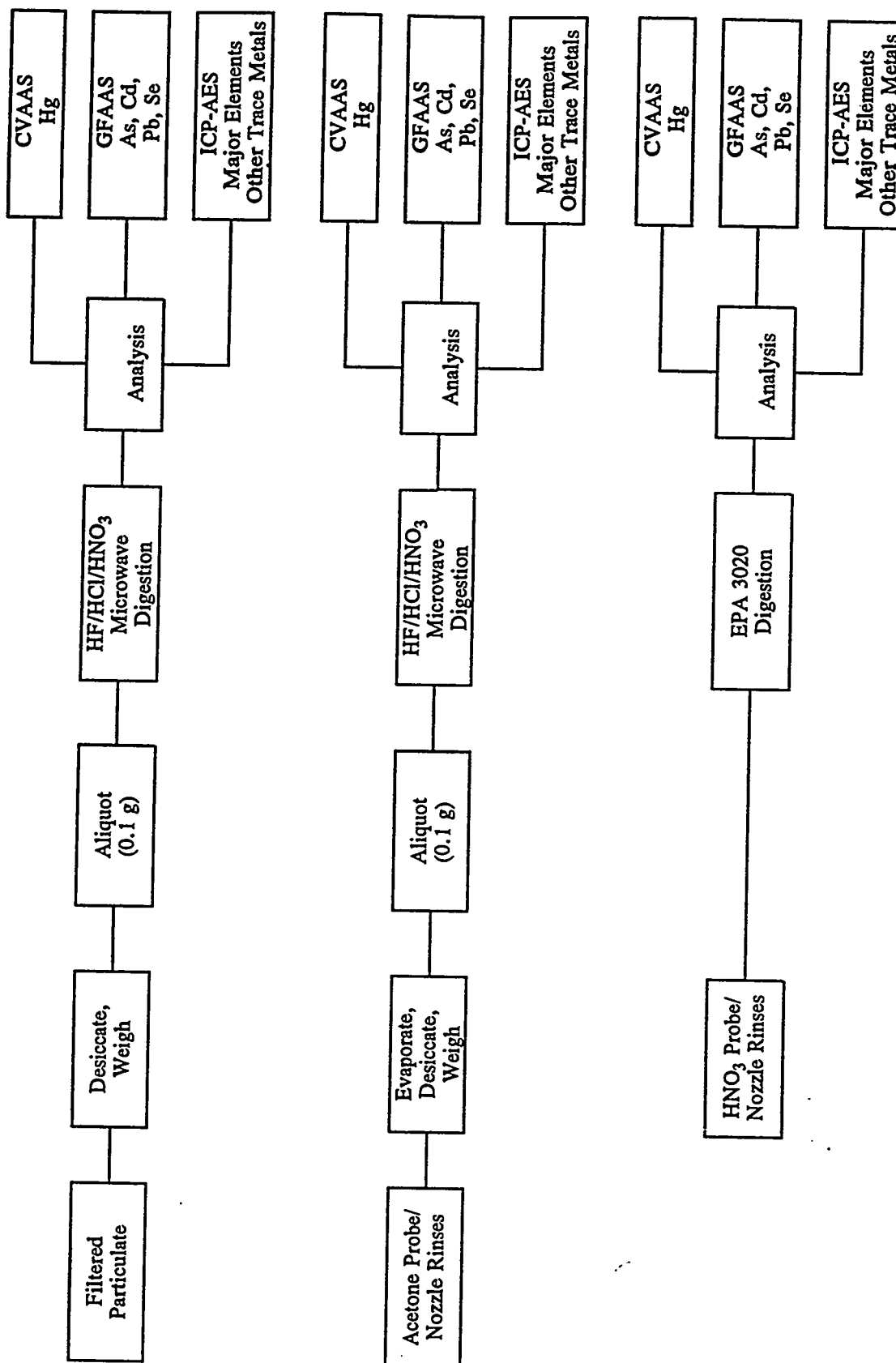


Figure A-3
Gas Particulate Sample Preparation and Analysis Plan for Metals (ESP Inlet)

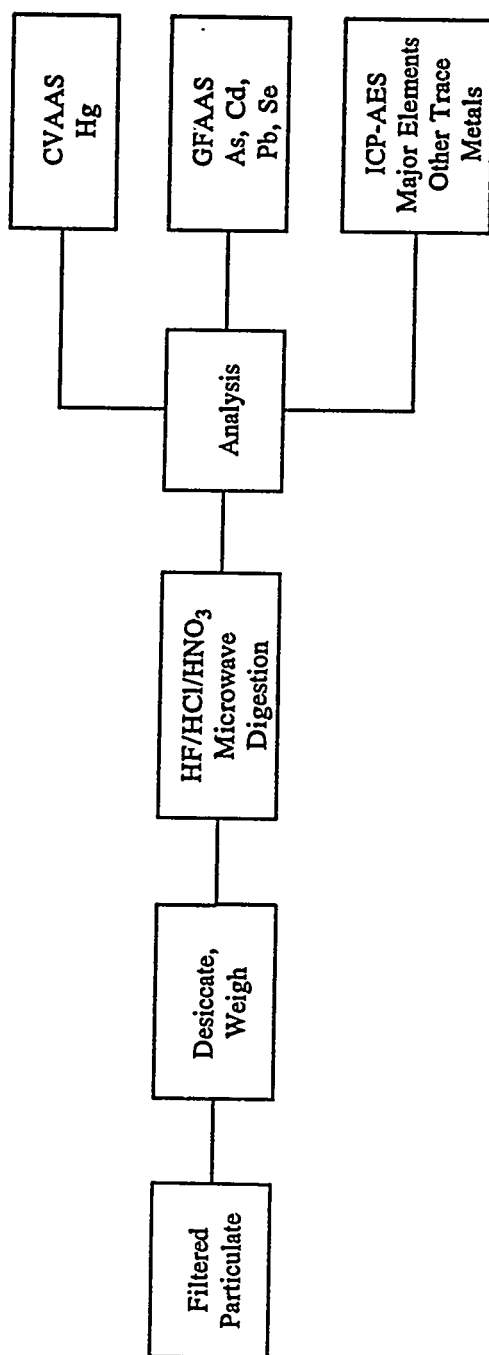


Figure A-4
Gas Particulate Sample Preparation and Analysis Plan for Metals (APF Outlet)

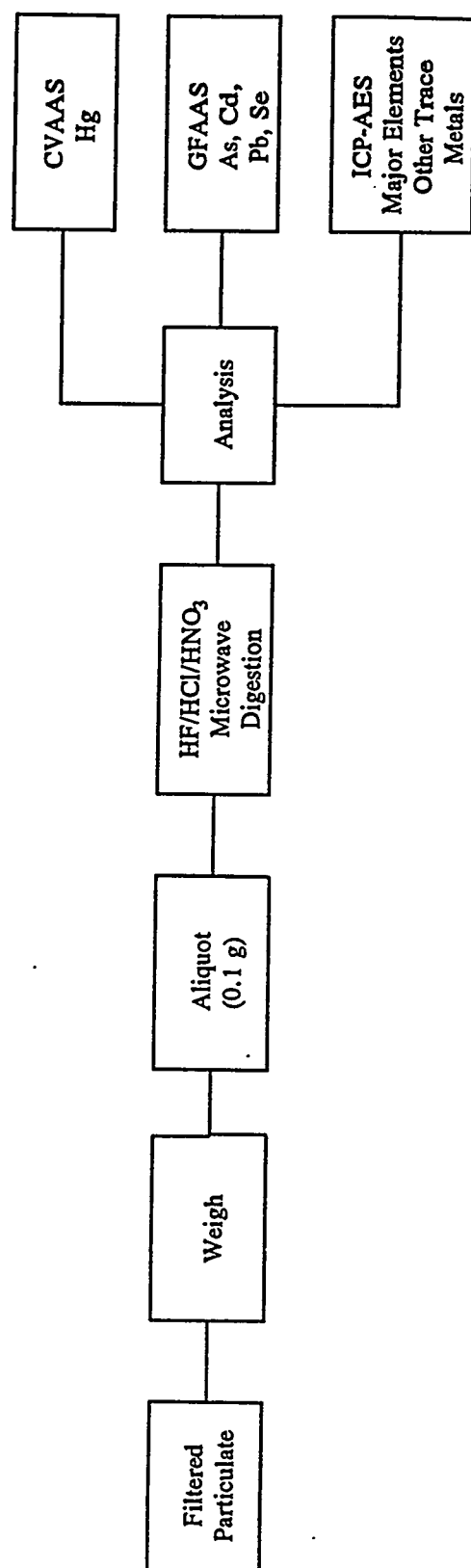


Figure A-5
Gas Particulate Sample Preparation and Analysis Plan for Metals (APF Inlet)

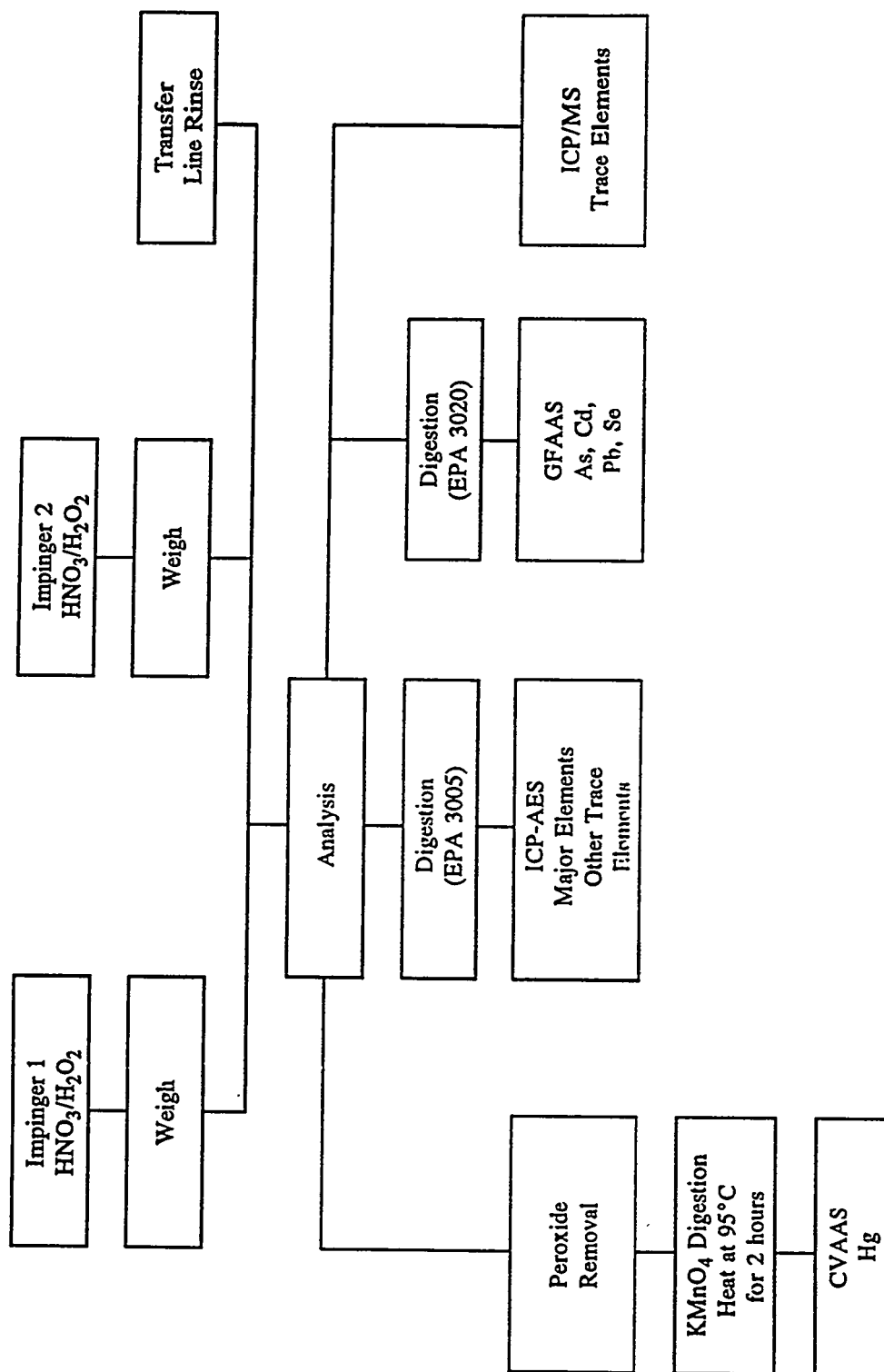


Figure A-6
Flue Gas Impinger Sample Preparation and Analysis Plan for Metals

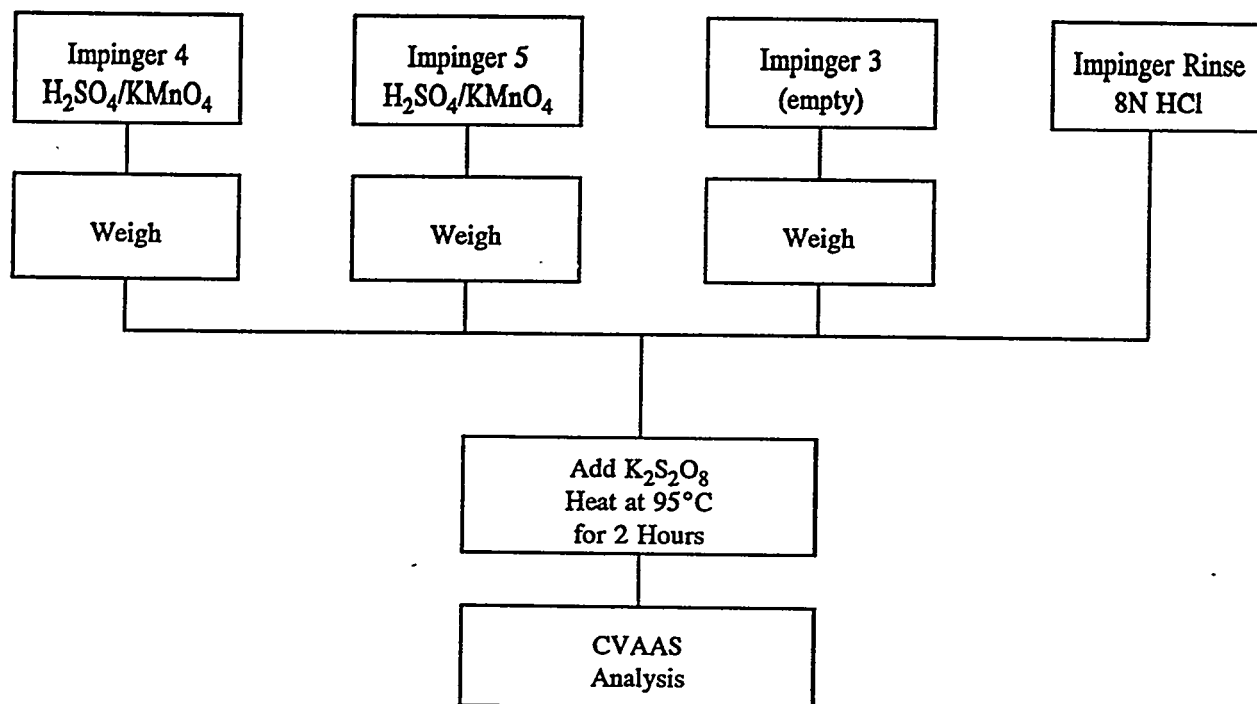


Figure A-7. Flue Gas Impinger Sample Preparation and Analysis Plan for Mercury

the solids recovered from the acetone PNR, and the volume reduced to 10 mL by evaporation on a hot plate. This volume was quantitatively transferred, along with the filter, to a microwave-digestion vessel. The total particulate sample from the collected gas was microwave digested⁵ with a mixture of hydrofluoric, hydrochloric, and nitric acids. For the ESP inlet, the nitric acid PNR and the acetone PNR were analyzed separately due to the high mass loadings recovered on the filter and in the acetone PNR. The APF outlet samples were analyzed similarly to the ESP outlet samples, without the presence of probe rinses. The APF inlet particulate was collected and analyzed directly.

The digestates were analyzed for metals (except boron) by a combination of techniques including inductively coupled plasma atomic emission spectroscopy (ICP-AES)⁶ and graphite furnace atomic absorption spectroscopy (GFAAS).^{7,8,9,10} Mercury was determined from an aliquot of the microwave digestate by cold vapor atomic absorption spectroscopy (CVAAS).¹¹ Boric acid was added to the digestate to solubilize metal fluorides that precipitate during the digestion. This addition of boric acid makes the analysis of boron in these samples impractical; however, boron was determined in all collected ash samples from the ESP, APF, and cyclone systems as described later.

Vapor Phase. The two $\text{HNO}_3/\text{H}_2\text{O}_2$ impinger samples were combined, digested, and analyzed for metals by ICP-AES and GFAAS. Aliquots of undigested impinger solutions were analyzed by ICP/MS.¹² A separate aliquot was removed for mercury analysis and the excess peroxide in the sample matrix was eliminated by the addition of solid KMnO_4 until a pale pink color persisted. The sample was then digested in $\text{KMnO}_4/\text{H}_2\text{SO}_4$ solution and analyzed for mercury by CVAAS.¹³

The contents of the third impinger, the two $\text{KMnO}_4/\text{H}_2\text{SO}_4$ impingers, and the hydrogen chloride (HCl) impinger rinse sample were combined and an aliquot was digested in $\text{KMnO}_4/\text{H}_2\text{SO}_4$ solution and analyzed for mercury by CVAAS.

Anions

The Method 5 train was used to collect vapor phase and particulate samples for acid gas species. Hydrochloric, hydrofluoric, and sulfuric acids along with sulfur dioxide and sulfur trioxide were collected using two impingers each containing 200 mL of a carbonate/bicarbonate solution containing hydrogen peroxide. Approximately 30-45 dscf of gas was collected at each location.

A description of the sampling train and sample fraction recovery for the Method 5 anions sampling train is presented in Table A-8. The sample fractions generated by the anions/acid gas sampling train and an overview of the sample handling process are shown in Figures A-8 through A-11. The particulate and vapor phases were prepared and analyzed separately for chloride, fluoride, and sulfate.

Particulate Phase. The filter was desiccated and weighed prior to being combined with the PNR. The PNR sample was evaporated, desiccated, and weighed before being combined with the filter sample. The particulate matter was then sonicated with 100 mL of fresh carbonate/bicarbonate solution. The carbonate solution was analyzed for chloride and sulfate by ion chromatography (IC)¹⁴ and fluoride was determined by specific ion electrode (SIE).¹⁵

Vapor Phase. The impinger solutions received from the test site were sent directly to the analytical laboratory for chloride and sulfate analysis by IC, and fluoride analysis by SIE¹⁶.

Ammonia/Hydrogen Cyanide

Sample collection for ammonia and hydrogen cyanide in the gas streams was performed in conjunction with the Method 5 anions sampling train. Similarly, gas was extracted isokinetically at a single point in the duct through the anions train filter, then directed to an impinger train. For ammonia collection, 0.1 N sulfuric acid was placed in the first two impingers of the sampling train. The low pH of the H₂SO₄ solution allowed HCN to pass

Table A-8
Description and Recovery of Anions Sampling Train

Component	Solution	Recovery ^a	Container	Preparation & Analysis
Probe Nozzle Rinse and front half of filter holder rinse ^b	NA	Rinse probe, nozzle, and front half of filter holder with acetone/water into sample container.	500 mL plastic nalgene	See Figures A-8 through A-10
Filter ^b	Tared quartz filter	Place filter in sample container.	Plastic petri dish	See Figures A-8 through A-10
Thimble ^c	Tared ceramic thimble	Place thimble in sample container.	Glass jar	See Figure A-8 through A-10
Transfer Line Rinse ^d	NA	Rinse transfer line with absorbing solution into sample container.	1000 mL plastic nalgene	See Figure A-11
Impinger #1	Absorbing solution (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with absorbing solution into sample container.	Cool to 4°C	
Impinger #2	Absorbing solution (200 mL)	Recover impinger solution, then rinse impingers and connecting glassware with absorbing solution into sample container.		
Impinger #3	Dry	Recover condensate, then rinse impinger and connecting glassware with absorbing solution into sample container.		
Impinger #4	Silica gel (300 g)	Not recovered.	None	None

^a All impingers were weighed prior to recovery.

^b ESP inlet and outlet and APF outlet.

^c APF inlet only.

^d Includes back half of filter holder at ESP inlet and outlet and gas cooling system at APF inlet and outlet.
NA = Not applicable.

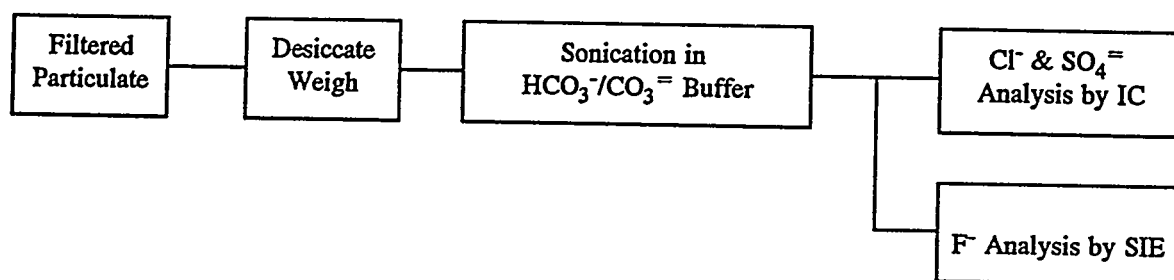


Figure A-8
Gas Particulate Sample Preparation and Analysis Plan for Anions (APF Outlet)

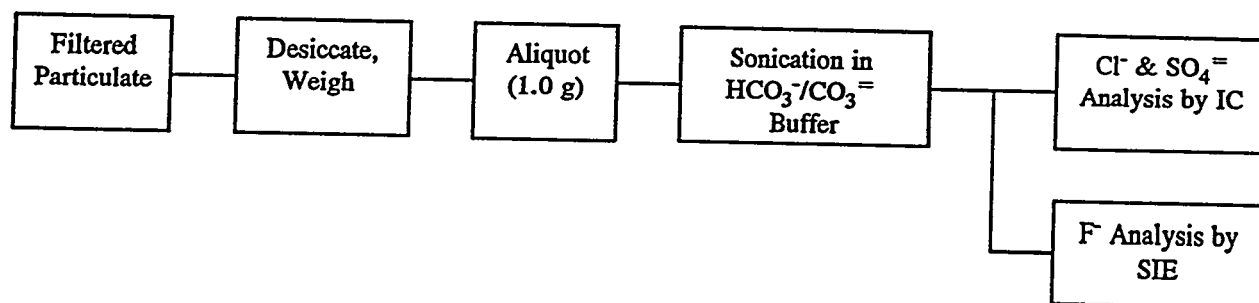


Figure A-9
Gas Particulate Sample Preparation and Analysis Plan for Anions (APF Inlet and ESP Inlet)

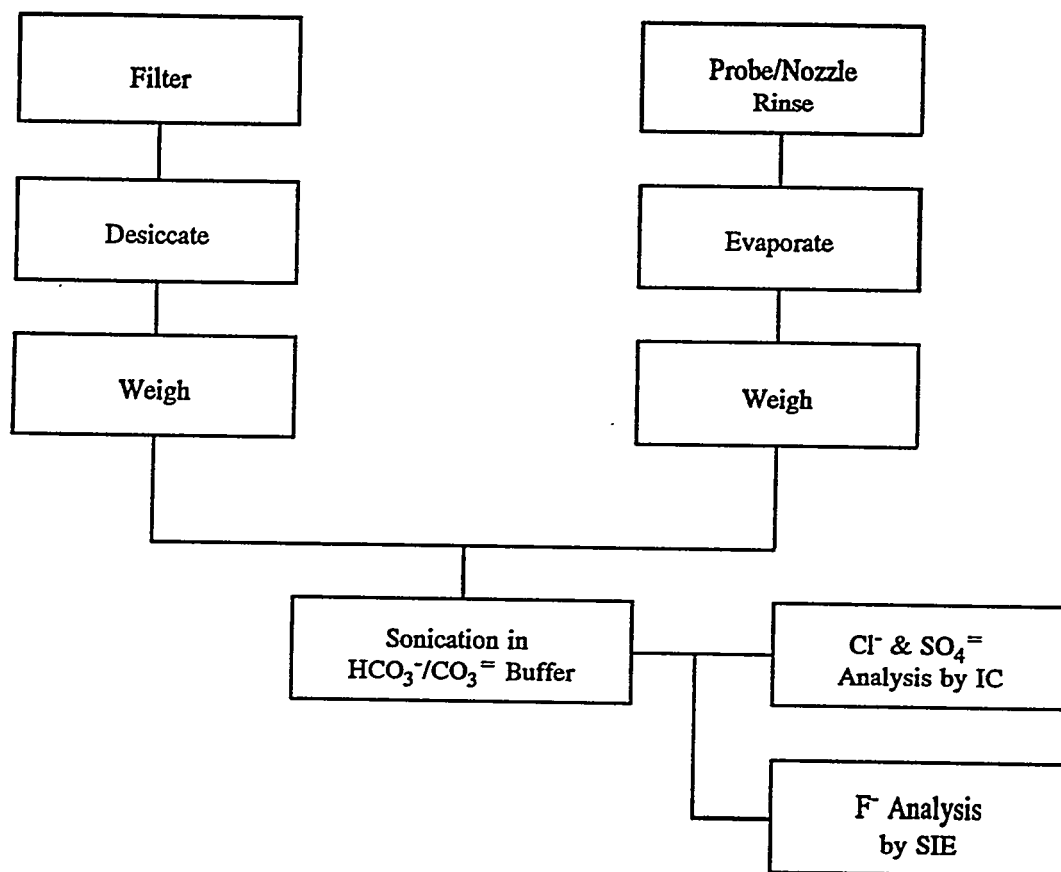


Figure A-10
Gas Particulate Sample Preparation and Analysis Plan for Anions (ESP Outlet)

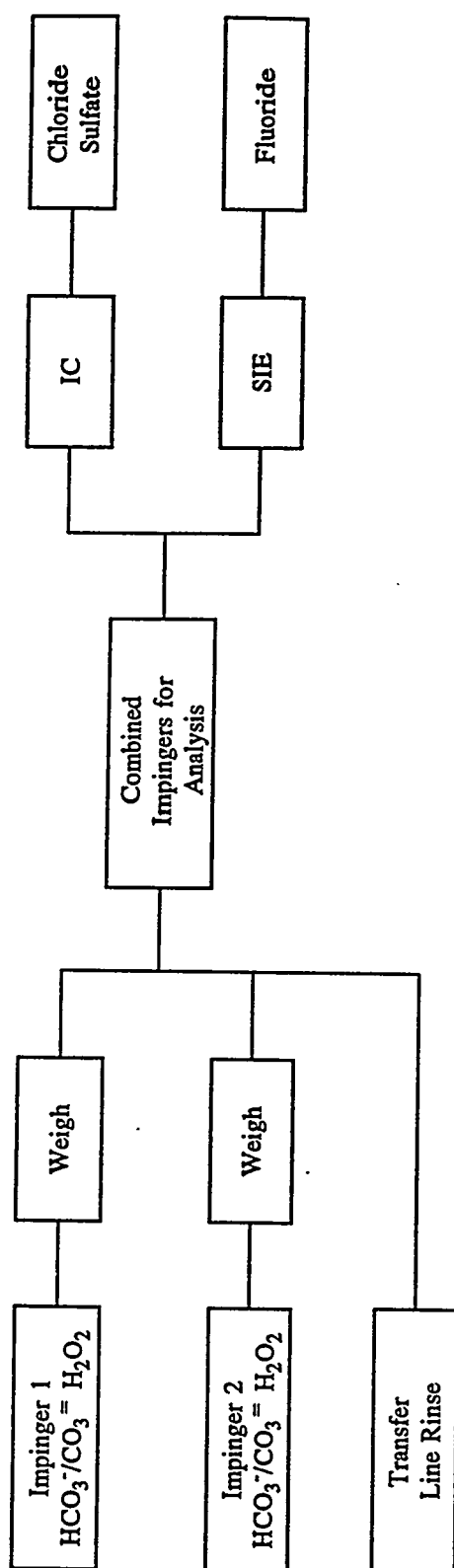


Figure A-11
Flue Gas Impinger Sample Preparation and Analysis Plan for Anions

through. A 2% zinc acetate solution was placed in the fourth and fifth impingers for the collection of cyanide. The gas sample volume for each run was approximately 40 to 60 dscf.

A description of the sampling train and sample fraction recovery for the ammonia/hydrogen cyanide trains is presented in Table A-9. The sample fractions generated by the combined ammonia/hydrogen cyanide sampling train were sent directly to the laboratory for analysis as shown in Figure A-12. The sulfuric acid impinger solutions (0.1 N H₂SO₄) were prepared for analysis by distillation according to EPA Method 350.2¹⁷ and the recovered distillates were analyzed by EPA 350.1,¹⁸ an automated colorimetric method. Cyanide impinger samples (0.1 M zinc acetate) were digested and analyzed according to EPA Method 9012.¹⁹

Formaldehyde

Formaldehyde was collected using an acidic solution of 2,4-dinitrophenylhydrazine (DNPH) according to EPA Method 0011.²⁰ Approximately 60 dscf of gas was collected isokinetically in conjunction with the anions sampling train using the same filter for particulate removal. The impinger solutions were combined into one sample along with the methylene chloride glassware rinses. The solutions were sealed in amber glass containers with Teflon[®] closures and stored at 4°C.

A description of the sampling train and sample fraction recovery for the aldehydes sampling train is presented in Table A-10. The sample fractions generated by the aldehydes sampling train and an overview of the sample handling process are shown in Figure A-13. The aqueous and methylene chloride layers of the sample were separated, and the aqueous fraction was then extracted with fresh methylene chloride. The methylene chloride portion of the sample and the aqueous extract are then combined. Since low levels of formaldehyde were expected, if any, an aliquot of this extract was concentrated during a solvent exchange procedure into acetonitrile. The resulting extract was then analyzed by high performance liquid chromatography (HPLC) according to EPA Method 0011A. Air Toxics, Ltd. was subcontracted to perform this analysis.

Table A-9
Description and Recovery of Ammonia and Hydrogen Cyanide Sampling Train

Component	Solution	Recovery ^a	Container	Preparation & Analysis
Transfer Line Rinse ^b	NA	Rinse transfer line with deionized water into sample container.	1000 mL Nalgene bottle	See Figure A-12
Impinger #1 (NH ₃)	0.1N H ₂ SO ₄ (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with deionized water into sample container.		
Impinger #2 (NH ₃)	0.1N H ₂ SO ₄ (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with deionized water into sample container.		
Impinger #3	Dry	Recover condensate, then rinse impinger and connecting glassware with deionized water into sample container.		
Impinger #4 (CN)	0.1M ZnOAc (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with deionized water into sample container.	1000 mL Nalgene bottle	See Figure A-12
Impinger #5 (CN)	0.1M ZnOAc (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with deionized water into sample container.	Cool to 4°C	
Impinger #6	Silica Gel (300 g)	Not recovered.	None	None

^a All impingers were weighed prior to analysis.

^b Includes back half of filter holder at ESP inlet and outlet and gas cooling system at APF inlet and outlet.

NA = Not applicable.

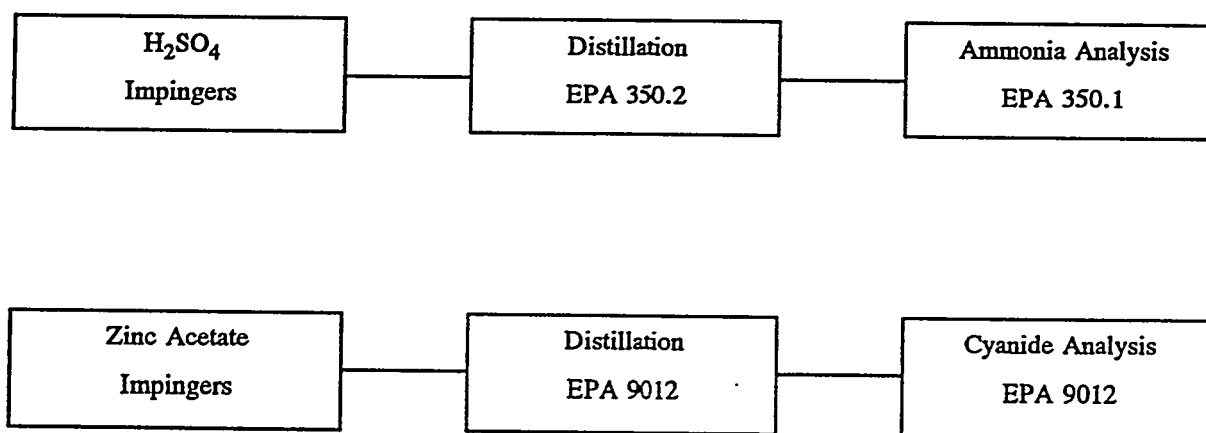


Figure A-12
Flue Gas Impinger Sample Preparation and Analysis Plan for Ammonia and Cyanide

Table A-10
Description and Recovery of Aldehydes Sampling Train

Component	Solution	Recovery ^a	Container	Preparation & Analysis
Transfer Line Rinse ^b	NA	Rinse transfer line with MeCl ₂ into sample container.	1000 mL amber glass bottle Cool to 4°C	See Figure A-13
Impinger #1	DNPH solution (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ into sample container.		
Impinger #2	DNPH solution (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ into sample container.		
Impinger #3	Dry	Recover condensate into sample container.		
Impinger #4	Silica gel (300 g)	Not recovered.	None	None

^a All impingers will be weighed prior to recovery.

^b Includes back half of filter holder at ESP inlet and outlet and gas cooling system at APF inlet and outlet.

NA = Not applicable.

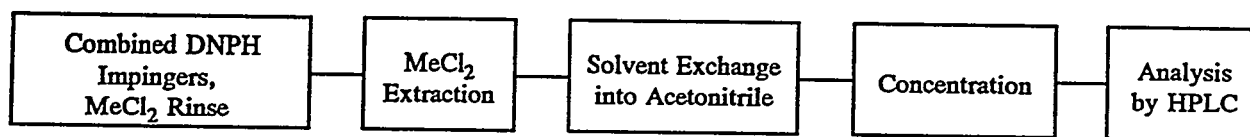


Figure A-13
Flue Gas Impinger Sample Preparation and Analysis Plan for Formaldehyde

Volatile Organics

Benzene, toluene, and other volatile organic compounds were sampled using a volatile organic sampling train (VOST). The VOST is described in Method 0030²¹ in SW-846. Volatile organics were removed from the sample gas by sorbent traps maintained at 20°C. The first sorbent trap contains Tenax resin and the second trap contains Tenax resin and petroleum-based charcoal. A dry gas meter was used to measure the volume of gas passed through the pair of traps. Sample volumes of 20 L were collected on two separate pairs of traps at a rate of 0.5 L/min.

Leak checks were performed before and after collection of each pair of resin traps. After the post-collection leak check was been completed, the traps were sealed with their end caps and returned to their respective glass containers for storage and transport. During storage and transportation, the traps were kept cool (<4°C).

The sample fractions generated by the VOST and an overview of the sample handling process are shown in Figure A-14. The Tenax and Tenax/charcoal cartridges were sent directly from the test site to the analytical laboratory for volatile organic compound analysis. The contents of the Tenax and Tenax/charcoal cartridges were spiked with internal standards and surrogates, thermally desorbed according to EPA Method 5040²², and directly analyzed for the compounds listed in Table A-5 by GC/MS according to EPA Method 8240.²³ Air Toxics, Ltd. was subcontracted to perform VOST analyses.

Semivolatile Compounds

Semivolatile organic compounds (SVOCs) were collected using a Modified Method 5 (MM5)²⁴ sampling train. The probe washes, filter catches, XAD sorbent traps, and aqueous condensate were extracted and analyzed for SVOCs by a combination of analytical protocols, SW-846 Method 8270²⁵ and CARB Method 429.²⁶

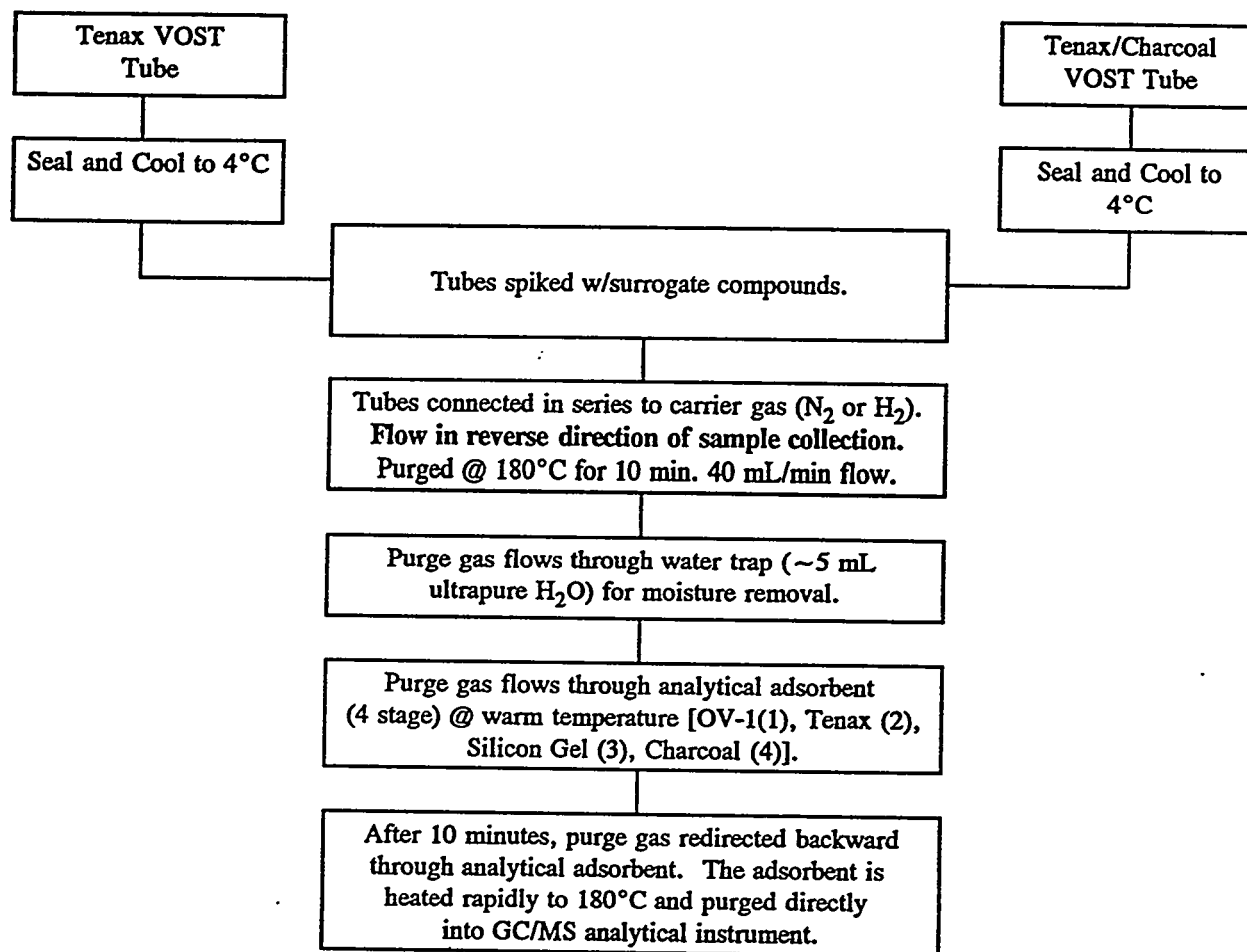


Figure A-14
VOST Sorbent Sample Preparation and Analysis Plan for Volatile Organic Compounds

The MM5 sampling protocol is Method 0010 in SW-846. The sampling system consists of a heated probe, heated filter, sorbent module, and pumping and metering unit.

From the heated filter, sample gas entered a sorbent module. The sorbent module consists of a water-cooled condenser followed by an XAD-2 resin trap. After the resin trap was a dry, modified Greenburg-Smith impinger (a standard size impinger without the dispersion plate at the base of the glass nozzle as specified in Method 0010) which collected the aqueous condensate.

Samples were collected isokinetically at a sampling rate of approximately 0.5 dscfm for each train. Approximately 100 to 125 dscf of gas were collected by each train over a minimum sampling period of two hours.

Sampling train preparation and sample retrieval was performed in a controlled environment to reduce the possibility of sample contamination. Prior to assembly, each component of the sampling train was thoroughly rinsed with methylene chloride.

After sample collection, the ends of the sampling train were sealed with solvent-rinsed foil and returned to the clean-up area for sample retrieval. The filter was recovered and placed in a glass petri dish that was rinsed with methylene chloride. Aqueous condensate collected in the first two impingers and in the sorbent trap were transferred to amber glass bottles rinsed with methylene chloride with Teflon®-lined screw cap closures.

A description of the sampling train and sample fraction recovery for the MM5 sampling train is presented in Table A-11. The sample fractions generated by the MM5 sampling train and an overview of the sample handling process are shown in Figure A-15. The particulate-phase and vapor-phase sample fractions were analyzed separately for the semivolatile organic compounds presented in Table A-5. The sample extracts were split to provide analysis of the particulate and vapor phase samples by both SW-8270 and CARB Method 429 protocols.

Table A-11
Description and Recovery of Modified Method 5 (Semivolatile and PAHs 429) Sampling Train

Component	Solution	Recovery ^a	Container	Preparation & Analysis
Probe/Nozzle Rinse ^b	NA	Rinse probe, nozzle, and front half of filter holder with MeCl ₂ into sample container.	500 mL amber glass bottle. Cool to 4°C.	See Figure A-15
Filter ^b	Pretreated quartz filter	Place filter in sample container.	Glass petri dish. Cool to 4°C.	See Figure A-15
Thimble ^c	Tared thimble	Place thimble in sample container.	Glass jar. Cool to 4°C.	See Figure A-15
XAD Cartridge	XAD-2 resin	Seal resin cartridge.	Wrap in aluminum foil. Cool to 4°C.	See Figure A-15
Transfer Line Rinse ^d	NA	Rinse transfer line with MeCl ₂ into sample container.	1000 mL amber glass bottle. Cool to 4°C	See Figure A-15
Condenser	NA	Rinse condenser with MeCl ₂ into sample container.		
Impinger #1	Dry	Recover condensate, then rinse impinger and connecting glassware with MeCl ₂ into sample container.		
Impinger #2	Ultrapure water (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ into sample container.		
Impinger #3	Ultrapure water (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ into sample container.		
Impinger #4	Silica gel (300 g)	Not recovered.	None	None

^a All impingers were weighed prior to analysis.

^b ESP inlet and outlet and APF outlet.

^c APF inlet only.

^d Includes back half of filter holder at ESP inlet and outlet and gas cooling system at APF inlet and outlet.

NA = Not applicable.

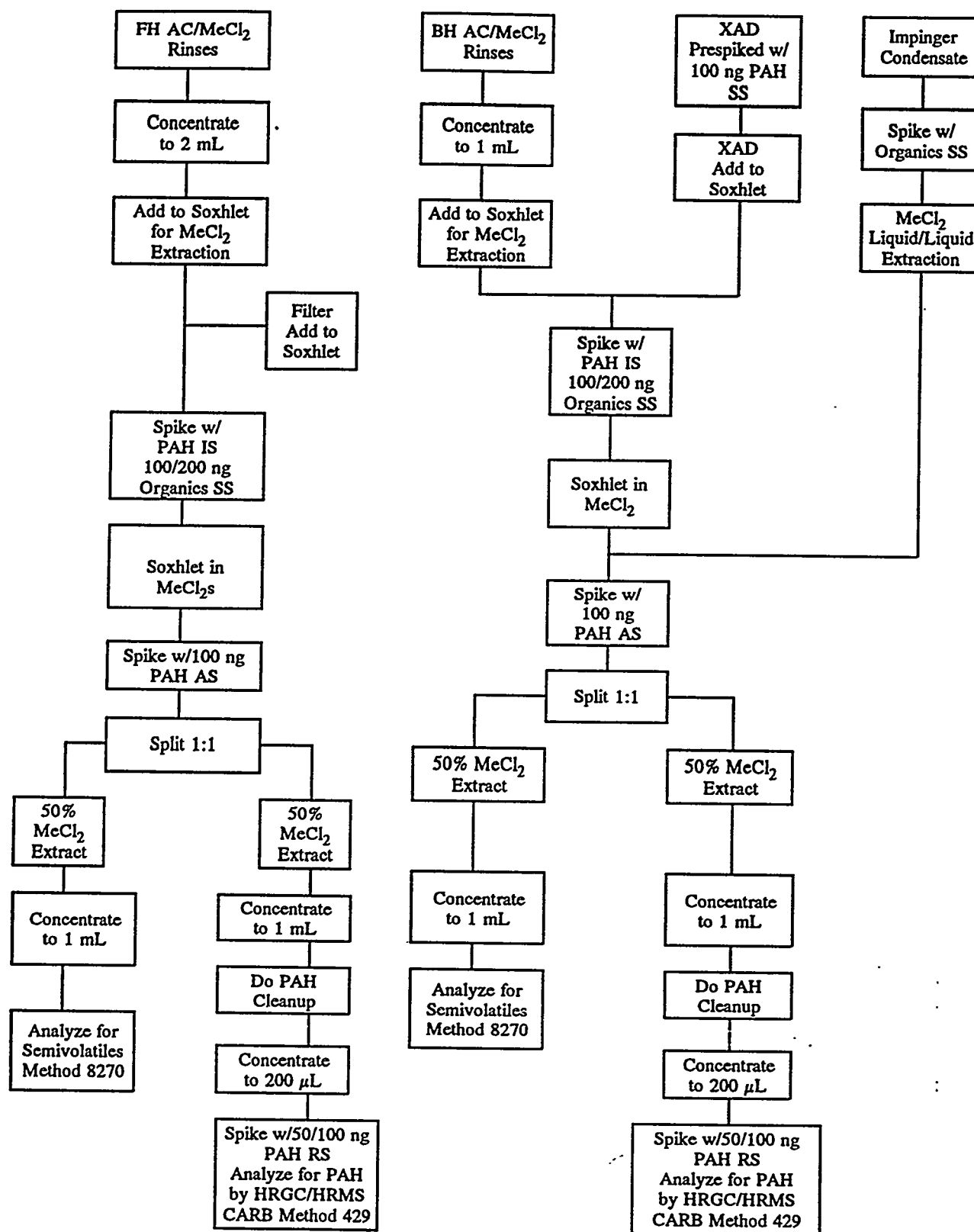


Figure A-15
Flue Gas Sample Preparation and Analysis Plan for Semivolatile Organic Compounds and PAHs

The particulate phase consisted of the front-half acetone/methylene chloride PNR and the filter. The vapor phase consisted of the back-half acetone/methylene chloride rinse, the XAD resin, and the impinger condensate. The combined acetone/methylene chloride PNR/filter fraction and XAD fractions were soxhlet-extracted separately with methylene chloride. The impinger condensate fraction was liquid-liquid extracted with methylene chloride. The XAD extract and the impinger condensate extract were then combined, concentrated to 1 mL, and analyzed by gas chromatography/mass spectrometry (GC/MS) according to EPA Method 8270 and by high resolution GC/MS according to CARB Method 429. Triangle Laboratories, Inc. was subcontracted to perform these analyses.

Dioxins and Furans

Sampling for dioxins and furans in the selected gas streams was performed using EPA Reference Method 23.²⁷ Sample collection procedures specified in Method 23 were followed with the following exception: All train component rinses were performed with methylene chloride and acetone. The toluene rinse was then performed and added to the respective front half and back half acetone/methylene chloride rinse samples.

Adding the toluene rinses to the other solvent rinses provided a single sample for analysis of all congeners of dioxins and furans. Sample rate, volume and procedures were identical to the MM5 procedures described previously.

At the APF outlet, the particulate- and vapor-phase sample fractions were prepared and analyzed separately. At all other sampling locations, the particulate- and vapor-phase samples were combined for a single analysis. A description of the sampling train and sample fraction recovery for the Method 23 sampling train is presented in Table A-12. The sample fractions generated by the Method 23 sampling train and an overview of the sample handling process are shown in Figures A-16 and A-17.

Particulate Phase. The particulate phase consisted of the combined front-half toluene and acetone/methylene chloride rinses, and the filtered particulate matter. The toluene/

Table A-12
Description and Recovery of Method 23 (Dioxins/Furans) Sampling Train

Component	Solution	Recovery ^a	Container	Preparation & Analysis
Probe/Nozzle Rinse ^b	NA	Rinse probe, nozzle, and front half of filter holder with MeCl ₂ , acetone, then toluene into sample container.	500 mL amber glass bottle. Cool to 4°C.	See Figures A-16 and A-17
Filter ^b	Pretreated quartz filter	Place filter in sample container.	Glass petri dish. Cool to 4°C.	See Figures A-16 and A-17
Thimble ^c	Thimble	Place thimble in sample container.	Glass jar. Cool to 4°C.	See Figures A-16 and A-17
Transfer Line Rinse ^d	NA	Rinse transfer line with MeCl ₂ , acetone, then toluene into sample container.	1000 mL amber glass bottle. Cool to 4°C.	See Figure A-16 and A-17
Condenser	NA	Rinse condenser with MeCl ₂ , acetone, then toluene into sample container.		
XAD Cartridge	Spiked XAD-2 resin	Seal resin cartridge.		
Impinger #1	Dry	Recover condensate, then rinse impinger and connecting glassware with MeCl ₂ , acetone, then toluene into sample container.	Wrap in aluminum foil. Cool to 4°C.	See Figure A-16 and A-17
Impinger #2	Ultrapure water (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ , acetone, then toluene into sample container.	Discard.	None
Impinger #3	Ultrapure water (200 mL)	Recover impinger solution, then rinse impinger and connecting glassware with MeCl ₂ , acetone, then toluene into sample container.		
Impinger #4	Silica Gel (300 g)	Not recovered.	None	None

^a All impingers were weighed prior to recovery.

^b ESP inlet and outlet and APF outlet.

^c APF inlet only.

^d Includes back half of filter holder at ESP inlet and outlet and gas cooling system at APF inlet and outlet.

NA = Not applicable.

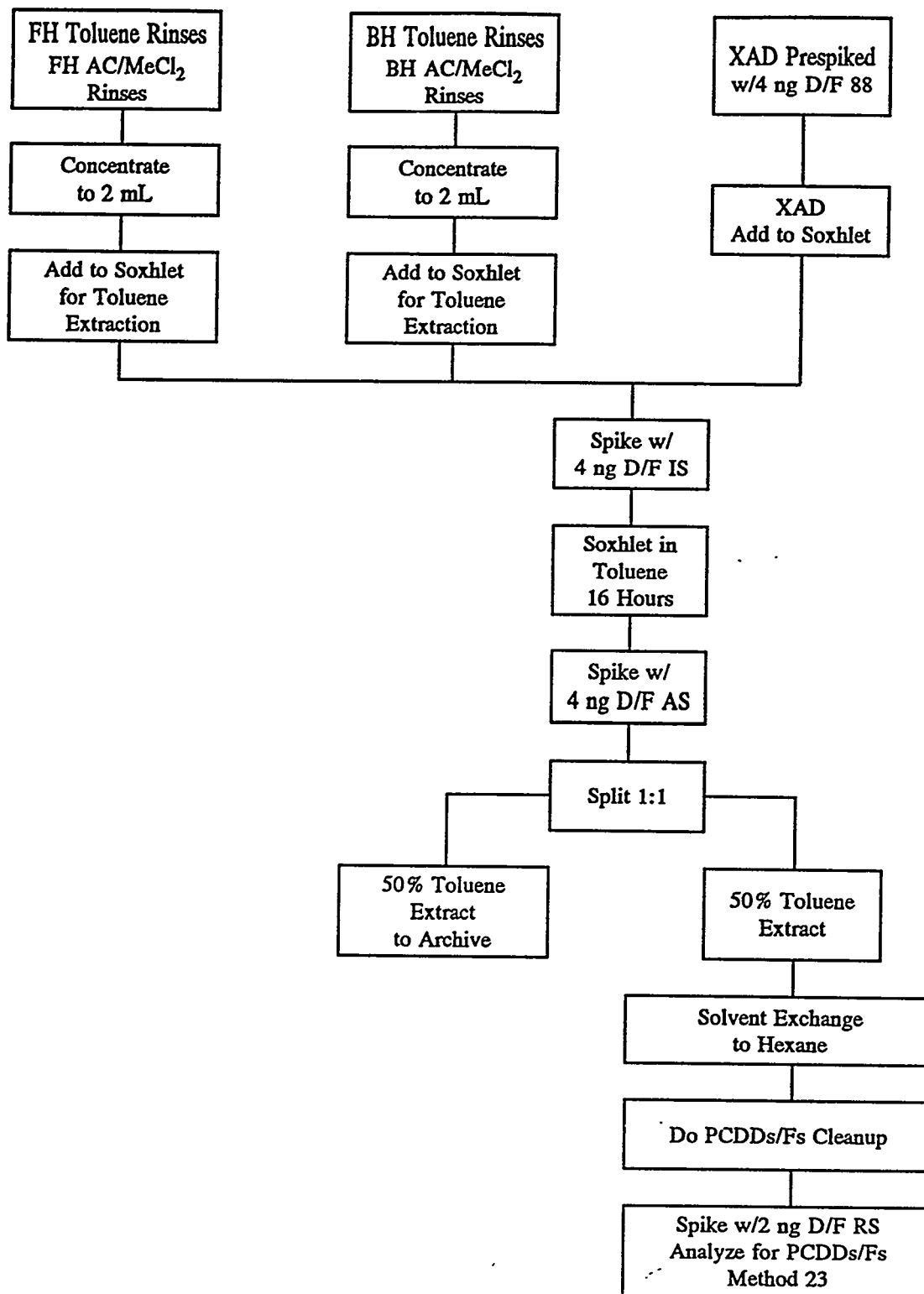


Figure A-16
Flue Gas Sample Preparation and Analysis Plan for Dioxins and Furans (ESP Inlet and Outlet and APF Inlet)

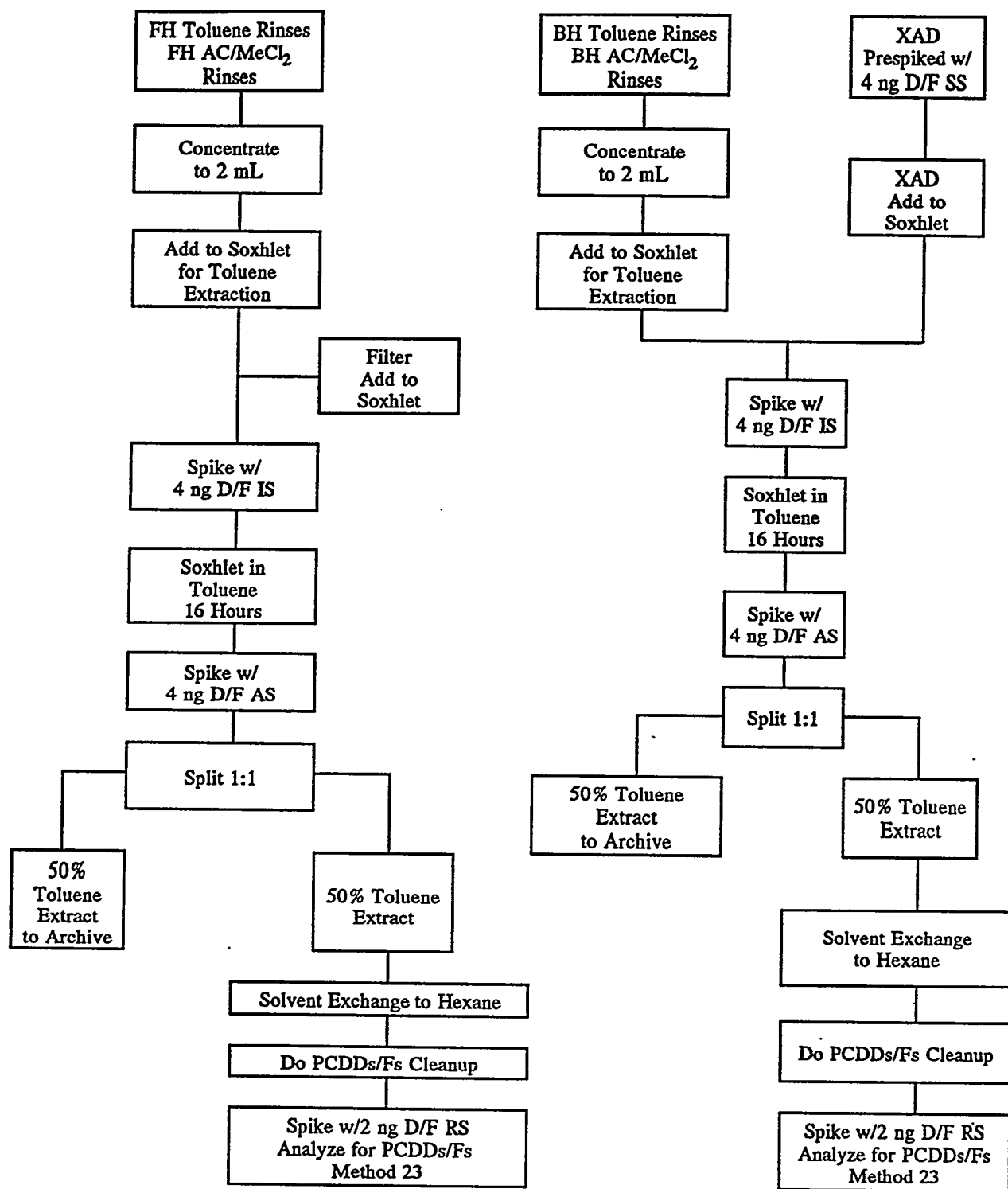


Figure A-17
Flue Gas Sample Preparation and Analysis Plan for Dioxins and Furans (APF Outlet only)

acetone/methylene chloride rinse was concentrated to 2 mL and added to the filter fraction (and XAD fraction if particulate and vapor phases were combined). This was then spiked with internal standards and extracted with toluene. The extract was spiked with alternate standards and then split into two fractions. One fraction was archived while the other fraction was extracted with toluene, solvent-exchanged, spiked with recovery standards, and then analyzed by high resolution GC/MS according to EPA Method 23.

Vapor Phase. The vapor phase consisted of the combined back-half toluene/acetone/methylene chloride rinse, and the XAD resin. The toluene/acetone/methylene chloride rinses were combined, concentrated to 2 mL, and added to the XAD fraction (and particulate fraction if particulate and vapor phases were combined). This was then spiked with internal standards and extracted with toluene. The extract was spiked with alternate standards and then split into two fractions. One fraction was archived while the other fraction is extracted with toluene, solvent exchanged, spiked with recovery standards, and then analyzed by high resolution GC/MS according to EPA Method 23.

The QA/QC sample requirements for the Method 23 dioxins and furans trains are provided in the following table. Triangle Laboratories, Inc. was subcontracted to perform the high resolution GC/MS analyses.

Particle Size Distribution

The particle size distribution (PSD) of material in the sample gas was measured using cascade impactors at the ESP inlet and outlet. These impactors classify particulate matter with respect to aerodynamic particle size.

The impactor separates the particulate matter into 11 size fractions (10 impacted fractions and one fraction collected on a back-up filter). The impactor stages were selected to provide 10 cut-points at aerodynamic particle diameters of $<0.1 \mu\text{m}$ to $>11 \mu\text{m}$. The isokinetic flow rate through the sampling nozzle was precalculated for a single point in the duct representing the average gas velocity. To maintain specified cut-points, the flow rate through the

impactor was kept constant. This nullifies the performance of traverses where adjusting the flow rate for variations in stack gas velocity is necessary. After sampling, the impactor was unloaded, the collected particulate material desiccated, and then weighed. The particulate mass collected on each stage was used to calculate the PSD. As planned, particle size distribution samples were not collected at the APF inlet and outlet because of the severe conditions and incompatibility of the sampling system for PSD measurements.

A description of the sampling train and sample fraction recovery for the PSD sampling train is presented in Table A-13.

Hexavalent Chromium

ESP outlet gas samples for hexavalent chromium were collected using the EPA method for Cr(VI).²⁸ Gas samples totaling 40-60 dscf were collected isokinetically at a single point representative of the average gas velocity. As specified in the method, all sampling train components were Teflon®. This eliminated the interferences experienced with chromium adsorption onto glass components.

Sulfur dioxide (SO₂) and carbon dioxide (CO₂) create an adverse chemical environment that affects the preservation and determination of Cr(VI) in gas streams from coal-combustion sources. The EPA method for Cr(VI), validated for incinerator flue gases, specifies a 0.10 N potassium hydroxide (KOH) impinger solution for gas sampling. A 1.0 N KOH solution was used for the test at Plant Tidd as discussed in the following paragraphs.

The KOH provides a solution pH > 9 that inhibits the reduction of Cr(VI) to Cr(III). For a 40 dscf gas sample at the 200 ppmv SO₂ concentration in the ESP outlet gas, all of the KOH in a 0.1 normal solution would have been neutralized by the SO₂. The SO₂ effectively reduces the solution pH, and thereby increases the potential for reducing Cr(VI), potentially biasing the results low. The presence of CO₂ in the flue gas also reacts with the KOH to produce a carbonate/bicarbonate buffered solution with a lower pH (pH ~ 8.3). In solutions

Table A-13

Description and Recovery of the Particle Size Distribution Sampling Train

Component	Contents	Recovery	Container	Preparation & Analysis
Glass Fiber Substrates (3)	1 set glass fiber substrates	Place substrates in individual sample containers.	Plastic petri dish	Desiccate and weigh to nearest 0.1 mg
Filter		Place filter in individual sample container.	Plastic petri dish	Desiccate and weigh to nearest 0.1 mg
Impinger #1	3 % H ₂ O ₂	Not recovered.	None	None
Impinger #2	Dry	Not recovered.	None	None
Impinger #3	Silica gel (300 g)	Not recovered.	None	None

with a pH <9, preservation of Cr(VI) is less effective. The reaction of CO₂ in caustic solutions is unavoidable; however, additional KOH can be added in the impinger solution to prevent an SO₂-induced drop in pH. Therefore, for the Cr(VI) tests at Plant Tidd, a 1.0 normal KOH solution was used to prevent the pH from dropping below that of the resulting carbonate/bicarbonate buffer.

Increasing the KOH concentration above 1.0 N is counterproductive. The concentration of CO₂ in the flue gas would have required a KOH concentration in excess of 20 normal to maintain a pH >8.3. This concentration is unattainable. In addition, the background level of Cr(VI) in the KOH reagent tends to obscure the low levels of Cr(VI) potentially detectable in the sample.

The impinger solutions recovered from the EPA Cr(VI) sampling train were analyzed on site immediately after collection to minimize reduction of any Cr(VI) to Cr(III). The pH of each sample was measured prior to analysis with a pH color strip. All samples showed a pH >9 which was sufficient to inhibit the reduction of Cr(VI) to Cr(III). The analysis was performed using an IC equipped with a post-column reactor and UV-VIS detector as specified in the sampling method. A concentrator column was used to load samples and an eluent solution of ammonium sulfate and ammonium hydroxide was used as the mobil phase. An acidic solution of 1,5-diphenyl carbazide was applied in the post-column reactor to develop a colored chromium complex with an absorbance maximum of 540 nm. The absorbance of the sample was measured at this wavelength to determine the concentration of Cr(VI) in the impinger sample. Following recovery of the caustic impinger solution, the sampling train was rinsed with 0.1 N HNO₃. These rinses and the caustic impinger solution were returned to Radian's Austin laboratory for total chromium analysis as a cross-check against the Cr(VI) results. Total chromium was determined on these samples by ICP emission spectroscopy.

A description of the sampling train and sample fraction recovery for the Cr(VI) sampling train is presented in Table A-14. The sample fractions generated by the Cr(VI) sampling train and an overview of the sample handling process are shown in Figure A-18.

Table A-14
Description and Recovery of Cr⁺⁶ Sampling Train

Component	Solution	Recovery	Container	Preparation & Analysis
Probe/Nozzle Rinse	NA	Rinse probe nozzle, aspirator sample and recirculation lines with DI water into sample container.	500 mL plastic bottle	See Figure A-18
Impinger #1	1.0 N KOH (150 mL)	Recover impinger, then rinse impinger and connecting Teflon® with DI water into sample container.		
Impinger #2	1.0 N KOH (75 mL)	Recover impinger, then rinse impinger and connecting Teflon® with DI water into sample container.		
Impinger #3	1.0 N KOH (75 mL)	Recover impinger, then rinse impinger and connecting Teflon® with DI water into sample container.		
Impinger #4	Dry	Not recovered.	None	None
Impinger #5	Silica gel (300 g)	Not recovered.	None	None
Nitric Acid Impinger Rinses	NA	Rinse all impingers and connecting Teflon® with 0.1 N HNO ₃ .	500 mL plastic bottle	Analyze for total chromium

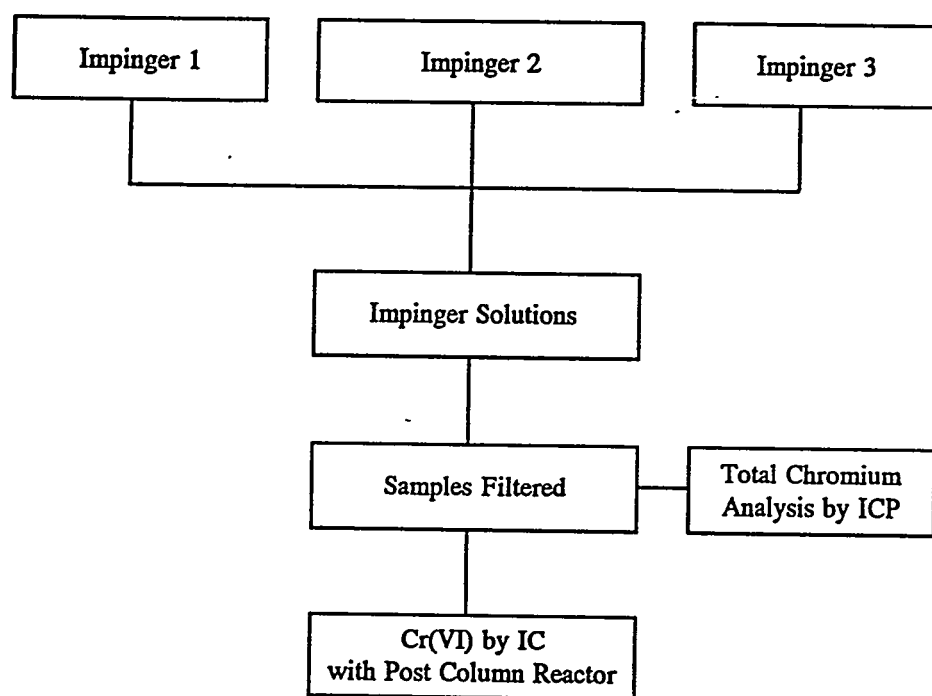


Figure A-18
Gas Impinger Sample Preparation and Analysis for Cr^{+6} and Total Chromium

Solid Streams

There were seven solid process streams identified for HAP sampling. Feed streams included the raw coal fed to the grinding mill, the coal-water paste fed to the PFBC, and the dry dolomite sorbent. Collected ash streams included the bed ash from the bottom of the PFBC unit, the primary cyclone ash, the APF ash, and the ESP hopper ash (four hoppers). The sample collection and analysis approach for each of these streams is presented in this section. An overview of the field sampling requirements for solids is shown in Tables A-2 and A-3. Duplicate samples were collected during one of the three test runs to assess sample collection precision.

Raw Coal

Samples of raw coal were collected from the coal conveyer by an ASTM autosampler. This sample, although it may be representative of the coal feedstock, was not the best representation of the coal fed to the PFBC unit since a four- to six-hour delay exists between sample collection and actual feed to the PFBC unit. The raw coal is mixed with water and pulverized to make a paste (70-75% coal by weight) which is fed to a mixing tank that supplies the unit with fuel. The coal paste provided the most representative fuel sample since it is closest to the point of injection. Nevertheless, raw coal samples were collected daily and held as a backup should coal paste sample integrity be questioned. Sample splits of the raw coal collected by the ASTM sampling system were stored at room temperature in sealed plastic bags.

Coal Paste Sampling

Coal paste is a 70-75 wt% slurry that is fed to the PFBC boiler. The paste is mixed in a run tank before being fed to the PFBC. The residence time is approximately two hours. For each run, multiple grab samples were taken at half-hour intervals from the paddle feeder when the paddle feeder was actively feeding coal paste to the mixing tank. The collection started approximately one hour before gas sampling to ensure that the sample was

representative of the burned mixture. The samples were composited and collected into a five-gallon bucket which was labeled, sealed, and sent to Radian's laboratories for preparation and analysis. Table A-15 presents the sampling plan.

Coal Paste Preparation. The coal paste in each bucket was thoroughly mixed and subsampled for drying. Weights were obtained on one subsample of the coal paste before and after drying at 104°C to determine the weight percent of solids in the paste. A second subsample was air dried, ground to -60 mesh, and sealed in plastic bags for the analyses shown in Figure A-19. All results were reported on a dry coal basis.

Coal Paste Analysis

Metals. A fraction of the subsample was analyzed by instrumental neutron activation (INAA).²⁹ A second subsample was prepared and analyzed by ASTM D3683³⁰ for target elements (beryllium, phosphorus, and lead) which cannot be determined by INAA. In addition, ASTM D3684³¹ was used to prepare and analyze samples for some of the more volatile metals such as arsenic, cadmium, and selenium. This technique combusts the prepared coal sample in a closed oxygen combustion bomb containing a small amount of nitric acid. The bomb washings were recovered and analyzed by GFAAS. Mercury was determined by combusting a sample and trapping the mercury vapors using a double gold amalgamation technique. The amalgamated mercury was thermally desorbed and analyzed by cold vapor atomic absorption spectroscopy (DGAA-CVAAS).³²

Anions. Chlorine and fluorine in coal were determined by ASTM D4208³³ and D3761,³⁴ respectively. Prepared coal samples were combusted in a closed oxygen combustion bomb containing a dilute basic solution. The bomb washings were analyzed by SIE.

Ultimate, Proximate, and Higher Heating Value. In conjunction with the other analyses, higher heating value (HHV), proximate (intrinsic moisture, volatile and fixed carbon, and ash), and ultimate (percent carbon, hydrogen, nitrogen, sulfur, oxygen, and ash) analyses were performed according to standard ASTM procedures.^{35,36,37}

Table A-15
Description and Recovery of Coal Paste

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	Hourly during coal paste feed to storage tank.	Grab samples composited directly into a 5 gallon plastic bucket	Sealed container	Air-dried sample aliquots split into sealed plastic bags	See Figure A-19
Anions (Cl, F)					
Radionuclides					
HHV					
Ultimate/ Proximate					

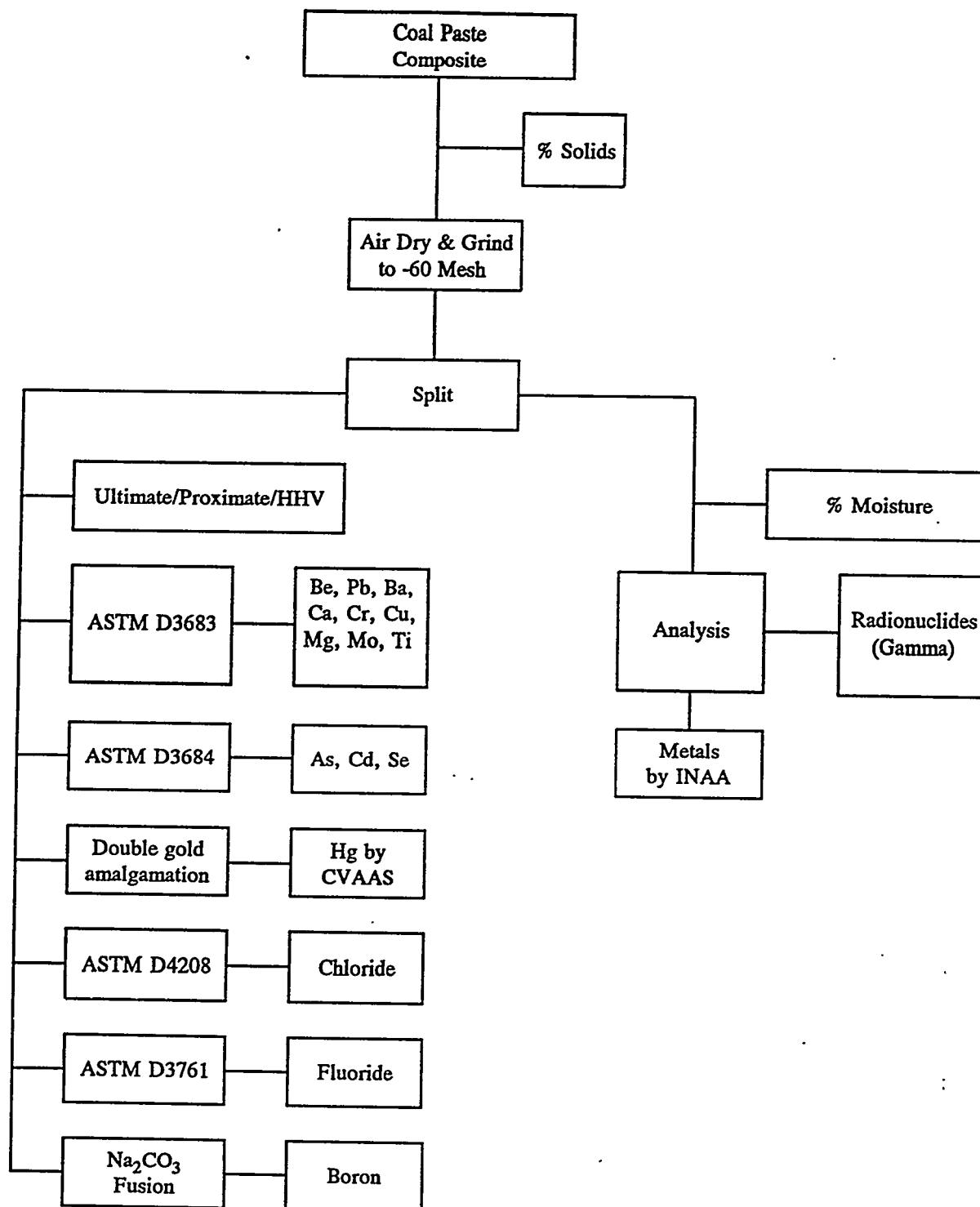


Figure A-19
Coal Sample Preparation and Analysis Plan

Radionuclides. Coal samples were analyzed by EPA Method 901.1.³⁸ This method uses gamma emitting spectrometry to measure radioactivity through gamma decay.

