INNOVATIVE CLEAN COAL TECHNOLOGY

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

Plant Hammond

Environmental Monitoring Program

Report of Phase 1 (Baseline Tests)

Prepared by:

Southern Company Services, Inc.
Birmingham, Alabama

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EXECUTIVE SUMMARY

This report summarizes the results obtained during Environmental Monitoring Program (EMP) activities conducted during the first testing phase of the Innovative Clean Coal Technology (ICCT) project entitled "500 MW Demonstration of Advanced Wall-Fired Combustion Techniques for the Reduction of Nitrogen Oxide (NO_x) Emissions from Coal-Fired Boilers." This first phase demonstrates and documents the existing conditions of Unit 4 prior to any retrofitting of NO_x reduction technologies. The project is being conducted at Georgia Power Company's Plant Hammond Unit 4 located near Rome, Georgia.

The primary goal of this project is to characterize the effects of low NO_x combustion equipment through the collection and analysis of both long-term emissions data and short-term characterization data. During each test phase, diagnostic, performance, long-term, and verification tests are performed. The advanced combustion techniques included in this demonstration project are being tested in a stepwise manner using the following phased approach:

Phase 1: Baseline testing on the "as found" Unit 4 boiler;

Phase 2: Advanced Overfire Air (AOFA) installation and testing;

Phase 3a: Low NO_x burner (LNB) installation and testing; and

Phase 3b: LNB plus AOFA testing.

EMP activities consist of sampling and analysis activities performed during testing periods for each phase together with compliance monitoring performed on gaseous and aqueous streams. Energy Technology Consultants, Inc. (ETEC) is responsible for the preparation of interim test reports on each project phase, as well as a comprehensive test report to be prepared at the end of the project. Radian Corporation is responsible to Southern Company Services, Inc. (SCS) for the preparation of the EMP reports.

During Phase 1, a total of 36 diagnostic, 7 performance and 11 verification tests were performed. Twelve weeks of long-term testing were conducted. All of the sampling and analytical methods used were specified and approved in the Environmental Monitoring Plan that was prepared for this project.

The data obtained during Phase 1 were sufficient to characterize the unit operation and the level of emissions produced by Unit 4 during baseline conditions. The monitoring results gathered in future phases will be compared to the baseline results to determine how the NO_x reduction techniques affect NO_x and other environmental monitoring parameters.

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1.0 INTRODUCTION

As an Innovative Clean Coal Technology (ICCT) Program demonstration, this project, entitled "500 MW Demonstration of Advanced, Wall-Fired Combustion Techniques for the Reduction of Nitrogen Oxide (NO_x) Emissions from Coal-Fired Boilers," is required to develop and implement an approved Environmental Monitoring Plan (EMP). The EMP for this project was prepared by Radian Corporation for Southern Company Services, Inc. and submitted to the U.S. Department of Energy (DOE) in final form on September 14, 1990 [1]. The EMP includes supplemental and compliance monitoring of several gaseous, aqueous, and solid streams.

This report presents the results of EMP activities conducted during Phase 1 (Baseline Testing) of the project.

1.1 Project Description

Southern Company Services (SCS) was selected for this ICCT Round II project on December 20, 1989. In this project, retrofit NO_x reduction techniques are being tested on Unit 4 at Georgia Power Company's (GPC) Plant Hammond, near Rome, Georgia. Emissions and performance are being characterized for this wall-fired boiler while operating in the following configurations:

- Baseline ("as-found") configuration--Phase 1;
- Advanced Overfire Air (AOFA) retrofit--Phase 2;
- Low NO_x burner (LNB) retrofit--Phase 3a; and
- Combined AOFA and LNB configuration--Phase 3b.

[1] Some changes in the EMP are currently under consideration by DOE.

The major objectives of the project are to:

- Demonstrate (in a logical stepwise fashion) the performance of three combustion NO_x control technologies (i.e., AOFA, LNB, and AOFA plus LNB);
- Determine the short-term NO_x emission trends for each of the operating configurations;
- Determine the dynamic long-term NO_x emission characteristics for each of the operating configurations, using advanced statistical techniques;
- Evaluate progressive cost-effectiveness (i.e., dollars per ton of NO_x removed) of the low NO_x technologies tested; and
- Determine the effects on other combustion parameters (e.g., CO production, carbon carry-over, particulate characteristics) of applying the low NO_x combustion technologies.

Each of the phases of the project involve three distinct testing periods: short-term characterization, long-term characterization, and short-term verification. The short-term characterization testing establishes the impacts of selected parameters on NO_x emissions and establishes the influence of the operating mode on other combustion parameters. The long-term characterization testing, which occurs over 50-80 days of continuous testing, establishes the dynamic response on NO_x emissions while the unit is operated under normal system dispatch conditions. The short-term verification testing is conducted to determine if any fundamental changes in NO_x emission characteristics have occurred during the long-term test period.

The EMP activities consist of a specific set of sampling and analytical activities performed during testing periods for each test phase. Energy Technology Consultants (ETEC) Inc. prepares phase reports summarizing all the results obtained in fulfillment of the project's objectives as outlined above. Radian has prepared this EMP Phase Report to present the data obtained during the Phase I EMP monitoring. The reader is referred to the ETEC Phase 1 report entitled "Innovative Clean Coal

Technology (ICCT) 500 MW Demonstration of Advanced Wall-Fired Combustion Techniques for the Reduction of Nitrogen Oxide (NO_x) Emissions from Coal-Fired Boilers; Phase 1--Baseline Tests," dated December 5, 1990, for additional test results.

1.2 Project Organization

The project organization is shown in Figure 1-1. The SCS Project Manager has overall responsibility for project execution. Energy Technology Consultants (ETEC) has responsibility for the on-site testing and for analysis of the data for all project phases. Spectrum Systems, Inc. provides a full-time on-site instrument technician who is responsible for operation and maintenance of the data acquisition system (DAS) which is housed within the instrument control room. Southern Research Institute (SoRI) is responsible for the flue gas particulate measurements during the performance testing portion of the short-term characterization tests. Flame Refractories, Inc. (Flame) is responsible for measuring fuel/air input parameters and furnace output temperatures during the performance testing portion of the short-term characterization tests. W. S. Pitts, Inc. (WSPC) is responsible for analysis of emission and performance data for the long-term characterization tests. Radian Corporation is responsible to SCS for EMP activities, including preparation of the Environmental Monitoring Plan, and associated quarterly, annual, and phase reports.

1.3 Hammond Unit 4 Description

Four generating units operate at Plant Hammond, which has a total nameplate capacity of 800 MW. Units 1 through 3 are 100 MW Babcock & Wilcox wall-fired boilers; Unit 4, a 500 MW Foster-Wheeler wall-fired boiler, is the site of the ICCT demonstration project. Particulate emissions are controlled by electrostatic precipitators. All four units exhaust to a single 750 foot high stack. The exhaust gas streams from Units 1, 2, and 3 are combined and discharged through a single Liner, while Unit 4

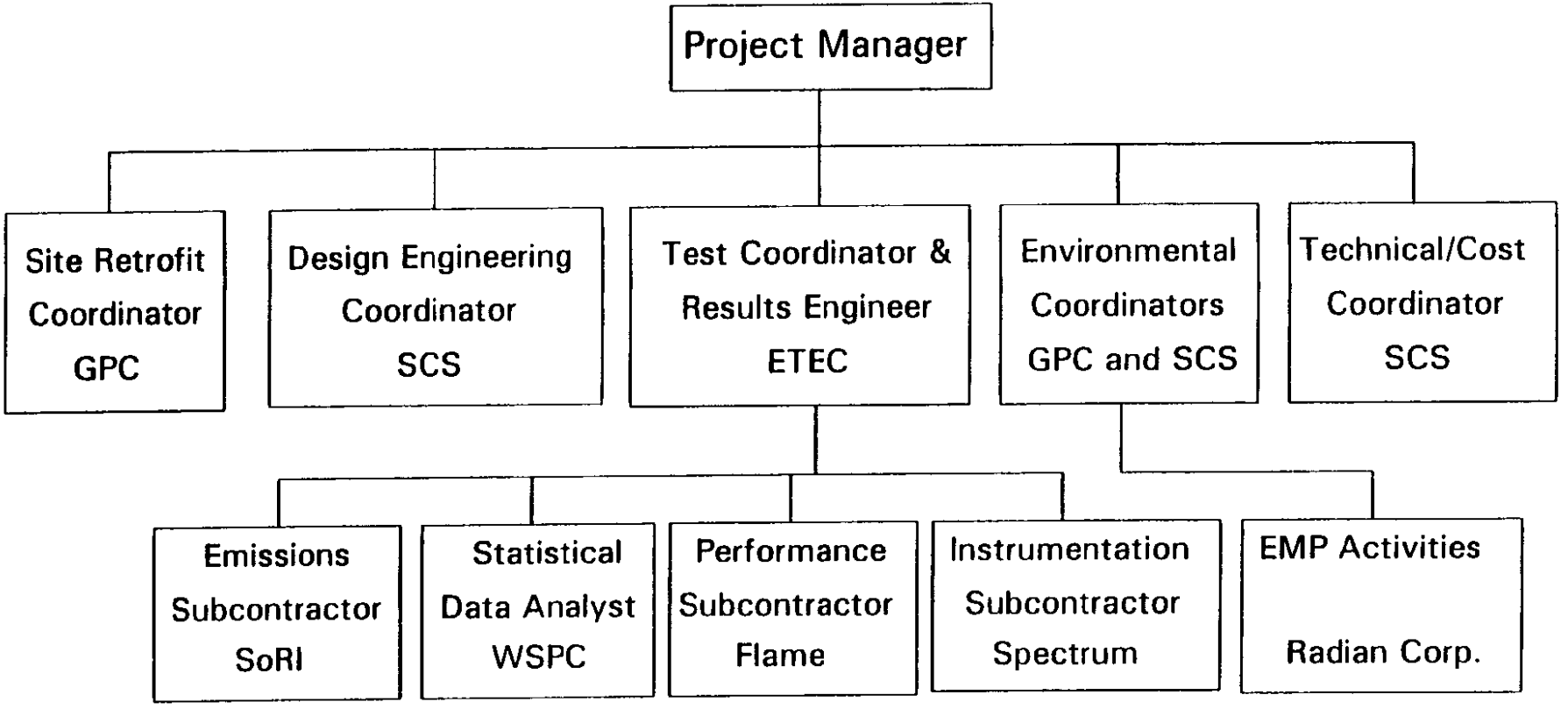

Figure 1-1. Project Organization

exhausts through a separate liner. Figure 1-2 is a schematic diagram of Unit 4, which also shows the monitoring location for coal, bottom ash, CEGRIT fly ash, economizer outlet gas, preheater outlet gas, and stack gas, specified in the Environmental Monitoring Plan. CEGRIT fly ash is economizer fly ash collected using on-line samplers named "CEGRIT."

Wastewater from low-volume waste streams, coal pile runoff, and the ash sluice system flows into three on-site ash ponds, from which blowdown is discharged, along with once-through cooling water, to the Coosa River. Solid waste, in the form of bottom ash and fly ash, is sluiced to the ash pond system.

1.4 Report Organization

The remainder of this report is organized as follows:

- Section 2.0 discusses the EMP monitoring planned for each of the test periods during Phase 1;
- Section 3.0 briefly summarizes the sampling and analytical methods;
- Section 4.0 presents and discusses the gaseous stream monitoring results;
- Section 5.0 presents and discusses the aqueous stream monitoring results;
- Section 6.0 presents and discusses the solid stream monitoring results;
- Section 7.0 discusses EMP-related quality assurance/quality control activities performed during Phase 1;
- Section 8.0 provides a summary of reports that were prepared of compliance monitoring activities; and
- Section 9.0 presents conclusions based on the EMP monitoring results.

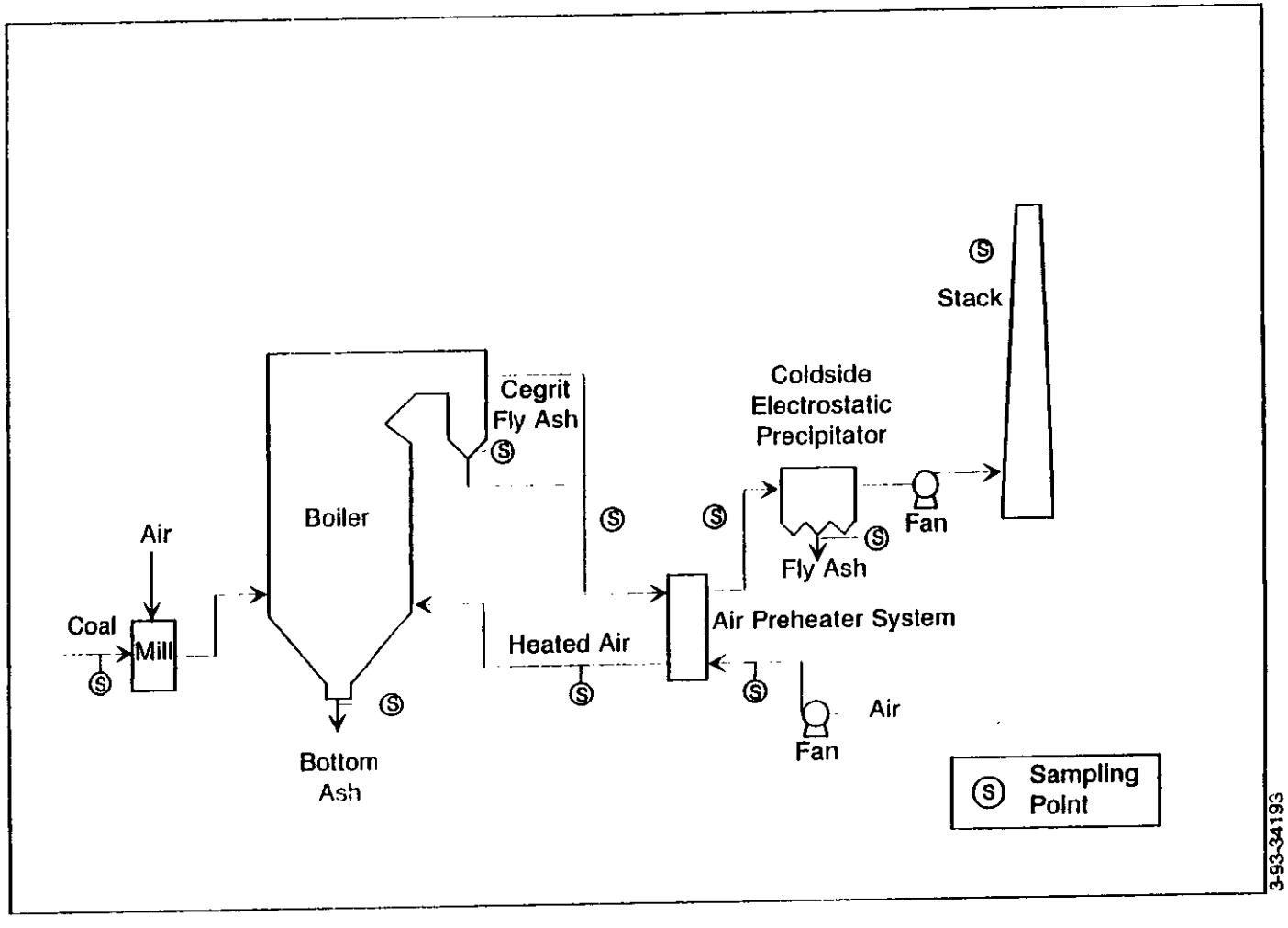

Figure 1-2. Unit 4 Schematic Diagram

The appendices contain data tables for each of the streams monitored as part of the EMP.

2.0 PHASE 1 EMP MONITORING

Phase 1 consisted of three test elements: short-term characterization, long-term characterization, and short-term verification tests. The results of this testing provided baseline operating conditions before the addition of the NO_x control systems.

Short-term characterization tests were performed to establish the trends of NO_x emissions under the most representative boiler operating conditions. The short-term testing is divided into two elements: diagnostic tests and performance tests. Diagnostic tests are used to establish gaseous emission trends; these tests last from one to three hours each. Performance testing is used to establish boiler efficiency and steaming capability, as well as gaseous and particulate emissions and mill performance. Each performance test lasts from 10 to 12 hours. All of the short-term characterization tests are conducted with the unit in a fixed configuration while it is off system load dispatch, to ensure steady boiler operation. The primary operating parameters varied during these tests include boiler load, excess oxygen, mill pattern, and mill bias. Throughout these tests, the emphasis of the EMP is on the measurement of gaseous and particulate emissions, as well as the coal feed characteristics. During Phase 1, a total of 36 diagnostic tests and 7 performance tests were conducted.

Long-term testing was conducted under normal system load dispatch control. Long-term testing provides emission and operational results that are subsequently subjected to sophisticated statistical analysis to obtain a true representation of the emissions from the unit. This testing includes most of the parameters that can affect NO_x emissions from a boiler, including such parameters as coal variability, mill in-service patterns, mill bias ranges, excess oxygen excursions, equipment conditions, and weather-related factors. Data were recorded continuously over the entire long-term testing period, which lasted 12 weeks during Phase 1.

Following the long-term testing period, verification testing was conducted to determine whether changes in unit condition and coal feed had occurred that might have an impact on the interpretation of the long-term test data. Verification tests are conducted in a manner similar to the diagnostic tests; four or five basic test configurations are tested during this short effort. A total of 11 verification tests were conducted during Phase 1.

Table 2-1 is a summary of the tests performed during Phase 1. For each series of tests, the table shows the dates, number of tests, and the total days of testing. This information was used to determine the total number of planned EMP samples for each selected parameter during each series of tests.

Tables 2-2, 2-3, and 2-4 present the EMP integrated monitoring schedules for gaseous, aqueous, and solid streams, respectively, for Phase 1.

Table 2-1

Phase 1 (Baseline) Testing Summary

Test Series	Dates	Number of Tests	Number of Days
Diagnostic	11/2/89 - 11/13/89	36	11
Performance	11/29/89 - 12/5/89	7	7
Long-Term Characterization	Early January 1990 - Early April 1990	NA	12 full weeks
Verification	4/2/90 - 4/5/90	11	4

NA = Not applicable.

Table 2-2

Gaseous Streams: Integrated EMP Monitoring Schedule
Plant Hammond

Parameter	Economizer Outlet Gas			Preheater Outlet Gas			Stack Gas								
							KVB CEM[3]			Opacity Monitor			Other		
	D/V[1]	P	L	D/V	P	L	D/V	P	L	D/V	P	L	D/V	P	L
Opacity												C [c][2,4]			
SO_2							a	a	C						
CO	a	b		a	b		a	a	C						
NO_x	a	b		a	b		a	a	C						
O_2	a	b		a	b		a	a	C						
THC							a	a	C						
SO_2/SO_3					4/T										
Particulate Matter:															
Loading					3/T										A[c]
Size Distribution					3/T										
Carbon Content, %					d										
Loss-on-Ignition					d										
Resistivity					3/T										

Notes:

1. Monitoring phase elements:
   - D = Diagnostic tests
   - P = Performance tests
   - L = Long-term tests
   - V = Verification tests

2. Monitoring frequency:
   - a = At least 2 averages per test
   - b = At least 10 averages per test
   - d = Composite of solids from mass loading measurement
   - n/T = Sampled a minimum of n times per test
   - C = Continuous
   - A = Annual
   - [c] = Compliance parameter

3. The KVB CEM is configured so that flue gas samples can be drawn from the economizer outlet, air heater outlet, and stack. Except for the stack probe, all lines pass through individual flow control valves and bubblers.

4. Opacity is measured in the stack using a dedicated monitor.

Table 2-3

Aqueous Streams: Integrated EMP Monitoring Schedule

Parameter	Ash Pond Emergency Overflow[1]	Ash Transport Water Blowdown	Ash Pond Final Discharge
Total Suspended Solids	2/M [c][2]	2/M [c]	
pH	2/M [c]		2/M [c]
Oil and Grease	2/M [c]	2/M [c]	

Notes:

1. Ash pond emergency overflow is sampled only during discharge.
2. Monitoring frequency:

   2/M = Twice per month

   [c] = Compliance monitoring

Table 2-4

Solid Streams: Integrated EMP Monitoring Schedule
Plant Hammond

Parameter	Coal[1]			Bottom Ash[2]			ESP Fly Ash[3]			CEGRIT Fly Ash[4]		
	D/V[5]	P	L	D/V	P	L	D/V	P	L	D/V	P	L
Ultimate Analysis [C, H, N, S, and O (by diff.)], and Cl	1/Da[6]	3/Da	1/W									
Proximate Analysis [Ash, Moisture, and HHV]	1/Da	3/Da	1/W									
Volatile/Semivolatile Organics							a					
Loss-on-Ignition					1/Da			1/T		1/T	2/T	1/W
Laboratory Resistivity								1/T				

Notes:

1. Coal sample is a composite from all operating mills.

2. Bottom ash sample is composited from east and west bottom ash hoppers.

3. ESP ash is collected from precipitator ash hoppers.

4. CEGRIT samples consist of east- and west-side samples, each analyzed separately.

5. *Monitoring phase elements:*
   - D = Diagnostic tests
   - P = Performance tests
   - L = Long-term tests
   - V = Verification tests

6. Monitoring frequency:
   - a = Sampled once during Baseline (Phase 1) and once during one of the NO_x reduction test Phases.
   - n/T = Sampled a minimum of n times per test
   - n/Da = Minimum of n samples per day
   - n/W = Minimum of n samples per week
   - [c] = Compliance parameter

3.0 SAMPLING AND ANALYTICAL METHODS

The sampling and analytical methods specified by the Environmental Monitoring Plan and used during Phase 1 are summarized in Tables 3-1 through 3-3. The required sample volume or weight, type of containers, preservation conditions, and holding times for the aqueous and solid stream samples, as specified in the EMP, are summarized in Tables 3-4 and 3-5. The ETEC phase reports contain additional details on the sampling and analytical methods used in this project.

3.1 Gaseous Stream Parameters

The KVB Extractive Continuous Emissions Monitor (KVB CEM) was used to provide quantitative analyses for NO_x, SO_2, CO, O_2, and total hydrocarbons. SoRI was responsible for sulfur (SO_2, SO_3) and solids emissions testing, which included measurement of particulate matter loading, size distribution, ash resistivity, carbon content, and LOI. The EMP-specified analytical and sampling methods were followed during the Phase 1 gaseous monitoring.