Dolomite Sorbent Sampling

The original plan called for collection of a run composite from the autosampler at the sorbent storage silo. However, the autosampler experienced mechanical problems on Days 1 and 2 of the test, so Run 3 samples were collected from the diversion gate upstream of the east and west silos. A single grab sample was collected 12 hours before the beginning of Run 3 to account for the lag time in the hopper. The samples were collected in plastic bottles, labeled, and sent to Radian laboratories for preparation and analysis. Table A-16 presents the sampling plan.

Dolomite Sorbent Analysis

Metals. The sorbent samples were air dried, ground to pass through a 60-mesh sieve, then subsampled for mercury analysis by CVAAS. Aliquots of the remaining material were digested with nitric acid by EPA Method 3050.³⁹ The digestate was analyzed by ICP-AES and GFAAS.

Anions. Separate preparatory techniques were necessary for the analysis of fluoride, chloride, and sulfate in these solids. All sample aliquots were taken from the ground, air-dried material prepared for metal analysis. Fluoride sample aliquots were prepared by fusion with sodium hydroxide.⁴⁰ The fusion melt was dissolved in deionized water and analyzed potentiometrically by fluoride-specific ion electrode. Samples for chloride analysis were prepared by mild digestion in nitric acid. The digestate was analyzed potentiometrically by chloride-specific ion electrode. For the analysis of sulfate, the sample was digested in HCl⁴¹ and the digestate was analyzed by IC.

Table A-16
Description and Recovery of Dolomite Sorbent

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	1 daily run sample from autosampler or diversion gate upstream of silos.	Grab sample collected from autosampler into a sealed plastic container.	None	Air dried sample aliquots split into sealed plastic bags.	See Figure A-20
Anions (Cl, F, SO ₄)					

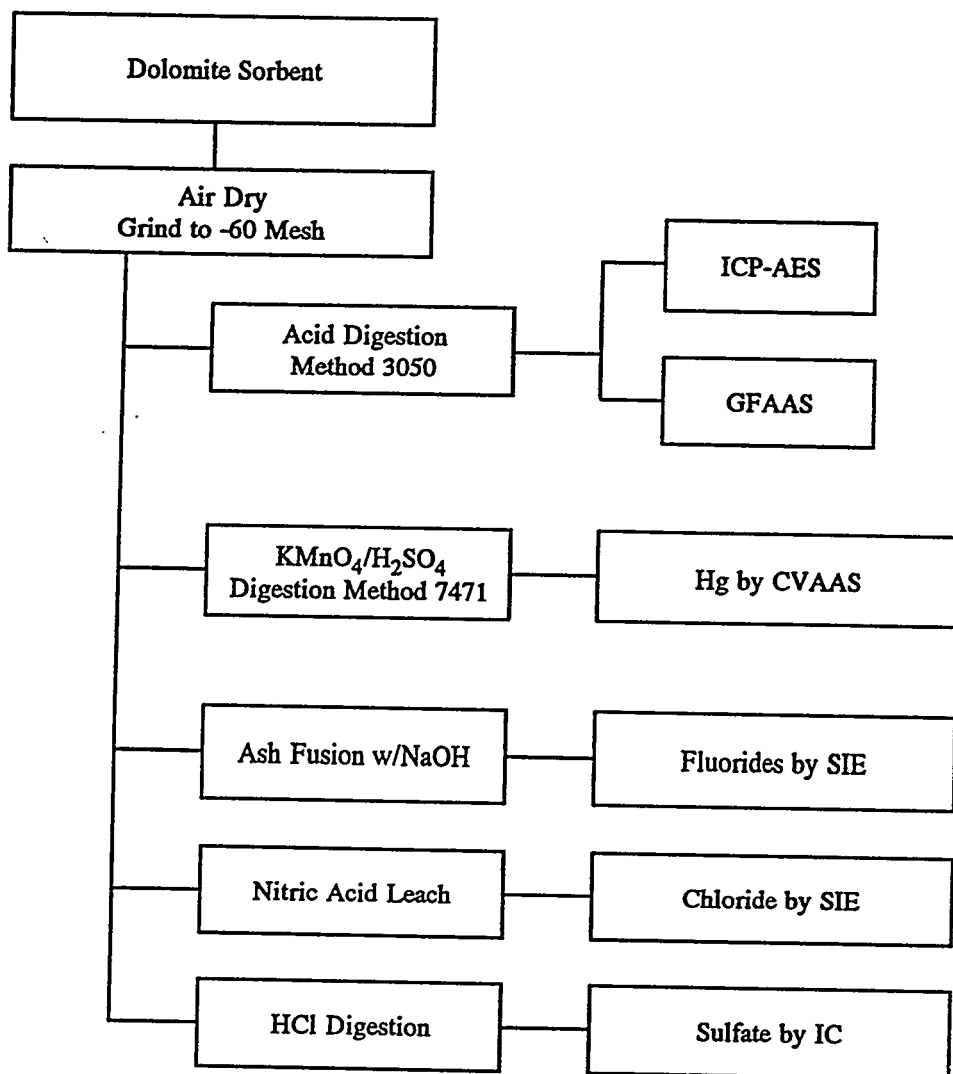


Figure A-20
Sorbent Sample Preparation and Analysis Plan

Ash Sampling

Ash was collected by autosampler at the primary cyclone and by composited grab samples at the other locations. Each composite was collected on site in two separate labeled containers. Plastic containers were used for samples targeted for inorganic analysis, and 1 L amber glass bottles were used for samples for organic analysis. Samples for organic analysis were cooled immediately after collection and stored at 4°C.

Bed Ash. Bed ash was grab-sampled manually as the ash was dumped to the ash conveyer. The grab samples were collected during each ash dumping cycle during the sample run and composited directly into a galvanized metal container. The daily composite was tumbled, riffled, and split for inorganic and organic analysis. Table A-17 presents the sample handling and preservation techniques.

Primary Cyclone Ash. This ash was collected from the facility's autosampler located at the ash feed line into the storage silo. The sampler was purged prior to a run and allowed to fill throughout the run period. The sampling frequency of the autosampler was set for sample collection every 15 minutes. The autosampler was not functioning properly during Run 3, so fewer sample cuts were obtained for the composite. Table A-18 presents the sample handling and preservation techniques.

APF Ash. The initial plan was to collect multiple grab samples of the APF ash from the ash collection truck. However, an alternate sampling location at the bottom of the APF ash lockhopper was identified once the crew arrived on site. The lockhopper system was disengaged a minimum of two times during each run to allow collection of grab samples from the system. These grab samples were then composited to obtain a run composite. Table A-19 presents the sample handling and preservation techniques.

ESP Ash. The ESP system was made up of four fields with two hoppers per field. ESP Fields 1 and 2 were dumped each morning before the test began and samples were collected at the end each test period for metals and anions analyses. ESP Fields 3 and 4 were dumped

Table A-17
Description and Recovery of Bed Ash

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	Grab samples collected during each ash dumping cycle.	Grab samples composited directly into a galvanized metal can.	None	Plastic bottle or sealed plastic bags	See Figure A-21
Anions (Cl, F, PO ₄ , SO ₄)					
Radionuclides		Riffle bulk composite collect into a plastic container.			
Carbon					
PSD					
Semivolatle Organics	Riffle bulk composite collect into separate sample bottles.	Cool to 4 °C	1000 mL amber glass bottle		

Table A-18
Description and Recovery of Primary Cyclone Ash

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis	
Metals	Every 15 minutes by autosampler.	Daily run composite collected from autosampler into a plastic bottle.	None	Plastic bottle or sealed plastic bag	See Figure A-21	
Anions (Cl, F, PO ₄ , SO ₄)						
Radionuclides						
Carbon						
Dioxins and Furans		Bulk composite split into separate sample bottles.	Cool to 4°C	1000 mL amber glass bottle		
Semivolatile Organics						

Table A-19
Description and Recovery of APF Ash

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	Minimum of two grab samples during each test run.	Multiple grab samples taken from the APF ash hopper. Collected as a bulk composite in a plastic bottle.	None	Plastic bottle	See Figure A-21
Anions (Cl, F, PO ₄ , SO ₄)					
Radionuclides					
Carbon					
Dioxins and Furans					
Semivolatile Organics		Bulk composite split into amber glass bottles.	Cool to 4°C	1000 mL amber glass bottle	

at the beginning of the first test period. Samples were collected after the ash was allowed to accumulate over a three-day period so that enough material could be obtained for analysis.

Table A-20 presents the sample handling and preservation techniques.

Ash Preparation. All ash samples were collected dry. Bed ash samples were ground to pass through a 60-mesh sieve prior to taking aliquots for mercury analysis. All other ash samples did not require grinding. Figure A-21 presents the sampling handling and preparation procedures for each ash sample analyzed for the following analytes.

Ash Analysis

Metals. Samples were digested in a microwave digestion vessel using nitric, hydrochloric, and hydrofluoric acids. The digestate was analyzed by ICP-AES and GFAAS. Mercury was analyzed by CVAAS (EPA Method 7471).

Anions. Separate preparatory techniques were necessary for analysis of fluoride, chloride, and sulfur in ash. All sample aliquots were taken from the ground, air-dried material prepared for trace element analysis. Subsamples for fluoride analysis were fused with sodium hydroxide. The fusion melt was dissolved in deionized water and analyzed potentiometrically by fluoride-specific ion electrode. Ash samples for chloride analysis were prepared by mild digestion in nitric acid. The digestate was analyzed potentiometrically by chloride-specific ion electrode. Sulfur analysis was performed directly on the ground sample by ASTM Method D4239.⁴²

Semivolatile Organic Compounds. Ash samples targeted for SVOC analyses were separated at the test site and shipped directly to the laboratory. The ash samples were soxhlet-extracted in methylene chloride by EPA Method 3540.⁴³ The extracts were then analyzed by GC/MS according to EPA Method 8270.

Table A-20
Description and Recovery of ESP Ash

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	Fields 1 & 2: Daily at end of test period. Fields 3 & 4: At conclusion of test run.	Grab samples composited into plastic containers as a bulk composite for each field.	None	Plastic bottle or sealed plastic bag.	See Figure A-21
Anions (Cl, F, SO ₄)					
Radionuclides					
Carbon					
PSD					
Dioxins and Furans	Fields 1 & 2: Daily at end of test period.	Bulk composite split into amber glass bottles.	Cool to 4°C	1000 mL amber glass bottle.	
Semivolatile Organics	Fields 3 & 4: At conclusion of test run.				

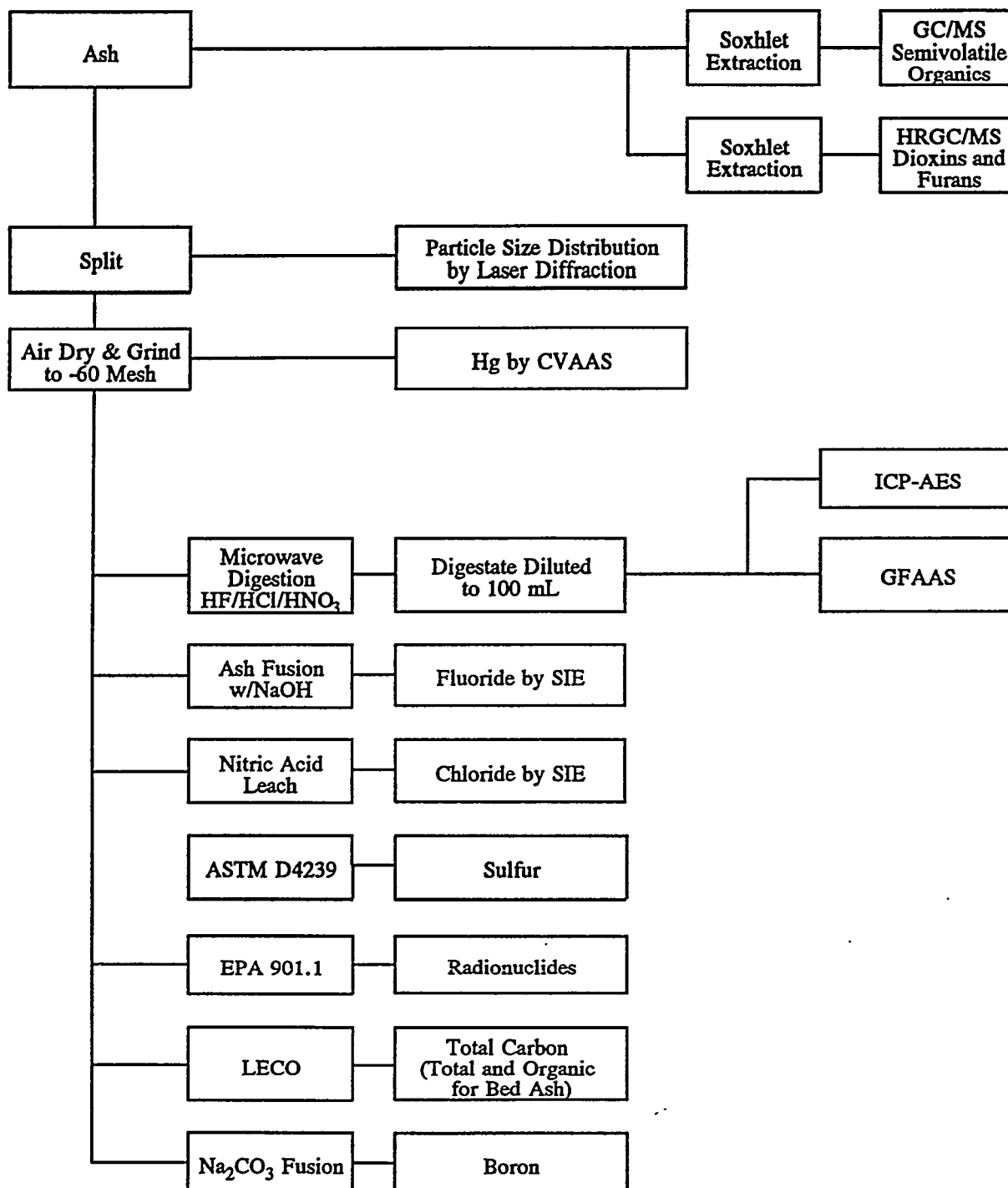


Figure A-21
Ash Sample Preparation and Analysis Plan

Dioxins and Furans. Ash samples analyzed for dioxins and furans were separated on site and shipped chilled directly to the laboratory for analysis. The ashes were toluene soxhlet-extracted and purified. The extract was analyzed using high resolution GC/MS. Both preparation and analysis are a part of EPA Method 8290.⁴⁴

Particle Size Distribution. Dry ash samples from the individual ESP fields were analyzed for PSD by laser diffraction using the Microtrac analyzer. Sample aliquots of well-mixed ash were suspended in either water or alcohol and injected into the recirculation system of a Microtrac particle-size analyzer.

Radionuclides. Ash samples were analyzed by EPA Method 901.1. This method uses gamma emitting spectrometry to measure radioactivity through gamma decay.

Carbon. Ash samples were analyzed for percent carbon by a LECO carbon-hydrogen-nitrogen analyzer. This analyzer combusts the sample in an oxygen atmosphere and measures the carbon dioxide in the combustion gas.

Service Water Sampling and Analysis

Plant service water was the only liquid stream sampled. A single grab sample was collected daily to represent the coal paste make-up water source during active paste preparation. The daily composite was collected into plastic sample bottles. Samples for metals analysis were preserved on site with HNO_3 to a pH <2. Samples for anions were cooled to 4°C. Table A-21 presents the sampling plan, and Figure A-22 lists the sample preparation and analysis procedures.

Metals

The unfiltered service water samples were prepared for total metal analysis according to EPA Methods 3005⁴⁵ and 3020.⁴⁶ The samples were vigorously digested in concentrated nitric acid to dissolve any suspended material that may be present in the samples. The

Table A-21
Description and Recovery of Service Water

Parameter	Sample Frequency	Sample Handling	Preservation	Container	Preparation & Analysis
Metals	Once daily during coal paste preparation.	Grab samples collected directly into plastic bottle containing preservative.	HNO ₃ to pH <2	1000 mL plastic bottle	See Figure A-22
Anions (Cl, F, PO ₄ , SO ₄)		Grab samples collected directly into 1 L plastic bottle.	Cool to 4°C		

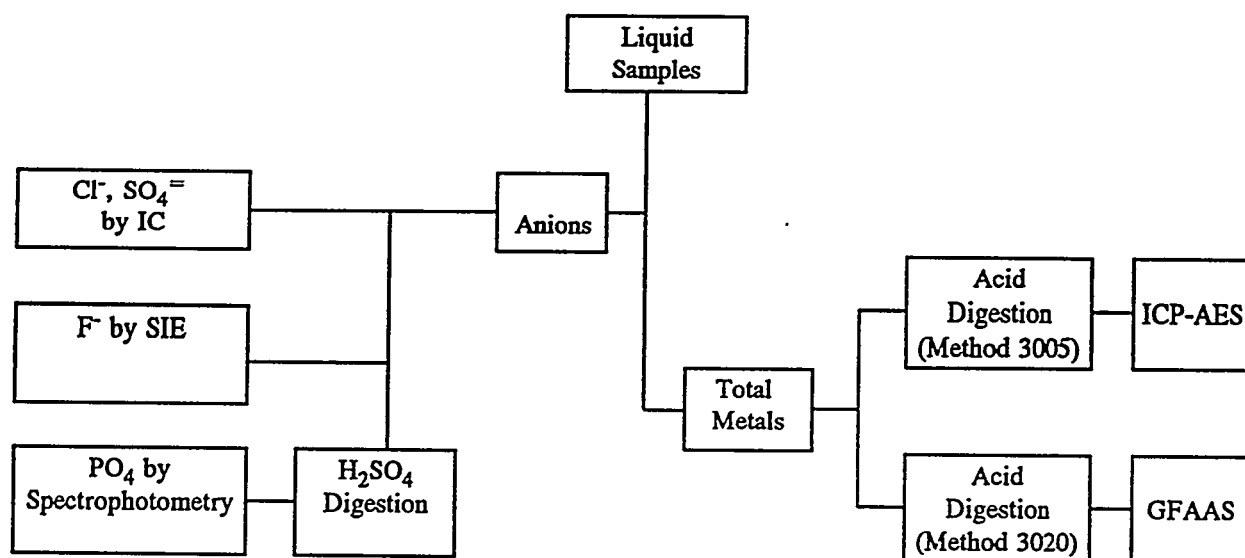


Figure A-22
Liquid Sample Preparation and Analysis Plan

digestates were diluted to a known volume and analyzed by ICP-AES and GFAAS.

Mercury was determined by EPA Method 7470.

Anions

Sample aliquots for the analysis of chloride, fluoride, sulfate, sulfite, and phosphate were collected in separate containers and filtered. Chloride and sulfate were determined by IC according to EPA Method 300.0. Fluoride was determined potentiometrically by fluoride SIE. Phosphate was determined spectrophotometrically as a measure of total phosphorus after the sample was digested according to EPA Method 365.1.

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APPENDIX B: DETAILED ANALYTICAL DATA

Key to Appendix B Data Flags

Comment	Description
B	Analyte detected in method blank.
C	Result corrected with reagent blank result.
E	Result exceeds instrument calibration range.
F	PCDF peak eluted at the same time as the associated diphenyl ether (DPE) and the DPE peak intensity is 10% or more of the PCDF peak intensity.
G	Estimated result because of coelution with sulfur dioxide.
J	Result is less than the quantitation limit but greater than the detection limit.
S	Result is an estimate because of saturated peak.

DATA USED IN CALCULATIONS

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg	ND (0.012)		ND (0.012)		ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g	ND (0.0063)		ND (0.0064)		ND (0.0063)	
1,2-Dichlorobenzene	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g	ND (0.023)		ND (0.023)		ND (0.023)	
2,4,5-Trichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g	ND (0.042)		ND (0.042)		ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g	ND (0.086)		ND (0.086)		ND (0.085)	
2,4-Dinitrotoluene	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g	ND (0.035)		ND (0.035)		ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g	ND (0.030)		ND (0.030)		ND (0.030)	
2-Chlorophenol	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
2-Methylphenol	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitroaniline	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitrophenol	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g	ND (0.036)		ND (0.036)		ND (0.036)	
3-Nitroaniline	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g	ND (0.041)		ND (0.041)		ND (0.041)	
4-Nitroaniline	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Nitrophenol	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
Acenaphthene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Acenaphthylene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Anthracene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benz(a)anthracene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Benz(a)pyrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g	ND (0.032)		ND (0.032)		ND (0.032)	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzo(g,h,i)perylene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g	ND (0.027)		ND (0.027)		ND (0.027)	
Benzoic acid	GCMS	ug/g	ND (0.099)		ND (0.099)		ND (0.099)	
Benzyl alcohol	GCMS	ug/g	ND (0.048)		ND (0.048)		ND (0.047)	
Butylbenzylphthalate	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Chrysene	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g	ND (0.023)		ND (0.023)		ND (0.022)	
Dibenzofuran	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Diethylphthalate	GCMS	ug/g	ND (0.012)		ND (0.012)		ND (0.012)	
Dimethylphthalate	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.015)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Fluoranthene	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
Fluorene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Hexachlorobenzene	GCMS	ug/g	ND (0.017)		ND (0.018)		ND (0.017)	
Hexachlorobutadiene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g	ND (0.054)		ND (0.054)		ND (0.054)	
Hexachloroethane	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Isophorone	GCMS	ug/g	ND (0.0100)		ND (0.010)		ND (0.0100)	
N-Nitroso-di-n-propylamine	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
Naphthalene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Nitrobenzene	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Pentachlorophenol	GCMS	ug/g	ND (0.0063)		ND (0.0064)		ND (0.0063)	
Phenanthrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Phenol	GCMS	ug/g	ND (0.033)		ND (0.034)		ND (0.033)	
Pyrene	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g	ND (0.054)		ND (0.054)		ND (0.054)	
p-Chloronitro	GCMS	ug/g	ND (0.032)		ND (0.033)		ND (0.032)	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	mg/kg	235 B	B	274 B	B	291 B	B
Cadmium	GFAA	mg/kg	1.54 B	B	1.54 B	B	1.61 B	B
Lead	GFAA	mg/kg	63.7		78.2		66.4	
Selenium	GFAA	mg/kg	ND (0.99)		1.08		ND (0.96)	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt	ND (0.60)		ND (0.30)		ND (0.10)	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt	ND (0.30)		ND (0.10)		0.130	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt	ND (0.50)		ND (0.20)		ND (0.10)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt	ND (0.50)		ND (0.20)		ND (0.10)	
1,2,3,4,7,8-HxCDF	IIR GCMS	ppt	ND (0.30)		ND (0.10)		ND (0.070)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt	ND (0.40)		ND (0.20)		ND (0.10)	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt	ND (0.20)		ND (0.10)		ND (0.060)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt	ND (0.40)		ND (0.20)		ND (0.10)	
1,2,3,7,8,9-HxCDF	IIR GCMS	ppt	ND (0.30)		ND (0.20)		ND (0.080)	
1,2,3,7,8-PeCDD	HR GCMS	ppt	ND (0.40)		ND (0.20)		ND (0.10)	
1,2,3,7,8-PeCDF	HR GCMS	ppt	ND (0.30)		ND (0.10)		ND (0.080)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt	0.480		0.270		0.260	
2,3,4,7,8-PeCDF	HR GCMS	ppt	ND (0.20)		ND (0.10)		ND (0.080)	
2,3,7,8-TCDD	HR GCMS	ppt	ND (0.30)		ND (0.10)		ND (0.10)	
2,3,7,8-TCDF	HR GCMS	ppt	ND (0.20)		ND (0.090)		ND (0.080)	
OCDD	HR GCMS	ppt	ND (0.80)		0.290		0.220	
OCDF	HR GCMS	ppt	ND (0.70)		ND (0.30)		ND (0.20)	
Total HpCDD	HR GCMS	ppt	ND (0.60)		ND (0.30)		ND (0.10)	
Total HpCDF	HR GCMS	ppt	ND (0.30)		ND (0.30)		ND (0.10)	
Total HxCDD	HR GCMS	ppt	ND (0.30)		ND (0.20)		0.160	
Total HxCDF	HR GCMS	ppt	ND (0.40)		ND (0.20)		ND (0.10)	
Total PeCDD	HR GCMS	ppt	0.480		0.270		0.260	
Total PeCDF	HR GCMS	ppt	ND (0.40)		ND (0.20)		ND (0.10)	
Total TCDD	HR GCMS	ppt	ND (0.20)		ND (0.10)		ND (0.080)	
Total TCDF	HR GCMS	ppt	ND (0.30)		0.150		ND (0.10)	
			ND (0.20)		ND (0.090)		ND (0.080)	
Aluminum	ICAP	mg/kg	55100 B		52500		56800 B	B
Antimony	ICAP	mg/kg	ND (45)		ND (49)		ND (50)	
Barium	ICAP	mg/kg	198		189		214	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Beryllium	ICAP	mg/kg	7.30		5.75		6.54	
Boron	ICAP	ug/g	180		600		150	
Calcium	ICAP	mg/kg	90200 B		88100		84300 B	
Chromium	ICAP	mg/kg	73.7 B		70.5		76.6 B	
Cobalt	ICAP	mg/kg	13.0 B		18.6		17.2 B	
Copper	ICAP	mg/kg	4.14		ND (4.2)		4.40	
Iron	ICAP	mg/kg	28200		28800		29200	
Magnesium	ICAP	mg/kg	48200 B		46800		44400 B	
Manganese	ICAP	mg/kg	100 B		97.8		102 B	
Molybdenum	ICAP	mg/kg	ND (3.0)		ND (3.2)		ND (3.3)	
Nickel	ICAP	mg/kg	41.4 B		17.8		28.0 B	
Phosphorus	ICAP	mg/kg	ND (71)		ND (68)		ND (69)	
Potassium	ICAP	mg/kg	12500		12200		13100	
Silver	ICAP	mg/kg	ND (3.4)		ND (3.7)		ND (3.8)	
Sodium	ICAP	mg/kg	2150 B		1980		2150 B	
Titanium	ICAP	mg/kg	2950 B		2760		3050 B	
Vanadium	ICAP	mg/kg	86.0		82.7		93.2	
Chloride	SIE	mg/kg	ND (78)		279		ND (78)	
Fluoride	SIE	mg/kg	ND (12) B		16.3 B		13.3 B	
Carbon	Ultimate	%	0.0600		0.100		0.0700	
Sulfur	Ultimate	%	14.8		16.6		16.1	
Actinium-228 @338	gamma	pCi/g	1.20		0.700		1.30	
Actinium-228 @911	gamma	pCi/g	0.880		0.860		1.50	
Actinium-228 @968	gamma	pCi/g	0.670		0.390		0.800	
Bismuth-212 @727	gamma	pCi/g	1.10		0.510		2.00	
Bismuth-214 @1120.4	gamma	pCi/g	1.70		1.40		3.20	
Bismuth-214 @1764.7	gamma	pCi/g	3.10		0.910		2.40	
Bismuth-214 @609.4	gamma	pCi/g	2.10		1.40		2.30	
K-40 @1460	gamma	pCi/g	16.0		9.00		18.0	
Lead-210 @46	gamma	pCi/g	2.90		3.70		5.30	
Lead-212 @238	gamma	pCi/g	2.00		1.00		2.40	
Lead-214 @295.2	gamma	pCi/g	1.80		1.10		2.20	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Lead-214 @352.0	gamma	pCi/g	2.40		1.40		2.80	
Radium-226 @186.0	gamma	pCi/g	5.10		1.90		3.00	
Thallium-208 @583	gamma	pCi/g	0.390		0.300		0.560	
Thallium-208 @860	gamma	pCi/g	0.610		ND (0.12)		0.0700	
Thorium-234 @63.3	gamma	pCi/g	2.60		2.50		5.30	
Thorium-234 @92.6	gamma	pCi/g	0.200		0.0900		1.20	
Uranium-235 @143.8	gamma	pCi/g	0.310		0.120		0.190	

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg					ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g					ND (0.0064)	
1,2-Dichlorobenzene	GCMS	ug/g					ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g					ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g					ND (0.023)	
2,4,5-Trichlorophenol	GCMS	ug/g					ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g					ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g					ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g					ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g					ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g					ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g					ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g					ND (0.030)	
2-Chlorophenol	GCMS	ug/g					ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g					ND (0.020)	
2-Methylphenol	GCMS	ug/g					ND (0.026)	
2-Nitroaniline	GCMS	ug/g					ND (0.026)	
2-Nitrophenol	GCMS	ug/g					ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g					ND (0.036)	
3-Nitroaniline	GCMS	ug/g					ND (0.011)	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
4,6-Dinitro-2-methylphenol	GCMS	ug/g					ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g					ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g					ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g					ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g					ND (0.041)	
4-Nitroaniline	GCMS	ug/g					ND (0.020)	
4-Nitrophenol	GCMS	ug/g					ND (0.021)	
Acenaphthene	GCMS	ug/g					ND (0.016)	
Acenaphthylene	GCMS	ug/g					ND (0.022)	
Anthracene	GCMS	ug/g					ND (0.018)	
Benz(a)anthracene	GCMS	ug/g					ND (0.011)	
Benz(a)pyrene	GCMS	ug/g					ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g					ND (0.032)	
Benzo(g,h,i)perylene	GCMS	ug/g					ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g					ND (0.027)	
Benzoic acid	GCMS	ug/g					ND (0.099)	
Benzyl alcohol	GCMS	ug/g					ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g					ND (0.025)	
Chrysene	GCMS	ug/g					ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g					ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g					ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g					ND (0.023)	
Dibenzofuran	GCMS	ug/g					ND (0.013)	
Diethylphthalate	GCMS	ug/g					ND (0.012)	
Dimethylphthalate	GCMS	ug/g					ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g					ND (0.025)	
Fluoranthene	GCMS	ug/g					ND (0.014)	
Fluorene	GCMS	ug/g					ND (0.011)	
Hexachlorobenzene	GCMS	ug/g					ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g					ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g					ND (0.054)	
Hexachloroethane	GCMS	ug/g					ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g					ND (0.016)	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Isophorone	GCMS	ug/g					ND (0.010)	
N-Nitroso-di-n-propylamine	GCMS	ug/g					ND (0.026)	
Naphthalene	GCMS	ug/g					ND (0.022)	
Nitrobenzene	GCMS	ug/g					ND (0.013)	
Pentachlorophenol	GCMS	ug/g					ND (0.0064)	
Phenanthrene	GCMS	ug/g					ND (0.018)	
Phenol	GCMS	ug/g					ND (0.034)	
Pyrene	GCMS	ug/g					ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g					ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g					ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g					ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g					ND (0.054)	
p-Chloroaniline	GCMS	ug/g					ND (0.033)	
Arsenic	GFAA	mg/kg					285 B	
Cadmium	GFAA	mg/kg					1.53 B	
Lead	GFAA	mg/kg					60.3	
Selenium	GFAA	mg/kg					ND (0.96)	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt					ND (0.40)	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt					ND (0.20)	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt					ND (0.30)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt					ND (0.30)	
1,2,3,4,7,8-HxCDF	HR GCMS	ppt					ND (0.20)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt					ND (0.30)	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt					ND (0.10)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt					ND (0.30)	
1,2,3,7,8,9-HxCDF	HR GCMS	ppt					ND (0.20)	
1,2,3,7,8-PeCDD	HR GCMS	ppt					ND (0.40)	
1,2,3,7,8-PeCDF	HR GCMS	ppt					ND (0.20)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt					0.210	
2,3,4,7,8-PeCDF	HR GCMS	ppt					ND (0.20)	
2,3,7,8-TCDD	HR GCMS	ppt					ND (0.20)	
2,3,7,8-TCDF	HR GCMS	ppt					0.180	

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
OCDD	HR GCMS	ppt					ND (0.60)	
OCDF	HR GCMS	ppt					ND (0.50)	
Total HpCDD	HR GCMS	ppt					ND (0.40)	
Total HpCDF	HR GCMS	ppt					ND (0.30)	
Total HxCDD	HR GCMS	ppt					ND (0.30)	
Total HxCDF	HR GCMS	ppt					0.210	
Total PeCDD	HR GCMS	ppt					ND (0.40)	
Total PeCDF	HR GCMS	ppt					ND (0.20)	
Total TCDD	HR GCMS	ppt					ND (0.20)	
Total TCDF	HR GCMS	ppt					0.180	
Aluminum	ICAP	mg/kg					56500	B
Antimony	ICAP	mg/kg					ND (41)	
Barium	ICAP	mg/kg					217	
Beryllium	ICAP	mg/kg					6.61	
Boron	ICAP	ug/g					105	
Calcium	ICAP	mg/kg					83600	B
Chromium	ICAP	mg/kg					76.4	B
Cobalt	ICAP	mg/kg					18.6	B
Copper	ICAP	mg/kg					6.61	
Iron	ICAP	mg/kg					29100	
Magnesium	ICAP	mg/kg					44500	B
Manganese	ICAP	mg/kg					103	B
Molybdenum	ICAP	mg/kg					ND (2.7)	B
Nickel	ICAP	mg/kg					26.2	B
Phosphorus	ICAP	mg/kg					ND (69)	
Potassium	ICAP	mg/kg					13600	
Silver	ICAP	mg/kg					ND (3.1)	B
Sodium	ICAP	mg/kg					2250	B
Titanium	ICAP	mg/kg					3090	B
Vanadium	ICAP	mg/kg					93.4	
Chloride	SIE	mg/kg					261	
Fluoride	SIE	mg/kg					23.2	B

Analytical Data Used In Calculations

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Carbon	Ultimate	%					0.0900	
Sulfur	Ultimate	%					15.2	
Actinium-228 @338	gamma	pCi/g					1.00	
Actinium-228 @911	gamma	pCi/g					0.800	
Actinium-228 @968	gamma	pCi/g					0.560	
Bismuth-212 @727	gamma	pCi/g					1.30	
Bismuth-214 @1120.4	gamma	pCi/g					1.80	
Bismuth-214 @1764.7	gamma	pCi/g					0.980	
Bismuth-214 @609.4	gamma	pCi/g					1.30	
K-40 @1460	gamma	pCi/g					9.50	
Lead-210 @46	gamma	pCi/g					2.90	
Lead-212 @238	gamma	pCi/g					0.920	
Lead-214 @295.2	gamma	pCi/g					1.20	
Lead-214 @352.0	gamma	pCi/g					1.60	
Radium-226 @186.0	gamma	pCi/g					2.00	
Thallium-208 @583	gamma	pCi/g					0.310	
Thallium-208 @860	gamma	pCi/g					0.110	
Thorium-234 @63.3	gamma	pCi/g					0.650	
Thorium-234 @92.6	gamma	pCi/g					0.590	
Uranium-235 @143.8	gamma	pCi/g					0.0100	

Stream: APF Inlet Collection Method: Ammonia/Cyanide Sample Type: Ammonia Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Ammonia - Distilled	distil	ug/Nm3	255	B	179	B	165	B

Stream: APF Inle Collection Method: Ammonia/Cyanide Sample Type: Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Cyanide	tot CN	ug/Nm3	1610		1580		955	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: Anions Train Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	1050		1100		5260	
Chloride	IC	ug/g	287		231		1520	
Sulfate	IC	ug/Nm3	2680000		3850000		4590000	
Sulfate	IC	ug/g	736000		805000		1330000	
Fluoride	SIE	ug/Nm3	639	C	772	C	1840	C
Fluoride	SIE	ug/g	175	C	162	C	532	C

Stream: APF Inlet Collection Method: Anions Train Sample Type: Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	79100		71700		65400	
Sulfate	IC	ug/Nm3	791000		953000		811000	
Fluoride	SIE	ug/Nm3	7240	B	6860	B	5950	B

Stream: APF Inlet Collection Method: M0011a Sample Type: Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Formaldehyde	HPLC	ug/Nm3	39.9		146		17.0	

Stream: APF Inlet Collection Method: M29 Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	ND (0.042)		ND (0.050)		ND (0.046)	
Arsenic	GFAA	ug/Nm3	831		1420		1030	
Cadmium	GFAA	ug/Nm3	4.96		6.93		8.23	
Lead	GFAA	ug/Nm3	196		287		236	
Selenium	GFAA	ug/Nm3	50.7		54.0		48.6	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: M29 Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Aluminum	ICAP	ug/Nm3	210000	C	271000	C	235000	C
Antimony	ICAP	ug/Nm3	ND (190)		ND (270)		ND (220)	
Barium	ICAP	ug/Nm3	711	C	970	C	892	C
Beryllium	ICAP	ug/Nm3	24.4		28.3		27.2	
Calcium	ICAP	ug/Nm3	323000	C	474000	C	356000	C
Chromium	ICAP	ug/Nm3	616	C	492	C	402	C
Cobalt	ICAP	ug/Nm3	48.1	C	87.9	C	73.1	C
Copper	ICAP	ug/Nm3	170		95.1		63.2	
Iron	ICAP	ug/Nm3	114000		152000		120000	
Magnesium	ICAP	ug/Nm3	170000	C	249000	C	186000	C
Manganese	ICAP	ug/Nm3	376	C	521	C	436	C
Molybdenum	ICAP	ug/Nm3	66.4		ND (18)		ND (14)	
Nickel	ICAP	ug/Nm3	298		108		163	
Phosphorus	ICAP	ug/Nm3	ND (240)	C	ND (310)	C	ND (260)	C
Potassium	ICAP	ug/Nm3	44300	C	62600	C	54000	C
Silver	ICAP	ug/Nm3	ND (14)	C	ND (20)	C	ND (16)	C
Sodium	ICAP	ug/Nm3	7750		10100		8880	
Titanium	ICAP	ug/Nm3	10600	C	14100	C	12600	C
Vanadium	ICAP	ug/Nm3	325	C	445	C	380	C

Stream: APF Inlet Collection Method: MM5 Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (2.9)		ND (2.8)		ND (2.9)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.7)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (2.5)		ND (2.4)		ND (2.6)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (4.3)		ND (4.3)		ND (4.5)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (4.6)		ND (4.6)		ND (4.8)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (3.4)		ND (3.3)		ND (3.5)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (3.8)		ND (3.7)		ND (3.9)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (13)		ND (13)		ND (13)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: MMS Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (4.2)		ND (4.2)		ND (4.4)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (6.0)		ND (6.0)		ND (6.2)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (1.7)		ND (1.7)		ND (1.8)	
2-Chlorophenol	GCMS	ug/Nm3	ND (2.8)		ND (2.8)		ND (2.9)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (1.7)		ND (1.6)		ND (1.7)	
2-Methylphenol	GCMS	ug/Nm3	ND (3.4)		ND (3.3)		ND (3.5)	
2-Nitroaniline	GCMS	ug/Nm3	ND (6.1)		ND (6.1)		ND (6.3)	
2-Nitrophenol	GCMS	ug/Nm3	ND (5.1)		ND (5.1)		ND (5.3)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (3.1)		ND (3.1)		ND (3.4)	
3-Nitroaniline	GCMS	ug/Nm3	ND (5.4)		ND (5.3)		ND (5.5)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (7.6)		ND (7.7)		ND (8.3)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (1.6)		ND (1.6)		ND (1.8)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (3.7)		ND (3.7)		ND (3.9)	
4-Nitroaniline	GCMS	ug/Nm3	ND (5.0)		ND (5.0)		ND (5.2)	
4-Nitrophenol	GCMS	ug/Nm3	ND (12)		ND (12)		ND (13)	
Acenaphthene	GCMS	ug/Nm3	ND (1.9)		ND (1.9)		ND (2.0)	
Acenaphthylene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.1)	
Acetophenone	GCMS	ug/Nm3	ND (2.8)		ND (2.7)		ND (2.9)	
Aniline	GCMS	ug/Nm3	ND (2.2)		ND (2.2)		ND (2.3)	
Anthracene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.2)	
Benidine	GCMS	ug/Nm3	ND (2.2)		ND (2.1)		ND (2.3)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.94)		ND (0.95)		ND (0.96)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.91)		ND (0.91)		ND (0.93)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (1.0)		ND (1.0)		ND (1.0)	
Benzoic acid	GCMS	ug/Nm3	ND (10)		ND (10)		ND (11)	
Benzyl alcohol	GCMS	ug/Nm3	ND (5.2)		ND (5.1)		ND (5.3)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (1.5)		ND (1.5)		ND (1.6)	
Chrysene	GCMS	ug/Nm3	ND (0.89)		ND (0.87)		ND (0.95)	
Di-n-butylphthalate	GCMS	ug/Nm3	3.09 BJ		20.3 B		10.9 B	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.82)		ND (0.82)		ND (0.84)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.1)	
Dibenzofuran	GCMS	ug/Nm3	ND (1.2)		ND (1.2)		ND (1.3)	
Diethylphthalate	GCMS	ug/Nm3	ND (1.4)		ND (1.4)		ND (1.5)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: MMS Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Dimethylphthalate	GCMS	ug/Nm3	ND (1.6)		ND (1.6)		ND (1.6)	
Fluoranthene	GCMS	ug/Nm3	ND (0.87)		ND (0.88)		ND (0.95)	
Fluorene	GCMS	ug/Nm3	ND (1.6)		ND (1.6)		ND (1.7)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (3.5)		ND (3.6)		ND (3.8)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (4.7)		ND (4.7)		ND (4.9)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (6.4)		ND (6.4)		ND (6.6)	
Hexachloroethane	GCMS	ug/Nm3	ND (5.1)		ND (5.1)		ND (5.3)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.81)		ND (0.82)		ND (0.83)	
Isophorone	GCMS	ug/Nm3	ND (1.7)		ND (1.7)		ND (1.8)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (5.1)		ND (5.0)		ND (5.3)	
Naphthalene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.1)	
Nitrobenzene	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (3.0)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (16)		ND (16)		ND (17)	
Pentachlorophenol	GCMS	ug/Nm3	ND (8.1)		ND (8.1)		ND (8.8)	
Phenanthrene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.2)	
Phenol	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.4)	
Pyrene	GCMS	ug/Nm3	ND (0.75)		ND (0.74)		ND (0.81)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (2.5)		ND (2.5)		ND (2.6)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (3.0)		ND (3.0)		ND (3.1)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	1.20 BJ		ND (1.1)		ND (1.2)	

Stream: APF Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (2.3)		ND (1.5)		ND (0.88)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (2.0)		ND (1.3)		ND (0.76)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (1.9)		ND (1.2)		ND (0.71)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (1.9)		ND (1.2)		ND (0.70)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (3.4)		ND (1.8)		ND (1.1)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (3.5)		ND (1.9)		ND (1.2)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (2.6)		ND (0.71)		ND (0.48)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (2.5)		ND (1.5)		ND (0.81)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (9.6)		ND (5.3)		ND (2.7)	
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (3.1)		ND (1.8)		ND (1.0)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (4.6)		ND (2.6)		ND (1.5)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (1.3)		ND (0.73)		ND (0.47)	
2-Chlorophenol	GCMS	ug/Nm3	ND (2.0)		ND (1.2)		ND (0.77)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (1.3)		ND (0.70)		0.0824 J	
2-Methylphenol	GCMS	ug/Nm3	ND (2.5)		ND (1.7)		ND (0.88)	
2-Nitroaniline	GCMS	ug/Nm3	ND (4.0)		ND (2.5)		ND (1.2)	
2-Nitrophenol	GCMS	ug/Nm3	ND (3.8)		ND (2.7)		0.285 J	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (1.7)		ND (2.1)		ND (1.2)	
3-Nitroaniline	GCMS	ug/Nm3	ND (3.9)		ND (2.2)		ND (1.3)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (5.3)		ND (3.2)		ND (1.8)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (1.0)		ND (0.50)		ND (0.43)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (2.8)		ND (1.5)		ND (0.85)	
4-Nitroaniline	GCMS	ug/Nm3	ND (3.5)		ND (1.9)		ND (1.2)	
4-Nitrophenol	GCMS	ug/Nm3	ND (8.5)		0.645 J		0.539 J	
Acenaphthene	GCMS	ug/Nm3	ND (1.4)		ND (0.76)		ND (0.49)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.80)		ND (0.45)		ND (0.28)	
Acetophenone	GCMS	ug/Nm3	1.35 J		1.75 J		2.62 J	
Aniline	GCMS	ug/Nm3	ND (1.6)		ND (1.2)		ND (0.96)	
Anthracene	GCMS	ug/Nm3	ND (0.78)		ND (0.36)		ND (0.26)	
Benzo(a)fluoranthene	GCMS	ug/Nm3	ND (1.2)		ND (1.1)		ND (0.71)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.49)		ND (0.61)		ND (0.45)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.52)		ND (0.56)		ND (0.49)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (0.51)		ND (0.61)		ND (0.48)	
Benzoic acid	GCMS	ug/Nm3	88.4		124 E		113	
Benzyl alcohol	GCMS	ug/Nm3	ND (3.8)		ND (2.5)		ND (1.4)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (0.90)		ND (0.74)		ND (0.40)	
Chrysene	GCMS	ug/Nm3	ND (0.54)		ND (0.54)		ND (0.35)	
Di-n-butylphthalate	GCMS	ug/Nm3	1.34 J		5.43 J		54.6	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.38)		ND (0.50)		ND (0.27)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (0.61)		ND (0.75)		ND (0.55)	
Dibenzofuran	GCMS	ug/Nm3	ND (0.92)		ND (0.46)		ND (0.31)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Diethylphthalate	GCMS	ug/Nm3	ND (1.1)		ND (0.46)		ND (0.30)	
Dimethylphthalate	GCMS	ug/Nm3	ND (1.2)		ND (0.61)		ND (0.37)	
Fluoranthene	GCMS	ug/Nm3	ND (0.55)		ND (0.34)		ND (0.25)	
Fluorene	GCMS	ug/Nm3	ND (1.2)		ND (0.54)		ND (0.37)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (2.6)		ND (1.4)		ND (1.2)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (3.7)		ND (2.3)		ND (1.5)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (4.4)		ND (2.3)		ND (1.3)	
Hexachloroethane	GCMS	ug/Nm3	ND (4.0)		ND (2.5)		ND (1.5)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.45)		ND (0.56)		ND (0.43)	
Isophorone	GCMS	ug/Nm3	ND (1.3)		ND (0.91)		ND (0.38)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (3.6)		ND (2.8)		ND (1.1)	
Naphthalene	GCMS	ug/Nm3	ND (0.81)		ND (0.45)		0.734 BJ	
Nitrobenzene	GCMS	ug/Nm3	ND (2.2)		ND (1.7)		ND (0.66)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (10)		ND (3.1)		ND (2.6)	
Pentachlorophenol	GCMS	ug/Nm3	ND (6.7)		ND (3.0)		ND (2.6)	
Phenanthrene	GCMS	ug/Nm3	ND (0.79)		ND (0.36)		ND (0.26)	
Phenol	GCMS	ug/Nm3	ND (1.7)		ND (1.4)		0.659 J	
Pyrene	GCMS	ug/Nm3	ND (0.52)		ND (0.36)		ND (0.22)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (1.9)		ND (1.5)		ND (0.70)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (2.3)		ND (1.9)		ND (0.90)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	1.08 J		ND (0.62)		1.47 J	

Stream: APF Inlet Collection Method: Multimetals Train Sample Type: Mercury Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	0.299		0.530		0.284	

Stream: APF Inlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	16.2		15.0		16.4	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Aluminum	ICAP	ug/Nm3	263	BC	1190	BC	395	BC
Barium	ICAP	ug/Nm3	1.59	BC	6.05	BC	2.32	BC
Boron	ICAP	ug/Nm3	246	BC	209	BC	205	BC
Calcium	ICAP	ug/Nm3	703	BC	2510	BC	1220	BC
Iron	ICAP	ug/Nm3	136	BC	332	BC	174	BC
Magnesium	ICAP	ug/Nm3	214	C	1070	C	817	C
Phosphorus	ICAP	ug/Nm3	ND (17)	BC	ND (19)	BC	ND (16)	BC
Potassium	ICAP	ug/Nm3	ND (220)	BC	282	BC	ND (220)	BC
Silver	ICAP	ug/Nm3	ND (1.4)	B	ND (1.6)	B	ND (1.4)	B
Sodium	ICAP	ug/Nm3	148	BC	123	BC	135	BC
Titanium	ICAP	ug/Nm3	12.7		63.3		18.7	
Antimony	ICPMS	ug/Nm3	0.0433	C	0.0852	C	2.76	C
Arsenic	ICPMS	ug/Nm3	1.71	C	7.85	C	2.23	C
Barium	ICPMS	ug/Nm3	ND (0.0047)	C	4.83	C	1.55	C
Beryllium	ICPMS	ug/Nm3	0.0528	C	0.233	C	0.0635	C
Cadmium	ICPMS	ug/Nm3	0.309	C	ND (0.0063)	C	ND (0.0055)	C
Chromium	ICPMS	ug/Nm3	41.1	C	2.95	C	12.9	C
Cobalt	ICPMS	ug/Nm3	0.431	C	0.218	C	0.149	C
Copper	ICPMS	ug/Nm3	67.5	C	7.68	C	44.3	C
Lead	ICPMS	ug/Nm3	1.23	C	2.90	C	1.09	C
Manganese	ICPMS	ug/Nm3	33.2	C	8.73	C	3.21	C
Molybdenum	ICPMS	ug/Nm3	5.87	C	0.702	C	1.22	C
Nickel	ICPMS	ug/Nm3	58.3	C	19.4	C	25.3	C
Selenium	ICPMS	ug/Nm3	14.4	C	18.4	C	14.8	C
Vanadium	ICPMS	ug/Nm3	1.88	C	3.06	C	1.67	C

Stream: APF Inlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234678-HpCDD	Meth 23X	ug/Nm3	0.000268		0.000458		0.000866	
1234678-HpCDF	Meth 23X	ug/Nm3	0.000189		0.000206		0.000693	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
123478-HxCDD	Meth 23X	ug/Nm3	0.0000510		0.000105		0.000248	
123478-HxCDF	Meth 23X	ug/Nm3	0.000160		0.000213		0.000802	
1234789-HpCDF	Meth 23X	ug/Nm3	0.0000394		0.0000493		0.0000874	
123678-HxCDD	Meth 23X	ug/Nm3	0.0000723		0.000128		0.000209	
123678-HxCDF	Meth 23X	ug/Nm3	0.0000530		0.0000758		0.000243	
12378-PeCDD	Meth 23X	ug/Nm3	0.0000466		0.0000813		0.000132	
12378-PeCDF	Meth 23X	ug/Nm3	0.0000333	F	0.0000648	F	0.000185	
123789-HxCDD	Meth 23X	ug/Nm3	0.0000831		0.000174		0.000269	
123789-HxCDF	Meth 23X	ug/Nm3	0.0000934		0.000182		0.0000663	
234678-HxCDF	Meth 23X	ug/Nm3	0.0000526	B	0.0000900		0.000234	
23478-PeCDF	Meth 23X	ug/Nm3	0.0000530		0.000107	F	0.000300	
2378-TCDD	Meth 23X	ug/Nm3	0.00000575	B	0.00000648	B	0.000182	B
2378-TCDF	Meth 23X	ug/Nm3	0.0000933		0.000174		0.000628	
OCDD	Meth 23X	ug/Nm3	0.0000331		0.000492		0.00114	
OCDF	Meth 23X	ug/Nm3	0.000237		0.000156		0.000353	
TOTAL HpCDD	Meth 23X	ug/Nm3	0.0000564		0.000939		0.00191	
TOTAL HpCDF	Meth 23X	ug/Nm3	0.000309		0.000340		0.00106	
TOTAL HxCDD	Meth 23X	ug/Nm3	0.00114		0.00187		0.00308	
TOTAL HxCDF	Meth 23X	ug/Nm3	0.000509		0.000698		0.00253	
TOTAL PeCDD	Meth 23X	ug/Nm3	0.00136		0.00263		0.00351	
TOTAL PeCDF	Meth 23X	ug/Nm3	0.000538		0.000609		0.00334	
TOTAL TCDD	Meth 23X	ug/Nm3	0.00116		0.00258		0.00327	
TOTAL TCDF	Meth 23X	ug/Nm3	0.000744		0.00159		0.00490	

Stream: APF Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,2-Dichloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
2-Butanone	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (2.9)	
2-Hexanone	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (2.9)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (2.9)	
Acetone	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (2.9)	
Benzene	GCMS	ug/Nm3	1.34		3.90		2.29	
Bromodichloromethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		0.975	
Bromoform	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		0.631	
Bromomethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Carbon Disulfide	GCMS	ug/Nm3	1.69		6.30		1.78	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		0.631	
Chlorobenzene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Chloroethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		2.24	
Chloroform	GCMS	ug/Nm3	ND (0.58)		0.745		1.95	
Chloromethane	GCMS	ug/Nm3	ND (0.58)		2.23		4.59	
Dibromochloromethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		0.746	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Methylene Chloride	GCMS	ug/Nm3	1.40		14.3		3.79	
Styrene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Tetrachloroethene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Toluene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Trichloroethene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
Vinyl Acetate	GCMS	ug/Nm3	ND (2.9)		ND (2.9)		ND (2.9)	
Vinyl Chloride	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
o-Xylene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.58)		ND (0.57)		ND (0.57)	

Stream: APF Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,2-Dichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
2-Butanone	GCMS	ug/Nm3	ND (2.6)		ND (2.9)		ND (2.9)	
2-Hexanone	GCMS	ug/Nm3	ND (2.6)		ND (2.9)		ND (2.9)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.6)		ND (2.9)		ND (2.9)	
Acetone	GCMS	ug/Nm3	ND (2.6)		ND (2.9)		ND (2.9)	
Benzene	GCMS	ug/Nm3	1.11		4.32		5.15	
Bromodichloromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Bromoform	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Bromomethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Carbon Disulfide	GCMS	ug/Nm3	1.90		4.03		6.44	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Chlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Chloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		35.7	
Chloroform	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		1.29	
Chloromethane	GCMS	ug/Nm3	0.793		3.57		5.21	
Dibromochloromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Methylene Chloride	GCMS	ug/Nm3	ND (0.53)		8.07		105	E

Analytical Data Used In Calculations

Stream: APF Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Styrene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Tetrachloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		0.644	
Toluene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		2.46	
Trichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
Vinyl Acetate	GCMS	ug/Nm3	ND (2.6)		ND (2.9)		ND (2.9)	
Vinyl Chloride	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		1.17	
o-Xylene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.53)		ND (0.58)		ND (0.59)	

Stream: APF Outlet Collection Method: Ammonia/Cyanide Sample Type: Ammonia Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Ammonia - Distilled	distil	ug/Nm3	168 B		154 B		124 B	

Stream: APF Outlet Collection Method: Ammonia/Cyanide Sample Type: Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Cyanide	tot CN	ug/Nm3	509		432		358	

Stream: APF Outlet Collection Method: Anions Train Sample Type: 47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	0.192 C		0.155 C		ND (0.11) C	
Chloride	IC	ug/g	4060 C		407 C		ND (570) C	
Sulfate	IC	ug/Nm3	37.8		83.6		52.3	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: Anions Train Sample Type: 47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Sulfate	IC	ug/g	801000		219000		262000	
Fluoride	SIE	ug/Nm3	0.0463	C	0.219	C	0.117	C
Fluoride	SIE	ug/g	980	C	575	C	584	C

Stream: APF Outlet Collection Method: Anions Train Sample Type: Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	60100		72700		50400	
Sulfate	IC	ug/Nm3	474000		532000		470000	
Fluoride	SIE	ug/Nm3	8500	B	9430	B	8870	B

Stream: APF Outlet Collection Method: M0011a Sample Type: Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Formaldehyde	HPLC	ug/Nm3	3.65		4.08		3.81	

Stream: APF Outlet Collection Method: M29 Sample Type: 47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	ND (0.00027)	C	ND (0.00030)	C	ND (0.00021)	C
Arsenic	GFAA	ug/Nm3	0.212	C	0.361	C	0.271	C
Cadmium	GFAA	ug/Nm3	ND (0.0043)		ND (0.0048)		ND (0.0035)	
Lead	GFAA	ug/Nm3	0.0191		0.0346		0.0334	
Selenium	GFAA	ug/Nm3	ND (0.0044)	C	ND (0.0050)	C	ND (0.0036)	C
Aluminum	ICAP	ug/Nm3	0.875	C	4.81	C	2.41	C
Antimony	ICAP	ug/Nm3	ND (0.32)		ND (0.36)		ND (0.26)	
Barium	ICAP	ug/Nm3	0.0914	C	0.0174	C	0.00491	C

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: M29 Sample Type: 47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Beryllium	ICAP	ug/Nm3	ND (0.0018)		ND (0.0020)		ND (0.0015)	
Calcium	ICAP	ug/Nm3	0.0923 C	C	5.82	C	2.68	C
Chromium	ICAP	ug/Nm3	8.00 C	C	12.9	C	8.89	C
Cobalt	ICAP	ug/Nm3	ND (0.030)	C	ND (0.033)	C	ND (0.024)	C
Copper	ICAP	ug/Nm3	ND (0.028)	C	ND (0.031)	C	ND (0.022)	C
Iron	ICAP	ug/Nm3	1.39 C	C	7.29	C	2.84	C
Magnesium	ICAP	ug/Nm3	ND (0.53)	C	2.79	C	1.30	C
Manganese	ICAP	ug/Nm3	0.205	C	0.619	C	0.137	C
Molybdenum	ICAP	ug/Nm3	3.35 C	C	6.48	C	2.92	C
Nickel	ICAP	ug/Nm3	0.257 C	C	1.26	C	0.344	C
Phosphorus	ICAP	ug/Nm3	ND (0.40)	C	ND (0.45)	C	ND (0.33)	C
Potassium	ICAP	ug/Nm3	ND (2.4)	C	ND (2.7)	C	ND (2.0)	C
Silver	ICAP	ug/Nm3	0.312	C	0.372	C	0.138	C
Sodium	ICAP	ug/Nm3	ND (0.17)	C	1.39	C	ND (0.14)	C
Titanium	ICAP	ug/Nm3	0.0606 C	C	0.409	C	0.232	C
Vanadium	ICAP	ug/Nm3	0.959 C	C	0.814	C	0.848	C

Stream: APF Outlet Collection Method: MM5 Sample Type: 47 mm Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (0.44)		ND (0.37)		ND (0.42)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.43)		ND (0.35)		ND (0.39)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.40)		ND (0.34)		ND (0.37)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.39)		ND (0.32)		ND (0.36)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (0.68)		ND (0.58)		ND (0.63)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (0.72)		ND (0.62)		ND (0.67)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (0.52)		ND (0.44)		ND (0.49)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (0.58)		ND (0.49)		ND (0.55)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (2.0)		ND (1.7)		ND (1.9)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (0.66)		ND (0.56)		ND (0.61)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (0.94)		ND (0.80)		ND (0.87)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (0.27)		ND (0.23)		ND (0.25)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: MM5 Sample Type: 47 mm Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Chlorophenol	GCMS	ug/Nm3	ND (0.44)		ND (0.37)		ND (0.40)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (0.26)		ND (0.22)		ND (0.24)	
2-Methylphenol	GCMS	ug/Nm3	ND (0.53)		ND (0.44)		ND (0.49)	
2-Nitroaniline	GCMS	ug/Nm3	ND (0.95)		ND (0.81)		ND (0.88)	
2-Nitrophenol	GCMS	ug/Nm3	ND (0.80)		ND (0.67)		ND (0.75)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (0.46)		ND (0.39)		ND (0.44)	
3-Nitroaniline	GCMS	ug/Nm3	ND (0.84)		ND (0.71)		ND (0.78)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (1.2)		ND (1.1)		ND (1.2)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (0.26)		ND (0.23)		ND (0.25)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (0.58)		ND (0.49)		ND (0.55)	
4-Nitroaniline	GCMS	ug/Nm3	ND (0.78)		ND (0.67)		ND (0.73)	
4-Nitrophenol	GCMS	ug/Nm3	ND (1.9)		ND (1.6)		ND (1.8)	
Acenaphthene	GCMS	ug/Nm3	ND (0.30)		ND (0.26)		ND (0.28)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.17)		ND (0.15)		ND (0.16)	
Acetophenone	GCMS	ug/Nm3	ND (0.44)		ND (0.36)		ND (0.40)	
Aniline	GCMS	ug/Nm3	ND (0.35)		ND (0.29)		ND (0.32)	
Anthracene	GCMS	ug/Nm3	ND (0.18)		ND (0.16)		ND (0.17)	
Benazidine	GCMS	ug/Nm3	ND (0.32)		ND (0.27)		ND (0.30)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.14)		ND (0.11)		ND (0.11)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.14)		ND (0.11)		ND (0.11)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (0.15)		ND (0.12)		ND (0.12)	
Benzoic acid	GCMS	ug/Nm3	ND (1.6)		ND (1.4)		ND (1.5)	
Benzoalcohol	GCMS	ug/Nm3	ND (0.81)		ND (0.67)		ND (0.74)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (0.22)		ND (0.18)		ND (0.21)	
Chrysene	GCMS	ug/Nm3	ND (0.13)		ND (0.11)		ND (0.12)	
Di-n-butylphthalate	GCMS	ug/Nm3	17.8 B		1.19 B		10.0 B	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.12)		ND (0.099)		ND (0.096)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (0.16)		ND (0.13)		ND (0.13)	
Dibenzofuran	GCMS	ug/Nm3	ND (0.19)		ND (0.16)		ND (0.18)	
Diethylphthalate	GCMS	ug/Nm3	ND (0.23)		ND (0.19)		ND (0.21)	
Dimethylphthalate	GCMS	ug/Nm3	ND (0.25)		ND (0.21)		ND (0.23)	
Fluoranthene	GCMS	ug/Nm3	ND (0.14)		ND (0.12)		ND (0.13)	
Fluorene	GCMS	ug/Nm3	ND (0.25)		ND (0.21)		ND (0.23)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: MM5 Sample Type: 47 mm Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Hexachlorobenzene	GCMS	ug/Nm3	ND (0.56)		ND (0.50)		ND (0.53)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (0.73)		ND (0.62)		ND (0.69)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (1.0)		ND (0.85)		ND (0.93)	
Hexachloroethane	GCMS	ug/Nm3	ND (0.81)		ND (0.67)		ND (0.74)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.12)		ND (0.099)		ND (0.095)	
Isophorone	GCMS	ug/Nm3	ND (0.26)		ND (0.22)		ND (0.25)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (0.80)		ND (0.67)		ND (0.73)	
Naphthalene	GCMS	ug/Nm3	ND (0.17)		ND (0.14)		ND (0.16)	
Nitrobenzene	GCMS	ug/Nm3	ND (0.45)		ND (0.38)		ND (0.43)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (2.5)		ND (2.3)		ND (2.4)	
Pentachlorophenol	GCMS	ug/Nm3	ND (1.3)		ND (1.1)		ND (1.2)	
Phenanthrene	GCMS	ug/Nm3	ND (0.17)		ND (0.16)		ND (0.16)	
Phenol	GCMS	ug/Nm3	ND (0.37)		ND (0.30)		ND (0.33)	
Pyrene	GCMS	ug/Nm3	ND (0.11)		ND (0.094)		ND (0.10)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (0.39)		ND (0.33)		ND (0.37)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (0.48)		ND (0.40)		ND (0.44)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	0.0940	BJ	0.103	BJ	0.0703	BJ

Stream: APF Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (1.4)		ND (0.89)		ND (0.94)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (1.3)		ND (0.75)		ND (0.83)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (1.2)		ND (0.70)		ND (0.78)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (1.1)		ND (0.69)		ND (0.76)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (2.1)		ND (1.1)		ND (1.1)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (2.2)		ND (1.2)		ND (1.2)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (0.68)		ND (0.49)		ND (0.51)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (1.5)		ND (0.82)		ND (0.86)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (6.1)		ND (2.7)		ND (2.7)	
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (2.0)		ND (1.0)		ND (1.0)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (3.0)		ND (1.5)		ND (1.5)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Chloronaphthalene	GCMS	ug/Nm3	ND (0.84)		ND (0.46)		ND (0.47)	
2-Chlorophenol	GCMS	ug/Nm3	ND (1.2)		ND (0.76)		ND (0.84)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (0.66)		ND (0.46)		ND (0.49)	
2-Methylphenol	GCMS	ug/Nm3	ND (1.7)		ND (0.87)		ND (0.96)	
2-Nitroaniline	GCMS	ug/Nm3	ND (2.8)		ND (1.1)		ND (1.2)	
2-Nitrophenol	GCMS	ug/Nm3	ND (2.6)		ND (1.2)		ND (1.3)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (2.5)		ND (1.2)		ND (1.3)	
3-Nitroaniline	GCMS	ug/Nm3	ND (2.6)		ND (1.3)		ND (1.3)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (3.1)		ND (1.7)		ND (1.8)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (0.49)		ND (0.43)		ND (0.44)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (1.4)		ND (0.86)		ND (0.91)	
4-Nitroaniline	GCMS	ug/Nm3	ND (2.2)		ND (1.1)		ND (1.2)	
4-Nitrophenol	GCMS	ug/Nm3	ND (4.1)		ND (1.7)		ND (1.7)	
Acenaphthene	GCMS	ug/Nm3	ND (0.88)		ND (0.48)		ND (0.48)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.52)		ND (0.27)		ND (0.28)	
Acetophenone	GCMS	ug/Nm3	2.02 J		1.59 J		2.81 J	
Aniline	GCMS	ug/Nm3	ND (1.1)		ND (0.95)		ND (1.1)	
Anthracene	GCMS	ug/Nm3	ND (0.35)		ND (0.26)		ND (0.26)	
Benidine	GCMS	ug/Nm3	ND (1.4)		ND (0.73)		ND (0.74)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (16)		ND (0.51)		ND (0.44)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (15)		ND (0.56)		ND (0.48)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (16)		ND (0.54)		ND (0.47)	
Benzoic acid	GCMS	ug/Nm3	125 E		106		194 E	
Benzyl alcohol	GCMS	ug/Nm3	ND (2.5)		ND (1.4)		ND (1.5)	
Butylnaphthalene	GCMS	ug/Nm3	ND (0.92)		ND (0.41)		ND (0.42)	
Chrysene	GCMS	ug/Nm3	ND (0.66)		ND (0.36)		ND (0.37)	
Di-n-butylphthalate	GCMS	ug/Nm3	3.73 J		1.01 J		102	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (13)		ND (0.30)		ND (0.26)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (20)		ND (0.63)		ND (0.55)	
Dibenzofuran	GCMS	ug/Nm3	ND (0.54)		ND (0.30)		ND (0.31)	
Diethylphthalate	GCMS	ug/Nm3	ND (0.54)		ND (0.29)		ND (0.30)	
Dimethylphthalate	GCMS	ug/Nm3	ND (0.71)		ND (0.37)		ND (0.37)	
Fluoranthene	GCMS	ug/Nm3	ND (0.34)		ND (0.25)		ND (0.26)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Fluorene	GCMS	ug/Nm3	ND (0.63)		ND (0.37)		ND (0.37)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (1.3)		ND (1.2)		ND (1.3)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (2.2)		ND (1.5)		ND (1.6)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (2.7)		ND (1.3)		ND (1.3)	
Hexachloroethane	GCMS	ug/Nm3	ND (2.5)		ND (1.4)		ND (1.6)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (15)		ND (0.48)		ND (0.42)	
Isophorone	GCMS	ug/Nm3	1.71 J		ND (0.38)		ND (0.40)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (2.8)		ND (1.1)		ND (1.2)	
Naphthalene	GCMS	ug/Nm3	ND (0.43)		ND (0.29)		0.562 BJ	
Nitrobenzene	GCMS	ug/Nm3	ND (1.6)		ND (0.67)		ND (0.71)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (3.1)		ND (2.6)		ND (2.7)	
Pentachlorophenol	GCMS	ug/Nm3	ND (3.0)		ND (2.5)		ND (2.6)	
Phenanthrene	GCMS	ug/Nm3	ND (0.35)		ND (0.26)		ND (0.27)	
Phenol	GCMS	ug/Nm3	1.28 J		0.646 J		1.18 J	
Pyrene	GCMS	ug/Nm3	ND (0.44)		ND (0.22)		ND (0.23)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (1.5)		ND (0.71)		ND (0.75)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (1.8)		ND (0.89)		ND (0.98)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	1.03 J		0.522 J		9.87	

Stream: APF Outlet Collection Method: Multimetals Train Sample Type: Mercury Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	4.76		2.38		4.87	

Stream: APF Outle Collection Method: Multimetals Trai Sample Type: Nitric Acid Impingers + TL

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	9.30		13.1		9.44	
Aluminum	ICAP	ug/Nm3	53.2 BC		55.0 BC		58.9 BC	
Barium	ICAP	ug/Nm3	0.543 BC		0.740 BC		0.788 BC	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: Multimetal Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	ug/Nm3	377 BC	BC	382 BC	BC	321 BC	BC
Calcium	ICAP	ug/Nm3	214 BC	BC	280 BC	BC	361 BC	BC
Iron	ICAP	ug/Nm3	58.0 BC	BC	36.8 BC	BC	810 BC	BC
Magnesium	ICAP	ug/Nm3	19.7 C	C	23.1 C	C	25.3 C	C
Phosphorus	ICAP	ug/Nm3	ND (18)		ND (21)		ND (17)	
Potassium	ICAP	ug/Nm3	ND (250) BC	BC	ND (280)	BC	ND (230) BC	BC
Silver	ICAP	ug/Nm3	ND (1.6) B	B	ND (1.8)	B	ND (1.5) B	B
Sodium	ICAP	ug/Nm3	260 BC	BC	363 BC	BC	413 BC	BC
Titanium	ICAP	ug/Nm3	1.87		2.10		2.08	
Antimony	ICPMS	ug/Nm3	0.0223 C	C	0.0230 C	C	0.0331 C	C
Arsenic	ICPMS	ug/Nm3	2.95 C	C	3.89 C	C	4.12 C	C
Barium	ICPMS	ug/Nm3	ND (0.0052) C	C	ND (0.0059) C	C	ND (0.0049) C	C
Beryllium	ICPMS	ug/Nm3	ND (0.0047) C	C	ND (0.0054) C	C	ND (0.0045) C	C
Cadmium	ICPMS	ug/Nm3	ND (0.0062) C	C	ND (0.0071) C	C	ND (0.0059) C	C
Chromium	ICPMS	ug/Nm3	3.22 C	C	1.67 C	C	147 C	C
Cobalt	ICPMS	ug/Nm3	0.0616 C	C	0.0204 C	C	0.832 C	C
Copper	ICPMS	ug/Nm3	0.751 C	C	0.771 C	C	0.885 C	C
Lead	ICPMS	ug/Nm3	ND (0.0050) C	C	ND (0.0057) C	C	ND (0.0047) C	C
Manganese	ICPMS	ug/Nm3	0.565 C	C	0.717 C	C	22.0 C	C
Molybdenum	ICPMS	ug/Nm3	7.75 C	C	3.36 C	C	3.43 C	C
Nickel	ICPMS	ug/Nm3	54.5 C	C	6.73 C	C	89.1 C	C
Selenium	ICPMS	ug/Nm3	58.5		46.1		41.2	
Vanadium	ICPMS	ug/Nm3	1.03 C	C	1.01 C	C	1.36 C	C

Stream: APF Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: 47 mm Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234678-HpCDD	Meth 23X	ug/Nm3	ND (0.00000049)		ND (0.00000080)		ND (0.00000021)	
1234678-HpCDF	Meth 23X	ug/Nm3	ND (0.00000027)		ND (0.00000043)		ND (0.0000011)	
123478-HxCDD	Meth 23X	ug/Nm3	ND (0.00000044)		ND (0.00000068)		ND (0.0000018)	
123478-HxCDF	Meth 23X	ug/Nm3	ND (0.00000027)		ND (0.00000043)		ND (0.0000011)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: 47 mm Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234789-HpCDF	Meth 23X	ug/Nm3	ND (0.00000040)		ND (0.00000068)		ND (0.0000018)	
123678-HxCDD	Meth 23X	ug/Nm3	ND (0.00000035)		ND (0.00000055)		ND (0.0000016)	
123678-HxCDF	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000031)		ND (0.00000085)	
12378-PeCDD	Meth 23X	ug/Nm3	ND (0.00000040)		ND (0.00000062)		ND (0.0000016)	
12378-PeCDF	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000037)		ND (0.00000092)	
123789-HxCDD	Meth 23X	ug/Nm3	ND (0.00000040)		ND (0.00000062)		ND (0.0000016)	
123789-HxCDF	Meth 23X	ug/Nm3	ND (0.00000027)		ND (0.00000043)		ND (0.0000011)	
234678-HxCDF	Meth 23X	ug/Nm3	0.000000350	F	ND (0.00000037)		ND (0.00000099)	
23478-PeCDF	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000031)		ND (0.00000092)	
2378-TCDD	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000037)		ND (0.00000092)	
2378-TCDF	Meth 23X	ug/Nm3	ND (0.00000018)		ND (0.00000025)		ND (0.00000078)	
OCDD	Meth 23X	ug/Nm3	ND (0.00000080)		ND (0.0000013)		ND (0.0000049)	
OCDF	Meth 23X	ug/Nm3	ND (0.00000066)		ND (0.0000011)		ND (0.0000042)	
TOTAL HpCDD	Meth 23X	ug/Nm3	ND (0.00000049)		ND (0.00000080)		ND (0.0000021)	
TOTAL HpCDF	Meth 23X	ug/Nm3	ND (0.00000031)		ND (0.00000055)		ND (0.0000013)	
TOTAL HxCDD	Meth 23X	ug/Nm3	ND (0.00000040)		ND (0.00000062)		ND (0.0000016)	
TOTAL HxCDF	Meth 23X	ug/Nm3	0.000000350	F	ND (0.00000037)		ND (0.00000099)	
TOTAL PeCDD	Meth 23X	ug/Nm3	ND (0.00000040)		ND (0.00000062)		ND (0.0000016)	
TOTAL PeCDF	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000037)		ND (0.00000092)	
TOTAL TCDD	Meth 23X	ug/Nm3	ND (0.00000022)		ND (0.00000037)		ND (0.00000092)	
TOTAL TCDF	Meth 23X	ug/Nm3	ND (0.00000018)		ND (0.00000025)		ND (0.00000078)	