3.2 Aqueous Stream Parameters

The streams and parameters to be monitored and the monitoring schedules are specified in the Georgia Department of Natural Resources (GDNR) NPDES Permit No. GA0001457. Georgia Power personnel obtained samples and performed all aqueous parameter analyses. Results were reported in Operational Monitoring Reports submitted to the GDNR by Georgia Power. The specified GDNR analytical and sampling methods were used for the aqueous stream monitoring.

Table 3-1

Sampling and Analytical Summary: Gaseous Streams

Parameter	Sampling Method	Analytical Method/Instrument
Opacity	--	Lear Siegler Opacity Monitor
SO_2	Gas	Western Research Ultraviolet
CO	Gas	Siemens NDIR
NO_x	Gas	TECO Chemiluminescence
O_2	Gas	Thermox O_2 Electrocatalytic (stack gas) and Yokagawa *in-situ* O_2 probes (economizer outlet and air preheater outlet)
SO_3	Cheney-Homolya Controlled Condensation	Titration
Total Hydrocarbons	Gas	Rosemount FID
Particulate Matter:		
Loading	EPA Method 17	Gravimetric
Size Distribution	Isokinetic	Gravimetric
Carbon Content, %	EPA Method 17	
Resistivity	*In-situ* Probe	Electrode Cell

Gas = Continuous extractive and in-situ gas analysis system.

Table 3-2

Sampling and Analytical Methods: Aqueous Streams

Parameter	Sampling Method	Analytical Method
Total Suspended Solids	Grab	EPA 160.2 - Filtration/ Drying/Gravimetric
pH	Grab	SM 423 - Electrometric
Oil and Grease	Grab	EPA 413.1, SM 503 A - Freon Extraction/Gravimetric

Table 3-3

Sampling and Analytical Methods: Solid Streams

Parameter	Sampling Method	Analytical Method
Ultimate Analyses	Grab/Composite	ASTM D3176 - Combustion/ Gravimetric/Titration
Moisture Content	Grab/Composite	ASTM D3173 - Gravimetric
Chlorine	Grab/Composite	ASTM D2361 - Fusion/IC or Titration
Higher Heating Value	Grab/Composite	ASTM D2015 - Combustion
Sulfur	Grab/Composite	ASTM D3177 - High Temperature Combustion
Ash	Grab/Composite	ASTM D3174 - Combustion/Gravimetric
Volatile/Semivolatile Organics	Grab/Composite	EPA 8240 or EPA 8270 - Purge and Trap or Extraction/GC/MS/Analyses

Table 3-4

Sample Information: Aqueous Streams

Parameter	Sample Volume Required (mL)	Container Type[a]	Preservation	Holding Time (Days)
Total Suspended Solids	1,000	P,G	Cool, 4 °C	7
pH	500	P,G	None	Analyze Immediately
Oil and Grease	1,000	G	H_2SO_4 to pH <2; Cool, 4 °C	28

[a]P = plastic; G = glass.

Table 3-5

Sample Information: Solid Streams

Parameter	Sample Weight (g)	Container Type	Preservation	Holding Time (Days)
Ultimate and Proximate Analyses and Chlorine	1,000	Plastic Bag	Eliminate air and seal	--
Volatile/Semivolatile Organics	1,000	Glass	Cool, 4° C	14/28[a]

[a]Fourteen days for volatiles; 28 days for semivolatiles.

3.3 Solid Stream Parameters

Coal, bottom ash, and ESP fly ash samples were obtained by plant personnel. The CEGRIT on-line samplers automatically collected grab samples of fly ash in the furnace backpass. Coal samples were shipped to Alabama Power's General Test Laboratory in Birmingham, where they were subjected to proximate and ultimate analyses. Loss-on-Ignition (LOI) measurements were performed on bottom ash, ESP fly ash, and CEGRIT fly ash. The analytical and sampling methods specified in the EMP were used for the solid stream monitoring.

4.0 GASEOUS STREAM MONITORING RESULTS

This section presents the results of the gaseous stream EMP monitoring performed during the period covered by Phase 1. Three gas streams were monitored as specified by the EMP: economizer outlet gas, air preheater outlet gas, and stack gas. Both supplemental and compliance monitoring were conducted. The parameters selected for monitoring and their monitoring frequencies are presented in Table 2-2.

Table 4-1 presents the actual and planned gaseous stream monitoring. As shown in this table, most of the planned EMP monitoring was performed during Phase 1 (in some cases, more than the planned amount of monitoring was conducted). A small number of planned preheater outlet gas and stack gas samples were not collected during the diagnostic tests. However, even in these cases, more than 80% of the planned samples were collected. The effect of the small number of uncollected samples on the results is minimal; in all cases, there are enough data from which to develop analyses and draw conclusions.

Appendix A contains all the short-term results in tabular form for the economizer outlet gas, air preheater outlet gas, and stack gas. The daily averages obtained during long-term testing are also listed.

The following sections present the results (in graphical form) of the baseline testing for gaseous streams. The short-term monitoring results for the stack gas stream were selected for presentation since all of the long-term monitoring was also done on the stack gas. These results are presented in Section 4.1. The SO_3/SO_2 and particulate matter results for the preheater outlet gas are presented in Section 4.2. The long-term testing results for stack gas are presented in Section 4.3. Section 4.4 presents the results of compliance monitoring during baseline.

Table 4-1

Gaseous Streams: Actual and Planned Monitoring [1]

Parameter	Economizer Outlet Gas			Preheater Outlet Gas			Stack Gas			
	D[2]	P	V	D	P	V	D	P	L	V
SO_2							59/72	28/14	C/C	28/22
CO	246/72	364/70	139/22	60/72	149/70	62/22	59/72	28/14	C/C	28/22
NO_x	246/72	364/70	139/22	60/72	149/70	62/22	59/72	28/14	C/C	28/22
O_2	246/72	364/70	139/22	60/72	149/70	62/22	59/72	28/14	C/C	28/22
THC							59/72	28/14	C/C	28/22
SO_3/SO_2					28/28					
Particulate Matter:										
Loading					12/21					
Size Distribution					12/21					
Carbon Content, %					4/14					
Loss on Ignition (LOI)					4/14					
Resistivity (Spark, V-I Methods)					52/21					

[1]59/72 = 59 measurements taken/72 measurements planned.

[2]Monitoring phase elements:

D = Diagnostic tests
P = Performance tests
L = Long-term tests
V = Verification tests

C = Continuous

Additional gaseous stream monitoring (not shown above):

- Stack gas opacity is measured on a continuous basis in response to a compliance requirement.
- Stack gas particulate loading is measured annually in response to a compliance requirement.

4.1 Short-Term Results for the Stack Gas

Figures 4-1 through 4-5 present the short-term test results for the stack gas. Figures 4-1 through 4-3 present the NO_x emissions in the stack gas as a function of oxygen levels in the stack gas for the different load levels during the short-term tests. As expected, the diagnostic tests indicate a trend of higher NO_x levels in the stack gas at higher oxygen levels. NO_x emissions also increase with increasing load, even at comparable oxygen levels.

Figures 4-4 and 4-5 present the short-term test results for total hydrocarbons (THC) and CO levels as a function of load, respectively. The unit operating load does not appear to have an effect on the level of either THC or CO emissions. There was a wide variation in the THC emissions at each load level, but all emission levels were less than 25 ppmw. Most of the CO values were less than 50 ppmv, except for two data points around 200 ppm that occurred during verification testing.

No relationship between SO_2 and load was evident, which is to be expected since stack gas SO_2 is a function of coal sulfur. The range of sulfur levels in the coal was narrow during the tests.

4.2 Short-Term Results for Preheater Outlet Gas

Figures 4-6 through 4-12 present the performance test results for SO_3/SO_2 and particulate matter levels in the preheater outlet gas. The SO_3/SO_2 ratio as a function of load is presented in Figure 4-6. The average ratio and 95% confidence interval (CI) determined for each tested load are presented. The 95% CIs for the 300 and 400 MW load are both wide, 0.05% to 0.65% and 0% to 0.55%, respectively. At the 480 MW load, the range is much narrower, 0.17% to 0.23%.

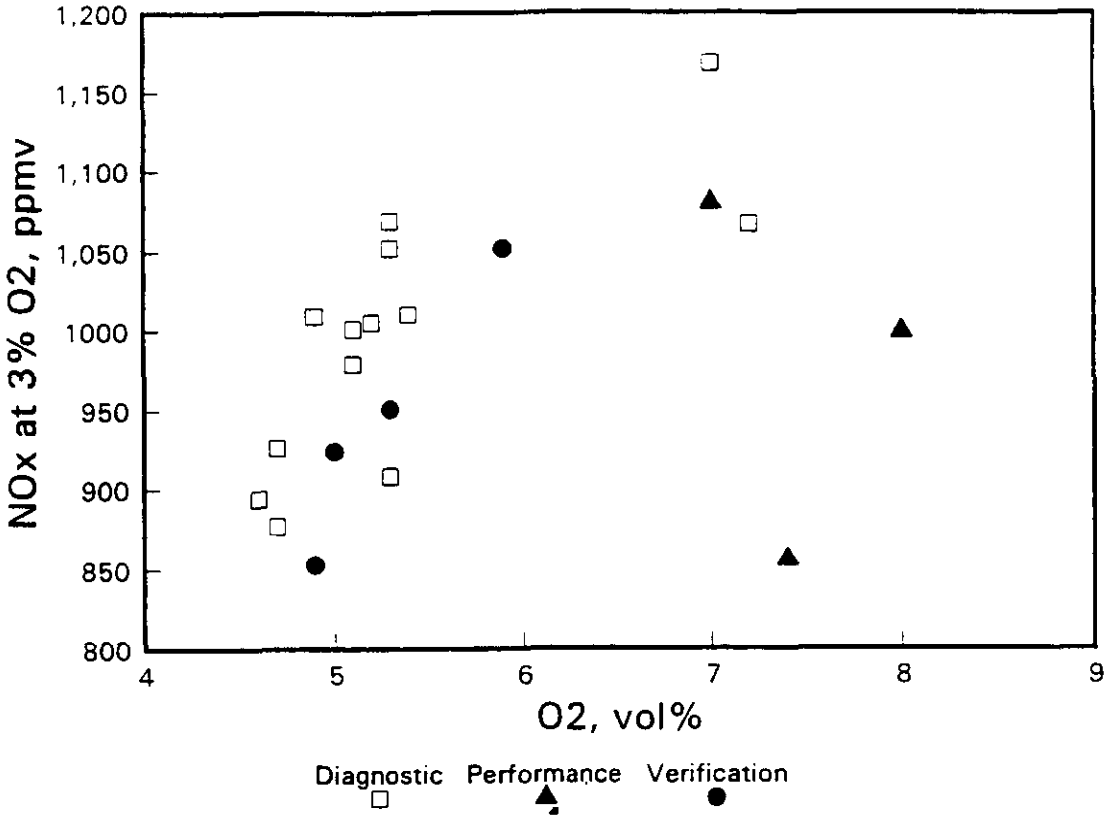

Figure 4-1. Stack Gas NO_x Emissions as a Function of Oxygen Content During Short-Term Testing at 480 MW Unit Load

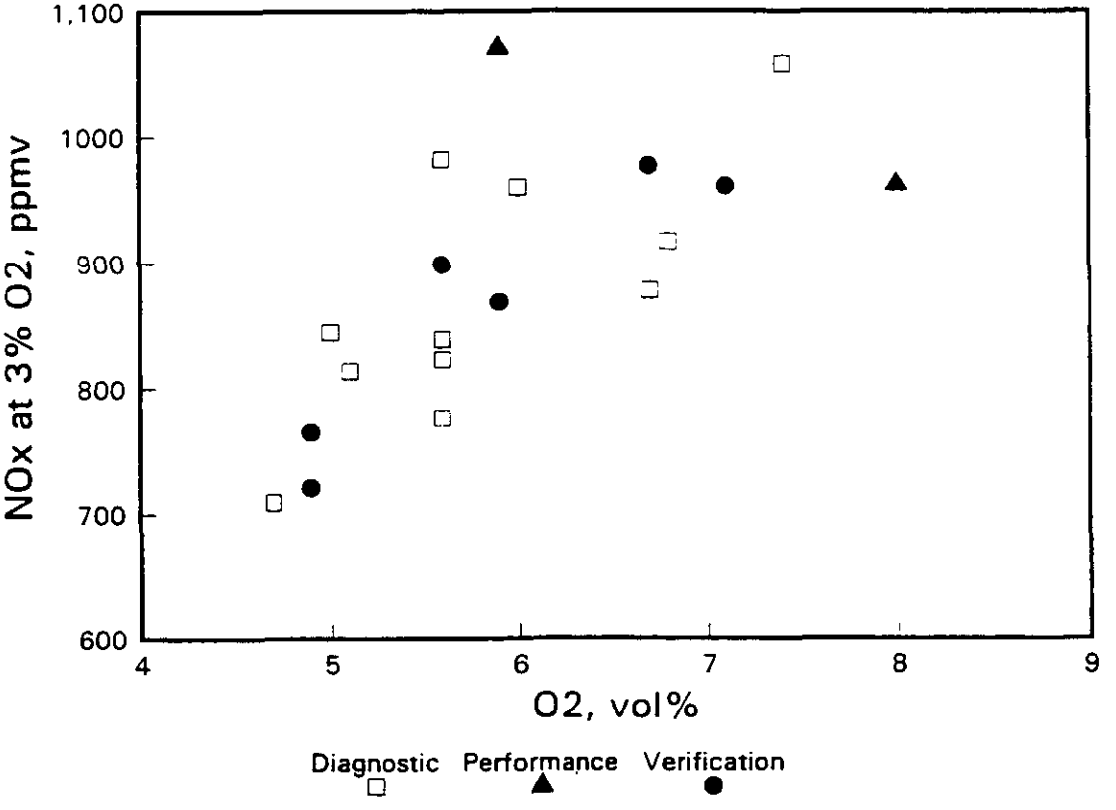

Figure 4-2. Stack Gas NO_x Emissions as a Function of Oxygen Content During Short-Term Testing at 400 MW Unit Load

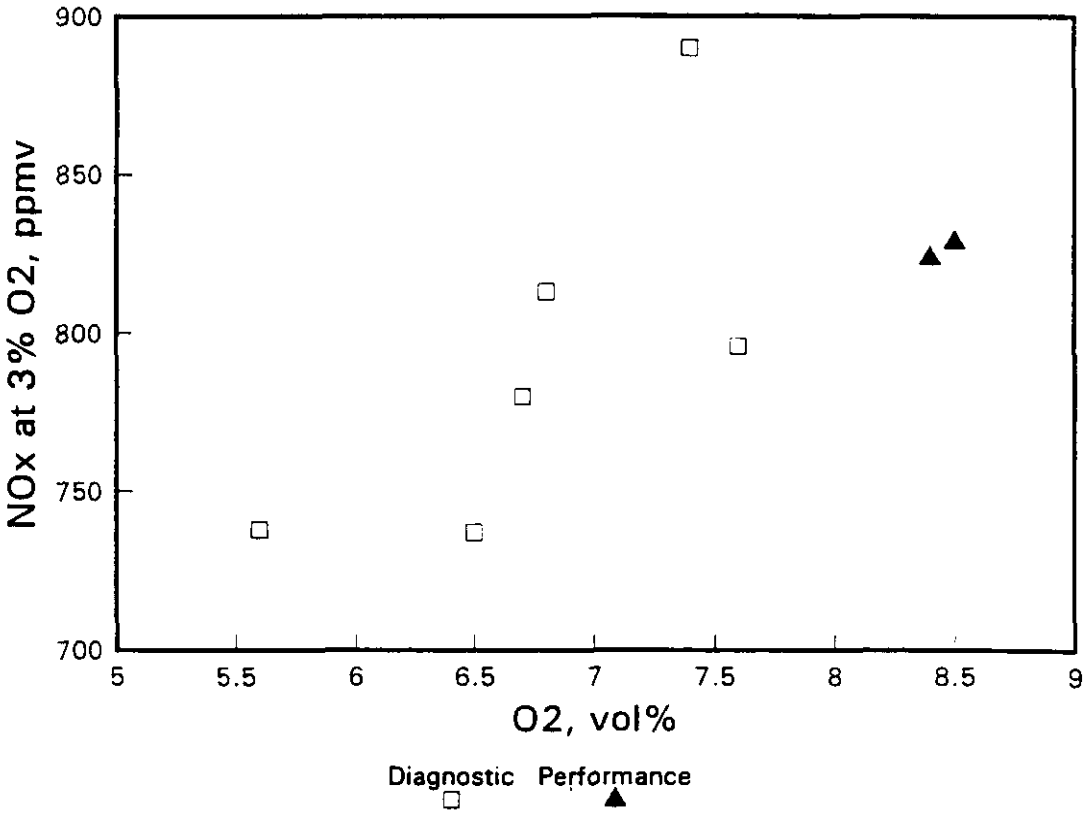

Figure 4-3. Stack Gas NO_x Emissions as a Function of Oxygen Content During Short-Term Testing at 300 MW Unit Load

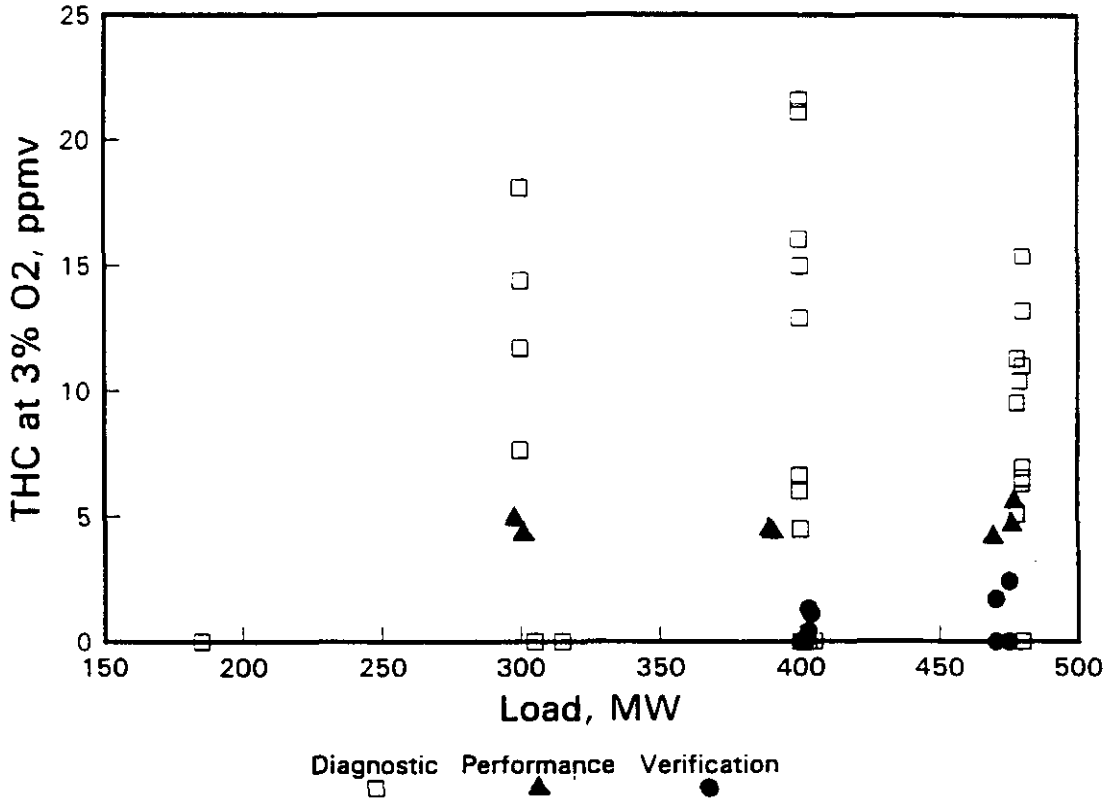

Figure 4-4. Stack Gas THC Emissions as a Function of Unit Load During Short-Term Testing

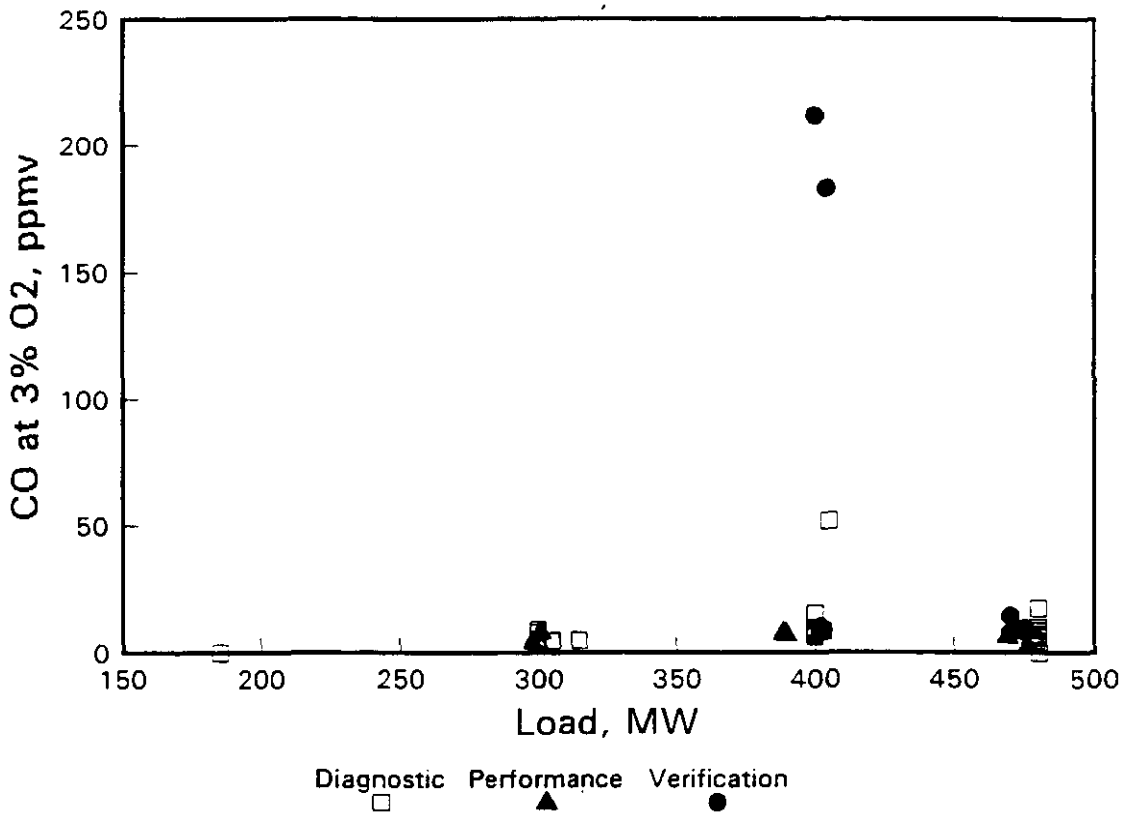

Figure 4-5. Stack Gas CO Emissions as a Function of Unit Load During Performance Testing