Stream: APF Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resi

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234678-HpCDD	Meth 23X	ug/Nm3	0.000000877		0.00000223		0.0000103	
1234678-HpCDF	Meth 23X	ug/Nm3	0.00000113	B	0.0000174	B	0.0000128	B
123478-HxCDD	Meth 23X	ug/Nm3	ND (0.00000071)		0.00000346	F	ND (0.0000056)	
123478-HxCDF	Meth 23X	ug/Nm3	0.00000907	B	0.0000239	B	0.0000145	B
1234789-HpCDF	Meth 23X	ug/Nm3	ND (0.00000071)		0.00000446	F	0.00000523	
123678-HxCDD	Meth 23X	ug/Nm3	ND (0.00000060)		0.00000570		ND (0.0000045)	
123678-HxCDF	Meth 23X	ug/Nm3	ND (0.00000030)		0.00000545		0.00000346	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
12378-PeCDD	Meth 23X	ug/Nm3	ND (0.0000060)		0.0000292	F	ND (0.0000053)	
12378-PeCDF	Meth 23X	ug/Nm3	ND (0.0000030)		0.0000684		ND (0.0000030)	
123789-HxCDD	Meth 23X	ug/Nm3	ND (0.0000063)		0.0000567		ND (0.0000053)	
123789-HxCDF	Meth 23X	ug/Nm3	ND (0.0000041)		0.0000253		ND (0.0000034)	
234678-HxCDF	Meth 23X	ug/Nm3	0.00000332	F	0.0000599		0.00000508	F
23478-PeCDF	Meth 23X	ug/Nm3	ND (0.0000030)		0.0000499	F	ND (0.0000030)	
2378-TCDD	Meth 23X	ug/Nm3	ND (0.0000030)		0.0000121	F	ND (0.0000034)	
2378-TCDF	Meth 23X	ug/Nm3	ND (0.0000011)		0.0000120		0.00000450	
OCDD	Meth 23X	ug/Nm3	0.0000351	B	0.0000446	BF	0.0000345	BF
OCDF	Meth 23X	ug/Nm3	0.0000321	F	0.0000661		0.0000423	
TOTAL HpCDD	Meth 23X	ug/Nm3	0.00000877		0.0000223		0.0000103	
TOTAL HpCDF	Meth 23X	ug/Nm3	0.0000140		0.0000243		0.0000199	
TOTAL HxCDD	Meth 23X	ug/Nm3	0.00000522		0.0000458		0.00000520	F
TOTAL HxCDF	Meth 23X	ug/Nm3	0.00000858		0.0000512		0.0000178	
TOTAL PeCDD	Meth 23X	ug/Nm3	ND (0.0000060)		0.0000412		0.0000104	F
TOTAL PeCDF	Meth 23X	ug/Nm3	0.00000396		0.0000529		0.00000719	F
TOTAL TCDD	Meth 23X	ug/Nm3	ND (0.0000030)		0.000127		0.0000136	
TOTAL TCDF	Meth 23X	ug/Nm3	0.00000282		0.0000988		0.0000122	

Stream: APF Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,2-Dichloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	

Stream: APF Outlet Collection Method: VOST Analytical Data Used In Calculations
Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Butanone	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.8)	
2-Hexanone	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.8)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.8)	
Acetone	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.8)	
Benzene	GCMS	ug/Nm3	10.2		ND (0.47)		0.938	
Bromodichloromethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Bromoform	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Bromomethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Carbon Disulfide	GCMS	ug/Nm3	14.9		ND (0.47)		ND (0.55)	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.47)		12.6		46.3	
Chlorobenzene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Chloroethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Chloroform	GCMS	ug/Nm3	1.30		ND (0.47)		ND (0.55)	
Chloromethane	GCMS	ug/Nm3	9.32		ND (0.47)		1.16	
Dibromochloromethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Methylene Chloride	GCMS	ug/Nm3	> 1860	S	ND (0.47)		ND (0.55)	
Styrene	GCMS	ug/Nm3	ND (0.47)		> 419	S	662	E
Tetrachloroethene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Toluene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Trichloroethene	GCMS	ug/Nm3	4.66		0.559		0.993	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Vinyl Acetate	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
Vinyl Chloride	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (2.8)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
o-Xylene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.47)		ND (0.47)		ND (0.55)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,2-Dichloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
2-Butanone	GCMS	ug/Nm3	ND (1.7)		ND (2.7)		ND (2.5)	
2-Hexanone	GCMS	ug/Nm3	ND (1.7)		ND (2.7)		ND (2.5)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (1.7)		ND (2.7)		ND (2.5)	
Acetone	GCMS	ug/Nm3	ND (1.7)		ND (2.7)		ND (2.5)	
Benzene	GCMS	ug/Nm3	5.79		0.850		0.641	
Bromodichloromethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Bromoform	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Bromomethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		4.19	
Carbon Disulfide	GCMS	ug/Nm3	27.9		48.9		ND (0.49)	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Chlorobenzene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Chloroethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Chloroform	GCMS	ug/Nm3	0.953		ND (0.53)		ND (0.49)	
Chloromethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		3.40	
Dibromochloromethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Methylene Chloride	GCMS	ug/Nm3	> 1230	S	154	E	ND (0.49)	
Styrene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Tetrachloroethene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Toluene	GCMS	ug/Nm3	0.613		ND (0.53)		ND (0.49)	
Trichloroethene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
Vinyl Acetate	GCMS	ug/Nm3	ND (1.7)		ND (2.7)		ND (2.5)	

Analytical Data Used In Calculations

Stream: APF Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Vinyl Chloride	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
o-Xylene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.34)		ND (0.53)		ND (0.49)	

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Ash + Mg + Ca

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	ug/g	100		100		89.0	
Carbon	Ultimate	%	3.44		3.42		3.75	
Sulfur	Ultimate	%	7.47		8.06		7.97	
Actinium-228 @338	gamma	pCi/g	0.240		0.150		0.310	
Actinium-228 @911	gamma	pCi/g	0.0200		0.0500		0.100	
Actinium-228 @968	gamma	pCi/g	0.0700		0.0700		ND (0.010)	
Bismuth-212 @727	gamma	pCi/g	0.260		0.260		ND (0.21)	
Bismuth-214 @1120.4	gamma	pCi/g	0.370		0.280		0.770	
Bismuth-214 @1764.7	gamma	pCi/g	0.290		0.450		0.520	
Bismuth-214 @609.4	gamma	pCi/g	0.680		0.440		0.650	
K-40 @1460	gamma	pCi/g	1.00		0.890		1.10	
Lead-210 @46	gamma	pCi/g	0.200		ND (0.10)		0.580	
Lead-212 @238	gamma	pCi/g	0.310		0.0800		0.190	
Lead-214 @295.2	gamma	pCi/g	0.470		0.450		0.600	
Lead-214 @352.0	gamma	pCi/g	0.510		0.610		0.640	
Radium-226 @186.0	gamma	pCi/g	0.620		0.900		1.60	
Thallium-208 @583	gamma	pCi/g	0.0300		0.0900		0.0600	
Thallium-208 @860	gamma	pCi/g	ND (0.28)		0.0500		0.200	
Thorium-234 @63.3	gamma	pCi/g	0.440		1.70		0.830	
Thorium-234 @92.6	gamma	pCi/g	0.210		ND (0.010)		0.190	
Uranium-235 @143.8	gamma	pCi/g	0.0400		0.0600		0.100	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Ash + Mg + Ca FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	ug/g					81.5	
Carbon	Ultimate	%					3.74	
Sulfur	Ultimate	%					7.94	
Actinium-228 @338	gamma	pCi/g					0.290	
Actinium-228 @911	gamma	pCi/g					0.150	
Actinium-228 @968	gamma	pCi/g					ND (0.050)	
Bismuth-212 @727	gamma	pCi/g					ND (0.20)	
Bismuth-214 @1120.4	gamma	pCi/g					0.610	
Bismuth-214 @1764.7	gamma	pCi/g					0.550	
Bismuth-214 @609.4	gamma	pCi/g					0.560	
K-40 @1460	gamma	pCi/g					0.710	
Lead-210 @46	gamma	pCi/g					ND (0.60)	
Lead-212 @238	gamma	pCi/g					0.230	
Lead-214 @295.2	gamma	pCi/g					0.440	
Lead-214 @352.0	gamma	pCi/g					0.520	
Radium-226 @186.0	gamma	pCi/g					0.900	
Thallium-208 @583	gamma	pCi/g					0.0400	
Thallium-208 @860	gamma	pCi/g					0.0200	
Thorium-234 @63.3	gamma	pCi/g					0.410	
Thorium-234 @92.6	gamma	pCi/g					0.760	
Uranium-235 @143.8	gamma	pCi/g					0.0600	

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg	ND (0.012)		ND (0.012)		ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g	ND (0.0064)		ND (0.0063)		ND (0.0064)	
1,2-Dichlorobenzene	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g	ND (0.023)		ND (0.023)		ND (0.023)	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4,5-Trichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g	ND (0.042)		ND (0.042)		ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g	ND (0.086)		ND (0.085)		ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g	ND (0.035)		ND (0.035)		ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g	ND (0.030)		ND (0.030)		ND (0.030)	
2-Chlorophenol	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
2-Methylphenol	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitroaniline	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitrophenol	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g	ND (0.036)		ND (0.036)		ND (0.036)	
3-Nitroaniline	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g	ND (0.041)		ND (0.041)		ND (0.041)	
4-Nitroaniline	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Nitrophenol	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
Acenaphthene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Acenaphthylene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Anthracene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benz(a)anthracene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Benz(a)pyrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g	ND (0.032)		ND (0.032)		ND (0.032)	
Benzo(g,h,i)perylene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g	ND (0.027)		ND (0.027)		ND (0.027)	
Benzoic acid	GCMS	ug/g	ND (0.099)		ND (0.099)		ND (0.099)	
Benzyl alcohol	GCMS	ug/g	ND (0.048)		ND (0.048)		ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chrysene	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g	ND (0.023)		ND (0.022)		ND (0.023)	
Dibenzofuran	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Diethylphthalate	GCMS	ug/g	ND (0.012)		ND (0.012)		ND (0.012)	
Dimethylphthalate	GCMS	ug/g	ND (0.016)		ND (0.015)		ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Fluoranthene	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
Fluorene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Hexachlorobenzene	GCMS	ug/g	ND (0.018)		ND (0.017)		ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g	ND (0.054)		ND (0.054)		ND (0.054)	
Hexachloroethane	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Isophorone	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
N-Nitroso-di-n-propylamine	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
Naphthalene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Nitrobenzene	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Pentachlorophenol	GCMS	ug/g	ND (0.0064)		ND (0.0063)		ND (0.0064)	
Phenanthrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Phenol	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.034)	
Pyrene	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g	ND (0.054)		ND (0.054)		ND (0.054)	
p-Chloroaniline	GCMS	ug/g	ND (0.032)		ND (0.032)		ND (0.033)	
Arsenic	GFAA	mg/kg	67.8 B		82.6 B		61.2 B	
Cadmium	GFAA	mg/kg	ND (1.6) B		ND (0.22) B		ND (0.23) B	
Lead	GFAA	mg/kg	6.26		5.06		3.65	
Selenium	GFAA	mg/kg	5.27		4.25 B		4.33 B	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Aluminum	ICAP	mg/kg	6770 B		12500 B		7690 B	
Antimony	ICAP	mg/kg	ND (46)		ND (54)		ND (50)	
Barium	ICAP	mg/kg	26.1		45.8		31.0	
Beryllium	ICAP	mg/kg	0.510		0.877		0.570	
Calcium	ICAP	mg/kg	160000 B		166000 B		166000 B	
Chromium	ICAP	mg/kg	19.5 B		21.8 B		17.1 B	
Cobalt	ICAP	mg/kg	11.1 B		15.0 B		11.4 B	
Copper	ICAP	mg/kg	ND (3.9)		ND (4.6)		ND (4.3)	
Iron	ICAP	mg/kg	11300		21600		13000	
Magnesium	ICAP	mg/kg	120000 B		133000 B		121000 B	
Manganese	ICAP	mg/kg	96.3 B		119 B		97.6 B	
Molybdenum	ICAP	mg/kg	ND (3.0)		ND (3.5)		ND (3.3)	
Nickel	ICAP	mg/kg	9.30 B		ND (11)		ND (9.7)	
Phosphorus	ICAP	mg/kg	ND (70)		ND (68)		ND (69)	
Potassium	ICAP	mg/kg	679		1460		896	
Silver	ICAP	mg/kg	ND (3.5)		ND (4.1)		ND (3.8)	
Sodium	ICAP	mg/kg	210 B		198 B		248 B	
Titanium	ICAP	mg/kg	373 B		664 B		417 B	
Vanadium	ICAP	mg/kg	19.0		24.3		16.1	
Chloride	SIE	mg/kg	750		1050		866	
Fluoride	SIE	mg/kg	105 B		104 B		94.5 B	

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg					ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g					ND (0.0063)	
1,2-Dichlorobenzene	GCMS	ug/g					ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g					ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g					ND (0.023)	
2,4,5-Trichlorophenol	GCMS	ug/g					ND (0.019)	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4,6-Trichlorophenol	GCMS	ug/g					ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g					ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g					ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g					ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g					ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g					ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g					ND (0.030)	
2-Chlorophenol	GCMS	ug/g					ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g					ND (0.020)	
2-Methylphenol	GCMS	ug/g					ND (0.026)	
2-Nitroaniline	GCMS	ug/g					ND (0.026)	
2-Nitrophenol	GCMS	ug/g					ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g					ND (0.036)	
3-Nitroaniline	GCMS	ug/g					ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g					ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g					ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g					ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g					ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g					ND (0.041)	
4-Nitroaniline	GCMS	ug/g					ND (0.020)	
4-Nitrophenol	GCMS	ug/g					ND (0.021)	
Acenaphthene	GCMS	ug/g					ND (0.016)	
Acenaphthylene	GCMS	ug/g					ND (0.022)	
Anthracene	GCMS	ug/g					ND (0.018)	
Benz(a)anthracene	GCMS	ug/g					ND (0.011)	
Benz(a)pyrene	GCMS	ug/g					ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g					ND (0.032)	
Benzo(g,h,i)perylene	GCMS	ug/g					ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g					ND (0.027)	
Benzoic acid	GCMS	ug/g					ND (0.099)	
Butyl alcohol	GCMS	ug/g					ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g					ND (0.025)	
Chrysene	GCMS	ug/g					ND (0.019)	

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Di-n-butylphthalate	GCMS	ug/g					ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g					ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g					ND (0.023)	
Dibenzofuran	GCMS	ug/g					ND (0.013)	
Diethylphthalate	GCMS	ug/g					ND (0.012)	
Dimethylphthalate	GCMS	ug/g					ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g					ND (0.025)	
Fluoranthene	GCMS	ug/g					ND (0.014)	
Fluorene	GCMS	ug/g					ND (0.011)	
Hexachlorobenzene	GCMS	ug/g					ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g					ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g					ND (0.054)	
Hexachloroethane	GCMS	ug/g					ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g					ND (0.016)	
Isophorone	GCMS	ug/g					ND (0.0100)	
N-Nitroso-di-n-propylamine	GCMS	ug/g					ND (0.026)	
Naphthalene	GCMS	ug/g					ND (0.022)	
Nitrobenzene	GCMS	ug/g					ND (0.013)	
Pentachlorophenol	GCMS	ug/g					ND (0.0063)	
Phenanthrene	GCMS	ug/g					ND (0.018)	
Phenol	GCMS	ug/g					ND (0.033)	
Pyrene	GCMS	ug/g					ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g					ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g					ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g					ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g					ND (0.054)	
p-Chloroaniline	GCMS	ug/g					ND (0.032)	
Arsenic	GFAA	mg/kg					67.9 B	B
Cadmium	GFAA	mg/kg					0.336 B	B
Lead	GFAA	mg/kg					3.57	
Selenium	GFAA	mg/kg					3.20 B	B
Aluminum	ICAP	mg/kg					7270	B

Analytical Data Used In Calculations

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Antimony	ICAP	mg/kg					ND (46)	
Barium	ICAP	mg/kg					26.6	
Beryllium	ICAP	mg/kg					0.513	
Calcium	ICAP	mg/kg					146000	B
Chromium	ICAP	mg/kg					14.6	B
Cobalt	ICAP	mg/kg					7.91	B
Copper	ICAP	mg/kg					ND (4.0)	
Iron	ICAP	mg/kg					13200	
Magnesium	ICAP	mg/kg					125000	B
Manganese	ICAP	mg/kg					107	B
Molybdenum	ICAP	mg/kg					ND (3.0)	
Nickel	ICAP	mg/kg					ND (9.0)	B
Phosphorus	ICAP	mg/kg					ND (70)	
Potassium	ICAP	mg/kg					1100	
Silver	ICAP	mg/kg					ND (3.5)	
Sodium	ICAP	mg/kg					123	B
Titanium	ICAP	mg/kg					409	B
Vanadium	ICAP	mg/kg					18.3	
Chloride	SIE	mg/kg					930	
Fluoride	SIE	mg/kg					146	B

Stream: Coal Paste Collection Method: Grab Composite Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/g	0.160		0.155		0.130	
Fluorine	D3761	ug/g	120		99.0		120	
Chlorine	D4208	ug/g	990		1260		1230	
Cadmium	GFAA	ug/g	0.0800		0.0600		0.190	
Lead	GFAA	ug/g	6.00		6.00		7.00	

Analytical Data Used In Calculations

Stream: Coal Past Collection Method: Grab Composit Sample Type: Filtered Solid

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Barium	ICAP	ug/g	49.0		51.0		61.0	
Beryllium	ICAP	ug/g	1.70		1.50		1.55	
Boron	ICAP	ug/g	79.0		83.0		ND (3.0)	
Calcium	ICAP	ug/g	1100		1400		1400	
Chromium	ICAP	ug/g	15.0		17.0		17.0	
Copper	ICAP	ug/g	6.80		6.70		7.40	
Magnesium	ICAP	ug/g	840		820		910	
Phosphorus	ICAP	ug/g	90.0		97.0		99.5	
Titanium	ICAP	ug/g	680		680		720	
Aluminum	NAA	ug/g	14800		15300		16800	
Antimony	NAA	ug/g	0.441		0.469		0.518	
Arsenic	NAA	ug/g	37.5		50.4		47.6	
Cobalt	NAA	ug/g	3.69		3.85		4.20	
Iron	NAA	ug/g	20200		17200		23200	
Manganese	NAA	ug/g	21.8		25.9		28.8	
Molybdenum	NAA	ug/g	1.19		0.304		ND (0.51)	
Nickel	NAA	ug/g	12.3		8.48		17.9	
Potassium	NAA	ug/g	5040		4310		3540	
Silver	NAA	ug/g	0.799		0.437		0.644	
Sodium	NAA	ug/g	310		407		297	
Vanadium	NAA	ug/g	24.8		21.2		25.8	
Fixed Carbon	Proximate	%	53.0		53.2		50.8	
HHV	Proximate	Btu/lb	12900		12700		12600	
Volatile	Proximate	%	35.8		34.9		35.1	
Ash	Ultimate	%	11.2		11.8		14.1	
Carbon	Ultimate	%	72.3		71.7		70.3	
Hydrogen	Ultimate	%	4.62		4.55		4.68	
Moisture	Ultimate	%	3.20		4.17		2.80	
Nitrogen	Ultimate	%	1.58		1.35		1.37	
Oxygen	Ultimate	%	7.15		7.21		5.98	
Sulfur	Ultimate	%	3.11		3.35		3.62	

Analytical Data Used In Calculations

Stream: Coal Past Collection Method: Grab Composite Sample Type: Filtered Solid

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Actinium-228 @338	gamma	pCi/g	ND (0.010)		0.146		0.206	
Actinium-228 @911	gamma	pCi/g	0.145		0.146		0.0720	
Actinium-228 @968	gamma	pCi/g	0.155		ND (0.021)		0.216	
Bismuth-212 @727	gamma	pCi/g	0.475		ND (0.31)		0.113	
Bismuth-214 @1120.4	gamma	pCi/g	0.0207		0.0939		0.391	
Bismuth-214 @1764.7	gamma	pCi/g	0.279		0.0522		0.0103	
Bismuth-214 @609.4	gamma	pCi/g	0.217		0.271		0.278	
K-40 @1460	gamma	pCi/g	1.34		1.57		1.95	
Lead-210 @46	gamma	pCi/g	0.878		0.0939		0.494	
Lead-212 @238	gamma	pCi/g	0.0826		0.115		0.298	
Lead-214 @295.2	gamma	pCi/g	0.165		0.230		0.144	
Lead-214 @352.0	gamma	pCi/g	0.341		0.323		0.154	
Radium-226 @186.0	gamma	pCi/g	0.186		0.616		ND (0.10)	
Thallium-208 @583	gamma	pCi/g	0.0413		0.0522		0.0412	
Thallium-208 @860	gamma	pCi/g	ND (0.14)		0.104		0.0514	
Thorium-234 @63.3	gamma	pCi/g	0.0207		ND (0.10)		0.607	
Thorium-234 @92.6	gamma	pCi/g	ND (0.10)		0.219		ND (0.082)	
Uranium-235 @143.8	gamma	pCi/g	0.0103		0.0417		ND (0.010)	

Stream: Coal Paste Collection Method: Grab Composite Sample Type: Filtered Solids FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/g					0.270	
Fluorine	D3761	ug/g					120	
Chlorine	D4208	ug/g					1080	
Cadmium	GFAA	ug/g					0.120	
Lead	GFAA	ug/g					7.00	
Barium	ICAP	ug/g					58.0	
Beryllium	ICAP	ug/g					1.50	
Boron	ICAP	ug/g					80.0	

Analytical Data Used In Calculations

Stream: Coal Past Collection Method: Grab Composit Sample Type: Filtered Solid FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Calcium	ICAP	ug/g					1600	
Chromium	ICAP	ug/g					16.0	
Copper	ICAP	ug/g					7.30	
Magnesium	ICAP	ug/g					1000	
Phosphorus	ICAP	ug/g					110	
Titanium	ICAP	ug/g					710	
Aluminum	NAA	ug/g					16500	
Antimony	NAA	ug/g					0.431	
Arsenic	NAA	ug/g					45.3	
Cobalt	NAA	ug/g					4.42	
Iron	NAA	ug/g					23100	
Manganese	NAA	ug/g					33.1	
Molybdenum	NAA	ug/g					1.47	
Nickel	NAA	ug/g					15.9	
Potassium	NAA	ug/g					1130	
Silver	NAA	ug/g					0.622	
Sodium	NAA	ug/g					329	
Vanadium	NAA	ug/g					25.5	
Fixed Carbon	Proximate	%					51.2	
HHV	Proximate	Btu/lb					12600	
Volatile	Proximate	%					35.5	
Ash	Ultimate	%					13.3	
Carbon	Ultimate	%					70.5	
Hydrogen	Ultimate	%					4.74	
Moisture	Ultimate	%					2.91	
Nitrogen	Ultimate	%					1.37	
Oxygen	Ultimate	%					6.79	
Sulfur	Ultimate	%					3.34	
Actinium-228 @338	gamma	pCi/g					0.154	
Actinium-228 @911	gamma	pCi/g					0.113	
Actinium-228 @968	gamma	pCi/g					0.227	

Analytical Data Used In Calculations

Stream: Coal Past Collection Method: Grab Composite Sample Type: Filtered Solid FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Bismuth-212 @727	gamma	pCi/g					0.330	
Bismuth-214 @1120.4	gamma	pCi/g					0.0515	
Bismuth-214 @1764.7	gamma	pCi/g					0.247	
Bismuth-214 @609.4	gamma	pCi/g					0.175	
K-40 @1460	gamma	pCi/g					2.68	
Lead-210 @46	gamma	pCi/g					0.257	
Lead-212 @238	gamma	pCi/g					0.288	
Lead-214 @295.2	gamma	pCi/g					0.257	
Lead-214 @352.0	gamma	pCi/g					0.206	
Radium-226 @186.0	gamma	pCi/g					0.402	
Thallium-208 @583	gamma	pCi/g					0.0515	
Thallium-208 @860	gamma	pCi/g					0.196	
Thorium-234 @63.3	gamma	pCi/g					ND (0.22)	
Thorium-234 @92.6	gamma	pCi/g					0.206	
Uranium-235 @143.8	gamma	pCi/g					0.0206	

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Ash + Mg + Ca

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	ug/g	99.0		120		100	
Carbon	Ultimate	%	5.16		5.47		5.24	
Sulfur	Ultimate	%	3.82		4.07		3.86	
Actinium-228 @338	gamma	pCi/g	0.650		0.590		0.800	
Actinium-228 @911	gamma	pCi/g	0.550		0.520		0.600	
Actinium-228 @968	gamma	pCi/g	0.500		0.850		0.460	
Bismuth-212 @727	gamma	pCi/g	1.40		0.470		0.250	
Bismuth-214 @1120.4	gamma	pCi/g	1.20		1.00		1.10	
Bismuth-214 @1764.7	gamma	pCi/g	1.00		1.10		0.800	
Bismuth-214 @609.4	gamma	pCi/g	1.00		1.00		0.960	
K-40 @1460	gamma	pCi/g	7.30		6.70		5.80	
Lead-210 @46	gamma	pCi/g	1.00		0.990		2.00	

Analytical Data Used In Calculations

Stream: Cyclone As Collection Method: Grab Composite Sample Type: Ash + Mg + C

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Lead-212 @238	gamma	pCi/g	0.650		0.590		0.660	
Lead-214 @295.2	gamma	pCi/g	1.00		0.990		1.10	
Lead-214 @352.0	gamma	pCi/g	1.20		1.00		1.10	
Radium-226 @186.0	gamma	pCi/g	2.30		2.30		1.40	
Thallium-208 @583	gamma	pCi/g	0.250		0.200		0.200	
Thallium-208 @860	gamma	pCi/g	0.380		0.320		ND (0.44)	
Thorium-234 @63.3	gamma	pCi/g	1.80		0.470		0.720	
Thorium-234 @92.6	gamma	pCi/g	0.300		0.950		0.180	
Uranium-235 @143.8	gamma	pCi/g	0.140		0.140		0.0900	

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Ash + Mg + Ca FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	ug/g					87.5	
Carbon	Ultimate	%					5.30	
Sulfur	Ultimate	%					3.57	
Actinium-228 @338	gamma	pCi/g					0.610	
Actinium-228 @911	gamma	pCi/g					0.750	
Actinium-228 @968	gamma	pCi/g					0.290	
Bismuth-212 @727	gamma	pCi/g					0.520	
Bismuth-214 @1120.4	gamma	pCi/g					0.820	
Bismuth-214 @1764.7	gamma	pCi/g					0.660	
Bismuth-214 @609.4	gamma	pCi/g					1.10	
K-40 @1460	gamma	pCi/g					6.50	
Lead-210 @46	gamma	pCi/g					0.610	
Lead-212 @238	gamma	pCi/g					0.730	
Lead-214 @295.2	gamma	pCi/g					1.10	
Lead-214 @352.0	gamma	pCi/g					1.10	
Radium-226 @186.0	gamma	pCi/g					1.70	
Thallium-208 @583	gamma	pCi/g					0.200	
Thallium-208 @860	gamma	pCi/g					0.430	

Analytical Data Used In Calculations

Stream: Cyclone As Collection Method: Grab Composite Sample Type: Ash + Mg + C FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Thorium-234 @63.3	gamma	pCi/g						
Thorium-234 @92.6	gamma	pCi/g					1.40	
Uranium-235 @143.8	gamma	pCi/g					0.730	
							0.100	

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg	ND (0.012)		ND (0.012)		ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g	ND (0.0064)		ND (0.0064)		ND (0.0064)	
1,2-Dichlorobenzene	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g	ND (0.023)		ND (0.024)		ND (0.024)	
2,4,5-Trichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g	ND (0.042)		ND (0.042)		ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g	ND (0.086)		ND (0.086)		ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g	ND (0.025)		ND (0.026)		ND (0.026)	
2,6-Dinitrotoluene	GCMS	ug/g	ND (0.035)		ND (0.035)		ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g	ND (0.030)		ND (0.030)		ND (0.030)	
2-Chlorophenol	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
2-Methylphenol	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitroaniline	GCMS	ug/g	ND (0.026)		ND (0.027)		ND (0.027)	
2-Nitrophenol	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g	ND (0.036)		ND (0.036)		ND (0.036)	
3-Nitroaniline	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	

Analytical Data Used In Calculations

Stream: Cyclone As Collection Method: Grab Composit Sample Type: Fly As

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
4-Methylphenol/3-Methylphenol	GCMS	ug/g	ND (0.041)		ND (0.041)		ND (0.041)	
4-Nitroaniline	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Nitrophenol	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
Acenaphthene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Acenaphthylene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Anthracene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benz(a)anthracene	GCMS	ug/g	ND (0.011)		ND (0.012)		ND (0.012)	
Benz(a)pyrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g	ND (0.032)		ND (0.032)		ND (0.032)	
Benzo(g,h,i)perylene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g	ND (0.027)		ND (0.027)		ND (0.027)	
Benzoic acid	GCMS	ug/g	ND (0.099)		ND (0.100)		ND (0.099)	
Benzoil alcohol	GCMS	ug/g	ND (0.048)		ND (0.048)		ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Chrysene	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g	ND (0.023)		ND (0.023)		ND (0.023)	
Dibenzofuran	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Diethylphthalate	GCMS	ug/g	ND (0.012)		ND (0.012)		ND (0.012)	
Dimethylphthalate	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Fluoranthene	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
Fluorene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Hexachlorobenzene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g	ND (0.054)		ND (0.055)		ND (0.054)	
Hexachloroethane	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Isophorone	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
N-Nitroso-di-n-propylamine	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
Naphthalene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Nitrobenzene	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	

Analytical Data Used In Calculations

Stream: Cyclone As Collection Method: Grab Composit Sample Type: Fly As

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Pentachlorophenol	GCMS	ug/g	ND (0.0064)		ND (0.0064)		ND (0.0064)	
Phenanthrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Phenol	GCMS	ug/g	ND (0.034)		ND (0.034)		ND (0.034)	
Pyrene	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g	ND (0.054)		ND (0.055)		ND (0.054)	
p-Chloroaniline	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Arsenic	GFAA	mg/kg	87.0	B	100	B	93.1	B
Cadmium	GFAA	mg/kg	0.284	B	0.442	B	0.320	B
Lead	GFAA	mg/kg	17.7		21.3		16.7	
Selenium	GFAA	mg/kg	1.65		2.95		7.46	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt	ND (0.90)		ND (0.90)		ND (0.80)	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt	ND (0.50)		0.510		ND (0.40)	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt	ND (0.80)		ND (0.80)		ND (0.70)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt	ND (0.80)		ND (0.70)		ND (0.70)	
1,2,3,4,7,8-HxCDF	HR GCMS	ppt	ND (0.40)		ND (0.40)		ND (0.40)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt	ND (0.60)		ND (0.60)		ND (0.60)	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt	ND (0.30)		ND (0.30)		ND (0.30)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt	ND (0.70)		ND (0.60)		ND (0.60)	
1,2,3,7,8,9-HxCDF	HR GCMS	ppt	ND (0.50)		ND (0.50)		ND (0.40)	
1,2,3,7,8-PeCDD	HR GCMS	ppt	ND (0.70)		ND (0.70)		ND (0.50)	
1,2,3,7,8-PeCDF	HR GCMS	ppt	ND (0.40)		ND (0.40)		ND (0.30)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt	0.280		ND (0.40)		ND (0.40)	
2,3,4,7,8-PeCDF	HR GCMS	ppt	ND (0.40)		ND (0.40)		ND (0.30)	
2,3,7,8-TCDD	HR GCMS	ppt	ND (0.40)		ND (0.40)		ND (0.30)	
2,3,7,8-TCDF	HR GCMS	ppt	ND (0.30)		ND (0.30)		ND (0.20)	
OCDD	HR GCMS	ppt	ND (1.6)		ND (0.30)		ND (0.20)	
OCDF	HR GCMS	ppt	ND (1.3)		ND (1.6)		ND (1.5)	
Total HpCDD	HR GCMS	ppt	ND (0.90)		ND (1.4)		ND (1.3)	
Total HpCDF	HR GCMS	ppt	ND (0.60)		ND (0.90)		ND (0.80)	
					0.630		ND (0.50)	

Analytical Data Used In Calculations

Stream: Cyclone As Collection Method: Grab Composit Sample Type: Fly As

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Total HxCDD	HR GCMS	ppt	ND (0.70)		ND (0.70)		ND (0.60)	
Total HxCDF	HR GCMS	ppt	0.280		ND (0.40)		ND (0.40)	
Total PeCDD	HR GCMS	ppt	ND (0.70)		ND (0.70)		ND (0.50)	
Total PeCDF	HR GCMS	ppt	ND (0.40)		ND (0.40)		ND (0.30)	
Total TCDD	HR GCMS	ppt	ND (0.40)		ND (0.30)		ND (0.20)	
Total TCDF	HR GCMS	ppt	ND (0.30)		ND (0.30)		ND (0.20)	
Aluminum	ICAP	mg/kg	32400	B	30600	B	32700	B
Antimony	ICAP	mg/kg	ND (43)		ND (43)		ND (40)	
Barium	ICAP	mg/kg	142		144		154	
Beryllium	ICAP	mg/kg	4.39		3.61		3.48	
Calcium	ICAP	mg/kg	127000	B	125000	B	120000	B
Chromium	ICAP	mg/kg	44.4	B	42.1	B	45.6	B
Cobalt	ICAP	mg/kg	10.8	B	12.7	B	14.6	B
Copper	ICAP	mg/kg	ND (3.7)		ND (3.7)		ND (3.4)	
Iron	ICAP	mg/kg	49700		51100		49800	
Magnesium	ICAP	mg/kg	79900	B	79300	B	78700	B
Manganese	ICAP	mg/kg	115	B	110	B	115	B
Molybdenum	ICAP	mg/kg	ND (2.8)		ND (2.8)		3.18	
Nickel	ICAP	mg/kg	28.2	B	ND (8.4)	B	9.96	B
Phosphorus	ICAP	mg/kg	ND (67)		ND (70)		ND (67)	
Potassium	ICAP	mg/kg	6310		5980		6750	
Silver	ICAP	mg/kg	ND (3.3)		ND (3.3)		ND (3.0)	
Sodium	ICAP	mg/kg	1040	B	868	B	981	B
Titanium	ICAP	mg/kg	1740	B	1600	B	1660	B
Vanadium	ICAP	mg/kg	59.2		49.8		55.4	
Chloride	SIE	mg/kg	313		365		400	
Fluoride	SIE	mg/kg	75.5	B	150	B	104	B

Analytical Data Used In Calculations

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg					ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g					ND (0.0064)	
1,2-Dichlorobenzene	GCMS	ug/g					ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g					ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g					ND (0.024)	
2,4,5-Trichlorophenol	GCMS	ug/g					ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g					ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g					ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g					ND (0.042)	
2,4-Dinitrophenol	GCMS	ug/g					ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g					ND (0.026)	
2,6-Dinitrotoluene	GCMS	ug/g					ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g					ND (0.030)	
2-Chlorophenol	GCMS	ug/g					ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g					ND (0.020)	
2-Methylphenol	GCMS	ug/g					ND (0.026)	
2-Nitroaniline	GCMS	ug/g					ND (0.027)	
2-Nitrophenol	GCMS	ug/g					ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g					ND (0.036)	
3-Nitroaniline	GCMS	ug/g					ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g					ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g					ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g					ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g					ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g					ND (0.041)	
4-Nitroaniline	GCMS	ug/g					ND (0.020)	
4-Nitrophenol	GCMS	ug/g					ND (0.021)	
Acenaphthene	GCMS	ug/g					ND (0.016)	
Acenaphthylene	GCMS	ug/g					ND (0.022)	
Anthracene	GCMS	ug/g					ND (0.018)	
Benz(a)anthracene	GCMS	ug/g					ND (0.012)	
Benz(a)pyrene	GCMS	ug/g					ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g					ND (0.032)	

Analytical Data Used In Calculations

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzo(g,h,i)perylene	GCMS	ug/g					ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g					ND (0.027)	
Benzoic acid	GCMS	ug/g					ND (0.100)	
Benzyl alcohol	GCMS	ug/g					ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g					ND (0.025)	
Chrysene	GCMS	ug/g					ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g					ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g					ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g					ND (0.023)	
Dibenzofuran	GCMS	ug/g					ND (0.013)	
Diethylphthalate	GCMS	ug/g					ND (0.012)	
Dimethylphthalate	GCMS	ug/g					ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g					ND (0.025)	
Fluoranthene	GCMS	ug/g					ND (0.014)	
Fluorene	GCMS	ug/g					ND (0.011)	
Hexachlorobenzene	GCMS	ug/g					ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g					ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g					ND (0.055)	
Hexachloroethane	GCMS	ug/g					ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g					ND (0.016)	
Isophorone	GCMS	ug/g					ND (0.010)	
N-Nitroso-di-n-propylamine	GCMS	ug/g					ND (0.026)	
Naphthalene	GCMS	ug/g					ND (0.022)	
Nitrobenzene	GCMS	ug/g					ND (0.013)	
Pentachlorophenol	GCMS	ug/g					ND (0.0064)	
Phenanthrene	GCMS	ug/g					ND (0.018)	
Phenol	GCMS	ug/g					ND (0.034)	
Pyrene	GCMS	ug/g					ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g					ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g					ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g					ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g					ND (0.055)	
p-Chloroaniline	GCMS	ug/g					ND (0.033)	

Analytical Data Used In Calculations

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	mg/kg					93.0 B	
Cadmium	GFAA	mg/kg					0.419 B	
Lead	GFAA	mg/kg					16.0	
Selenium	GFAA	mg/kg					3.93	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt					ND (1.3)	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt					ND (0.60)	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt					ND (1.0)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt					ND (0.90)	
1,2,3,4,7,8-HxCDF	HR GCMS	ppt					ND (0.50)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt					ND (0.80)	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt					ND (0.40)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt					ND (0.90)	
1,2,3,7,8,9-HxCDF	HR GCMS	ppt					ND (0.60)	
1,2,3,7,8-PeCDD	HR GCMS	ppt					ND (0.70)	
1,2,3,7,8-PeCDF	HR GCMS	ppt					ND (0.40)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt					ND (0.50)	
2,3,4,7,8-PeCDF	HR GCMS	ppt					ND (0.40)	
2,3,7,8-TCDD	HR GCMS	ppt					ND (0.30)	
2,3,7,8-TCDF	HR GCMS	ppt					ND (0.20)	
OCDD	HR GCMS	ppt					ND (2.1)	
OCDF	HR GCMS	ppt					ND (1.8)	
Total HpCDD	HR GCMS	ppt					ND (1.3)	
Total HpCDF	HR GCMS	ppt					ND (0.80)	
Total HxCDD	HR GCMS	ppt					ND (0.90)	
Total HxCDF	HR GCMS	ppt					ND (0.50)	
Total PeCDD	HR GCMS	ppt					ND (0.70)	
Total PeCDF	HR GCMS	ppt					ND (0.40)	
Total TCDD	HR GCMS	ppt					ND (0.30)	
Total TCDF	HR GCMS	ppt					ND (0.20)	
Aluminum	ICAP	mg/kg					33500 B	
Antimony	ICAP	mg/kg					ND (45)	
Barium	ICAP	mg/kg					165	

Analytical Data Used In Calculations

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Beryllium	ICAP	mg/kg					3.76	
Calcium	ICAP	mg/kg					128000	B
Chromium	ICAP	mg/kg					45.9	B
Cobalt	ICAP	mg/kg					14.8	B
Copper	ICAP	mg/kg					ND (3.9)	
Iron	ICAP	mg/kg					51100	
Magnesium	ICAP	mg/kg					79400	B
Manganese	ICAP	mg/kg					115	B
Molybdenum	ICAP	mg/kg					ND (3.0)	
Nickel	ICAP	mg/kg					26.4	B
Phosphorus	ICAP	mg/kg					ND (71)	
Potassium	ICAP	mg/kg					6370	
Silver	ICAP	mg/kg					ND (3.4)	
Sodium	ICAP	mg/kg					1040	B
Titanium	ICAP	mg/kg					1690	B
Vanadium	ICAP	mg/kg					55.2	
Chloride	SIE	mg/kg					382	
Fluoride	SIE	mg/kg					130	B

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg	ND (0.012)		ND (0.012)		ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g	ND (0.0064)		ND (0.0064)		ND (0.0064)	
1,2-Dichlorobenzene	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
1,4-Dichlorobenzene	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
2,4,5-Trichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g	ND (0.042)		ND (0.042)		ND (0.042)	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dinitrophenol	GCMS	ug/g	ND (0.086)		ND (0.086)		ND (0.086)	
2,4-Dinitrotoluene	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g	ND (0.035)		ND (0.035)		ND (0.035)	
2-Chloronaphthalene	GCMS	ug/g	ND (0.030)		ND (0.030)		ND (0.030)	
2-Chlorophenol	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
2-Methylphenol	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
2-Nitroaniline	GCMS	ug/g	ND (0.027)		ND (0.027)		ND (0.026)	
2-Nitrophenol	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g	ND (0.036)		ND (0.036)		ND (0.036)	
3-Nitroaniline	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g	ND (0.024)		ND (0.024)		ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g	ND (0.041)		ND (0.041)		ND (0.041)	
4-Nitroaniline	GCMS	ug/g	ND (0.020)		ND (0.020)		ND (0.020)	
4-Nitrophenol	GCMS	ug/g	ND (0.021)		ND (0.021)		ND (0.021)	
Acenaphthene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Acenaphthylene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Anthracene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benz(a)anthracene	GCMS	ug/g	ND (0.012)		ND (0.012)		ND (0.012)	
Benz(a)pyrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g	ND (0.032)		ND (0.032)		ND (0.032)	
Benzo(g,h,i)perylene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g	ND (0.027)		ND (0.027)		ND (0.027)	
Benzoic acid	GCMS	ug/g	ND (0.100)		ND (0.100)		ND (0.099)	
Benzyl alcohol	GCMS	ug/g	ND (0.048)		ND (0.048)		ND (0.048)	
Butylbenzylphthalate	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Chrysene	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g	ND (0.023)		ND (0.023)		ND (0.023)	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Dibenzofuran	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Diethylphthalate	GCMS	ug/g	ND (0.012)		ND (0.012)		ND (0.012)	
Dimethylphthalate	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g	ND (0.025)		ND (0.025)		ND (0.025)	
Fluoranthene	GCMS	ug/g	ND (0.014)		ND (0.014)		ND (0.014)	
Fluorene	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
Hexachlorobenzene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Hexachlorobutadiene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Hexachlorocyclopentadiene	GCMS	ug/g	ND (0.055)		ND (0.055)		ND (0.054)	
Hexachloroethane	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g	ND (0.016)		ND (0.016)		ND (0.016)	
Isophorone	GCMS	ug/g	ND (0.010)		ND (0.010)		ND (0.010)	
N-Nitroso-di-n-propylamine	GCMS	ug/g	ND (0.026)		ND (0.026)		ND (0.026)	
Naphthalene	GCMS	ug/g	ND (0.022)		ND (0.022)		ND (0.022)	
Nitrobenzene	GCMS	ug/g	ND (0.013)		ND (0.013)		ND (0.013)	
Pentachlorophenol	GCMS	ug/g	ND (0.0064)		ND (0.0064)		ND (0.0064)	
Phenanthrene	GCMS	ug/g	ND (0.018)		ND (0.018)		ND (0.018)	
Phenol	GCMS	ug/g	ND (0.034)		ND (0.034)		ND (0.034)	
Pyrene	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g	ND (0.011)		ND (0.011)		ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g	ND (0.015)		ND (0.015)		ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g	ND (0.019)		ND (0.019)		ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g	0.0573		0.204		0.753	
p-Chloroaniline	GCMS	ug/g	ND (0.033)		ND (0.033)		ND (0.033)	
Arsenic	GFAA	mg/kg	354 B		403 B		388 B	
Cadmium	GFAA	mg/kg	1.96 B		1.79 B		1.96 B	
Lead	GFAA	mg/kg	63.7		85.7		102	
Selenium	GFAA	mg/kg	5.38		4.41		4.92	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt	1.30		1.00		1.80	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt	ND (0.50)		ND (1.1)		ND (0.50)	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt	ND (0.90)		ND (1.8)		ND (0.80)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt	ND (0.80)		ND (1.5)		ND (0.70)	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,3,4,7,8-HxCDF	HR GCMS	ppt	ND (0.50)		ND (0.90)		ND (0.40)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt	ND (0.70)		ND (1.3)		0.500	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt	ND (0.40)		ND (0.70)		ND (0.30)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt	ND (0.70)		ND (1.4)		ND (0.60)	
1,2,3,7,8,9-HxCDF	HR GCMS	ppt	ND (0.50)		ND (0.90)		ND (0.40)	
1,2,3,7,8-PeCDD	HR GCMS	ppt	ND (0.70)		ND (1.2)		ND (0.60)	
1,2,3,7,8-PeCDF	HR GCMS	ppt	ND (0.30)		ND (0.60)		ND (0.30)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt	ND (0.40)		ND (0.80)		ND (0.40)	
2,3,4,7,8-PeCDF	HR GCMS	ppt	ND (0.30)		ND (0.60)		ND (0.30)	
2,3,7,8-TCDD	HR GCMS	ppt	ND (0.30)		ND (0.50)		ND (0.30)	
2,3,7,8-TCDF	HR GCMS	ppt	ND (0.20)		ND (0.40)		0.210	
OCDD	HR GCMS	ppt	ND (1.8)		ND (3.5)		1.60	
OCDF	HR GCMS	ppt	ND (1.5)		ND (3.0)		ND (1.4)	
Total HpCDD	HR GCMS	ppt	2.50		2.50		1.80	
Total HpCDF	HR GCMS	ppt	ND (0.70)		ND (1.3)		ND (0.60)	
Total HxCDD	HR GCMS	ppt	5.90		5.00		6.40	
Total HxCDF	HR GCMS	ppt	ND (0.40)		ND (0.80)		ND (0.40)	
Total PeCDD	HR GCMS	ppt	4.40		5.30		4.20	
Total PeCDF	HR GCMS	ppt	ND (0.30)		ND (0.60)		ND (0.30)	
Total TCDD	HR GCMS	ppt	2.80		3.30		3.50	
Total TCDF	HR GCMS	ppt	ND (0.20)		ND (0.40)		0.210	
Aluminum	ICAP	mg/kg	62900	B	55700	B	62600	B
Antimony	ICAP	mg/kg	ND (59)		ND (57)		ND (57)	
Barium	ICAP	mg/kg	231		209		226	
Beryllium	ICAP	mg/kg	9.12		7.36		7.62	
Boron	ICAP	ug/g	97.0				83.0	
Calcium	ICAP	mg/kg	94900	B	83100	B	91200	B
Chromium	ICAP	mg/kg	97.5	B	89.7	B	94.0	B
Cobalt	ICAP	mg/kg	24.4	B	20.2	B	20.3	B
Copper	ICAP	mg/kg	8.59		ND (4.8)		8.52	
Iron	ICAP	mg/kg	27800		26200		28100	
Magnesium	ICAP	mg/kg	47700	B	43100	B	46100	B
Manganese	ICAP	mg/kg	114	B	107	B	113	B

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Molybdenum	ICAP	mg/kg	ND (3.8)		ND (3.7)		ND (3.8)	
Nickel	ICAP	mg/kg	60.3	B	32.6	B	57.3	B
Phosphorus	ICAP	mg/kg	ND (70)		ND (71)		ND (68)	
Potassium	ICAP	mg/kg	15800		14800		15600	
Silver	ICAP	mg/kg	ND (4.4)		ND (4.3)		ND (4.3)	
Sodium	ICAP	mg/kg	2600	B	2630	B	2560	B
Titanium	ICAP	mg/kg	3920	B	3650	B	3700	B
Vanadium	ICAP	mg/kg	123		111		111	
Chloride	SIE	mg/kg	ND (78)		ND (78)		ND (78)	
Fluoride	SIE	mg/kg	143	B	109	B	69.5	B
Carbon	Ultimate	%	0.335				0.340	
Sulfur	Ultimate	%	13.6				13.9	
Actinium-228 @338	gamma	pCi/g	1.20		1.10		1.20	
Actinium-228 @911	gamma	pCi/g	1.10		0.890		0.970	
Actinium-228 @968	gamma	pCi/g	1.10		1.30		0.850	
Bismuth-212 @727	gamma	pCi/g	1.50		1.40		0.940	
Bismuth-214 @1120.4	gamma	pCi/g	1.70		1.60		2.00	
Bismuth-214 @1764.7	gamma	pCi/g	1.60		1.70		1.60	
Bismuth-214 @609.4	gamma	pCi/g	1.90		1.80		1.70	
K-40 @1460	gamma	pCi/g	11.0		11.0		10.0	
Lead-210 @46	gamma	pCi/g	6.40		0.690		7.30	
Lead-212 @238	gamma	pCi/g	1.00		0.970		0.940	
Lead-214 @295.2	gamma	pCi/g	1.90		1.80		1.60	
Lead-214 @352.0	gamma	pCi/g	2.00		1.80		1.80	
Radium-226 @186.0	gamma	pCi/g	3.10		2.50		2.20	
Thallium-208 @583	gamma	pCi/g	0.360		0.310		0.420	
Thallium-208 @860	gamma	pCi/g	0.280		0.220		0.330	
Thorium-234 @63.3	gamma	pCi/g	2.20		0.860		1.60	
Thorium-234 @92.6	gamma	pCi/g	0.550		1.10		0.440	
Uranium-235 @143.8	gamma	pCi/g	0.190		0.150		0.140	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg					ND (0.012)	
1,2,4-Trichlorobenzene	GCMS	ug/g					ND (0.0063)	
1,2-Dichlorobenzene	GCMS	ug/g					ND (0.021)	
1,3-Dichlorobenzene	GCMS	ug/g					ND (0.023)	
1,4-Dichlorobenzene	GCMS	ug/g					ND (0.023)	
2,4,5-Trichlorophenol	GCMS	ug/g					ND (0.019)	
2,4,6-Trichlorophenol	GCMS	ug/g					ND (0.016)	
2,4-Dichlorophenol	GCMS	ug/g					ND (0.019)	
2,4-Dimethylphenol	GCMS	ug/g					ND (0.041)	
2,4-Dinitrophenol	GCMS	ug/g					ND (0.084)	
2,4-Dinitrotoluene	GCMS	ug/g					ND (0.025)	
2,6-Dinitrotoluene	GCMS	ug/g					ND (0.034)	
2-Chloronaphthalene	GCMS	ug/g					ND (0.029)	
2-Chlorophenol	GCMS	ug/g					ND (0.011)	
2-Methylnaphthalene	GCMS	ug/g					ND (0.020)	
2-Methylphenol	GCMS	ug/g					ND (0.026)	
2-Nitroaniline	GCMS	ug/g					ND (0.026)	
2-Nitrophenol	GCMS	ug/g					ND (0.014)	
3,3'-Dichlorobenzidine	GCMS	ug/g					ND (0.035)	
3-Nitroaniline	GCMS	ug/g					ND (0.011)	
4,6-Dinitro-2-methylphenol	GCMS	ug/g					ND (0.024)	
4-Bromophenylphenyl ether	GCMS	ug/g					ND (0.020)	
4-Chloro-3-methylphenol	GCMS	ug/g					ND (0.015)	
4-Chlorophenylphenyl ether	GCMS	ug/g					ND (0.024)	
4-Methylphenol/3-Methylphenol	GCMS	ug/g					ND (0.040)	
4-Nitroaniline	GCMS	ug/g					ND (0.019)	
4-Nitrophenol	GCMS	ug/g					ND (0.021)	
Acenaphthene	GCMS	ug/g					ND (0.016)	
Acenaphthylene	GCMS	ug/g					ND (0.021)	
Anthracene	GCMS	ug/g					ND (0.018)	
Benz(a)anthracene	GCMS	ug/g					ND (0.011)	
Benz(a)pyrene	GCMS	ug/g					ND (0.018)	
Benzo(b)fluoranthene	GCMS	ug/g					ND (0.031)	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzo(g,h,i)perylene	GCMS	ug/g					ND (0.018)	
Benzo(k)fluoranthene	GCMS	ug/g					ND (0.027)	
Benzoic acid	GCMS	ug/g					ND (0.097)	
Benzyl alcohol	GCMS	ug/g					ND (0.047)	
Butylbenzylphthalate	GCMS	ug/g					ND (0.025)	
Chrysene	GCMS	ug/g					ND (0.019)	
Di-n-butylphthalate	GCMS	ug/g					ND (0.010)	
Di-n-octylphthalate	GCMS	ug/g					ND (0.019)	
Dibenz(a,h)anthracene	GCMS	ug/g					ND (0.022)	
Dibenzofuran	GCMS	ug/g					ND (0.013)	
Diethylphthalate	GCMS	ug/g					ND (0.012)	
Dimethylphthalate	GCMS	ug/g					ND (0.015)	
Diphenylamine/N-NitrosoDPA	GCMS	ug/g					ND (0.025)	
Fluoranthene	GCMS	ug/g					ND (0.014)	
Fluorene	GCMS	ug/g					ND (0.011)	
Hexachlorobenzene	GCMS	ug/g					ND (0.017)	
Hexachlorobutadiene	GCMS	ug/g					ND (0.021)	
Hexachlorocyclopentadiene	GCMS	ug/g					ND (0.053)	
Hexachloroethane	GCMS	ug/g					ND (0.033)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/g					ND (0.016)	
Isophorone	GCMS	ug/g					ND (0.0098)	
N-Nitroso-di-n-propylamine	GCMS	ug/g					ND (0.026)	
Naphthalene	GCMS	ug/g					ND (0.022)	
Nitrobenzene	GCMS	ug/g					ND (0.013)	
Pentachlorophenol	GCMS	ug/g					ND (0.0063)	
Phenanthrene	GCMS	ug/g					ND (0.018)	
Phenol	GCMS	ug/g					ND (0.033)	
Pyrene	GCMS	ug/g					ND (0.015)	
bis(2-Chloroethoxy)methane	GCMS	ug/g					ND (0.011)	
bis(2-Chloroethyl)ether	GCMS	ug/g					ND (0.015)	
bis(2-Chloroisopropyl)ether	GCMS	ug/g					ND (0.019)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/g					0.632	
p-Chloroaniline	GCMS	ug/g					ND (0.032)	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	mg/kg					388	B
Cadmium	GFAA	mg/kg					1.92	B
Lead	GFAA	mg/kg					94.7	
Selenium	GFAA	mg/kg					4.67	
1,2,3,4,6,7,8-HpCDD	HR GCMS	ppt					1.40	
1,2,3,4,6,7,8-HpCDF	HR GCMS	ppt					ND (0.40)	
1,2,3,4,7,8,9-HpCDF	HR GCMS	ppt					ND (0.70)	
1,2,3,4,7,8-HxCDD	HR GCMS	ppt					ND (0.70)	
1,2,3,4,7,8-HxCDF	HR GCMS	ppt					ND (0.40)	
1,2,3,6,7,8-HxCDD	HR GCMS	ppt					ND (0.60)	
1,2,3,6,7,8-HxCDF	HR GCMS	ppt					ND (0.30)	
1,2,3,7,8,9-HxCDD	HR GCMS	ppt					ND (0.60)	
1,2,3,7,8,9-HxCDF	HR GCMS	ppt					ND (0.40)	
1,2,3,7,8-PeCDD	HR GCMS	ppt					ND (0.50)	
1,2,3,7,8-PeCDF	HR GCMS	ppt					ND (0.30)	
2,3,4,6,7,8-HxCDF	HR GCMS	ppt					0.350	
2,3,4,7,8-PeCDF	HR GCMS	ppt					ND (0.30)	
2,3,7,8-TCDD	HR GCMS	ppt					ND (0.30)	
2,3,7,8-TCDF	HR GCMS	ppt					ND (0.30)	
OCDD	HR GCMS	ppt					2.20	
OCDF	HR GCMS	ppt					ND (1.4)	
Total HpCDD	HR GCMS	ppt					2.90	
Total HpCDF	HR GCMS	ppt					ND (0.60)	
Total HxCDD	HR GCMS	ppt					8.00	
Total HxCDF	HR GCMS	ppt					0.340	
Total PeCDD	HR GCMS	ppt					6.00	
Total PeCDF	HR GCMS	ppt					ND (0.30)	
Total TCDD	HR GCMS	ppt					3.60	
Total TCDF	HR GCMS	ppt					ND (0.30)	
Aluminum	ICAP	mg/kg					61300	B
Antimony	ICAP	mg/kg					ND (52)	
Barium	ICAP	mg/kg					215	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Beryllium	ICAP	mg/kg					7.51	
Boron	ICAP	ug/g			100		90.0	
Calcium	ICAP	mg/kg					89200	B
Chromium	ICAP	mg/kg					93.4	B
Cobalt	ICAP	mg/kg					15.4	B
Copper	ICAP	mg/kg					7.90	
Iron	ICAP	mg/kg					28300	
Magnesium	ICAP	mg/kg					45300	B
Manganese	ICAP	mg/kg					107	B
Molybdenum	ICAP	mg/kg					ND (3.4)	
Nickel	ICAP	mg/kg					28.7	B
Phosphorus	ICAP	mg/kg					ND (67)	
Potassium	ICAP	mg/kg					14400	
Silver	ICAP	mg/kg					ND (3.9)	
Sodium	ICAP	mg/kg					2500	B
Titanium	ICAP	mg/kg					3560	B
Vanadium	ICAP	mg/kg					106	
Chloride	SIE	mg/kg					277	
Fluoride	SIE	mg/kg					94.9	B
Carbon	Ultimate	%			0.320		0.340	
Sulfur	Ultimate	%			12.6		13.7	
Actinium-228 @338	gamma	pCi/g					1.00	
Actinium-228 @911	gamma	pCi/g					0.970	
Actinium-228 @968	gamma	pCi/g					0.760	
Bismuth-212 @727	gamma	pCi/g					1.50	
Bismuth-214 @1120.4	gamma	pCi/g					1.60	
Bismuth-214 @1764.7	gamma	pCi/g					1.50	
Bismuth-214 @609.4	gamma	pCi/g					1.70	
K-40 @1460	gamma	pCi/g					10.0	
Lead-210 @46	gamma	pCi/g					6.30	
Lead-212 @238	gamma	pCi/g					1.00	
Lead-214 @295.2	gamma	pCi/g					1.50	

Analytical Data Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Lead-214 @352.0	gamma	pCi/g					1.80	
Radium-226 @186.0	gamma	pCi/g					2.40	
Thallium-208 @583	gamma	pCi/g					0.330	
Thallium-208 @860	gamma	pCi/g					0.380	
Thorium-234 @63.3	gamma	pCi/g					1.20	
Thorium-234 @92.6	gamma	pCi/g					1.30	
Uranium-235 @143.8	gamma	pCi/g					0.150	

Stream: ESP Inle Collection Method: Ammonia/Cyanide Sample Type: Ammonia Impinger

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Ammonia - Distilled	distil	ug/Nm3	164	B	94.7	B	119	B

Stream: ESP Inle Collection Method: Ammonia/Cyanide Sample Type: Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Cyanide	tot CN	ug/Nm3	870		614		392	

Stream: ESP Inlet Collection Method: Anions Train Sample Type: Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	68300		67300		73600	
Sulfate	IC	ug/Nm3	795000		756000		784000	
Fluoride	SIE	ug/Nm3	7000	B	6340	B	6360	B

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: Anions/Ammonia/Cyanide/Aldehydes Sample Type: M5 Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	1560		1790		861	
Chloride	IC	ug/g	852		1020		481	
Sulfate	IC	ug/Nm3	9440000		9150000		9260000	
Sulfate	IC	ug/g	5160000		5210000		5180000	
Fluoride	SIE	ug/Nm3	4100	C	3170	C	2330	C
Fluoride	SIE	ug/g	2240	C	1800	C	1300	C

Stream: ESP Inlet Collection Method: M0011a Sample Type: Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Formaldehyde	HPLC	ug/Nm3	8.74		4.48		3.03	

Stream: ESP Inlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (2.9)		ND (2.4)		ND (2.7)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (2.8)		ND (2.3)		ND (2.5)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (2.7)		ND (2.2)		ND (2.4)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (2.6)		ND (2.1)		ND (2.3)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (4.4)		ND (3.7)		ND (4.0)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (4.7)		ND (4.0)		ND (4.3)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (3.4)		ND (2.9)		ND (3.1)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (3.9)		ND (3.2)		ND (3.5)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (13)		ND (11)		ND (12)	
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (4.3)		ND (3.6)		ND (3.9)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (6.1)		ND (5.2)		ND (5.6)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (1.8)		ND (1.5)		ND (1.6)	
2-Chlorophenol	GCMS	ug/Nm3	ND (2.9)		ND (2.4)		ND (2.6)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (1.7)		ND (1.4)		ND (1.5)	
2-Methylphenol	GCMS	ug/Nm3	ND (3.5)		ND (2.9)		ND (3.2)	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Nitroaniline	GCMS	ug/Nm3	ND (6.2)		ND (5.2)		ND (5.6)	
2-Nitrophenol	GCMS	ug/Nm3	ND (5.3)		ND (4.4)		ND (4.8)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (2.9)		ND (2.5)		ND (2.8)	
3-Nitroaniline	GCMS	ug/Nm3	ND (5.4)		ND (4.6)		ND (4.9)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (8.2)		ND (7.0)		ND (7.3)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (1.8)		ND (1.5)		ND (1.6)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (3.8)		ND (3.2)		ND (3.5)	
4-Nitroaniline	GCMS	ug/Nm3	ND (5.1)		ND (4.3)		ND (4.6)	
4-Nitrophenol	GCMS	ug/Nm3	ND (12)		ND (10)		ND (11)	
Acenaphthene	GCMS	ug/Nm3	ND (2.0)		ND (1.7)		ND (1.8)	
Acenaphthylene	GCMS	ug/Nm3	ND (1.1)		ND (0.94)		ND (1.0)	
Acetophenone	GCMS	ug/Nm3	ND (2.9)		ND (2.3)		ND (2.6)	
Aniline	GCMS	ug/Nm3	ND (2.3)		ND (1.9)		ND (2.1)	
Anthracene	GCMS	ug/Nm3	ND (1.2)		ND (1.0)		ND (1.1)	
Benidine	GCMS	ug/Nm3	ND (2.0)		ND (1.7)		ND (1.9)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.79)		ND (0.64)		ND (0.74)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.77)		ND (0.62)		ND (0.72)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (0.85)		ND (0.69)		ND (0.79)	
Benzoic acid	GCMS	ug/Nm3	ND (11)		ND (9.0)		ND (9.8)	
Benzyl alcohol	GCMS	ug/Nm3	ND (5.4)		ND (4.3)		ND (4.8)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (1.4)		ND (1.2)		ND (1.3)	
Chrysene	GCMS	ug/Nm3	ND (0.81)		ND (0.70)		ND (0.78)	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.69)		ND (0.56)		ND (0.64)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (0.92)		ND (0.75)		ND (0.86)	
Dibenzofuran	GCMS	ug/Nm3	ND (1.3)		ND (1.1)		ND (1.1)	
Diethylphthalate	GCMS	ug/Nm3	ND (1.5)		ND (1.2)		ND (1.3)	
Dimethylphthalate	GCMS	ug/Nm3	ND (1.6)		ND (1.4)		ND (1.5)	
Fluoranthene	GCMS	ug/Nm3	ND (0.94)		ND (0.80)		ND (0.83)	
Fluorene	GCMS	ug/Nm3	ND (1.6)		ND (1.4)		ND (1.5)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (3.8)		ND (3.3)		ND (3.4)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (4.9)		ND (4.1)		ND (4.4)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (6.5)		ND (5.5)		ND (5.9)	
Hexachloroethane	GCMS	ug/Nm3	ND (5.3)		ND (4.3)		ND (4.8)	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.69)		ND (0.56)		ND (0.64)	
Isophorone	GCMS	ug/Nm3	ND (1.7)		ND (1.5)		ND (1.6)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (5.3)		ND (4.3)		ND (4.8)	
Naphthalene	GCMS	ug/Nm3	5.34 J		ND (0.92)		ND (1.0)	
Nitrobenzene	GCMS	ug/Nm3	ND (3.0)		ND (2.5)		ND (2.7)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (17)		ND (15)		ND (15)	
Pentachlorophenol	GCMS	ug/Nm3	ND (8.7)		ND (7.4)		ND (7.7)	
Phenanthrene	GCMS	ug/Nm3	ND (1.2)		ND (1.0)		ND (1.0)	
Phenol	GCMS	ug/Nm3	ND (2.4)		ND (2.0)		ND (2.2)	
Pyrene	GCMS	ug/Nm3	ND (0.69)		ND (0.60)		ND (0.67)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (2.6)		ND (2.2)		ND (2.4)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (3.2)		ND (2.6)		ND (2.8)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	8.54 B		4.68 BJ		5.46 BJ	

Stream: ESP Inlet Collection Method: MMS Sample Type: MeCl2 PNR/MM5 Filter 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Di-n-butylphthalate	GCMS	ug/Nm3	108 B					

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (0.90)		ND (0.98)		ND (1.0)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.78)		ND (0.86)		ND (0.91)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.73)		ND (0.81)		ND (0.85)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.72)		ND (0.79)		ND (0.83)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.3)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (1.2)		ND (1.2)		ND (1.4)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (0.49)		ND (0.53)		ND (0.56)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (0.83)		ND (0.90)		ND (0.95)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (2.7)		ND (2.8)		ND (3.2)	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (1.0)		ND (1.1)		ND (1.2)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (1.5)		ND (1.6)		ND (1.8)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (0.45)		ND (0.48)		ND (0.55)	
2-Chlorophenol	GCMS	ug/Nm3	ND (0.79)		ND (0.87)		ND (0.92)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (0.47)		ND (0.50)		ND (0.54)	
2-Methylphenol	GCMS	ug/Nm3	ND (0.90)		ND (1.0)		ND (1.0)	
2-Nitroaniline	GCMS	ug/Nm3	ND (1.1)		ND (1.2)		ND (1.4)	
2-Nitrophenol	GCMS	ug/Nm3	ND (1.3)		ND (1.4)		ND (1.4)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (1.3)		ND (1.3)		ND (1.5)	
3-Nitroaniline	GCMS	ug/Nm3	ND (1.3)		ND (1.3)		ND (1.5)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (1.8)		ND (1.8)		ND (2.0)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (0.45)		ND (0.45)		ND (0.48)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (0.87)		ND (0.95)		ND (1.0)	
4-Nitroaniline	GCMS	ug/Nm3	ND (1.1)		ND (1.2)		ND (1.4)	
4-Nitrophenol	GCMS	ug/Nm3	ND (1.7)		0.469 J		ND (2.0)	
Acenaphthene	GCMS	ug/Nm3	ND (0.47)		ND (0.50)		ND (0.57)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.27)		ND (0.28)		ND (0.32)	
Acetophenone	GCMS	ug/Nm3	4.13 J		4.67 J		2.46 J	
Aniline	GCMS	ug/Nm3	ND (0.99)		ND (1.1)		ND (1.1)	
Anthracene	GCMS	ug/Nm3	ND (0.27)		ND (0.27)		ND (0.29)	
Benazidine	GCMS	ug/Nm3	ND (0.74)		ND (0.79)		ND (0.86)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.51)		ND (0.53)		ND (1.2)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.56)		ND (0.58)		ND (1.3)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (0.54)		ND (0.56)		ND (1.3)	
Benzyl alcohol	GCMS	ug/Nm3	ND (1.4)		ND (1.6)		ND (1.7)	
Butylbenzylphthalate	GCMS	ug/Nm3	0.696 J		ND (0.44)		ND (0.48)	
Chrysene	GCMS	ug/Nm3	ND (0.37)		ND (0.39)		ND (0.42)	
Di-n-butylphthalate	GCMS	ug/Nm3	10.8 J		1.95 J		28.9	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.30)		0.185 J		ND (0.70)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (0.63)		ND (0.65)		ND (1.5)	
Dibenzofuran	GCMS	ug/Nm3	ND (0.30)		ND (0.32)		ND (0.36)	
Diethylphthalate	GCMS	ug/Nm3	0.770 J		0.966 J		ND (0.35)	
Dimethylphthalate	GCMS	ug/Nm3	ND (0.37)		ND (0.39)		ND (0.44)	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Fluoranthene	GCMS	ug/Nm3	ND (0.26)		ND (0.26)		ND (0.28)	
Fluorene	GCMS	ug/Nm3	ND (0.37)		ND (0.39)		ND (0.44)	
Hexachlorobenzene	GCMS	ug/Nm3	33.8		ND (1.3)		ND (1.4)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (1.5)		ND (1.6)		ND (1.7)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (1.3)		ND (1.4)		ND (1.6)	
Hexachloroethane	GCMS	ug/Nm3	ND (1.5)		ND (1.7)		ND (1.7)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.49)		ND (0.50)		ND (1.1)	
Isophorone	GCMS	ug/Nm3	ND (0.39)		6.82 J		11.2	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (1.1)		ND (1.3)		ND (1.3)	
Naphthalene	GCMS	ug/Nm3	0.668 BJ		0.729 BJ		ND (0.34)	
Nitrobenzene	GCMS	ug/Nm3	ND (0.68)		ND (0.73)		ND (0.78)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.9)	
Pentachlorophenol	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.9)	
Phenanthrene	GCMS	ug/Nm3	ND (0.27)		ND (0.27)		ND (0.29)	
Phenol	GCMS	ug/Nm3	2.80 J		3.00 J		1.66 J	
Pyrene	GCMS	ug/Nm3	ND (0.23)		ND (0.24)		ND (0.26)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (0.72)		ND (0.78)		ND (0.82)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (0.92)		ND (1.0)		ND (1.1)	

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:10 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3	89.3 J					
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	467					

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3					122	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3			216			

Stream: ESP Inlet Collection Method: Multimetals Train Sample Type: Mercury Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	3.40		2.06		1.75	

Stream: ESP Inle Collection Method: Multimetals Trai Sample Type: Nitric Acid Impingers + TL

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	11.8		14.3		13.3	
Aluminum	ICAP	ug/Nm3	36.5 BC	BC	43.3 BC	BC	65.6 BC	BC
Barium	ICAP	ug/Nm3	0.459 BC	BC	0.728 BC	BC	0.836 BC	BC
Boron	ICAP	ug/Nm3	197 BC	BC	206 BC	BC	186 BC	BC
Calcium	ICAP	ug/Nm3	182 BC	BC	259 BC	BC	366 BC	BC
Iron	ICAP	ug/Nm3	30.6 BC	BC	30.1 BC	BC	178 BC	BC
Magnesium	ICAP	ug/Nm3	26.3 C	C	27.5 C	C	58.0 C	C
Phosphorus	ICAP	ug/Nm3	ND (19)	BC	ND (19)	BC	ND (17)	BC
Potassium	ICAP	ug/Nm3	ND (250)	BC	ND (250)	BC	ND (230)	BC
Silver	ICAP	ug/Nm3	ND (1.6)	B	ND (1.6)	B	ND (1.4)	B
Sodium	ICAP	ug/Nm3	207 BC	BC	294 BC	BC	250 BC	BC
Titanium	ICAP	ug/Nm3	1.23		1.56		2.97	
Antimony	ICPMS	ug/Nm3	0.0163 C	C	0.0162 C	C	0.0169 C	C
Arsenic	ICPMS	ug/Nm3	0.389 C	C	0.255 C	C	0.361 C	C
Barium	ICPMS	ug/Nm3	ND (0.0053) C	C	ND (0.0053) C	C	ND (0.0048) C	C
Beryllium	ICPMS	ug/Nm3	ND (0.0048) C	C	ND (0.0048) C	C	0.0262 C	C
Cadmium	ICPMS	ug/Nm3	1.08 C	C	0.226 C	C	0.154 C	C
Chromium	ICPMS	ug/Nm3	3.78 C	C	0.770 C	C	26.2 C	C
Cobalt	ICPMS	ug/Nm3	0.0186 C	C	0.0185 C	C	1.13 C	C

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Copper	ICPMS	ug/Nm3	0.630	C	0.232	C	2.38	C
Lead	ICPMS	ug/Nm3	ND (0.0051)	C	ND (0.0050)	C	ND (0.0046)	C
Manganese	ICPMS	ug/Nm3	1.16	C	1.18	C	3.32	C
Molybdenum	ICPMS	ug/Nm3	0.143	C	ND (0.0078)	C	3.32	C
Nickel	ICPMS	ug/Nm3	0.154	C	0.204	C	29.3	C
Selenium	ICPMS	ug/Nm3	20.2	C	13.9	C	17.5	C
Vanadium	ICPMS	ug/Nm3	1.46	C	0.837	C	0.940	C

Stream: ESP Inlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234678-HpCDD	Meth 23X	ug/Nm3	0.00000641	B	0.00000638	B	0.00000345	BF
1234678-HpCDF	Meth 23X	ug/Nm3	0.00000200		0.000000490	F	0.00000179	F
123478-HxCDD	Meth 23X	ug/Nm3	ND (0.0000044)		ND (0.0000041)		ND (0.0000027)	
123478-HxCDF	Meth 23X	ug/Nm3	0.00000200	B	0.00000686	BF	0.00000116	BF
1234789-HpCDF	Meth 23X	ug/Nm3	ND (0.0000041)		ND (0.0000045)		ND (0.0000043)	
123678-HxCDD	Meth 23X	ug/Nm3	ND (0.0000037)		ND (0.0000034)		ND (0.0000020)	
123678-HxCDF	Meth 23X	ug/Nm3	ND (0.0000020)		0.00000220		ND (0.0000017)	
12378-PeCDD	Meth 23X	ug/Nm3	ND (0.0000027)		ND (0.0000026)		ND (0.0000013)	
12378-PeCDF	Meth 23X	ug/Nm3	ND (0.0000017)		0.00000116	F	ND (0.00000099)	
123789-HxCDD	Meth 23X	ug/Nm3	ND (0.0000041)		ND (0.0000037)		ND (0.0000023)	
123789-HxCDF	Meth 23X	ug/Nm3	ND (0.0000031)		ND (0.0000030)		ND (0.0000023)	
234678-HxCDF	Meth 23X	ug/Nm3	0.00000295	B	0.00000440	BF	0.00000394	BF
23478-PeCDF	Meth 23X	ug/Nm3	ND (0.0000017)		ND (0.0000015)		ND (0.00000099)	
2378-TCDD	Meth 23X	ug/Nm3	ND (0.0000015)		ND (0.0000017)		ND (0.0000013)	
2378-TCDF	Meth 23X	ug/Nm3	ND (0.0000015)		ND (0.0000017)		0.000000810	F
OCDD	Meth 23X	ug/Nm3	0.0000425	B	0.0000565	B	0.0000340	B
OCDF	Meth 23X	ug/Nm3	0.00000519		0.00000836		ND (0.0000043)	
TOTAL HpCDD	Meth 23X	ug/Nm3	0.0000105		0.00000638		0.00000365	
TOTAL HpCDF	Meth 23X	ug/Nm3	0.00000258		0.00000291	F	0.00000441	F
TOTAL HxCDD	Meth 23X	ug/Nm3	0.00000237	F	0.00000201	F	0.00000235	F
TOTAL HxCDF	Meth 23X	ug/Nm3	0.00000634		0.00000720		0.00000507	F

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Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
TOTAL PeCDD	Meth 23X	ug/Nm3	0.00000217		ND (0.0000026)		0.00000199	F
TOTAL PeCDF	Meth 23X	ug/Nm3	0.00000217		0.00000537		0.00000103	F
TOTAL TCDD	Meth 23X	ug/Nm3	0.00000509	F	ND (0.0000017)		0.00000159	
TOTAL TCDF	Meth 23X	ug/Nm3	ND (0.0000015)		ND (0.0000017)		0.000000810	F

Stream: ESP Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,2-Dichloroethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,2-Dichloropropane	GCMS	ug/Nm3	2.76		ND (0.53)		ND (0.56)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
2-Butanone	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
2-Hexanone	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
Acetone	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
Benzene	GCMS	ug/Nm3	5.84		13.4		6.70	
Bromodichloromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Bromoform	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Bromomethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Carbon Disulfide	GCMS	ug/Nm3	0.584		1.23		1.23	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Chlorobenzene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Chloroethane	GCMS	ug/Nm3	0.903	G	ND (0.53)		ND (0.56)	
Chloroform	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Chloromethane	GCMS	ug/Nm3	2.12		2.46		1.95	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Dibromochloromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Methylene Chloride	GCMS	ug/Nm3	0.531		2.24		2.57	
Styrene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Tetrachloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Toluene	GCMS	ug/Nm3	ND (0.53)		1.60		1.23	
Trichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
Vinyl Acetate	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (2.8)	
Vinyl Chloride	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.53)		0.748		ND (0.56)	
o-Xylene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.53)		ND (0.53)		ND (0.56)	

Stream: ESP Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,1-Dichloroethene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,2-Dichloroethane	GCMS	ug/Nm3	1.19				ND (0.55)	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
2-Butanone	GCMS	ug/Nm3	ND (5.4)				ND (2.8)	
2-Hexanone	GCMS	ug/Nm3	ND (5.4)				ND (2.8)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (5.4)				ND (2.8)	

Analytical Data Used In Calculations

Stream: ESP Inlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Acetone	GCMS	ug/Nm3	ND (5.4)				ND (2.8)	
Benzene	GCMS	ug/Nm3	7.12				6.64	
Bromodichloromethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Bromoform	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Bromomethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Carbon Disulfide	GCMS	ug/Nm3	1.08				0.719	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Chlorobenzene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Chloroethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Chloroform	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Chloromethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Dibromochloromethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Ethyl Benzene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Methylene Chloride	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Styrene	GCMS	ug/Nm3	ND (1.1)				4.43	
Tetrachloroethene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Toluene	GCMS	ug/Nm3	ND (1.1)				0.996	
Trichloroethene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
Vinyl Acetate	GCMS	ug/Nm3	ND (5.4)				ND (2.8)	
Vinyl Chloride	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
m,p-Xylene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
o-Xylene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (1.1)				ND (0.55)	

Stream: ESP Outlet Collection Method: Ammonia/Cyanide Sample Type: Ammonia Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Ammonia - Distilled	distil	ug/Nm3	93.7 B		131 B		92.6 B	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: Ammonia/Cyanide Sample Type: Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Cyanide	tot CN	ug/Nm3	806		374		300	

Stream: ESP Outlet Collection Method: Anions Train Sample Type: Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	65700		65600		69300	
Sulfate	IC	ug/Nm3	780000		746000		135000	
Fluoride	SIE	ug/Nm3	5140	B	4050	B	4250	B

Stream: ESP Outlet Collection Method: Anions Train Sample Type: Water + Acetone PNR/47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chloride	IC	ug/Nm3	1.28	C	1.20	C	3.80	C
Chloride	IC	ug/g	11.3	C	27.1	C	56.3	C
Sulfate	IC	ug/Nm3	447	C	4940	C	198	C
Sulfate	IC	ug/g	3950	C	112000	C	2940	C
Fluoride	SIE	ug/Nm3	ND (0.12)	C	ND (0.13)	C	ND (0.12)	C
Fluoride	SIE	ug/g	ND (1.1)	C	ND (2.9)	C	ND (1.8)	C

Stream: ESP Outlet Collection Method: Chromium Test Sample Type: Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chromium	ICAP	ug/Nm3	5.07	B	ND (1.1)	B	9.82	B

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: Chromium Test Sample Type: Impingers/Nitric Acid Rinses

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chromium VI	IC	ug/Nm3	2.18	B	0.963	B	1.04	B

Stream: ESP Outle Collection Method: Chromium Tes Sample Type: Nitric Acid Rinse

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chromium	ICAP	ug/Nm3	ND (0.23)	B	ND (0.24)	B	ND (0.45)	B

Stream: ESP Outlet Collection Method: M0011a Sample Type: Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Formaldehyde	HPLC	ug/Nm3	5.14		3.52		3.58	

Stream: ESP Outlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (1.8)		ND (1.9)		ND (2.6)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (1.6)		ND (1.6)		ND (2.3)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (1.5)		ND (1.5)		ND (2.2)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (1.4)		ND (1.5)		ND (2.2)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (2.6)		ND (2.7)		ND (3.9)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (2.8)		ND (2.8)		ND (4.1)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (2.1)		ND (2.1)		ND (3.1)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (2.0)		ND (2.1)		ND (3.2)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (7.5)		ND (7.6)		ND (10)	
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (2.5)		ND (2.5)		ND (3.7)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (3.6)		ND (3.6)		ND (5.2)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (0.99)		ND (1.0)		ND (1.5)	
2-Chlorophenol	GCMS	ug/Nm3	ND (1.6)		ND (1.6)		ND (2.4)	
2-Methylnaphthalene	GCMS	ug/Nm3	ND (1.0)		ND (1.1)		ND (1.5)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Methylphenol	GCMS	ug/Nm3	ND (1.9)		ND (2.0)		ND (2.9)	
2-Nitroaniline	GCMS	ug/Nm3	ND (3.1)		ND (3.2)		ND (4.6)	
2-Nitrophenol	GCMS	ug/Nm3	ND (3.1)		ND (3.2)		ND (4.5)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (1.3)		ND (1.4)		ND (2.8)	
3-Nitroaniline	GCMS	ug/Nm3	ND (3.1)		ND (3.1)		ND (4.4)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (4.2)		ND (4.5)		ND (6.4)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (0.81)		ND (0.86)		ND (1.4)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (2.3)		ND (2.3)		ND (3.2)	
4-Nitroaniline	GCMS	ug/Nm3	ND (2.7)		ND (2.7)		ND (4.0)	
4-Nitrophenol	GCMS	ug/Nm3	ND (6.6)		ND (6.7)		ND (9.0)	
Acenaphthene	GCMS	ug/Nm3	ND (1.1)		ND (1.1)		ND (1.7)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.63)		ND (0.63)		ND (0.94)	
Acetophenone	GCMS	ug/Nm3	ND (1.6)		ND (1.7)		ND (2.4)	
Aniline	GCMS	ug/Nm3	ND (1.3)		ND (1.3)		ND (1.9)	
Anthracene	GCMS	ug/Nm3	ND (0.61)		ND (0.66)		ND (0.95)	
Benzidine	GCMS	ug/Nm3	ND (0.98)		ND (1.1)		ND (1.9)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (0.39)		ND (0.42)		ND (0.92)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (0.41)		ND (0.44)		ND (0.94)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (0.41)		ND (0.43)		ND (1.0)	
Benzoic acid	GCMS	ug/Nm3	ND (6.2)		ND (6.4)		ND (1.1)	
Benzyl alcohol	GCMS	ug/Nm3	ND (2.9)		ND (3.0)		ND (4.6)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (0.71)		ND (0.76)		ND (1.2)	
Chrysene	GCMS	ug/Nm3	ND (0.43)		ND (0.46)		ND (0.81)	
Di-n-butylphthalate	GCMS	ug/Nm3	ND (0.39)		2.41 BJ		32.3 B	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.30)		ND (0.32)		ND (0.71)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (0.49)		ND (0.52)		ND (1.1)	
Dibenzofuran	GCMS	ug/Nm3	ND (0.72)		ND (0.72)		ND (1.1)	
Diethylphthalate	GCMS	ug/Nm3	ND (0.85)		ND (0.86)		ND (1.2)	
Dimethylphthalate	GCMS	ug/Nm3	ND (0.93)		ND (0.94)		ND (1.4)	
Fluoranthene	GCMS	ug/Nm3	ND (0.44)		ND (0.47)		ND (0.79)	
Fluorene	GCMS	ug/Nm3	ND (0.95)		ND (0.96)		ND (1.4)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (2.1)		ND (2.2)		ND (3.1)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (3.0)		ND (3.1)		ND (4.3)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: MMS Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (3.4)		ND (3.4)		ND (6.0)	
Hexachloroethane	GCMS	ug/Nm3	ND (3.1)		ND (3.2)		ND (4.3)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.36)		ND (0.39)		ND (0.84)	
Isophorone	GCMS	ug/Nm3	ND (1.0)		ND (1.0)		ND (1.4)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (2.8)		ND (2.9)		ND (4.0)	
Naphthalene	GCMS	ug/Nm3	ND (0.65)		ND (0.67)		ND (0.94)	
Nitrobenzene	GCMS	ug/Nm3	ND (1.7)		ND (1.8)		ND (2.4)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (8.1)		ND (8.6)		ND (13)	
Pentachlorophenol	GCMS	ug/Nm3	ND (5.3)		ND (5.7)		ND (7.9)	
Phenanthrene	GCMS	ug/Nm3	ND (0.63)		ND (0.67)		ND (0.96)	
Phenol	GCMS	ug/Nm3	ND (1.3)		ND (1.4)		ND (2.0)	
Pyrene	GCMS	ug/Nm3	ND (0.41)		ND (0.44)		ND (0.66)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (1.5)		ND (1.6)		ND (2.2)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (1.8)		ND (1.8)		ND (2.6)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	1.45 BJ		ND (0.61)		0.638 BJ	

Stream: ESP Outlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (0.89)		ND (0.92)		ND (1.1)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.77)		ND (0.81)		ND (0.87)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.72)		ND (0.76)		ND (0.81)	
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.71)		ND (0.75)		ND (0.80)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (1.4)		ND (1.1)		ND (5.4)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (1.6)		ND (1.2)		ND (5.8)	
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (0.49)		ND (0.50)		ND (0.61)	
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (0.82)		ND (0.84)		ND (1.0)	
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (3.6)		ND (2.7)		ND (13)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (1.4)		ND (1.0)		ND (5.0)	
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (2.0)		ND (1.5)		ND (7.3)	
2-Chloronaphthalene	GCMS	ug/Nm3	ND (0.60)		ND (0.46)		ND (2.2)	
2-Chlorophenol	GCMS	ug/Nm3	ND (0.78)		ND (0.82)		ND (0.88)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Methylnaphthalene	GCMS	ug/Nm3	ND (0.46)		ND (0.48)		ND (0.58)	
2-Methylphenol	GCMS	ug/Nm3	ND (0.89)		ND (0.94)		ND (1.0)	
2-Nitroaniline	GCMS	ug/Nm3	ND (1.5)		ND (1.2)		ND (5.6)	
2-Nitrophenol	GCMS	ug/Nm3	ND (1.2)		ND (1.3)		ND (1.6)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (1.9)		ND (1.3)		ND (8.8)	
3-Nitroaniline	GCMS	ug/Nm3	ND (1.7)		ND (1.3)		ND (6.2)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (1.8)		ND (1.8)		ND (4.0)	
4-Aminobiphenyl	GCMS	ug/Nm3	ND (0.43)		ND (0.44)		ND (0.99)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (0.86)		ND (0.89)		ND (1.1)	
4-Nitroaniline	GCMS	ug/Nm3	ND (1.5)		ND (1.1)		ND (5.6)	
4-Nitrophenol	GCMS	ug/Nm3	ND (2.2)		ND (1.7)		ND (8.2)	
Acenaphthene	GCMS	ug/Nm3	ND (0.63)		ND (0.48)		ND (2.3)	
Acenaphthylene	GCMS	ug/Nm3	ND (0.36)		ND (0.27)		ND (1.3)	
Acetophenone	GCMS	ug/Nm3	2.97 J		2.71 J		3.77 J	
Aniline	GCMS	ug/Nm3	ND (0.98)		ND (1.0)		ND (1.1)	
Anthracene	GCMS	ug/Nm3	ND (0.26)		ND (0.26)		ND (0.59)	
Benzidine	GCMS	ug/Nm3	ND (1.1)		ND (0.74)		ND (5.2)	
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (6.6)		ND (0.55)		ND (0.37)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (7.2)		ND (0.60)		ND (0.40)	
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (7.0)		ND (0.58)		ND (0.39)	
Benzyl alcohol	GCMS	ug/Nm3	ND (1.4)		ND (1.5)		ND (1.6)	
Butylbenzylphthalate	GCMS	ug/Nm3	ND (0.63)		ND (0.42)		ND (2.9)	
Chrysene	GCMS	ug/Nm3	ND (0.56)		ND (0.37)		ND (2.6)	
Di-n-butylphthalate	GCMS	ug/Nm3	19.1		6.29		13.7	
Di-n-octylphthalate	GCMS	ug/Nm3	ND (3.9)		ND (0.32)		ND (0.22)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (8.2)		ND (0.68)		ND (0.45)	
Dibenzofuran	GCMS	ug/Nm3	0.0789 J		ND (0.30)		ND (1.5)	
Diethylphthalate	GCMS	ug/Nm3	3.26 J		ND (0.30)		ND (1.4)	
Dimethylphthalate	GCMS	ug/Nm3	ND (0.49)		ND (0.37)		ND (1.8)	
Fluoranthene	GCMS	ug/Nm3	ND (0.25)		ND (0.26)		ND (0.58)	
Fluorene	GCMS	ug/Nm3	ND (0.49)		ND (0.37)		ND (1.8)	
Hexachlorobenzene	GCMS	ug/Nm3	ND (1.2)		ND (1.2)		ND (2.8)	
Hexachlorobutadiene	GCMS	ug/Nm3	ND (1.5)		ND (1.5)		ND (1.9)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (1.7)		ND (1.3)		ND (6.4)	
Hexachloroethane	GCMS	ug/Nm3	ND (1.5)		ND (1.6)		ND (1.7)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (6.3)		ND (0.52)		ND (0.35)	
Isophorone	GCMS	ug/Nm3	20.2		ND (0.39)		31.4	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (1.1)		ND (1.2)		ND (1.3)	
Naphthalene	GCMS	ug/Nm3	0.777 BJ		0.441 BJ		0.916 BJ	
Nitrobenzene	GCMS	ug/Nm3	ND (0.67)		ND (0.69)		ND (0.84)	
Pentachloronitrobenzene	GCMS	ug/Nm3	ND (2.6)		ND (2.6)		ND (5.9)	
Pentachlorophenol	GCMS	ug/Nm3	ND (2.6)		ND (2.6)		ND (5.9)	
Phenanthrene	GCMS	ug/Nm3	ND (0.26)		ND (0.26)		ND (0.60)	
Phenol	GCMS	ug/Nm3	1.22 J		1.25 J		ND (0.74)	
Pyrene	GCMS	ug/Nm3	ND (0.34)		ND (0.23)		ND (1.6)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (0.71)		ND (0.73)		ND (0.89)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (0.91)		ND (0.96)		ND (1.0)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	22.2		1.63 J		14.2	

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3	111		146			

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3						
							135	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: Multimetal Train Sample Type: Acetone PNR/Nitric PNR/MS Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	0.00416	C	0.00446	C	ND (0.0082)	C
Mercury	CVAA	ug/g	0.0675	C	0.540	C	ND (0.15)	C
Arsenic	GFAA	ug/Nm3	0.776	C	1.05	C	0.629	C
Arsenic	GFAA	ug/g	12.6	C	128	C	11.6	C
Cadmium	GFAA	ug/Nm3	0.669	C	0.274	C	0.381	C
Cadmium	GFAA	ug/g	10.9	C	33.2	C	6.99	C
Lead	GFAA	ug/Nm3	1.40	C	ND (0.027)	C	ND (0.13)	C
Lead	GFAA	ug/g	22.8	C	ND (3.3)	C	ND (2.4)	C
Selenium	GFAA	ug/Nm3	18.6	C	19.2	C	18.8	C
Selenium	GFAA	ug/g	302	C	2330	C	344	C
Aluminum	ICAP	ug/Nm3	138	C	55.8	C	29.4	C
Aluminum	ICAP	ug/g	2250	C	6760	C	539	C
Antimony	ICAP	ug/Nm3	ND (2.0)	C	ND (2.1)	C	ND (2.0)	C
Antimony	ICAP	ug/g	ND (33)	C	ND (250)	C	ND (37)	C
Barium	ICAP	ug/Nm3	1.92	C	0.193	C	0.110	C
Barium	ICAP	ug/g	31.2	C	23.4	C	2.01	C
Beryllium	ICAP	ug/Nm3	ND (0.011)	C	ND (0.012)	C	ND (0.011)	C
Beryllium	ICAP	ug/g	ND (0.18)	C	ND (1.4)	C	ND (0.21)	C
Calcium	ICAP	ug/Nm3	274	C	227	C	152	C
Calcium	ICAP	ug/g	4460	C	27500	C	2800	C
Chromium	ICAP	ug/Nm3	1.70	C	1.79	C	0.756	C
Chromium	ICAP	ug/g	27.6	C	217	C	13.9	C
Cobalt	ICAP	ug/Nm3	ND (0.19)	C	ND (0.19)	C	ND (0.18)	C
Cobalt	ICAP	ug/g	ND (3.0)	C	ND (23)	C	ND (3.4)	C
Copper	ICAP	ug/Nm3	1.64	C	2.29	C	0.709	C
Copper	ICAP	ug/g	26.7	C	277	C	13.0	C
Iron	ICAP	ug/Nm3	221	C	705	C	91.8	C
Iron	ICAP	ug/g	3590	C	85400	C	1680	C
Magnesium	ICAP	ug/Nm3	110	C	93.7	C	61.2	C
Magnesium	ICAP	ug/g	1790	C	11300	C	1120	C
Manganese	ICAP	ug/Nm3	2.37	C	7.44	C	1.02	C
Manganese	ICAP	ug/g	38.5	C	901	C	18.8	C

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Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: Multimetals Train Sample Type: Acetone PNR/Nitric PNR/M5 Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Molybdenum	ICAP	ug/Nm3	0.317	C	ND (0.13)	C	0.371	C
Molybdenum	ICAP	ug/g	5.16	C	ND (16)	C	6.80	C
Nickel	ICAP	ug/Nm3	0.980	C	8.85	C	1.35	C
Nickel	ICAP	ug/g	15.9	C	1070	C	24.8	C
Phosphorus	ICAP	ug/Nm3	3.35	C	3.77	C	3.13	C
Phosphorus	ICAP	ug/g	54.4	C	457	C	57.4	C
Potassium	ICAP	ug/Nm3	38.7	C	24.0	C	18.4	C
Potassium	ICAP	ug/g	629	C	2900	C	338	C
Silver	ICAP	ug/Nm3	ND (0.15)	C	1.05	C	ND (0.15)	C
Silver	ICAP	ug/g	ND (2.5)	C	127	C	ND (2.8)	C
Sodium	ICAP	ug/Nm3	77.3	C	47.9	C	35.7	C
Sodium	ICAP	ug/g	1250	C	5800	C	656	C
Titanium	ICAP	ug/Nm3	16.3	C	5.86	C	3.98	C
Titanium	ICAP	ug/g	264	C	710	C	73.0	C
Vanadium	ICAP	ug/Nm3	0.238	C	0.184	C	0.141	C
Vanadium	ICAP	ug/g	3.87	C	22.2	C	2.60	C

Stream: ESP Outlet Collection Method: Multimetals Train Sample Type: Mercury Impingers

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	1.79				1.86	

Stream: ESP Outlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	ug/Nm3	13.1		13.9		12.4	
Aluminum	ICAP	ug/Nm3	38.1	BC	42.2	BC	52.6	BC
Barium	ICAP	ug/Nm3	0.504	BC	0.533	BC	0.848	BC
Boron	ICAP	ug/Nm3	173	BC	163	BC	159	BC
Calcium	ICAP	ug/Nm3	213	BC	256	BC	342	BC

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: Multimetal Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Iron	ICAP	ug/Nm3	41.7 BC		47.7 BC		61.0 BC	
Magnesium	ICAP	ug/Nm3	24.6 C		15.9 C		29.9 C	
Phosphorus	ICAP	ug/Nm3	ND (16)		ND (19)		ND (15)	
Potassium	ICAP	ug/Nm3	ND (210) BC		ND (250) BC		ND (210) BC	
Silver	ICAP	ug/Nm3	ND (1.3) B		ND (1.6) B		ND (1.3) B	
Sodium	ICAP	ug/Nm3	287 BC		308 BC		338 BC	
Titanium	ICAP	ug/Nm3	1.23		1.60		1.84	
Antimony	ICPMS	ug/Nm3	0.0131 C		0.0165 C		0.0233 C	
Arsenic	ICPMS	ug/Nm3	0.162 C		0.240 C		0.264 C	
Barium	ICPMS	ug/Nm3	ND (0.0044) C		ND (0.0053) C		ND (0.0044) C	
Beryllium	ICPMS	ug/Nm3	ND (0.0040) C		ND (0.0048) C		0.0485 C	
Cadmium	ICPMS	ug/Nm3	ND (0.0053) C		0.551 C		3.51 C	
Chromium	ICPMS	ug/Nm3	1.35 C		0.887 C		4.67 C	
Cobalt	ICPMS	ug/Nm3	0.0210 C		0.0477 C		0.0654 C	
Copper	ICPMS	ug/Nm3	0.456 C		2.18 C		4.90 C	
Lead	ICPMS	ug/Nm3	ND (0.0042) C		0.427 C		0.527 C	
Manganese	ICPMS	ug/Nm3	ND (0.0059) C		1.03 C		8.69 C	
Molybdenum	ICPMS	ug/Nm3	ND (0.0065) C		ND (0.0078) C		0.0711 C	
Nickel	ICPMS	ug/Nm3	0.709 C		1.31 C		4.85 C	
Selenium	ICPMS	ug/Nm3	13.1		18.6		29.6	
Vanadium	ICPMS	ug/Nm3	0.671 C		0.849 C		1.03 C	

Stream: ESP Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1234678-HpCDD	Meth 23X	ug/Nm3	0.00000193 BF		0.00000531 B		0.0000106 B	
1234678-HpCDF	Meth 23X	ug/Nm3	0.00000598 F		ND (0.000016)		0.00000595 F	
123478-HxCDD	Meth 23X	ug/Nm3	ND (0.0000036)		ND (0.0000031)		ND (0.0000039)	
123478-HxCDF	Meth 23X	ug/Nm3	0.0000102 B		0.00000193 BF		0.00000145 BF	
1234789-HpCDF	Meth 23X	ug/Nm3	ND (0.0000040)		ND (0.0000028)		ND (0.0000039)	
123678-HxCDD	Meth 23X	ug/Nm3	ND (0.0000029)		ND (0.0000025)		ND (0.0000032)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: PCDD/PCDF for Dioxins and Furans (M23) Sample Type: Filtered Solids/Solvent Rinses/XAD Resin

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
123678-HxCDF	Meth 23X	ug/Nm3	0.00000237		ND (0.0000012)		ND (0.0000018)	
12378-PeCDD	Meth 23X	ug/Nm3	ND (0.0000018)		ND (0.0000019)		ND (0.0000028)	
12378-PeCDF	Meth 23X	ug/Nm3	0.00000204	F	ND (0.0000012)		ND (0.0000018)	
123789-HxCDD	Meth 23X	ug/Nm3	ND (0.0000033)		ND (0.0000028)		ND (0.0000035)	
123789-HxCDF	Meth 23X	ug/Nm3	ND (0.0000026)		ND (0.0000022)		ND (0.0000028)	
234678-HxCDF	Meth 23X	ug/Nm3	0.00000401	B	0.00000264	BF	0.00000389	B
23478-PeCDF	Meth 23X	ug/Nm3	0.00000135	F	ND (0.0000012)		ND (0.0000018)	
2378-TCDD	Meth 23X	ug/Nm3	ND (0.0000015)		ND (0.0000012)		ND (0.0000016)	
2378-TCDF	Meth 23X	ug/Nm3	0.00000248	F	ND (0.0000012)		ND (0.0000016)	
OCDD	Meth 23X	ug/Nm3	0.00000278	BF	0.0000475	B	0.000109	B
OCDF	Meth 23X	ug/Nm3	ND (0.0000062)		0.00000612		0.0000205	
TOTAL HpCDD	Meth 23X	ug/Nm3	0.00000394		0.000106		0.000197	
TOTAL HpCDF	Meth 23X	ug/Nm3	0.00000237		ND (0.0000019)		0.00000750	
TOTAL HxCDD	Meth 23X	ug/Nm3	ND (0.0000033)		ND (0.0000028)		0.0000273	F
TOTAL HxCDF	Meth 23X	ug/Nm3	0.00000216		0.00000593	F	0.00000644	
TOTAL PeCDD	Meth 23X	ug/Nm3	ND (0.0000018)		0.00000134	F	ND (0.0000028)	
TOTAL PeCDF	Meth 23X	ug/Nm3	0.00000667		ND (0.0000012)		0.00000319	
TOTAL TCDD	Meth 23X	ug/Nm3	ND (0.0000015)		ND (0.0000012)		0.000000800	
TOTAL TCDF	Meth 23X	ug/Nm3	0.00000248	F	0.00000106	F	ND (0.0000016)	

Stream: ESP Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	0.671		0.966		36.8	
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,1-Dichlorobenzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,2-Dichloroethane	GCMS	ug/Nm3	15.0		4.12		2.53	
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal A

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
2-Butanone	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.6)	
2-Hexanone	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.6)	
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.6)	
Acetone	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.6)	
Benzene	GCMS	ug/Nm3	2.63		6.61		6.84	
Bromodichloromethane	GCMS	ug/Nm3	0.619		ND (0.51)		ND (0.53)	
Bromoform	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Bromomethane	GCMS	ug/Nm3	0.774		0.661		ND (0.53)	
Carbon Disulfide	GCMS	ug/Nm3	1.19		0.762		0.737	
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Chlorobenzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Chloroethane	GCMS	ug/Nm3	1.96 G		ND (0.51)		ND (0.53)	
Chloroform	GCMS	ug/Nm3	ND (0.52)		0.813		ND (0.53)	
Chloromethane	GCMS	ug/Nm3	9.80		ND (0.51)		3.68	
Dibromochloromethane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Ethyl Benzene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Methylene Chloride	GCMS	ug/Nm3	1.24		0.762		5.79	
Styrene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Tetrachloroethene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Toluene	GCMS	ug/Nm3	1.03		2.54		0.894	
Trichloroethene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
Vinyl Acetate	GCMS	ug/Nm3	ND (2.6)		ND (2.5)		ND (2.6)	
Vinyl Chloride	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
m,p-Xylene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		0.631	
o-Xylene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.52)		ND (0.51)		ND (0.53)	

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,1,1-Trichloroethane	GCMS	ug/Nm3	0.701		ND (0.49)			
1,1,2,2-Tetrachloroethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,1,2-Trichloroethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,1-Dichloroethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,1-Dichlorobenzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,2-Dichloroethane	GCMS	ug/Nm3	17.3		0.829			
1,2-Dichloropropane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
2-Butanone	GCMS	ug/Nm3	ND (2.7)		ND (2.4)			
2-Hexanone	GCMS	ug/Nm3	ND (2.7)		ND (2.4)			
4-Methyl-2-Pentanone	GCMS	ug/Nm3	ND (2.7)		ND (2.4)			
Acetone	GCMS	ug/Nm3	ND (2.7)		ND (2.4)			
Benzene	GCMS	ug/Nm3	5.02		4.29			
Bromodichloromethane	GCMS	ug/Nm3	0.593		ND (0.49)			
Bromoform	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Bromomethane	GCMS	ug/Nm3	0.593		ND (0.49)			
Carbon Disulfide	GCMS	ug/Nm3	0.863		0.683			
Carbon Tetrachloride	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Chlorobenzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Chloroethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Chloroform	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Chloromethane	GCMS	ug/Nm3	3.56		ND (0.49)			
Dibromochloromethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Ethyl Benzene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Methylene Chloride	GCMS	ug/Nm3	2.97		ND (0.49)			
Styrene	GCMS	ug/Nm3	ND (0.54)		0.878			
Tetrachloroethene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Toluene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Trichloroethene	GCMS	ug/Nm3	0.863		0.780			
Trichlorofluoromethane	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
Vinyl Acetate	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
	GCMS	ug/Nm3	ND (2.7)		ND (2.4)			

Analytical Data Used In Calculations

Stream: ESP Outlet Collection Method: VOST Sample Type: Tenax-Tenax + Charcoal B

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Vinyl Chloride	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
cis-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
m,p-Xylene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
o-Xylene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
trans-1,2-Dichloroethene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			
trans-1,3-Dichloropropene	GCMS	ug/Nm3	ND (0.54)		ND (0.49)			

Stream: Service Water Collection Method: Grab Sample Type: Not Specified

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/L	ND (0.000033)		ND (0.000033)		ND (0.000033)	
Arsenic	GFAA	mg/L	ND (0.00065)		0.00113		0.00171	
Cadmium	GFAA	mg/L	ND (0.00027)		ND (0.00027)		ND (0.00027)	
Lead	GFAA	mg/L	0.00626	B	0.0124	B	0.0125	B
Selenium	GFAA	mg/L	ND (0.0018)		ND (0.0018)		ND (0.0018)	
Chloride	IC	mg/L	11.5		11.6		12.4	
Sulfate	IC	mg/L	59.2		58.3		47.1	
Aluminum	ICAP	mg/L	1.25	B	2.20	B	1.89	B
Antimony	ICAP	mg/L	ND (0.076)		ND (0.076)	B	ND (0.076)	B
Barium	ICAP	mg/L	0.0494	B	0.0691	B	0.0659	B
Beryllium	ICAP	mg/L	0.00156		0.000540		0.00458	
Boron	ICAP	mg/L	0.0427	B	0.0410	B	0.0417	B
Calcium	ICAP	mg/L	23.9	B	25.8	B	21.8	B
Chromium	ICAP	mg/L	ND (0.0052)		ND (0.0052)		0.00788	
Cobalt	ICAP	mg/L	0.00713	B	0.00460	B	ND (0.0041)	B
Copper	ICAP	mg/L	0.0128	B	0.0173	B	0.0212	B
Iron	ICAP	mg/L	3.00		4.70		4.52	
Magnesium	ICAP	mg/L	6.27	B	6.71	B	5.75	B
Manganese	ICAP	mg/L	0.286		0.438		0.432	
Molybdenum	ICAP	mg/L	ND (0.0074)	B	ND (0.0074)	B	0.0115	B

Analytical Data Used In Calculations

Stream: Service Water Collection Method: Grab Sample Type: Not Specified

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Nickel	ICAP	mg/L	ND (0.014)		ND (0.014)		0.0145	
Phosphorus	ICAP	mg/L	ND (0.061)		ND (0.061)		ND (0.061)	
Potassium	ICAP	mg/L	1.62		1.76		1.84	
Silver	ICAP	mg/L	ND (0.0052)		ND (0.0052)		ND (0.0052)	
Sodium	ICAP	mg/L	10.4	B	10.9	B	10.1	B
Titanium	ICAP	mg/L	0.0139	B	0.0229	B	0.0251	B
Vanadium	ICAP	mg/L	0.00532	B	ND (0.0045)	B	0.00757	B
Fluoride	SIE	mg/L	0.114	B	0.120	B	0.116	B
Total phosphate	tot P	mg/L	ND (0.020)		ND (0.020)		0.0331	

Stream: Service Water Collection Method: Grab Sample Type: Not Specified FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/L					ND (0.000033)	
Arsenic	GFAA	mg/L					0.00218	
Cadmium	GFAA	mg/L					ND (0.00027)	
Lead	GFAA	mg/L					0.0119	B
Selenium	GFAA	mg/L					ND (0.0018)	
Chloride	IC	mg/L					12.1	
Sulfate	IC	mg/L					46.9	
Aluminum	ICAP	mg/L						
Antimony	ICAP	mg/L					2.35	B
Barium	ICAP	mg/L					ND (0.076)	B
Beryllium	ICAP	mg/L					0.0669	B
Boron	ICAP	mg/L					ND (0.00051)	
Calcium	ICAP	mg/L					0.0364	B
Chromium	ICAP	mg/L					23.0	B
Cobalt	ICAP	mg/L					ND (0.0052)	
Copper	ICAP	mg/L					0.00480	B
							0.0163	B

Analytical Data Used In Calculations

Stream: Service Water Collection Method: Grab Sample Type: Not Specified FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Iron	ICAP	mg/L					5.89	
Magnesium	ICAP	mg/L					6.02 B	
Manganese	ICAP	mg/L					0.460	
Molybdenum	ICAP	mg/L					ND (0.0074) B	
Nickel	ICAP	mg/L					0.0160	
Phosphorus	ICAP	mg/L					ND (0.061)	
Potassium	ICAP	mg/L					1.87	
Silver	ICAP	mg/L					ND (0.0052)	
Sodium	ICAP	mg/L					10.3 B	
Titanium	ICAP	mg/L					0.0281 B	
Vanadium	ICAP	mg/L					0.00619 B	
Fluoride	SIE	mg/L					0.117 B	
Total phosphate	tot P	mg/L					0.0242	

Stream: Sorbent Collection Method: Grab Composite Sample Type: Dolomite

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg	ND (0.012)		ND (0.012)		ND (0.012)	
Arsenic	GFAA	mg/kg	2.19		2.12		1.24	
Cadmium	GFAA	mg/kg	0.140		0.173		0.0929	
Lead	GFAA	mg/kg	7.30 B		6.15 B		7.22 B	
Selenium	GFAA	mg/kg	0.903		0.475		0.982	
Sulfate	IC	mg/kg	6420		6370		6460	
Aluminum	ICAP	mg/kg	659		662		632	
Antimony	ICAP	mg/kg	ND (4.9)		ND (5.5)		ND (5.5)	
Barium	ICAP	mg/kg	3.45 B		3.50 B		3.43 B	
Beryllium	ICAP	mg/kg	0.0492		ND (0.031)		ND (0.031)	
Boron	ICAP	mg/kg	32.9 B		31.0 B		33.7 B	
Calcium	ICAP	mg/kg	193000 B		192000 B		193000 B	

Analytical Data Used In Calculations

Stream: Sorbent Collection Method: Grab Composite Sample Type: Dolomite

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chromium	ICAP	mg/kg	2.79 B					
Cobalt	ICAP	mg/kg	0.461 B		2.38 B	B	2.86 B	B
Copper	ICAP	mg/kg	ND (0.42)		ND (0.50) B	B	ND (0.50) B	B
Iron	ICAP	mg/kg	2130 B		ND (0.47)		ND (0.47)	
Magnesium	ICAP	mg/kg	106000		2430 B	B	2160 B	B
Manganese	ICAP	mg/kg	72.0		106000		106000	
Molybdenum	ICAP	mg/kg	1.42 B		72.9		71.9	
Nickel	ICAP	mg/kg	19.6 B		1.34 B	B	1.62 B	B
Phosphorus	ICAP	mg/kg	ND (6.1)		16.8 B	B	0.524 B	B
Potassium	ICAP	mg/kg	ND (0.37)		ND (6.8)		ND (6.8)	
Silver	ICAP	mg/kg	240 B		218 B	B	255 B	B
Sodium	ICAP	mg/kg	194 B		ND (0.41)		ND (0.41)	
Titanium	ICAP	mg/kg	7.49 B		198 B	B	202 B	B
Vanadium	ICAP	mg/kg	4.75		10.9 B	B	9.65 B	B
					4.88		5.17	
Chloride	SIE	mg/kg	369		336		246	
Fluoride	SIE	mg/kg	297 B		208 B	B	136 B	B

Stream: Sorbent Collection Method: Grab Composite Sample Type: Dolomite FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Mercury	CVAA	mg/kg					ND (0.012)	
Arsenic	GFAA	mg/kg						
Cadmium	GFAA	mg/kg					2.09	
Lead	GFAA	mg/kg					0.164	
Selenium	GFAA	mg/kg					6.69 B	B
							1.10	
Sulfate	IC	mg/kg						
							6420	
Aluminum	ICAP	mg/kg						
Antimony	ICAP	mg/kg					647	
Barium	ICAP	mg/kg					ND (5.8)	B
Beryllium	ICAP	mg/kg					4.14 B	B
							ND (0.033)	

Analytical Data Used In Calculations

Stream: Sorbent Collection Method: Grab Composit Sample Type: Dolomite FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Boron	ICAP	mg/kg					33.3	B
Calcium	ICAP	mg/kg					194000	B
Chromium	ICAP	mg/kg					2.84	B
Cobalt	ICAP	mg/kg					ND (0.53)	B
Copper	ICAP	mg/kg					ND (0.50)	B
Iron	ICAP	mg/kg					2160	B
Magnesium	ICAP	mg/kg					107000	B
Manganese	ICAP	mg/kg					72.7	B
Molybdenum	ICAP	mg/kg					1.54	B
Nickel	ICAP	mg/kg					1.71	B
Phosphorus	ICAP	mg/kg					ND (7.2)	B
Potassium	ICAP	mg/kg					247	B
Silver	ICAP	mg/kg					ND (0.44)	B
Sodium	ICAP	mg/kg					200	B
Titanium	ICAP	mg/kg					11.1	B
Vanadium	ICAP	mg/kg					5.35	B
Chloride	SIE	mg/kg					321	B
Fluoride	SIE	mg/kg					385	B

DATA NOT USED IN CALCULATIONS

Analytical Data Not Used In Calculations

Stream: APF As Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg						
Cadmium	ICAP	mg/kg	272		291		309	
Lead	ICAP	mg/kg	ND (2.9)		4.41		ND (3.2)	
Selenium	ICAP	mg/kg	32.2 B		65.5		69.2 B	
			ND (45)		ND (49)		ND (50)	

Stream: APF Ash Collection Method: Grab Composite Sample Type: Fly Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg						
Cadmium	ICAP	mg/kg						
Lead	ICAP	mg/kg					307	
Selenium	ICAP	mg/kg					ND (2.6)	
							98.4 B	
							ND (41)	

Stream: APF Inlet Collection Method: M29 Sample Type: Filtered Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	ug/Nm3						
Cadmium	ICAP	ug/Nm3	959		1390		1310	
Lead	ICAP	ug/Nm3	ND (12) C		ND (17) C		ND (14) C	
Selenium	ICAP	ug/Nm3	267 C		308 C		315 C	
			ND (190) C		ND (270) C		ND (220) C	

Stream: APF Inlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/Nm3	0.986		9.47		1.97	
Cadmium	GFAA	ug/Nm3	0.336 C		0.191 C		0.144 C	
Lead	GFAA	ug/Nm3	1.50 BC		3.37 BC		1.26 BC	
Selenium	GFAA	ug/Nm3	12.9 C		20.3 C		13.6 C	
Antimony	ICAP	ug/Nm3						
			ND (21) B		ND (23) B		ND (20) B	

Analytical Data Not Used In Calculations

Stream: APF Inle Collection Method: Multimetals Trai Sample Type: Nitric Acid Impingers + TL

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	ug/Nm3	ND (13)		ND (14)		ND (13)	
Beryllium	ICAP	ug/Nm3	ND (0.14)		ND (0.16)		ND (0.14)	
Cadmium	ICAP	ug/Nm3	ND (1.1)	C	ND (1.2)	C	ND (1.0)	C
Chromium	ICAP	ug/Nm3	39.0	C	2.52	C	13.7	C
Cobalt	ICAP	ug/Nm3	ND (1.1)	BC	ND (1.3)	BC	ND (1.1)	BC
Copper	ICAP	ug/Nm3	166	BC	9.21	BC	52.8	BC
Lead	ICAP	ug/Nm3	7.14	BC	8.55	BC	8.46	BC
Manganese	ICAP	ug/Nm3	33.4	BC	11.3	BC	4.31	BC
Molybdenum	ICAP	ug/Nm3	4.97		ND (2.3)		ND (2.0)	
Nickel	ICAP	ug/Nm3	57.1	C	20.8	C	30.0	C
Selenium	ICAP	ug/Nm3	ND (24)	B	ND (27)	B	ND (24)	B
Vanadium	ICAP	ug/Nm3	ND (1.2)	C	2.57	C	ND (1.2)	C
Mercury	ICPMS	ug/Nm3	30.9	C	29.2	C	32.7	C

Stream: APF Outlet Collection Method: M29 Sample Type: 47 mm Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	ug/Nm3	0.200		ND (0.21)		ND (0.16)	
Cadmium	ICAP	ug/Nm3	ND (0.021)		ND (0.023)		ND (0.017)	
Lead	ICAP	ug/Nm3	ND (0.12)		0.165		ND (0.095)	
Selenium	ICAP	ug/Nm3	ND (0.32)		ND (0.36)	C	ND (0.26)	

Stream: APF Outlet Collection Method: MM5 Sample Type: 47 mm Filter 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3					ND (1.3)	
1,2-Dichlorobenzene	GCMS	ug/Nm3					ND (1.1)	
1,3-Dichlorobenzene	GCMS	ug/Nm3					ND (1.0)	
1,4-Dichlorobenzene	GCMS	ug/Nm3					ND (0.98)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3					ND (1.7)	

Analytical Data Not Used In Calculations

Stream: APF Outle Collection Method: MMS Sample Type: 47 mm Filte 1:4 di

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4,6-Trichlorophenol	GCMS	ug/Nm3					ND (1.8)	
2,4-Dichlorophenol	GCMS	ug/Nm3					ND (0.71)	
2,4-Dimethylphenol	GCMS	ug/Nm3					ND (1.2)	
2,4-Dinitrophenol	GCMS	ug/Nm3					ND (4.3)	
2,4-Dinitrotoluene	GCMS	ug/Nm3					ND (1.6)	
2,6-Dinitrotoluene	GCMS	ug/Nm3					ND (2.4)	
2-Chloronaphthalene	GCMS	ug/Nm3					ND (0.71)	
2-Chlorophenol	GCMS	ug/Nm3					ND (1.2)	
2-Methylnaphthalene	GCMS	ug/Nm3					ND (0.67)	
2-Methylphenol	GCMS	ug/Nm3					ND (1.4)	
2-Nitroaniline	GCMS	ug/Nm3					ND (1.7)	
2-Nitrophenol	GCMS	ug/Nm3					ND (1.9)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3					ND (2.3)	
3-Nitroaniline	GCMS	ug/Nm3					ND (2.1)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3					ND (2.7)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3					ND (1.3)	
4-Nitroaniline	GCMS	ug/Nm3					ND (1.7)	
4-Nitrophenol	GCMS	ug/Nm3					ND (1.8)	
Acenaphthene	GCMS	ug/Nm3					ND (0.77)	
Acenaphthylene	GCMS	ug/Nm3					ND (0.43)	
Anthracene	GCMS	ug/Nm3					ND (0.39)	
Benzo(b)fluoranthene	GCMS	ug/Nm3					ND (0.60)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3					ND (0.65)	
Benzo(k)fluoranthene	GCMS	ug/Nm3					ND (0.62)	
Benzoic acid	GCMS	ug/Nm3					22.6	
Benzyl alcohol	GCMS	ug/Nm3					ND (2.4)	
Butylbenzylphthalate	GCMS	ug/Nm3					ND (0.58)	
Chrysene	GCMS	ug/Nm3					ND (0.48)	
Di-n-butylphthalate	GCMS	ug/Nm3					15.4	
Di-n-octylphthalate	GCMS	ug/Nm3					ND (0.36)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3					ND (0.73)	
Dibenzofuran	GCMS	ug/Nm3					ND (0.46)	
Diethylphthalate	GCMS	ug/Nm3					ND (0.44)	

Analytical Data Not Used In Calculations

Stream: APF Outle Collection Method: MMS Sample Type: 47 mm Filte 1:4 di

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Dimethylphthalate	GCMS	ug/Nm3					ND (0.57)	
Fluoranthene	GCMS	ug/Nm3					ND (0.34)	
Fluorene	GCMS	ug/Nm3					ND (0.56)	
Hexachlorobenzene	GCMS	ug/Nm3					ND (1.8)	
Hexachlorobutadiene	GCMS	ug/Nm3					ND (1.8)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3					ND (1.7)	
Hexachloroethane	GCMS	ug/Nm3					ND (1.9)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3					ND (0.55)	
Isophorone	GCMS	ug/Nm3					ND (0.54)	
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3					ND (1.6)	
Naphthalene	GCMS	ug/Nm3					ND (0.44)	
Nitrobenzene	GCMS	ug/Nm3					ND (0.91)	
Pentachlorophenol	GCMS	ug/Nm3					ND (3.4)	
Phenanthrene	GCMS	ug/Nm3					ND (0.39)	
Phenol	GCMS	ug/Nm3					ND (1.0)	
Pyrene	GCMS	ug/Nm3					ND (0.31)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3					ND (1.1)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3					ND (1.4)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3					1.58	J

Stream: APF Outlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/Nm3	2.82	C	3.99	C	4.89	C
Cadmium	GFAA	ug/Nm3	0.108	BC	ND (0.066)	BC	ND (0.054)	C
Lead	GFAA	ug/Nm3	ND (0.62)	C	ND (0.71)	C	0.650	BC
Selenium	GFAA	ug/Nm3	22.0	C	53.5	C	48.1	C
Antimony	ICAP	ug/Nm3	ND (23)	B	ND (26)	B	ND (22)	B
Arsenic	ICAP	ug/Nm3	ND (14)		ND (16)		ND (13)	
Beryllium	ICAP	ug/Nm3	ND (0.15)		ND (0.18)		ND (0.15)	
Cadmium	ICAP	ug/Nm3	ND (1.2)	C	ND (1.3)	C	ND (1.1)	C

Stream: APF Outle Collection Method: Multimetals Trai Sample Type: Nitric Acid Impingers + TL

Analytical Data Not Used In Calculations

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Chromium	ICAP	ug/Nm3	2.79 C		ND (1.8) C		167 C	
Cobalt	ICAP	ug/Nm3	ND (1.2) BC		ND (1.4) BC		ND (1.2) BC	
Copper	ICAP	ug/Nm3	ND (2.8) BC		ND (3.2) BC		ND (2.6) BC	
Lead	ICAP	ug/Nm3	ND (6.5) BC		ND (7.4) BC		ND (6.1) BC	
Manganese	ICAP	ug/Nm3	1.68 BC		1.95 BC		25.6 BC	
Molybdenum	ICAP	ug/Nm3	6.10		ND (2.5) C		2.54	
Nickel	ICAP	ug/Nm3	61.0 C		7.97 C		99.8 C	
Selenium	ICAP	ug/Nm3	61.3 B		53.0 B		48.6 B	
Vanadium	ICAP	ug/Nm3	ND (1.4) C		ND (1.6) C		ND (1.3) C	
Mercury	ICPMS	ug/Nm3	19.1 C		24.4 C		18.6 C	

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg	60.8		75.9		ND (30)	
Cadmium	ICAP	mg/kg	ND (2.9)		ND (3.4)		ND (3.2)	
Lead	ICAP	mg/kg	ND (17) B		32.1 B		ND (18) B	
Selenium	ICAP	mg/kg	ND (46)		ND (54)		ND (50)	

Stream: Bed Ash Collection Method: Grab Composite Sample Type: Bottom Ash FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg					59.6	
Cadmium	ICAP	mg/kg					ND (2.9)	
Lead	ICAP	mg/kg					ND (17) B	
Selenium	ICAP	mg/kg					ND (46)	

Analytical Data Not Used In Calculations

Stream: Coal Past Collection Method: Grab Composit Sample Type: Filtered Solid

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/g	21.0		29.0		31.0	
Selenium	GFAA	ug/g	ND (0.50)		0.600		1.00	
Molybdenum	ICAP	ug/g	ND (3.0)		ND (3.0)		83.0	
Barium	NAA	ug/g	88.4		114		82.5	
Bromine	NAA	ug/g	15.5		16.1		15.1	
Cadmium	NAA	ug/g	ND (2.6)		ND (2.7)		ND (2.2)	
Calcium	NAA	ug/g	1200		1500		1300	
Cerium	NAA	ug/g	13.9		14.2		15.3	
Cesium	NAA	ug/g	1.45		1.57		1.57	
Chlorine	NAA	ug/g	848		873		838	
Chromium	NAA	ug/g	17.8		19.7		18.2	
Copper	NAA	ug/g	14.3		14.3		12.9	
Europium	NAA	ug/g	0.289		0.314		0.325	
Hafnium	NAA	ug/g	0.785		0.804		0.913	
Iodine	NAA	ug/g	1.90		1.88		2.38	
Lanthanum	NAA	ug/g	6.65		8.09		7.66	
Lutetium	NAA	ug/g	0.135		0.137		0.168	
Magnesium	NAA	ug/g	627		745		777	
Mercury	NAA	ug/g	0.0474		0.110		0.0292	
Neodymium	NAA	ug/g	9.34		7.34		6.59	
Rubidium	NAA	ug/g	26.1		19.7		19.0	
Samarium	NAA	ug/g	1.41		1.46		1.52	
Scandium	NAA	ug/g	3.21		3.31		3.41	
Selenium	NAA	ug/g	1.59		1.77		1.91	
Strontium	NAA	ug/g	18.9		51.6		49.7	
Tantalum	NAA	ug/g	0.236		0.200		0.243	
Terbium	NAA	ug/g	0.161		0.166		0.174	
Thorium	NAA	ug/g	2.28		2.35		2.44	
Tin	NAA	ug/g	ND (7.7)		ND (7.8)		ND (7.7)	
Titanium	NAA	ug/g	809		829		969	
Tungsten	NAA	ug/g	56.0		65.2		77.6	
Uranium	NAA	ug/g	0.836		0.719		0.698	

Analytical Data Not Used In Calculations

Stream: Coal Past Collection Method: Grab Composite Sample Type: Filtered Solid

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Ytterbium	NAA	ug/g	0.547		0.460		0.420	
Zinc	NAA	ug/g	7.72		11.2		11.1	
Zirconium	NAA	ug/g	28.0		20.2		36.3	

Stream: Coal Paste Collection Method: Grab Composite Sample Type: Filtered Solids FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/g					27.0	
Selenium	GFAA	ug/g					ND (0.50)	
Molybdenum	ICAP	ug/g					ND (3.0)	
Barium	NAA	ug/g					101	
Bromine	NAA	ug/g					15.9	
Cadmium	NAA	ug/g					ND (2.6)	
Calcium	NAA	ug/g					1010	
Cerium	NAA	ug/g					16.5	
Cesium	NAA	ug/g					1.73	
Chlorine	NAA	ug/g					775	
Chromium	NAA	ug/g					20.1	
Copper	NAA	ug/g					13.3	
Europium	NAA	ug/g					0.353	
Hafnium	NAA	ug/g					0.986	
Iodine	NAA	ug/g					2.02	
Lanthanum	NAA	ug/g					7.74	
Lutetium	NAA	ug/g					0.127	
Magnesium	NAA	ug/g					820	
Mercury	NAA	ug/g					0.0811	
Neodymium	NAA	ug/g					7.07	
Rubidium	NAA	ug/g					20.6	
Samarium	NAA	ug/g					1.57	
Scandium	NAA	ug/g					3.68	
Selenium	NAA	ug/g					2.03	

Analytical Data Not Used In Calculations

Stream: Coal Past Collection Method: Grab Composite Sample Type: Filtered Solid FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Strontium	NAA	ug/g					37.4	
Tantalum	NAA	ug/g					2110	
Terbium	NAA	ug/g					0.178	
Thorium	NAA	ug/g					2.52	
Tin	NAA	ug/g					ND (7.7)	
Titanium	NAA	ug/g					868	
Tungsten	NAA	ug/g					60.0	
Uranium	NAA	ug/g					1.01	
Ytterbium	NAA	ug/g					0.784	
Zinc	NAA	ug/g					25.2	
Zirconium	NAA	ug/g					53.8	

Stream: Cyclone Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg					171	
Cadmium	ICAP	mg/kg	121		130		ND (2.5)	
Lead	ICAP	mg/kg	ND (2.8)		ND (2.7)		ND (2.5)	
Selenium	ICAP	mg/kg	ND (16)	B	38.4	B	41.3	B
			ND (43)		ND (43)		ND (40)	

Stream: Cyclone As Collection Method: Grab Composite Sample Type: Fly As FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg					129	
Cadmium	ICAP	mg/kg					ND (2.9)	
Lead	ICAP	mg/kg					38.7	B
Selenium	ICAP	mg/kg					46.3	

Analytical Data Not Used In Calculations

Stream: ESP Ash Collection Method: Grab Composite Sample Type: Fly Ash

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg						
Cadmium	ICAP	mg/kg	406		350		411	
Lead	ICAP	mg/kg	ND (3.7)		ND (3.6)		ND (3.6)	
Selenium	ICAP	mg/kg	80.6 B		94.2 B		122 B	
	ICAP	mg/kg	ND (58)		ND (56)		ND (57)	

Stream: ESP As Collection Method: Grab Composite Sample Type: Fly As FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg						
Cadmium	ICAP	mg/kg					350	
Lead	ICAP	mg/kg					ND (3.3)	
Selenium	ICAP	mg/kg					136 B	
							ND (52)	

Stream: ESP Inlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Di-n-butylphthalate	GCMS	ug/Nm3	118	BE				

Stream: ESP Inlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (4.8)					
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (4.2)					
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (4.0)					
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (3.8)					
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (7.1)					
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (7.4)					
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (5.4)					
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (5.3)					

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (20)					
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (6.6)					
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (9.6)					
2-Chloronaphthalene	GCMS	ug/Nm3	ND (2.7)					
2-Chlorophenol	GCMS	ug/Nm3	ND (4.2)					
2-Methylnaphthalene	GCMS	ug/Nm3	ND (2.7)					
2-Methylphenol	GCMS	ug/Nm3	ND (5.1)					
2-Nitroaniline	GCMS	ug/Nm3	ND (8.4)					
2-Nitrophenol	GCMS	ug/Nm3	ND (8.0)					
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (3.6)					
3-Nitroaniline	GCMS	ug/Nm3	ND (8.2)					
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (12)					
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (5.9)					
4-Nitroaniline	GCMS	ug/Nm3	ND (7.3)					
4-Nitrophenol	GCMS	ug/Nm3	ND (18)					
Acenaphthene	GCMS	ug/Nm3	ND (3.0)					
Acenaphthylene	GCMS	ug/Nm3	ND (1.7)					
Anthracene	GCMS	ug/Nm3	ND (1.7)					
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (1.0)					
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (1.1)					
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (1.1)					
Benzoic acid	GCMS	ug/Nm3	ND (16)					
Benzyl alcohol	GCMS	ug/Nm3	ND (7.8)					
Butylbenzylphthalate	GCMS	ug/Nm3	ND (1.9)					
Chrysene	GCMS	ug/Nm3	ND (1.2)					
Di-n-octylphthalate	GCMS	ug/Nm3	ND (0.79)					
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (1.3)					
Dibenzofuran	GCMS	ug/Nm3	ND (1.9)					
Diethylphthalate	GCMS	ug/Nm3	ND (2.3)					
Dimethylphthalate	GCMS	ug/Nm3	ND (2.5)					
Fluoranthene	GCMS	ug/Nm3	ND (1.2)					
Fluorene	GCMS	ug/Nm3	ND (2.6)					
Hexachlorobenzene	GCMS	ug/Nm3	ND (5.7)					

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: MeCl2 PNR/MM5 Filter 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Hexachlorobutadiene	GCMS	ug/Nm3	ND (7.8)					
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (9.2)					
Hexachloroethane	GCMS	ug/Nm3	ND (8.2)					
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (0.95)					
Isophorone	GCMS	ug/Nm3	ND (2.6)					
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (7.4)					
Naphthalene	GCMS	ug/Nm3	4.88 J					
Nitrobenzene	GCMS	ug/Nm3	ND (4.5)					
Pentachlorophenol	GCMS	ug/Nm3	ND (15)					
Phenanthrene	GCMS	ug/Nm3	ND (1.7)					
Phenol	GCMS	ug/Nm3	ND (3.5)					
Pyrene	GCMS	ug/Nm3	ND (1.1)					
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (4.0)					
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (4.7)					
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	7.28 BJ					

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3	119 E		228 E		124 E	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	469 E					

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl 1:10 di

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (22)					
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (19)					
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (18)					
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (17)					
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (30)					
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (31)					

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:10 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (12)					
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (20)					
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (74)					
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (27)					
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (42)					
2-Chloronaphthalene	GCMS	ug/Nm3	ND (12)					
2-Chlorophenol	GCMS	ug/Nm3	ND (20)					
2-Methylnaphthalene	GCMS	ug/Nm3	ND (11)					
2-Methylphenol	GCMS	ug/Nm3	ND (24)					
2-Nitroaniline	GCMS	ug/Nm3	ND (29)					
2-Nitrophenol	GCMS	ug/Nm3	ND (32)					
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (34)					
3-Nitroaniline	GCMS	ug/Nm3	ND (36)					
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (45)					
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (22)					
4-Nitroaniline	GCMS	ug/Nm3	ND (29)					
4-Nitrophenol	GCMS	ug/Nm3	ND (31)					
Acenaphthene	GCMS	ug/Nm3	ND (13)					
Acenaphthylene	GCMS	ug/Nm3	ND (7.5)					
Anthracene	GCMS	ug/Nm3	ND (6.5)					
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (9.9)					
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (11)					
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (10)					
Benzyl alcohol	GCMS	ug/Nm3	ND (42)					
Butylbenzylphthalate	GCMS	ug/Nm3	ND (8.6)					
Chrysene	GCMS	ug/Nm3	ND (7.1)					
Di-n-butylphthalate	GCMS	ug/Nm3	10.9 J					
Di-n-octylphthalate	GCMS	ug/Nm3	ND (6.0)					
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (12)					
Dibenzofuran	GCMS	ug/Nm3	ND (8.0)					
Diethylphthalate	GCMS	ug/Nm3	ND (7.6)					
Dimethylphthalate	GCMS	ug/Nm3	ND (9.8)					
Fluoranthene	GCMS	ug/Nm3	ND (5.6)					

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:10 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Fluorene	GCMS	ug/Nm3	ND (9.7)					
Hexachlorobenzene	GCMS	ug/Nm3	27.7	J				
Hexachlorobutadiene	GCMS	ug/Nm3	ND (31)					
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (30)					
Hexachloroethane	GCMS	ug/Nm3	ND (34)					
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (9.1)					
Isophorone	GCMS	ug/Nm3	ND (9.3)					
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (27)					
Naphthalene	GCMS	ug/Nm3	ND (7.5)					
Nitrobenzene	GCMS	ug/Nm3	ND (16)					
Pentachlorophenol	GCMS	ug/Nm3	ND (57)					
Phenanthrene	GCMS	ug/Nm3	ND (6.6)					
Phenol	GCMS	ug/Nm3	ND (18)					
Pyrene	GCMS	ug/Nm3	ND (4.6)					
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (19)					
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (25)					

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3					ND (5.0)	
1,2-Dichlorobenzene	GCMS	ug/Nm3					ND (4.3)	
1,3-Dichlorobenzene	GCMS	ug/Nm3					ND (4.1)	
1,4-Dichlorobenzene	GCMS	ug/Nm3					ND (3.9)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3					ND (6.3)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3					ND (6.6)	
2,4-Dichlorophenol	GCMS	ug/Nm3					ND (2.8)	
2,4-Dimethylphenol	GCMS	ug/Nm3					ND (4.6)	
2,4-Dinitrophenol	GCMS	ug/Nm3					ND (16)	
2,6-Dinitrotoluene	GCMS	ug/Nm3					ND (5.8)	
2,6-Dinitrotoluene	GCMS	ug/Nm3					ND (8.9)	
2-Chloronaphthalene	GCMS	ug/Nm3					ND (2.6)	

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
2-Chlorophenol	GCMS	ug/Nm3					ND (4.6)	
2-Methylnaphthalene	GCMS	ug/Nm3					ND (2.7)	
2-Methylphenol	GCMS	ug/Nm3					ND (5.5)	
2-Nitroaniline	GCMS	ug/Nm3					ND (6.2)	
2-Nitrophenol	GCMS	ug/Nm3					ND (7.5)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3					ND (7.9)	
3-Nitroaniline	GCMS	ug/Nm3					ND (7.7)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3					ND (8.9)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3					ND (5.2)	
4-Nitroaniline	GCMS	ug/Nm3					ND (6.1)	
4-Nitrophenol	GCMS	ug/Nm3					ND (6.6)	
Acenaphthene	GCMS	ug/Nm3					ND (2.8)	
Acenaphthylene	GCMS	ug/Nm3					ND (1.6)	
Anthracene	GCMS	ug/Nm3					ND (1.3)	
Benzo(b)fluoranthene	GCMS	ug/Nm3					ND (2.3)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3					ND (2.5)	
Benzo(k)fluoranthene	GCMS	ug/Nm3					ND (2.4)	
Benzyl alcohol	GCMS	ug/Nm3					ND (9.6)	
Butylbenzylphthalate	GCMS	ug/Nm3					ND (2.0)	
Chrysene	GCMS	ug/Nm3					ND (1.6)	
Di-n-butylphthalate	GCMS	ug/Nm3					28.4	
Di-n-octylphthalate	GCMS	ug/Nm3					ND (1.4)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3					ND (2.8)	
Dibenzofuran	GCMS	ug/Nm3					ND (1.7)	
Diethylphthalate	GCMS	ug/Nm3					ND (1.6)	
Dimethylphthalate	GCMS	ug/Nm3					ND (2.1)	
Fluoranthene	GCMS	ug/Nm3					ND (1.1)	
Fluorene	GCMS	ug/Nm3					ND (2.1)	
Hexachlorobenzene	GCMS	ug/Nm3					ND (5.9)	
Hexachlorobutadiene	GCMS	ug/Nm3					ND (7.2)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3					ND (6.4)	
Hexachloroethane	GCMS	ug/Nm3					ND (7.7)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3					ND (2.1)	

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Isophorone	GCMS	ug/Nm3					11.3	J
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3					ND (6.2)	
Naphthalene	GCMS	ug/Nm3					ND (1.7)	
Nitrobenzene	GCMS	ug/Nm3					ND (3.6)	
Pentachlorophenol	GCMS	ug/Nm3					ND (11)	
Phenanthrene	GCMS	ug/Nm3					ND (1.3)	
Phenol	GCMS	ug/Nm3					1.68	J
Pyrene	GCMS	ug/Nm3					ND (1.1)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3					ND (4.4)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3					ND (5.6)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3					ND (1.7)	

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3			ND (9.7)			
1,2-Dichlorobenzene	GCMS	ug/Nm3			ND (8.0)			
1,3-Dichlorobenzene	GCMS	ug/Nm3			ND (7.6)			
1,4-Dichlorobenzene	GCMS	ug/Nm3			ND (7.2)			
2,4,5-Trichlorophenol	GCMS	ug/Nm3			ND (13)			
2,4,6-Trichlorophenol	GCMS	ug/Nm3			ND (14)			
2,4-Dichlorophenol	GCMS	ug/Nm3			ND (5.4)			
2,4-Dimethylphenol	GCMS	ug/Nm3			ND (8.9)			
2,4-Dinitrophenol	GCMS	ug/Nm3			ND (33)			
2,4-Dinitrotoluene	GCMS	ug/Nm3			ND (12)			
2,6-Dinitrotoluene	GCMS	ug/Nm3			ND (19)			
2-Chloronaphthalene	GCMS	ug/Nm3			ND (5.4)			
2-Chlorophenol	GCMS	ug/Nm3			ND (8.5)			
2-Methylnaphthalene	GCMS	ug/Nm3			ND (5.1)			
2-Methylphenol	GCMS	ug/Nm3			ND (10)			
2-Nitroaniline	GCMS	ug/Nm3			ND (13)			
2-Nitrophenol	GCMS	ug/Nm3			ND (14)			

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Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
3,3-Dichlorobenzidine	GCMS	ug/Nm3			ND (16)			
3-Nitroaniline	GCMS	ug/Nm3			ND (16)			
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3			ND (19)			
4-Chloro-3-methylphenol	GCMS	ug/Nm3			ND (9.9)			
4-Nitroaniline	GCMS	ug/Nm3			ND (13)			
4-Nitrophenol	GCMS	ug/Nm3			ND (14)			
Acenaphthene	GCMS	ug/Nm3			ND (6.0)			
Acenaphthylene	GCMS	ug/Nm3			ND (3.3)			
Anthracene	GCMS	ug/Nm3			ND (2.8)			
Benzo(b)fluoranthene	GCMS	ug/Nm3			ND (4.2)			
Benzo(g,h,i)perylene	GCMS	ug/Nm3			ND (4.6)			
Benzo(k)fluoranthene	GCMS	ug/Nm3			ND (4.4)			
Benzyl alcohol	GCMS	ug/Nm3			ND (18)			
Butylbenzylphthalate	GCMS	ug/Nm3			ND (4.0)			
Chrysene	GCMS	ug/Nm3			ND (3.3)			
Di-n-butylphthalate	GCMS	ug/Nm3			3.79 J			
Di-n-octylphthalate	GCMS	ug/Nm3			ND (2.6)			
Dibenz(a,h)anthracene	GCMS	ug/Nm3			ND (5.2)			
Dibenzofuran	GCMS	ug/Nm3			ND (3.6)			
Diethylphthalate	GCMS	ug/Nm3			ND (3.4)			
Dimethylphthalate	GCMS	ug/Nm3			ND (4.4)			
Fluoranthene	GCMS	ug/Nm3			ND (2.4)			
Fluorene	GCMS	ug/Nm3			ND (4.3)			
Hexachlorobenzene	GCMS	ug/Nm3			ND (13)			
Hexachlorobutadiene	GCMS	ug/Nm3			ND (14)			
Hexachlorocyclopentadiene	GCMS	ug/Nm3			ND (13)			
Hexachloroethane	GCMS	ug/Nm3			ND (14)			
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3			ND (3.9)			
Isophorone	GCMS	ug/Nm3			ND (4.1)			
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3			ND (11)			
Naphthalene	GCMS	ug/Nm3			ND (3.3)			
Nitrobenzene	GCMS	ug/Nm3			ND (6.9)			
Pentachlorophenol	GCMS	ug/Nm3			ND (24)			

Analytical Data Not Used In Calculations

Stream: ESP Inlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Phenanthrene	GCMS	ug/Nm3			ND (2.8)			
Phenol	GCMS	ug/Nm3			2.84 J			
Pyrene	GCMS	ug/Nm3			ND (2.1)			
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3			ND (8.5)			
bis(2-Chloroethyl)ether	GCMS	ug/Nm3			ND (10)			
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3			11.2 J			

Stream: ESP Inlet Collection Method: Multimetals Train Sample Type: Nitric Acid Impingers + TLR

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/Nm3	ND (0.20)		ND (0.20)		ND (0.18)	
Cadmium	GFAA	ug/Nm3	0.621 C		0.165 C		0.267 C	
Lead	GFAA	ug/Nm3	ND (0.63) BC		ND (0.63) BC		ND (0.57) BC	
Selenium	GFAA	ug/Nm3	12.0 C		10.9 C		15.6 C	
Antimony	ICAP	ug/Nm3	ND (23) B		ND (23) B		ND (21) B	
Arsenic	ICAP	ug/Nm3	ND (14)		ND (14)		ND (13)	
Beryllium	ICAP	ug/Nm3	ND (0.16)		ND (0.16)		ND (0.14)	
Cadmium	ICAP	ug/Nm3	ND (1.2) C		ND (1.2) C		ND (1.1) C	
Chromium	ICAP	ug/Nm3	ND (1.6) C		ND (1.6) C		27.7 C	
Cobalt	ICAP	ug/Nm3	ND (1.3) BC		ND (1.2) BC		ND (1.1) BC	
Copper	ICAP	ug/Nm3	2.95 BC		ND (2.8) BC		2.62 BC	
Lead	ICAP	ug/Nm3	ND (6.6) BC		ND (6.6) BC		ND (6.0) BC	
Manganese	ICAP	ug/Nm3	1.84 BC		3.21 BC		4.40 BC	
Molybdenum	ICAP	ug/Nm3	ND (2.3)		ND (2.3)		2.97	
Nickel	ICAP	ug/Nm3	ND (4.3) C		ND (4.3) C		29.7 C	
Selenium	ICAP	ug/Nm3	ND (27) B		ND (27) B		ND (25) B	
Vanadium	ICAP	ug/Nm3	ND (1.4) C		ND (1.4) C		ND (1.3) C	
Mercury	ICPMS	ug/Nm3	24.6 C		26.9 C		24.9 C	

Analytical Data Not Used In Calculations

Stream: ESP Outlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzoic acid	GCMS	ug/Nm3		115 E	121 E			215 E

Stream: ESP Outlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3	ND (4.3)		ND (4.4)			
1,2-Dichlorobenzene	GCMS	ug/Nm3	ND (3.9)		ND (3.6)			
1,3-Dichlorobenzene	GCMS	ug/Nm3	ND (3.7)		ND (3.4)			
1,4-Dichlorobenzene	GCMS	ug/Nm3	ND (3.5)		ND (3.3)			
2,4,5-Trichlorophenol	GCMS	ug/Nm3	ND (5.1)		ND (5.5)			
2,4,6-Trichlorophenol	GCMS	ug/Nm3	ND (5.4)		ND (5.8)			
2,4-Dichlorophenol	GCMS	ug/Nm3	ND (2.4)		ND (2.4)			
2,4-Dimethylphenol	GCMS	ug/Nm3	ND (4.0)		ND (4.0)			
2,4-Dinitrophenol	GCMS	ug/Nm3	ND (13)		ND (14)			
2,4-Dinitrotoluene	GCMS	ug/Nm3	ND (4.7)		ND (5.0)			
2,6-Dinitrotoluene	GCMS	ug/Nm3	ND (7.2)		ND (7.7)			
2-Chloronaphthalene	GCMS	ug/Nm3	ND (2.1)		ND (2.3)			
2-Chlorophenol	GCMS	ug/Nm3	ND (4.1)		ND (3.8)			
2-Methylnaphthalene	GCMS	ug/Nm3	ND (2.3)		ND (2.3)			
2-Methylphenol	GCMS	ug/Nm3	ND (4.9)		ND (4.6)			
2-Nitroaniline	GCMS	ug/Nm3	ND (5.0)		ND (5.4)			
2-Nitrophenol	GCMS	ug/Nm3	ND (6.4)		ND (6.5)			
3,3'-Dichlorobenzidine	GCMS	ug/Nm3	ND (6.5)		ND (6.9)			
3-Nitroaniline	GCMS	ug/Nm3	ND (6.2)		ND (6.7)			
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3	ND (7.0)		ND (8.2)			
4-Chloro-3-methylphenol	GCMS	ug/Nm3	ND (4.4)		ND (4.5)			
4-Nitroaniline	GCMS	ug/Nm3	ND (5.0)		ND (5.3)			
4-Nitrophenol	GCMS	ug/Nm3	ND (5.4)		ND (5.8)			
Acenaphthene	GCMS	ug/Nm3	ND (2.3)		ND (2.5)			
Acenaphthylene	GCMS	ug/Nm3	ND (1.3)		ND (1.4)			
Anthracene	GCMS	ug/Nm3	ND (1.0)		ND (1.2)			
Benzo(b)fluoranthene	GCMS	ug/Nm3	ND (2.2)		ND (1.9)			

Analytical Data Not Used In Calculations

Stream: ESP Outlet Collection Method: MMS Sample Type: XAD Resin/Impingers + MeCl2 1:2 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Benzo(g,h,i)perylene	GCMS	ug/Nm3	ND (2.4)		ND (2.0)			
Benzo(k)fluoranthene	GCMS	ug/Nm3	ND (2.3)		ND (1.9)			
Benzyl alcohol	GCMS	ug/Nm3	ND (8.7)		ND (8.1)			
Butylbenzylphthalate	GCMS	ug/Nm3	ND (1.6)		ND (1.7)			
Chrysene	GCMS	ug/Nm3	ND (1.3)		ND (1.4)			
Di-n-butylphthalate	GCMS	ug/Nm3	17.6		5.86 J			
Di-n-octylphthalate	GCMS	ug/Nm3	ND (1.3)		ND (1.1)			
Dibenz(a,h)anthracene	GCMS	ug/Nm3	ND (2.7)		ND (2.3)			
Dibenzofuran	GCMS	ug/Nm3	ND (1.4)		ND (1.5)			
Diethylphthalate	GCMS	ug/Nm3	2.88 J		ND (1.4)			
Dimethylphthalate	GCMS	ug/Nm3	ND (1.7)		ND (1.8)			
Fluoranthene	GCMS	ug/Nm3	ND (0.88)		ND (1.0)			
Fluorene	GCMS	ug/Nm3	ND (1.7)		ND (1.8)			
Hexachlorobenzene	GCMS	ug/Nm3	ND (4.7)		ND (5.4)			
Hexachlorobutadiene	GCMS	ug/Nm3	ND (6.2)		ND (6.3)			
Hexachlorocyclopentadiene	GCMS	ug/Nm3	ND (5.2)		ND (5.6)			
Hexachloroethane	GCMS	ug/Nm3	ND (6.9)		ND (6.4)			
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3	ND (2.0)		ND (1.7)			
Isophthalene	GCMS	ug/Nm3	21.7		ND (1.9)			
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3	ND (5.5)		ND (5.2)			
Naphthalene	GCMS	ug/Nm3	ND (1.5)		ND (1.5)			
Nitrobenzene	GCMS	ug/Nm3	ND (3.1)		ND (3.1)			
Pentachlorophenol	GCMS	ug/Nm3	ND (9.0)		ND (10)			
Phenanthrene	GCMS	ug/Nm3	ND (1.0)		ND (1.2)			
Phenol	GCMS	ug/Nm3	1.82 J		1.28 J			
Pyrene	GCMS	ug/Nm3	ND (0.87)		ND (0.92)			
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3	ND (3.8)		ND (3.9)			
bis(2-Chloroethyl)ether	GCMS	ug/Nm3	ND (5.0)		ND (4.7)			
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3	15.4		ND (1.5)			

Analytical Data Not Used In Calculations

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
1,2,4-Trichlorobenzene	GCMS	ug/Nm3					ND (9.5)	
1,2-Dichlorobenzene	GCMS	ug/Nm3					ND (8.4)	
1,3-Dichlorobenzene	GCMS	ug/Nm3					ND (8.0)	
1,4-Dichlorobenzene	GCMS	ug/Nm3					ND (7.6)	
2,4,5-Trichlorophenol	GCMS	ug/Nm3					ND (12)	
2,4,6-Trichlorophenol	GCMS	ug/Nm3					ND (13)	
2,4-Dichlorophenol	GCMS	ug/Nm3					ND (5.3)	
2,4-Dimethylphenol	GCMS	ug/Nm3					ND (8.7)	
2,4-Dinitrophenol	GCMS	ug/Nm3					ND (31)	
2,4-Dinitrotoluene	GCMS	ug/Nm3					ND (11)	
2,6-Dinitrotoluene	GCMS	ug/Nm3					ND (17)	
2-Chloronaphthalene	GCMS	ug/Nm3					ND (5.1)	
2-Chlorophenol	GCMS	ug/Nm3					ND (9.0)	
2-Methylnaphthalene	GCMS	ug/Nm3					ND (5.0)	
2-Methylphenol	GCMS	ug/Nm3					ND (11)	
2-Nitroaniline	GCMS	ug/Nm3					ND (12)	
2-Nitrophenol	GCMS	ug/Nm3					ND (14)	
3,3'-Dichlorobenzidine	GCMS	ug/Nm3					ND (15)	
3-Nitroaniline	GCMS	ug/Nm3					ND (15)	
4,6-Dinitro-2-methylphenol	GCMS	ug/Nm3					ND (17)	
4-Chloro-3-methylphenol	GCMS	ug/Nm3					ND (9.8)	
4-Nitroaniline	GCMS	ug/Nm3					ND (12)	
4-Nitrophenol	GCMS	ug/Nm3					ND (13)	
Acenaphthene	GCMS	ug/Nm3					ND (5.6)	
Acenaphthylene	GCMS	ug/Nm3					ND (3.1)	
Anthracene	GCMS	ug/Nm3					ND (2.5)	
Benzo(b)fluoranthene	GCMS	ug/Nm3					ND (10)	
Benzo(g,h,i)perylene	GCMS	ug/Nm3					ND (11)	
Benzo(k)fluoranthene	GCMS	ug/Nm3					ND (10)	
Benzyl alcohol	GCMS	ug/Nm3					ND (19)	
Butylbenzylphthalate	GCMS	ug/Nm3					ND (3.7)	
Chrysene	GCMS	ug/Nm3					ND (3.1)	
Di-n-butylphthalate	GCMS	ug/Nm3					9.08 J	