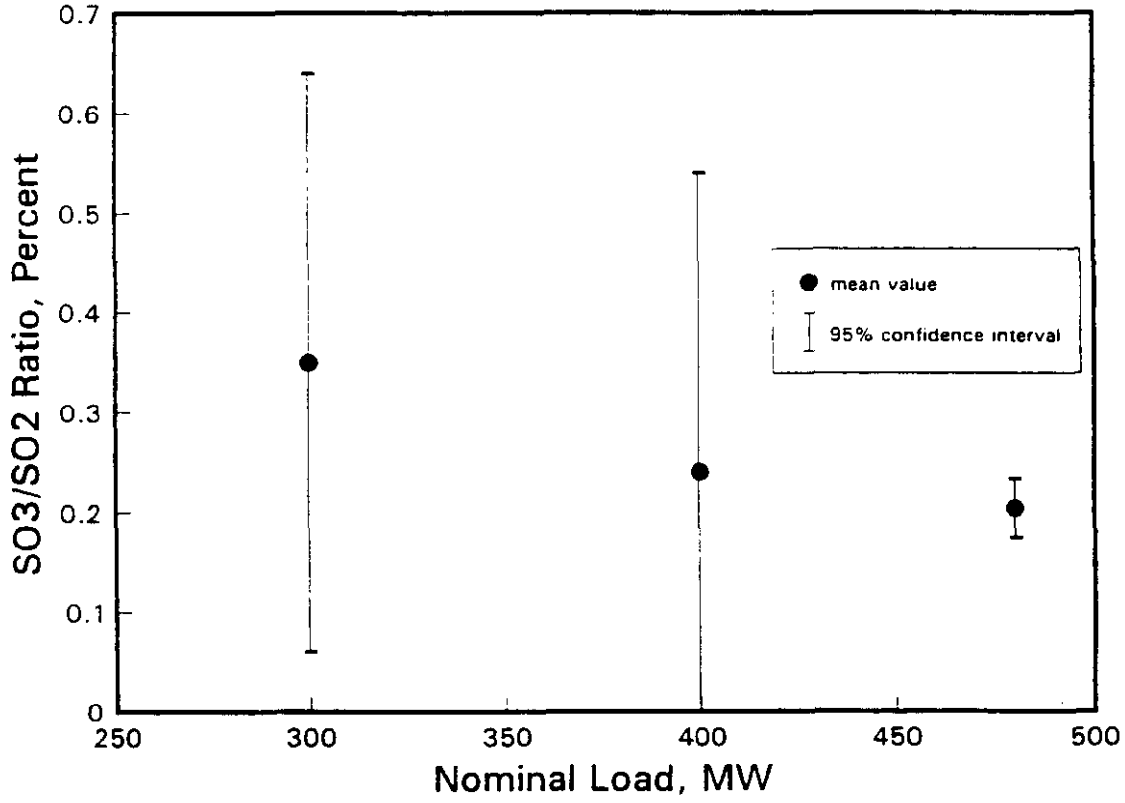

Figure 4-6. Preheater Outlet Gas SO_3/SO_2 Ratio as a Function of Unit Load During Performance Testing

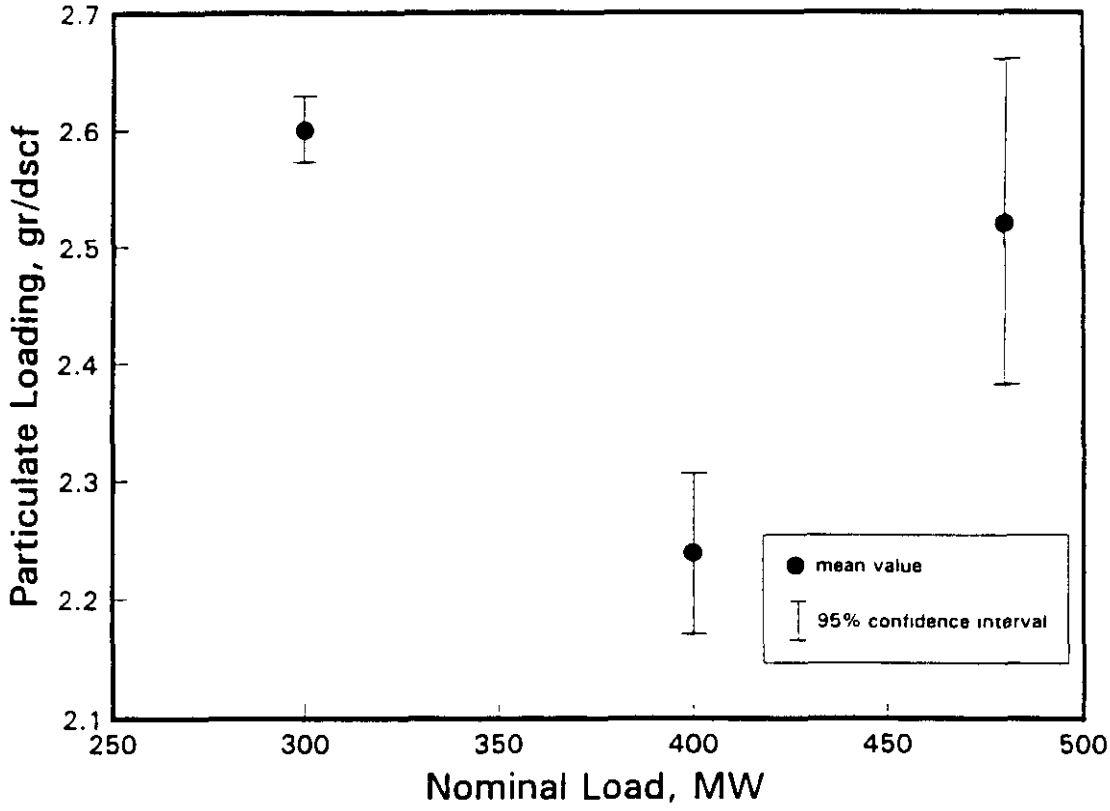

Figure 4-7. Preheater Outlet Gas Particulate Loading as a Function of Unit Load During Performance Testing

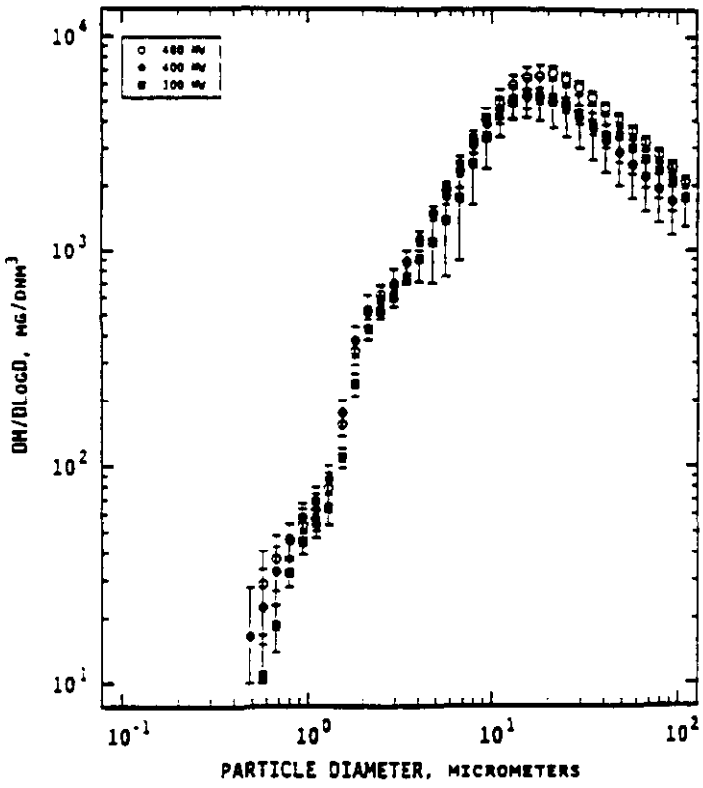

Figure 4-8. Preheater Outlet Gas Particle Mass Distribution as a Function of Particle Diameter During Performance Testing

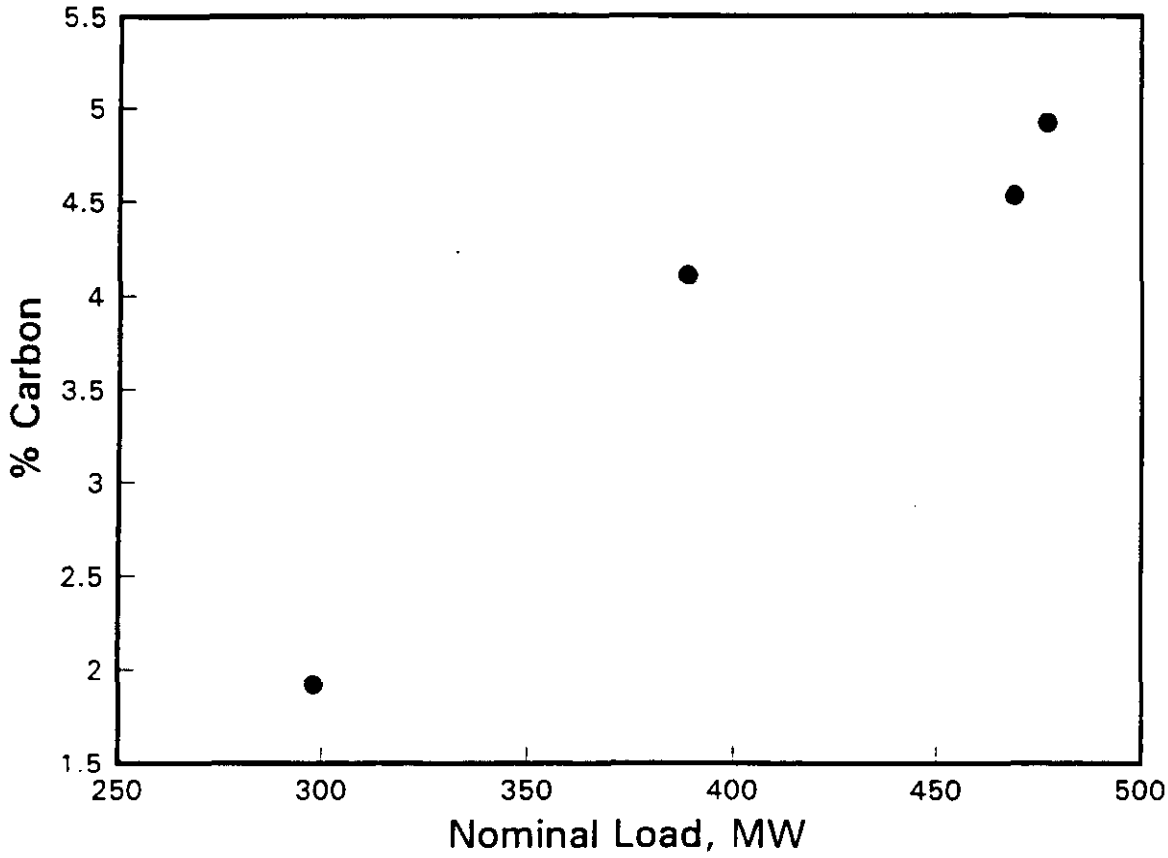

Figure 4-9. Preheater Outlet Gas Carbon as a Function of Unit Load During Performance Testing

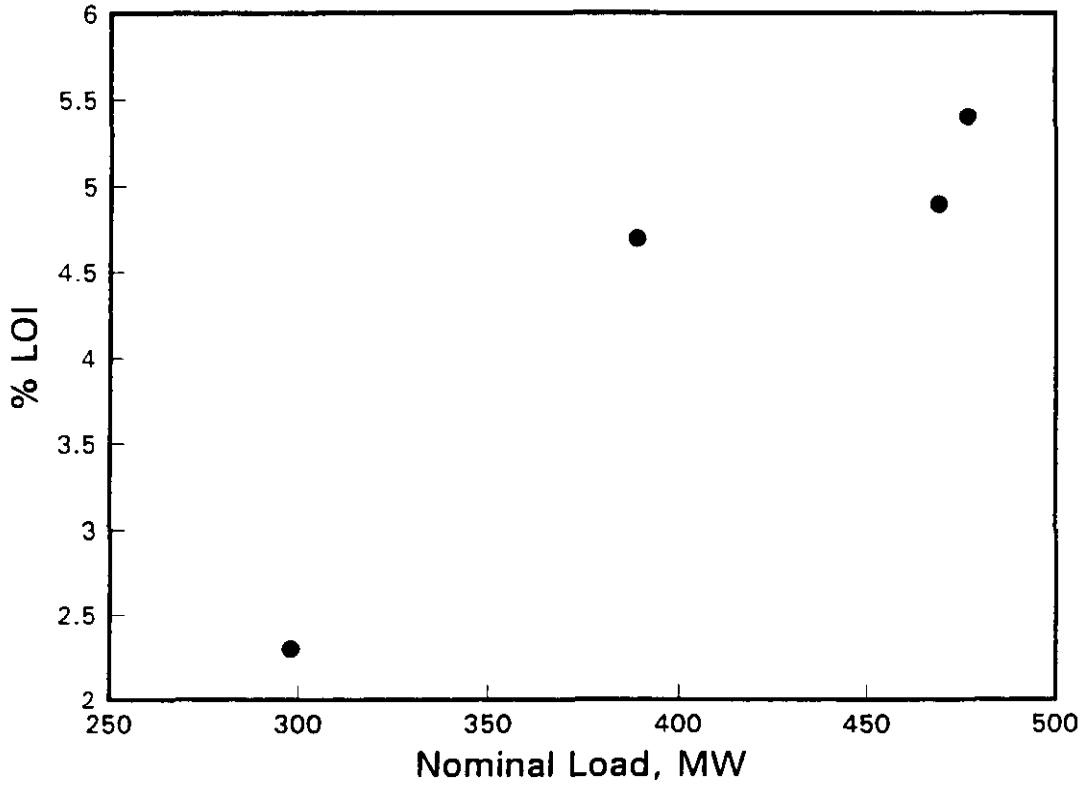

Figure 4-10. Preheater Outlet Gas LOI as a Function of Unit Load During Performance Testing

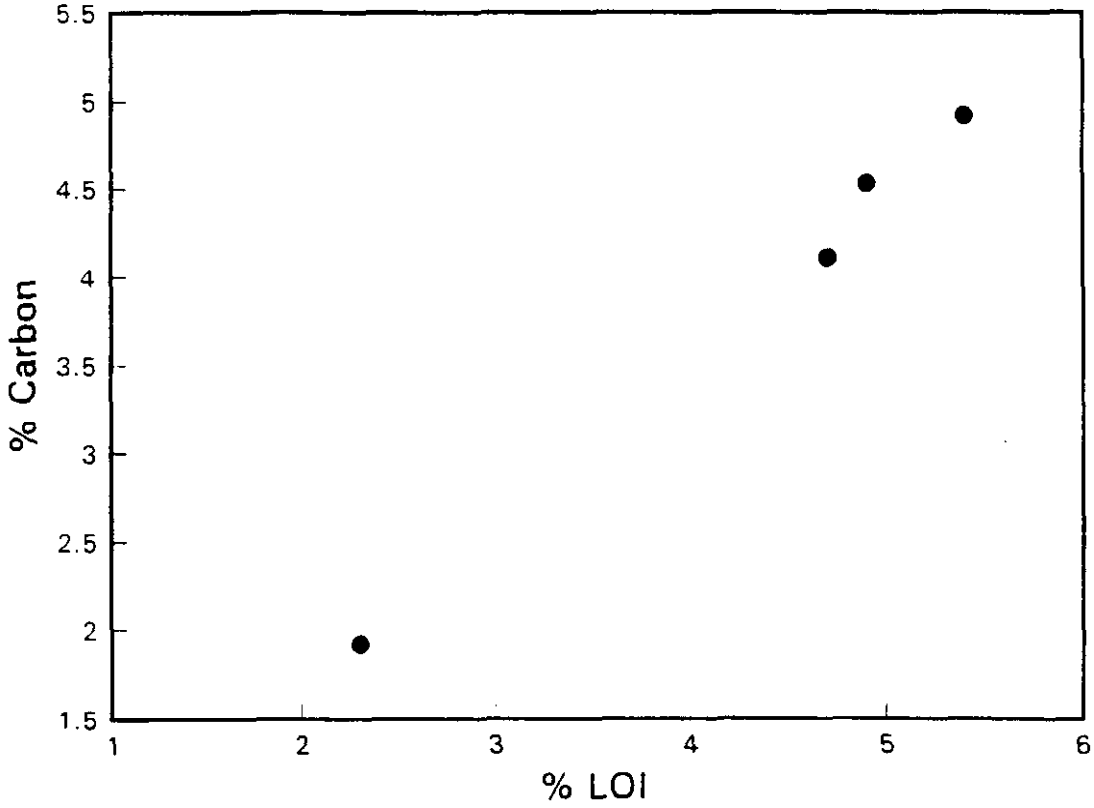

Figure 4-11. Preheater Outlet Gas LOI as a Function of Carbon Content During Performance Testing

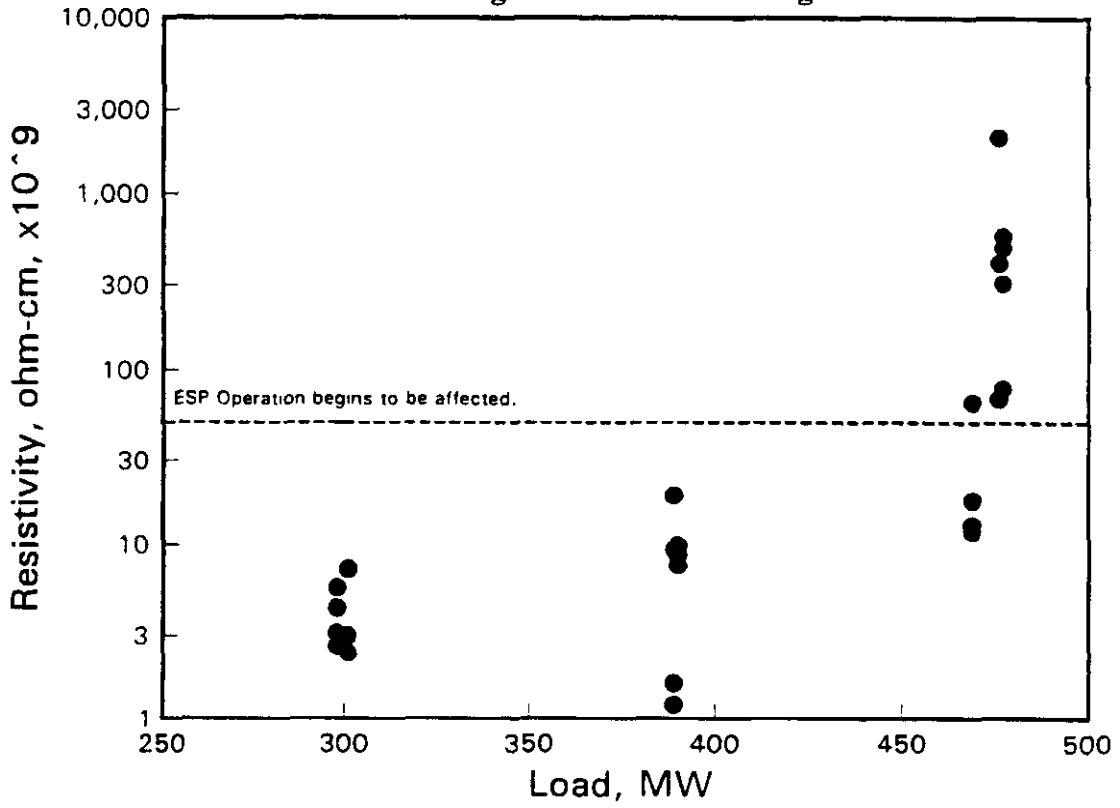

Figure 4-12. Preheater Outlet Gas Resistivity as a Function of Unit Load During Performance Testing

Figure 4-7 presents the measured particulate loading as a function of load. The data were fairly consistent at each total load, and there does not seem to be any clearly identifiable relationship between loading and unit operating load. The derivative of cumulative mass with respect to particle diameter (DM/D log D) as a function of particle diameter is presented in Figure 4-8.

Figures 4-9 through 4-11 present data on the loss on ignition (LOI) and carbon content of the particulate matter in the preheater outlet gas. Both LOI and carbon content increase with increasing load. Figure 4-11 demonstrates that roughly 80-90% of material lost on ignition is carbon.

The ash resistivity was measured by two methods, spark and voltage/ current. Only the results for the spark method are presented in Figure 4-12. Resistivities for the low-load tests, 300 and 400 MW were below 50×10^9 ohm-cm. The authors of the ETEC Phase 1 report suggest that ESP performance may begin to be adversely impacted if the resistivity exceeds $20\text{-}50 \times 10^9$ ohm-cm. The measured resistivities for Tests 12 and 13, at 480 MW were above 50×10^{10} ohm-cm. No changes in dust chemistry, flue gas composition, or temperature were identified which would have produced a real change in resistivity. The spark data for Tests 12 and 13 are believed to be invalidated by carbon in the ash, a known interferant for this analysis. The LOI and carbon levels found during these two tests were the highest measured for the test program.

4.3 Long-Term Results for Stack Gas

Stack gas results from long-term testing during Phase 1 are presented in Figures 4-13 through 4-18. Although the data in Figure 4-13 are scattered, NO_x tends to increase with load, as indicated. This trend is also evident in Figure 4-14, which shows the measured five-minute NO_x concentration as a function of load.