Analytical Data Not Used In Calculations

Stream: ESP Outlet Collection Method: MM5 Sample Type: XAD Resin/Impingers + MeCl2 1:4 dil

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Di-n-octylphthalate	GCMS	ug/Nm3					ND (6.2)	
Dibenz(a,h)anthracene	GCMS	ug/Nm3					ND (12)	
Dibenzofuran	GCMS	ug/Nm3					ND (3.3)	
Diethylphthalate	GCMS	ug/Nm3					ND (3.2)	
Dimethylphthalate	GCMS	ug/Nm3					ND (4.1)	
Fluoranthene	GCMS	ug/Nm3					ND (2.1)	
Fluorene	GCMS	ug/Nm3					ND (4.1)	
Hexachlorobenzene	GCMS	ug/Nm3					ND (11)	
Hexachlorobutadiene	GCMS	ug/Nm3					ND (14)	
Hexachlorocyclopentadiene	GCMS	ug/Nm3					ND (13)	
Hexachloroethane	GCMS	ug/Nm3					ND (15)	
Indeno(1,2,3-cd)pyrene	GCMS	ug/Nm3					ND (9.3)	
Isophorone	GCMS	ug/Nm3					22.0	J
N-Nitroso-di-n-propylamine	GCMS	ug/Nm3					ND (12)	
Naphthalene	GCMS	ug/Nm3					ND (3.3)	
Nitrobenzene	GCMS	ug/Nm3					ND (6.8)	
Pentachlorophenol	GCMS	ug/Nm3					ND (22)	
Phenanthrene	GCMS	ug/Nm3					ND (2.5)	
Phenol	GCMS	ug/Nm3					ND (8.1)	
Pyrene	GCMS	ug/Nm3					ND (2.0)	
bis(2-Chloroethoxy)methane	GCMS	ug/Nm3					ND (8.3)	
bis(2-Chloroethyl)ether	GCMS	ug/Nm3					ND (11)	
bis(2-Ethylhexyl)phthalate	GCMS	ug/Nm3					ND (3.1)	

Stream: ESP Outlet Collection Method: Multimetals Train Sample Type: Acetone PNR/Nitric PNR/M5 Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	ug/Nm3	ND (1.2)	C	ND (1.2)	C	ND (1.2)	
Arsenic	ICAP	ug/g	ND (19)	C	ND (150)	C	ND (22)	
Cadmium	ICAP	ug/Nm3	0.640		0.266		0.483	
Cadmium	ICAP	ug/g	10.4		32.2		8.86	
Lead	ICAP	ug/Nm3	ND (0.73)	C	ND (0.74)	C	ND (0.73)	

Analytical Data Not Used In Calculations

Stream: ESP Outlet Collection Method: Multimetal Train Sample Type: Acetone PNR/Nitric PNR/M5 Filter + Solids

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Lead	ICAP	ug/g	ND (12)	C	ND (90)	C	ND (13)	
Selenium	ICAP	ug/Nm3	21.7	C	20.2	C	19.9	
Selenium	ICAP	ug/g	353	C	2440	C	365	

Stream: ESP Outle Collection Method: Multimetal Train Sample Type: Nitric Acid Impingers + TL

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	GFAA	ug/Nm3	ND (0.17)		ND (0.20)		ND (0.16)	
Cadmium	GFAA	ug/Nm3	0.172	C	0.787	C	0.558	C
Lead	GFAA	ug/Nm3	ND (0.53)	BC	0.654	BC	ND (0.52)	BC
Selenium	GFAA	ug/Nm3	13.5	C	24.5	C	22.0	C
Antimony	ICAP	ug/Nm3	ND (20)	B	ND (23)	B	ND (19)	B
Arsenic	ICAP	ug/Nm3	ND (12)		ND (14)		ND (12)	
Beryllium	ICAP	ug/Nm3	ND (0.13)		ND (0.16)		ND (0.13)	
Cadmium	ICAP	ug/Nm3	ND (0.99)	C	ND (1.2)	C	ND (0.98)	C
Chromium	ICAP	ug/Nm3	ND (1.3)	C	ND (1.6)	C	2.73	C
Cobalt	ICAP	ug/Nm3	ND (1.0)	BC	ND (1.2)	BC	ND (1.0)	BC
Copper	ICAP	ug/Nm3	ND (2.4)	BC	ND (2.8)	BC	3.89	BC
Lead	ICAP	ug/Nm3	ND (5.6)	BC	ND (6.6)	BC	ND (5.5)	BC
Manganese	ICAP	ug/Nm3	0.970	BC	3.11	BC	7.75	BC
Molybdenum	ICAP	ug/Nm3	ND (1.9)		ND (2.3)		ND (1.9)	
Nickel	ICAP	ug/Nm3	ND (3.6)	C	ND (4.3)	C	4.69	C
Selenium	ICAP	ug/Nm3	ND (23)	B	ND (27)	B	ND (23)	B
Vanadium	ICAP	ug/Nm3	ND (1.2)	C	ND (1.4)	C	ND (1.2)	C
Mercury	ICPMS	ug/Nm3	21.3	C	26.8	C	31.1	C

Analytical Data Not Used In Calculations

Stream: Service Water Collection Method: Grab Sample Type: Not Specified

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/L	ND (0.047)		ND (0.047)		ND (0.047)	
Cadmium	ICAP	mg/L	0.00482 B		ND (0.0039)	B	0.00500 B	
Lead	ICAP	mg/L	0.0377 B		ND (0.022)	B	0.0312 B	
Selenium	ICAP	mg/L	ND (0.089) B		ND (0.089)	B	ND (0.089)	

Stream: Service Water Collection Method: Grab Sample Type: Not Specified FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/L					ND (0.047)	
Cadmium	ICAP	mg/L					0.00446 B	
Lead	ICAP	mg/L					ND (0.022) B	
Selenium	ICAP	mg/L					ND (0.089)	

Stream: Sorbent Collection Method: Grab Composite Sample Type: Dolomite

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg	ND (2.9) B		ND (3.2) B		ND (3.2) B	
Cadmium	ICAP	mg/kg	0.589 B		0.552 B		0.922 B	
Lead	ICAP	mg/kg	ND (1.8)		ND (11)		ND (2.0)	
Selenium	ICAP	mg/kg	ND (4.9)		ND (5.5)		ND (5.5)	

Stream: Sorbent Collection Method: Grab Composite Sample Type: Dolomite FD

Analyte	Analytical Technique	Units	Run 1	Com 1	Run 2	Com 2	Run 3	Com 3
Arsenic	ICAP	mg/kg					ND (3.4) B	
Cadmium	ICAP	mg/kg					0.763 B	
Lead	ICAP	mg/kg					ND (2.1)	
Selenium	ICAP	mg/kg					ND (5.8)	

APPENDIX C: SOURCE SAMPLING DATA SUMMARY AND PSD PLOTS

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant
Location ESP Inlet
Train Aldehyde

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1946	1500	1452	-
Time Finish	2114	1624	1620	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate	0.007	0.010	0.005	-
Final Leak Rate	0.005	0.010	0.004	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2460	0.2850	0.2850	-
Barometric Pressure ("Hg)	29.29	29.29	29.2	29.26
Static Pressure ("H2O)	2.8	2.8	2.8	2.8
Meter Volume (acf)	64.002	63.769	67.129	64.967
Average square root of delta p	0.7740	0.6860	0.7070	0.7223
Average delta H (" H2O)	1.40	1.95	2.00	1.78
Average Stack Temperature (F)	393	392	393	393
Average DGM Temp (F)	91.8	81.6	90.3	87.9
Test Duration (minutes)	89.0	84.0	88.0	87.0
Condensed Water (g)	140.4	151.9	121.3	137.9
% CO2	12.0	10.0	11.0	11.0
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	81.0	81.7
Meter Volume (dscf)	60.705	61.704	63.740	62.050
Flue Gas Moisture (%)	9.8	10.4	8.2	9.5
Gas Molecular Weight (Wet) (g/g-mole)	28.96	28.68	29.08	28.91
Absolute Stack Pressure (" Hg)	29.50	29.50	29.41	29.47
Absolute Stack Temperature (R)	853	852	853	853
Average Gas Velocity (f/sec)	55.54	49.43	50.71	51.90
Avg Flow Rate (acfm)	333,240	296,603	304,277	311,373
Avg Flow Rate (dscfm)	183,262	162,314	169,724	171,767
Isokinetic Sampling Rate (%)	112.78	102.17	96.35	103.77

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant

Location ESP Inlet

Train Ammonia/Hydrogen Cyanide

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1815	1317	1304	-
Time Finish	1921	1446	1430	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate		0.010	0.007	-
Final Leak Rate		0.010	0.010	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2460	0.2850	0.2850	-
Barometric Pressure ("Hg)	29.29	29.26	29.2	29.25
Static Pressure ("H2O)	2.8	2.8	3.5	3.0
Meter Volume (acf)	42.280	66.953	65.822	58.352
Average square root of delta p	0.7750	0.6860	0.7090	0.7233
Average delta H (" H2O)	1.40	1.90	2.00	1.77
Average Stack Temperature (F)	397	391	392	393
Average DGM Temp (F)	87.2	81.1	86.3	84.9
Test Duration (minutes)	66.0	89.0	86.0	80.3
Condensed Water (g)	115.1	149.2	170.1	144.8
% CO2	12.0	10.0	11.0	11.0
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	81.0	81.7
Meter Volume (dscf)	40.439	64.770	62.957	56.055
Flue Gas Moisture (%)	11.8	9.8	11.3	11.0
Gas Molecular Weight (Wet) (g/g-mole)	28.72	28.75	28.71	28.73
Absolute Stack Pressure (" Hg)	29.50	29.47	29.46	29.47
Absolute Stack Temperature (R)	857	851	852	853
Average Gas Velocity (f/sec)	55.97	49.38	51.10	52.15
Avg Flow Rate (acfm)	335,827	296,260	306,599	312,895
Avg Flow Rate (dscfm)	179,784	163,187	165,843	169,605
Isokinetic Sampling Rate (%)	103.27	100.68	99.66	101.21

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant

Location ESP Inlet

Train Anions

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1313	1157	1126	-
Time Finish	1500	1304	1238	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate	0.005	0.007	0.010	-
Final Leak Rate	0.010	0.010	0.010	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2460	0.2850	0.2850	-
Barometric Pressure ("Hg)	29.44	29.26	29.20	29.30
Static Pressure ("H2O)	2.5	2.8	3.5	2.9
Meter Volume (acf)	66.891	51.500	55.230	57.874
Average square root of delta p	0.7750	0.7230	0.7120	0.7367
Average delta H (" H2O)	1.36	2.09	2.10	1.85
Average Stack Temperature (F)	386	393	396	392
Average DGM Temp (F)	81.7	83.0	74.1	79.6
Test Duration (minutes)	107.0	67.0	72.0	82.0
Condensed Water (g)	38.8	183.2	120.6	114.2
Filter Weight Gain (g)	6.9959	7.0968	5.8575	6.6501
PNR Weight Gain (g)	1.0230	1.4225	2.6727	1.7061
% CO2	12.0	10.0	11.0	11.0
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	81.0	81.7
Meter Volume (dscf)	64.951	49.672	54.046	56.223
Particulate Meter Volume (dscf)	166.094	176.146	180.744	
Flue Gas Moisture (%)	2.7	14.8	9.5	9.0
Gas Molecular Weight (Wet) (g/g-mole)	29.83	28.15	28.93	28.97
Absolute Stack Pressure (" Hg)	29.62	29.47	29.46	29.52
Absolute Stack Temperature (R)	846	853	856	852
Average Gas Velocity (f/sec)	54.46	52.65	51.24	52.78
Avg Flow Rate (acfm)	326,746	315,893	307,432	316,690
Avg Flow Rate (dscfm)	196,293	163,550	168,881	176,374
Isokinetic Sampling Rate (%)	93.71	102.09	100.35	98.72
Particulate Concentration (gr/dscf)	7.45E-01	7.47E-01	7.28E-01	7.40E-01
Particulate Concentration (lbs/dscf)	1.06E-04	1.07E-04	1.04E-04	1.06E-04
Particulate Emission (grams/sec)	157.97	132.18	132.86	141.00
Particulate Emission (lbs/hour)	1253.79	1049.06	1054.47	1119.11

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant

Location ESP Inlet

Train Metals

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	0903	0904	0938	-
Time Finish	1315	1333	1349	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate	0.010	0.002	0.010	-
Final Leak Rate	0.005	0.010	0.005	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2360	0.2460	0.2500	-
Barometric Pressure ("Hg)	29.44	29.26	29.20	29.30
Static Pressure ("H2O)	2.5	2.8	3.5	2.9
Meter Volume (acf)	101.297	104.446	100.749	102.164
Average square root of delta p	0.7690	0.7590	0.6710	0.7330
Average delta H (" H2O)	1.14	1.27	1.06	1.16
Average Stack Temperature (F)	388	388	390	389
Average DGM Temp (F)	58.8	67.0	63.8	63.2
Test Duration (minutes)	175.0	175.0	175.0	175.0
Condensed Water (g)	247.9	238.6	223.8	236.8
Filter Weight Gain (g)	2.7063	3.1061	3.1091	2.9738
PNR Weight Gain (g)	1.2417	1.0874	0.8819	1.0703
% CO2	12.0	10.0	11.0	11.0
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	81.0	81.7
Meter Volume (dscf)	102.643	103.586	100.269	102.166
Flue Gas Moisture (%)	10.2	9.8	9.5	9.9
Gas Molecular Weight (Wet) (g/g-mole)	28.92	28.75	28.93	28.87
Absolute Stack Pressure (" Hg)	29.62	29.47	29.46	29.52
Absolute Stack Temperature (R)	848	848	850	849
Average Gas Velocity (f/sec)	54.95	54.54	48.14	52.54
Avg Flow Rate (acfm)	329,692	327,266	288,814	315,258
Avg Flow Rate (dscfm)	182,355	180,841	159,657	174,284
Isokinetic Sampling Rate (%)	105.90	99.19	105.30	103.46
Particulate Concentration (gr/dscf)	5.94E-01	6.25E-01	6.14E-01	6.11E-01
Particulate Concentration (lbs/dscf)	8.48E-05	8.93E-05	8.78E-05	8.73E-05
Particulate Emission (grams/sec)	116.92	122.04	105.93	114.96
Particulate Emission (lbs/hour)	927.95	968.57	840.75	912.42

Plant Name AEP Tidd Demonstration Plant
Location ESP Inlet
Train M23

Run No.	2	3	1	Average
Date	04-13-94	04-14-94	04-15-94	-
Time Start	1835	1750	0949	-
Time Finish	2203	2235	1325	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate	0.005	0.010	0.010	-
Final Leak Rate	0.010	0.010	0.010	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2500	0.2850	0.2770	-
Barometric Pressure ("Hg)	29.26	29.2	29.26	29.24
Static Pressure ("H2O)	2.8	2.8	3.1	2.9
Meter Volume (acf)	103.858	118.665	115.014	112.512
Average square root of delta p	0.7050	0.6460	0.6580	0.6697
Average delta H (" H2O)	1.24	2.59	1.46	1.76
Average Stack Temperature (F)	393	392	392	392
Average DGM Temp (F)	74.3	83.0	78.0	78.4
Test Duration (minutes)	175.0	175.0	175.0	175.0
Condensed Water (g)	221.0	289.7	248.6	253.1
% CO2	12.0	10.0	10.0	10.7
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	82.0	82.0
Meter Volume (dscf)	101.597	114.365	111.788	109.250
Flue Gas Moisture (%)	9.3	10.7	9.5	9.8
Gas Molecular Weight (Wet) (g/g-mole)	29.03	28.65	28.79	28.82
Absolute Stack Pressure (" Hg)	29.47	29.41	29.49	29.45
Absolute Stack Temperature (R)	853	852	852	852
Average Gas Velocity (f/sec)	50.55	46.65	47.34	48.18
Avg Flow Rate (acfm)	303,314	279,925	284,031	289,090
Avg Flow Rate (dscfm)	167,655	152,225	156,935	158,938
Isokinetic Sampling Rate (%)	101.60	96.92	97.28	98.60

Plant Name AEP Tidd Demonstration Plant
Location ESP Inlet
Train MM5

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1850	1530	1458	-
Time Finish	2255	1917	1918	-
Operator	TJB	TJB	TJB	-
Initial Leak Rate	0.010	0.010	0.010	-
Final Leak Rate	0.010	0.010	0.010	-
Duct Dimensions (ft)	10 x 10	10 x 10	10 x 10	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	1.009	1.009	1.009	1.009
Nozzle Diameter (inches)	0.2460	0.2450	0.2770	-
Barometric Pressure ("Hg)	29.29	29.26	29.2	29.25
Static Pressure ("H2O)	2.8	2.8	2.8	2.8
Meter Volume (acf)	110.566	96.973	114.507	107.349
Average square root of delta p	0.7720	0.6880	0.6410	0.7003
Average delta H (" H2O)	1.42	1.10	1.54	1.35
Average Stack Temperature (F)	389	387	392	389
Average DGM Temp (F)	76.6	67.0	82.7	75.4
Test Duration (minutes)	175.0	175.0	175.0	175.0
Condensed Water (g)	184.3	201.0	236.7	207.3
% CO2	12.0	10.0	10.0	10.7
% O2	6.0	8.0	8.0	7.3
% N2	82.0	82.0	82.0	82.0
Meter Volume (dscf)	107.848	96.136	110.132	104.705
Flue Gas Moisture (%)	7.5	9.0	9.2	8.6
Gas Molecular Weight (Wet) (g/g-mole)	29.25	28.85	28.82	28.97
Absolute Stack Pressure (" Hg)	29.50	29.47	29.41	29.46
Absolute Stack Temperature (R)	849	847	852	849
Average Gas Velocity (f/sec)	55.00	49.31	46.15	50.16
Avg Flow Rate (acfm)	329,995	295,885	276,920	300,933
Avg Flow Rate (dscfm)	187,097	165,286	153,061	168,481
Isokinetic Sampling Rate (%)	99.81	101.54	98.27	99.87

Plant Name AEP Tidd Demonstration Plant
Location ESP Inlet
Train VOST

Run No.	1A	1B	2A	2B	3A	3B	Average
Date	04-13-94	04-13-94	04-13-94	04-13-94	04-14-94	04-14-94	-
Time Start	0032	0120	2235	2320	2010	2120	-
Time Finish	0112	0140	2315	0000	2050	2200	-
Operator	TJB	TJB	TJB	TJB	TJB	TJB	-
Initial Leak Rate	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Final Leak Rate	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Tenax Tube ID	30437A	30441A	30415A	30401A	30411A	30408A	-
Tenax/Charcoal Tube ID	30437B	30441B	30415B	30401B	30411B	30408B	-
Dry Gas Meter Calibration (Yd)	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Barometric Pressure ("Hg)	29.29	29.29	29.26	29.26	29.2	29.2	29.25
Meter Volume (liters)	20.500	10.100	20.215	20.010	20.110	20.100	18.506
Average delta H (" H ₂ O)	1.13	1.25	1.00	1.50	1.20	1.20	1.21
Average DGM Temp (F)	66.0	66.5	61.0	65.0	80.5	75.5	69.1
1st Condenser Temp (F)	63.5	60.5	46.5	60.0	47.0	50.5	54.7
2nd Condenser Temp (F)	63.0	61.5	59.5	47.5	47.5	52.0	55.2
Test Duration (minutes)	40.0	20.0	40.0	40.0	40.0	40.0	36.7
% CO ₂	12.0	12.0	11.0	11.0	11.0	11.0	11.3
% O ₂	6.0	6.0	8.0	8.0	8.0	8.0	7.3
% N ₂	82.0	82.0	81.0	81.0	81.0	81.0	81.3
Meter Volume (dsL)	20.202	9.947	20.085	19.755	19.230	19.400	18.103

Plant Name AEP Tidd Demonstration Plant
 Location ESP Outlet
 Train Aldehyde

Run No.	1	2	3	Average
Date	04-12-94	04-13-93	04-14-94	-
Time Start	1950	1500	1520	-
Time Finish	2130	1640	1655	-
Operator	JEH	JEH	JEH	-
Initial Leak Rate	0.005	<0.001	0.006	-
Final Leak Rate	0.009	0.007		-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.997	0.997	0.997	0.997
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.41	29.14	29.35	29.3
Static Pressure ("H2O)	1.6	1.5	1.6	1.566667
Meter Volume (acf)	64.455	69.285	66.305	66.682
Average square root of delta p	0.7810	0.8370	0.8310	0.8163
Average delta H (" H2O)	1.37	1.58	1.59	1.51
Average Stack Temperature (F)	389	387	388	388
Average DGM Temp (F)	87.2	83.3	99.7	90.1
Test Duration (minutes)	95.0	100.0	95.0	96.7
Condensed Water (g)	140.5	155.2	226.6	174.1
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	61.158	65.648	61.417	62.741
Flue Gas Moisture (%)	9.8	10.0	14.8	11.6
Gas Molecular Weight (Wet) (g/g-mole)	28.97	28.98	28.29	28.74
Absolute Stack Pressure (" Hg)	29.53	29.25	29.47	29.42
Absolute Stack Temperature (R)	849	847	848	848
Average Gas Velocity (f/sec)	55.86	60.10	60.19	58.72
Avg Flow Rate (acfm)	263,252	283,205	283,634	276,697
Avg Flow Rate (dscfm)	145,759	155,149	148,076	149,661
Isokinetic Sampling Rate (%)	101.78	97.51	100.61	99.97

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train Ammonia/Hydrogen Cyanide

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1803	1325	1338	-
Time Finish	1923	1436	1508	-
Operator	JEH	JEH	JEH	-
Initial Leak Rate	0.009	0.010	0.007	-
Final Leak Rate		0.007	0.014	-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.997	0.997	0.997	0.997
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.16	29.32	29.31
Static Pressure ("H2O)	1.5	1.4	2.0	1.6
Meter Volume (acf)	56.125	50.460	60.918	55.834
Average square root of delta p	0.8660	0.8440	0.8370	0.8490
Average delta H (" H2O)	1.68	1.59	1.55	1.61
Average Stack Temperature (F)	389	389	389	389
Average DGM Temp (F)	82.8	82.4	94.8	86.6
Test Duration (minutes)	80.0	76.0	90.0	82.0
Condensed Water (g)	145.8	117.8	133.4	132.3
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	53.787	47.922	56.868	52.859
Flue Gas Moisture (%)	11.3	10.4	10.0	10.6
Gas Molecular Weight (Wet) (g/g-mole)	28.78	28.93	28.88	28.86
Absolute Stack Pressure (" Hg)	29.55	29.26	29.47	29.43
Absolute Stack Temperature (R)	849	849	849	849
Average Gas Velocity (f/sec)	62.13	60.69	60.03	60.95
Avg Flow Rate (acfm)	292,769	286,013	282,897	287,226
Avg Flow Rate (dscfm)	159,402	155,819	155,974	157,065
Isokinetic Sampling Rate (%)	97.20	93.25	93.35	94.60

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train Anions

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1312	1148	1150	-
Time Finish	1427	1303	1313	-
Operator	JEH	JEH	JEH	-
Initial Leak Rate	0.011	0.007	< 0.001	-
Final Leak Rate	0.012	0.010	< 0.001	-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.997	0.997	0.997	0.997
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.5	29.18	29.35	29.34
Static Pressure ("H2O)	1.5	2.3	3.8	2.5
Meter Volume (acf)	53.946	50.345	56.165	53.485
Average square root of delta p	0.8540	0.7940	0.8370	0.8283
Average delta H (" H2O)	1.77	1.40	1.54	1.57
Average Stack Temperature (F)	388	390	389	389
Average DGM Temp (F)	77.0	80.1	84.0	80.4
Test Duration (minutes)	75.0	75.0	73.0	74.3
Condensed Water (g)	126.5	100.2	109.2	112.0
Filter Weight Gain (g)	0.1631	0.1426	0.1348	0.1468
PNR Weight Gain (g)	0.3358	0.0454	0.1711	0.1841
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	52.370	48.022	53.520	51.304
Particulate Meter Volume, (dscf)	167.315	161.593	171.804	
Flue Gas Moisture (%)	10.2	9.0	8.8	9.3
Gas Molecular Weight (Wet) (g/g-mole)	28.92	29.11	29.02	29.01
Absolute Stack Pressure (" Hg)	29.61	29.35	29.63	29.53
Absolute Stack Temperature (R)	848	850	849	849
Average Gas Velocity (f/sec)	61.03	56.88	59.71	59.21
Avg Flow Rate (acfm)	287,610	268,025	281,375	279,004
Avg Flow Rate (dscfm)	159,023	148,613	158,097	155,244
Isokinetic Sampling Rate (%)	101.19	99.29	106.86	102.45
Particulate Concentration (gr/dscf)	4.60E-02	1.80E-02	2.75E-02	3.05E-02
Particulate Concentration (lbs/dscf)	6.57E-06	2.57E-06	3.93E-06	4.36E-06
Particulate Emission (grams/sec)	7.90	2.88	4.69	5.16
Particulate Emission (lbs/hour)	62.73	22.87	37.24	40.95

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train Chrome IV

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1620	0840	0820	-
Time Finish	1740	1010	0945	-
Operator	JEH	JEH	JEH	-
Initial Leak Rate	0.011	< 0.001	0.005	-
Final Leak Rate	0.015	0.006		-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.987	0.987	0.987	0.987
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.5	29.26	29.38	29.38
Static Pressure ("H2O)	1.5	1.7	1.8	1.7
Meter Volume (acf)	49.100	57.450	52.460	53.003
Average square root of delta p	0.6630	0.7940	0.7680	0.7417
Average delta H (" H2O)	1.00	1.44	1.28	1.24
Average Stack Temperature (F)	388	390	389	389
Average DGM Temp (F)	79.3	73.4	66.2	72.9
Test Duration (minutes)	80.0	90.0	85.0	85.0
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	46.901	55.090	51.184	51.058
Flue Gas Moisture (%)	10.0	10.0	10.0	10.0
Gas Molecular Weight (Wet) (g/g-mole)	28.94	28.98	28.87	28.93
Absolute Stack Pressure (" Hg)	29.61	29.39	29.51	29.50
Absolute Stack Temperature (R)	848	850	849	849
Average Gas Velocity (f/sec)	47.36	56.95	55.05	53.12
Avg Flow Rate (acfm)	223,176	268,365	259,424	250,322
Avg Flow Rate (dscfm)	123,718	147,377	143,169	138,088
Isokinetic Sampling Rate (%)	109.20	95.71	96.92	100.61

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train Metals

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	0915	0910	0945	-
Time Finish	1310	1300	1310	-
Operator	JEH	JLM	JLM	-
Initial Leak Rate	0.019	0.009	0.016	-
Final Leak Rate	0.020	0.002	0.020	-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.981	0.981	0.981	0.981
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.7	29.26	29.38	29.45
Static Pressure ("H ₂ O)	3.0	1.7	1.8	2.2
Meter Volume (acf)	113.186	115.758	119.108	116.017
Average square root of delta p	0.8240	0.8090	0.8330	0.8220
Average delta H (" H ₂ O)	1.67	1.74	1.88	1.76
Average Stack Temperature (F)	388	390	391	390
Average DGM Temp (F)	70.4	83.6	89.9	81.3
Test Duration (minutes)	160.0	160.0	160.0	160.0
Condensed Water (g)	240.6	256.5	253.2	250.1
Filter Weight Gain (g)	0.0542	0.0197	0.0070	0.0270
PNR Weight Gain (g)	0.1248	0.0039	0.1521	0.0936
% CO ₂	12.0	12.0	11.0	11.7
% O ₂	6.0	7.0	8.0	7.0
% N ₂	82.0	81.0	81.0	81.3
Meter Volume (dscf)	110.165	108.333	110.684	109.727
Flue Gas Moisture (%)	9.3	10.1	9.7	9.7
Gas Molecular Weight (Wet) (g/g-mole)	29.02	28.97	28.90	28.97
Absolute Stack Pressure (" Hg)	29.92	29.39	29.51	29.61
Absolute Stack Temperature (R)	848	850	851	850
Average Gas Velocity (f/sec)	58.49	58.03	59.74	58.75
Avg Flow Rate (acfm)	275,615	273,465	281,496	276,858
Avg Flow Rate (dscfm)	155,440	150,091	155,496	153,675
Isokinetic Sampling Rate (%)	102.08	103.96	102.52	102.85
Particulate Concentration (gr/dscf)	2.51E-02	3.36E-03	2.22E-02	1.69E-02
Particulate Concentration (lbs/dscf)	3.58E-06	4.80E-07	3.17E-06	2.41E-06
Particulate Emission (grams/sec)	4.21	0.55	3.73	2.83
Particulate Emission (lbs/hour)	33.41	4.33	29.57	22.44

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train M23

Run No.	2	3	1	Average
Date	04-13-94	04-14-94	04-15-94	-
Time Start	1840	1812	0937	-
Time Finish	2301	2106	1223	-
Operator	JEH	JEH	TJC	-
Initial Leak Rate	0.005	0.005	0.015	-
Final Leak Rate	0.005	0.007	0.015	-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.997	0.997	0.981	0.992
Nozzle Diameter (inches)	0.2500	0.2700	0.2700	-
Barometric Pressure ("Hg)	29.14	29.32	29.41	29.29
Static Pressure ("H2O)	1.6	1.9	1.5	1.7
Meter Volume (acf)	126.424	113.832	111.076	117.111
Average square root of delta p	0.8080	0.7980	0.7780	0.7947
Average delta H (" H2O)	1.46	1.98	1.99	1.81
Average Stack Temperature (F)	388	389	389	389
Average DGM Temp (F)	73.0	91.1	86.5	83.5
Test Duration (minutes)	187.0	146.0	144.0	159.0
Condensed Water (g)	252.2	242.3	230.4	241.6
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	122.055	107.090	103.997	111.047
Flue Gas Moisture (%)	8.9	9.6	9.5	9.3
Gas Molecular Weight (Wet) (g/g-mole)	29.08	29.02	28.94	29.01
Absolute Stack Pressure (" Hg)	29.26	29.46	29.52	29.41
Absolute Stack Temperature (R)	848	849	849	849
Average Gas Velocity (f/sec)	57.93	57.11	55.69	56.91
Avg Flow Rate (acfm)	272,997	269,144	262,443	268,195
Avg Flow Rate (dscfm)	151,368	148,794	145,766	148,642
Isokinetic Sampling Rate (%)	99.37	97.39	97.89	98.22

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train MM5

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1852	1523	1440	-
Time Finish	0010	1923	1900	-
Operator	JLM	JLM	JLM	-
Initial Leak Rate	0.020	0.020	0.010	-
Final Leak Rate		0.010	0.007	-
Stack Diameter (ft)	10.0	10.0	10.0	-
Pitot Tube Correction Factor (Cp)	0.84	0.84	0.84	0.84
Dry Gas Meter Calibration (Yd)	0.981	0.981	0.981	0.981
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.4	29.26	29.32	29.33
Static Pressure ("H2O)	1.6	1.8	1.8	1.7
Meter Volume (acf)	137.116	130.704	123.013	130.278
Average square root of delta p	0.8240	0.8110	0.8190	0.8180
Average delta H (" H2O)	1.68	1.72	1.95	1.78
Average Stack Temperature (F)	390	388	390	390
Average DGM Temp (F)	80.3	76.9	95.7	84.3
Test Duration (minutes)	200.0	184.0	162.0	182.0
Condensed Water (g)	389.8	252.0	220.2	287.3
% CO2	12.0	12.0	11.0	11.7
% O2	6.0	7.0	8.0	7.0
% N2	82.0	81.0	81.0	81.3
Meter Volume (dscf)	129.706	123.836	112.913	122.152
Flue Gas Moisture (%)	12.4	8.8	8.4	9.9
Gas Molecular Weight (Wet) (g/g-mole)	28.65	29.13	29.06	28.95
Absolute Stack Pressure (" Hg)	29.52	29.39	29.45	29.45
Absolute Stack Temperature (R)	850	848	850	850
Average Gas Velocity (f/sec)	59.33	57.97	58.61	58.64
Avg Flow Rate (acfm)	279,592	273,157	276,211	276,320
Avg Flow Rate (dscfm)	149,960	152,341	154,573	152,291
Isokinetic Sampling Rate (%)	99.66	101.81	103.91	101.79

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant
Location ESP Outlet
Train VOST

Run No.	1A	1B	2A	2B	3A	3B	Average
Date	04-12-94	04-13-94	04-13-94	04-13-94	04-14-94	04-14-94	-
Time Start	2330	0015	2105	2200	2028	2115	-
Time Finish	0010	0055	2155	2240	2108	2155	-
Operator	JEH	JEH	JEH	JEH	JEH	JEH	-
Initial Leak Rate	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Final Leak Rate	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Tenax Tube ID	30419A	30422A	30417A	30410A	30432A	30438A	-
Tenax/Charcoal Tube ID	30419B	30422B	30417B	30410B	30432B	30438B	-
Dry Gas Meter Calibration (Yd)	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Barometric Pressure ("Hg)	29.4	29.4	29.14	29.14	29.41	29.41	29.32
Meter Volume (liters)	21.180	20.400	21.500	22.430	21.200	22.300	21.502
Average delta H (" H ₂ O)	2.00	2.00	1.40	1.33	1.30	1.28	1.55
Average DGM Temp (F)	66.8	70.3	61.3	61.8	76.8	77.0	69.0
1st Condenser Temp (F)	44.0	43.5	57.3	57.0	43.0	40.3	47.5
2nd Condenser Temp (F)	43.3	45.3	48.8	46.8	47.0	44.5	45.9
Test Duration (minutes)	40.0	40.0	40.0	40.0	40.0	40.0	40.0
% CO ₂	12.0	12.0	12.0	12.0	11.0	11.0	11.7
% O ₂	6.0	6.0	7.0	7.0	8.0	8.0	7.0
% N ₂	82.0	82.0	81.0	81.0	81.0	81.0	81.3
Meter Volume (dsL)	20.798	19.900	21.115	22.003	20.399	21.448	20.944

Plant Name AEP Tidd Demonstration Plant
 Location APF Inlet
 Train Aldehyde

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	2025	1348	1600	-
Time Finish	0045	1538	2247	-
Operator	RVW	RVW	RVW	-
Initial Leak Rate	0.005	0.012	0.008	-
Final Leak Rate			0.006	-
Dry Gas Meter Calibration (Yd)	0.993	0.993	0.993	0.993
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	63.205	74.832	64.475	67.504
Average delta H (" H ₂ O)	1.50	1.50	0.93	1.31
Average DGM Temp (F)	100.9	97.0	91.3	96.4
Test Duration (minutes)	95.0	110.0	119.0	108.0
Condensed Water (g)	180.4	165.2	142.5	162.7
% CO ₂	12.5	12.5	11.0	12.0
% O ₂	5.5	5.5	8.0	6.3
% N ₂	82.0	82.0	81.0	81.7
Meter Volume (dscf)	58.351	68.863	60.292	62.502
Flue Gas Moisture (%)	12.7	10.2	10.0	11.0
Gas Molecular Weight (Wet) (g/g-mole)	28.66	28.98	28.87	28.84

Plant Name AEP Tidd Demonstration Plant
Location APF Inlet
Train Ammonia/Hydrogen Cyanide

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1810	1345	1423	-
Time Finish	1925	1455	1533	-
Operator	RVW	RVW	RVW	-
Initial Leak Rate	0.006	0.010	0.004	-
Final Leak Rate	0.008	0.006	0.010	-
Dry Gas Meter Calibration (Yd)	0.993	1.018	1.018	1.010
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	48.540	47.521	44.682	46.914
Average delta H (" H ₂ O)	1.50	1.51	1.50	1.50
Average DGM Temp (F)	105.3	89.5	92.9	95.9
Test Duration (minutes)	75.0	70.0	70.0	71.7
Condensed Water (g)	128.1	106.4	109.9	114.8
% CO ₂	12.5	12.5	11.0	12.0
% O ₂	5.5	5.5	8.0	6.3
% N ₂	82.0	82.0	81.0	81.7
Meter Volume (dscf)	44.464	45.444	42.772	44.227
Flue Gas Moisture (%)	12.0	10.0	10.8	10.9
Gas Molecular Weight (Wet) (g/g-mole)	28.76	29.00	28.77	28.84

Plant Name AEP Tidd Demonstration Plant
 Location APF Inlet
 Train Anions

Run No.	1	2	3	1	Average
Date	04-12-94	04-13-94	04-14-94	04-15-94	-
Time Start	1315	0908	1420	1627	-
Time Finish	1415	1018	1530	1735	-
Operator	RVW	RVW	RVW	RVW	-
Initial Leak Rate	0.006	0.005	0.008	0.007	-
Final Leak Rate		0.006	0.006	0.010	-
Dry Gas Meter Calibration (Yd)	1.018	1.018	0.993	0.993	1.006
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.41	29.34
Meter Volume (acf)	29.981	46.758	42.764	44.870	41.093
Average delta H (" H ₂ O)	1.00	1.50	1.50	1.50	1.38
Average DGM Temp (F)	95.2	73.8	87.4	87.5	86.0
Test Duration (minutes)	55.0	70.0	70.0	68.0	65.8
Condensed Water (g)		108.4	100.7	105.9	105.0
% CO ₂	12.5	12.5	11.0	11.0	11.8
% O ₂	5.5	5.5	8.0	8.0	6.8
% N ₂	82.0	82.0	81.0	81.0	81.5
Meter Volume (dscf)	28.630	46.029	40.330	42.395	39.346
Flue Gas Moisture (%)	0.0	10.0	10.5	10.5	7.8
Gas Molecular Weight (Wet) (g/g-mole)	30.22	29.00	28.81	28.81	29.21

Plant Name AEP Tidd Demonstration Plant
Location APF Inlet
Train Metals

Run No.	1	2	3	4	Average
Date	04-12-94	04-13-94	04-14-94	04-15-94	-
Time Start	1322	0905	0955	2132	-
Time Finish	1417	1125	1215	2352	-
Operator	RVW	RVW	RVW	RVW	-
Initial Leak Rate	0.012	0.012	0.010	0.010	-
Final Leak Rate		0.014		0.012	-
Dry Gas Meter Calibration (Yd)	0.993	0.993	0.993	1.018	0.999
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.41	29.335
Meter Volume (acf)	41.375	106.315	104.156	103.282	88.782
Average delta H (" H2O)	1.90	1.76	1.90	1.90	1.86
Average DGM Temp (F)	107.5	98.1	94.3	87.5	96.9
Test Duration (minutes)	55.0	140.0	140.0	140.0	118.8
Condensed Water (g)		158.3	118.5	266.1	181.0
% CO2	12.5	12.5	11.0	11.0	11.8
% O2	5.5	5.5	8.0	8.0	6.8
% N2	82.0	82.0	81.0	81.0	81.5
Meter Volume (dscf)	37.791	97.697	97.103	100.141	83.183
Flue Gas Moisture (%)	0.0	7.1	5.4	11.1	5.9
Gas Molecular Weight (Wet) (g/g-mole)	30.22	29.35	29.42	28.73	29.43

Plant Name AEP Tidd Demonstration Plant
 Location APF Inlet
 Train M23

Run No.	2	3	1	Average
Date	04-13-94	04-15-94	04-15-94	-
Time Start	1803	1043	2125	-
Time Finish	2233	1550	2350	-
Operator	RVW	RVW	RVW	-
Initial Leak Rate	0.009	0.003	0.009	-
Final Leak Rate	0.007	0.004	0.010	-
Dry Gas Meter Calibration (Yd)	0.993	0.993	1.016	1.001
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.14	29.41	29.41	29.32
Meter Volume (acf)	107.555	111.103	108.501	109.053
Average delta H (" H ₂ O)	0.93	1.22	1.90	1.35
Average DGM Temp (F)	93.9	89.8	95.7	93.1
Test Duration (minutes)	200.0	200.0	165.0	188.3
Condensed Water (g)	327.1	267.0	7.7	200.6
% CO ₂	12.5	11.0	11.0	11.5
% O ₂	8.5	8.0	8.0	8.2
% N ₂	79.0	81.0	81.0	80.3
Meter Volume (dscf)	99.387	104.471	103.449	102.435
Flue Gas Moisture (%)	13.4	10.8	0.4	8.2
Gas Molecular Weight (Wet) (g/g-mole)	28.68	28.78	30.04	29.17

Plant Name AEP Tidd Demonstration Plant
 Location APF Inlet
 Train MM5

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-15-94	-
Time Start	1928	1805	1045	-
Time Finish	0103	2230	1553	-
Operator	RVW	RVW	RVW	-
Initial Leak Rate	0.002	0.008	0.006	-
Final Leak Rate	0.010	0.005	0.006	-
Dry Gas Meter Calibration (Yd)	1.018	1.018	1.018	1.018
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.41	29.33
Meter Volume (acf)	111.710	104.953	111.810	109.491
Average delta H (" H2O)	1.50	0.93	1.19	1.21
Average DGM Temp (F)	94.9	84.1	88.7	89.2
Test Duration (minutes)	150.0	200.0	200.0	183.3
Condensed Water (g)	256.6	231.0	248.5	245.4
% CO2	12.5	12.5	11.0	12.0
% O2	5.5	5.5	8.0	6.3
% N2	82.0	82.0	81.0	81.7
Meter Volume (dscf)	106.875	101.215	107.986	105.358
Flue Gas Moisture (%)	10.2	9.7	9.8	9.9
Gas Molecular Weight (Wet) (g/g-mole)	28.98	29.03	28.90	28.97

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant

Location APF Inlet

Train VOST

Run No.	2A	2B	3A	3B	1A	1B	Average
Date	04-13-94	04-13-94	04-14-94	04-14-94	04-15-94	04-15-94	-
Time Start	2252	2340	1642	2012	1624	1710	-
Time Finish	2332	0020	1722	2247	1704	1750	-
Operator	RVW	RVW	RVW	RVW	RVW	RVW	-
Initial Leak Rate	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Final Leak Rate	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Tenax Tube ID	30442A	30444A	30428A	30404A	30424A	30403a	-
Tenax/Charcoal Tube ID	30442B	30444B	30428B	30404B	30424B	30403B	-
Dry Gas Meter Calibration (Yd)	0.982	0.982	0.982	0.982	0.982	0.982	0.982
Barometric Pressure ("Hg)	29.14	29.14	29.41	29.41	29.41	29.41	29.32
Meter Volume (liters)	20.070	20.075	20.410	20.085	20.110	20.150	20.150
Average delta H (" H ₂ O)	1.20	1.20	1.40	1.20	1.20	1.20	1.23
Average DGM Temp (F)	82.7	86.0	98.0	100.0	97.0	47.3	85.2
1st Condenser Temp (F)	46.7	47.3	50.7	47.7	57.7	47.3	49.6
2nd Condenser Temp (F)	50.3	48.3	57.3	55.7	60.3	51.0	53.8
Test Duration (minutes)	40.0	40.0	40.0	40.0	40.0	40.0	40.0
% CO ₂	12.5	12.5	11.0	11.0	11.0	11.0	11.5
% O ₂	5.5	5.5	8.0	8.0	8.0	8.0	7.2
% N ₂	82.0	82.0	81.0	81.0	81.0	81.0	81.3
Meter Volume (dsL)	18.733	18.623	18.707	18.334	18.456	20.303	18.859

Plant Name AEP Tidd Demonstration Plant

Location APF Outlet

Train Aldehyde

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1945	1345	1359	-
Time Finish	2141	1537	2041	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	< 0.001	< 0.001	< 0.001	-
Final Leak Rate	< 0.001	< 0.001	< 0.001	-
Dry Gas Meter Calibration (Yd)	1.016	1.003	1.003	1.007
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	62.303	62.505	61.873	62.227
Average delta H (" H ₂ O)	0.93	0.93	0.93	0.93
Average DGM Temp (F)	106.1	101.6	108.1	105.2
Test Duration (minutes)	116.0	112.0	118.0	115.3
Condensed Water (g)	133.4	127.5	132.7	131.2
% CO ₂	12.0	12.0	12.0	12.0
% O ₂	6.0	6.0	6.0	6.0
% N ₂	82.0	82.0	82.0	82.0
Meter Volume (dscf)	58.227	57.544	56.713	57.495
Flue Gas Moisture (%)	9.8	9.5	9.9	9.7
Gas Molecular Weight (Wet) (g/g-mole)	28.97	29.01	28.95	28.98

Plant Name AEP Tidd Demonstration Plant
Location APF Outlet
Train Ammonia/Hydrogen Cyanide

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1802	1346	1424	-
Time Finish	1917	1515	1542	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	< 0.001	0.005	< 0.001	-
Final Leak Rate	< 0.001	0.004	< 0.001	-
Dry Gas Meter Calibration (Yd)	1.003	1.016	1.003	1.007
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	40.628	42.319	42.829	41.925
Average delta H (" H ₂ O)	0.95	0.93	0.93	0.94
Average DGM Temp (F)	101.6	90.1	101.1	97.6
Test Duration (minutes)	85.0	79.0	78.0	80.7
Condensed Water (g)	100.1	87.4	105.1	97.5
% CO ₂	12.0	12.0	12.0	12.0
% O ₂	6.0	6.0	6.0	6.0
% N ₂	82.0	82.0	82.0	82.0
Meter Volume (dscf)	37.784	40.287	39.744	39.272
Flue Gas Moisture (%)	11.1	9.3	11.1	10.5
Gas Molecular Weight (Wet) (g/g-mole)	28.81	29.03	28.81	28.88

Plant Name AEP Tidd Demonstration Plant
Location APF Outlet
Train Anions

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	1315	0906	0953	-
Time Finish	1430	1025	1110	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	< 0.001	< 0.001	0.002	-
Final Leak Rate	< 0.001	< 0.001	0.002	-
Dry Gas Meter Calibration (Yd)	1.016	1.016	1.003	1.012
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	40.761	42.134	42.338	41.744
Average delta H (" H2O)	0.97	0.93	0.93	0.94
Average DGM Temp (F)	99.2	89.0	100.3	96.1
Test Duration (minutes)	85.0	79.0	77.0	80.3
Condensed Water (g)	97.5	93.6	91.2	94.1
% CO2	12.0	12.0	12.0	12.0
% O2	6.0	6.0	6.0	6.0
% N2	82.0	82.0	82.0	82.0
Meter Volume (dscf)	38.569	40.191	39.350	39.370
Flue Gas Moisture (%)	10.7	9.9	9.9	10.1
Gas Molecular Weight (Wet) (g/g-mole)	28.86	28.96	28.96	28.93

Plant Name AEP Tidd Demonstration Plant
Location APF Outlet
Train Metals

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-14-94	-
Time Start	0909	0904	0952	-
Time Finish	1245	1140	1229	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	0.002	0.005	0.006	-
Final Leak Rate	0.002	0.003	0.004	-
Dry Gas Meter Calibration (Yd)	1.003	1.003	1.016	1.007
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.35	29.31
Meter Volume (acf)	100.626	103.896	103.459	102.660
Average delta H (" H2O)	1.46	1.40	1.40	1.42
Average DGM Temp (F)	110.4	98.1	93.8	100.8
Test Duration (minutes)	138.0	156.0	157.0	150.3
Condensed Water (g)	122.3	236.2	198.7	185.7
% CO2	12.0	12.0	12.0	12.0
% O2	6.0	6.0	6.0	6.0
% N2	82.0	82.0	82.0	82.0
Meter Volume (dscf)	92.265	96.351	98.657	95.758
Flue Gas Moisture (%)	5.9	10.4	8.7	8.3
Gas Molecular Weight (Wet) (g/g-mole)	29.44	28.90	29.10	29.15

Plant Name AEP Tidd Demonstration Plant
Location APF Outlet
Train M23

Run No.	2	3	1	Average
Date	04-13-94	04-15-94	04-15-94	-
Time Start	1800	1041	2058	-
Time Finish	2129	1541	2317	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	< 0.001	< 0.001	< 0.001	-
Final Leak Rate	< 0.001	< 0.001	< 0.001	-
Dry Gas Meter Calibration (Yd)	1.016	1.003	1.003	1.007
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.14	29.41	29.41	29.32
Meter Volume (acf)	111.877	108.139	107.633	109.216
Average delta H (" H ₂ O)	0.93	0.96	1.90	1.26
Average DGM Temp (F)	91.0	100.6	94.3	95.3
Test Duration (minutes)	229.0	193.0	139.0	187.0
Condensed Water (g)	239.2	244.1	241.9	241.7
% CO ₂	12.0	12.0	12.0	12.0
% O ₂	6.0	6.0	6.0	6.0
% N ₂	82.0	82.0	82.0	82.0
Meter Volume (dscf)	106.339	100.658	101.556	102.851
Flue Gas Moisture (%)	9.6	10.3	10.1	10.0
Gas Molecular Weight (Wet) (g/g-mole)	28.99	28.91	28.93	28.95

Plant Name AEP Tidd Demonstration Plant
 Location APF Outlet
 Train MM5

Run No.	1	2	3	Average
Date	04-12-94	04-13-94	04-15-94	-
Time Start	1850	1801	1040	-
Time Finish	2155	2121	1542	-
Operator	DJV	DJV	DJV	-
Initial Leak Rate	0.005	< 0.001	< 0.001	-
Final Leak Rate	0.001	< 0.001	< 0.011	-
Dry Gas Meter Calibration (Yd)	1.003	1.003	1.016	1.007
Nozzle Diameter (inches)	0.2500	0.2500	0.2500	-
Barometric Pressure ("Hg)	29.44	29.14	29.41	29.33
Meter Volume (acf)	107.349	110.284	106.209	107.947
Average delta H (" H ₂ O)	0.93	0.93	0.96	0.94
Average DGM Temp (F)	111.8	100.1	94.5	102.1
Test Duration (minutes)	185.0	200.0	195.0	193.3
Condensed Water (g)	234.7	228.8	226.9	230.1
% CO ₂	12.0	12.0	12.0	12.0
% O ₂	6.0	6.0	6.0	6.0
% N ₂	82.0	82.0	82.0	82.0
Meter Volume (dscf)	98.052	101.797	101.249	100.366
Flue Gas Moisture (%)	10.2	9.6	9.6	9.8
Gas Molecular Weight (Wet) (g/g-mole)	28.93	28.99	29.00	28.97

Appendix C: Source Sampling Data Summary & PSD Plots

Plant Name AEP Tidd Demonstration Plant
Location APF Outlet
Train VOST

Run No.	1A	1B	2A	2B	3A	3B	Average
Date	04-12-94	04-13-94	04-13-94	04-13-94	04-14-94	04-14-94	-
Time Start	2325	0013	2241	2324	1645	2000	-
Time Finish	0005	0053	2315	0000	1725	2040	-
Operator	DJV	DJV	DJV	DJV	DJV	DJV	-
Initial Leak Rate	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Final Leak Rate	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-
Tenax Tube ID	30418A	30435A	30414A	30416A	30420A	30430A	-
Tenax/Charcoal Tube ID	30418B	30435B	30414B	30416B	30420B	30430B	-
Dry Gas Meter Calibration (Yd)	1.005	1.005	1.005	1.005	1.005	1.005	1.005
Barometric Pressure ("Hg)	29.44	29.44	29.14	29.14	29.41	29.41	29.33
Meter Volume (liters)	24.112	32.604	23.833	20.976	20.354	22.821	24.117
Average delta H (" H2O)	1.20	1.30	1.60	1.40	1.20	1.30	1.33
Average DGM Temp (F)	88.0	88.3	77.0	78.5	87.3	88.5	84.6
1st Condenser Temp (F)	44.8	45.0	50.0	50.0	46.0	44.3	46.7
2nd Condenser Temp (F)	55.0	52.0	54.5	53.0	53.7	52.5	53.4
Test Duration (minutes)	40.0	40.0	34.0	36.0	40.0	40.0	38.3
% CO2	12.0	12.0	12.0	12.0	12.0	12.0	12.0
% O2	6.0	6.0	6.0	6.0	6.0	6.0	6.0
% N2	82.0	82.0	82.0	82.0	82.0	82.0	82.0
Meter Volume (dsL)	23.042	31.151	23.029	20.202	19.456	21.772	23.109

APF Sampling Locations Data Summary

Location	Run No.	Date	Time	Sample Time (min)	Filter ID	Delta P (CH20)	Orifice Temp (F)	Zone 1		Zone 2		Zone 3		Bar. Pres. (CH2)
								Temp (F)	Temp (F)	Temp (F)	Temp (F)	Temp (F)	Temp (F)	
APF Inlet	1	04-12-94	1255-1430	95	Q-1938	2.8	656	588	601	601	611	616	616	29.44
	1-3	04-12-94	1800-2052	172	Q-1940, Q-1944	2.8	664	597	622	622	616	616	616	29.44
	1-4	04-12-94	2306-0106	120	Q-1950, Q-1946	2.6	583	515	535	535	510	510	510	29.44
	2-1	04-13-94	0850-1120	150	Q-1936, Q-1942	2.6	567	532	505	505	489	489	489	29.14
	2-2	04-13-94	1345-1540	115	Q-1946, Q-1950	2.6	570	534	509	509	498	498	498	29.14
	2-3	04-13-94	1800-2025	145	Q-1936, Q-1942	2.6	576	567	522	522	504	504	504	29.14
	2-4	04-13-94	2130-2422	172	Q-1946, Q-1950	2.6	588	550	545	545	502	502	502	29.14
	3-1	04-14-94	0935-1225	150	Q-1942, Q-1936	2.4	508	508	511	511	495	495	495	29.41
	3-2	04-14-94	1418-1728	138	Q-1940, Q-1944	2.4	467	514	424	424	505	505	505	29.41
	4-1	04-15-94	1040-1316	156	Q-1940, Q-1944	2.4	497	503	542	542	546	546	546	29.41
	4-2	04-15-94	1500-1750	141	Q-1919, Q-1934	2.3	468	468	494	494	491	491	491	29.41
	4-3	04-15-94	2125-2355	150	Q-1940, Q-1944	2.4	498	508	531	531	518	518	518	29.41
APF Outlet	1 - Metals	04-12-94	0900-1603	423	Q-1966	2.5	561	524	598	598	310	310	310	29.44
	1 - Organics	04-12-94	1800-0059	419	Q-1956	2.4	518	502	569	569	159	159	159	29.44
	2 - Metals	04-13-94	0835-1538	423	Q-1958	2.4	540	509	569	569	158	158	158	29.14
	2 - Organics	04-13-94	1640-0005	445	Q-1982	2.4	497	534	572	572	143	143	143	29.14
	3 - Metals	04-14-94	0835-1729	534	Q-1980	2.4	517	523	567	567	136	136	136	29.41
	3 - Organics	04-14-94	1857-2346	289	Q-1954	2.4	479	495	549	549	98	98	98	29.41
	4 - Organics	04-15-94	0935-1554	379	Q-1976	2.4	525	520	566	566	184	184	184	29.41
	5 - Organics	04-15-94	1845-2329	284	Q-1970	2.4	497	529	555	555	93	93	93	29.41

% Isokinetic based on process design flow rates and determined to be 3 scfm.

APF Sampling Locations Data Summary

Location APF Inlet	Run No.	Date	Time	Gas Sampling Rate (dscfm)	Gas Sample Volume (dscf)	Gas Sample Volume (Nm3)	% Isokinetic	Particulate Mass (gm)	Particulate Loading (gr/dscf)
	1	04-12-94	1255-1430	3.016	286.52	7.56	101	N/A	1.50
	1-3	04-12-94	1800-2032	3.004	516.69	13.63	100	50.2	1.43
	1-4	04-12-94	2306-0106	3.005	360.72	9.52	100	57.3	1.94
	2-1	04-13-94	0850-1120	3.030	454.43	11.99	101	36.8	1.63
	2-2	04-13-94	1345-1540	3.025	347.88	9.18	101	34.4	1.21
	2-3	04-13-94	1800-2025	3.016	437.25	11.54	101	59.4	1.76
	2-4	04-13-94	2130-2422	3.021	519.61	13.71	101	45.5	1.56
	3-1	04-14-94	0955-1225	3.004	450.60	11.89	100	38.5	1.40
	3-2	04-14-94	1418-1728	3.064	422.76	11.16	102	45.5	1.49
	4-1	04-15-94	1040-1316	3.009	469.33	12.38	100	40.9	1.48
	4-2	04-15-94	1500-1750	3.016	425.19	11.22	101	53.7	1.84
	4-3	04-15-94	2125-2355	3.000	449.93	11.87	100		
APF Outlet	1 - Metals	04-12-94	0900-1603	2.979	1259.91	33.24	99	0.00246	3.01E-05
	1 - Organics	04-12-94	1800-0059	2.982	1249.25	32.96	99	-0.00568	-7.00E-05
	2 - Metals	04-13-94	0835-1538	2.949	1247.22	32.91	98	0.01031	1.27E-04
	2 - Organics	04-13-94	1640-0005	3.015	1341.68	35.40	101	0.00834	9.57E-05
	3 - Metals	04-14-94	0835-1729	2.984	1593.19	42.04	99	0.00759	7.34E-05
	3 - Organics	04-14-94	1857-2346	3.043	879.43	23.20	101	0.02204	3.86E-04
	4 - Organics	04-15-94	0935-1534	2.972	1126.20	29.72	99	0.01652	2.26E-04
	5 - Organics	04-15-94	1845-2329	3.015	856.12	22.59	100	0.01817	3.27E-04

% Isokinetic based on process design flow rates and determined to be 3 scfm.

Run ID : Inlet 1
Plant & Unit : AEP PFBC
Sampling Location : ESP Inlet
Type of Sizing Device : UWVD
Run Date : 4/11/94
Start time : 21:30

REMARKS:

Average Flue Gas Temperature	374.0	F	190.0	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.165E-04	lb-sec/ft2	.246E-03	Poise
Flue Gas Mean Free Path	.446E-05	inch	.113E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	64.6894	fps	19.7173	m/s
Average Flue Gas Flowrate	304842.	acfm	8633.	m3/min
	174904.	dscfm	4953.	m3/min
Volume Sampled (Dry, STP)	26.8489	dscf	.7604	m3
Test Duration	65.	min	65.	min
Total Catch	.135E-02	lb	.612E+03	mg
Sampling Rate in Device	.720	acfm	.020	m3/min
Collection Temperature	374.0	F	190.0	C
Percent Isokinetic	80.9	%	80.9	%
Nominal Mass Concentration	.352E+00	gr/dscf	.805E+00	g/m3
	.503E-04	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 1
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Inlet
 Type of Sizing Device : UWVD
 Run Date : 4/11/94
 Start time : 21:30

Nominal Mass Concentration .352E+00 gr/dscf .805E+00 g/m3
 .503E-04 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP (gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2		.033		33.92	.123E-01	.281E-01
	11.51		.967			
3		.384		7.53	.367E+00	.839E+00
	4.93		.583			
4		.268		3.46	.307E+00	.702E+00
	2.42		.315			
5		.150		1.80	.203E+00	.465E+00
	1.33		.165			
6		.086		1.09	.174E+00	.399E+00
	.89		.079			
7		.044		.79	.140E+00	.321E+00
	.69		.035			
8		.023		.61	.704E-01	.161E+00
	.53		.013			
9		.008		.47	.251E-01	.575E-01
	.41		.004			
10		.003		.38	.123E-01	.281E-01
	.34		.002			
FILTER		.002		.19	.112E-02	.255E-02
	.10		.000			

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 2
Plant & Unit : AEP PFBC
Sampling Location : ESP Inlet
Type of Sizing Device : UWVD
Run Date : 4/13/94
Start time : 4: 0

REMARKS:

Average Flue Gas Temperature	385.0	F	196.1	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.166E-04	lb-sec/ft2	.248E-03	Poise
Flue Gas Mean Free Path	.453E-05	inch	.115E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	51.4778	fps	15.6904	m/s
Average Flue Gas Flowrate	308867.	acfm	8747.	m3/min
	174905.	dscfm	4953.	m3/min
Volume Sampled (Dry, STP)	20.3670	dscf	.5768	m3
Test Duration	49.	min	49.	min
Total Catch	.788E-03	lb	.357E+03	mg
Sampling Rate in Device	.734	acfm	.021	m3/min
Collection Temperature	385.0	F	196.1	C
Percent Isokinetic	103.7	%	103.7	%
Nominal Mass Concentration	.271E+00	gr/dscf	.619E+00	g/m3
	.387E-04	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 2
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Inlet
 Type of Sizing Device : UWVD
 Run Date : 4/13/94
 Start time : 4: 0

Nominal Mass Concentration .271E+00 gr/dscf .619E+00 g/m3
 .387E-04 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP	
					(gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2		.022		33.83	.642E-02	.147E-01
	11.44		.978			
3		.280		7.49	.206E+00	.470E+00
	4.90		.698			
4		.321		3.44	.282E+00	.645E+00
	2.41		.377			
5		.185		1.79	.192E+00	.439E+00
	1.32		.193			
6		.101		1.08	.157E+00	.359E+00
	.89		.092			
7		.053		.78	.128E+00	.294E+00
	.69		.039			
8		.023		.60	.550E-01	.126E+00
	.53		.016			
9		.010		.47	.245E-01	.560E-01
	.41		.006			
10		.006		.37	.195E-01	.445E-01
	.34		.000			
FILTER		.000		.18	.228E-03	.522E-03
	.10		.000			

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 3
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Inlet
 Type of Sizing Device : UWVD
 Run Date : 4/14/94
 Start time : 0:30

REMARKS:

Average Flue Gas Temperature	385.0	F	196.1	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H ₂ O	7.620	cm H ₂ O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.166E-04	lb-sec/ft ²	.248E-03	Poise
Flue Gas Mean Free Path	.453E-05	inch	.115E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	51.4778	fps	15.6904	m/s
Average Flue Gas Flowrate	308867.	acfm	8747.	m ³ /min
	174905.	dscfm	4953.	m ³ /min
Volume Sampled (Dry, STP)	21.2597	dscf	.6021	m ³
Test Duration	50.	min	50.	min
Total Catch	.924E-03	lb	.419E+03	mg
Sampling Rate in Device	.751	acfm	.021	m ³ /min
Collection Temperature	385.0	F	196.1	C
Percent Isokinetic	106.0	%	106.0	%
Nominal Mass Concentration	.304E+00	gr/dscf	.696E+00	g/m ³
	.435E-04	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 3
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Inlet
 Type of Sizing Device : UWVD
 Run Date : 4/14/94
 Start time : 0:30

Nominal Mass Concentration .304E+00 gr/dscf .696E+00 g/m3
 .435E-04 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP	
					(gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2		.020		33.63	.642E-02	.147E-01
	11.31		.980			
3		.393		7.40	.324E+00	.741E+00
	4.84		.587			
4		.287		3.40	.284E+00	.649E+00
	2.38		.300			
5		.146		1.76	.171E+00	.391E+00
	1.31		.154			
6		.081		1.07	.143E+00	.327E+00
	.88		.072			
7		.042		.77	.115E+00	.263E+00
	.68		.030			
8		.018		.60	.491E-01	.112E+00
	.52		.012			
9		.007		.46	.175E-01	.401E-01
	.40		.006			
10		.003		.37	.124E-01	.284E-01
	.34		.002			
FILTER		.002		.18	.135E-02	.310E-02
	.10		.000			

```

Run ID           : Inlet 4
Plant & Unit      : AEP PFBC
Sampling Location : ESP Inlet
Type of Sizing Device : UWVD
Run Date         : 4/15/94
Start time       : 1:10
  
```

REMARKS:

Average Flue Gas Temperature	385.0	F	196.1	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.166E-04	lb-sec/ft2	.248E-03	Poise
Flue Gas Mean Free Path	.453E-05	inch	.115E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	52.4972	fps	16.0012	m/s
Average Flue Gas Flowrate	314983.	acfm	8920.	m3/min
	178369.	dscfm	5051.	m3/min
Volume Sampled (Dry, STP)	15.4589	dscf	.4378	m3
Test Duration	39.	min	39.	min
Total Catch	.761E-03	lb	.345E+03	mg
Sampling Rate in Device	.700	acfm	.020	m3/min
Collection Temperature	385.0	F	196.1	C
Percent Isokinetic	96.9	%	96.9	%
Nominal Mass Concentration	.344E+00	gr/dscf	.788E+00	g/m3
	.492E-04	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Inlet 4
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Inlet
 Type of Sizing Device : UWVD
 Run Date : 4/15/94
 Start time : 1:10

Nominal Mass Concentration .344E+00 gr/dscf .788E+00 g/m3
 .492E-04 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP (gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2		.026		34.24	.959E-02	.219E-01
	11.72		.974			
3		.346		7.67	.324E+00	.741E+00
	5.02		.628			
4		.329		3.52	.368E+00	.841E+00
	2.47		.299			
5		.161		1.83	.213E+00	.487E+00
	1.36		.139			
6		.078		1.11	.156E+00	.356E+00
	.91		.060			
7		.036		.80	.112E+00	.256E+00
	.71		.024			
8		.014		.62	.434E-01	.993E-01
	.55		.010			
9		.006		.48	.174E-01	.398E-01
	.42		.005			
10		.003		.38	.129E-01	.296E-01
	.35		.002			
FILTER		.002		.19	.103E-02	.235E-02
	.10		.000			

Run ID : Outlet 1
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/11/94
 Start time : 20:55

REMARKS:

Average Flue Gas Temperature	382.0	F	194.4	C
Flue Gas Pressure (Absolute)	29.92	"Hg	76.00	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.166E-04	lb-sec/ft2	.247E-03	Poise
Flue Gas Mean Free Path	.455E-05	inch	.115E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	61.0242	fps	18.6002	m/s
Average Flue Gas Flowrate	287569.	acfm	8144.	m3/min
	162233.	dscfm	4594.	m3/min
Volume Sampled (Dry, STP)	366.9825	dscf	10.3929	m3
Test Duration	1006.	min	1006.	min
Total Catch	.123E-03	lb	.557E+02	mg
Sampling Rate in Device	.647	acfm	.018	m3/min
Collection Temperature	382.0	F	194.4	C
Percent Isokinetic	94.6	%	94.6	%
Nominal Mass Concentration	.234E-02	gr/dscf	.536E-02	g/m3
	.335E-06	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Outlet 1
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/11/94
 Start time : 20:55

Nominal Mass Concentration .234E-02 gr/dscf .536E-02 g/m3
 .335E-06 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP (gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2	12.19	.362	.638	34.91	.929E-03	.213E-02
3	5.22	.256	.382	7.98	.163E-02	.373E-02
4	2.57	.157	.225	3.66	.120E-02	.274E-02
5	1.42	.058	.166	1.91	.525E-03	.120E-02
6	.95	.052	.114	1.16	.707E-03	.162E-02
7	.74	.024	.091	.84	.507E-03	.116E-02
8	.57	.018	.072	.65	.382E-03	.875E-03
9	.44	.021	.051	.50	.443E-03	.101E-02
10	.37	.024	.027	.40	.715E-03	.164E-02
FILTER	.10	.027	.000	.19	.112E-03	.257E-03

Run ID : Outlet 2
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/13/94
 Start time : 2:20

REMARKS:

Average Flue Gas Temperature	374.0	F	190.0	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.165E-04	lb-sec/ft2	.246E-03	Poise
Flue Gas Mean Free Path	.446E-05	inch	.113E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	59.6407	fps	18.1785	m/s
Average Flue Gas Flowrate	281050.	acfm	7959.	m3/min
	161253.	dscfm	4567.	m3/min
Volume Sampled (Dry, STP)	127.3540	dscf	3.6067	m3
Test Duration	347.	min	347.	min
Total Catch	.422E-04	lb	.191E+02	mg
Sampling Rate in Device	.640	acfm	.018	m3/min
Collection Temperature	374.0	F	190.0	C
Percent Isokinetic	95.7	%	95.7	%
Nominal Mass Concentration	.232E-02	gr/dscf	.531E-02	g/m3
	.332E-06	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Outlet 2
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/13/94
 Start time : 2:20

Nominal Mass Concentration .232E-02 gr/dscf .531E-02 g/m3
 .332E-06 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP	
					(gr/dscf)	(g/m3)
Rt Angle+1+2	100.00		1.000			
	12.22	.191	.809	34.95	.486E-03	.111E-02
3	5.23	.186	.622	8.00	.118E-02	.269E-02
4	2.58	.137	.485	3.67	.104E-02	.237E-02
5	1.42	.100	.385	1.91	.893E-03	.204E-02
6	.96	.083	.303	1.17	.111E-02	.254E-02
7	.74	.058	.245	.84	.122E-02	.280E-02
8	.57	.054	.191	.65	.111E-02	.255E-02
9	.44	.056	.135	.50	.117E-02	.268E-02
10	.37	.080	.054	.40	.237E-02	.543E-02
FILTER	.10	.054	.000	.19	.222E-03	.508E-03

Run ID : Outlet 3
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/13/94
 Start time : 23:55

REMARKS:

Average Flue Gas Temperature	374.0	F	190.0	C
Flue Gas Pressure (Absolute)	30.14	"Hg	76.56	cm Hg
Flue Gas Static Pressure	3.00	"H2O	7.620	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.165E-04	lb-sec/ft2	.246E-03	Poise
Flue Gas Mean Free Path	.446E-05	inch	.113E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	51.1415	fps	15.5879	m/s
Average Flue Gas Flowrate	240998.	acfm	6825.	m3/min
	138273.	dscfm	3916.	m3/min
Volume Sampled (Dry, STP)	194.4603	dscf	5.5071	m3
Test Duration	485.	min	485.	min
Total Catch	.407E-04	lb	.185E+02	mg
Sampling Rate in Device	.699	acfm	.020	m3/min
Collection Temperature	374.0	F	190.0	C
Percent Isokinetic	122.0	%	122.0	%
Nominal Mass Concentration	.147E-02	gr/dscf	.335E-02	g/m3
	.209E-06	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

Run ID : Outlet 3
 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/13/94
 Start time : 23:55

Nominal Mass Concentration .147E-02 gr/dscf .335E-02 g/m3
 .209E-06 lb/dscf

Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP (gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2	11.68	.171	.829	34.18	.269E-03	.615E-03
3	5.00	.086	.743	7.64	.340E-03	.779E-03
4	2.46	.123	.620	3.51	.588E-03	.135E-02
5	1.35	.111	.509	1.83	.626E-03	.143E-02
6	.91	.100	.409	1.11	.845E-03	.193E-02
7	.71	.088	.321	.80	.117E-02	.268E-02
8	.54	.089	.232	.62	.116E-02	.266E-02
9	.42	.090	.142	.48	.117E-02	.268E-02
10	.35	.083	.058	.38	.154E-02	.352E-02
FILTER	.10	.058	.000	.19	.158E-03	.360E-03

```

Run ID           : Outlet 4
Plant & Unit      : AEP PFBC
Sampling Location : ESP Outlet
Type of Sizing Device : UWVD
Run Date         : 4/14/94
Start time       : 22:28
  
```

REMARKS:

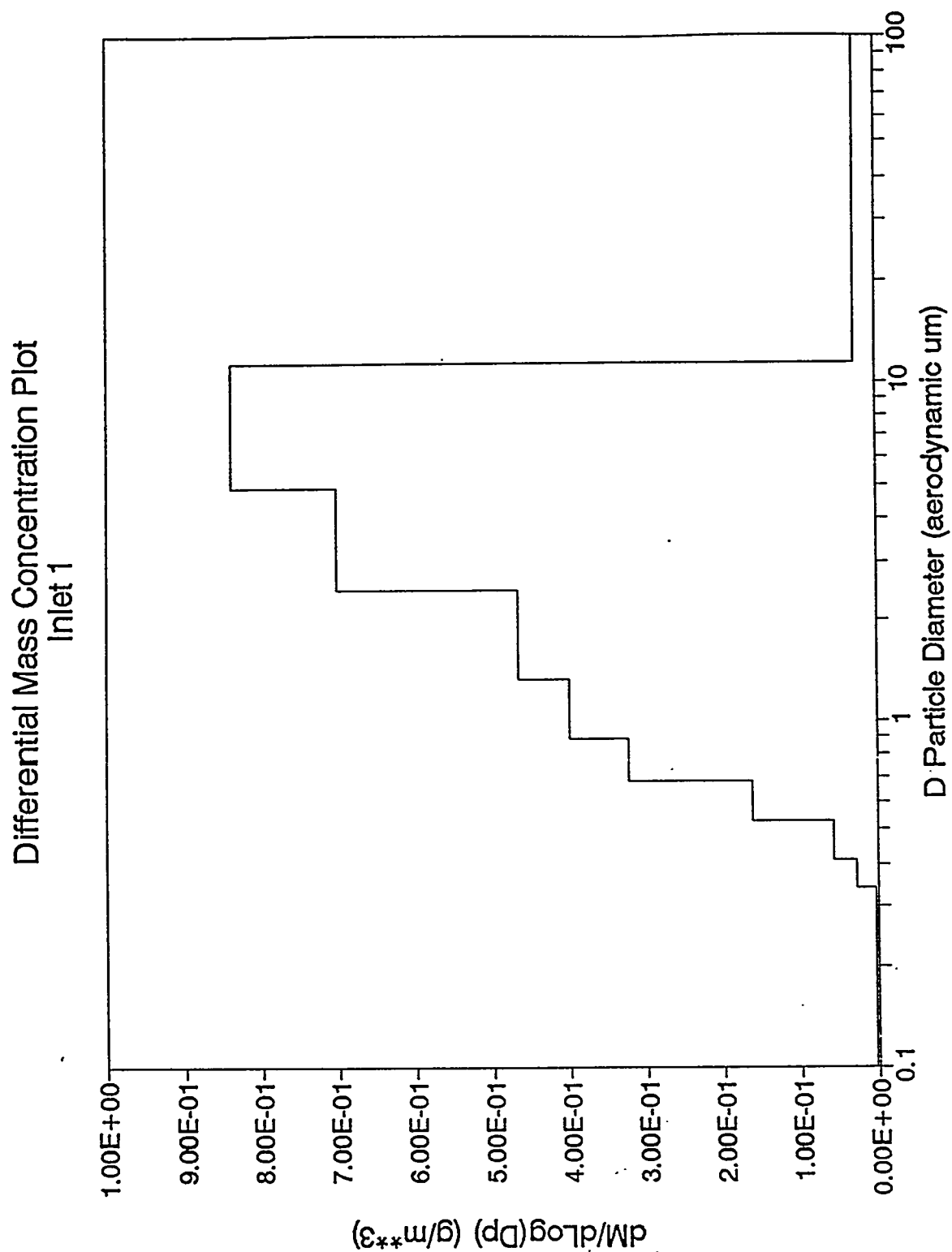
Average Flue Gas Temperature	374.0	F	190.0	C
Flue Gas Pressure (Absolute)	29.54	"Hg	75.04	cm Hg
Flue Gas Static Pressure	1.80	"H2O	4.572	cm H2O
Flue Gas Molecular Weight (Wet)	27.26	lb/lb-mole	27.2624	g/g-mole
Flue Gas Viscosity	.165E-04	lb-sec/ft2	.246E-03	Poise
Flue Gas Mean Free Path	.455E-05	inch	.116E-04	cm
Flue Gas Percent Moisture	10.00	%	10.00	%
Average Flue Gas Velocity	61.1210	fps	18.6297	m/s
Average Flue Gas Flowrate	288026.	acfm	8157.	m3/min
	161976.	dscfm	4587.	m3/min
Volume Sampled (Dry, STP)	297.2570	dscf	8.4183	m3
Test Duration	747.	min	747.	min
Total Catch	.766E-04	lb	.347E+02	mg
Sampling Rate in Device	.707	acfm	.020	m3/min
Collection Temperature	374.0	F	190.0	C
Percent Isokinetic	105.6	%	105.6	%
Nominal Mass Concentration	.180E-02	gr/dscf	.413E-02	g/m3
	.258E-06	lb/dscf		