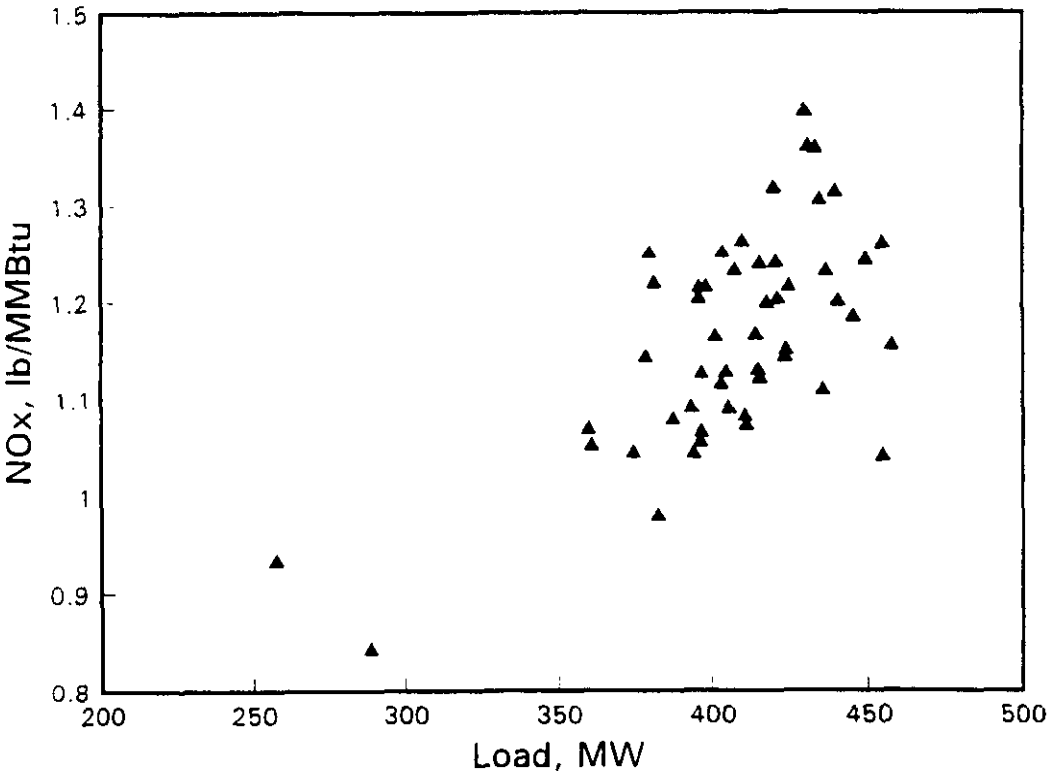

Figure 4-13. Gas Daily Average NO_x Emissions as a Function of Unit Load During Long-Term Testing

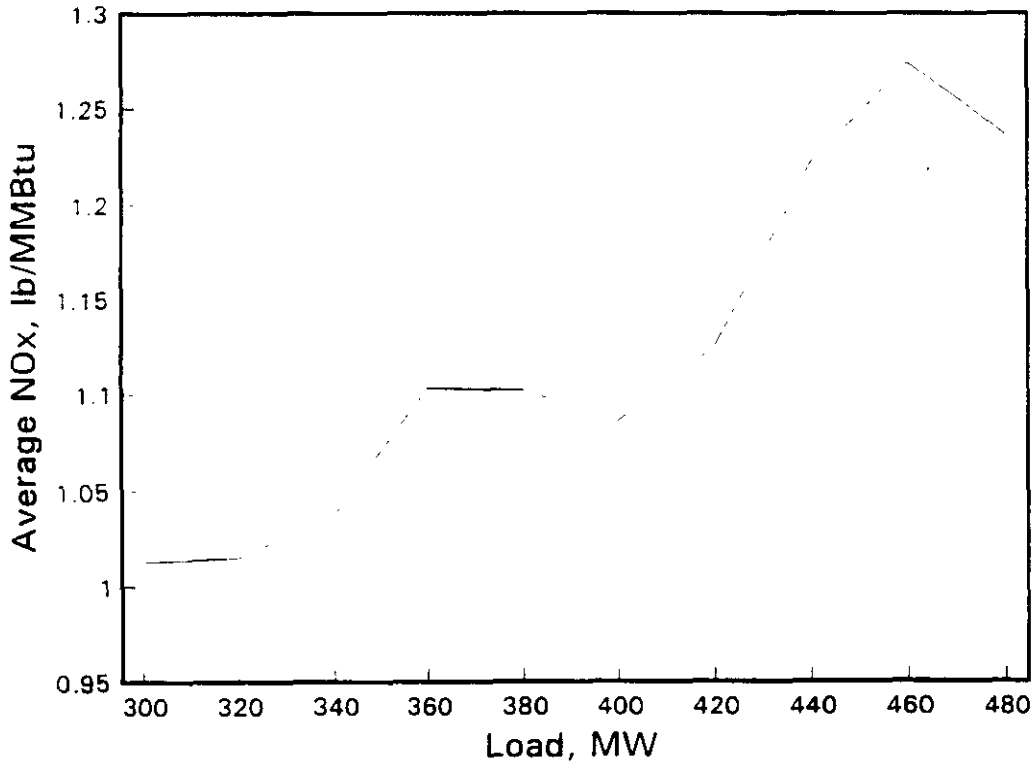

Figure 4-14. Stack Gas Five-Minute Average NO_x Emissions as a Function of Unit Load During Long-Term Testing

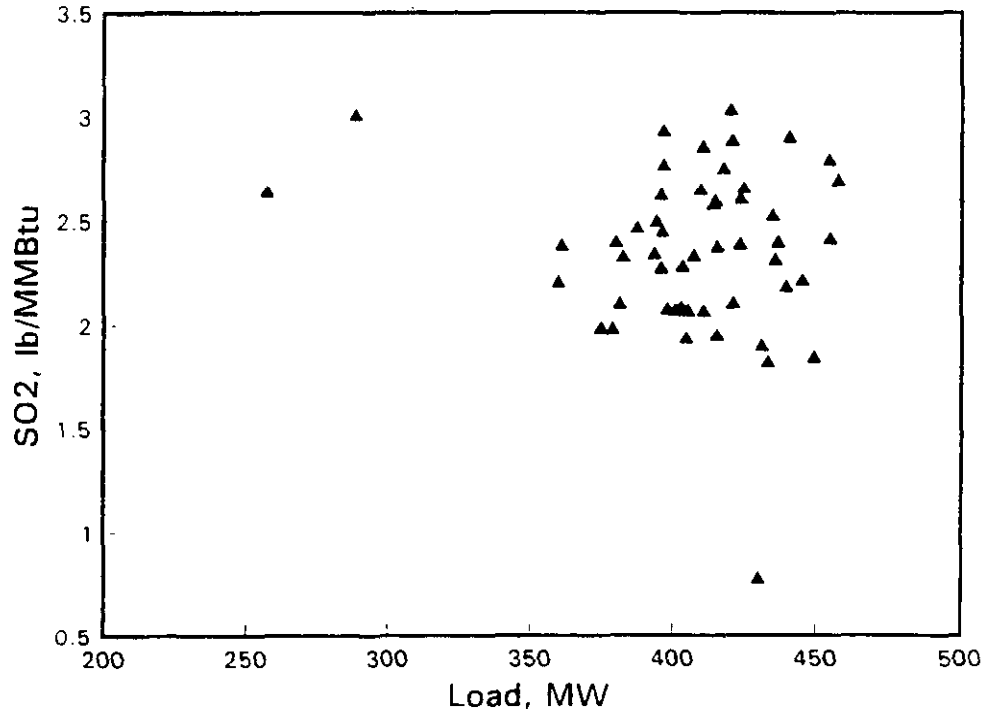

Figure 4-15. Stack Gas Daily Average SO_2 Emissions as a Function of Unit Load During Long-Term Testing

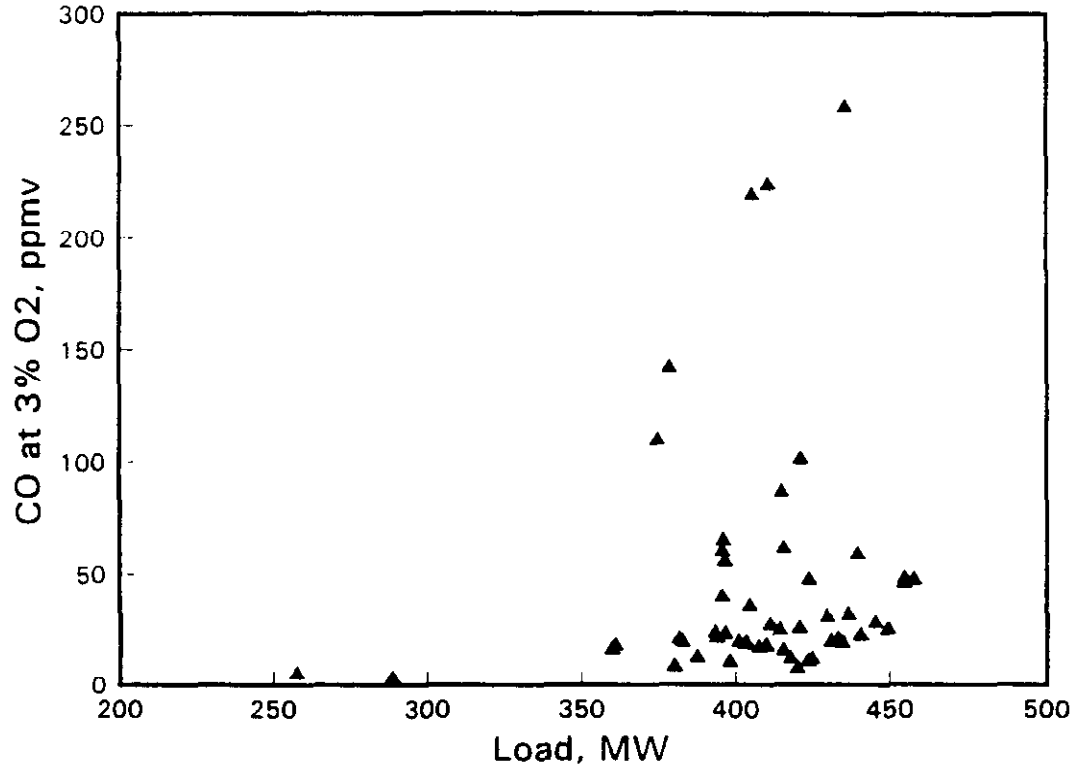

Figure 4-16. Stack Gas Daily Average CO Emissions as a Function of Unit Load During Long-Term Testing

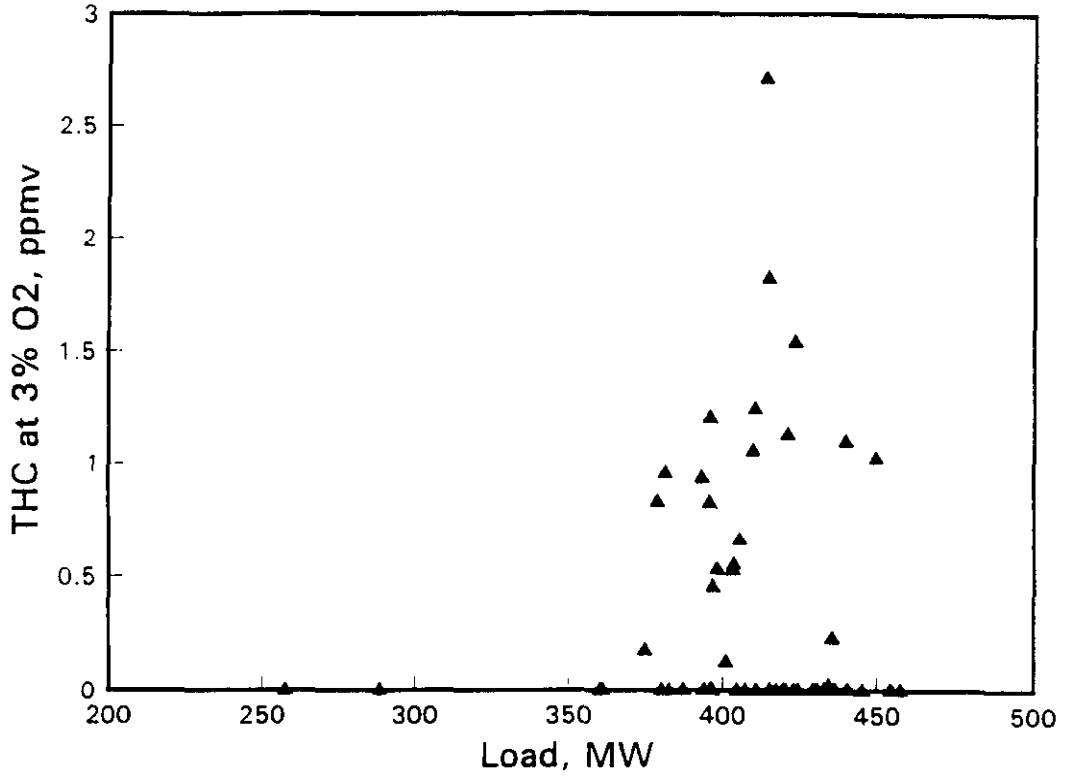

Figure 4-17. Stack Gas Daily Average THC Emissions as a Function of Unit Load During Long-Term Testing

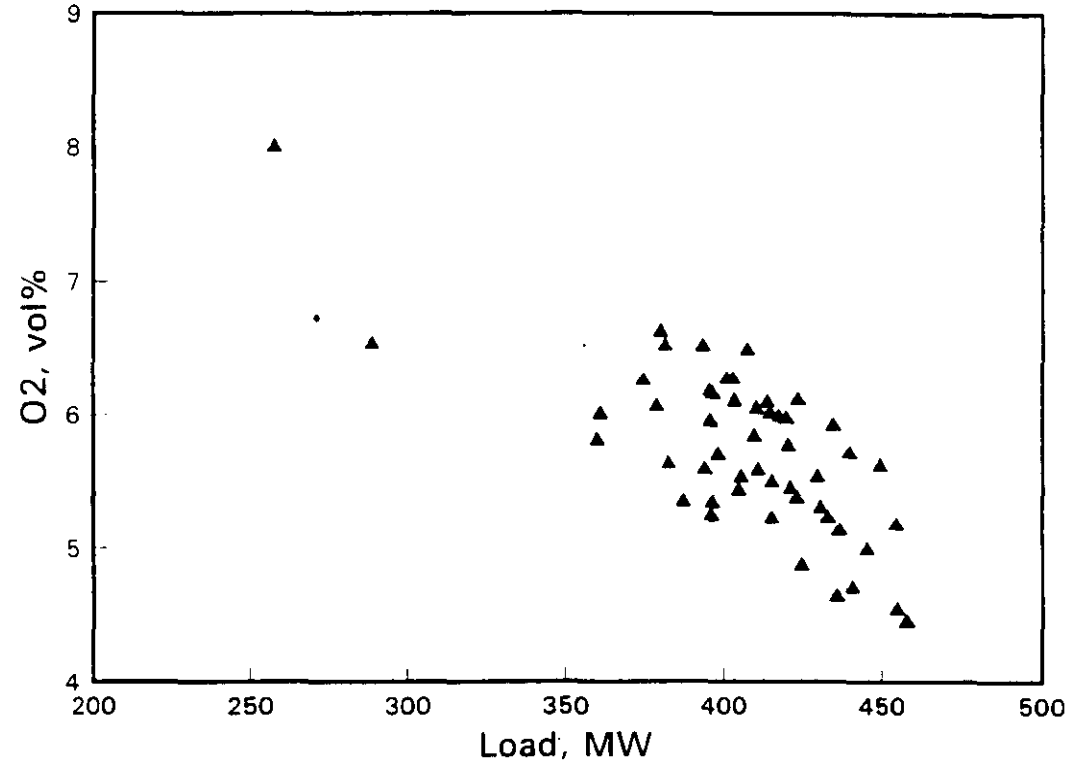

Figure 4-18. Stack Gas Daily Average O_2 Levels as a Function of Unit Load During Long-Term Testing

There is no discernable trend of SO_2, CO, and THC levels as functions of load as shown in Figures 4-15, 4-16, and 4-17, respectively. The zero values for THC concentrations shown in Figure 4-17 occurred during the first few days of testing, after which measurable THC levels were attained. However, around Day 72, zero values of THC concentration were again noted and lasted until the end of the test. These zero THC levels may be caused by a malfunctioning instrument, and may not be accurate.

Figure 4-18 presents oxygen levels in the stack as a function of operating load. Oxygen levels appear to generally decrease with increasing load.

4.4 Compliance Monitoring Results

As part of the EMP, data were obtained on the opacity of the stack gas stream using a continuous opacity monitor. Georgia Power Company provides a report to the Georgia Department of Natural Resources detailing the daily excess opacity emissions from each of the two plant stacks (i.e., Units 1-3 and Unit 4). Copies of these reports are provided as appendixes to the quarterly progress reports prepared as part of the EMP.

5.0 AQUEOUS STREAM MONITORING RESULTS

This section presents the results of aqueous stream monitoring performed during the period covered by Phase 1. Three aqueous streams have been designated for monitoring: ash pond emergency overflow, ash transport water blowdown, and final ash pond discharge. The parameters selected for monitoring are those required for compliance with Plant Hammond's existing NPDES permit.

Table 5-1 presents the actual and planned aqueous stream monitoring. As shown in this table, all of the planned monitoring was performed during Phase 1. There were three emergency discharges from the ash pond during baseline testing. The aqueous stream monitoring results were taken from quarterly compliance reports submitted by Georgia Power Company to the Environmental Protection Division of the Georgia Department of Natural Resources. These compliance reports have been included as appendices to the quarterly EMP reports prepared and submitted to DOE for this project.

Table 5-2 summarizes the environmental monitoring results obtained during Phase 1; the average, standard deviation, number of data points, and range are shown for each parameter. No exceedances of the regulatory limits imposed by the plant's NPDES permit occurred.

Table 5-1

Aqueous Streams: Actual and Planned Monitoring[1]

Parameter	Ash Pond Emergency Overflow	Ash Transport Water Blowdown	Final Discharge
Total Suspended Solids	3/3	12/12	
pH	3/3		12/12
Oil & Grease	3/3	12/12	

[1] 3/3 = 3 measurements taken/3 measurements planned.

Table 5-2

Aqueous Streams: Phase 1

Parameter	Average	Standard Deviation	No. of Data Points	Range	Limits
Ash Pond Emergency Overflow					
TSS (mg/L)	4	0.8	3	3-5	Avg. 30, Max. 100
pH	7.2	0.1	3	7.10-7.29	Min. 6.0, Max 9.0
Oil & Grease (mg/L)	<5	0	3	<5	Avg. 15, Max. 20
Ash Transport Water Blowdown					
TSS (mg/L)	7.6	3.8	12	4-15	Avg. 30, Max. 100
Oil & Grease (mg/L)	<5	0	12	<5	Avg. 15, Max. 20
Final Discharge					
pH	7.10	0.20	12	6.70-7.39	Min. 6.0, Max. 9.0

6.0 SOLID STREAM MONITORING RESULTS

This section presents the results of solid stream monitoring performed during Phase 1. Four solid streams have been designated for monitoring: coal, bottom ash, ESP fly ash, and CEGRIT fly ash. Only supplemental monitoring of these solid streams is specified by the environmental monitoring plan.

Table 6-1 presents the actual and planned gas stream monitoring. As shown in this table, most of the planned monitoring was performed during Phase 1. Samples of CEGRIT fly ash were collected for LOI analyses from both the A and B sides of the economizer exit duct, resulting in twice the number of samples than were planned.

Only for the ESP fly ash LOI monitoring were the number of samples taken significantly different from the number planned. However, based on the small variability in the measured LOI of this stream, the smaller data set should not impact the results.

Appendix B contains all the short-term test results in tabular form for coal, bottom ash, ESP fly ash, and CEGRIT fly ash. Also contained in the appendix are the volatile/semivolatile data for the ESP fly ash.

Table 6-2 summarizes the environmental monitoring results obtained during Phase 1 for coal; the average value, standard deviation, number of data points, and range of values are shown for each parameter for each test. The monitoring results for coal were quite consistent throughout all the tests, as shown in Figure 6-1.

Table 6-1

Solid Streams: Actual and Planned Monitoring [1]

Parameter	Coal				Bottom Ash			ESP Fly Ash			CEGRIT Fly Ash			
	D	P	L	V	D	P	V	D	P	V	D	P	L	V
Proximate/Ultimate Analysis and Chlorine	11/11	24/21	11/12	6/4										
Volatile/Semivolatile Organics										4/4 [2]				
Loss on Ignition (LOI)						7/7			3/7		40/36	30/14	20/12	20/11
Laboratory Resistivity									4/7 [3]					

[1] 11/11 = Eleven measurements taken/11 measurements planned.

[2] Monitored during Phase 1.

[3] Samples were collected and results are presented graphically.