Appendix C: Source Sampling Data Summary & PSD Plots

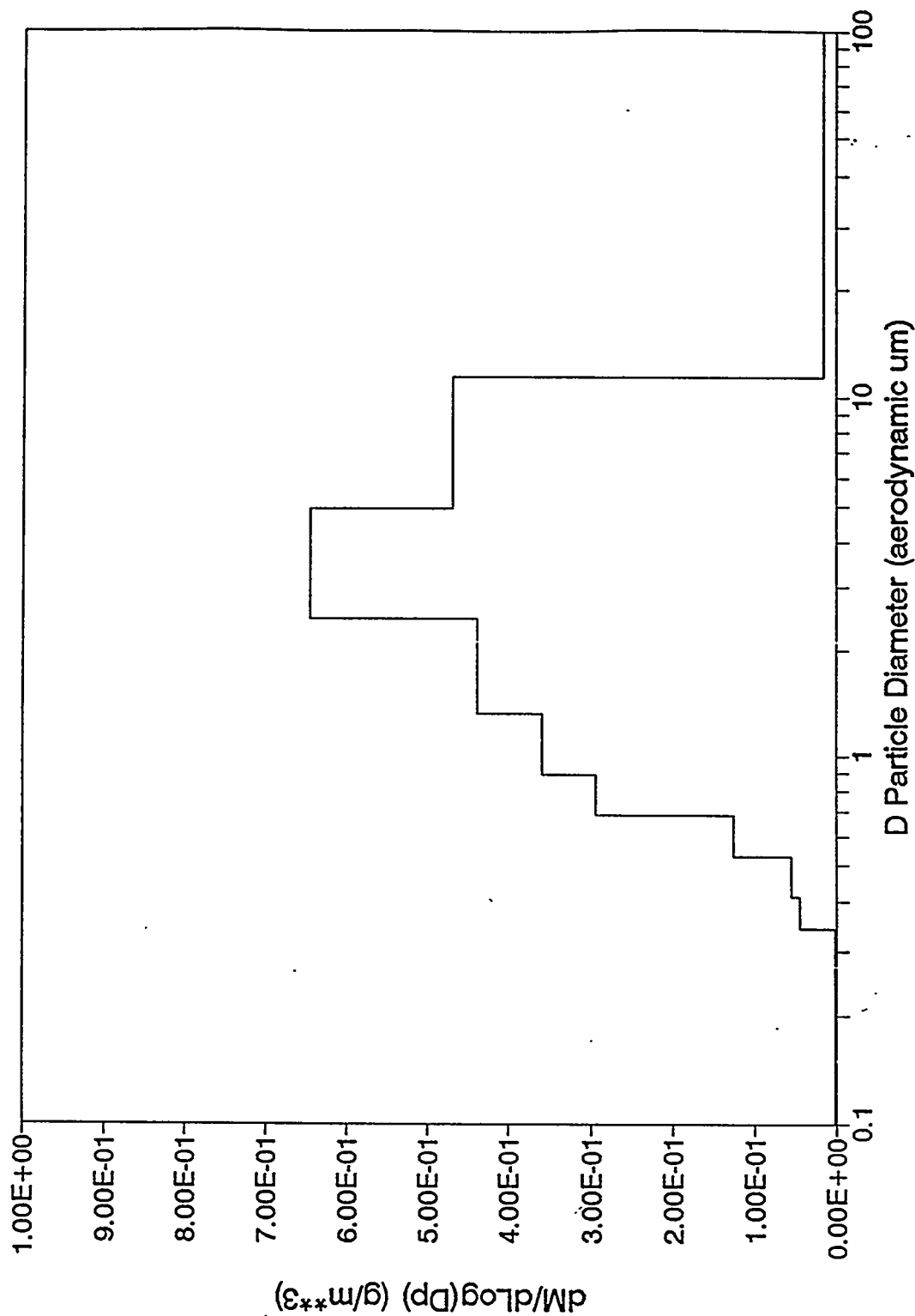
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 Plant & Unit : AEP PFBC
 Sampling Location : ESP Outlet
 Type of Sizing Device : UWVD
 Run Date : 4/14/94
 Start time : 22:28

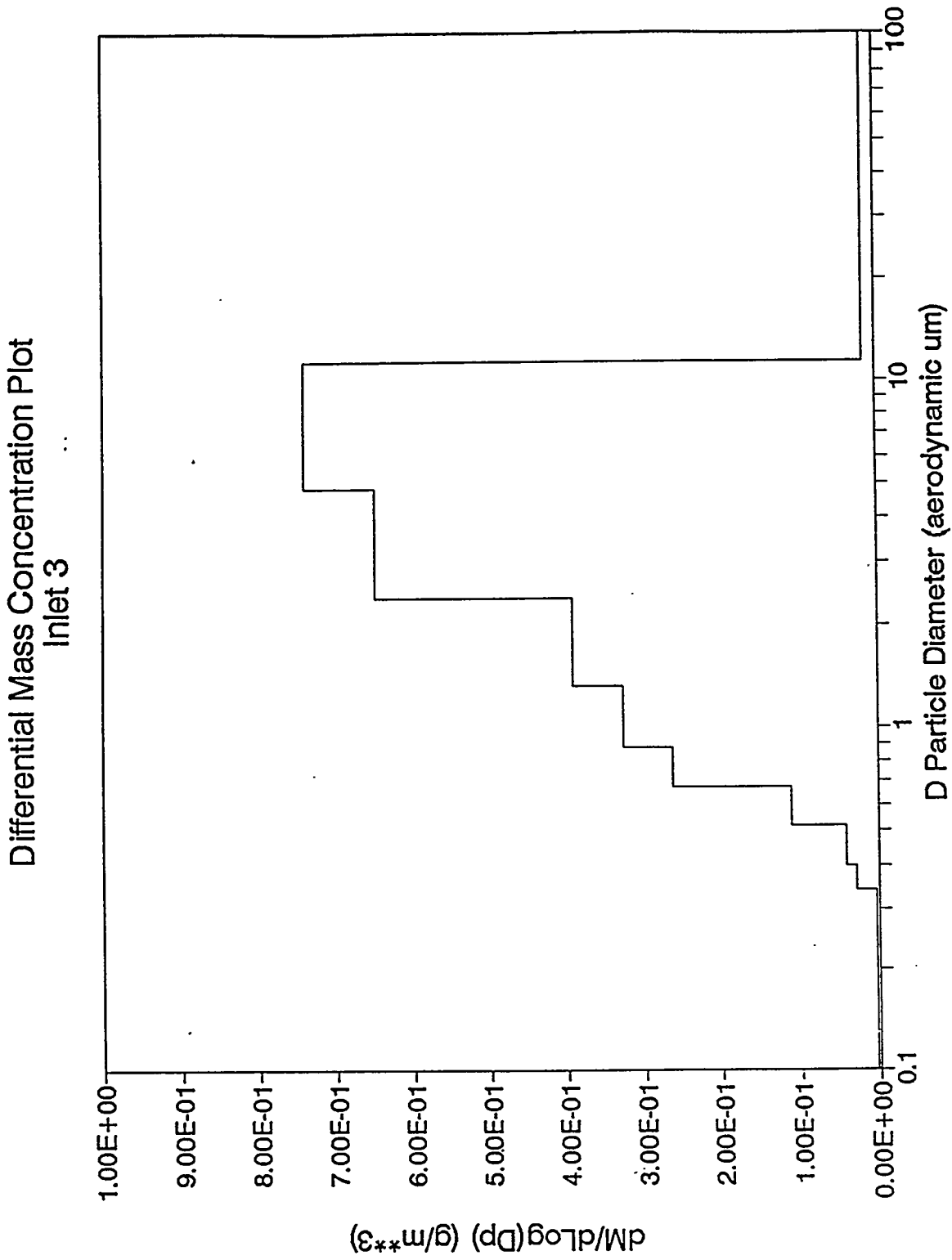
Nominal Mass Concentration .180E-02 gr/dscf .413E-02 g/m3
 .258E-06 lb/dscf

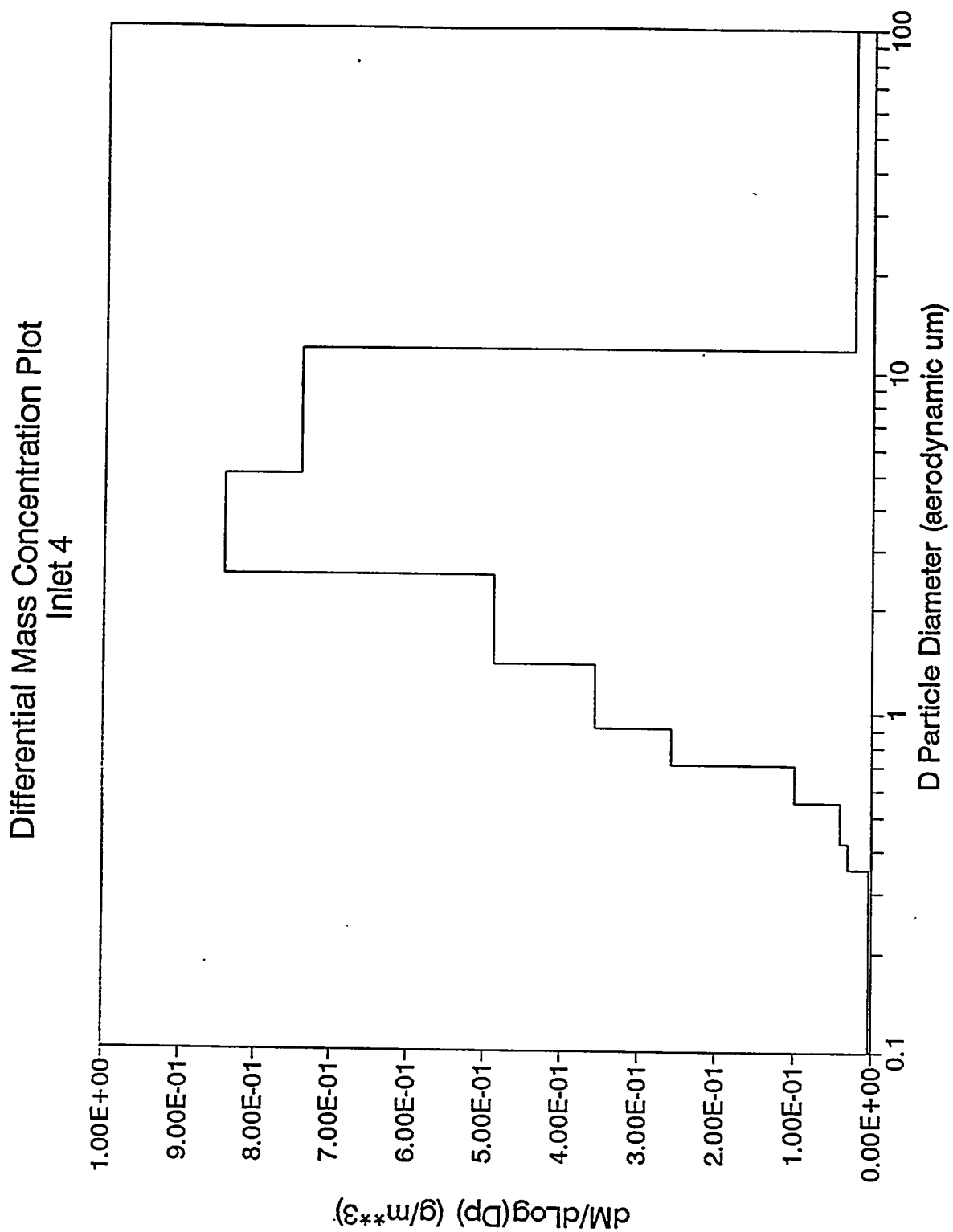
Stage Number	Interval Endpoint (um)	Mass Fraction	Mass Fraction Less Than	Interval Geometric Midpoint (um)	dM/d(logD) Dry, STP (gr/dscf)	(g/m3)
	100.00		1.000			
Rt Angle+1+2	11.60	.218	.782	34.07	.420E-03	.961E-03
3	4.97	.284	.498	7.59	.139E-02	.318E-02
4	2.44	.160	.338	3.48	.936E-03	.214E-02
5	1.34	.097	.241	1.81	.675E-03	.154E-02
6	.90	.061	.180	1.10	.639E-03	.146E-02
7	.70	.038	.141	.79	.623E-03	.143E-02
8	.54	.036	.106	.61	.570E-03	.130E-02
9	.42	.035	.070	.47	.566E-03	.130E-02
10	.35	.031	.039	.38	.704E-03	.161E-02
FILTER	.10	.039	.000	.19	.131E-03	.300E-03

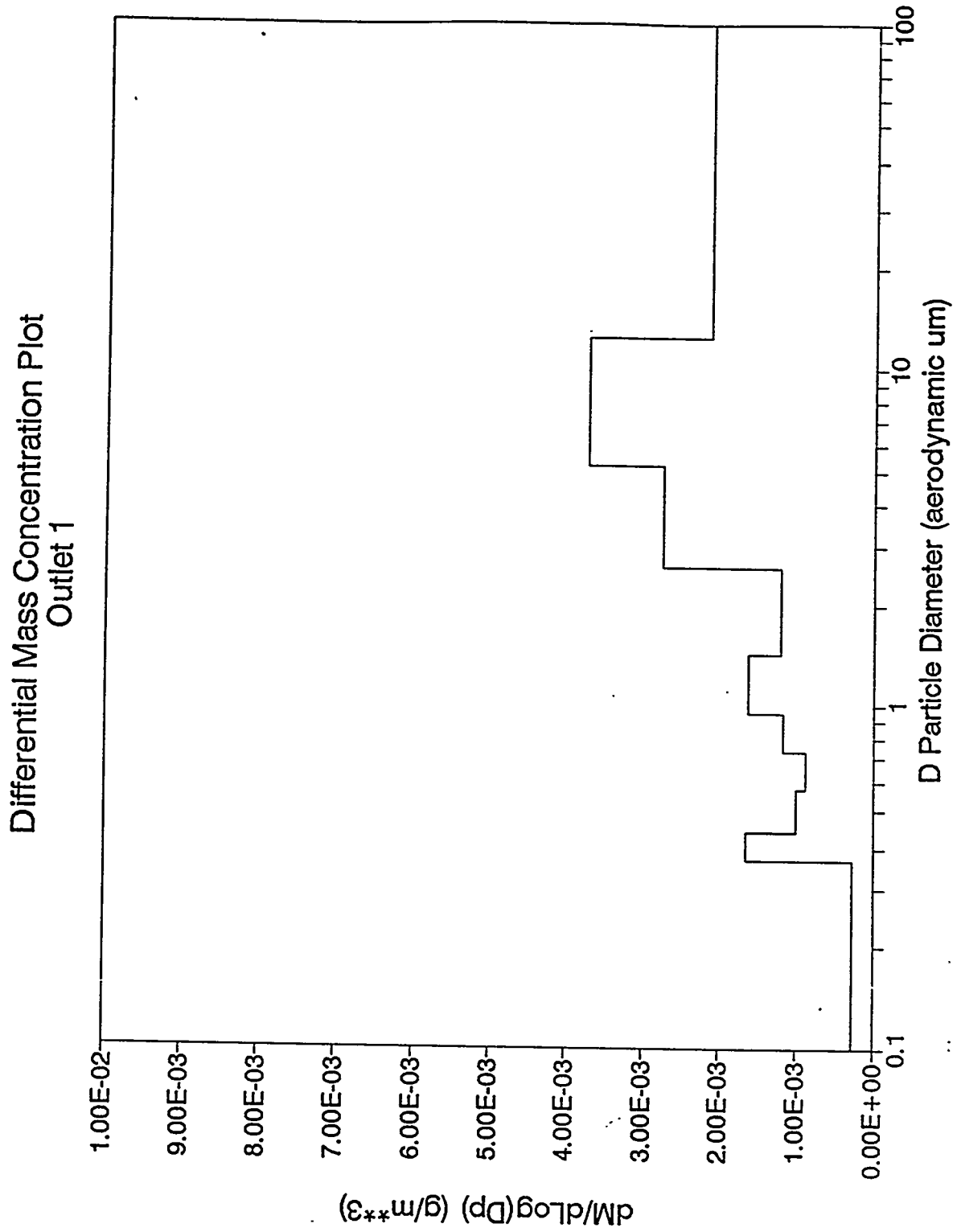


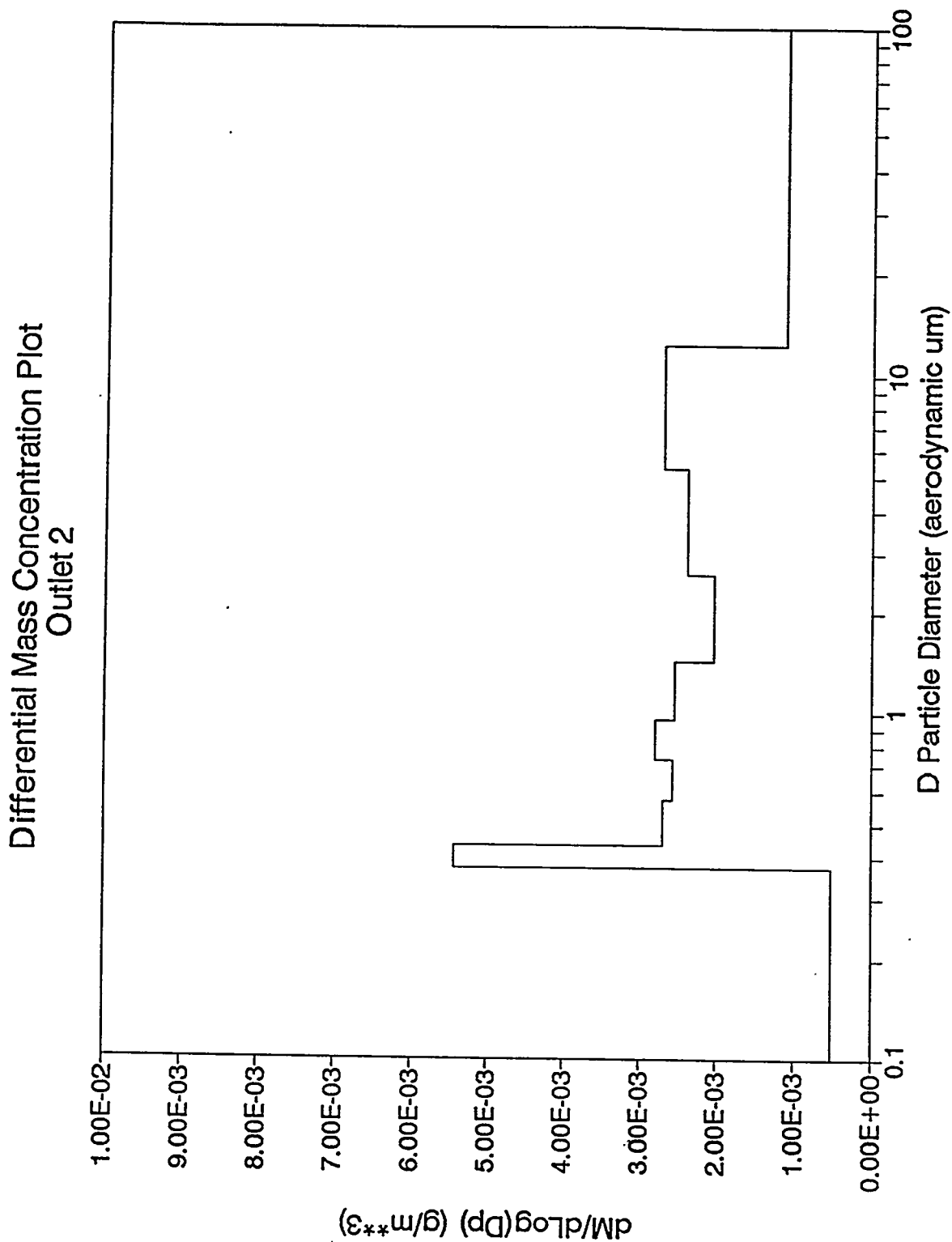
Differential Mass Concentration Plot
Inlet 2

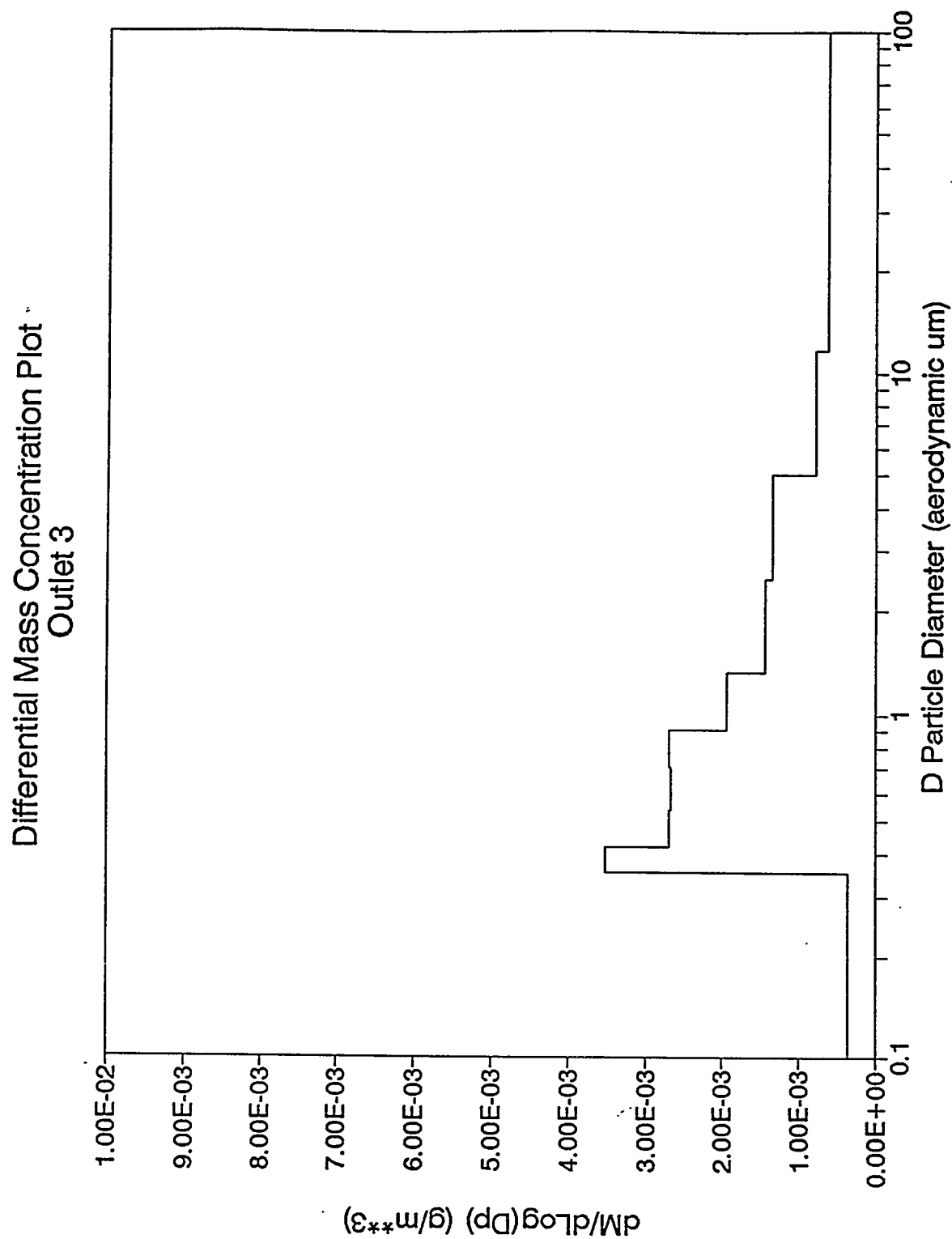




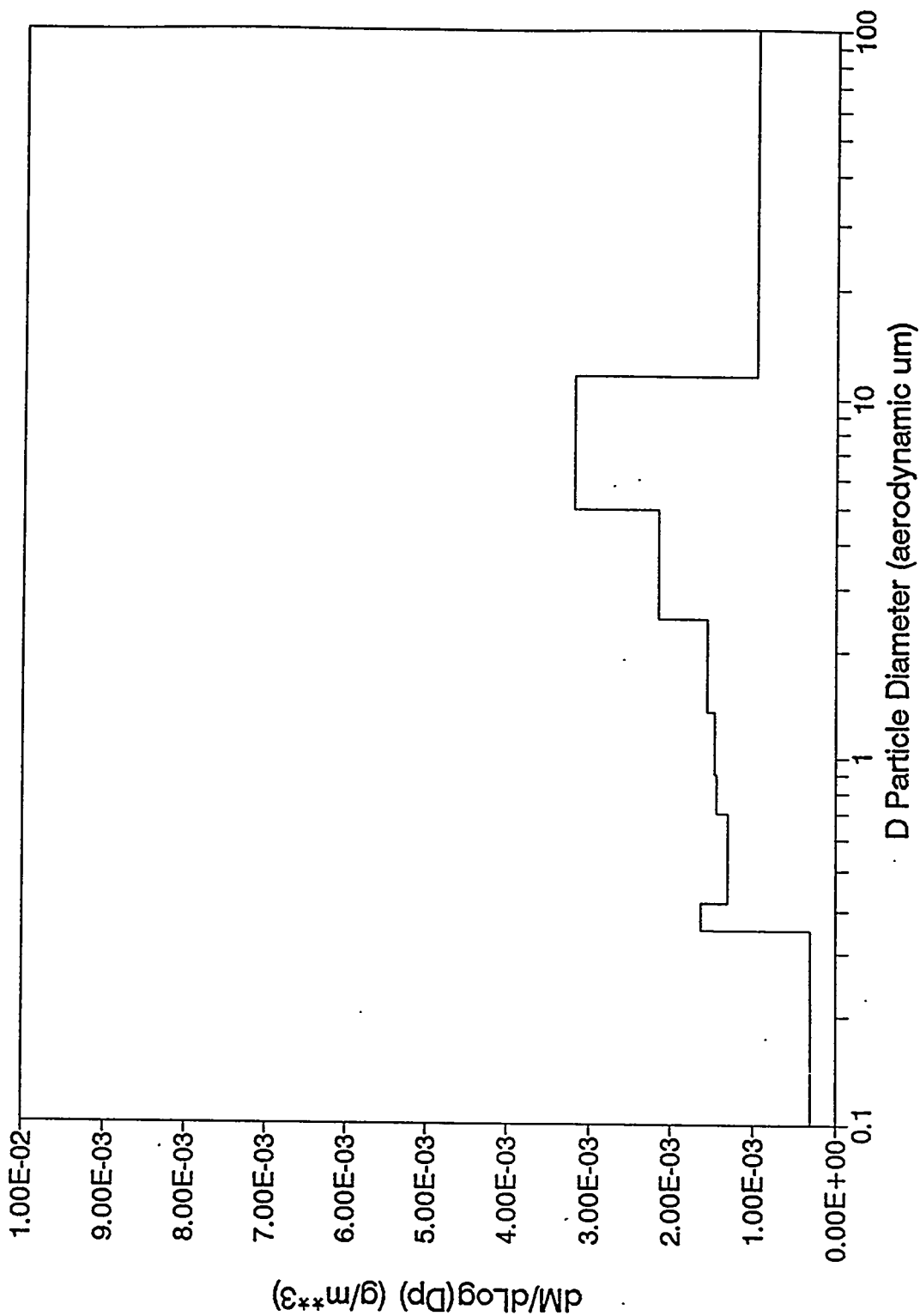


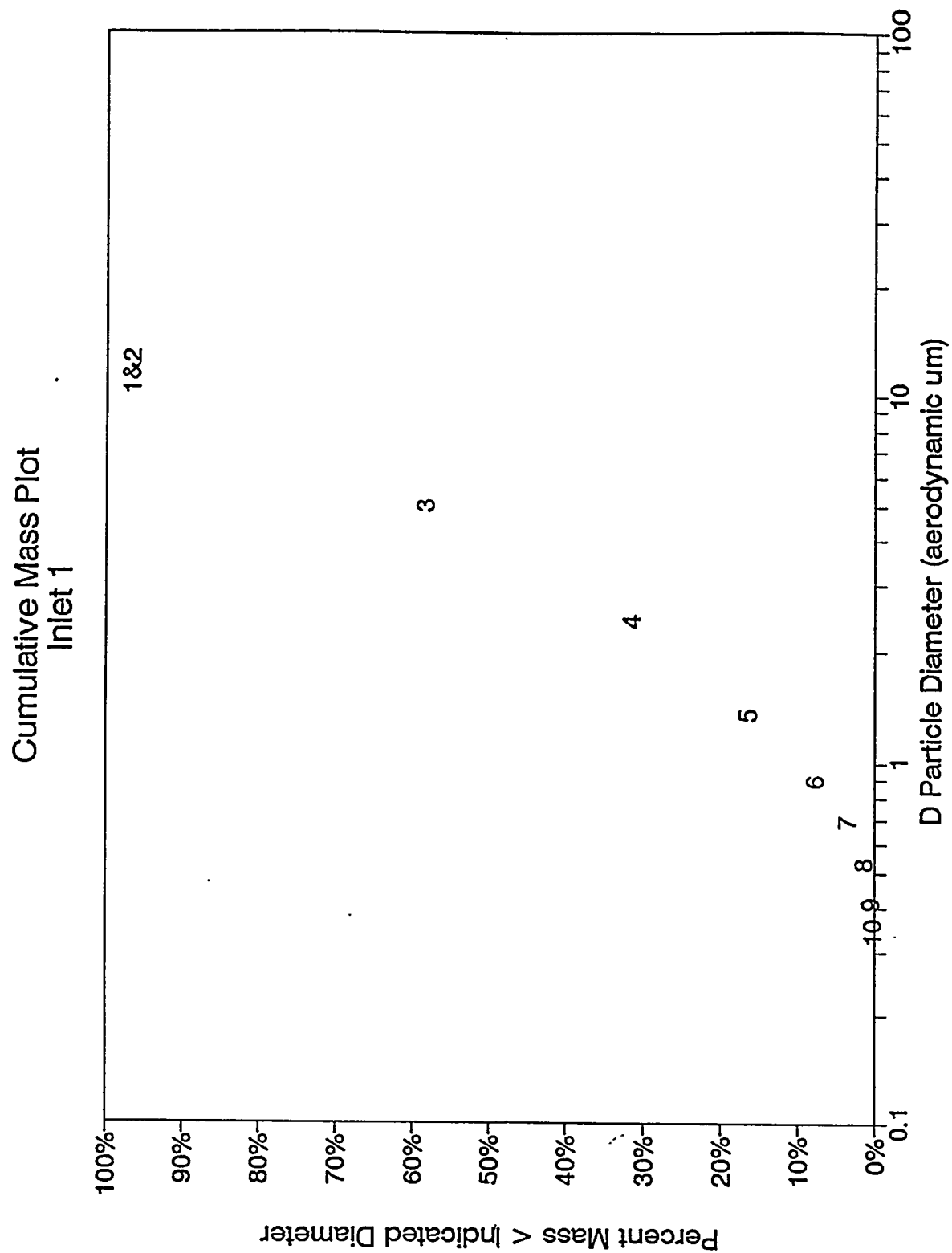


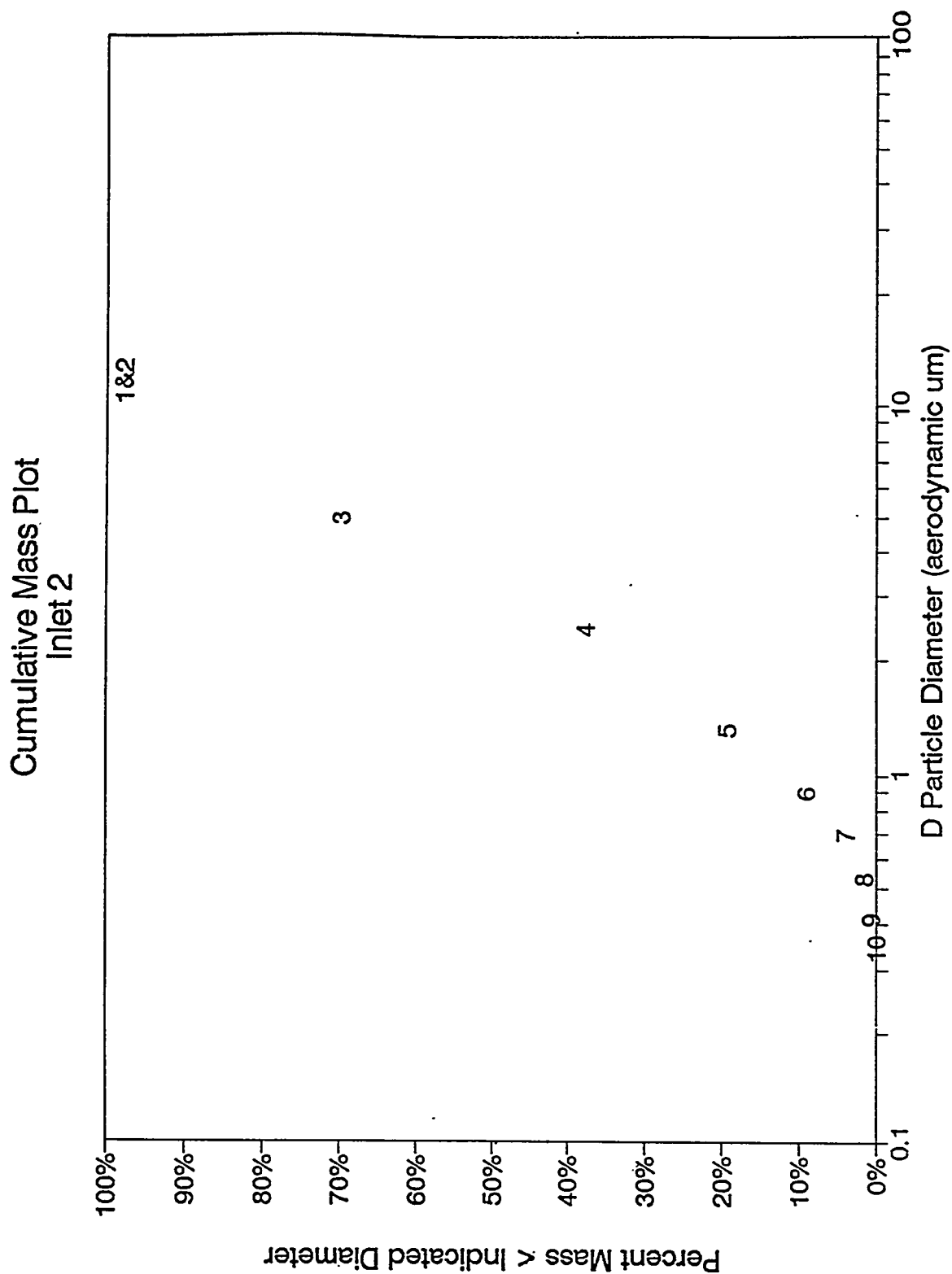


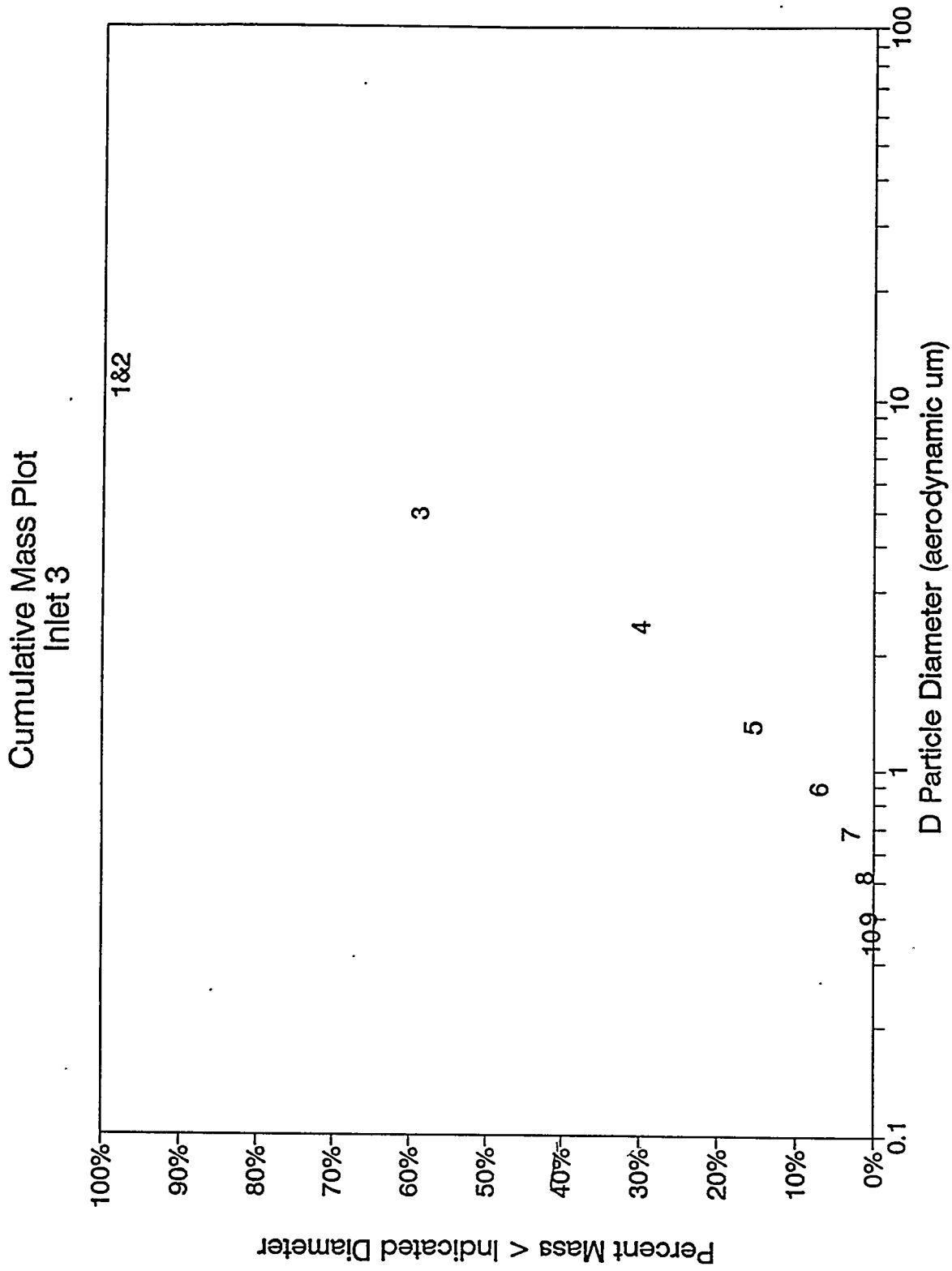


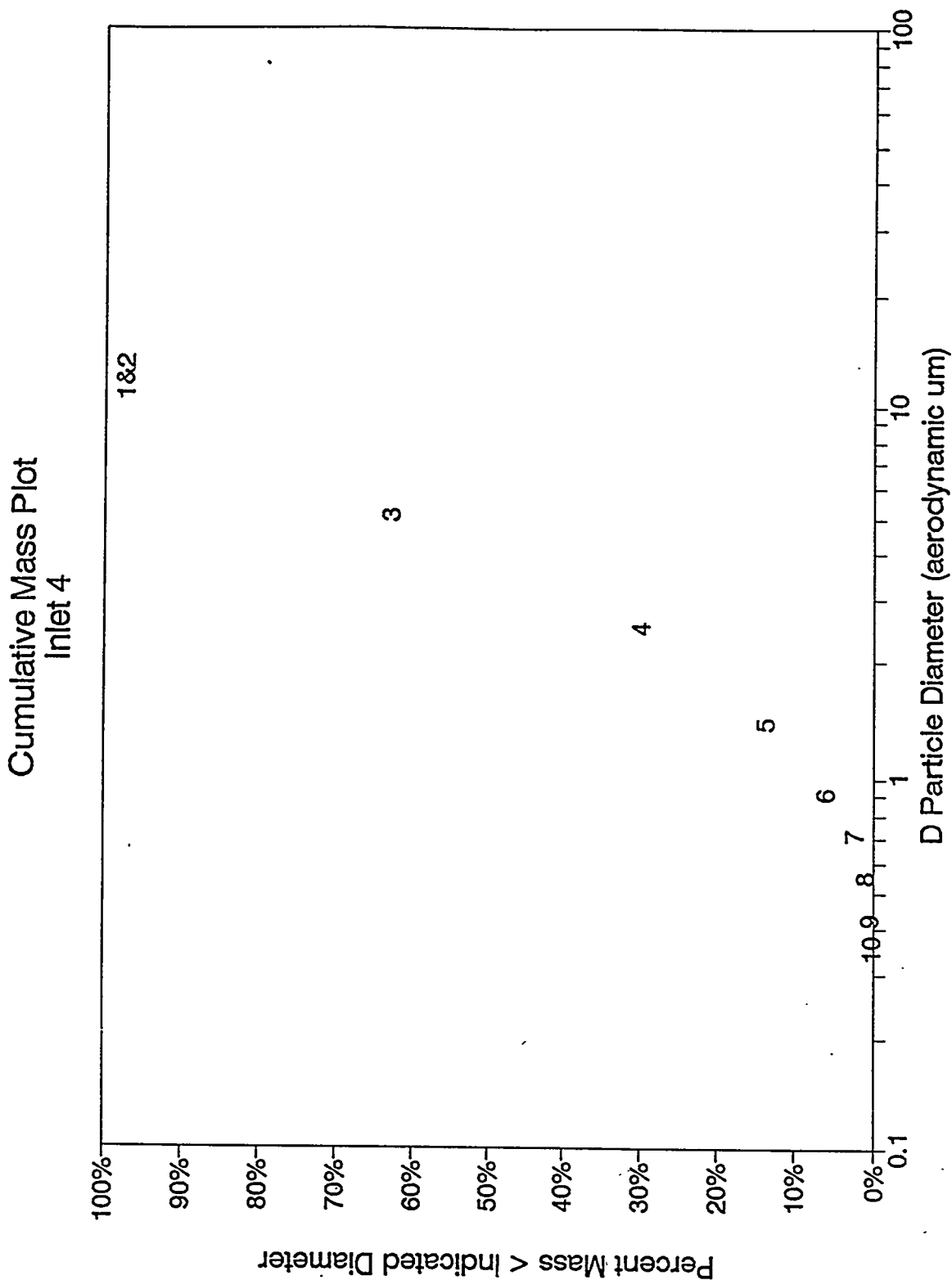
Differential Mass Concentration Plot
Outlet 4

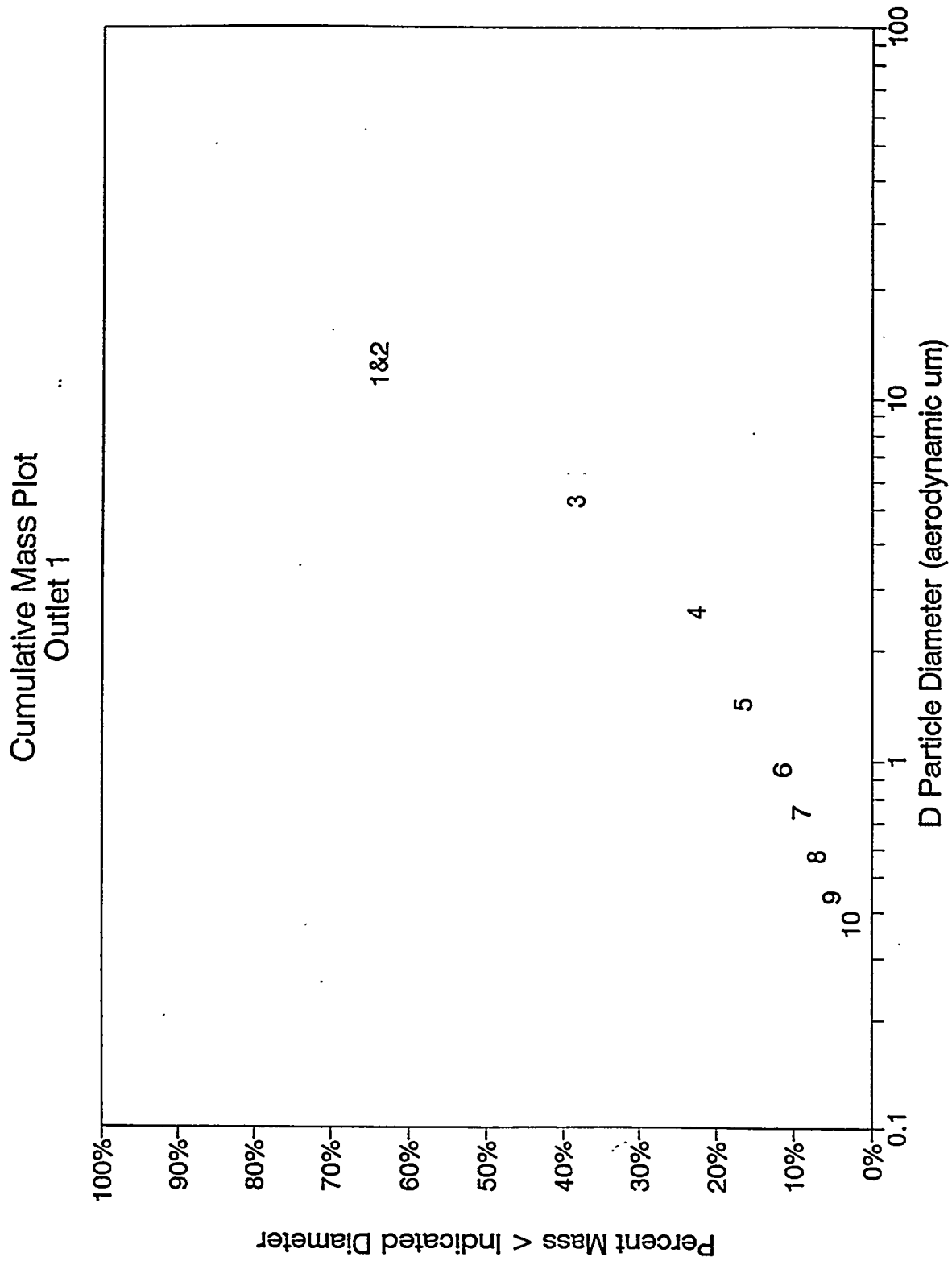


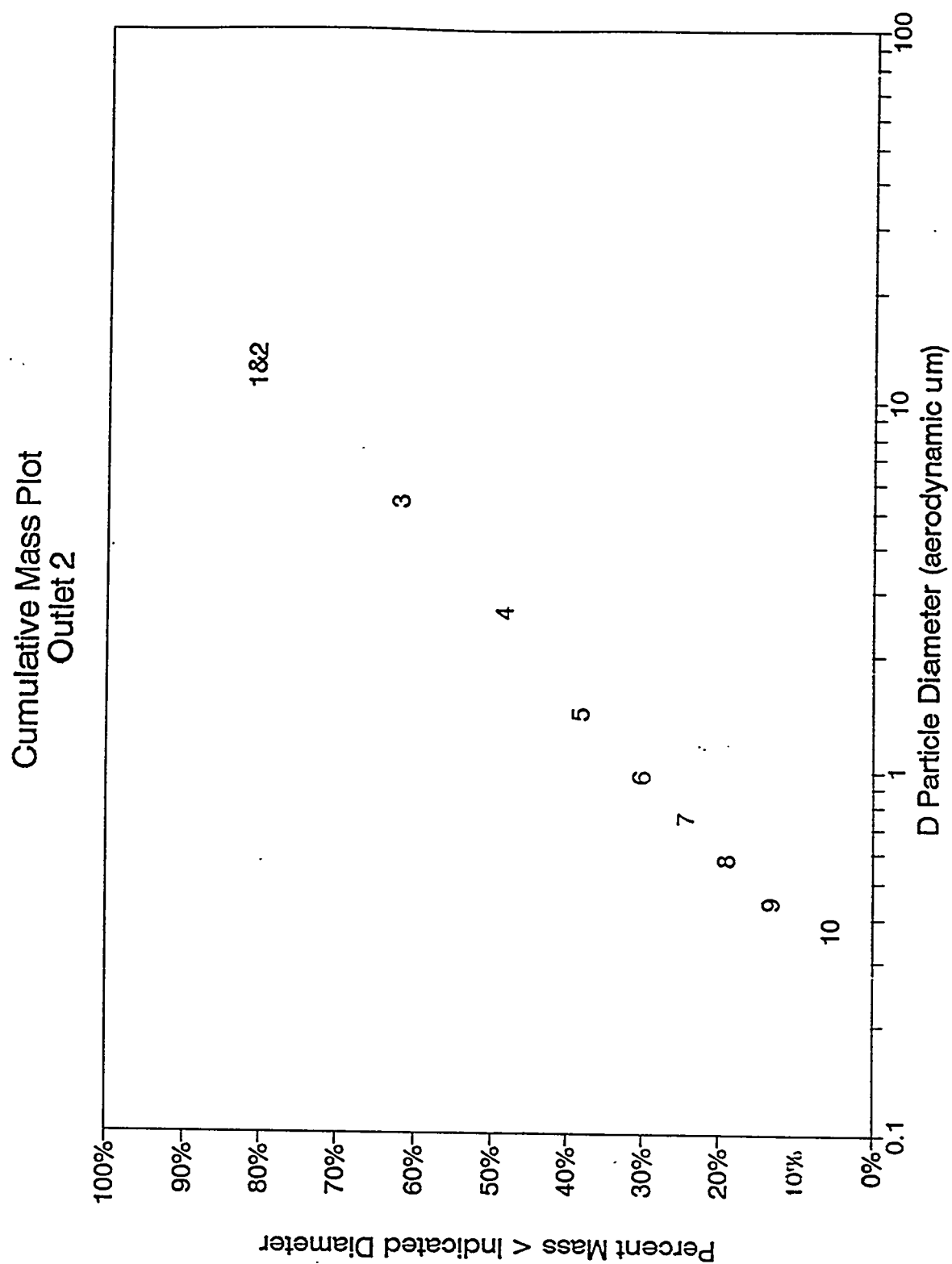


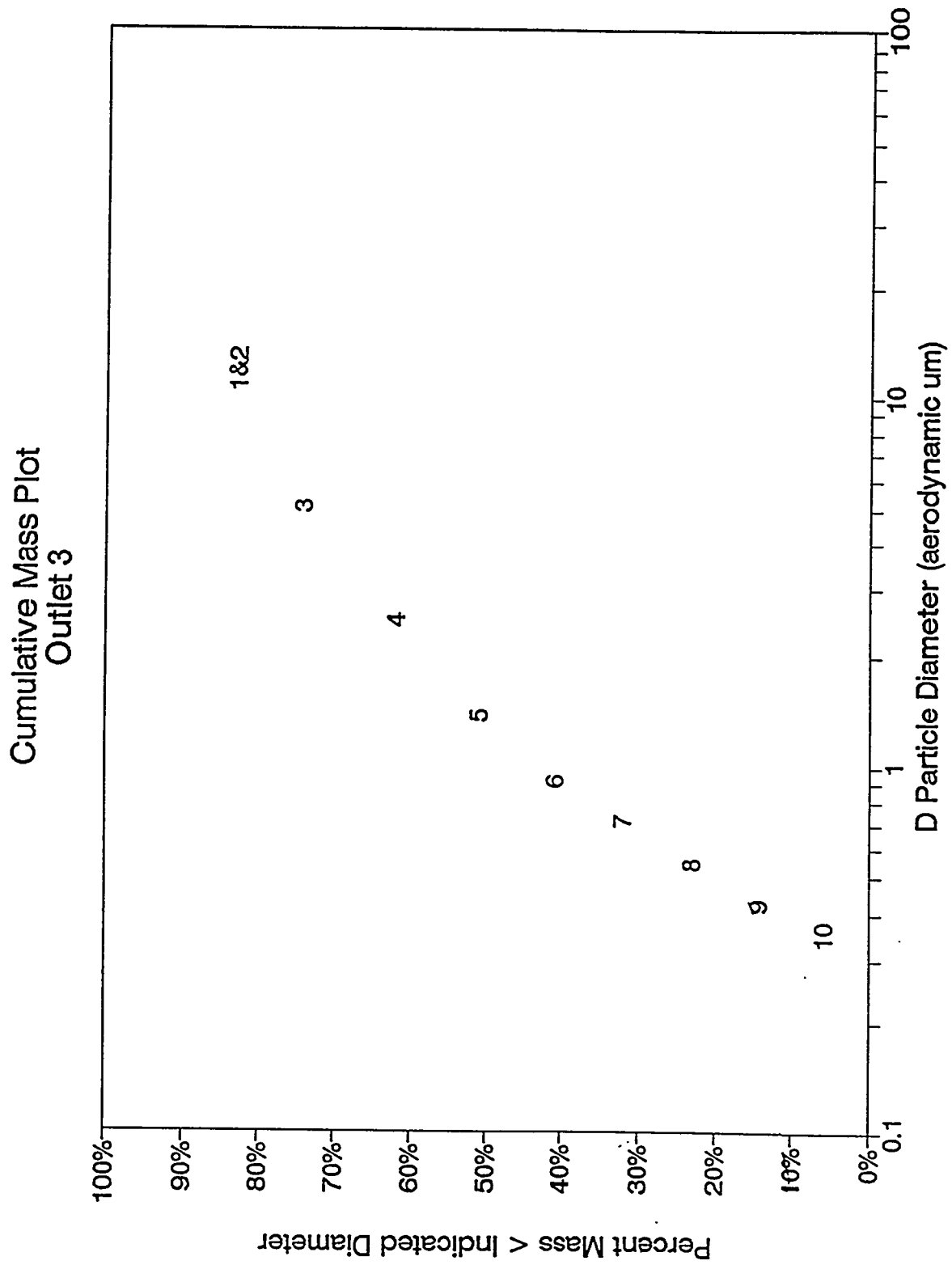


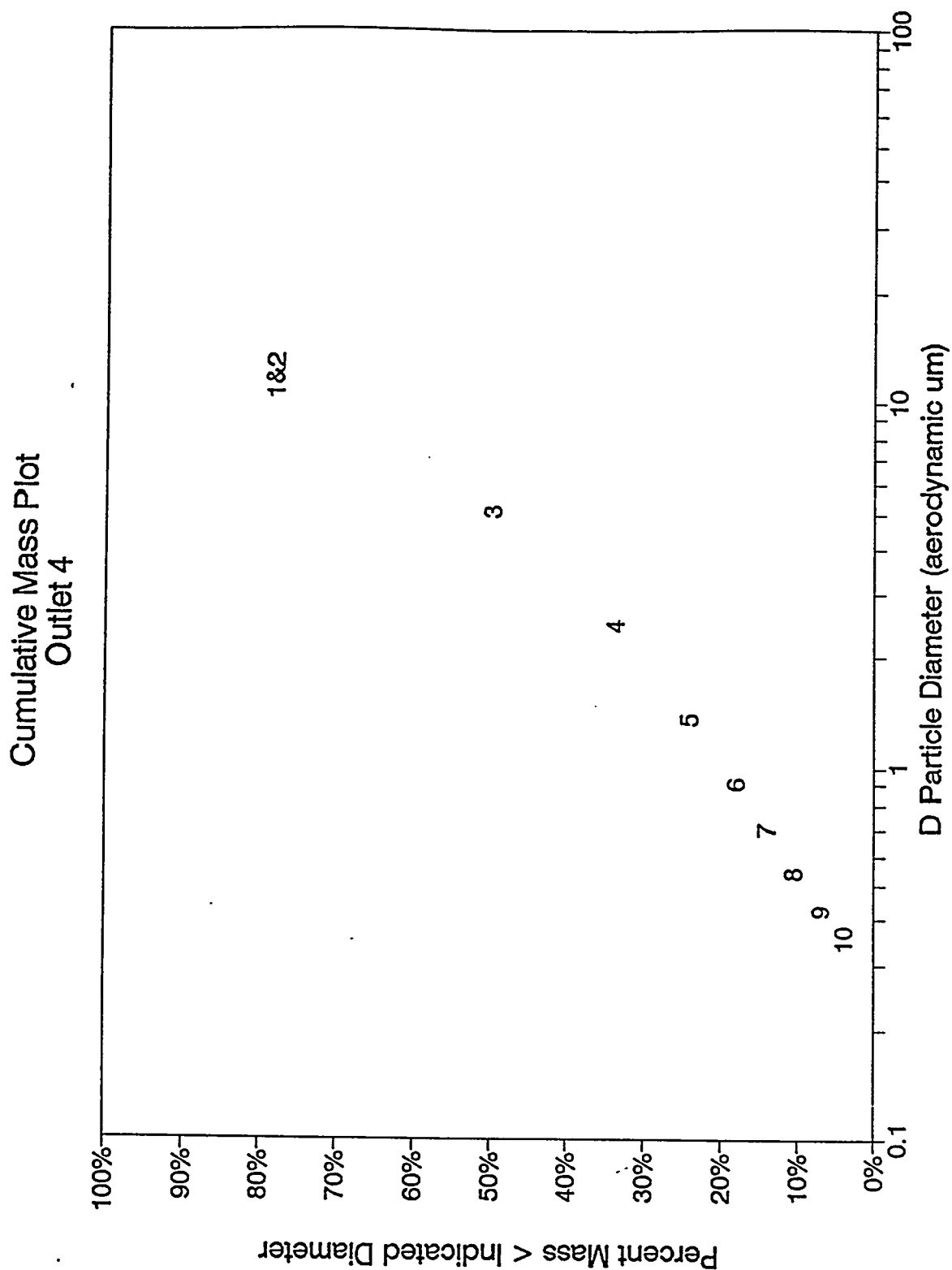


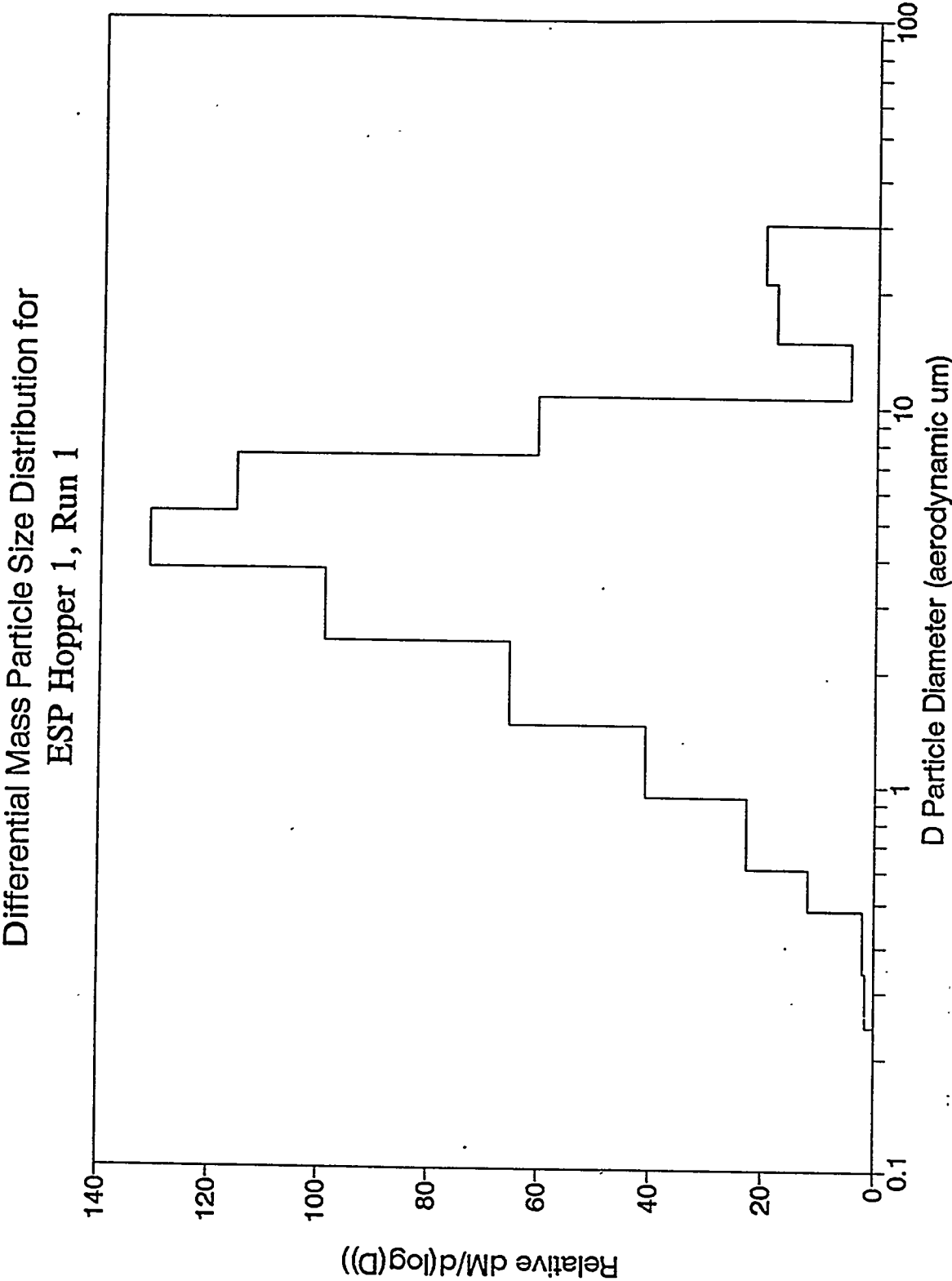


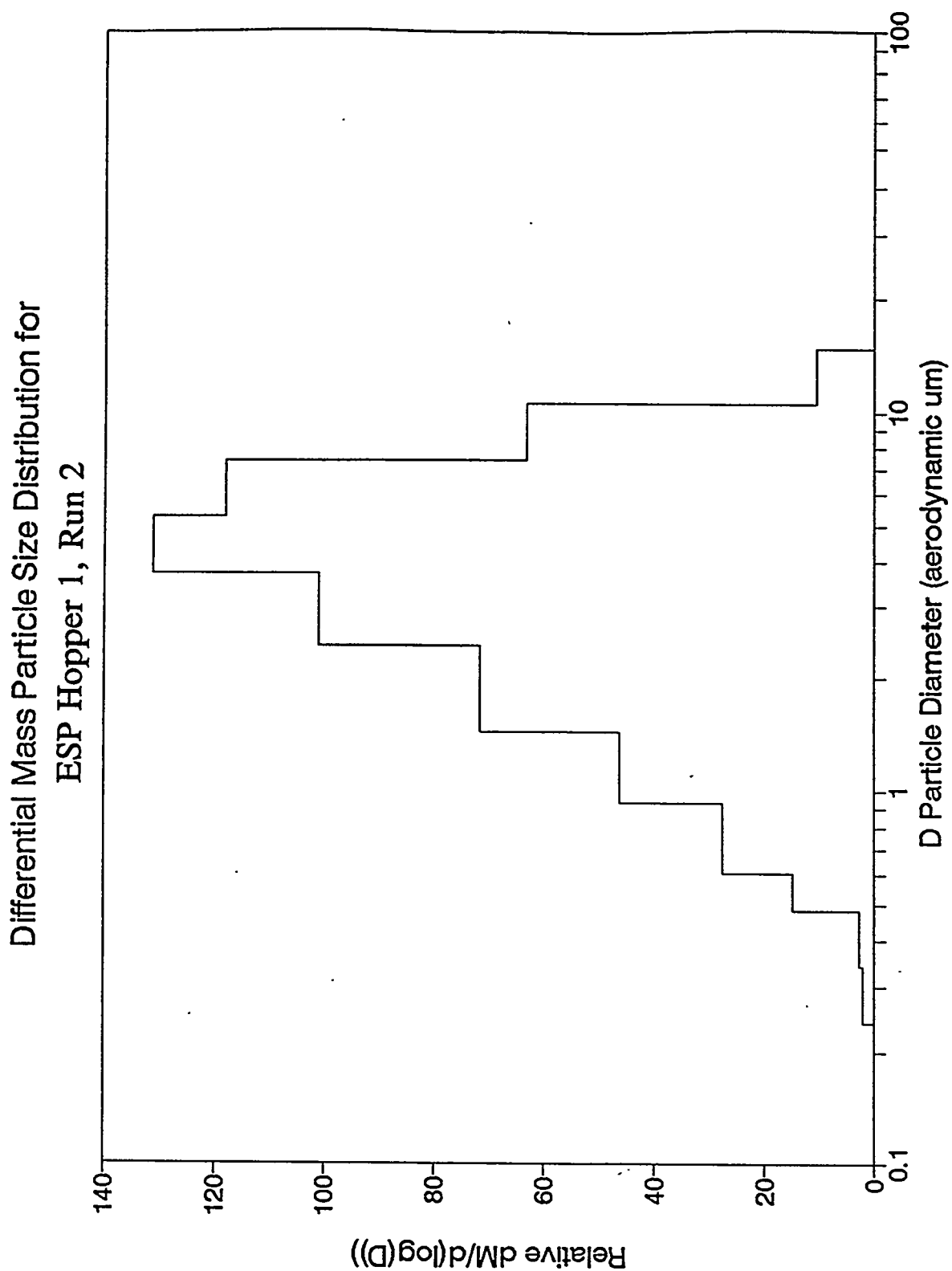




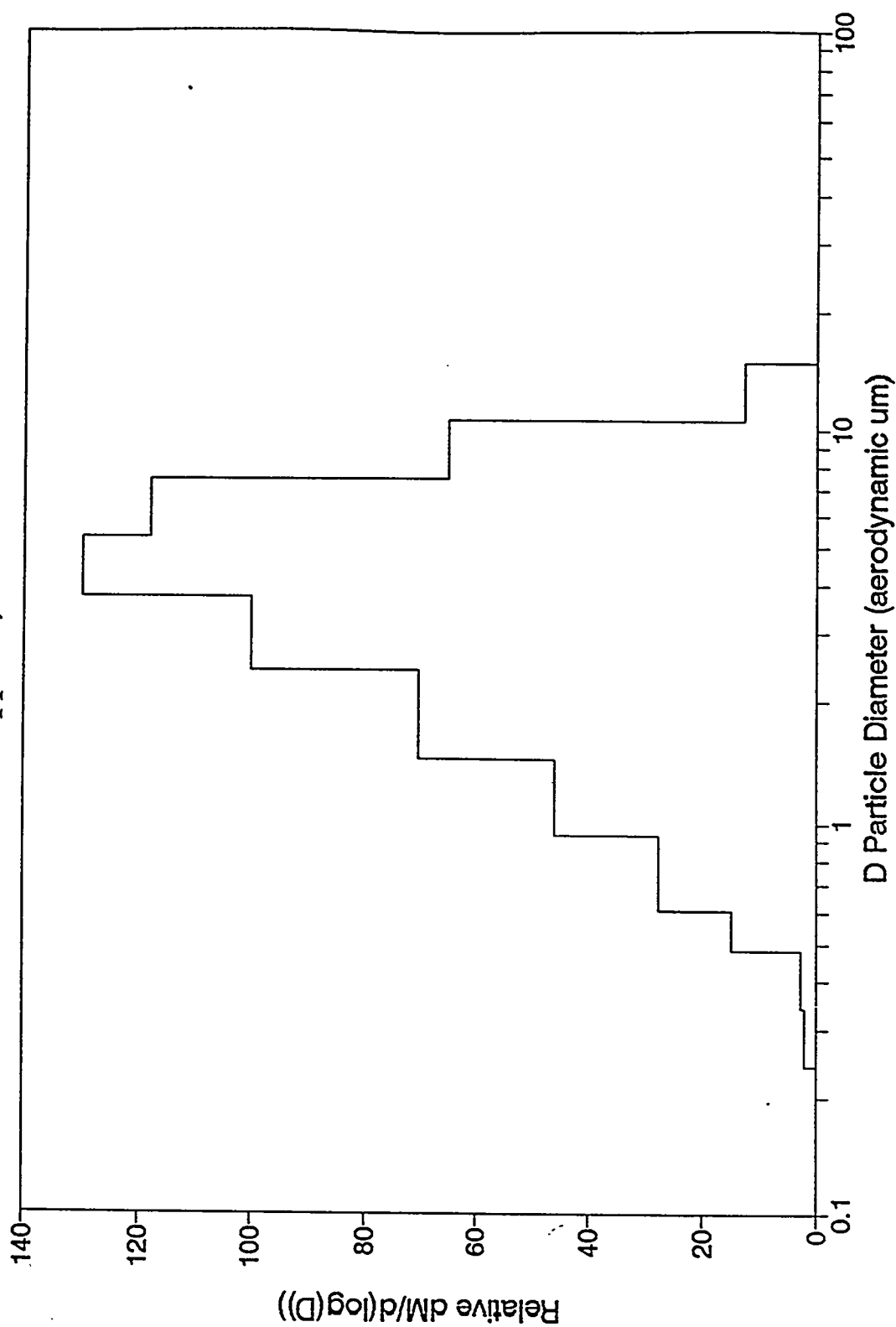


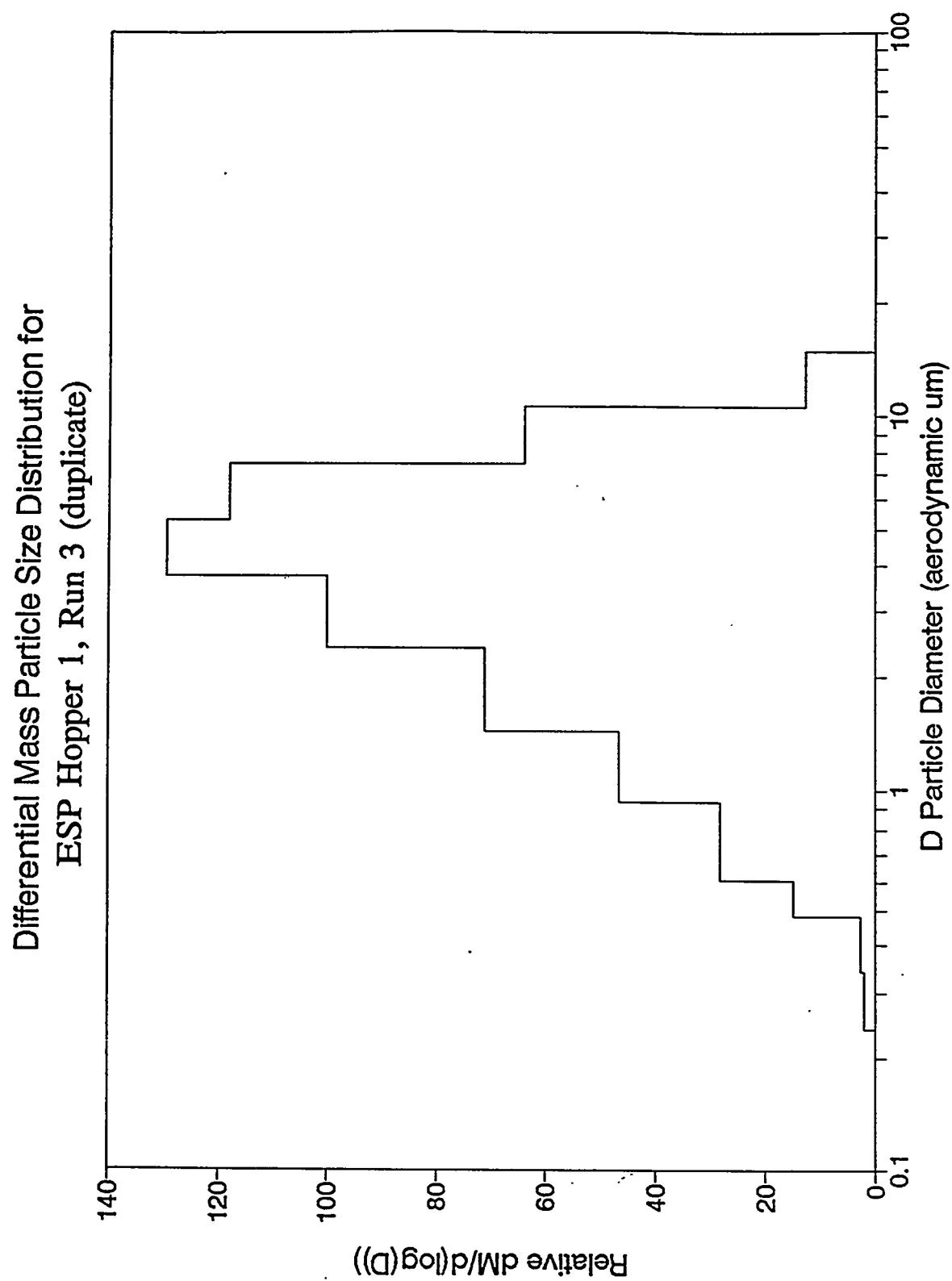


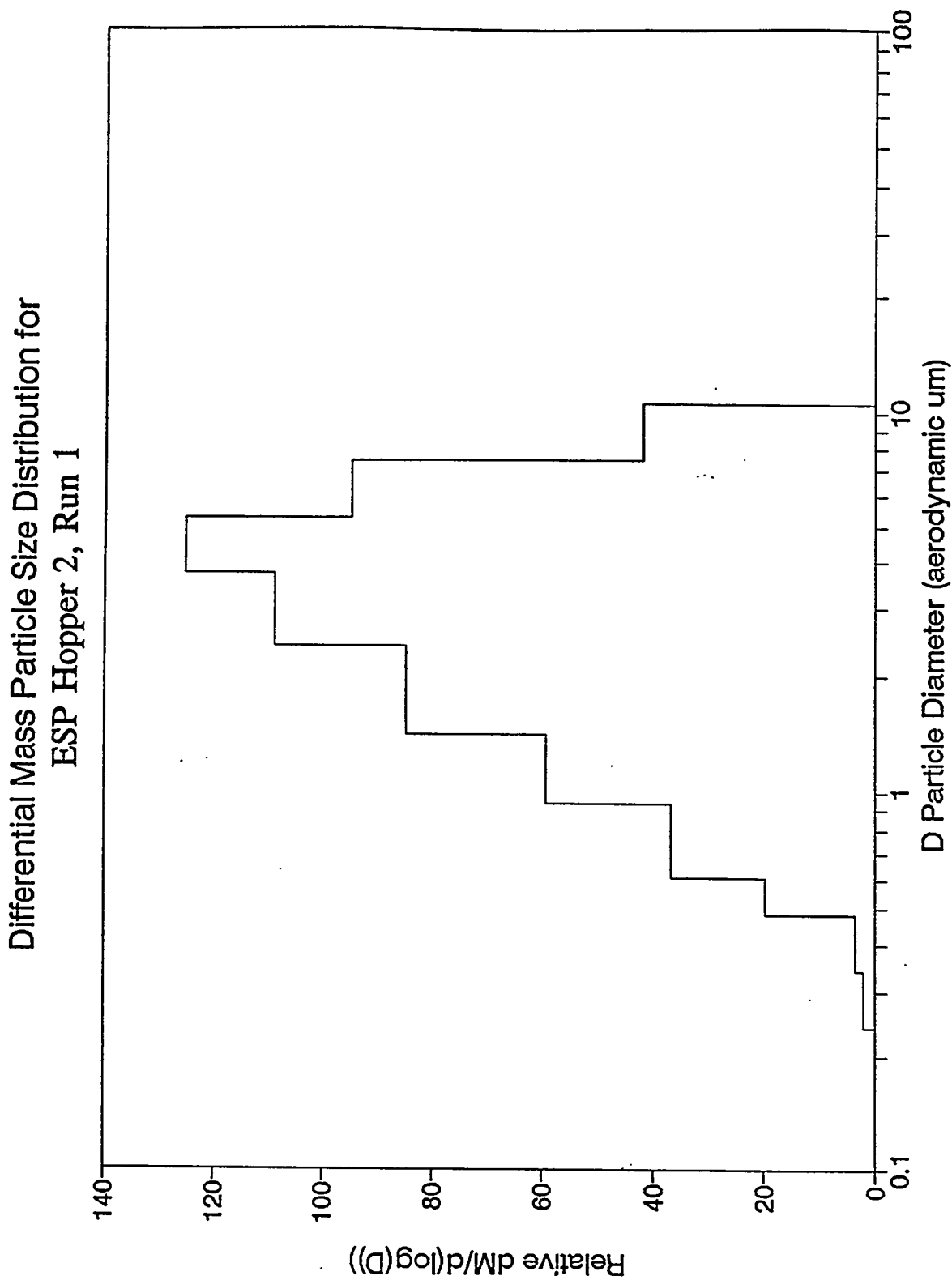




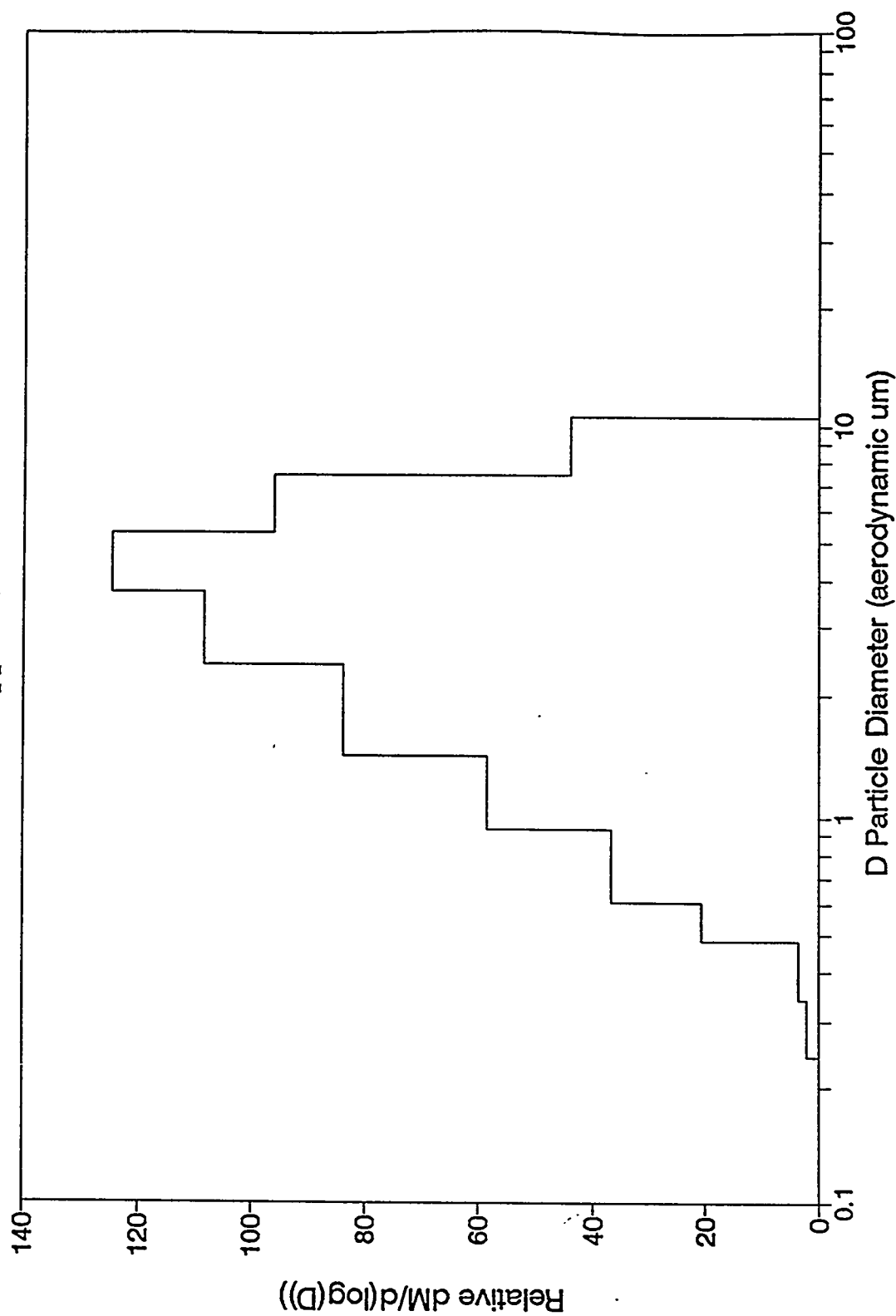
Differential Mass Particle Size Distribution for ESP Hopper 1, Run 3

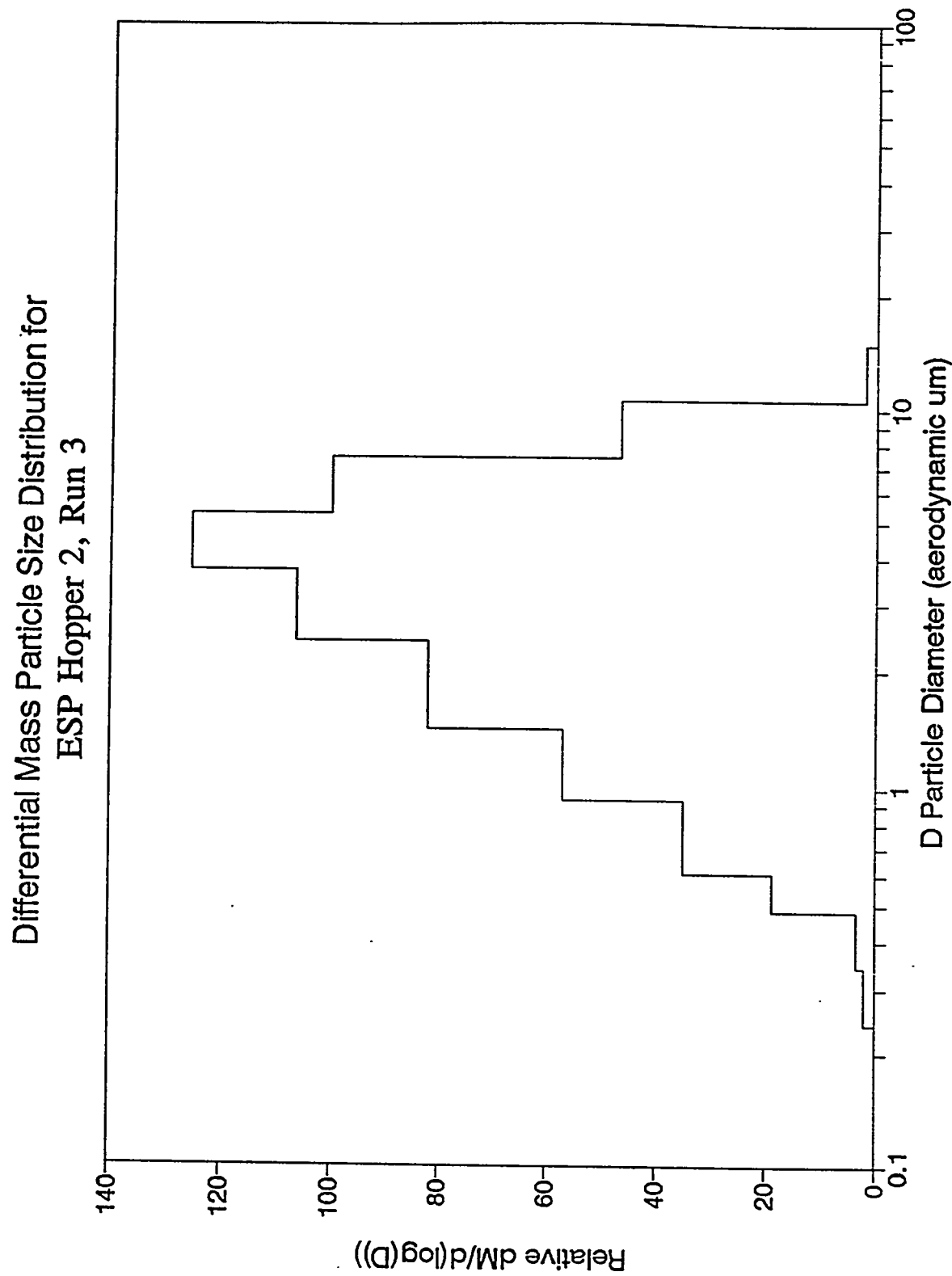




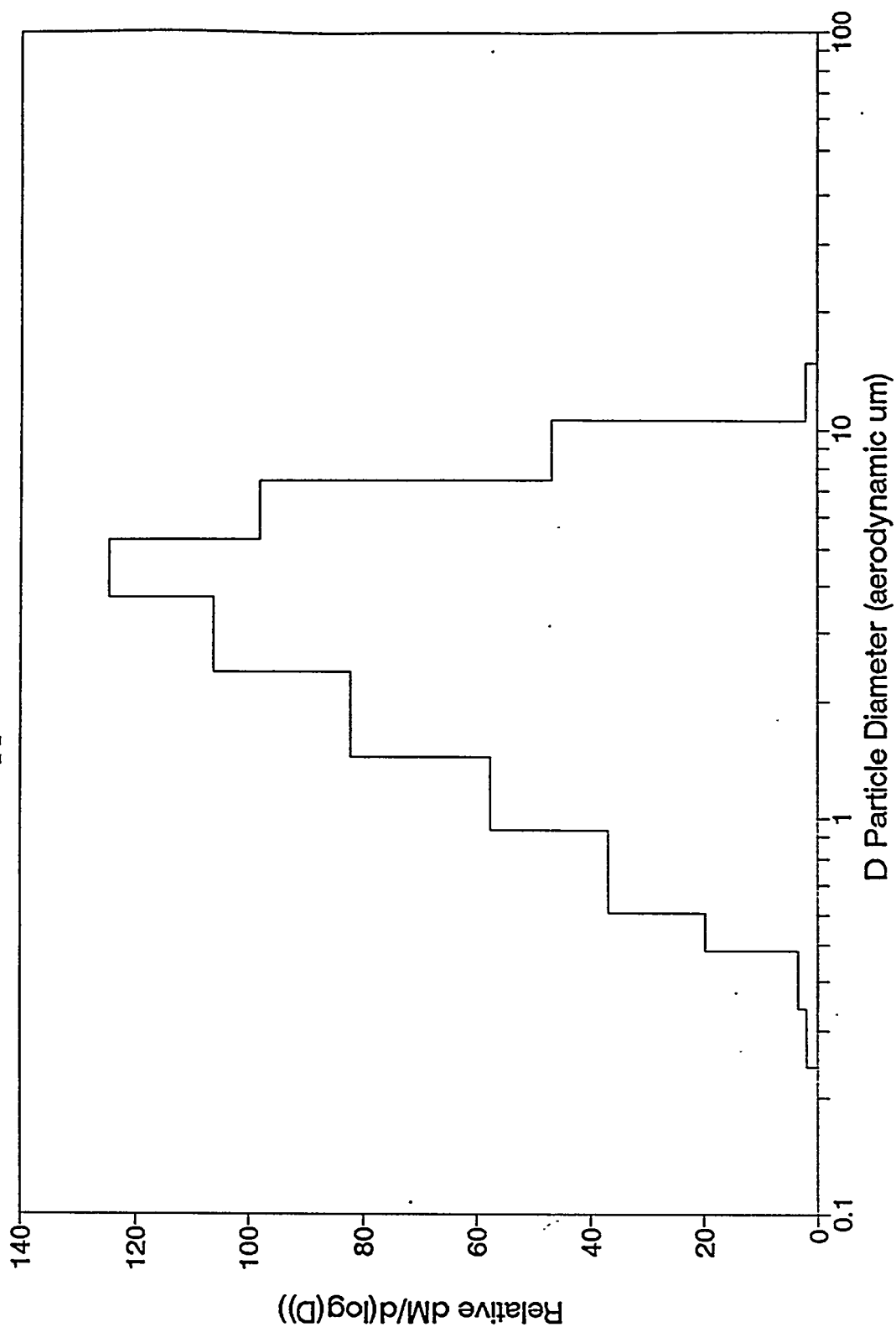


Differential Mass Particle Size Distribution for
ESP Hopper 2, Run 2

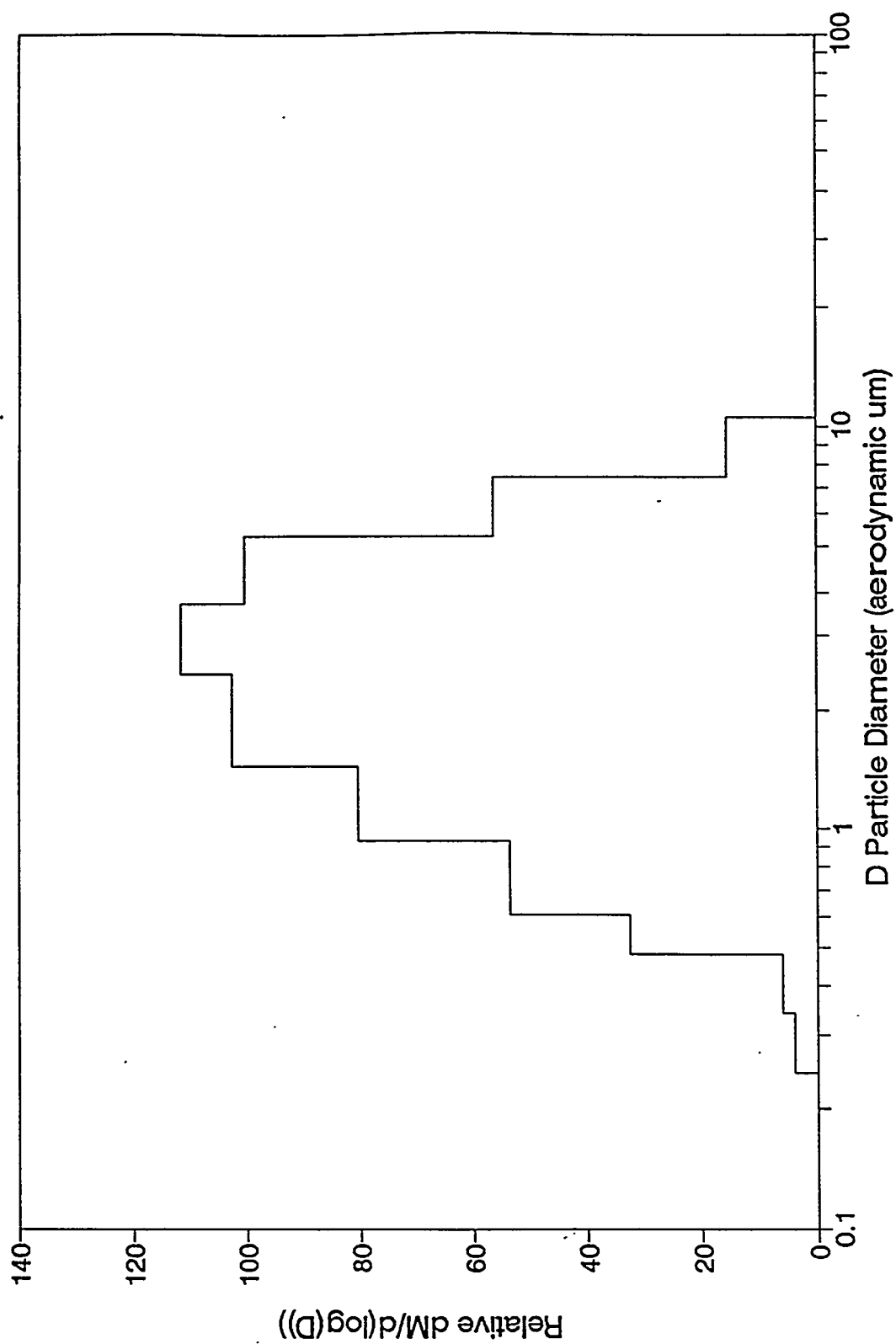


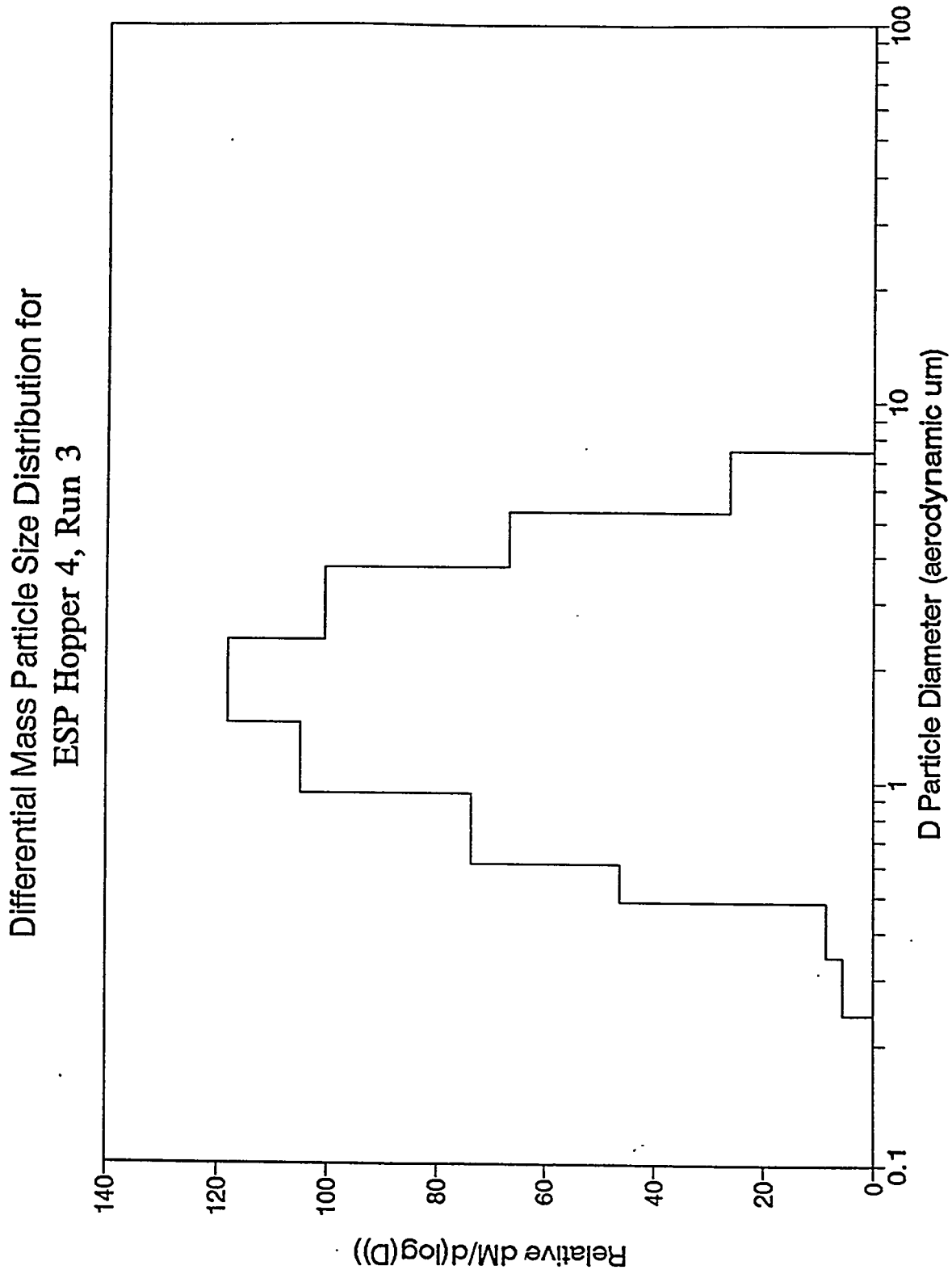


Differential Mass Particle Size Distribution for
ESP Hopper 2, Run 3 (duplicate)

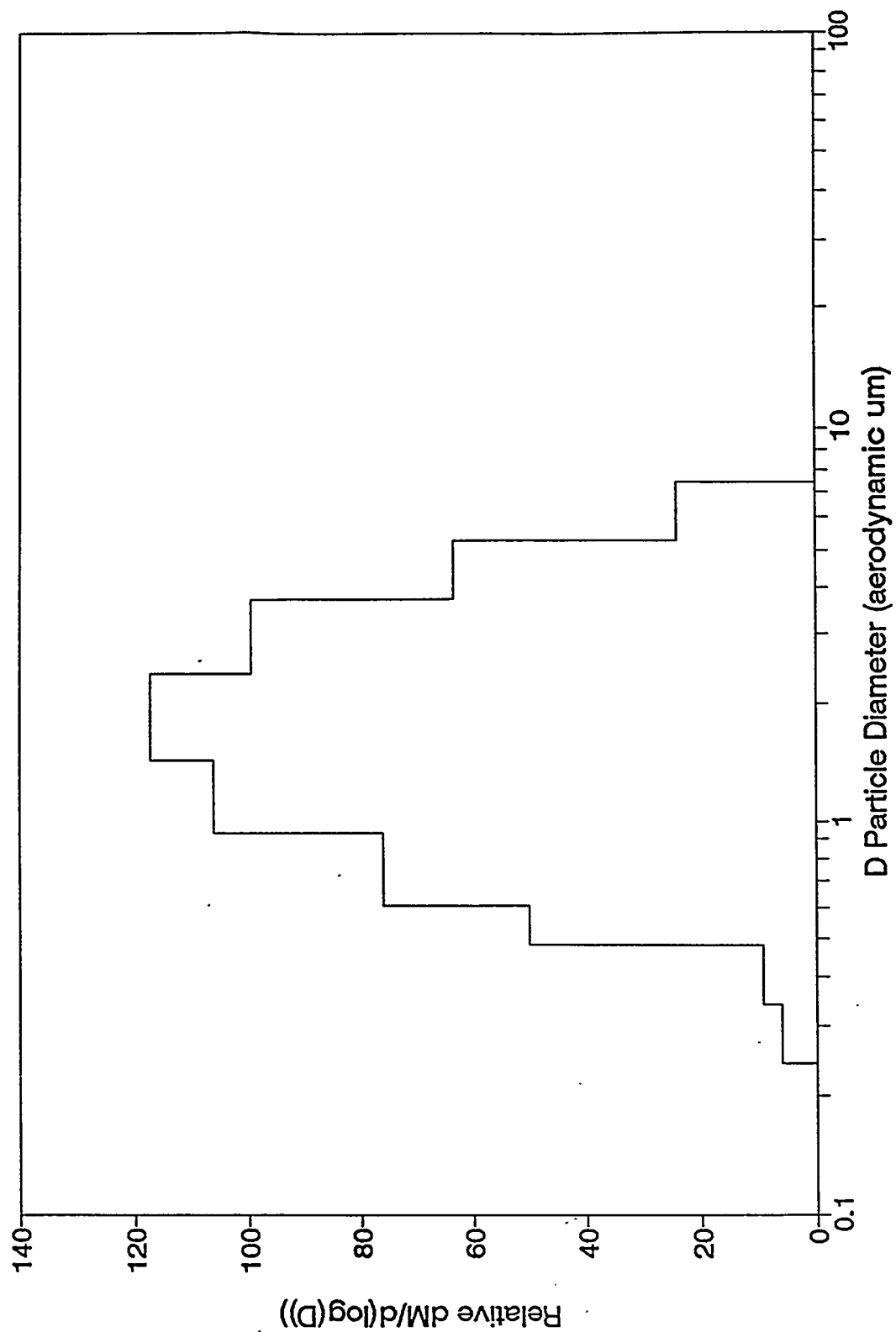


Differential Mass Particle Size Distribution for
ESP Hopper 3, Run 3





Differential Mass Particle Size Distribution for
ESP Hopper 4, Run 3 (duplicate)



APPENDIX D: QUALITY ASSURANCE/QUALITY CONTROL RESULTS

Appendix D presents detailed quality control sample results for blank samples (Table D-1), precision and accuracy measurements (Table D-2), and organic surrogate-spiked samples (Table D-3). In each table, the sample type, sample matrix, and sample stream are provided to identify the process samples directly related to the QC results. The source of the individual sample components listed (e.g., half filter, impinger solution, etc.) for each QC sample are shown in Appendix A, Figures A-2 through A-22.

Table D-1
Summary of Blank Sample Results

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Laboratory Method Blanks - Filtered Solids, Acetone PNR				
ICP-AES Metals				
Aluminum	2	2	5.97-7.93 µg/g	27.6 µg/g
Antimony	2	0	ND	58.6 µg/g
Barium	2	1	ND-0.460 µg/g	0.697 µg/g
Beryllium	2	0	ND	0.329 µg/g
Calcium	2	2	18.4-26.6 µg/g	13.7 µg/g
Chromium	2	2	7.45-8.15 µg/g	1.97 µg/g
Cobalt	2	2	7.68-8.32 µg/g	5.38 µg/g
Copper	2	0	ND	5.02 µg/g
Iron	2	0	ND	—
Magnesium	2	2	29.6-53.0 µg/g	96.3 µg/g
Manganese	2	2	0.490-1.99 µg/g	4.92 µg/g
Molybdenum	2	0	ND	3.84 µg/g
Nickel	2	1	ND-1.04 µg/g	11.4 µg/g
Phosphorus	2	2	7.67-15.4 µg/g	7.29 µg/g
Potassium	2	1	ND-122 µg/g	441 µg/g
Silver	2	1	ND-1.34 µg/g	4.43 µg/g
Sodium	2	1	ND-127 µg/g	30.5 µg/g
Titanium	2	2	0.970-2.43 µg/g	7.16 µg/g
Vanadium	2	1	ND-3.71 µg/g	2.92 µg/g
Laboratory Method Blanks - Nitric PNR				
ICP-AES Metals				
Aluminum	1	1	0.383 mg/L	0.0523 mg/L
Antimony	1	0	ND	0.076 mg/L
Barium	1	1	0.00023 mg/L	0.00086 mg/L
Beryllium	1	0	0.0 mg/L	0.00051 mg/L
Calcium	1	1	0.0306 mg/L	0.0175 mg/L
Chromium	1	0	ND	0.00524 mg/L
Cobalt	1	0	ND	0.00407 mg/L
Copper	1	1	0.0100 mg/L	0.00916 mg/L
Iron	1	1	0.0506 mg/L	0.00452 mg/L
Magnesium	1	0	ND	0.0479 mg/L
Manganese	1	1	0.00308 mg/L	0.00155 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Molybdenum	1	0	ND	0.00739 mg/L
Nickel	1	1	0.00052 mg/L	0.0141 mg/L
Phosphorus	1	1	0.810 mg/L	0.061 mg/L
Potassium	1	0	ND	0.822 mg/L
Silver	1	1	0.00497 mg/L	0.00519 mg/L
Sodium	1	1	0.00765 mg/L	0.0401 mg/L
Titanium	1	1	0.00129 mg/L	0.00159 mg/L
Vanadium	1	0	ND	0.00454 mg/L
Laboratory Method Blanks - Half Filter, Filters & PNRs				
ICP-AES Metals				
Aluminum	2	0	ND	2.76 µg
Antimony	2	0	ND	5.86 µg
Barium	2	0	ND	0.0697 µg
Beryllium	2	0	ND	0.0329 µg
Calcium	2	0	ND	1.37 µg
Chromium	2	2	0.360-0.440 µg	0.197 µg
Cobalt	2	2	0.140-0.230 µg	0.538 µg
Copper	2	0	ND	0.502 µg
Iron	2	1	ND-0.190 µg	—
Magnesium	2	1	ND-0.090 µg	9.63 µg
Manganese	2	0	ND	0.492 µg
Molybdenum	2	0	ND	0.384 µg
Nickel	2	2	1.01-1.08 µg	1.14 µg
Phosphorus	2	2	14.7-26.6 µg	7.29 µg
Potassium	2	0	ND	44.1 µg
Silver	2	0	ND	0.443 µg
Sodium	2	0	ND	3.05 µg
Titanium	2	2	0.150-0.370 µg	0.716 µg
Vanadium	2	0	ND	0.292 µg
Laboratory Method Blanks - H₂O₂/HNO₃ Impingers				
ICP-AES Metals				
Aluminum	2	2	0.00304-1.44 mg/L	0.0523 mg/L
Antimony	2	1	ND-0.00379 mg/L	0.076 mg/L
Barium	2	2	0.00014-0.00016 mg/L	0.00086 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Beryllium	2	0	ND	0.000510 mg/L
Calcium	2	2	0.0266-0.253 mg/L	0.0175 mg/L
Chromium	2	0	ND	0.00524 mg/L
Cobalt	2	1	0-0.00206 mg/L	0.00407 mg/L
Copper	2	2	0.00358-0.0102 mg/L	0.00916 mg/L
Iron	2	1	ND-0.00393 mg/L	0.00452 mg/L
Magnesium	2	1	ND-0.00205 mg/L	0.0479 mg/L
Manganese	2	2	0.00115-0.0092 mg/L	0.00155 mg/L
Molybdenum	2	1	ND-0.00027 mg/L	0.00739 mg/L
Nickel	2	1	ND-0.00161 mg/L	0.0141 mg/L
Phosphorus	1	0	ND	0.0610 mg/L
Potassium	2	2	0.022-0.0523 mg/L	0.822 mg/L
Silver	2	1	0-0.00057 mg/L	0.00519 mg/L
Sodium	2	2	0.00424-0.0654 mg/L	0.0401 mg/L
Titanium	2	1	ND-0.00033 mg/L	0.00159 mg/L
Vanadium	2	0	ND	0.00454 mg/L
Field Blank - Half Filter - APF				
ICP-AES Metals				
Aluminum	1	1	90.8 µg	2.76 µg
Antimony	1	0	ND	5.86 µg
Barium	1	1	2.35 µg	0.0697 µg
Beryllium	1	0	ND	0.0329 µg
Calcium	1	1	172 µg	1.37 µg
Chromium	1	1	1.89 µg	0.197 µg
Cobalt	1	0	ND	0.538 µg
Copper	1	0	ND	0.502 µg
Iron	1	1	12.7 µg	—
Magnesium	1	1	63.0 µg	9.63 µg
Manganese	1	0	ND	0.492 µg
Molybdenum	1	1	2.22 µg	0.384 µg
Nickel	1	1	2.06	1.14 µg
Phosphorus	1	1	33.3 µg	7.29 µg
Potassium	1	1	25.4	44.1 µg
Silver	1	1	0.003 µg	0.443 µg
Sodium	1	1	459 µg	3.05 µg
Titanium	1	1	0.847 µg	0.716 µg
Vanadium	1	1	0.191 µg	0.292 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Field Blank - Filter & PNR - ESP				
ICP-AES Metals				
Aluminum	1	1	437 µg	2.76 µg
Antimony	1	0	ND	5.86 µg
Barium	1	1	7.53 µg	0.0697 µg
Beryllium	1	1	0.016 µg	0.0329 µg
Calcium	1	1	661 µg	1.37 µg
Chromium	1	1	5.66 µg	0.197 µg
Cobalt	1	1	0.613 µg	0.538 µg
Copper	1	1	1.65 µg	0.502 µg
Iron	1	1	242 µg	--
Magnesium	1	1	181 µg	9.63 µg
Manganese	1	1	1.96 µg	0.492 µg
Molybdenum	1	1	17.6 µg	0.384 µg
Nickel	1	1	2.98 µg	1.14 µg
Phosphorus	1	1	22.4 µg	7.29 µg
Potassium	1	1	86.4 µg	44.1 µg
Silver	1	1	0.174 µg	0.443 µg
Sodium	1	1	320 µg	3.05 µg
Titanium	1	1	26.5 µg	0.716 µg
Vanadium	1	1	1.15 µg	0.292 µg
Field Blank - H₂O₂/HNO₃ Impingers - APF				
ICP-AES Metals				
Aluminum	1	1	0.0136 mg/L	0.0523 mg/L
Antimony	1	0	ND	0.076 mg/L
Barium	1	1	0.0004 mg/L	0.00086 mg/L
Beryllium	1	0	ND	0.00051 mg/L
Calcium	1	1	0.328 mg/L	0.0175 mg/L
Chromium	1	0	ND	0.00524 mg/L
Cobalt	1	0	ND	0.00407 mg/L
Copper	1	1	0.00183 mg/L	0.00916 mg/L
Iron	1	1	0.0212 mg/L	0.00452 mg/L
Magnesium	1	1	0.142 mg/L	0.0479 mg/L
Manganese	1	1	0.00281 mg/L	0.00155 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Defects	Range of Compounds Detected ^a	Detection Limit
Molybdenum	1	0	ND	0.00739 mg/L
Nickel	1	1	0.00229 mg/L	0.0141 mg/L
Phosphorus	1	0	ND	0.061 mg/L
Potassium	1	0	ND	0.822 mg/L
Silver	1	0	ND	0.00519 mg/L
Sodium	1	1	0.672 mg/L	0.0401 mg/L
Titanium	1	1	0.00068 mg/L	0.00159 mg/L
Vanadium	1	0	ND	0.00454 mg/L
Field Blank - H₂O₂/HNO₃				
Impingers - ESP				
ICP-AES Metals				
Aluminum	1	1	0.0228 mg/L	0.0523 mg/L
Antimony	1	0	ND	0.076 mg/L
Barium	1	1	0.00048 mg/L	0.00086 mg/L
Beryllium	1	0	ND	0.00051 mg/L
Calcium	1	1	0.248 mg/L	0.0175 mg/L
Chromium	1	1	0.00065 mg/L	0.00524 mg/L
Cobalt	1	1	0.00078 mg/L	0.00407 mg/L
Copper	1	1	0.00344 mg/L	0.00916 mg/L
Iron	1	1	0.0413 mg/L	0.00452 mg/L
Magnesium	1	1	0.127 mg/L	0.0479 mg/L
Manganese	1	1	0.00704 mg/L	0.00155 mg/L
Molybdenum	1	1	0.00048 mg/L	0.00739 mg/L
Nickel	1	1	0.00246 mg/L	0.0141 mg/L
Phosphorus	1	0	ND	0.061 mg/L
Potassium	1	1	0.484 mg/L	0.822 mg/L
Silver	1	0	ND	0.00519 mg/L
Sodium	1	1	0.629 mg/L	0.0401 mg/L
Titanium	1	1	0.00046 mg/L	0.00159 mg/L
Vanadium	1	1	0.00083 mg/L	0.00454 mg/L
Reagent Blank - Filter & PNR				
ICP-AES Metals				
Aluminum	1	1	192 µg	2.76 µg
Antimony	1	0	ND	5.86 µg
Barium	1	1	6.21 µg	0.0697 µg
Beryllium	1	0	ND	0.0329 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Calcium	1	1	133 µg	1.37 µg
Chromium	1	1	3.43 µg	0.197 µg
Cobalt	1	1	0.658 µg	0.538 µg
Copper	1	0	ND	0.502 µg
Iron	1	1	77.5 µg	—
Magnesium	1	1	23.1 µg	9.63 µg
Manganese	1	1	0.657 µg	0.492 µg
Molybdenum	1	1	18.2 µg	0.384 µg
Nickel	1	1	1.57 µg	1.14 µg
Phosphorus	1	1	25.8 µg	7.29 µg
Potassium	1	1	34.7 µg	44.1 µg
Silver	1	1	0.134 µg	0.443 µg
Sodium	1	1	260 µg	3.05 µg
Titanium	1	1	8.13 µg	0.716 µg
Vanadium	1	1	0.782 µg	0.292 µg
Reagent Blank - Half Filter				
ICP-AES Metals				
Aluminum	1	1	90.6 µg	2.76 µg
Antimony	1	0	ND	5.86 µg
Barium	1	1	0.615 µg	0.0697 µg
Beryllium	1	0	ND	0.0329 µg
Calcium	1	1	173 µg	1.37 µg
Chromium	1	1	1.38 µg	0.197 µg
Cobalt	1	1	0.366 µg	0.538 µg
Copper	1	0	ND	0.502 µg
Iron	1	1	6.10 µg	—
Magnesium	1	1	62.2 µg	9.63 µg
Manganese	1	0	ND	0.492 µg
Molybdenum	1	1	1.97 µg	0.384 µg
Nickel	1	1	1.21 µg	1.14 µg
Phosphorus	1	1	36.7 µg	7.29 µg
Potassium	1	1	29.3 µg	44.1 µg
Silver	1	0	ND	0.443 µg
Sodium	1	1	460 µg	3.05 µg
Titanium	1	1	0.909 µg	0.716 µg
Vanadium	1	1	0.161 µg	0.292 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Reagent Blank - HNO₃/H₂O₂ Impingers				
ICP-AES Metals				
Aluminum	1	1	0.00891 mg/L	0.0523 mg/L
Antimony	1	0	ND	0.076 mg/L
Barium	1	1	0.00024 mg/L	0.00086 mg/L
Beryllium	1	0	0 mg/L	0.00051 mg/L
Calcium	1	1	0.299 mg/L	0.0175 mg/L
Chromium	1	1	0.00399 mg/L	0.00524 mg/L
Cobalt	1	1	0.00348 mg/L	0.00407 mg/L
Copper	1	1	0.00127 mg/L	0.00916 mg/L
Iron	1	1	0.0179 mg/L	0.00452 mg/L
Magnesium	1	1	0.0133 mg/L	0.0479 mg/L
Manganese	1	1	0.00141 mg/L	0.00155 mg/L
Molybdenum	1	0	ND	0.00739 mg/L
Nickel	1	1	0.00008 mg/L	0.0141 mg/L
Phosphorus	1	0	ND	0.061 mg/L
Potassium	1	1	0.264 mg/L	0.822 mg/L
Silver	1	0	ND	0.00519 mg/L
Sodium	1	1	0.513 mg/L	0.0401 mg/L
Titanium	1	0	ND	0.00159 mg/L
Vanadium	1	1	0.0002 mg/L	0.00454 mg/L
Laboratory Method Blank - Ash				
ICP-AES Metals				
Aluminum	2	2	5.97-7.93 µg/g	27.6 µg/g
Antimony	2	0	ND	58.6 µg/g
Barium	2	1	ND-0.460 µg/g	0.697 µg/g
Beryllium	2	0	ND	0.329 µg/g
Calcium	2	2	18.4-26.6 µg/g	13.7 µg/g
Chromium	2	2	7.45-8.15 µg/g	1.97 µg/g
Cobalt	2	2	7.68-8.32 µg/g	5.38 µg/g
Copper	2	0	ND	5.02 µg/g
Iron	2	0	ND	—
Magnesium	2	2	29.6-53.0 µg/g	96.3 µg/g
Manganese	2	2	0.490-1.99 µg/g	4.92 µg/g
Molybdenum	2	0	ND	3.84 µg/g
Nickel	2	1	ND-1.04 µg/g	11.4 µg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Phosphorus	1	0	ND	7.29 µg/g
Potassium	2	1	ND-122 µg/g	441 µg/g
Silver	2	1	ND-1.34 µg/g	4.43 µg/g
Sodium	2	1	ND-127 µg/g	30.5 µg/g
Titanium	2	2	0.970-2.43 µg/g	7.16 µg/g
Vanadium	2	1	ND-3.71 µg/g	2.92 µg/g
Laboratory Method Blank - Sorbent				
ICP-AES Metals				
Aluminum	1	0	ND	--
Antimony	1	0	ND	5.86 µg/g
Barium	1	1	0.014 µg/g	0.0697 µg/g
Beryllium	1	0	ND	0.0329 µg/g
Calcium	1	1	2.29 µg/g	39.8 µg/g
Chromium	1	1	0.341 µg/g	0.197 µg/g
Cobalt	1	1	0.069 µg/g	0.538 µg/g
Copper	1	0	ND	0.502 µg/g
Iron	1	1	0.165 µg/g	--
Magnesium	1	0	ND	9.63 µg/g
Manganese	1	0	ND	0.492 µg/g
Molybdenum	1	1	0.099 µg/g	0.384 µg/g
Nickel	1	1	0.75 µg/g	--
Phosphorus	1	0	ND	7.29 µg/g
Potassium	1	1	6.51 µg/g	44.1 µg/g
Silver	1	0	ND	0.443 µg/g
Sodium	1	1	0.076 µg/g	3.05 µg/g
Titanium	1	1	0.09 µg/g	0.716 µg/g
Vanadium	1	0	0 µg/g	0.292 µg/g
Laboratory Method Blank - Service Water				
ICP-AES Metals				
Aluminum	1	1	0.148 mg/L	0.0523 mg/L
Antimony	1	1	0.0566 mg/L	0.076 mg/L
Barium	1	1	0.00151 mg/L	0.00086 mg/L
Beryllium	1	0	ND	0.00051 mg/L
Calcium	1	1	0.238 mg/L	0.0175 mg/L
Chromium	1	0	ND	0.00524 mg/L
Cobalt	1	1	0.00177 mg/L	0.00407 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Defects	Range of Compounds Detected ^a	Detection Limit
Copper	1	1	0.00324 mg/L	0.00916 mg/L
Iron	1	0	ND	0.00452 mg/L
Magnesium	1	1	0.019 mg/L	0.0479 mg/L
Manganese	1	0	ND	0.00155 mg/L
Molybdenum	1	1	0.00853 mg/L	0.00739 mg/L
Nickel	1	0	ND	0.0141 mg/L
Phosphorus	1	0	ND	0.061 mg/L
Potassium	1	0	ND	0.822 mg/L
Silver	1	0	0 mg/L	0.00519 mg/L
Sodium	1	1	0.0198 mg/L	0.0401 mg/L
Titanium	1	1	0.00082 mg/L	0.00159 mg/L
Vanadium	1	1	0.00187 mg/L	0.00454 mg/L
Field Blank - HNO ₃ /H ₂ O ₂ Impingers - APF				
ICP-MS Metals				
Antimony	1	1	0.13 µg/L	0.003 µg/L
Arsenic	1	1	0.09 µg/L	0.008 µg/L
Barium	1	1	3.57 µg/L	0.017 µg/L
Beryllium	1	1	0.01 µg/L	0.015 µg/L
Cadmium	1	1	0.49 µg/L	0.020 µg/L
Chromium	1	1	3.7 µg/L	0.020 µg/L
Cobalt	1	1	0.10 µg/L	0.003 µg/L
Copper	1	1	1.70 µg/L	0.106 µg/L
Lead	1	1	2.27 µg/L	0.016 µg/L
Manganese	1	1	2.02 µg/L	0.022 µg/L
Mercury	1	1	0.01 µg/L	0.021 µg/L
Molybdenum	1	1	0.46 µg/L	0.024 µg/L
Nickel	1	1	5.39 µg/L	0.024 µg/L
Selenium	1	0	<0.134 µg/L	0.134 µg/L
Vanadium	1	1	0.09 µg/L	0.006 µg/L
Field Blank - HNO ₃ /H ₂ O ₂ Impingers - ESP				
ICP-MS Metals				
Antimony	1	1	0.04 µg/L	0.003 µg/L
Arsenic	1	1	0.10 µg/L	0.008 µg/L
Barium	1	1	3.87 µg/L	0.017 µg/L
Beryllium	1	1	0.02 µg/L	0.015 µg/L
Cadmium	1	1	0.46 µg/L	0.020 µg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Chromium	1	1	2.9 µg/L	0.020 µg/L
Cobalt	1	1	0.09 µg/L	0.003 µg/L
Copper	1	1	2.04 µg/L	0.106 µg/L
Lead	1	1	1.28 µg/L	0.016 µg/L
Manganese	1	1	5.63 µg/L	0.022 µg/L
Mercury	1	1	0.05 µg/L	0.021 µg/L
Molybdenum	1	1	0.68 µg/L	0.024 µg/L
Nickel	1	1	1.38 µg/L	0.024 µg/L
Selenium	1	0	<0.134 µg/L	0.134 µg/L
Vanadium	1	1	0.10 µg/L	0.006 µg/L
Reagent Blank - HNO ₃ /H ₂ O ₂ Impingers				
ICP-MS Metals				
Antimony	1	1	0.04 µg/L	0.003 µg/L
Arsenic	1	1	0.22 µg/L	0.008 µg/L
Barium	1	1	7.58 µg/L	0.017 µg/L
Beryllium	1	1	0.09 µg/L	0.015 µg/L
Cadmium	1	1	0.95 µg/L	0.020 µg/L
Chromium	1	1	3.79 µg/L	0.020 µg/L
Cobalt	1	1	0.05 µg/L	0.003 µg/L
Copper	1	1	1.56 µg/L	0.106 µg/L
Lead	1	1	2.11 µg/L	0.016 µg/L
Manganese	1	1	1.80 µg/L	0.022 µg/L
Mercury	1	1	2.13 µg/L	0.021 µg/L
Molybdenum	1	1	0.47 µg/L	0.024 µg/L
Nickel	1	1	0.57 µg/L	0.024 µg/L
Selenium	1	0	<0.134 µg/L	0.134 µg/L
Vanadium	1	1	0.30 µg/L	0.006 µg/L
Laboratory Method Blank - Filtered Solids				
GFAAS and CVAAS Metals				
Arsenic	2	2	0.89-2.7 µg/g	1.82 µg/g
Cadmium	1	0	ND	0.238 µg/g
Lead	1	0	ND	0.0776 µg/g
Mercury	1	0	ND	0.012 µg/g
Selenium	1	1	0.121 µg/g	0.101 µg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Laboratory Method Blank - Acetone PNR				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.296 µg/g	0.182 µg/g
Cadmium	1	0	ND	0.783 µg/g
Lead	1	0	ND	0.776 µg/g
Mercury	1	1	0.015 µg/g	0.024 µg/g
Selenium	1	0	ND	0.0802 µg/g
Laboratory Method Blank - Nitric PNR				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.00214 mg/L
Cadmium	1	0	ND	0.00027 mg/L
Lead	1	0	ND	0.000996 mg/L
Mercury	1	0	ND	0.000033 mg/L
Selenium	1	0	ND	0.000592 mg/L
Laboratory Method Blank - Half Filter				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.144 µg	0.182 µg
Cadmium	1	0	ND	0.0783 µg
Lead	1	0	ND	0.0776 µg
Mercury	1	1	0.002 µg	0.0048 µg
Selenium	1	1	0.066 µg	0.0802 µg
Laboratory Method Blank - Filter & PNRs				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.376 µg	0.182 µg
Cadmium	2	0	ND	0.0783 µg
Lead	1	0	ND	0.0776 µg
Mercury	1	1	0.008 µg	0.0048 µg
Selenium	1	0	ND	0.0802 µg
Laboratory Method Blank - HNO₃/H₂O₂ Impingers				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.000647 mg/L
Cadmium	1	0	ND	0.000191 mg/L
Lead	1	1	0.00047 mg/L	0.00205 mg/L
Mercury	1	0	ND	0.000048 mg/L
Selenium	2	0	ND	0.00177 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Field Blank - Half Filter - APF				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.110 µg	0.182 µg
Cadmium	1	0	ND	0.0783 µg
Lead	1	0	ND	0.0776 µg
Mercury	1	1	0.016 µg	0.0048 µg
Selenium	1	1	0.113 µg	0.0802 µg
Field Blank - Filter & PNR - ESP				
GFAAS and CVAAS Metals				
Arsenic	1	1	2.36 µg	0.182 µg
Cadmium	1	1	2.02 µg	0.157 µg
Lead	1	1	0.884 µg	0.0776 µg
Mercury	1	1	0.033 µg	0.0048 µg
Selenium	1	1	0.373 µg	0.0802 µg
Field Blank - H₂O₂/HNO₃ Impingers - APF				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.000647 mg/L
Cadmium	1	1	0.00054 mg/L	0.000191 mg/L
Lead	1	1	0.00168 mg/L	0.00205 mg/L
Mercury	1	0	ND	0.00024 mg/L
Selenium	1	1	0.00183 mg/L	0.00177 mg/L
Field Blank - H₂O₂/HNO₃ Impingers - ESP				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.000647 mg/L
Cadmium	1	1	0.00047 mg/L	0.000191 mg/L
Lead	1	1	0.00058 mg/L	0.00205 mg/L
Mercury	1	0	ND	0.00024 mg/L
Selenium	1	1	0.0019 mg/L	0.00177 mg/L
Reagent Blank - Half Filter				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.453 µg	0.182 µg
Cadmium	1	0	ND	0.0783 µg
Lead	1	0	ND	0.0776 µg
Mercury	1	1	0.019 µg	0.0048 µg
Selenium	1	1	0.132 µg	0.0802 µg
Mercury				

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Reagent Blank - Filter & PNR				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.270 µg	0.182 µg
Cadmium	1	1	0.018 µg	0.0783 µg
Lead	1	1	1.17 µg	0.0776 µg
Mercury	1	1	0.022 µg	0.0048 µg
Selenium	1	1	0.127 µg	0.0802 µg
Reagent Blank - H₂O₂/HNO₃ Impingers				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.000647 mg/L
Cadmium	1	1	0.00002 mg/L	0.000191 mg/L
Lead	1	1	0.00069 mg/L	0.00205 mg/L
Mercury	1	0	ND	0.00024 mg/L
Selenium	1	1	0.0014 mg/L	0.00177 mg/L
Laboratory Method Blank - KMNO₄ Impingers				
CVAAS Metals				
Mercury	1	0	ND	0.000033 mg/L
Field Blank - KMNO₄ Impingers - APF				
CVAAS Metals				
Mercury	1	1	0.00018 mg/L	0.000033 mg/L
Field Blank - KMNO₄ Impingers - ESP				
CVAAS Metals				
Mercury	1	1	0.00001 mg/L	0.000033 mg/L
Reagent Blank - KMNO₄ Impingers				
CVAAS Metals				
Mercury	1	0	ND	0.000033 mg/L
Laboratory Method Blank - Ash				
GFAAS and CVAAS Metals				
Arsenic	1	1	0.082 µg/g	0.118 µg/g
Cadmium	1	1	0.060 µg/g	0.238 µg/g
Lead	3	0	ND	0.999 µg/g
Mercury	1	0	ND	0.012 µg/g
Selenium	2	1	ND -0.31 µg/g	1.01 µg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Laboratory Method Blank - Sorbent				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.118 µg/g
Cadmium	1	0	ND	0.0238 µg/g
Lead	1	1	0.016 µg/g	0.0999 µg/g
Mercury	1	0	ND	0.012 µg/g
Selenium	1	0	ND	0.101 µg/g
Laboratory Method Blank - Service Water				
GFAAS and CVAAS Metals				
Arsenic	1	0	ND	0.000647 mg/L
Cadmium	1	0	ND	0.00027 mg/L
Lead	1	1	0.00065 mg/L	0.0022 mg/L
Mercury	1	0	ND	0.000033 mg/L
Selenium	1	0	ND	0.00177 mg/L
Laboratory Method Blank - Ash and Sorbent				
Anions				
Chloride (Potentiometric)	2	0	0 µg/g	78.1 µg/g
Fluoride (EPA 340.2)	3	3	8.40-9.21 µg/g	11.8 µg/g
Sulfur (EPA 300)	2	1	0-4.03 mg/L	0.0471 mg/L
Laboratory Method Blank - Service Water				
Anions				
Chloride (EPA 300)	1	0	0 mg/L	0.0281 mg/L
Fluoride (EPA 340.2)	1	1	0.0126 mg/L	0.00551 mg/L
Sulfate (EPA 300)	1	0	0 mg/L	0.0471 mg/L
Phosphate (EPA 365.2)	1	0	ND	0.0200 mg/L
Laboratory Method Blank - Half Filter, Filtered Solids, Filter & PNRs				
Anions				
Chloride (BIF)	2	0	0 mg/L	0.0225 mg/L
Fluoride (EPA 340.2)	1	1	0.0144 mg/L	0.00551 mg/L
Sulfate (EPA 300)	2	0	0 mg/L	0.0471 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Laboratory Method Blank - CO₃/H₂O₂ Impingers				
Anions				
Chloride (EPA 300)	1	0	0 mg/L	0.0281 mg/L
Fluoride (EPA 340.2)	2	2	0.0126-0.0143 mg/L	0.00551 mg/L
Sulfate (EPA 300)	2	0	0 mg/L	0.0471 mg/L
Field Blanks - Half Filter, Filter & PNR				
Anions				
Chloride (BIF)	2	2	0.062-0.401 mg/L	0.0225 mg/L
Fluoride (EPA 340.2)	2	2	0.0291-0.38 mg/L	0.00551 mg/L
Sulfate (EPA 300)	2	1	0-4.08 mg/L	0.0471 mg/L
Field Blanks - CO₃/H₂O₂ Impingers				
Anions				
Chloride (EPA 300)	2	2	0.389-0.443 mg/L	0.0281 mg/L
Fluoride (EPA 340.2)	2	2	0.237-0.254 mg/L	0.00551 mg/L
Sulfate (EPA 300)	2	0	0 mg/L	0.0471 mg/L
Reagent Blank - Filter & PNR				
Anions				
Chloride (BIF)	1	1	0.278 mg/L	0.0225 mg/L
Fluoride (EPA 340.2)	1	1	0.647 mg/L	0.00551 mg/L
Sulfate (EPA 300)	1	1	1.38 mg/L	0.0471 mg/L
Reagent Blank - CO₃/H₂O₂ Impingers				
Anions				
Chloride (EPA 300)	1	1	0.637 mg/L	0.0281 mg/L
Fluoride (EPA 340.2)	1	1	0.184 mg/L	0.00551 mg/L
Sulfate (EPA 300)	1	1	2.25 mg/L	0.0471 mg/L
Laboratory Method Blank - Ammonia in Stack Gas (EPA 350.2)				
Ammonia	1	1	0.0686 mg/L	0.0156 mg/l
Field Blanks - Ammonia in Stack Gas (EPA 350.2)				
Ammonia	2	2	0.167-0.169 mg/L	0.0468 mg/L
Reagent Blank - Ammonia in Stack Gas (EPA 350.2)				
Ammonia	1	1	0.167 mg/L	0.0468 mg/L

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Laboratory Method Blank - Cyanide in Stack Gas (SW 9012)				
Cyanide	1	0	ND	0.00942 mg/L
Field Blanks - Cyanide in Stack Gas (SW 9012)				
Cyanide	2	2	0.0014-0.0021 mg/L	0.00942 mg/L
Reagent Blank - Cyanide in Stack Gas (SW 9012)				
Cyanide	1	1	0.0020 mg/L	0.00942 mg/L
Field Blanks - Chromium VI in Stack Gas (Ion Chromatography)				
Chromium VI (KOH Impingers)	1	1	0.00757 mg/L	0.0001 mg/L
Reagent Blanks - Chromium VI in Stack Gas (Ion Chromatography)				
Chromium VI (KOH Impingers)	4	4	0.00743-0.00955 mg/L	0.0001 mg/L
Laboratory Method Blank - Total Chromium in Stack Gas (SW 6010)				
Chromium (SW 6010)	1	1	0.00233 µg/g	0.00273 µg/g
Field Blanks - Total Chromium in Stack Gas (SW 6010)				
Chromium (Nitric Rinse)	1	1	0.00618 mg/L	0.00524 mg/L
Chromium (KOH Impinger)	1	1	0.0221 mg/L	0.00524 mg/L
Reagent Blank - Total Chromium in Stack Gas (SW 6010)				
Chromium (KOH Impinger)	1	1	0.00684 mg/L	0.00524 mg/L
Laboratory Method Blank - Formaldehyde in Stack Gas (BIF 0011)				
Formaldehyde	2	0	ND	0.50 µg
Field Blanks - Formaldehyde in Stack Gas (BIF 0011)				
Formaldehyde	2	2	5.7-6.0 µg	0.50 µg
Reagent Blanks - Formaldehyde in Stack Gas (BIF 0011)				
Formaldehyde	4	0	ND	0.50 µg
Laboratory Method Blank - Volatile Organic Compounds in Stack Gas				
Chloromethane	6	0	ND	10 ng
Vinyl Chloride	6	0	ND	10 ng
Bromomethane	6	0	ND	10 ng
Chloroethane	6	0	ND	10 ng

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Trichlorofluoromethane	6	0	ND	10 ng
1,1-Dichloroethene	6	0	ND	10 ng
Carbon Disulfide	6	0	ND	10 ng
Acetone	6	0	ND	50 ng
Methylene Chloride	6	0	ND	10 ng
trans-1,2-Dichloroethene	6	0	ND	10 ng
1,1-Dichloroethane	6	0	ND	10 ng
Vinyl Acetate	6	0	ND	50 ng
2-Butanone	6	0	ND	50 ng
Chloroform	6	0	ND	10 ng
1,1,1-Trichloroethane	6	0	ND	10 ng
Carbon Tetrachloride	6	0	ND	10 ng
Benzene	6	0	ND	10 ng
1,2-Dichloroethane	6	0	ND	10 ng
Trichloroethene	6	0	ND	10 ng
1,2-Dichloropropane	6	0	ND	10 ng
Bromodichloromethane	6	0	ND	10 ng
trans-1,3-Dichloropropene	6	0	ND	10 ng
4-methyl-2-Pentanone	6	0	ND	50 ng
Toluene	6	0	ND	10 ng
cis-1,3-Dichloropropene	6	0	ND	10 ng
1,1,2-Trichloroethane	6	0	ND	10 ng
Tetrachloroethene	6	0	ND	10 ng
2-Hexanone	6	0	ND	50 ng
Dibromochloromethane	6	0	ND	10 ng
Chlorobenzene	6	0	ND	10 ng
Ethyl Benzene	6	0	ND	10 ng
m,p-Xylene	6	0	ND	10 ng
o-Xylene	6	0	ND	10 ng
Styrene	6	0	ND	10 ng
Bromoform	6	0	ND	10 ng
1,1,2,2-Tetrachloroethane	6	0	ND	10 ng
1,3-Dichlorobenzene	6	0	ND	10 ng
1,4-Dichlorobenzene	6	0	ND	10 ng
1,2-Dichlorobenzene	6	0	ND	10 ng

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Field Blanks - Volatile Organic Compounds in Stack Gas				
Chloromethane	12	3	10-14 ng	10 ng
Vinyl Chloride	12	0	ND	10 ng
Bromomethane	12	0	ND	10 ng
Chloroethane	12	0	ND	10 ng
Trichlorofluoromethane	12	0	ND	10 ng
1,1-Dichloroethene	12	0	ND	10 ng
Carbon Disulfide	12	0	ND	10 ng
Acetone	12	0	ND	50 ng
Methylene Chloride	12	3	48-230 ng	10 ng
trans-1,2-Dichloroethene	12	0	ND	10 ng
1,1-Dichloroethane	12	0	ND	10 ng
Vinyl Acetate	12	0	ND	50 ng
2-Butanone	12	0	ND	50 ng
Chloroform	12	0	ND	10 ng
1,1,1-Trichloroethane	12	0	ND	10 ng
Carbon Tetrachloride	12	0	ND	10 ng
Benzene	12	0	ND	10 ng
1,2-Dichloroethane	12	0	ND	10 ng
Trichloroethene	12	0	ND	10 ng
1,2-Dichloropropane	12	0	ND	10 ng
Bromodichloromethane	12	0	ND	10 ng
trans-1,3-Dichloropropene	12	0	ND	10 ng
4-methyl-2-Pentanone	12	0	ND	50 ng
Toluene	12	1	37 ng	10 ng
cis-1,3-Dichloropropene	12	0	ND	10 ng
1,1,2-Trichloroethane	12	0	ND	10 ng
Tetrachloroethene	12	0	ND	10 ng
2-Hexanone	12	0	ND	50 ng
Dibromochloromethane	12	0	ND	10 ng
Chlorobenzene	12	0	ND	10 ng
Ethyl Benzene	12	0	ND	10 ng
m,p-Xylene	12	0	ND	10 ng
o-Xylene	12	0	ND	10 ng
Styrene	12	0	ND	10 ng
Bromoform	12	0	ND	10 ng
1,1,2,2-Tetrachloroethane	12	0	ND	10 ng

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
1,3-Dichlorobenzene	12	0	ND	10 ng
1,4-Dichlorobenzene	12	0	ND	10 ng
1,2-Dichlorobenzene	12	0	ND	10 ng
Trip Blank - Volatile Organic Compounds in Stack Gas				
Chloromethane	1	0	ND	10 ng
Vinyl Chloride	1	0	ND	10 ng
Bromomethane	1	0	ND	10 ng
Chloroethane	1	0	ND	10 ng
Trichlorofluoromethane	1	0	ND	10 ng
1,1-Dichloroethene	1	0	ND	10 ng
Carbon Disulfide	1	0	ND	10 ng
Acetone	1	0	ND	50 ng
Methylene Chloride	1	0	ND	10 ng
trans-1,2-Dichloroethene	1	0	ND	10 ng
1,1-Dichloroethane	1	0	ND	10 ng
Vinyl Acetate	1	0	ND	50 ng
2-Butanone	1	0	ND	50 ng
Chloroform	1	0	ND	10 ng
1,1,1-Trichloroethane	1	0	ND	10 ng
Carbon Tetrachloride	1	0	ND	10 ng
Benzene	1	0	ND	10 ng
1,2-Dichloroethane	1	0	ND	10 ng
Trichloroethene	1	0	ND	10 ng
1,2-Dichloropropane	1	0	ND	10 ng
Bromodichloromethane	1	0	ND	10 ng
trans-1,3-Dichloropropene	1	0	ND	10 ng
4-methyl-2-Pentanone	1	0	ND	50 ng
Toluene	1	0	ND	10 ng
cis-1,3-Dichloropropene	1	0	ND	10 ng
1,1,2-Trichloroethane	1	0	ND	10 ng
Tetrachloroethene	1	0	ND	10 ng
2-Hexanone	1	0	ND	50 ng
Dibromochloromethane	1	0	ND	10 ng
Chlorobenzene	1	0	ND	10 ng
Ethyl Benzene	1	0	ND	10 ng
m,p-Xylene	1	0	ND	10 ng
o-Xylene	1	0	ND	10 ng

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Defects	Range of Compounds Detected ^a	Detection Limit
Styrene	1	0	ND	10 ng
Bromoform	1	0	ND	10 ng
1,1,2,2-Tetrachloroethane	1	0	ND	10 ng
1,3-Dichlorobenzene	1	0	ND	10 ng
1,4-Dichlorobenzene	1	0	ND	10 ng
1,2-Dichlorobenzene	1	0	ND	10 ng
Laboratory Method Blank - Semivolatile Compounds in Stack Gas				
Acenaphthene	2	0	ND	1.49-6.07 µg
Acenaphthylene	2	0	ND	0.86-3.44 µg
Anthracene	2	0	ND	0.96-3.54 µg
Benz(a)anthracene	2	0	ND	1.16-3.12 µg
Benzo(b)fluoranthene	2	0	ND	1.29-2.99 µg
Benzo(e)pyrene	2	0	ND	1.38-3.33 µg
Benzo(g,h,i)perylene	2	0	ND	1.19-3.13 µg
Benzo(k)fluoranthene	2	0	ND	1.40-3.19 µg
Benzoic Acid	2	0	ND	5.18-43.22 µg
Benzyl alcohol	2	0	ND	3.52-16.84 µg
4-Bromophenylphenylether	2	0	ND	5.06-19.08 µg
Butylbenzylphthalate	2	0	ND	1.87-4.65 µg
4-Chloro-3-methylphenol	2	0	ND	2.76-11.21 µg
p-Chloroaniline	2	0	ND	2.17-8.42 µg
bis(2-Chloroethoxy)methane	2	0	ND	1.79-6.86 µg
bis(2-Chloroethyl)ether	2	0	ND	2.18-8.62 µg
bis(2-Chloroisopropyl)ether	2	0	ND	1.55-5.62 µg
2-Chloronaphthalene	2	0	ND	1.38-5.43 µg
2-Chlorophenol	2	0	ND	2.17-9.70 µg
4-Chlorophenylphenylether	2	0	ND	2.64-11.00 µg
Chrysene	2	0	ND	1.23-3.36 µg
Di-n-butylphthalate	2	1	1.47 µg	2.14 µg
Di-n-octylphthalate	2	0	ND	1.07-2.02 µg
Dibenz(a,h)anthracene	2	0	ND	1.34-3.73 µg
Dibenzofuran	2	0	ND	1.00-3.94 µg
1,2-Dichlorobenzene	2	0	ND	2.18-9.25 µg
1,3-Dichlorobenzene	2	0	ND	2.08-8.85 µg
1,4-Dichlorobenzene	2	0	ND	2.03-8.61 µg
3,3-Dichlorobenzidine	2	0	ND	3.79-10.54 µg
2,4-Dichlorophenol	2	0	ND	2.75-11.73 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Diethylphthalate	2	0	ND	1.15-4.65 µg
2,4-Dimethylphenol	2	0	ND	2.51-10.77 µg
Dimethylphthalate	2	0	ND	1.26-5.01 µg
4,6-Dinitro-2-methylphenol	2	0	ND	7.84-29.52 µg
2,4-Dinitrophenol	2	0	ND	11.06-50.58 µg
2,4-Dinitrotoluene	2	0	ND	3.59-14.20 µg
2,6-Dinitrotoluene	2	0	ND	4.96-19.61 µg
Diphenylamine/N-Nitroso DPA	2	0	ND	2.18-8.13 µg
bis(2-Ethylhexyl)phthalate	2	1	0.90 µg	3.43 µg
Fluoranthene	2	0	ND	0.76-2.72 µg
Fluorene	2	0	ND	1.29-5.11 µg
Hexachlorobenzene	2	0	ND	3.58-13.40 µg
Hexachlorobutadiene	2	0	ND	4.45-18.56 µg
Hexachlorocyclopentadiene	2	0	ND	6.52-23.24 µg
Hexachloroethane	2	0	ND	4.21-16.31 µg
Indeno(1,2,3)pyrene	2	0	ND	1.02-2.80 µg
Isophorone	2	0	ND	1.12-4.32 µg
2-Methylnaphthalene	2	0	ND	1.39-5.63 µg
4-Methylphenol/3-Methylphenol	2	0	ND	2.29-10.07 µg
2-Methylphenol	2	0	ND	2.39-10.44 µg
N-Nitrosodipropylamine	2	0	ND	3.14-12.39 µg
Naphthalene	2	1	4.77 µg	0.87 µg
2-Nitroaniline	2	0	ND	3.61-13.26 µg
3-Nitroaniline	2	0	ND	4.45-17.05 µg
4-Nitroaniline	2	0	ND	3.81-14.86 µg
Nitrobenzene	2	0	ND	1.98-7.27 µg
2-Nitrophenol	2	0	ND	4.17-16.67 µg
4-Nitrophenol	2	0	ND	7.74-31.19 µg
Pentachlorophenol	2	0	ND	7.40-47.23 µg
Phenanthrene	2	0	ND	0.97-3.52 µg
Phenol	2	0	ND	1.62-6.97 µg
Pyrene	2	0	ND	1.08-2.90 µg
1,2,4-Trichlorobenzene	2	0	ND	2.50-10.01 µg
2,4,5-Trichlorophenol	2	0	ND	3.56-14.79 µg
2,4,6-Trichlorophenol	2	0	ND	3.79-16.54 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Field Blanks - Semivolatile Compounds in Stack Gas				
Acenaphthene	4	0	ND	6.20-7.31 µg
Acenaphthylene	4	0	ND	3.51-4.14 µg
Anthracene	4	0	ND	3.71-4.34 µg
Benz(a)anthracene	4	0	ND	2.91-3.36 µg
Benzo(b)fluoranthene	4	0	ND	2.75-3.12 µg
Benzo(e)pyrene	4	0	ND	3.06-3.47 µg
Benzo(g,h,i)perylene	4	0	ND	2.87-3.26 µg
Benzo(k)fluoranthene	4	0	ND	2.93-3.32 µg
Benzoic Acid	4	0	ND	43.48-50.08 µg
Benzyl alcohol	4	0	ND	17.21-19.54 µg
4-Bromophenylphenylether	4	0	ND	20.00-23.42 µg
Butylbenzylphthalate	4	0	ND	4.34-5.00 µg
4-Chloro-3-methylphenol	4	0	ND	11.28-12.99 µg
p-Chloroaniline	4	0	ND	8.47-9.76 µg
bis(2-Chloroethoxy)methane	4	0	ND	6.90-7.95 µg
bis(2-Chloroethyl)ether	4	0	ND	8.80-10.0 µg
bis(2-Chloroisopropyl)ether	4	0	ND	5.74-6.52 µg
2-Chloronaphthalene	4	0	ND	5.54-6.53 µg
2-Chlorophenol	4	0	ND	9.91-11.26 µg
4-Chlorophenylphenylether	4	0	ND	11.23-13.24 µg
Chrysene	4	0	ND	3.13-3.62 µg
Di-n-butylphthalate	4	4	5.08-10.97 µg	—
Di-n-octylphthalate	4	0	ND	1.85-2.10 µg
Dibenz(a,h)anthracene	4	0	ND	3.42-3.88 µg
Dibenzofuran	4	0	ND	4.02-4.74 µg
1,2-Dichlorobenzene	4	0	ND	9.45-10.74 µg
1,3-Dichlorobenzene	4	0	ND	9.04-10.27 µg
1,4-Dichlorobenzene	4	0	ND	8.79-9.99 µg
3,3-Dichlorobenzidine	4	0	ND	9.84-11.35 µg
2,4-Dichlorophenol	4	0	ND	11.80-13.59 µg
Diethylphthalate	4	0	ND	4.75-5.60 µg
2,4-Dimethylphenol	4	0	ND	10.84-12.48 µg
Dimethylphthalate	4	0	ND	5.11-6.02 µg
4,6-Dinitro-2-methylphenol	4	0	ND	30.94-36.22
2,4-Dinitrophenol	4	0	ND	51.62-60.84 µg
2,4-Dinitrotoluene	4	0	ND	14.49-17.08 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
2,6-Dinitrotoluene	4	0	ND	20.01-23.58 µg
Diphenylamine/N-Nitroso DPA	4	0	ND	8.52-9.97 µg
bis(2-Ethylhexyl)phthalate	4	2	2.54-3.51	3.40-3.69 µg
Fluoranthene	4	0	ND	2.85-3.34 µg
Fluorene	4	0	ND	5.22-6.15 µg
Hexachlorobenzene	4	0	ND	14.04-16.44 µg
Hexachlorobutadiene	4	0	ND	18.67-21.50 µg
Hexachlorocyclopentadiene	4	0	ND	23.72-27.96 µg
Hexachloroethane	4	0	ND	16.66-18.92 µg
Indeno(1,2,3)pyrene	4	0	ND	2.57-2.91 µg
Isophorone	4	0	ND	4.34-5.00 µg
2-Methylnaphthalene	4	0	ND	5.67-6.53 µg
4-Methylphenol/3-Methylphenol	4	0	ND	10.29-11.69 µg
2-Methylphenol	4	0	ND	10.66-12.11 µg
N-Nitrosodipropylamine	4	0	ND	12.66-14.38 µg
Naphthalene	4	1	31.39 µg	3.52-4.05 µg
2-Nitroaniline	4	0	ND	13.53-15.95 µg
3-Nitroaniline	4	0	ND	17.40-20.51 µg
4-Nitroaniline	4	0	ND	15.17-17.88 µg
Nitrobenzene	4	0	ND	7.31-8.42 µg
2-Nitrophenol	4	0	ND	16.78-19.32 µg
4-Nitrophenol	4	0	ND	31.83-37.52 µg
Pentachlorophenol	4	0	ND	49.50-57.96 µg
Phenanthrene	4	0	ND	3.69-4.33 µg
Phenol	4	0	ND	7.12-8.09 µg
Pyrene	4	0	ND	2.71-3.12 µg
1,2,4-Trichlorobenzene	4	0	ND	10.08-11.60 µg
2,4,5-Trichlorophenol	4	0	ND	15.09-17.79 µg
2,4,6-Trichlorophenol	4	0	ND	16.87-19.89 µg
Trip Blank - Semivolatile Compounds in Stack Gas				
Acenaphthene	1	0	ND	3.96 µg
Acenaphthylene	1	0	ND	2.25 µg
Anthracene	1	0	ND	2.18 µg
Benz(a)anthracene	1	0	ND	1.53 µg
Benzo(b)fluoranthene	1	0	ND	1.52 µg
Benzo(e)pyrene	1	0	ND	1.66 µg
Benzo(g,h,i)perylene	1	0	ND	1.59 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Defects	Range of Compounds Detected ^a	Detection Limit
Benzo(k)fluoranthene	1	0	ND	1.56 µg
Benzoic Acid	1	0	ND	21.82 µg
Benzyl alcohol	1	0	ND	10.57 µg
4-Bromophenylphenylether	1	0	ND	10.36 µg
Butylbenzylphthalate	1	0	ND	2.73 µg
4-Chloro-3-methylphenol	1	0	ND	7.99 µg
p-Chloroaniline	1	0	ND	5.48 µg
bis(2-Chloroethoxy)methane	1	0	ND	5.40 µg
bis(2-Chloroethyl)ether	1	0	ND	6.32 µg
bis(2-Chloroisopropyl)ether	1	0	ND	4.82 µg
2-Chloronaphthalene	1	0	ND	3.54 µg
2-Chlorophenol	1	0	ND	5.70 µg
4-Chlorophenylphenylether	1	0	ND	6.62 µg
Chrysene	1	0	ND	1.64 µg
Di-n-butylphthalate	1	1	7.32 µg	--
Di-n-octylphthalate	1	0	ND	1.17 µg
Dibenz(a,h)anthracene	1	0	ND	1.88 µg
Dibenzofuran	1	0	ND	2.56 µg
1,2-Dichlorobenzene	1	0	ND	5.65 µg
1,3-Dichlorobenzene	1	0	ND	5.35 µg
1,4-Dichlorobenzene	1	0	ND	5.20 µg
3,3-Dichlorobenzidine	1	0	ND	5.10 µg
2,4-Dichlorophenol	1	0	ND	7.25 µg
Diethylphthalate	1	0	ND	3.05 µg
2,4-Dimethylphenol	1	0	ND	7.07 µg
Dimethylphthalate	1	0	ND	3.32 µg
4,6-Dinitro-2-methylphenol	1	0	ND	14.95 µg
2,4-Dinitrophenol	1	0	ND	26.89 µg
2,4-Dinitrotoluene	1	0	ND	8.79 µg
2,6-Dinitrotoluene	1	0	ND	12.73 µg
Diphenylamine/N-Nitroso DPA	1	0	ND	5.33 µg
bis(2-Ethylhexyl)phthalate	1	0	11.13 µg	--
Fluoranthene	1	0	ND	1.54 µg
Fluorene	1	0	ND	3.40 µg
Hexachlorobenzene	1	0	ND	7.42 µg
Hexachlorobutadiene	1	0	ND	10.46 µg
Hexachlorocyclopentadiene	1	0	ND	12.17 µg
Hexachloroethane	1	0	ND	11.17 µg