Table 6-2

Solid Streams: Phase 1 Results - Coal

Diagnostic Test				
Parameter	**Average**	**Standard Deviation**	**No. of Data Points**	**Range**
Ultimate Analysis:				
C (%)	70.3	0.5	11	69.4 - 71.3
H (%)	4.59	0.09	11	4.51 - 4.82
N (%)	1.48	0.08	11	1.38 - 1.60
S (%)	1.74	0.04	11	1.68 - 1.83
Cl (%)	0.029	0.007	11	0.008 - 0.034
O_2 (%)	6.43	0.31	11	6.00 - 7.00
Proximate Analysis:				
Ash (%)	10.0	0.5	11	9.3 - 11.0
Moisture (%)	5.50	0.58	11	4.39 - 6.42
HHV (Btu/lb)	12,550	90	11	12,403 - 12,748
Performance Test				
Ultimate Analysis:				
C (%)	72.4	0.7	24	71.0 - 74.2
H (%)	4.69	0.07	24	4.54 - 4.82
N (%)	1.43	0.07	24	1.29 - 1.56
S (%)	1.72	0.11	24	1.51 - 2.01
Cl (%)	0.030	0.004	24	0.020 - 0.037
O_2 (%)	5.65	0.48	24	4.58 - 6.53
Proximate Analysis:				
Ash (%)	98	0.4	24	9.0 - 10.8
Moisture (%)	4.28	0.63	24	3.12 - 5.58
HHV (Btu/lb)	12,900	100	24	12,693 - 13,210

Table 6-2

(Continued)

Long-Term Testing				
Parameter	**Average**	**Standard Deviation**	**No. of Data Points**	**Range**
Ultimate Analysis:				
C (%)	60.4	26.9	11	68.6 - 74.6
H (%)	3.94	1.76	11	4.59 - 4.98
N (%)	1.20	0.53	11	1.33 - 1.57
S (%)	1.43	0.62	11	1.61 - 1.82
Cl (%)	0.041	0.028	11	0.030 - 0.100
O_2 (%)	4.64	1.99	11	5.05 - 5.79
Proximate Analysis:				
Ash (%)	8.37	3.69	11	9.2 - 10.7
Moisture (%)	3.59	2.02	11	2.42 - 7.86
HHV (Btu/lb)	11,500	4,100	11	12,760 - 13,307
Verification Testing				
Ultimate Analysis:				
C(%)	73.2	0.8	6	71.8 - 74.0
H (%)	4.72	0.04	6	4.65 - 4.77
N (%)	1.40	0.05	6	1.30 - 1.45
S (%)	1.72	0.22	6	1.44 - 2.15
Cl (%)	0.06	0.01	6	0.039 - 0.070
O_2 (%)	5.02	0.31	6	4.70 - 5.60
Proximate Analysis:				
Ash (%)	9.80	0.46	6	9.1 - 10.6
Moisture (%)	4.16	0.73	6	3.03 - 5.11
HHV (Btu/lb)	13,000	100	6	12,819 - 13,134

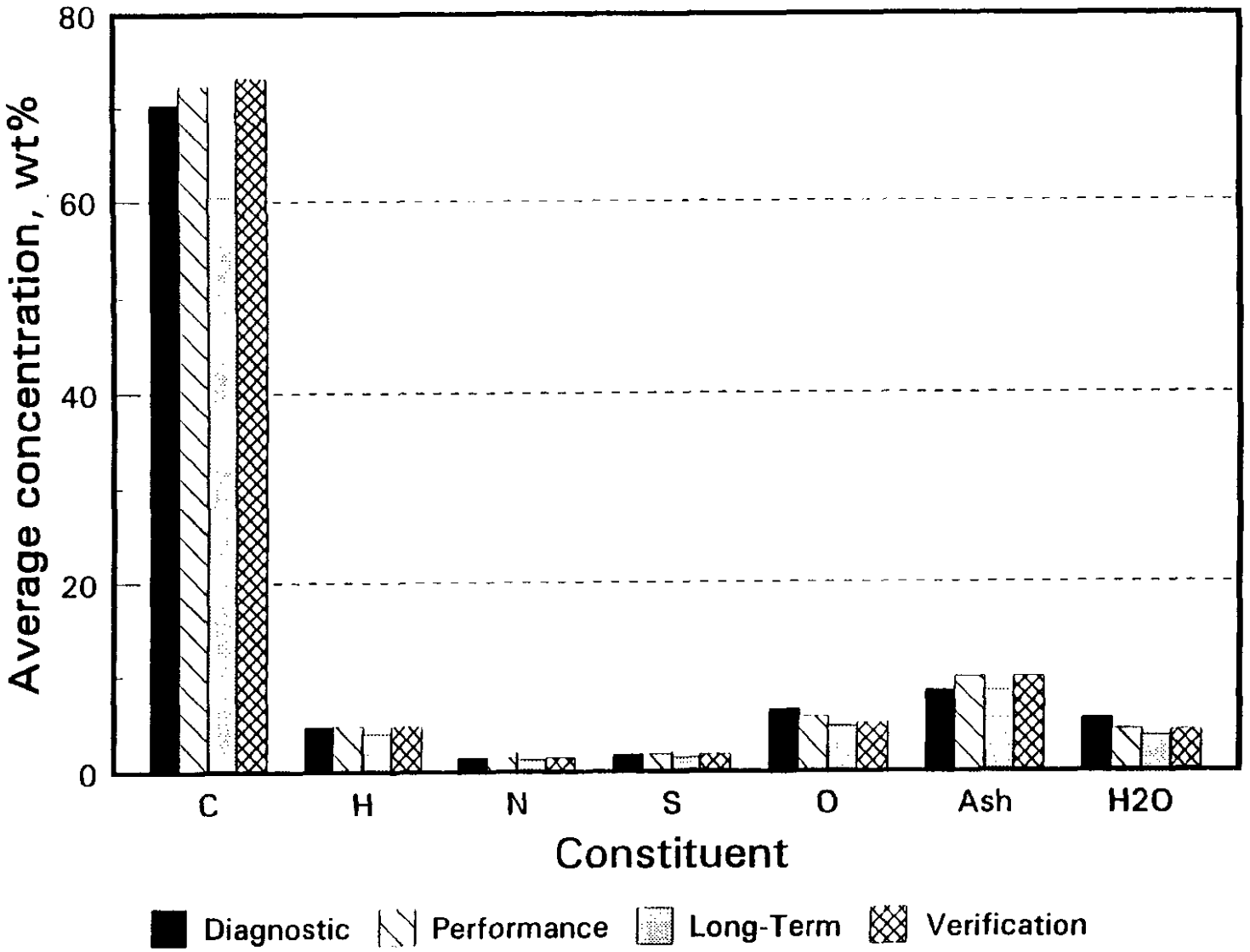

Figure 6-1. Average Ultimate Analysis Results for Coal Feed During Phase 1 Short-Term Testing Periods

Samples of ESP fly ash were collected each day during verification testing and analyzed for volatile/semivolatile species (EPA 8270, EPA 8240, EPA SW 846). None of the target compounds were present at a detection limit of 1.0 mg/kg. Another set of ESP fly ash samples will be collected for volatile/semivolatile analyses during a future test phase in order to compare the effect of NO_x reduction techniques on the levels of these substances.

Figure 6-2 presents the LOI results for bottom ash as a function of unit load. With the exception of one point, all the LOI levels for bottom ash were less than 0.25%, indicating good coal utilization. The sample taken on 11/29/89 appears to be an outlier, at 17.3% and is not presented in Figure 6-2. The authors of the ETEC Phase I report have dismissed this point as anomalous since no indication of combustion upset occurred, and no high fly ash LOI, opacity or low-furnace oxygen, were observed. Figure 6-3 indicates that ESP fly ash LOI levels increase with load; similarly the same trend is seen in the air preheater outlet gas particulate.

Figure 6-4 presents the collected ESP fly ash resistivity as a function of temperature at different loads. There does not appear to be much affect on resistivity by unit load, although the level of SO_3 has a pronounced impact on the ESP fly ash resistivity at the lower temperatures.

Figure 6-5 presents the LOI levels as a function of load for CEGRIT fly ash. There does not appear to be any strong relationship between LOI and unit load for the CEGRIT fly ash, although it appears that LOI levels are somewhat lower at 300 MW load than at higher loads.

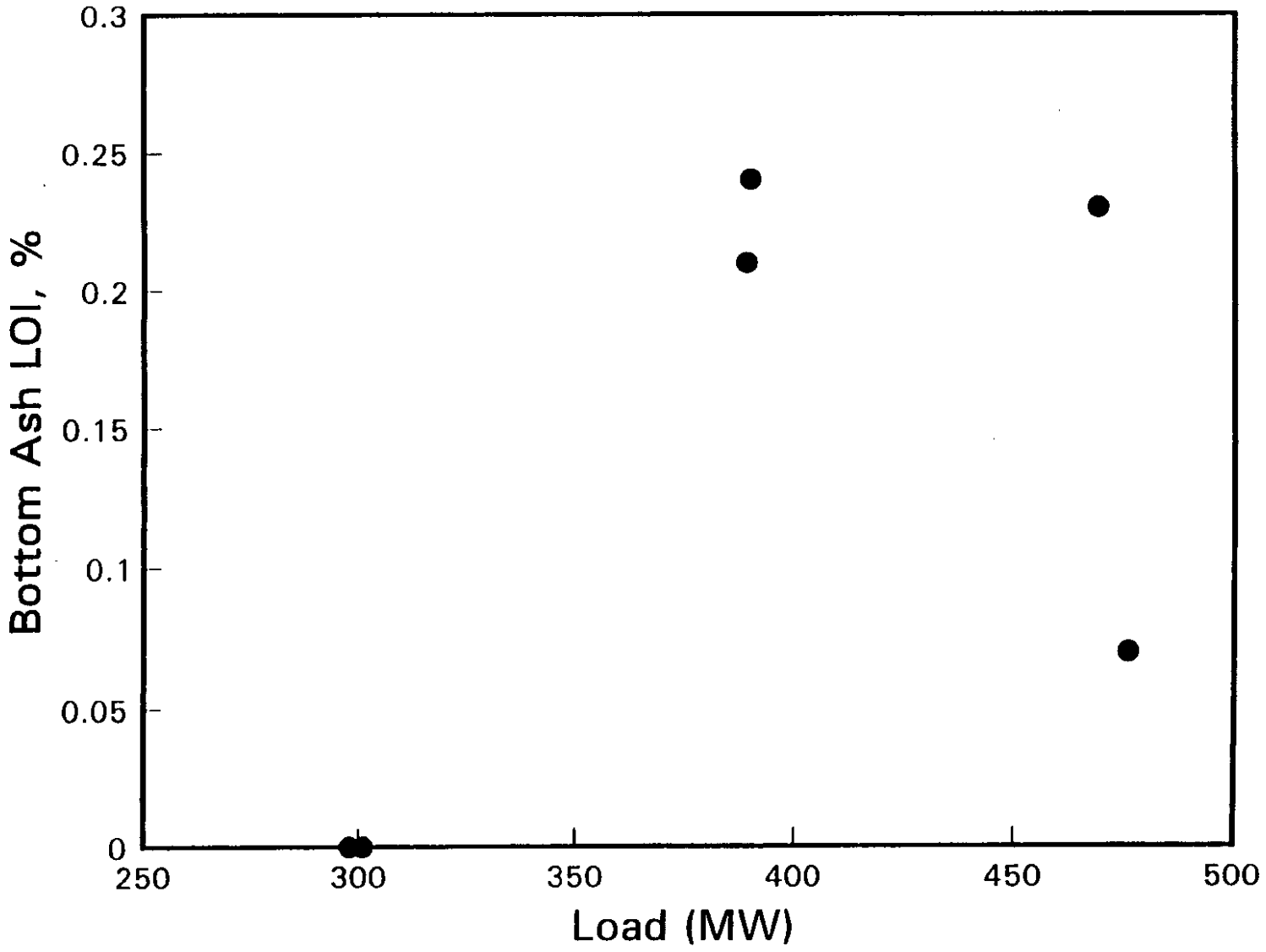

Figure 6-2. Bottom Ash LOI as a Function of Unit Load During Performance Testing

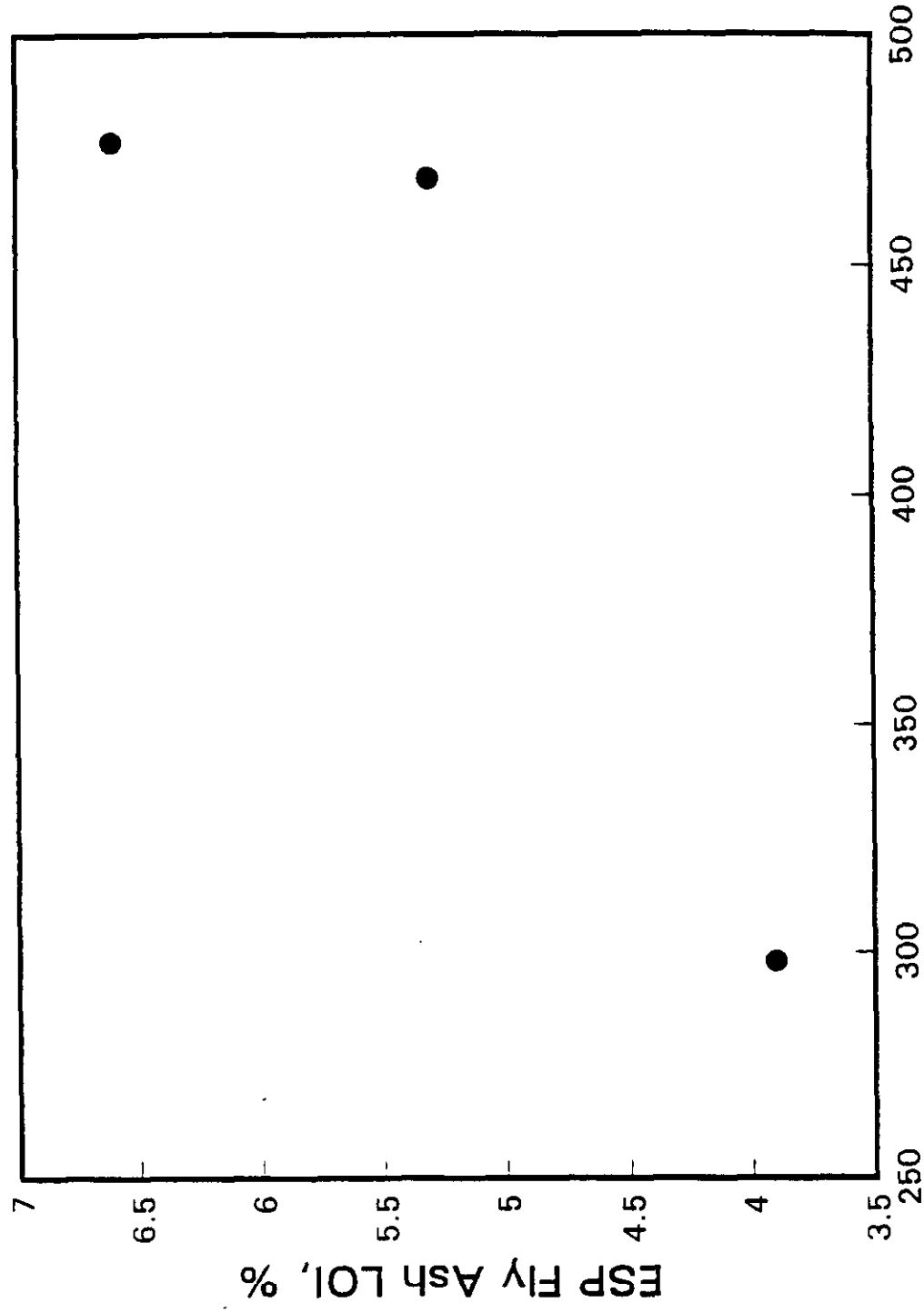

Figure 6-3. ESP Fly Ash LOI as a Function of Unit Load During Performance Testing

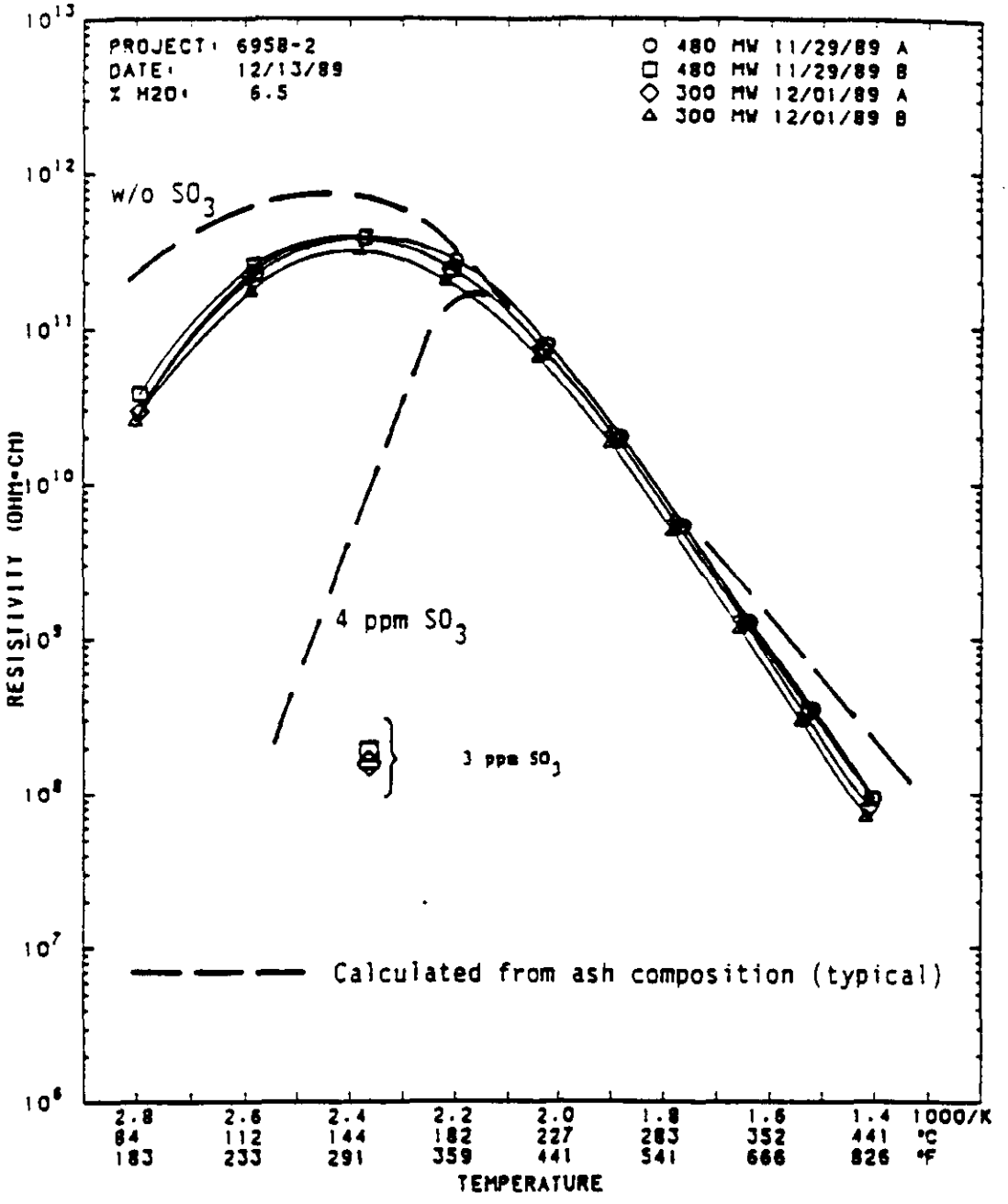

Figure 6-4. ESP Fly Ash Resistivity as a Function of Temperature for Various Unit Load During Performance Testing

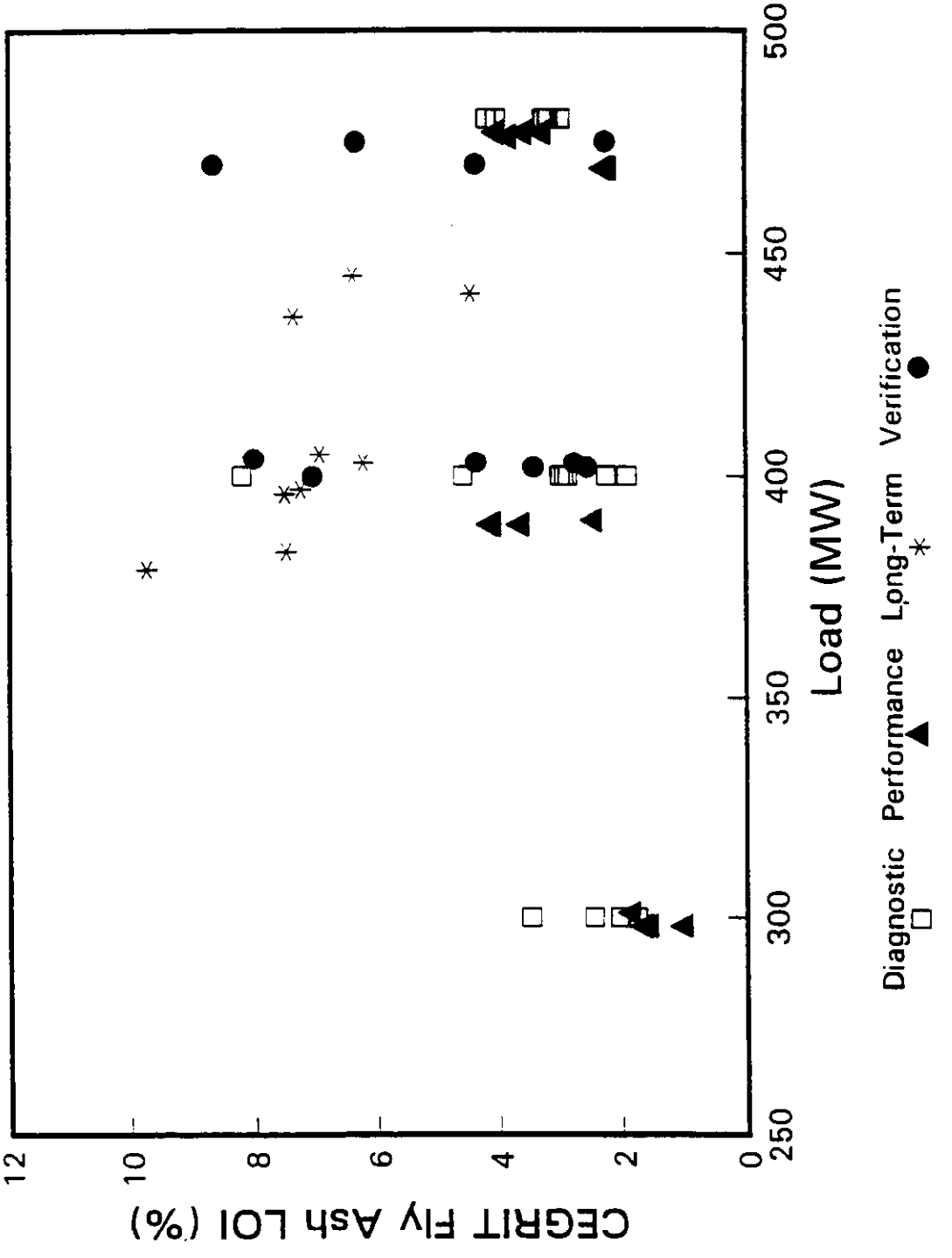

Figure 6-5. CEGRIT Fly Ash LOI as a Function of Unit Load During Baseline Testing

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

The Environmental Monitoring Plan for the Plant Hammond Clean Coal project includes, as an appendix, a Quality Assurance/Quality Control (QA/QC) Plan. That plan describes procedures for producing data and results of acceptable quality including:

- Adherence to accepted methods;
- Adequate documentation and sample custody; and
- Quality assessment.

This section presents the results of each of these QA/QC procedures performed during Phase 1 testing.

7.1 Adherence to Accepted Methods

The sampling and analytical methods specified by the Environmental Monitoring Plan and used during Phase 1 are summarized in Section 3.0 of this report.

As discussed in Section 3.0, there were no deviations from the procedures specified in the Environmental Monitoring Plan during Phase 1.

7.2 Adequate Documentation and Sample Custody

At Plant Hammond, documentation and sample custody procedures that are part of the existing compliance monitoring programs have been approved by the state regulatory agency and are followed during EMP activities. Documentation is reviewed during audits of both compliance and supplemental monitoring.

7.3 Quality Assessment

Quality assessment is provided by the collection and analysis of replicate samples and "blind" audit samples. That is, the results of these analyses provide the basis for estimating precision and accuracy for the parameters measured.

During Phase 1, replicate samples of the coal feed were collected and analyzed as summarized in Table 7-1. The results show that good accuracy (as measured using the coefficient of variation, defined as the sample standard deviation divided by the sample mean) was obtained for nearly all of the ultimate/proximate analysis parameters measured under the EMP. As expected, the results were not as good for chlorine, which is present at very low concentrations.

No audit samples (coal feed and fly ash) were analyzed during Phase 1 because that activity was scheduled for later phases of the project.