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Indeno(1,2,3)pyrene	1	0	ND	1.39 µg
Isophorone	1	0	ND	3.54 µg
2-Methylnaphthalene	1	0	ND	3.62 µg
4-Methylphenol/3-Methylphenol	1	0	ND	6.41 µg
2-Methylphenol	1	0	ND	6.89 µg
N-Nitrosodipropylamine	1	0	ND	9.96 µg
Naphthalene	1	0	ND	2.28 µg
2-Nitroaniline	1	0	ND	11.19 µg
3-Nitroaniline	1	0	ND	10.92 µg
4-Nitroaniline	1	0	ND	9.64 µg
Nitrobenzene	1	0	ND	6.07 µg
2-Nitrophenol	1	0	ND	10.79 µg
4-Nitrophenol	1	0	ND	23.71 µg
Pentachlorophenol	1	0	ND	18.79 µg
Phenanthrene	1	0	ND	2.23 µg
Phenol	1	0	ND	4.73 µg
Pyrene	1	0	ND	1.57 µg
1,2,4-Trichlorobenzene	1	0	ND	6.46 µg
2,4,5-Trichlorophenol	1	0	ND	9.43 µg
2,4,6-Trichlorophenol	1	0	ND	9.82 µg
Laboratory Method Blank - Semivolatile Compounds in Ash				
Acenaphthene	1	0	ND	0.0161 µg/g
Acenaphthylene	1	0	ND	0.0219 µg/g
Anthracene	1	0	ND	0.0180 µg/g
Benz(a)anthracene	1	0	ND	0.0116 µg/g
Benz(a)pyrene	1	0	ND	0.0180 µg/g
Benzo(b)fluoranthene	1	0	ND	0.0320 µg/g
Benzo(g,h,i)perylene	1	0	ND	0.0185 µg/g
Benzo(k)fluoranthene	1	0	ND	0.0273 µg/g
Benzoic Acid	1	0	ND	0.0997 µg/g
Benzyl alcohol	1	0	ND	0.0480 µg/g
4-Bromophenylphenylether	1	0	ND	0.0203 µg/g
Butylbenzylphthalate	1	0	ND	0.0250 µg/g
4-Chloro-3-methylphenol	1	0	ND	0.0153 µg/g
p-Chloroaniline	1	0	ND	0.0327 µg/g
bis(2-Chloroethoxy)methane	1	0	ND	0.0111 µg/g
bis(2-Chloroethyl)ether	1	0	ND	0.0155 µg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
bis(2-Chloroisopropyl)ether	1	0	ND	0.0190 µg/g
2-Chloronaphthalene	1	0	ND	0.0300 µg/g
2-Chlorophenol	1	0	ND	0.0109 µg/g
4-Chlorophenylphenylether	1	0	ND	0.0244 µg/g
Chrysene	1	0	ND	0.0195 µg/g
Di-n-butylphthalate	1	0	ND	0.0103 µg/g
Di-n-octylphthalate	1	0	ND	0.0194 µg/g
Dibenz(a,h)anthracene	1	0	ND	0.0228 µg/g
Dibenzofuran	1	0	ND	0.0130 µg/g
1,2-Dichlorobenzene	1	0	ND	0.0214 µg/g
1,3-Dichlorobenzene	1	0	ND	0.0237 µg/g
1,4-Dichlorobenzene	1	0	ND	0.0236 µg/g
3,3-Dichlorobenzidine	1	0	ND	0.0363 µg/g
2,4-Dichlorophenol	1	0	ND	0.0194 µg/g
Diethylphthalate	1	0	ND	0.0123 µg/g
2,4-Dimethylphenol	1	0	ND	0.0423 µg/g
Dimethylphthalate	1	0	ND	0.0157 µg/g
4,6-Dinitro-2-methylphenol	1	0	ND	0.0244 µg/g
2,4-Dinitrophenol	1	0	ND	0.0863 µg/g
2,4-Dinitrotoluene	1	0	ND	0.0256 µg/g
2,6-Dinitrotoluene	1	0	ND	0.0350 µg/g
Diphenylamine/N-Nitroso DPA	1	0	ND	0.0255 µg/g
bis(2-Ethylhexyl)phthalate	1	0	ND	0.0547 µg/g
Fluoranthene	1	0	ND	0.0142 µg/g
Fluorene	1	0	ND	0.0115 µg/g
Hexachlorobenzene	1	0	ND	0.0176 µg/g
Hexachlorobutadiene	1	0	ND	0.0219 µg/g
Hexachlorocyclopentadiene	1	0	ND	0.0547 µg/g
Hexachloroethane	1	0	ND	0.0333 µg/g
Indeno(1,2,3)pyrene	1	0	ND	0.0160 µg/g
Isophorone	1	0	ND	0.0101 µg/g
2-methylnaphthalene	1	0	ND	0.0202 µg/g
4-Methylphenol/3-Methylphenol	1	0	ND	0.0413 µg/g
2-Methylphenol	1	0	ND	0.0263 µg/g
N-Nitrosodipropylamine	1	0	ND	0.0262 µg/g
Naphthalene	1	0	ND	0.0223 µg/g
2-Nitroaniline	1	0	ND	0.0266 µg/g
3-Nitroaniline	1	0	ND	0.0107 µg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
4-Nitroaniline	1	0	ND	0.0200 µg/g
Nitrobenzene	1	0	ND	0.0130 µg/g
2-Nitrophenol	1	0	ND	0.0142 µg/g
4-Nitrophenol	1	0	ND	0.0210 µg/g
Pentachlorophenol	1	0	ND	0.00640 µg/g
Phenanthrene	1	0	ND	0.0185 µg/g
Phenol	1	0	ND	0.0337 µg/g
Pyrene	1	0	ND	0.0154 µg/g
1,2,4-Trichlorobenzene	1	0	ND	0.00640 µg/g
2,4,5-Trichlorophenol	1	0	ND	0.0195 µg/g
2,4,6-Trichlorophenol	1	0	ND	0.0162 µg/g
Laboratory Method Blank - PAHs in Stack Gas				
Naphthalene	2	2	43.1-115 ng	--
2-Methylnaphthalene	2	2	12.6-210 ng	--
Acenaphthene	2	2	2.1-309 ng	--
2-Chloronaphthalene	2	0	ND	0.07-0.09 ng
Acenaphthylene	2	2	0.69-2.6 ng	--
Fluorene	2	2	8.3-86.8 ng	--
Phenanthrene	2	2	33.4-59.6 ng	--
Anthracene	2	2	1.5-1.6 ng	--
Fluoranthene	2	2	5.5-11.4 ng	--
Pyrene	2	2	4.7-13.3 ng	--
Benzo(a)anthracene	2	2	0.56-0.67 ng	--
Chrysene	2	2	1.1-1.4 ng	--
Perylene	2	2	0.13-0.40 ng	--
Benzo(b)fluoranthene	2	2	1.4-1.8 ng	--
Benzo(k)fluoranthene	2	2	0.41-0.83 ng	--
Benzo(a)pyrene	2	2	0.56-0.77 ng	--
Benzo(e)pyrene	2	2	1.3-2.6 ng	--
Benzo(g,h,i)perylene	2	2	2.7-3.2 ng	--
Indeno(1,2,3-cd)pyrene	2	2	1.0-1.4 ng	--
Dibenz(a,h)anthracene	2	2	0.34-0.94 ng	--
Field Blanks - PAHs in Stack Gas				
Naphthalene	4	4	33.0-1050 ng	--
2-Methylnaphthalene	4	4	11.4-110 ng	--
Acenaphthene	4	4	2.1-29.5 ng	--
2-Chloronaphthalene	4	3	0.06-0.38 ng	0.08 ng

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Acenaphthalene	4	4	0.60-4.4 ng	--
Fluorene	4	4	7.9-17.9 ng	--
Phenanthrene	4	4	35.8-54.9 ng	--
Anthracene	4	4	1.2-2.6 ng	--
Fluoranthene	4	4	5.5-20.0 ng	--
Pyrene	4	4	4.1-13.7 ng	--
Benzo(a)anthracene	4	4	0.47-3.7 ng	--
Chrysene	4	4	0.75-10.0 ng	--
Perylene	4	3	0.16-1.5	0.5 ng
Benzo(b)fluoranthene	4	4	1.2-12.3 ng	--
Benzo(k)fluoranthene	4	4	0.24-3.6 ng	--
Benzo(a)pyrene	4	4	0.47-4.7 ng	--
Benzo(e)pyrene	4	4	1.8-9.3 ng	--
Benzo(g,h,i)perylene	4	4	2.0-11.4 ng	--
Indeno(1,2,3-cd)pyrene	4	4	0.77-6.2 ng	--
Dibenz(a,h)anthracene	4	1	1.5	0.09-0.9 ng
Trip Blank - PAHs in Stack Gas				
Naphthalene	2	2	29.1-49.6 ng	--
2-Methylnaphthalene	2	2	8.9-34.0 ng	--
Acenaphthene	2	2	1.7-8.9 ng	--
2-Chloronaphthalene	2	0	ND	0.3-0.9 ng
Acenaphthalene	2	1	2.2 ng	0.8 ng
Fluorene	2	2	0.66-23.5 ng	--
Phenanthrene	2	2	2.8-129 ng	--
Anthracene	2	1	4.3 ng	0.8 ng
Fluoranthene	2	2	1.3-15.3 ng	--
Pyrene	2	2	2.6-7.6 ng	--
Benzo(a)anthracene	2	2	0.25-0.64 ng	--
Chrysene	2	2	0.34-1.5 ng	--
Perylene	2	1	0.21 ng	1.3 ng
Benzo(b)fluoranthene	2	2	0.53-2.0 ng	--
Benzo(k)fluoranthene	2	2	0.19-0.59 ng	--
Benzo(a)pyrene	2	1	0.77 ng	1.1 ng
Benzo(e)pyrene	2	2	0.81-3.3 ng	--
Benzo(g,h,i)perylene	2	2	2.9 ng	--
Indeno(1,2,3-cd)pyrene	2	2	0.85-1.5 ng	--

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
Dibenz(a,h)anthracene	2	1	0.28 ng	2.1 ng
Laboratory Method Blank - Dioxins/Furans in Stack Gas				
2,3,7,8-TCDF	2	0	ND	0.005-0.006 ng
2,3,7,8-TCDD	2	1	0.009 ng	0.006 ng
1,2,3,7,8-PeCDF	2	0	ND	0.006
2,3,4,7,8-PeCDF	2	0	ND	0.006
1,2,3,7,8-PeCDD	2	0	ND	0.01 ng
1,2,3,4,7,8-HxCDF	2	2	0.007-0.01 ng	--
1,2,3,6,7,8-HxCDF	2	0	ND	0.006-0.008 ng
2,3,4,6,7,8-HxCDF	2	1	0.01 ng	0.008 ng
1,2,3,7,8,9-HxCDF	2	0	ND	0.008-0.01 ng
1,2,3,4,7,8-HxCDD	2	0	ND	0.01-0.02 ng
1,2,3,6,7,8-HxCDD	2	0	ND	0.01-0.02 ng
1,2,3,7,8,9-HxCDD	2	0	ND	0.01-0.02 ng
1,2,3,4,6,7,8-HpCDF	2	1	0.008 ng	0.009 ng
1,2,3,4,7,8,9-HpCDF	2	0	ND	0.01-0.02 ng
1,2,3,4,6,7,8-HpCDD	2	1	0.008 ng	0.02 ng
OCDF	2	0	ND	0.02 ng
OCDD	2	2	0.03-0.04 ng	--
Field Blanks - Dioxins/Furans in Stack Gas				
2,3,7,8-TCDF	3	1	0.004 ng	0.002-0.006 ng
2,3,7,8-TCDD	3	0	ND	0.002-0.007 ng
1,2,3,7,8-PeCDF	3	1	0.01 ng	0.002-0.005 ng
2,3,4,7,8-PeCDF	3	0	ND	0.002-0.006 ng
1,2,3,7,8-PeCDD	3	0	ND	0.004-0.01 ng
1,2,3,4,7,8-HxCDF	3	1	0.03 ng	0.002-0.009 ng
1,2,3,6,7,8-HxCDF	3	1	0.008 ng	0.002-0.007 ng
2,3,4,6,7,8-HxCDF	3	3	0.006-0.01 ng	--
1,2,3,7,8,9-HxCDF	3	0	ND	0.002-0.01 ng
1,2,3,4,7,8-HxCDD	3	0	ND	0.004-0.02 ng
1,2,3,6,7,8-HxCDD	3	1	0.01 ng	0.003-0.01 ng
1,2,3,7,8,9-HxCDD	3	1	0.007 ng	0.003-0.02 ng
1,2,3,4,6,7,8-HpCDF	3	3	0.005-0.03 ng	--

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
1,2,3,4,7,8,9-HpCDF	3	0	ND	0.004-0.02 ng
1,2,3,4,6,7,8-HpCDD	3	2	0.01-0.04 ng	0.004 ng
OCDF	3	1	0.09 ng	0.005-0.04 ng
OCDD	3	3	0.01-0.17 ng	--
Trip Blank - Dioxins/Furans in Stack Gas				
2,3,7,8-TCDF	1	0	ND	0.003 ng
2,3,7,8-TCDD	1	0	ND	0.004 ng
1,2,3,7,8-PeCDF	1	0	ND	0.003 ng
2,3,4,7,8-PeCDF	1	0	ND	0.003 ng
1,2,3,7,8-PeCDD	1	0	ND	0.004 ng
1,2,3,4,7,8-HxCDF	1	1	0.004 ng	--
1,2,3,6,7,8-HxCDF	1	0	ND	0.003 ng
2,3,4,6,7,8-HxCDF	1	1	0.006 ng	--
1,2,3,7,8,9-HxCDF	1	0	ND	0.005 ng
1,2,3,4,7,8-HxCDD	1	0	ND	0.007 ng
1,2,3,6,7,8-HxCDD	1	0	ND	0.006 ng
1,2,3,7,8,9-HxCDD	1	0	ND	0.006 ng
1,2,3,4,6,7,8-HpCDF	1	0	ND	0.004 ng
1,2,3,4,7,8,9-HpCDF	1	0	ND	0.007 ng
1,2,3,4,6,7,8-HpCDD	1	0	ND	0.008 ng
OCDF	1	0	ND	0.01 ng
OCDD	1	1	0.01 ng	--
Laboratory Method Blank - Dioxins/Furans in Ash				
2,3,7,8-TCDF	1	1	0.09 pg/g	--
2,3,7,8-TCDD	1	0	ND	0.1 pg/g
1,2,3,7,8-PeCDF	1	0	ND	0.1 pg/g
2,3,4,7,8-PeCDF	1	0	ND	0.1 pg/g
1,2,3,7,8-PeCDD	1	0	ND	0.2 pg/g
1,2,3,4,7,8-HxCDF	1	0	ND	0.1 pg/g
1,2,3,6,7,8-HxCDF	1	0	ND	0.09 pg/g
2,3,4,6,7,8-HxCDF	1	1	0.29 pg/g	--
1,2,3,7,8,9-HxCDF	1	0	ND	0.1 pg/g
1,2,3,4,7,8-HxCDD	1	0	ND	0.2 pg/g
1,2,3,6,7,8-HxCDD	1	0	ND	0.2 pg/g

Table D-1 (Continued)

Analyte	Number of Blanks Analyzed	Number of Detects	Range of Compounds Detected ^a	Detection Limit
1,2,3,7,8,9-HxCDD	1	0	ND	0.2 pg/g
1,2,3,4,6,7,8-HpCDF	1	1	0.16 pg/g	--
1,2,3,4,7,8,9-HpCDF	1	0	ND	0.2 pg/g
1,2,3,4,6,7,8-HpCDD	1	0	ND	0.2 pg/g
OCDF	1	1	0.41 pg/g	--
OCDD	1	1	0.40 pg/g	--

^a All analytes reporting a detectable analytical signal have been reported. Analytes detected at levels below the stated detection limit are presented for information only and are not considered valid for the assessment of blank or background contamination.

ND = Not detected.

Table D-2
Precision and Accuracy Estimates

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)	
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2		
Metals in Gas Solid Phase - ICP-AES											
Filtered Solids: APF, ESP Inlets		Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	58 Q	63 Q	8.3			58 Q	63 Q	8.3
Antimony		20	75-125	95	90	5.4			95	91	4.3
Barium		20	75-125	91	91	0			91	91	0
Beryllium		20	75-125	82	83	1.2			83	83	0
Calcium		20	75-125	66 Q	69 Q	4.4			66 Q	69 Q	4.4
Chromium		20	75-125	82	84	2.4			83	84	1.2
Cobalt		20	75-125	85	85	0			85	85	0
Copper		20	75-125	93	95	2.1			93	95	2.1
Iron		20	75-125	83	84	1.2			83	84	1.2
Magnesium		20	75-125	58 Q	60 Q	3.4			58 Q	60 Q	3.4
Manganese		20	75-125	84	84	0			84	84	0
Molybdenum		20	75-125	87	87	0			87	86	1.2
Nickel		20	75-125	87	86	1.2			85	86	1.2
Phosphorus		20	75-125	88	88	0					
Potassium		20	75-125	91	91	0			91	91	0
Silver		20	75-125	15 Q	18 Q	18			15 Q	18 Q	18
Sodium		20	75-125	86	85	1.2			86	85	1.2
Titanium		20	75-125	93	89	4.4			93	88	5.5
Vanadium		20	75-125	91	91	0			92	91	1.1

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Acetone PNR: ESP Inlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	67 Q	32 Q	71 Q				
Antimony		20	75-125	92	95	3.2			64 Q	32 Q
Barium		20	75-125	89	87	2.3			92	87
Beryllium		20	75-125	81	80	1.2			88	88
Calcium		20	75-125	75	53 Q	34 Q			81	81
Chromium		20	75-125	82	83	1.2			72 Q	52 Q
Cobalt		20	75-125	82	83	1.2			81	84
Copper		20	75-125	92	93	1.1			82	84
Iron		20	75-125	83	78	6.2			92	94
Magnesium		20	75-125	67 Q	35 Q	63 Q			81	78
Manganese		20	75-125	82	83	1.2			65 Q	35 Q
Molybdenum		20	75-125	85	86	1.2			82	84
Nickel		20	75-125	84	84	0			84	87
Phosphorus		20	75-125	87	89	2.3			86	87
Potassium		20	75-125	88	88	0				
Silver		20	75-125	65 Q	68 Q	4.5			88	88
Sodium		20	75-125	86	79	8.5			63 Q	66 Q
Titanium		20	75-125	78	72 Q	8			84	79
Vanadium		20	75-125	90	91	1.1			79	78
									89	91
										2.2

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Nitric PNR: ESP Inlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	112	109	2.7				
Antimony		20	75-125	108	104	3.8				
Barium		20	75-125	104	105	0.96				
Beryllium		20	75-125	106	107	0.94				
Boron		20	74-125	110	109	0.91				
Calcium		20	75-125	108	111	2.7				
Chromium		20	75-125	104	105	0.96				
Cobalt		20	75-125	103	104	0.97				
Copper		20	75-125	108	110	1.8				
Iron		20	75-125	109	107	1.8				
Magnesium		20	75-125	106	107	0.94				
Manganese		20	75-125	104	105	0.96				
Molybdenum		20	75-125	105	105	0				
Nickel		20	75-125	105	104	0.96				
Phosphorus		20	75-125	99	99	0				
Potassium		20	75-125	110	110	0				
Silver		20	75-125	99	100	1				
Sodium		20	75-125	107	107	0				
Titanium		20	75-125	113	111	1.8				
Vanadium		20	75-125	106	107	0.94				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Filter (Half): APF Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	93	94	1.1		93	92	1.1
Antimony		20	75-125	97	97	0		98	103	5
Barium		20	75-125	96	96	0		95	95	0
Beryllium		20	75-125	90	90	0		89	89	0
Calcium		20	75-125	96	96	0		96	95	1
Chromium		20	75-125	83	82	1.2		83	80	3.7
Cobalt		20	75-125	89	89	0		88	88	0
Copper		20	75-125	101	102	0.98		100	100	0
Iron		20	75-125	92	92	0		91	91	0
Magnesium		20	75-125	91	91	0		90	90	0
Manganese		20	75-125	90	91	1.1		90	90	0
Molybdenum		20	75-125	89	88	1.1		88	87	1.1
Nickel		20	75-125	89	90	1.1		88	88	0
Phosphorus		20	75-125	153 Q	99	43 Q				
Potassium		20	75-125	95	95	0		93	92	1.1
Silver		20	75-125	80	81	1.2		84	80	4.9
Sodium		20	75-125	97	98	1		98	97	1
Titanium		20	75-125	95	95	0		94	93	1.1
Vanadium		20	75-125	95	95	0		94	93	1.1

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Filter & PNRs: ESP Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	90	87	3.4		88	89	1.1
Antimony		20	75-125	78	88	12		82	91	10
Barium		20	75-125	93	91	2.2		93	94	1.1
Beryllium		20	75-125	88	86	2.3		87	89	2.3
Calcium		20	75-125	94	91	3.2		91	93	2.2
Chromium		20	75-125	89	86	3.4		86	89	3.4
Cobalt		20	75-125	85	83	2.4		84	85	1.2
Copper		20	75-125	103	99	4		101	103	2
Iron		20	75-125	89	87	2.3		87	88	1.1
Magnesium		20	75-125	83	80	3.7		80	82	2.5
Manganese		20	75-125	89	86	3.4		87	89	2.3
Molybdenum		20	75-125	89	87	2.3		86	89	3.4
Nickel		20	75-125	85	84	1.2		82	87	5.9
Phosphorus		20	75-125	92	92	0				
Potassium		20	75-125	89	86	3.4		87	88	1.1
Silver		20	75-125	80	78	2.5		78	80	2.5
Sodium		20	75-125	93	92	1.1		91	92	1.1
Titanium		20	75-125	93	91	2.2		91	93	2.2
Vanadium		20	75-125	94	91	3.2		92	94	2.2

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Gas Vapor Phase - ICP-AES										
HNO ₃ /H ₂ O ₂ Impingers	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	89	90	1.1		89	89	0
Antimony		20	75-125	91	81	12		94	79	17
Barium		20	75-125	94	94	0		94	94	0
Beryllium		20	75-125	91	91	0		91	91	0
Boron		20	75-125	91	93	2.2		92	93	1.1
Calcium		20	75-125	90	93	3.3		91	93	2.2
Chromium		20	75-125	88	89	1.1		89	89	0
Cobalt		20	75-125	88	89	1.1		89	89	0
Copper		20	75-125	92	92	0		93	91	2.2
Iron		20	75-125	89	91	2.2		90	90	0
Magnesium		20	75-125	86	87	1.2		87	87	0
Manganese		20	75-125	88	89	1.1		89	89	0
Molybdenum		20	75-125	90	90	0		91	90	1.1
Nickel		20	75-125	90	89	1.1		91	89	2.2
Phosphorus		20	75-125	101	99	2				
Potassium		20	75-125	90	92	2.2		90	90	0
Silver		20	75-125	85	85	0		86	85	1.2
Sodium		20	75-125	92	93	1.1		92	92	0
Titanium		20	75-125	91	92	1.1		92	91	1.1
Vanadium		20	75-125	95	95	0		95	95	0

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Coal - ICP-AES	Precision - Analytical Duplicate Accuracy - NA									
Barium		20	75-125	NA	NA	NA				
Beryllium		20	75-125	1.5	1.6	6.5				
Boron		20	75-125	NA	NA	NA				
Calcium		20	75-125	NA	NA	NA				
Chromium		20	75-125	17	17	0				
Copper		20	75-125	NA	NA	NA				
Magnesium		20	75-125	NA	NA	NA				
Molybdenum		20	75-125	NA	NA	NA				
Phosphorus		20	75-125	100	99	1				
Titanium		20	75-125	NA	NA	NA				
Metals in Coal - ICP-AES	Precision - NA Accuracy - Standard Reference Material									
Beryllium (1633-c)		20	75-125				101			
Chromium (1932-a)		20	75-125				95			
Metals in Ash - ICP-AES	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	71 Q	70 Q	1.4		71	69 Q	2.9
Antimony		20	75-125	86	85	1.2		91	93	2.2
Barium		20	75-125	90	91	1.1		90	90	0
Beryllium		20	75-125	81	81	0		81	81	0
Calcium		20	75-125	73 Q	74 Q	1.4		73 Q	74 Q	1.4

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Chromium		20	75-125	83	84	1.2		83	84	1.2
Cobalt		20	75-125	84	84	0		82	83	1.2
Copper		20	75-125	93	92	1.1		93	92	1.1
Iron		20	75-125	84	85	1.2		83	84	1.2
Magnesium		20	75-125	65 Q	64 Q	1.6		65 Q	63 Q	3.1
Manganese		20	75-125	83	84	1.2		83	84	1.2
Molybdenum		20	75-125	85	86	1.2		84	87	3.5
Nickel		20	75-125	86	85	1.2		82	82	0
Phosphorus		20	75-125	83	90	8.1				
Potassium		20	75-125	89	90	1.1		89	89	0
Silver		20	75-125	27 Q	13 Q	70 Q		27 Q	13 Q	70 Q
Sodium		20	75-125	82	82	0		83	83	0
Titanium		20	75-125	85	83	2.4		82	82	0
Vanadium		20	75-125	91	91	0		90	91	1.1
Metals in Sorbent - ICP-AES	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	87	84	3.5				
Antimony		20	75-125	81	89	9.4				
Barium		20	75-125	86	85	1.2				
Beryllium		20	75-125	78	78	0				
Boron		20	75-125	85	84	1.2				
Calcium		20	75-125	286 Q	286 Q	0		174 Q	274 Q	45 Q
Chromium		20	75-125	77	77	0				
Cobalt		20	75-125	74 Q	74 Q	0				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Copper		20	75-125	87	86	1.2				
Iron		20	75-125	75	74 Q	1.3				
Magnesium		20	75-125	113	97	15				
Manganese		20	75-125	80	79	1.3				
Molybdenum		20	75-125	81	80	1.2				
Nickel		20	75-125	76	76	0				
Phosphorus		20	75-125	89	90	1.1				
Potassium		20	75-125	87	86	1.2				
Silver		20	75-125	85	83	2.4				
Sodium		20	75-125	89	88	1.1				
Titanium		20	75-125	85	84	1.2				
Vanadium		20	75-125	85	84	1.2				
Metals in Service Water - ICP-AES	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Aluminum		20	75-125	102	103	0.98				
Antimony		20	75-125	108	98	9.7				
Barium		20	75-125	103	104	0.97				
Beryllium		20	75-125	99	101	2				
Boron		20	75-125	98	99	1				
Calcium		20	75-125	94	95	1.1				
Chromium		20	75-125	98	100	2				
Cobalt		20	75-125	94	96	2.1				
Copper		20	75-125	102	102	0				
Iron		20	75-125	98	99	1				
Magnesium		20	75-125	93	93	0				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Manganese		20	75-125	97	99	2				
Molybdenum		20	75-125	93	93	0				
Nickel		20	75-125	95	97	2.1				
Phosphorus		20	75-125	98	98	0				
Potassium		20	75-125	101	101	0				
Silver		20	75-125	101	102	0.98				
Sodium		20	75-125	106	104	1.9				
Titanium		20	75-125	94	95	1.1				
Vanadium		20	75-125	97	98	1				
Metals in Gas Vapor Phase - ICP/MS	Precision - NA Accuracy - Matrix-spiked Sample									
HNO ₃ /H ₂ O ₂ Impingers										
Antimony		20	75-125	84						
Arsenic		20	75-125	78						
Barium		20	75-125	80						
Beryllium		20	75-125	95						
Cadmium		20	75-125	95						
Chromium		20	75-125	83						
Cobalt		20	75-125	76						
Copper		20	75-125	77						
Lead		20	75-125	121						
Manganese		20	75-125	82						
Mercury ³		20	75-125	116						
Molybdenum		20	75-125	105						
Nickel		20	75-125	84						
Selenium		20	75-125	71 Q						
Vanadium		20	75-125	79						

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Coal - INAA	Precision - NA Accuracy - Standard Reference Material (NIST 1632-A)									
Aluminum		20	75-125				101			
Antimony		20	75-125				99			
Arsenic		20	75-125				99			
Barium		20	75-125				101			
Calcium		20	75-125				103			
Cadmium		20	75-125				NC			
Chromium		20	75-125				99			
Cobalt		20	75-125				98			
Copper		20	75-125				100			
Iron		20	75-125				100			
Magnesium		20	75-125				101			
Manganese		20	75-125				97			
Mercury		20	75-125				NC			
Molybdenum		20	75-125				103			
Nickel		20	75-125				90			
Potassium		20	75-125				101			
Selenium		20	75-125				104			
Silver		20	75-125				111			
Sodium		20	75-125				101			
Titanium		20	75-125				101			
Vanadium		20	75-125				111			

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Gas Solid Phase - GFAAS & CVAAS										
Filtered Solids: APF & ESP Inlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	93	102	9.2				
Cadmium		20	75-125	105	102	2.9				
Lead		20	75-125	72 Q	76	5.4		71 Q	76	6.8
Mercury		20	75-125	104	105	0.96				
Selenium		20	75-125	81	80	1.2				
Acetone PNR: ESP Inlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	116	114	1.7				
Lead		20	75-125	82	79	3.7				
Mercury		20	75-125	106	106	0				
Selenium		20	75-125	69 Q	67 Q	2.9		73 Q	67 Q	8.6
Nitric PNR: ESP Inlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Mercury		20	75-125	100	98	2				
Filter (Half): APF Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	104	104	0				
Cadmium		20	75-125	93	94	1.1				
Lead		20	75-125	105	108	2.8				
Mercury		20	75-125	101	102	0.98				
Selenium		20	75-125	101	101	0				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Filter & PNRs: ESP Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	105	111	5.6				
Cadmium		20	75-125	104	92	12				
Lead		20	75-125	110	100	9.5				
Mercury		20	75-125	111	111	0				
Selenium		20	75-125	82	89	8.2				
Cadmium (different Batch)		20	75-125	86	82	4.8		84	86	2.4
Mercury (different Batch)		20	75-125	112	113	0.89				
Metals in Gas Vapor Phase - GFAAS & CVAAS										
HNO ₃ /H ₂ O ₂ Impingers	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	103	102	0.98				
Cadmium		20	75-125	108	110	1.8				
Lead		20	75-125	99	100	1				
Mercury		20	75-125	96	96	0				
Selenium		20	75-125	38 Q	41 Q	7.6		56 Q	61 Q	8.6
Selenium (Different Batch)		20	75-125	4.6 Q	14 Q	101 Q				
KMnO ₄ Impingers	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Mercury		20	75-125	76	72 Q	5.4		76		

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Coal - GFAAS & CVAAS	Precision - Analytical Duplicate Accuracy - NA									
Arsenic		20	75-125	27	31	14				
Cadmium		20	75-125	0.1	0.08	22				
Lead		20	75-125	7	7	0				
Mercury		20	75-125	0.15	0.16	6.5				
Selenium		20	75-125	0.8	0.8	0				
Selenium		20	75-125	0.6	0.6	0				
Metals in Coal - GFAAS & CVAAS	Precision - NA Accuracy - Standard Reference Material									
Arsenic (1632-b)		20	75-125				76 Q			
Cadmium (1632-b)		20	75-125				877 Q			
Lead (1633-a)		20	75-125				107			
Mercury (SARM 20)		20	75-125				104			
Selenium (1632-b)		20	75-125				108			
Metals in Ash - GFAAS & CVAAS	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	100	91	9.4				
Cadmium		20	75-125	102	107	4.8				
Lead		20	75-125	97	99	2				
Mercury		20	75-125	90	95	5.4				
Selenium		20	75-125	84	87	3.5				
Lead (Different Batch)		20	75-125	92	90	2.2				
Selenium (Different Batch)		20	75-125	93	93	0				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Metals in Sorbent - GFAAS & CVAAS	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	111	111	0				
Cadmium		20	75-125	113	114	0.88				
Lead		20	75-125	108	108	0				
Mercury		20	75-125	104	108	3.8				
Selenium		20	75-125	97	104	7				
Metals in Service Water - GFAAS & CVAAS	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Arsenic		20	75-125	108	111	2.7				
Cadmium		20	75-125	105	103	1.9				
Lead		20	75-125	92	92	0				
Mercury		20	75-125	114	98	15				
Selenium		20	75-125	89	89	0				
Anions in Gas Particulate Phase										
Filter (Half): APF Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chloride		20	80-120	101	105	3.9				
Sulfate		20	80-120	82	80	2.5				
Chloride (Different Batch)		20	80-120	85	82	3.6				
Filter & PNRA: ESP Outlet	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Fluoride		20	80-120	100	102	2				
Anions in Gas Vapor Phase										

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
CO ₃ /H ₂ O ₂ Impingers	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chloride		20	80-120	99	95	4.1				
Fluoride		20	80-120	106	110	3.7				
Fluoride (Different Batch)		20	80-120	94	95	1.1				
Sulfate		20	80-120	98	96	2.1				
Anions in Coal	Precision - Analytical Duplicate Accuracy - None									
Chloride		20	80-120	990	990	0				
Fluoride		20	80-120	120	120	0				
Anions in Coal	Precision - NA Accuracy - Standard Reference Material									
Chloride (NBS 1632-b)		20	80-120				101			
Chloride (RR 985)		20	80-120				87			
Fluoride (BCR 40)		20	80-120				110			
Anions in Ash	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chloride		20	80-120	94	94	0				
Fluoride		20	80-120	32 Q	25 Q	25 Q				
Fluoride (Different Batch)		20	80-120	30 Q	23 Q	33 Q				
Anions in Ash	Precision - Analytical Duplicate Accuracy - NA									
Sulfur		20	80-120	14.7	14.8	0.68				
Anions in Ash	Precision - NA Accuracy - Standard Reference Material									
Sulfur - DOMTAR CYP-C		20	80-120				103			
Sulfur - USGS GXR-4		20	80-120				102			

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Anions in Sorbent	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chloride		20	80-120	99	99	0				
Fluoride		20	80-120	62 Q	80	25 Q				
Sulfate		20	80-120	83	82	1.2				
Anions in Service Water	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chloride		20	80-120	108	105	2.8				
Fluoride		20	80-120	106	107	0.94				
Sulfate		20	80-120	91	91	0				
Phosphate		20	75-125	102	105	2.9				
Carbon & Boron in Ash	Precision - NA Accuracy - Standard Reference Material									
Carbon (DOMTAR CYP-C)		20	75-125				101			
Carbon (MRG-I)		20	75-125				77			
Boron (SARM 20)		20	75-125				101			
Carbon & Boron in Ash	Precision - Analytical Duplicate Accuracy - NA									
Carbon		20	75-125	0.06	0.06	0				
Carbon		20	75-125	5.18	5.14	0.78				
Carbon		20	75-125	0.35	0.32	9				
Boron		20	75-125	110	100	9.5				
Boron		20	75-125	81	94	14.9				
Boron		20	75-125	81	82	1.2				
Ammonia in Gas Vapor Phase by 350.2	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Ammonia		20	80-120	97	108	11				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision (% RPD)	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision (% RPD)
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1			MS-2	MSD-2	
Cyanide in Gas Vapor Phase by 335.2	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Cyanide		20	75-125	100	98	2				
Chromium in Gas Vapor Phase	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Chromium (Nitric Rinse)		20	75-125	95	98	3.1				
Chromium (KOH Impinger)		20	75-125	92	101	9.3				
Formaldehyde in Gas Vapor Phase	Precision - Analytical Duplicate Accuracy - NA									
Formaldehyde		10	70-130	260	270	3.8				
Formaldehyde		10	70-130	63	60	4.9				
Formaldehyde in Gas Vapor Phase	Precision - NA Accuracy - Trip Spike									
Formaldehyde		10	70-130	94						
Formaldehyde		10	70-130	74						
Formaldehyde in Gas Vapor Phase	Precision - NA Accuracy - Lab Spike									
Formaldehyde		10	70-130	92						
Formaldehyde		10	70-130	91						
Semivolatile Compounds in Ash	Precision - Matrix-spiked Duplicate Accuracy - Matrix-spiked Sample									
Acenaphthene		50	47-145	82	90	9.3				
4-Chloro-3-methylphenol		70	22-147	68	86	23				
2-Chlorophenol		60	23-134	75	89	17				
1,4-Dichlorobenzene		50	20-124	83	91	9.2				

Table D-2 (Continued)

Measurement Parameter	How Measured	Objectives		Measured Accuracy (% Recovery)		Measured Precision	Audit Sample Accuracy (% Recovery)	Measured Accuracy (% Recovery)		Measured Precision
		Precision (% RPD)	Accuracy (% Recovery)	MS-1	MSD-1	(% RPD)		MS-2	MSD-2	(% RPD)
2,4-Dinitrotoluene		50	39-139	77	86	11				
N-nitrosodipropylamine		130	D-230	102	108	5.7				
4-Nitrophenol		80	D-132	3.1	1.8	53				
Pentachlorophenol		90	14-176	ND	1.1 Q	NC				
Phenol		50	5-112	76	89	16				
Pyrene		50	52-115	49 Q	59	18				
1,2,4-Trichlorobenzene		50	44-142	90	98	8.5				

NA = Not applicable.

NC = Not calculable.

ND = Not detected.

Q = Data flag indicating accuracy and precision results that do not meet the stated objectives.

Table D-3
Surrogate Spike Data

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
Volatile Organics in Vapor Phase - APF Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	92-104	6	0
Toluene d-8		77-122	90-99	6	0
4-Bromofluorobenzene		60-128	87-96	6	0
Volatile Organics in Vapor Phase - APF Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	73-104	6	0
Toluene d-8		77-122	87-98	6	0
4-Bromofluorobenzene		60-128	82-94	6	0
Volatile Organics in Vapor Phase - APF Field Blanks	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	92-105	6	0
Toluene d-8		77-122	87-96	6	0
4-Bromofluorobenzene		60-128	84-95	6	0
Volatile Organics in Vapor Phase - ESP Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	90-107	6	0
Toluene d-8		77-122	91-97	6	0
4-Bromofluorobenzene		60-128	86-93	6	0
Volatile Organics in Vapor Phase - ESP Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	95-107	6	0
Toluene d-8		77-122	83-100	6	0
4-Bromofluorobenzene		60-128	74-94	6	0
Volatile Organics in Vapor Phase - ESP Field Blanks	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	93-105	6	0
Toluene d-8		77-122	91-98	6	0
4-Bromofluorobenzene		60-128	91-98	6	0
Volatile Organics in Vapor Phase - Trip Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
1,2-Dichloroethane-d4		51-145	105	1	0
Toluene d-8		77-122	97	1	0
4-Bromofluorobenzene		60-128	94	1	0

Table D-3 (Continued)

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
Semivolatile Organics in APF Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
2-Fluorobiphenyl		30-115	92-99	4	0
2-Fluorophenol		25-121	92-95	4	0
Nitrobenzene-d5		23-120	99-103	4	0
Phenol-d5		24-113	94-99	4	0
Terphenyl-d14		18-137	98-109	4	0
2,4,6-Tribromophenol		19-122	76-88	4	0
Semivolatile Organics in ESP Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
2-Fluorobiphenyl		30-115	90-103	4	0
2-Fluorophenol		25-121	84-96	4	0
Nitrobenzene-d5		23-120	92-104	4	0
Phenol-d5		24-113	86-100	4	0
Terphenyl-d14		18-137	92-105	4	0
2,4,6-Tribromophenol		19-122	77-99	4	0
Semivolatile Organics in Bed Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
2-Fluorobiphenyl		30-115	94-100	4	0
2-Fluorophenol		25-121	68-76	4	0
Nitrobenzene-d5		23-120	94-98	4	0
Phenol-d5		24-113	86-93	4	0
Terphenyl-d14		18-137	102-106	4	0
2,4,6-Tribromophenol		19-122	26-43	4	0
Semivolatile Organics in Cyclone Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
2-Fluorobiphenyl		30-115	100-104	4	0
2-Fluorophenol		25-121	77-93	4	0
Nitrobenzene-d5		23-120	100-103	4	0
Phenol-d5		24-113	96-100	4	0
Terphenyl-d14		18-137	72-85	4	0
2,4,6-Tribromophenol		19-122	10-36	4	2
Semivolatile Organics in Gas Solid Phase - APF Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	17-84	6	3
Nitrobenzene-d5		50-150	30-80	6	3
1,3,5-Trichlorobenzene-d3		50-150	23-84	6	3
1,4-Dibromobenzene-d4		50-150	44-90	6	1

Table D-3 (Continued)

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
Semivolatile Organics in Gas Solid Phase - APF Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	31-78	7	2
Nitrobenzene-d5		50-150	35-77	7	2
1,3,5-Trichlorobenzene-d3		50-150	33-78	7	2
1,4-Dibromobenzene-d4		50-150	52-96	7	0
Semivolatile Organics in Gas Solid Phase - ESP Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	46-88	10	2
Nitrobenzene-d5		50-150	34-83	10	4
1,3,5-Trichlorobenzene-d3		50-150	29-82	9	3
1,4-Dibromobenzene-d4		50-150	70-115	10	0
Semivolatile Organics in Gas Solid Phase - ESP Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	2-99	8	4
Nitrobenzene-d5		50-150	44-80	9	2
1,3,5-Trichlorobenzene-d3		50-150	41-76	9	2
1,4-Dibromobenzene-d4		50-150	66-105	9	0
Semivolatile Organics in Gas Vapor Phase - APF Field Blanks	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	71-102	2	0
Nitrobenzene-d5		50-150	52-96	2	0
1,3,5-Trichlorobenzene-d3		50-150	50-97	2	0
1,4-Dibromobenzene-d4		50-150	75-109	2	0
Semivolatile Organics in Gas Solid Phase - ESP Field Blanks	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	53-70	2	0
Nitrobenzene-d5		50-150	43-72	2	1
1,3,5-Trichlorobenzene-d3		50-150	43-74	2	1
1,4-Dibromobenzene-d4		50-150	56-88	2	0
Semivolatile Organics in Gas Vapor Phase - Trip Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
Phenol-d5		50-150	60	1	0
Nitrobenzene-d5		50-150	60	1	0
1,3,5-Trichlorobenzene-d3		50-150	65	1	0
1,4-Dibromobenzene-d4		50-150	72	1	0

Table D-3 (Continued)

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
PAH Organics in Gas Vapor Phase - APF Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	94-96	3	0
d14-Terphenyl		50-150	103-121	3	0
PAH Organics in Gas Solid Phase - APF Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	93-99	3	0
d14-Terphenyl		50-150	108-115	3	0
PAH Organics in Gas Solid Phase - ESP Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	75-92	3	0
d14-Terphenyl		50-150	113-118	3	0
PAH Organics in Gas Solid Phase - ESP Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	76-97	3	0
d14-Terphenyl		50-150	95-122	3	0
PAH Organics in Gas Solid Phase - APF Field Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	96	1	0
d14-Terphenyl		50-150	115	1	0
PAH Organics in Gas Vapor Phase - ESP Field Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
d10-Fluorene		50-150	77	1	0
d14-Terphenyl		50-150	100	1	0
Dioxins/Furans in APF Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		40-130	34-49	4	2
13C12-2,3,4,7,8-PeCDF		40-130	49-55	4	0
13C12-1,2,3,4,7,8-HxCDF		40-130	70-98	4	0
13C12-1,2,3,4,7,8-HxCDD		40-130	67-81	4	0
13C12-1,2,3,4,7,8,9-HpCDF		25-130	73-82	4	0
Dioxins/Furans in ESP Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		40-130	46-60	4	0
13C12-2,3,4,7,8-PeCDF		40-130	47-59	4	0
13C12-1,2,3,4,7,8-HxCDF		40-130	82-98	4	0
13C12-1,2,3,4,7,8-HxCDD		40-130	79-93	4	0
13C12-1,2,3,4,7,8,9-HpCDF		25-130	71-83	4	0

Table D-3 (Continued)

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
Dioxins/Furans in Cyclone Ash	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		40-130	35-53	4	1
13C12-2,3,4,7,8-PeCDF		40-130	44-53	4	0
13C12-1,2,3,4,7,8-HxCDF		40-130	83-95	4	0
13C12-1,2,3,4,7,8-HxCDD		40-130	77-86	4	0
13C12-1,2,3,4,7,8,9-HpCDF		25-130	78-84	4	0
Dioxins/Furans in Gas: APF Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	88-110	3	0
13C12-2,3,4,7,8-PeCDF		70-130	78-108	3	0
13C12-1,2,3,4,7,8-HxCDF		70-130	91-127	3	0
13C12-1,2,3,4,7,8-HxCDD		70-130	89-118	3	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	60-122	3	1
Dioxins/Furans in Gas: APF Outlet - PNR/XAD Only	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	74-79	3	0
13C12-2,3,4,7,8-PeCDF		70-130	80-95	3	0
13C12-1,2,3,4,7,8-HxCDF		70-130	80-96	3	0
13C12-1,2,3,4,7,8-HxCDD		70-130	101-105	3	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	68-110	3	1
Dioxins/Furans in Gas: ESP Inlet	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	85-88	3	0
13C12-2,3,4,7,8-PeCDF		70-130	89-96	3	0
13C12-1,2,3,4,7,8-HxCDF		70-130	82-108	3	0
13C12-1,2,3,4,7,8-HxCDD		70-130	97-106	3	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	99-110	3	0
Dioxins/Furans in Gas: ESP Outlet	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	85-89	3	0
13C12-2,3,4,7,8-PeCDF		70-130	90-94	3	0
13C12-1,2,3,4,7,8-HxCDF		70-130	94-112	3	0
13C12-1,2,3,4,7,8-HxCDD		70-130	99-105	3	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	83-112	3	0

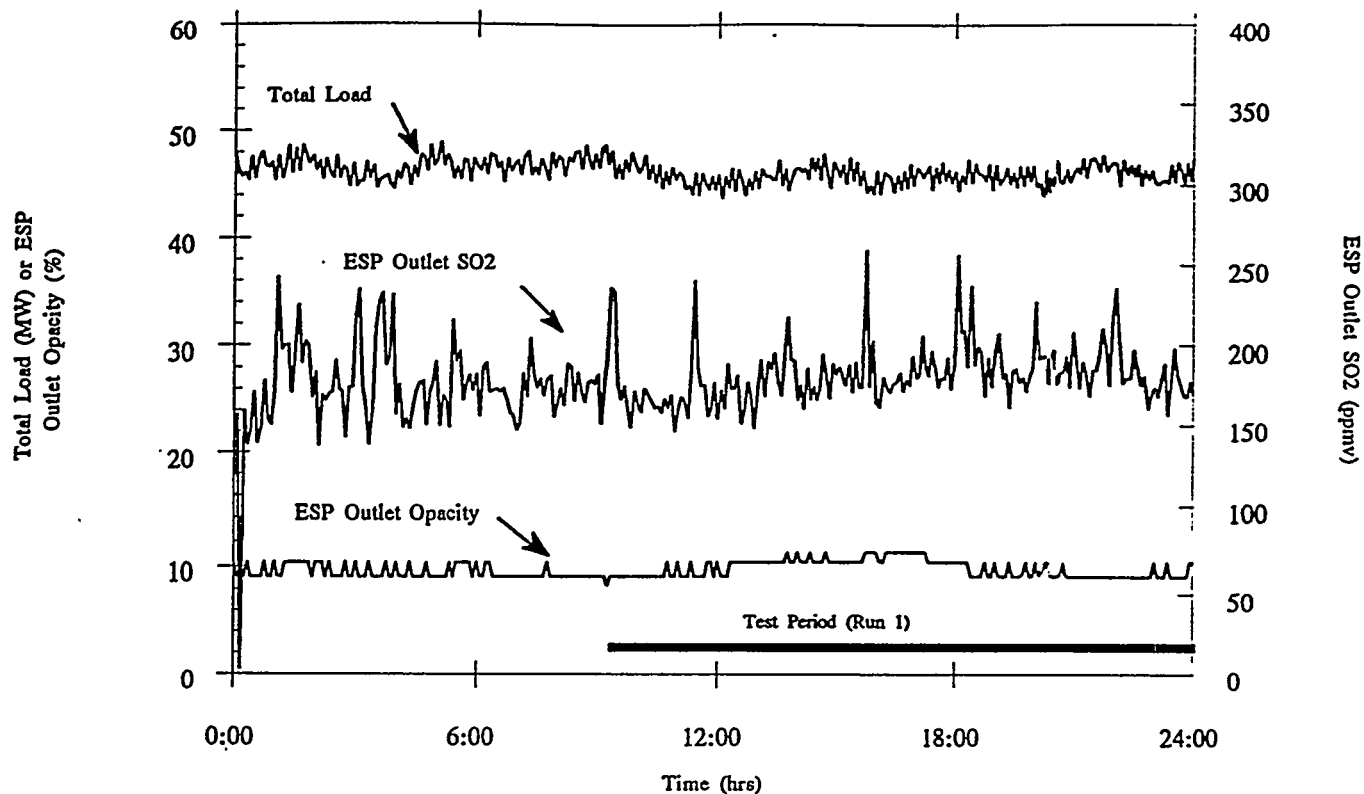
Table D-3 (Continued)

Measurement Parameter	How Measured	Objective (% Rec)	Range of Recovery (% Rec)	Number Analyzed	Number Outside Objective
Dioxins/Furans in Gas: APF Field Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	84	1	0
13C12-2,3,4,7,8-PeCDF		70-130	89	1	0
13C12-1,2,3,4,7,8-HxCDF		70-130	92	1	0
13C12-1,2,3,4,7,8-HxCDD		70-130	105	1	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	96	1	0
Dioxins/Furans in Gas: ESP Field Blank	Precision - NA Accuracy - Surrogate Spike Recovery				
37C14-2,3,7,8-TCDD		70-130	85	1	0
13C12-2,3,4,7,8-PeCDF		70-130	90	1	0
13C12-1,2,3,4,7,8-HxCDF		70-130	109	1	0
13C12-1,2,3,4,7,8-HxCDD		70-130	99	1	0
13C12-1,2,3,4,7,8,9-HpCDF		70-130	93	1	0

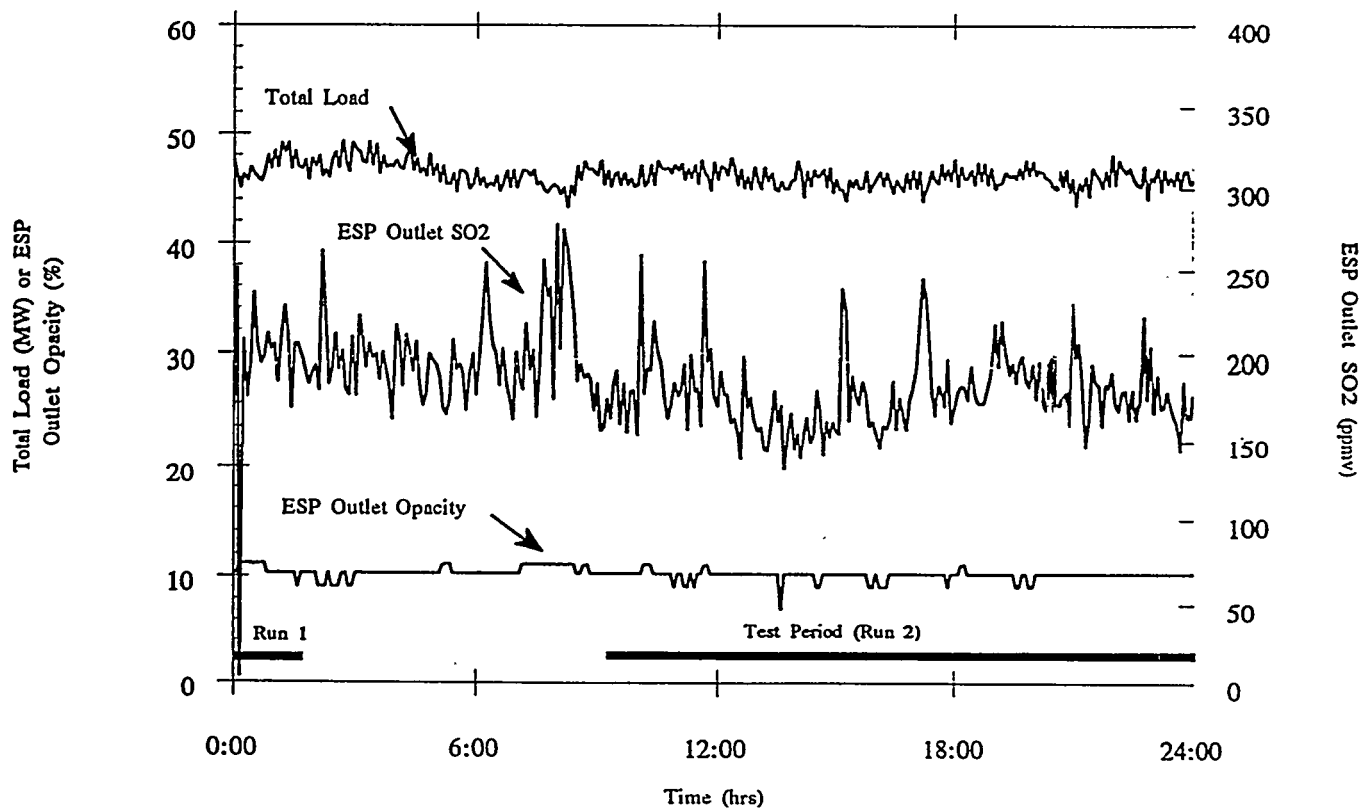
NA = Not applicable.

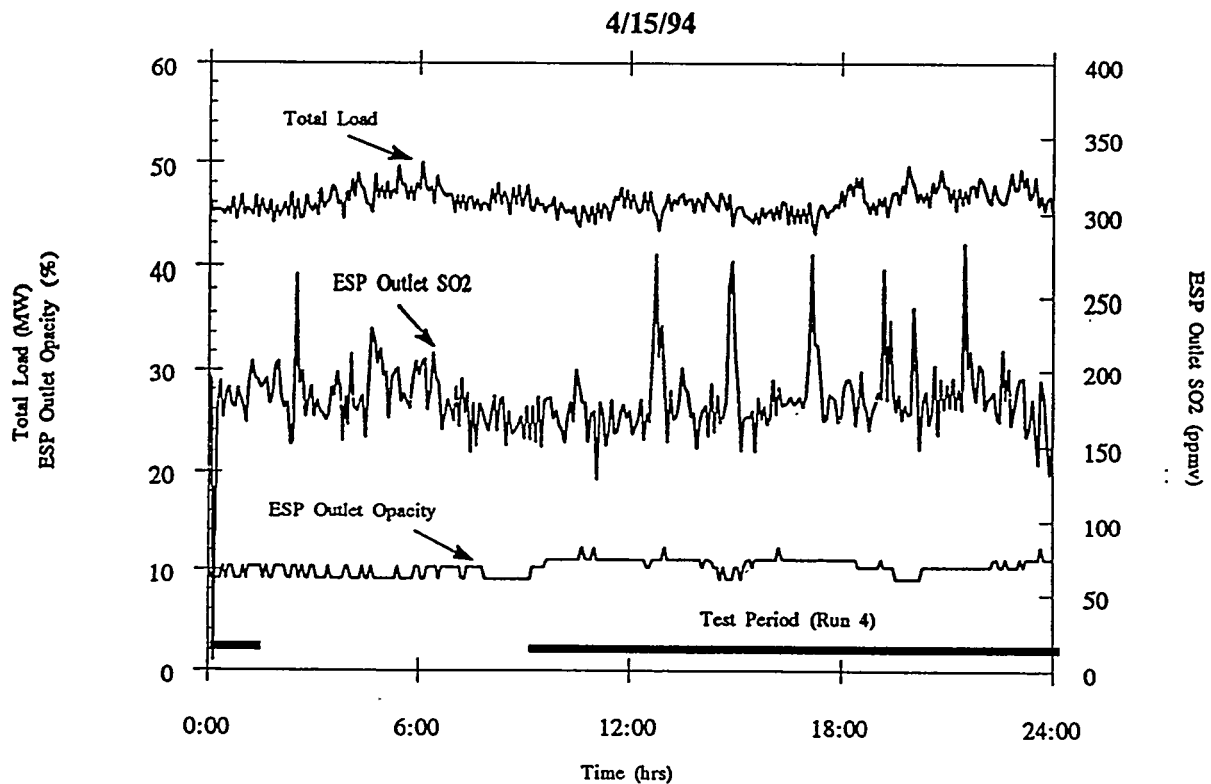
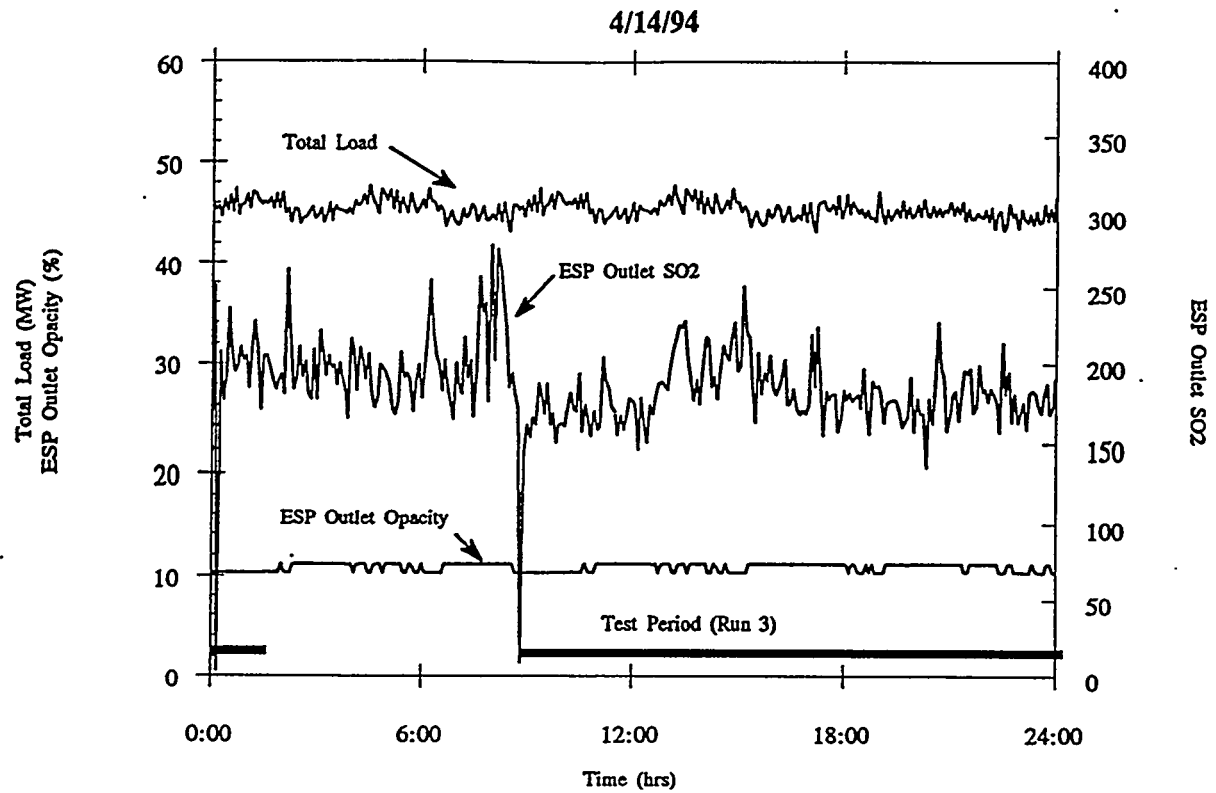
APPENDIX E: PROCESS DATA TREND PLOTS

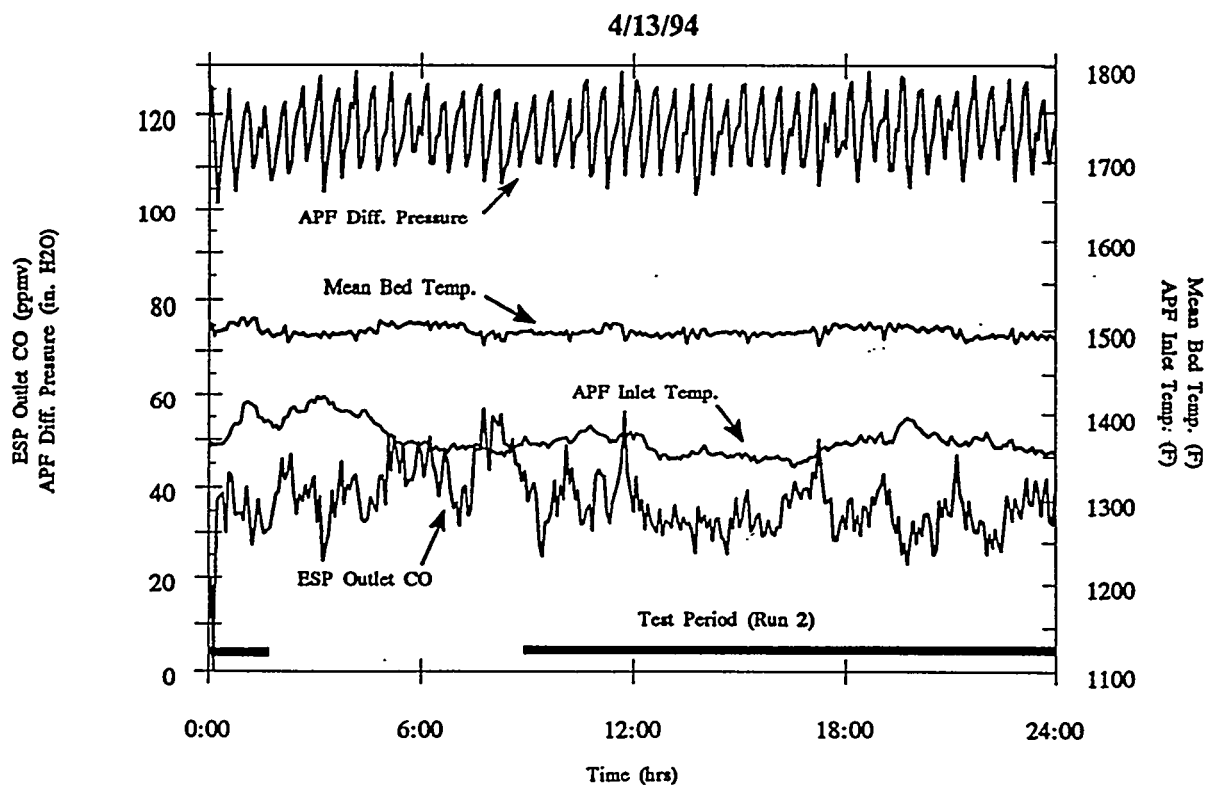
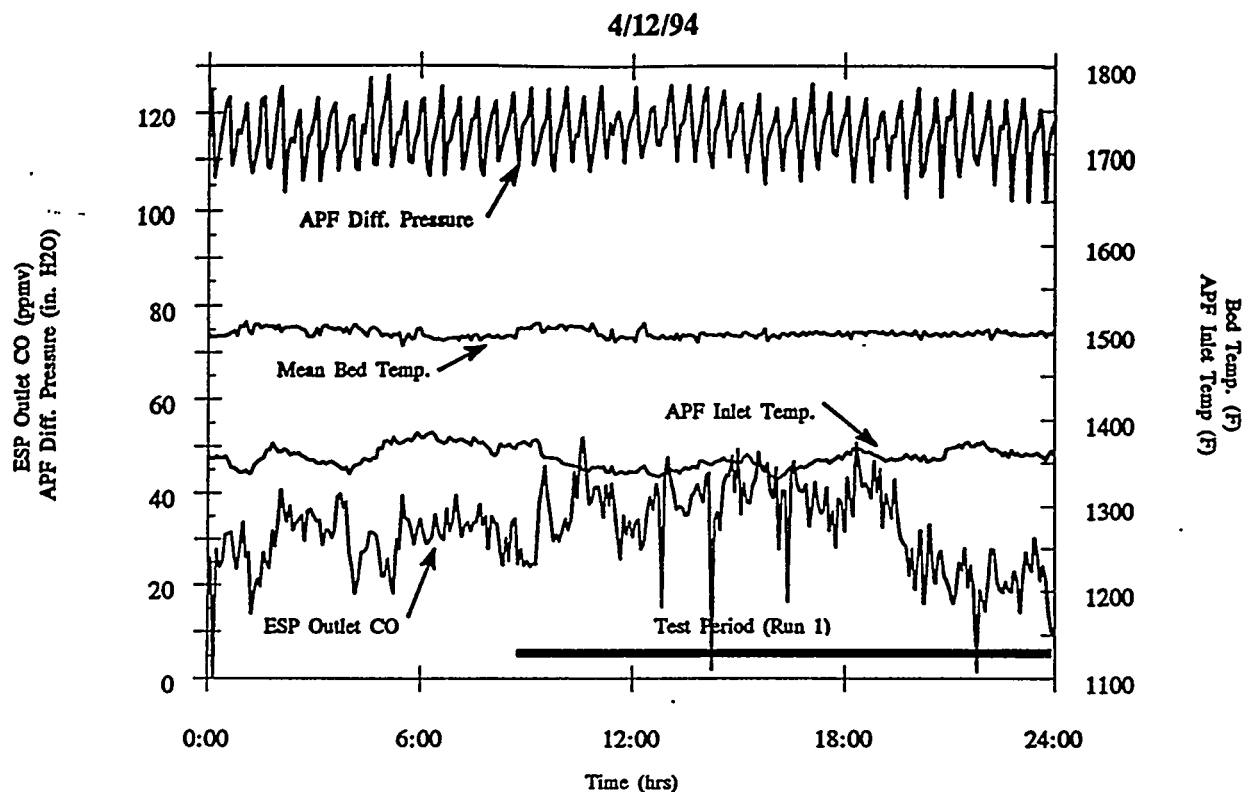
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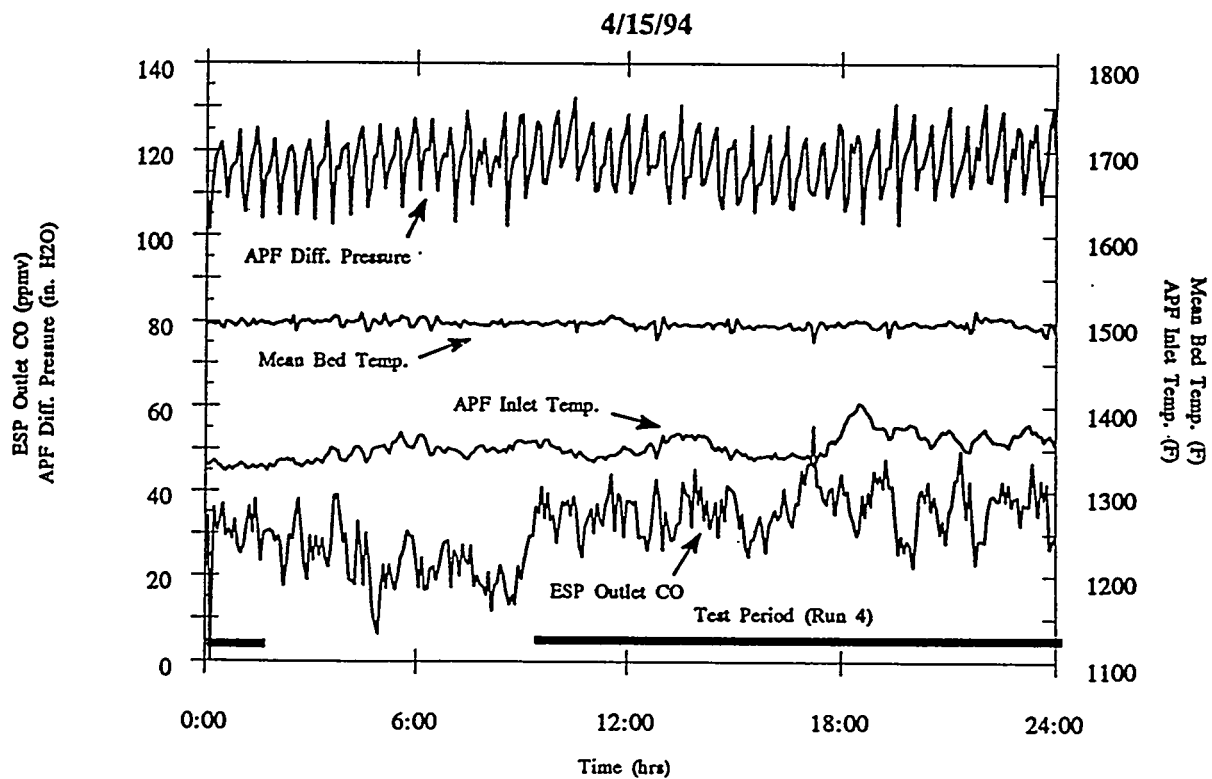
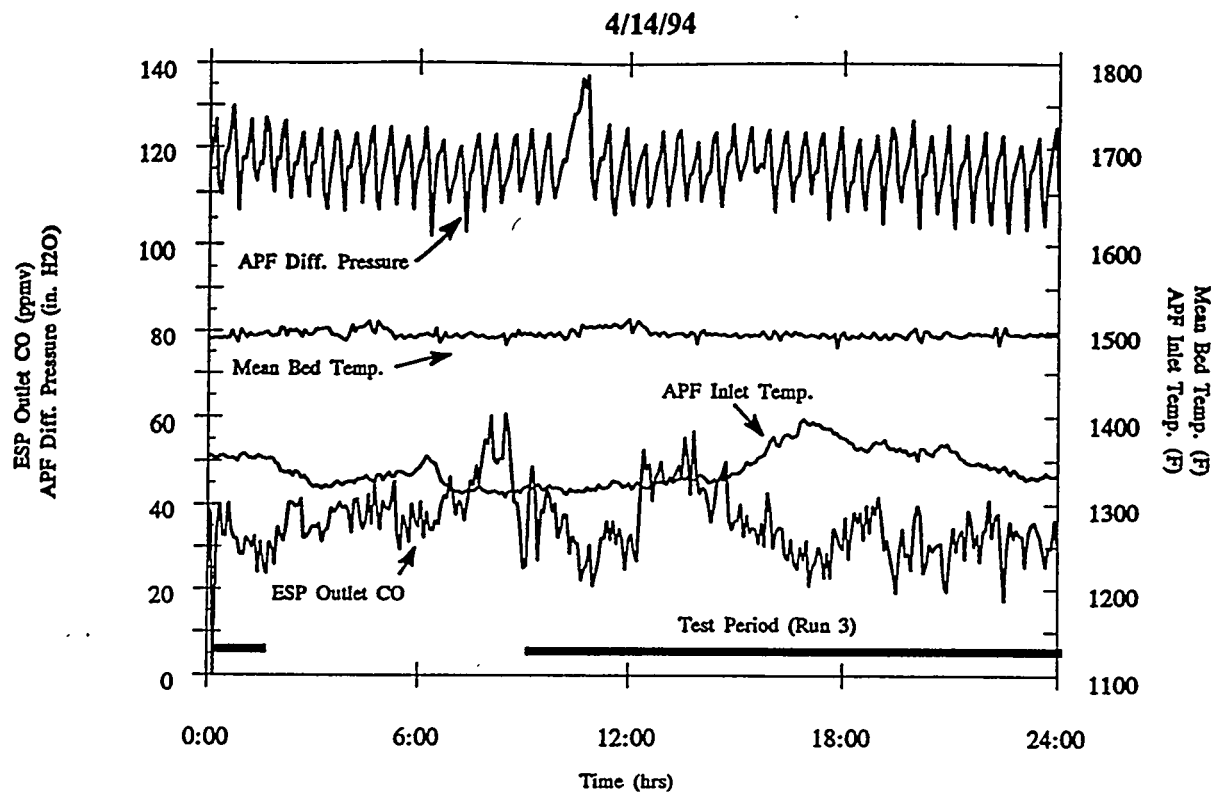


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APPENDIX F: FIELD SAMPLING EQUIPMENT CALIBRATION RECORDS AND FIELD DATA SHEETS

On file at Radian Corporation.

APPENDIX G: 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;
δ_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:

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

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

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

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

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

$$\theta_i = \frac{\partial r}{\partial p_i} \quad (\text{eq. 4})$$

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

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

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_{pi} , or the bias, β_{pi} .

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

$$S_{\bar{p}} = \frac{S_{pi}}{\sqrt{N}} \quad (\text{eq. 6})$$

The degrees of freedom for each parameter is found from

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

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

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

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. Accounting for long-term system variability will require repeated sampling trips to the same location.