Table 7-1

Summary of Replicate Samples for Supplemental Monitoring (Coal Feed Only)

Date/ Test	Moisture, %	C, %	H, %	N, %	Cl, %	S, %	Ash, %	HHV BTU/lb
11/29/89	3.70	71.00	4.63	1.53	0.030	1.82	10.79	12,693
Performance	3.48	72.38	4.68	1.56	0.020	1.77	9.92	12,930
% COV	3.1	0.96	0.54	0.97	20	1.4	4.2	0.92
12/1/89	3.98	72.90	4.80	1.38	0.033	2.01	9.67	12,986
Performance	3.96	72.17	4.64	1.45	0.020	1.96	10.01	12,988
% COV	0.25	0.50	1.7	2.5	25	1.3	1.7	0.0077
12/5/89	4.14	72.69	4.77	1.47	0.034	1.64	9.40	12,978
Performance	4.23	72.32	4.60	1.48	0.030	1.60	9.51	12,989
% COV	1.1	0.26	1.8	0.34	6.3	1.2	0.58	0.042
03/20/90	3.37	73.65	4.75	1.37	0.070	1.65	9.89	13,090
Long-Term	3.51	73.48	4.77	1.39	0.030	1.61	9.84	13,135
% COV	2.0	0.12	0.21	0.72	40	1.2	0.25	0.17

COV is the coefficient of variation, defined as (Standard Deviation/Mean) x 100 percent.

8.0 COMPLIANCE REPORTING

During Phase 1, which began on November 2, 1989, and ended on April 5, 1990, compliance reports were submitted by Georgia Power Company to the Environmental Protection Division of the Georgia Department of Natural Resources, in accordance with the requirements of Unit 4's air operating permit (No. 4911-057-5011-0), as amended; and of Plant Hammond's NPDES permit (GA0001457). The air operating permit was amended effective February 2, 1990, to account for the AOFA system and the low-NO_x burners.

The air operating permit requires the monitoring of coal feed composition (i.e., sulfur, ash, moisture, and heating value), particulate matter emissions (as total particulate loading), and opacity. The NPDES permit requires that the pH, concentrations of suspended solids, and oil and grease levels be reported for several aqueous discharge streams.

Copies of the compliance reports have been included as appendices to the quarterly and annual EMP reports for this project.

9.0 CONCLUSIONS

Most of the planned EMP monitoring was performed during the baseline testing. Any deviations from the planned monitoring are not expected to affect the quality of the data or the conclusions drawn from the data presented in this report.

The gaseous stream monitoring indicated that NO_x emissions increased with increasing oxygen levels in the flue gas and with increasing unit load. There does not seem to be an effect of unit load on SO_2, CO, or THC emissions. The oxygen content appeared to decrease with increasing load during the long-term testing.

The ratio of SO_3 to SO_2 in the preheater outlet gas appeared to decrease with increasing load. Both LOI and carbon content of the preheater outlet gas particulate matter increased with increasing load.

The aqueous stream monitoring showed no exceedances of permit limits for any of the monitored parameters during the Phase 1 testing period.

The solid stream monitoring showed that the coal composition was consistent throughout the testing period.

Appendix A

Phase I

Gaseous Stream Data

Appendix

testing. Table A-1 pres

outlet gas during the di

present similar results f

Table A-4

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Table A–1 Res

Diagnostic Tes Test
Test 1–3
Test 2–3
Test 3–1
Test 3–2
Test 4–1

Performance Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppm)	O2 (%)	CO [2] (ppm)
Test 12	11/29/89	477	None	993	2.96	10.57
Test 13	11/30/89	476	None	1140	3.08	7.72
Test 14	12/01/89	298	E	829	4.64	4.99
Test 15	12/02/89	301	E	820	4.22	8.36
Test 16	12/03/89	389	E	975	3.53	9.13
Test 17	12/04/89	469	None	1082	2.36	9.10
Test 18	12/05/89	390	E	1069	3.24	8.17

Verification Tests

Test	Date	Load (MW)	MOOS	NOx (ppm)	O2 (%)	CO (ppm)
Test 19–1	4/02/90	470	None	862	2.3	8.8
Test 19–2	4/02/90	470	None	943	2.4	7.6
Test 19–3	4/02/90	475	None	1063	3.7	11.3
Test 20–1	4/03/90	404	E	734	2.4	141.4
Test 20–2	4/03/90	403	E	876	3.5	8.5
Test 20–3	4/03/90	403	E	960	4.8	10.2
Test 21–1	4/04/90	400	B	785	2.3	152.2
Test 21–2	4/04/90	402	B	915	2.9	7.2
Test 21–3	4/04/90	402	B	974	4.3	12.0
Test 22–1	4/05/90	475	None	961	2.6	8.2
Test 22–2	4/05/90	475	None	963	2.8	8.9

[1] MOOS – Mills Out of Service

[2] NOx and CO are corrected to 3% O2.

Table A–2 Results for the Preheater Outlet Gas During Phase 1

Diagnostic Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppmv)	O2 (%)	CO [2] (ppmv)
Test 1–3	11/02/89	480	None	979.6	5.5	6.6
Test 2–1	11/03/89	480	None	923.1	5.5	8.9
Test 2–2	11/03/89	480	None	976.8	5.4	9.8
Test 2–3	11/03/89	400	E	977.9	6.2	6.2
Test 3–1	11/04/89	185	B&E	831.5	9.7	0.0
Test 3–2	11/04/89	185	B&E	784.9	6.3	0.0
Test 4–1	11/05/89	480	None	916.3	5.2	0.0
Test 4–2	11/05/89	480	None	855.1	5.0	14.7
Test 5–1	11/06/89	480	None	850.1	5.2	20.8
Test 5–2	11/06/89	400	E	795.4	5.6	8.8
Test 6–3	11/07/89	400	None	749.6	6.1	8.5
Test 7–2	11/08/89	300	B	734.1	6.7	9.9
Test 7–3	11/08/89	400	E	852.6	6.9	10.3
Test 7–4	11/08/89	400	B	827.8	6.2	10.3
Test 7–5	11/08/89	480	None	880.4	5.8	11.0
Test 8–1	11/09/89	300	B&E	714.2	6.8	5.5

Performance Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppm)	O2 (%)	CO [2] (ppm)
Test 12	11/29/89	477	None	955	5.7	16.5
Test 13	11/30/89	476	None	1101	5.4	3.9
Test 14	12/01/89	298	E	836	7.8	4.0
Test 15	12/02/89	301	E	807	7.3	8.0
Test 16	12/03/89	389	E	938	6.5	8.5
Test 17	12/04/89	469	None	1064	5.5	7.7
Test 18	12/05/89	390	E	1046	5.9	8.7

Verification Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppm)	O2 (%)	CO [2] (ppm)
Test 19–1	4/02/90	470	None	860	5.6	9.2
Test 19–2	4/02/90	470	None	925	5.5	8.1
Test 19–3	4/02/90	475	None	1063	6.6	9.1
Test 20–1	4/03/90	404	E	723	5.6	153.0
Test 20–2	4/03/90	403	E	866	6.5	8.1
Test 20–3	4/03/90	403	E	951	7.6	8.3
Test 21–1	4/04/90	400	B	768	5.6	146.4
Test 21–2	4/04/90	402	B	888	6.1	8.2
Test 21–3	4/04/90	402	B	967	7.3	10.5
Test 22–1	4/05/90	475	None	935	5.9	8.4
Test 22–2	4/05/90	475	None	936	5.6	8.1

[1] MOOS – Mills Out of Service

[2] NOx and CO are corrected to 3% O2.

Table A–3 Results for the Stack Gas During Phase 1

Diagnostic Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppmv)	SO2 [2] (ppmv)	O2 (%)	CO [2] (ppmv)	THC [2] (ppmv)
Test 1–3	11/02/89	480	None	979	1394	5.1	7.2	13.2
Test 2–2	11/03/89	480	None	1001	1486	5.1	8.6	11.0
Test 2–3	11/03/89	400	E	982	1379	5.6	6.1	12.9
Test 3–1	11/04/89	185	B&E	896	1225	9.3	0.0	0.0
Test 4–1	11/05/89	480	None	926	1232	4.7	0.0	0.0
Test 4–2	11/05/89	480	None	894	1289	4.6	0.0	0.0
Test 5–1	11/06/89	480	None	877	1316	4.7	17.3	0.0
Test 5–2	11/06/89	400	E	814	1316	5.1	7.0	21.1
Test 6–2	11/07/89	300	E	796	1257	7.6	9.0	14.4
Test 6–3	11/07/89	400	None	776	1385	5.6	6.4	21.6
Test 7–1	11/08/89	300	E	813	1329	6.8	9.0	11.7
Test 7–2	11/08/89	300	B	780	1326	6.7	7.8	18.1
Test 7–3	11/08/89	400	E	878	1260	6.7	9.7	16.1
Test 7–4	11/08/89	400	B	839	1289	5.6	8.8	15.0
Test 7–5	11/08/89	480	None	908	1265	5.3	9.9	15.4
Test 8–1	11/09/89	300	B&E	737	1433	6.5	3.9	17.6
Test 8–2	11/09/89	479	None	1010	1341	5.4	4.6	10.4
Test 8–3	11/09/89	478	None	1009	1349	4.9	3.2	9.5
Test 8–4	11/09/89	478	None	1168	1594	7	6.4	11.3
Test 9–1	11/10/89	400	B	845	1184	5.0	15.2	4.5
Test 9–2	11/10/89	400	B	960	1091	6.0	7.2	6.0
Test 9–3	11/10/89	400	B	1058	965	7.4	8.0	6.6
Test 9–4	11/10/89	480	None	1067	981	7.2	6.5	6.5
Test 9–5	11/10/89	480	None	1069	1119	5.3	6.0	6.9
Test 10–1	11/11/89	405	E	709	1171	4.7	51.8	0.0
Test 10–2	11/11/89	403	E	823	1085	5.6	8.2	0.0
Test 10–3	11/11/89	400	E	917	991	6.8	6.3	0.0
Test 10–4	11/11/89	305	E	738	1140	5.6	4.7	0.0
Test 10–5	11/11/89	315	E	890	1007	7.4	4.6	0.0
Test 11–1	11/13/89	478	None	1005	1034	5.2	5.7	5.1
Test 11–2	11/13/89	480	None	1052	990	5.3	4.0	6.3

Performance Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppm)	SO2 [2] (ppm)	O2 (%)	CO [2] (ppm)	THC [2] (ppm)
Test 12	11/29/89	477	None	999	1561	8.0	8.3	5.6
Test 13	11/30/89	476	None	856	1071	7.4	2.7	4.7
Test 14	12/01/89	298	E	829	1337	8.5	3.8	4.9
Test 15	12/02/89	301	E	824	1179	8.4	7.9	4.3
Test 16	12/03/89	389	E	962	978	8.0	7.6	4.5
Test 17	12/04/89	469	None	1080	1202	7.0	6.1	4.2
Test 18	12/05/89	390	E	1071	1100	5.9	7.1	4.4

Verification Tests

Test	Date	Load (MW)	MOOS [1]	NOx [2] (ppm)	SO2 [2] (ppm)	O2 (%)	CO [2] (ppm)	THC [2] (ppm)
Test 19–1	04/02/90	470	None	853	1106	4.9	14.5	0.0
Test 19–2	04/02/90	470	None	924	1201	5.0	7.9	1.7
Test 19–3	04/02/90	475	None	1052	1102	5.9	9.6	2.4
Test 20–1	04/03/90	404	E	721	1342	4.9	183.0	1.1
Test 20–2	04/03/90	403	E	869	1204	5.9	8.4	0.4
Test 20–3	04/03/90	403	E	961	1093	7.1	9.1	1.3
Test 21–1	04/04/90	400	B	765	1314	4.9	211.8	0.0
Test 21–2	04/04/90	402	B	899	1206	5.6	8.7	0.0
Test 21–3	04/04/90	402	B	977	1004	6.7	10.1	0.0
Test 22–1	04/05/90	475	None	951	972	5.3	8.6	0.0

[1] MOOS – Mills Out of Service

[2] NOx, SO2, CO, and THC (total hydrocarbons) are corrected to 3% O2.

Table A–4 Results for the Preheater Outlet Gas During Phase 1

Particulate Loading

Performance Tests

Test	Date	Load (MW)	Loading (gr/dscf)
Test 12	11/29/89	477	2.6317
			2.7289
			2.5363
Test 14	12/01/89	298	2.6335
			2.5671
			2.6143
Test 16	12/03/89	389	2.3347
			2.1715
			2.2014
Test 17	12/04/89	469	2.3753
			2.3379
			2.5132

Particulate Matter Resistivity

Performance Tests

Test	Date	Load (MW)	Resistivity Spark (ohm–cm)	Resistivity V–I (ohm–cm)
Test 12	11/29/89	477	5.0E+11	3.3E+10
			7.9E+10	1.3E+10
			3.1E+11	1.6E+10
			5.8E+11	2.9E+10
Test 13	11/30/89	476	2.1E+12	2.7E+10
			4.1E+11	2.6E+10
			6.9E+10	1.2E+10
Test 14	12/01/89	298	2.6E+09	3.7E+09
			3.1E+09	5.5E+09
			4.3E+09	3.1E+10
			5.6E+09	4.2E+10
Test 15	12/02/89	301	7.3E+09	7.4E+10
			7.1E+09	6.3E+10
			3.0E+09	1.1E+10
			2.4E+09	6.3E+09

Test 16	12/03/89	389	1.6E+09	4.3E+10
			1.2E+09	4.6E+10
			9.4E+09	7.8E+10
			1.9E+10	7.6E+10
Test 17	12/04/89	469	1.8E+10	6.8E+10
			6.6E+10	1.0E+11
			1.2E+10	2.3E+10
			1.3E+10	2.7E+10
Test 18	12/05/89	390	8.7E+09	1.1E+10
			9.9E+09	6.1E+09
			7.6E+09	3.0E+09

Particulate Matter Characteristics

Performance Tests

Test	Date	Load (MW)	Carbon (%)	LOI (%)
Test 12	11/29/89	477	4.92	5.4
Test 14	12/01/89	298	1.92	2.3
Test 16	12/03/89	389	4.11	4.7
Test 17	12/04/89	469	4.53	4.9

SO3/SO2 Results

Performance Tests

Test	Date	Load (MW)	SO3 (ppm)	SO2 (ppm)	SO3/SO2
Test 12	11/29/89	477	1.7	1347	0.00126
		477	1.9	1337	0.00142
		477	2.1	1349	0.00156
		477	2.0	1362	0.00147
Test 13	11/30/89	476	2.7	1025	0.00263
		476	2.5	1031	0.00242
		476	2.3	1042	0.00221
		476	2.3	1048	0.00219
Test 14	12/01/89	298	2.1	960	0.00219
		298	2.3	947	0.00243
		298	2.4	971	0.00247
		298	2.4	978	0.00245
Test 15	12/02/89	301	3.7	902	0.00410
		301	4.4	915	0.00481
		301	4.4	921	0.00478
		301	4.6	929	0.00495
Test 16	12/03/89	389	3.0	899	0.00334
		389	3.3	886	0.00372
		389	3.2	890	0.00360
		389	3.4	891	0.00382
Test 17	12/04/89	469	2.6	1073	0.00242
		469	2.7	1092	0.00247
		469	2.4	1108	0.00217
		469	2.5	1131	0.00221
Test 18	12/05/89	390	1.1	1005	0.00109
		390	1.2	1008	0.00119
		390	1.3	999	0.00130
		390	1.2	1008	0.00119

Table A–5 Daily Average Results for the Stack Inlet Gas During Phase 1

Long–Term Testing

Consecutive Test Day	Date	Load (MW)	NOx [1] (lb/MMBtu)	SO2 [1] (lb/MMBtu)	O2 (%)	CO [1] (ppmv)	THC [1] (ppmv)
15	01/09/90	420.013	1.317	3.025	5.971	7.638	0.000
16	01/10/90	379.923	1.250	2.391	6.622	8.418	0.000
17	01/11/90	434.655	1.305	2.522	5.920	19.389	0.021
18	01/12/90	417.710	1.198	2.747	5.985	12.055	0.000
19	01/13/90	407.507	1.232	2.328	6.487	17.196	0.000
20	01/14/90	454.558	1.260	2.791	5.177	46.223	0.000
21	01/15/90	420.622	1.240	2.881	5.764	25.734	0.000
29	01/23/90	414.955	1.129	2.592	6.010	86.938	1.822
30	01/24/90	414.040	1.166	2.576	6.091	24.971	2.715
31	01/25/90	423.746	1.150	2.602	6.108	47.554	1.541
36	01/30/90	410.610	1.081	2.852	6.043	223.715	1.245
45	02/08/90	396.718	1.126	2.764	6.155	55.749	0.453
50	02/13/90	395.842	1.214	2.621	6.172	39.903	0.826
51	02/14/90	378.724	1.143	1.974	6.061	141.873	0.832
52	02/15/90	381.435	1.219	2.097	6.521	20.844	0.958
53	02/16/90	403.533	1.250	2.276	6.099	19.409	0.552
57	02/20/90	409.854	1.262	2.645	5.834	18.038	1.057
58	02/21/90	395.882	1.203	2.267	5.947	60.079	1.202
64	02/27/90	393.370	1.090	2.336	6.513	23.526	0.936
65	02/28/90	449.303	1.243	1.835	5.618	25.250	1.026
66	03/01/90	439.658	1.313	2.178	5.711	59.188	1.097
67	03/02/90	403.116	1.115	2.079	6.266	18.681	0.529
68	03/03/90	401.083	1.164	2.064	6.269	19.473	0.126
69	03/04/90	374.681	1.044	1.979	6.255	109.571	0.177
70	03/05/90	405.567	1.089	2.064	5.531	219.274	0.662
71	03/06/90	435.664	1.109	2.306	4.643	258.250	0.227
73	03/08/90	421.195	1.202	2.098	5.445	101.382	1.130
74	03/09/90	398.194	1.215	2.071	5.698	10.564	0.530
75	03/10/90	396.205	1.055	2.444	5.242	65.152	0.000
76	03/11/90	361.059	1.051	2.378	6.003	17.952	0.000
77	03/12/90	457.683	1.155	2.692	4.457	47.645	0.000
78	03/13/90	382.525	0.980	2.322	5.632	19.530	0.000
79	03/14/90	454.733	1.040	2.410	4.549	48.099	0.000
80	03/15/90	445.229	1.184	2.210	4.992	28.353	0.000
81	03/16/90	415.536	1.121	2.371	5.224	61.447	0.000
82	03/17/90	257.533	0.932	2.637	8.003	4.919	0.000
83	03/18/90	288.370	0.842	3.004	6.533	3.158	0.000
84	03/19/90	396.609	1.065	2.928	5.340	23.274	0.000
85	03/20/90	440.537	1.200	2.898	4.708	22.781	0.000

86	03/21/90	387.346	1.078	2.461	5.349	12.648	0.000
87	03/22/90	423.391	1.143	2.383	5.375	10.786	0.000
88	03/23/90	394.017	1.043	2.492	5.589	21.614	0.000
89	03/24/90	411.082	1.072	2.061	5.584	27.366	0.000
90	03/25/90	360.035	1.068	2.200	5.806	16.201	0.000
91	03/26/90	436.611	1.231	2.392	5.133	31.884	0.000
92	03/27/90	424.792	1.215	2.654	4.871	11.941	0.000
93	03/28/90	404.727	1.127	1.927	5.433	35.753	0.000
94	03/29/90	429.671	1.396	0.772	5.532	30.918	0.000
95	03/30/90	433.151	1.358	1.811	5.228	21.088	0.000
96	03/31/90	430.848	1.360	1.890	5.301	19.754	0.000
97	04/01/90	415.376	1.239	1.943	5.493	15.578	0.000

[1]NOx, SO2, CO, and THC (total hydrocarbons) are corrected to 3% O2.

Appendix B

Phase 1

Solid Stream Data

Appendix B presents the solid stream results obtained during Phase 1 testing. Table B-1 presents the monitoring results by date for coal during the diagnostic, performance, long-term, and verification tests. Table B-2 presents the monitoring results by numbered test for bottom ash, ESP fly ash, and CEGRIT fly ash. Table B-3 presents the results for volatile/semivolatile analysis of the ESP fly ash.

Table B–1 Results for Coal During Phase 1

Diagnostic Tests

Date	C (%)	H (%)	N (%)	S (%)	O (%)	Ash (%)	H2O (%)	HHV (BTU/lb)	Cl (%)
11/02/89	70.33	4.51	1.41	1.71	6.57	10.11	5.36	12489	0.034
11/03/89	71.14	4.82	1.60	1.72	6.00	10.30	4.75	12708	0.029
11/04/89	70.20	4.55	1.57	1.73	6.96	9.41	5.58	12524	0.031
11/05/89	69.67	4.53	1.43	1.72	7.00	9.84	5.80	12561	0.031
11/06/89	70.17	4.53	1.55	1.80	6.27	9.83	5.85	12518	0.008
11/07/89	70.34	4.52	1.38	1.68	6.26	10.26	5.56	12497	0.034
11/08/89	70.17	4.58	1.45	1.76	6.16	11.04	4.86	12540	0.029
11/09/89	71.33	4.71	1.39	1.77	6.61	9.80	4.39	12748	0.028
11/10/89	69.43	4.51	1.43	1.74	6.23	10.24	6.42	12403	0.032
11/11/89	70.47	4.60	1.49	1.72	6.45	9.27	6.01	12566	0.027
11/13/89	69.79	4.64	1.57	1.83	6.25	9.97	5.95	12495	0.032

Performance Tests

Date	C (%)	H (%)	N (%)	S (%)	O (%)	Ash (%)	H2O (%)	HHV (BTU/lb)	Cl (%)
11/29/89	71.00	4.63	1.53	1.82	6.53	10.79	3.70	12693	0.030
11/29/89	72.38	4.68	1.56	1.77	6.19	9.92	3.48	12930	0.020
11/29/89	72.20	4.77	1.49	1.78	5.67	9.90	4.18	12847	0.031
11/29/89	71.39	4.57	1.50	1.75	6.34	9.95	4.49	12827	0.031
11/30/89	71.17	4.72	1.47	1.79	5.50	9.93	5.42	12706	0.027
11/30/89	72.08	4.61	1.44	1.69	5.57	10.05	4.55	12933	0.031
11/30/89	72.93	4.73	1.29	1.58	5.11	10.41	3.95	12963	0.032
12/01/89	73.23	4.70	1.39	1.70	5.68	10.07	3.22	13137	0.037
12/01/89	74.18	4.76	1.52	1.65	4.58	10.19	3.12	13210	0.030
12/01/89	73.32	4.75	1.40	1.66	5.21	9.88	3.77	13043	0.031
12/01/89	72.90	4.80	1.38	2.01	5.26	9.67	3.98	12986	0.033
12/01/89	72.17	4.64	1.45	1.96	5.79	10.01	3.96	12988	0.020
12/02/89	71.87	4.71	1.44	1.66	6.15	9.79	4.37	12865	0.035
12/02/89	72.51	4.82	1.40	1.73	5.77	9.88	3.89	12934	0.033
12/02/89	72.66	4.66	1.38	1.72	5.72	9.68	4.18	12942	0.031
12/03/89	71.42	4.54	1.38	1.77	6.02	10.04	4.83	12793	0.033
12/03/89	71.98	4.63	1.29	1.51	5.91	9.10	5.58	12793	0.030
12/03/89	72.78	4.66	1.43	1.62	5.21	9.37	4.94	12975	0.030
12/04/89	72.87	4.74	1.42	1.61	4.73	9.59	5.03	12925	0.031
12/04/89	72.56	4.77	1.42	1.76	5.41	9.00	5.07	12946	0.031
12/05/89	71.60	4.68	1.48	1.83	5.93	9.85	4.62	12810	0.030

12/05/89	72.69	4.77	1.47	1.64	5.89	9.40	4.14	12978	0.034
12/05/89	72.32	4.60	1.48	1.60	6.23	9.51	4.23	12989	0.030
12/05/89	72.70	4.68	1.39	1.76	5.30	10.13	4.04	12900	0.031

Long–Term Tests

Date	C (%)	H (%)	N (%)	S (%)	O (%)	Ash (%)	H2O (%)	HHV (BTU/lb)	Cl (%)
01/26/90	71.74	4.59	1.57	1.82	5.79	10.39	4.09	12760	0.100
02/08/90	72.04	4.78	1.50	1.77	5.56	10.74	3.60	12884	0.070
02/14/90	72.96	4.64	1.57	1.78	5.58	10.65	2.82	12977	0.070
02/21/90	68.57	4.43	1.33	1.79	5.62	10.58	7.68	12268	0.030
03/02/90	74.27	4.92	1.37	1.67	5.46	10.27	3.16	13011	0.030
03/06/90	74.56	4.98	1.42	1.72	5.05	9.85	2.42	13307	0.030
03/13/90	73.39	4.85	1.35	1.65	5.06	10.42	3.28	13055	0.049
03/15/90	69.57	4.68	1.42	1.66	5.40	9.42	7.86	12391	0.047
03/20/90	73.65	4.75	1.37	1.65	5.30	9.89	3.37	13090	0.070
03/20/90	73.48	4.77	1.39	1.61	5.37	9.84	3.51	13135	0.030
03/28/90	72.08	4.80	1.49	1.74	5.51	9.24	5.14	12838	0.090

Verification Tests

Date	C (%)	H (%)	N (%)	S (%)	O (%)	Ash (%)	H2O (%)	HHV (BTU/lb)	Cl (%)
04/02/90	73.97	4.76	1.43	1.58	5.60	9.63	3.03	13134	0.060
04/02/90	73.68	4.70	1.38	1.62	5.16	9.80	3.66	13020	0.070
04/02/90	73.24	4.77	1.45	1.76	4.87	10.13	3.77	13004	0.050
04/03/90	73.79	4.70	1.43	1.44	5.04	9.09	4.51	13095	0.039
04/04/90	72.72	4.74	1.39	1.77	4.72	9.56	5.11	12968	0.070
04/05/90	71.75	4.65	1.30	2.15	4.70	10.56	4.89	12819	0.060

Table B–2 Results for the Ash Streams During Phase 1

Bottom Ash

Performance Tests

Test	Date	Load (MW)	LOI (%)
Test 12	11/29/89	477	17.33
Test 13	11/30/89	476	0.07
Test 14	12/01/89	298	0
Test 15	12/02/89	301	0
Test 16	12/03/89	389	0.21
Test 17	12/04/89	469	0.23
Test 18	12/05/89	390	0.24

ESP Fly Ash

Performance Tests

Test	Date	Load (MW)	LOI (%)
Test 12	11/29/89	477	6.6
Test 14	12/01/89	298	3.9
Test 17	12/04/89	469	5.3

Cegrit Fly Ash

Diagnostic Tests

Test	Date	Load (MW)	LOI A–side (%)	LOI B–side (%)	LOI AVG (%)
Test 1–3	11/02/89	480	3.87	2.59	3.23
Test 2–1	11/03/89	480	4.00	2.33	3.17
Test 2–2	11/03/89	480	4.73	1.74	3.24
Test 2–3	11/03/89	400	1.72	2.06	1.89
Test 7–1	11/08/89	300	2.75	2.14	2.45
Test 7–2	11/08/89	300	2.33	1.70	2.02
Test 7–3	11/08/89	400	2.64	3.22	2.93
Test 7–4	11/08/89	400	2.23	3.51	2.87

Test 8–1	11/09/89	300	4.86	2.12	3.49
Test 8–2	11/09/89	480	3.36	2.60	2.98
Test 8–3	11/09/89	480	4.34	3.97	4.16
Test 9–1	11/10/89	400	3.51	2.49	3.00
Test 9–2	11/10/89	400	2.11	2.34	2.23
Test 9–4	11/10/89	480	3.46	3.07	3.27
Test 9–5	11/10/89	480	3.79	4.23	4.01
Test 10–1	11/11/89	400	9.79	6.58	8.19
Test 10–2	11/11/89	400	5.93	3.18	4.56
Test 10–3/4	11/11/89		4.73	3.23	3.98
Test 10–5	11/11/89	300	2.02	1.48	1.75
Test 11–1	11/13/89	480	3.43	2.95	3.19

Performance Tests

Test	Date	Load (MW)	LOI A–side (%)	LOI B–side (%)	LOI AVG (%)
Test 12	11/29/89	477	4.74	2.38	3.56
		477	4.43	2.09	3.26
		477	4.89	3.13	4.01
Test 13	11/30/89	476	3.98	3.61	3.80
Test 14	12/01/89	298	2.12	1.13	1.63
		298	1.86	1.21	1.54
		298	1.9	0.07	0.99
Test 15	12/02/89	301	2.43	1.22	1.83
Test 16	12/03/89	389	4.55	2.69	3.62
		389	5	3.13	4.07
		389	5.15	3.06	4.11
Test 17	12/04/89	469	2.66	1.75	2.21
		469	2.66	1.67	2.17
		469	2.72	1.8	2.26
Test 18	12/05/89	390	2.73	2.1	2.42

Long–Term Testing

	Date	Load (MW)	LOI A–side (%)	LOI B–side (%)	LOI AVG (%)
	01/26/90		14.95	2.9	8.93
	02/08/90	397	10.99	3.51	7.25
	02/14/90	379	16.17	3.29	9.73
	02/21/90	396	8.75	6.27	7.51

03/02/90	403	5.4	7.02	6.21
03/06/90	436	11.38	3.34	7.36
03/13/90	383	7.52	7.45	7.49
03/15/90	445	7.34	5.42	6.38
03/20/90	441	3.88	4.97	4.43
03/28/90	405	8.97	4.91	6.94

Verification Tests

Test	Date	Load (MW)	LOI A-side (%)	LOI B-side (%)	LOI AVG (%)
Test 19-1	04/02/90	470	9.81	7.48	8.65
Test 19-2	04/02/90	470	3.92	4.78	4.35
Test 19-3	04/02/90	475	2.08	2.4	2.24
Test 20-1	04/03/90	404	10.82	5.17	8.00
Test 20-2	04/03/90	403	4.98	3.71	4.35
Test 20-3	04/03/90	403	3.01	2.53	2.77
Test 21-1	04/04/90	400	10.45	3.66	7.06
Test 21-2	04/04/90	402	3.92	2.93	3.43
Test 21-3	04/03/90	402	2.97	2.12	2.55
Test 22-1	04/05/90	475	4.93	7.73	6.33

Table B-3

Results for Volatile/Semivolatile Organic Compound Analysis of the ESP Fly Ash

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/02/90
SAMPLE NUMBER : 900413-0007
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/2/90 1230

TEST	REFERENCE	RESULT	UNITS
PCB, 1242	EPA 8270/600	< 1.0	mg/kg
PCB, 1254	EPA 8270/600	< 1.0	mg/kg
PCB, 1221	EPA 8270/600	< 1.0	mg/kg
PCB, 1232	EPA 8270/600	< 1.0	mg/kg
PCB, 1248	EPA 8270/600	< 1.0	mg/kg
PCB, 1260	EPA 8270/600	< 1.0	mg/kg
PCB, 1016	EPA 8270/600	< 1.0	mg/kg
Aldrin	EPA SW 846/8080	< 1.0	mg/kg
Dieldrin	EPA SW 846/8080	< 1.0	mg/kg
Endrin	EPA SW 846/8080	< 1.0	mg/kg
Toxaphene	EPA SW 846/8080	< 1.0	mg/kg
Heptachlor	EPA SW 846/8080	< 1.0	mg/kg
Heptachlor epoxide	EPA SW 846/8080	< 1.0	mg/kg
Chlordane	EPA SW 846/8080	< 1.0	mg/kg
Hexachlorocyclopentadiene 358	EPA 8270/625	< 1.0	mg/kg
Chloroethane	EPA 8240/524.2	< 1.0	mg/kg
Bromomethane	EPA 8240/524.2	< 1.0	mg/kg
Vinyl Chloride	EPA 8240/524.2	< 1.0	mg/kg
Chloroethane	EPA 8240/524.2	< 1.0	mg/kg
Dichloromethane (Methylene Chloride)	EPA 8240/524.2	< 1.0	mg/kg
Fluorotrichloromethane	EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethylene	EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethane	EPA 8240/524.2	< 1.0	mg/kg
Trans-1,2-Dichloroethene	EPA 8240/524.2	1.0	mg/kg
Chloroform	EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloroethane	EPA 8240/524.2	< 1.0	mg/kg
1,1,1-Trichloroethane	EPA 8240/524.2	< 1.0	mg/kg
Carbon Tetrachloride	EPA 8240/524.2	< 1.0	mg/kg
Bromodichloromethane	EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloropropane	EPA 8240/524.2	< 1.0	mg/kg
Cis-1,3-Dichloropropene	EPA 8240/524.2	< 1.0	mg/kg
Trichloroethylene	EPA 8240/524.2	< 1.0	mg/kg
Benzene	EPA SW846/8240/524.2	< 1.0	mg/kg

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/02/90
SAMPLE NUMBER : 900413-0007
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE. 4/2/90 1230

TEST		REFERENCE	RESULT	UNITS
Chlorodibromomethane		EPA 8240/524.2	< 1.0	mg/kg
1,1,2-Trichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Trans-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	mg/kg
2-Chloroethylvinyl Ether		EPA 8240/524.2	< 1.0	mg/kg
Bromoform		EPA 8240/524.2	< 1.0	mg/kg
1,1,2,2-Tetrachloroethane		EPA 8240/524.2	< 1.0	mg/kg
Tetrachloroethylene		EPA 8240/524.2	< 1.0	mg/kg
Toluene		EPA SW846/8240/524.2	< 1.0	mg/kg
Chlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Ethylbenzene		EPA SW846/8240/524.2	< 1.0	mg/kg
Acenaphthylene	2B	EPA 8270/625	< 1.0	mg/kg
1,4-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,3-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Bis-2-Chloroisopropylether	12B	EPA 8270/625	< 1.0	mg/kg
1,2,4-Trichlorobenzene	46B	EPA 8270/625	< 1.0	mg/kg
Naphthalene	39B	EPA 8270/625	< 1.0	mg/kg
Hexachlorobutadiene	34B	EPA 8270/625	< 1.0	mg/kg
Anthracene	3B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Anthracene	5B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Pyrene	6B	EPA 8270/625	< 1.0	mg/kg
Benzo(B)Fluoranthene	7B	EPA 8270/625	< 1.0	mg/kg
Benzo(k)Fluoranthene	9B	EPA 8270/625	< 1.0	mg/kg
Benzo(g,h,i)Perylene	8B	EPA 8270/625	< 1.0	mg/kg
Chrysene	18B	EPA 8270/625	< 1.0	mg/kg
Dibenzo(a,h)Anthracene	19B	EPA 8270/625	< 1.0	mg/kg
Fluorene	33B	EPA 8270/625	< 1.0	mg/kg
Indeno(1,2,3-c,d)Pyrene	37B	EPA 8270/625	< 1.0	mg/kg
Phenanthrene	44B	EPA 8270/625	< 1.0	mg/kg
Pyrene	45B	EPA 8270/625	< 1.0	mg/kg
Fluoranthene	31B	EPA 8270/625	< 1.0	mg/kg
Butylbenzyl Phthalate	15B	EPA 8270/625	< 1.0	mg/kg
a-BHC		EPA SW 846/8080	< 1.0	mg/kg

Chemist Quality Control Supv Chemist Page 2 of

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/02/90
SAMPLE NUMBER : 900413-0007
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE. 4/2/90 1230

TEST		REFERENCE	RESULT	UNITS
g-BHC		EPA 8270/608	< 1.0	mg/kg
Bis(2-chloroethyl)ether	11B	EPA 8270/625	< 1.0	mg/kg
Bis(2-chloroethoxy)methane	10B	EPA 8270/625	< 1.0	mg/kg
4-Bromophenyl phenyl ether	14B	EPA 8270/625	< 1.0	mg/kg
4-Chlorophenyl phenyl ether	17B	EPA 8270/625	< 1.0	mg/kg
4,4' DDD		EPA SW 846/8080	< 1.0	mg/kg
4,4' DDE		EPA SW 846/8080	< 1.0	mg/kg
4,4' DDT		EPA SW 846/8080	< 1.0	mg/kg
Di-n-butylphthalate	26B	EPA 8270/625	< 1.0	mg/kg
3,3'-Dichlorobenzidine	23B	EPA 8270/625	< 1.0	mg/kg
Diethyl phthalate	24B	EPA 8270/625	< 1.0	mg/kg
Dimethyl phthalate	25B	EPA 8270/625	< 1.0	mg/kg
2,4-Dinitrotoluene	27B	EPA 8270/625	< 1.0	mg/kg
2,6-Dinitrotoluene	28B	EPA 8270/625	< 1.0	mg/kg
Di-n-octylphthalate	29B	EPA 8270/625	< 1.0	mg/kg
Endosulfan Sulfate		EPA SW 846/8080	< 1.0	mg/kg
Endrin Aldehyde		EPA SW 846/8080	< 1.0	mg/kg
Hexachloroethane	36B	EPA 8270/625	< 1.0	mg/kg
Isophorone	38B	EPA 8270/625	< 1.0	mg/kg
Nitrobenzene	40B	EPA 8270/625	< 1.0	mg/kg
N-Nitrosodi-n-propylamine	42B	EPA 8270/625	< 1.0	mg/kg
Bis(2-ethylhexyl)Phthalate	13B	EPA 8270/625	< 1.0	mg/kg
2-Chlorophenol	1A	EPA 8270/625	< 1.0	mg/kg
2-Nitrophenol	6A	EPA 8270/625	< 1.0	mg/kg
2,4-Dimethylphenol	3A	EPA 8270/625	< 1.0	mg/kg
2,4-Dichlorophenol	2A	EPA 8270/625	< 1.0	mg/kg
4-Chloro-3-Methylphenol	8A	EPA 8270/625	< 1.0	mg/kg
2,4,6-Trichlorophenol	11A	EPA 8270/625	< 1.0	mg/kg
2-Chloronaphthalene	16B	EPA 8270/625	< 1.0	mg/kg
Acenaphthene	1B	EPA 8270/625	< 1.0	mg/kg
2,4-Dinitrophenol	5A	EPA 8270/625	< 1.0	mg/kg
4-Nitrophenol	7A	EPA 8270/625	< 1.0	mg/kg
4,6-Dinitro-2-Methylphenol	4A	EPA 8270/625	< 1.0	mg/kg

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General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/02/90
SAMPLE NUMBER : 900413-0007
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/2/90 1230

TEST		REFERENCE	RESULT	UNITS
N-Nitrosodiphenylamine	43B	EPA 8270/625	< 1.0	mg/kg
Pentachlorophenol	9A	EPA 8270/625	< 1.0	mg/kg
Hexachlorobenzene	33B	EPA 8270/625	< 1.0	mg/kg
Phenol	10A	EPA 8270/625	< 1.0	mg/kg
Benzidine	4B	EPA 8270/625	< 1.0	mg/kg
N-Nitrosodimethylamine	41B	EPA 8270/625	< 1.0	mg/kg
b-BHC		EPA SW 846/8080	< 1.0	mg/kg
d-BHC		EPA SW 846/8080	< 1.0	mg/kg
a-Endosulfan		EPA SW 846/8080	< 1.0	mg/kg
b-Endosulfan		EPA SW 846/8080	< 1.0	mg/kg

CC: MR. W. E. HILL

Chemist Lab Supervisor Sr. Chemist Page 1

FILE: E1

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/98
SAMPLE DATE : 04/03/98
SAMPLE NUMBER : 980413-0016
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE. 4/3/98 1410

TEST		REFERENCE	RESULT	UNITS
PCB, 1242		EPA 8270/608	< 1.0	mg/kg
PCB, 1254		EPA 8270/608	< 1.0	mg/kg
PCB, 1221		EPA 8270/608	< 1.0	mg/kg
PCB, 1232		EPA 8270/608	< 1.0	mg/kg
PCB, 1248		EPA 8270/608	< 1.0	mg/kg
PCB, 1260		EPA 8270/608	< 1.0	mg/kg
PCB, 1016		EPA 8270/608	< 1.0	mg/kg
Aldrin		EPA SW 846/8080	< 1.0	mg/kg
Dieldrin		EPA SW 846/8080	< 1.0	mg/kg
Endrin		EPA SW 846/8080	< 1.0	mg/kg
Toxaphene		EPA SW 846/8080	< 1.0	mg/kg
Heptachlor		EPA SW 846/8080	< 1.0	mg/kg
Heptachlor epoxide		EPA SW 846/8080	< 1.0	mg/kg
Chlordane		EPA SW 846/8080	< 1.0	mg/kg
Hexachlorocyclopentadiene	35B	EPA 8270/625	< 1.0	mg/kg
Chloromethane		EPA 8240/524.2	< 1.0	mg/kg
Bromomethane		EPA 8240/524.2	< 1.0	mg/kg
Vinyl Chloride		EPA 8240/524.2	< 1.0	mg/kg
Chloroethane		EPA 8240/524.2	< 1.0	mg/kg
Dichloromethane (Methylene Chloride)		EPA 8240/524.2	< 1.0	mg/kg
Fluorotrichloromethane		EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethylene		EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Trans-1,2-Dichloroethene		EPA 8240/524.2	< 1.0	mg/kg
Chloroform		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloroethane		EPA 8240/524.2	< 1.0	mg/kg
1,1,1-Trichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Carbon Tetrachloride		EPA 8240/524.2	< 1.0	mg/kg
Bromodichloromethane		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloropropane		EPA 8240/524.2	< 1.0	mg/kg
Cis-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	mg/kg
Trichloroethylene		EPA 8240/524.2	< 1.0	mg/kg
Benzene		EPA SW846/8240/524.2	< 1.0	mg/kg

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/98
SAMPLE DATE : 04/03/98
SAMPLE NUMBER : 980413-0016
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE. 4/3/98 1410

TEST		REFERENCE	RESULT	UNITS
Chlorodibromoethane		EPA 8240/524.2	< 1.0	mg/kg
1,1,2-Trichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Trans-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	mg/kg
2-Chloroethylvinyl Ether		EPA 8240/524.2	< 1.0	mg/kg
Bromoform		EPA 8240/524.2	< 1.0	mg/kg
1,1,2,2-Tetrachloroethane		EPA 8240/524.2	< 1.0	mg/kg
Tetrachloroethylene		EPA 8240/524.2	< 1.0	mg/kg
Toluene		EPA SW846/8240/524.2	< 1.0	mg/kg
Chlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Ethylbenzene		EPA SW846/8240/524.2	< 1.0	mg/kg
Acenaphthylene	2B	EPA 8270/625	< 1.0	mg/kg
1,4-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,3-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Bis-2-Chloroisopropylether	12B	EPA 8270/625	< 1.0	mg/kg
1,2,4-Trichlorobenzene	46B	EPA 8270/625	< 1.0	mg/kg
Naphthalene	39B	EPA 8270/625	< 1.0	mg/kg
Hexachlorobutadiene	34B	EPA 8270/625	< 1.0	mg/kg
Anthracene	3B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Anthracene	5B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Pyrene	6B	EPA 8270/625	< 1.0	mg/kg
Benzo(B)Fluoranthene	7B	EPA 8270/625	< 1.0	mg/kg
Benzo(k)Fluoranthene	9B	EPA 8270/625	< 1.0	mg/kg
Benzo(g,h,i)Perylene	8B	EPA 8270/625	< 1.0	mg/kg
Chrysene	10B	EPA 8270/625	< 1.0	mg/kg
Dibenzo(a,h)Anthracene	19B	EPA 8270/625	< 1.0	mg/kg
Fluorene	32B	EPA 8270/625	< 1.0	mg/kg
Indeno(1,2,3-c,d)Pyrene	37B	EPA 8270/625	< 1.0	mg/kg
Phenanthrene	44B	EPA 8270/625	< 1.0	mg/kg
Pyrene	45B	EPA 8270/625	< 1.0	mg/kg
Fluoranthene	31B	EPA 8270/625	< 1.0	mg/kg
Butylbenzyl Phthalate	15B	EPA 8270/625	< 1.0	mg/kg
a-BHC		EPA SW 846/8080	< 1.0	mg/kg

Chemist Quality Control Supv Chemist Page 2

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General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/03/90
SAMPLE NUMBER : 900413-0016
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE. 4/3/90 1410

TEST		REFERENCE	RESULT	UNITS
g-BHC		EPA 8270/600	< 1.0	mg/kg
Bis(2-chloroethyl)ether	11B	EPA 8270/625	< 1.0	mg/kg
Bis(2-chloroethoxy)methane	10B	EPA 8270/625	< 1.0	mg/kg
4-Bromophenyl phenyl ether	14B	EPA 8270/625	< 1.0	mg/kg
4-Chlorophenyl phenyl ether	17B	EPA 8270/625	< 1.0	mg/kg
4,4' DDD		EPA SW 846/8080	< 1.0	mg/kg
4,4' DDE		EPA SW 846/8080	< 1.0	mg/kg
4,4' DDT		EPA SW 846/8080	< 1.0	mg/kg
Di-n-butylphthalate	26B	EPA 8270/625	< 1.0	mg/kg
3,3'-Dichlorobenzidine	23B	EPA 8270/625	< 1.0	mg/kg
Diethyl phthalate	24B	EPA 8270/625	< 1.0	mg/kg
Dimethyl phthalate	25B	EPA 8270/625	< 1.0	mg/kg
2,4-Dinitrotoluene	27B	EPA 8270/625	< 1.0	mg/kg
2,6-Dinitrotoluene	28B	EPA 8270/625	< 1.0	mg/kg
Di-n-octylphthalate	29B	EPA 8270/625	< 1.0	mg/kg
Endosulfan Sulfate		EPA SW 846/8080	< 1.0	mg/kg
Endrin Aldehyde		EPA SW 846/8080	< 1.0	mg/kg
Hexachloroethane	36B	EPA 8270/625	< 1.0	mg/kg
Isophorone	38B	EPA 8270/625	< 1.0	mg/kg
Nitrobenzene	40B	EPA 8270/625	< 1.0	mg/kg
N-Nitrosodi-n-propylamine	42B	EPA 8270/625	< 1.0	mg/kg
Bis(2-ethylhexyl)Phthalate	13B	EPA 8270/625	< 1.0	mg/kg
2-Chlorophenol	1A	EPA 8270/625	< 1.0	mg/kg
2-Nitrophenol	6A	EPA 8270/625	< 1.0	mg/kg
2,4-Dimethylphenol	3A	EPA 8270/625	< 1.0	mg/kg
2,4-Dichlorophenol	2A	EPA 8270/625	< 1.0	mg/kg
4-Chloro-3-Methylphenol	9A	EPA 8270/625	< 1.0	mg/kg
2,4,6-Trichlorophenol	11A	EPA 8270/625	< 1.0	mg/kg
2-Chloronaphthalene	16B	EPA 8270/625	< 1.0	mg/kg
Acenaphthene	1B	EPA 8270/625	< 1.0	mg/kg
2,4-Dinitrophenol	5A	EPA 8270/625	< 1.0	mg/kg
4-Nitrophenol	7A	EPA 8270/625	< 1.0	mg/kg
4,6-Dinitro-2-Methylphenol	4A	EPA 8270/625	< 1.0	mg/kg

Chemist Quality Control Supv. Chemist Page 3 of

2730 Rev 5 88

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/03/90
SAMPLE NUMBER : 900413-0016
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/3/90 1410

TEST		REFERENCE	RESULT	UNITS
N-Nitrosodiphenylamine	42B	EPA 8270/625	< 1.0	ug/kg
Pentachlorophenol	5A	EPA 8270/625	< 1.0	ug/kg
Hexachlorobenzene	33B	EPA 8270/625	< 1.0	ug/kg
Phenol	10A	EPA 8270/625	< 1.0	ug/kg
Benzidine	4B	EPA 8270/625	< 1.0	ug/kg
N-Nitrosodimethylamine	41B	EPA 8270/625	< 1.0	ug/kg
b-BHC		EPA SW 846/8080	< 1.0	mg/kg
a-BHC		EPA SW 846/8080	< 1.0	mg/kg
a-Endosulfan		EPA SW 846/8080	< 1.0	mg/kg
b-Endosulfan		EPA SW 846/8080	< 1.0	mg/kg

CC: MR. W. S. HILL

Chemist Quality Control Lab Chemist Page 4

FILE: E1

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/04/90
SAMPLE NUMBER : 900413-0017
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE. 4/4/90

TEST		REFERENCE	RESULT	UNITS
PCB, 1242		EPA 8270/608	< 1.0	mg/kg
PCB, 1254		EPA 8270/608	< 1.0	mg/kg
PCB, 1221		EPA 8270/608	< 1.0	mg/kg
PCB, 1232		EPA 8270/608	< 1.0	mg/kg
PCB, 1248		EPA 8270/608	< 1.0	mg/kg
PCB, 1260		EPA 8270/608	< 1.0	mg/kg
PCB, 1016		EPA 8270/608	< 1.0	mg/kg
Aldrin		EPA SW 846/8080	< 1.0	mg/kg
Dieldrin		EPA SW 846/8080	< 1.0	mg/kg
Endrin		EPA SW 846/8080	< 1.0	mg/kg
Toxaphene		EPA SW 846/8080	< 1.0	mg/kg
Heptachlor		EPA SW 846/8080	< 1.0	mg/kg
Heptachlor epoxide		EPA SW 846/8080	< 1.0	mg/kg
Chlordane		EPA SW 846/8080	< 1.0	mg/kg
Hexachlorocyclopentadiene	35B	EPA 8270/625	< 1.0	mg/kg
Chloromethane		EPA 8240/524.2	< 1.0	mg/kg
Bromomethane		EPA 8240/524.2	< 1.0	mg/kg
Vinyl Chloride		EPA 8240/524.2	< 1.0	mg/kg
Chloroethane		EPA 8240/524.2	< 1.0	mg/kg
Dichloromethane (Methylene Chlorice)		EPA 8240/524.2	< 1.0	mg/kg
Fluorotrichloromethane		EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethylene		EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Trans-1,2-Dichloroethene		EPA 8240/524.2	< 1.0	mg/kg
Chloroform		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloroethane		EPA 8240/524.2	< 1.0	mg/kg
1,1,1-Trichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Carbon Tetrachloride		EPA 8240/524.2	< 1.0	mg/kg
Bromodichloromethane		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloropropane		EPA 8240/524.2	< 1.0	mg/kg
Cis-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	mg/kg
Trichloroethylene		EPA 8240/524.2	< 1.0	mg/kg
Benzene		EPA SW846/8240/524.2	< 1.0	mg/kg

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/04/90
SAMPLE NUMBER : 900413-0017
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/4/90

TEST		REFERENCE	RESULT	UNITS
Chlorodibromomethane		EPA 8240/524.2	< 1.0	ug/kg
1,1,2-Trichloroethane		EPA 8240/524.2	< 1.0	ug/kg
Trans-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	ug/kg
2-Chloroethylvinyl Ether		EPA 8240/524.2	< 1.0	ug/kg
Bromoform		EPA 8240/524.2	< 1.0	ug/kg
1,1,2,2-Tetrachloroethane		EPA 8240/524.2	< 1.0	ug/kg
Tetrachloroethylene		EPA 8240/524.2	< 1.0	ug/kg
Toluene		EPA SW846/8240/524.2	< 1.0	ug/kg
Chlorobenzene		EPA 8240/524.2	< 1.0	ug/kg
Ethylbenzene		EPA SW846/8240/524.2	< 1.0	ug/kg
Acenaphthylene	2B	EPA 8270/625	< 1.0	ug/kg
1,4-Dichlorobenzene		EPA 8240/524.2	< 1.0	ug/kg
1,3-Dichlorobenzene		EPA 8240/524.2	< 1.0	ug/kg
1,2-Dichlorobenzene		EPA 8240/524.2	< 1.0	ug/kg
Bis-2-Chloroisopropylether	12B	EPA 8270/625	< 1.0	ug/kg
1,2,4-Trichlorobenzene	46B	EPA 8270/625	< 1.0	ug/kg
Naphthalene	39B	EPA 8270/625	< 1.0	ug/kg
Hexachlorobutadiene	34B	EPA 8270/625	< 1.0	ug/kg
Anthracene	3B	EPA 8270/625	< 1.0	ug/kg
Benzo(A)Anthracene	5B	EPA 8270/625	< 1.0	ug/kg
Benzo(A)Pyrene	6B	EPA 8270/625	< 1.0	ug/kg
Benzo(B)Fluoranthene	7B	EPA 8270/625	< 1.0	ug/kg
Benzo(k)Fluoranthene	9B	EPA 8270/625	< 1.0	ug/kg
Benzo(g,h,i)Perylene	8B	EPA 8270/625	< 1.0	ug/kg
Chrysene	18B	EPA 8270/625	< 1.0	ug/kg
Dibenzo(a,h)Anthracene	19B	EPA 8270/625	< 1.0	ug/kg
Fluorene	32B	EPA 8270/625	< 1.0	ug/kg
Indeno(1,2,3-c,d)Pyrene	37B	EPA 8270/625	< 1.0	ug/kg
Phenanthrene	44B	EPA 8270/625	< 1.0	ug/kg
Pyrene	45B	EPA 8270/625	< 1.0	ug/kg
Fluoranthene	31B	EPA 8270/625	< 1.0	ug/kg
Butylbenzyl Phthalate	15B	EPA 8270/625	< 1.0	ug/kg
a-BHC		EPA SW 846/8080	< 1.0	ug/kg

Chemist Quality Control Supv. Chemist Page 2 of

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/04/90
SAMPLE NUMBER : 900413-0017
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/4/90

TEST		REFERENCE	RESULT	UNITS
g-BHC		EPA 8270/600	< 1.0	ug/kg
Bis(2-chloroethyl)ether	11B	EPA 8270/625	< 1.0	ug/kg
Bis(2-chloroethoxy)methane	10B	EPA 8270/625	< 1.0	ug/kg
4-Bromophenyl phenyl ether	14B	EPA 8270/625	< 1.0	ug/kg
4-Chlorophenyl phenyl ether	17B	EPA 8270/625	< 1.0	ug/kg
4,4' DDD		EPA SW 846/8080	< 1.0	ug/kg
4,4' DDE		EPA SW 846/8080	< 1.0	ug/kg
4,4' DDT		EPA SW 846/8080	< 1.0	ug/kg
Di-n-butylphthalate	26B	EPA 8270/625	< 1.0	ug/kg
3,3'-Dichlorobenzidine	23B	EPA 8270/625	< 1.0	ug/kg
Diethyl phthalate	24B	EPA 8270/625	< 1.0	ug/kg
Dimethyl phthalate	25B	EPA 8270/625	< 1.0	ug/kg
2,4-Dinitrotoluene	27B	EPA 8270/625	< 1.0	ug/kg
2,6-Dinitrotoluene	28B	EPA 8270/625	< 1.0	ug/kg
Di-n-octylphthalate	29B	EPA 8270/625	< 1.0	ug/kg
Endosulfan Sulfate		EPA SW 846/8080	< 1.0	ug/kg
Endrin Aldehyde		EPA SW 846/8080	< 1.0	ug/kg
Hexachloroethane	35B	EPA 8270/625	< 1.0	ug/kg
Isophorone	38B	EPA 8270/625	< 1.0	ug/kg
Nitrobenzene	40B	EPA 8270/625	< 1.0	ug/kg
N-Nitrosodi-n-propylamine	42B	EPA 8270/625	< 1.0	ug/kg
Bis(2-ethylhexyl)Phthalate	13B	EPA 8270/625	< 1.0	ug/kg
2-Chlorophenol	1A	EPA 8270/625	< 1.0	ug/kg
2-Nitrophenol	6A	EPA 8270/625	< 1.0	ug/kg
2,4-Dimethylphenol	3A	EPA 8270/625	< 1.0	ug/kg
2,4-Dichlorophenol	2A	EPA 8270/625	< 1.0	ug/kg
4-Chloro-3-Methylphenol	8A	EPA 8270/625	< 1.0	ug/kg
2,4,6-Trichlorophenol	11A	EPA 8270/625	< 1.0	ug/kg
2-Chloronaphthalene	16B	EPA 8270/625	< 1.0	ug/kg
Acenaphthene	1B	EPA 8270/625	< 1.0	ug/kg
2,4-Dinitrophenol	5A	EPA 8270/625	< 1.0	ug/kg
4-Nitrophenol	7A	EPA 8270/625	< 1.0	ug/kg
4,6-Dinitro-2-Methylphenol	4A	EPA 8270/625	< 1.0	ug/kg

Chemist Quality Control Supv. Chemist Page 3 of

F-2730 Rev 4-85

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-672
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/04/90
SAMPLE NUMBER : 900413-0017
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES. FLY ASH SAMPLE, 4/4/90

TEST		REFERENCE	RESULT	UNITS
N-Nitrosodiphenylamine	43B	EPA 8270/625	< 1.0	ug/kg
Pentachlorophenol	9A	EPA 8270/625	< 1.0	ug/kg
Hexachlorobenzene	33B	EPA 8270/625	< 1.0	ug/kg
Phenol	10A	EPA 8270/625	< 1.0	ug/kg
Benzidine	4B	EPA 8270/625	< 1.0	ug/kg
N-Nitrosodimethylamine	41B	EPA 8270/625	< 1.0	ug/kg
b-BHC		EPA SW 846/8080	< 1.0	ug/kg
d-BHC		EPA SW 846/8080	< 1.0	ug/kg
a-Endosulfan		EPA SW 846/8080	< 1.0	ug/kg
b-Endosulfan		EPA SW 846/8080	< 1.0	ug/kg

CC: MR. W. S. HILL

Chemist | Section Chief | Supv. Chemist | Page 4 of

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General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN 8-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/05/90
SAMPLE NUMBER : 900413-0010
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE. 4/5/90

TEST	REFERENCE	RESULT	UNITS
PCB, 1242	EPA 8270/608	< 1.0	mg/kg
PCB, 1254	EPA 8270/608	< 1.0	mg/kg
PCB, 1221	EPA 8270/608	< 1.0	mg/kg
PCB, 1232	EPA 8270/608	< 1.0	mg/kg
PCB, 1248	EPA 8270/608	< 1.0	mg/kg
PCB, 1260	EPA 8270/608	< 1.0	mg/kg
PCB, 1016	EPA 8270/608	< 1.0	mg/kg
Aldrin	EPA SW 846/8080	< 1.0	mg/kg
Dieldrin	EPA SW 846/8080	< 1.0	mg/kg
Endrin	EPA SW 846/8080	< 1.0	mg/kg
Toxaphene	EPA SW 846/8080	< 1.0	mg/kg
Heptachlor	EPA SW 846/8080	< 1.0	mg/kg
Heptachlor epoxide	EPA SW 846/8080	< 1.0	mg/kg
Chlordane	EPA SW 846/8080	< 1.0	mg/kg
Hexachlorocyclopentadiene 358	EPA 8270/625	< 1.0	mg/kg
Chloromethane	EPA 8240/524.2	< 1.0	mg/kg
Bromomethane	EPA 8240/524.2	< 1.0	mg/kg
Vinyl Chloride	EPA 8240/524.2	< 1.0	mg/kg
Chloroethane	EPA 8240/524.2	< 1.0	mg/kg
Dichloromethane (Methylene Chloride)	EPA 8240/524.2	< 1.0	mg/kg
Fluorotrichloromethane	EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethylene	EPA 8240/524.2	< 1.0	mg/kg
1,1-Dichloroethane	EPA 8240/524.2	< 1.0	mg/kg
Trans-1,2-Dichloroethene	EPA 8240/524.2	< 1.0	mg/kg
Chloroform	EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloroethane	EPA 8240/524.2	< 1.0	mg/kg
1,1,1-Trichloroethane	EPA 8240/524.2	< 1.0	mg/kg
Carbon Tetrachloride	EPA 8240/524.2	< 1.0	mg/kg
Bromodichloromethane	EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichloropropane	EPA 8240/524.2	< 1.0	mg/kg
Cis-1,3-Dichloropropene	EPA 8240/524.2	< 1.0	mg/kg
Trichloroethylene	EPA 8240/524.2	< 1.0	mg/kg
Benzene	EPA SW846/8240/524.2	< 1.0	mg/kg

Chemist Quality Control Supv Chemist Page 1

2790 Rev. 8-85

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN 8-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/05/90
SAMPLE NUMBER : 900413-0018
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/5/90

TEST		REFERENCE	RESULT	UNITS
Chlorodibromomethane		EPA 8240/524.2	< 1.0	mg/kg
1,1,2-Trichloroethane		EPA 8240/524.2	< 1.0	mg/kg
Trans-1,3-Dichloropropene		EPA 8240/524.2	< 1.0	mg/kg
2-Chloroethylvinyl Ether		EPA 8240/524.2	< 1.0	mg/kg
Bromoform		EPA 8240/524.2	< 1.0	mg/kg
1,1,2,2-Tetrachloroethane		EPA 8240/524.2	< 1.0	mg/kg
Tetrachloroethylene		EPA 8240/524.2	< 1.0	mg/kg
Toluene		EPA SW846/8240/524.2	< 1.0	mg/kg
Chlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Ethylbenzene		EPA SW846/8240/524.2	< 1.0	mg/kg
Acenaphthylene	2B	EPA 8270/625	< 1.0	mg/kg
1,4-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,3-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
1,2-Dichlorobenzene		EPA 8240/524.2	< 1.0	mg/kg
Bis-2-Chloroisopropylether	12B	EPA 8270/625	< 1.0	mg/kg
1,2,4-Trichlorobenzene	46B	EPA 8270/625	< 1.0	mg/kg
Naphthalene	39B	EPA 8270/625	< 1.0	mg/kg
Hexachlorobutadiene	34B	EPA 8270/625	< 1.0	mg/kg
Anthracene	3B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Anthracene	5B	EPA 8270/625	< 1.0	mg/kg
Benzo(A)Pyrene	6B	EPA 8270/625	< 1.0	mg/kg
Benzo(B)Fluoranthene	7B	EPA 8270/625	< 1.0	mg/kg
Benzo(k)Fluoranthene	9B	EPA 8270/625	< 1.0	mg/kg
Benzo(g,h,i)Perylene	9B	EPA 8270/625	< 1.0	mg/kg
Chrysene	18B	EPA 8270/625	< 1.0	mg/kg
Dibenzo(a,h)Anthracene	19B	EPA 8270/625	< 1.0	mg/kg
Fluorene	32B	EPA 8270/625	< 1.0	mg/kg
Indeno(1,2,3-c,d)Pyrene	37B	EPA 8270/625	< 1.0	mg/kg
Phenanthrene	44B	EPA 8270/625	< 1.0	mg/kg
Pyrene	45B	EPA 8270/625	< 1.0	mg/kg
Fluoranthene	31B	EPA 8270/625	< 1.0	mg/kg
Butylbenzyl Phthalate	15B	EPA 8270/625	< 1.0	mg/kg
a-BHC		EPA SW 846/8080	< 1.0	mg/kg

Chemist Quality Control Supv. Chemist Page 2

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingham, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/05/90
SAMPLE NUMBER : 900413-0018
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/5/90

TEST		REFERENCE	RESULT	UNITS
g-BHC		EPA 8270/600	< 1.0	ug/kg
Bis(2-chloroethyl)ether	11B	EPA 8270/625	< 1.0	ug/kg
Bis(2-chloroethoxy)methane	10B	EPA 8270/625	< 1.0	ug/kg
4-Bromophenyl phenyl ether	14B	EPA 8270/625	< 1.0	ug/kg
4-Chlorophenyl phenyl ether	17B	EPA 8270/625	< 1.0	ug/kg
4,4' DDD		EPA SW 846/8080	< 1.0	ug/kg
4,4' DDE		EPA SW 846/8080	< 1.0	ug/kg
4,4' DDT		EPA SW 846/8080	< 1.0	ug/kg
Di-n-butylphthalate	26B	EPA 8270/625	< 1.0	ug/kg
3,3'-Dichlorobenzidine	23B	EPA 8270/625	< 1.0	ug/kg
Diethyl phthalate	24B	EPA 8270/625	< 1.0	ug/kg
Dimethyl phthalate	25B	EPA 8270/625	< 1.0	ug/kg
2,4-Dinitrotoluene	27B	EPA 8270/625	< 1.0	ug/kg
2,6-Dinitrotoluene	28B	EPA 8270/625	< 1.0	ug/kg
Di-n-octylphthalate	29B	EPA 8270/625	< 1.0	ug/kg
Endosulfan Sulfate		EPA SW 846/8080	< 1.0	ug/kg
Endrin Aldehyde		EPA SW 846/8080	< 1.0	ug/kg
Hexachloroethane	36B	EPA 8270/625	< 1.0	ug/kg
Isophorone	38B	EPA 8270/625	< 1.0	ug/kg
Nitrobenzene	40B	EPA 8270/625	< 1.0	ug/kg
N-Nitrosodi-n-propylamine	42B	EPA 8270/625	< 1.0	ug/kg
Bis(2-ethylhexyl)Phthalate	13B	EPA 8270/625	< 1.0	ug/kg
2-Chlorophenol	1A	EPA 8270/625	< 1.0	ug/kg
2-Nitrophenol	6A	EPA 8270/625	< 1.0	ug/kg
2,4-Dimethylphenol	3A	EPA 8270/625	< 1.0	ug/kg
2,4-Dichlorophenol	2A	EPA 8270/625	< 1.0	ug/kg
4-Chloro-3-Methylphenol	8A	EPA 8270/625	< 1.0	ug/kg
2,4,6-Trichlorophenol	11A	EPA 8270/625	< 1.0	ug/kg
2-Chloronaphthalene	16B	EPA 8270/625	< 1.0	ug/kg
Acenaphthene	1B	EPA 8270/625	< 1.0	ug/kg
2,4-Dinitrophenol	5A	EPA 8270/625	< 1.0	ug/kg
4-Nitrophenol	7A	EPA 8270/625	< 1.0	ug/kg
4,6-Dinitro-2-Methylphenol	4A	EPA 8270/625	< 1.0	ug/kg

Chemist Quality Control Supv. Chemist Page 3 of

2730 Rev 8/85

General Test Laboratory
Building Number 8
P.O. Box 2641
Birmingnam, Al. 35291

Alabama Power

Certificate of Analysis

TO : MR. DAN WARREN
ADDRESS: BIN B-872
SCS - BIRMINGHAM

REPORT DATE : 05/09/90
SAMPLE DATE : 04/05/90
SAMPLE NUMBER : 900413-0018
LOCATION NUMBER: SCS

DESCRIPTION: SOUTHERN COMPANY SERVICES, FLY ASH SAMPLE, 4/5/90

TEST		REFERENCE	RESULT	UNITS
N-Nitrosodiphenylamine	43B	EPA 8270/625	< 1.0	ug/kg
Pentachlorophenol	9A	EPA 8270/625	< 1.0	ug/kg
Hexachlorobenzene	33B	EPA 8270/625	< 1.0	ug/kg
Phenol	10A	EPA 8270/625	< 1.0	ug/kg
Benzidine	4B	EPA 8270/625	< 1.0	ug/kg
N-Nitrosodimethylamine	41B	EPA 8270/625	< 1.0	ug/kg
b-BHC		EPA SW 846/8080	< 1.0	ug/kg
a-BHC		EPA SW 846/8080	< 1.0	ug/kg
a-Endosulfan		EPA SW 846/8080	< 1.0	ug/kg
b-Endosulfan		EPA SW 846/8080	< 1.0	ug/kg

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