Phase I Report
on
Mercury Control Testing
at
Cedar Bay Cogeneration Project

Prepared by:

Cedar Bay Cogeneration Project

and

SBP Associates, Inc.

Cedar Bay Generating Company, Limited Partnership

November 22, 1994

RECEIVED
FEB 13 1995
Bureau of
Air Regulation

Mr. Hamilton Oven, P.E
Administrator, Office of Siting Coordinator
Florida Department of Environmental Protection
3900 Commonwealth Boulevard
Tallahassee, Florida 32399

Re: Submission of Phase I Report on Mercury Control Testing

Dear Mr. Oven:

The Cedar Bay Generating Company (CBGC), Limited Partnership, is pleased to submit the enclosed Phase I Report on Mercury Control Testing.

Key findings from the test report include:

* Average CFB boiler mercury emissions are 1.16 micrograms per cubic meter,
* Even though CBGC was unable to close its modeled mercury mass balance equation, a conservative estimate of mercury removal efficiency is 41 percent, and
* Given CBGC's plant design characteristics, little potential for substantial additional mercury removal using carbon injection exists.

The average CFB boiler mercury emission rate is lower than CBGC's proposed cutoff limit of 3.0 micrograms per cubic meter. Assessing the effectiveness of carbon injection would be difficult, if not impossible, at levels below this cutoff value, due to interferences caused by independent variables. Given our Phase I results, and the low probability that carbon injection testing would provide meaningful data for determining whether carbon injection could provide substantial additional mercury removal, we propose to cancel Phase II testing.

CBGC trusts that the information contained in the report will contribute to DEP's mercury emissions knowledge base. CBGC would be pleased to present the report findings to you or members of your staff. Should you desire a presentation, or should you or members of your staff wish to discuss the report, please contact me at (301) 718-6937.

Sincerely,

Barrett Parker

Enclosure

7500 Old Georgetown Road • Bethesda, Maryland 20814-6161 • 301-718-6800 • Fax 301-718-6900
An affiliate of U.S. Generating Company

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cc: C. Fancy, DEP
C. Kirts, DEP, NED
R. Pace, RESD

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1.0 Executive Summary

Cedar Bay Cogeneration Project (CBCP) submitted the Mercury Control Test Plan and Protocol to the Florida Department of Environmental Protection (DEP) on December 1, 1993. The Plan responded to Condition II.2.c of CBCP's site certification, which required CBCP to determine whether substantial additional mercury removal could be achieved using a carbon injection system such as that employed in Municipal Waste Combustors (MWCs). Because of the technical uncertainties associated with using carbon injection to control mercury emissions from a circulating fluidized bed (CFB) boiler, CBCP proposed a two-phased approach for satisfying the condition.

This report presents Phase I information on Cedar Bay's mercury emission rates, as well as estimated removal efficiencies calculated from coal, ash, and air emissions test data. The report also examines existing carbon injection technology and its potential application to Cedar Bay circulating fluidized bed (CFB) boilers.

Phase I findings are as follows:

- Atmospheric mercury emissions from a CBCP CFB boiler, as measured during Phase I testing, are average at 1.16 $\mu g/Nm^3$.
- The existing CBCP CFB boiler technology and emission controls are achieving an estimated 41% reduction in mercury emissions.
- CBCP's CFB mercury emissions were lower than those from other coal fired boilers, as reported in studies conducted by Florida Electric Power Coordinating Group (FCG) and the Electric Power Research Institute (EPRI).
- Based on findings of recent pilot scale studies examining the relationship between mercury removal and flue gas temperature, it is unlikely that measurable or substantial additional reductions in air emissions of mercury could be achieved at CBCP because the CFB boiler flue gas temperatures are above the effective range of carbon injection technology.

Finally, CBCP proposes that no Phase II testing of carbon injection be undertaken, since the CFB boiler mercury emissions are already low enough that it is doubtful whether or not any additional mercury removal by carbon injection can be accurately estimated and evaluated, as the error produced from sampling and analyses methods is in the range of actual mercury emission rates at CBCP.

2.0 Introduction

The report is organized as follows:

- Section 3 reviews test methods used, the basis for mass balance calculations, and the Quality Assurance program.
- Section 4 presents Phase I operations and test data.
- Section 5 discusses reduction and validation of this data.
- Section 6 summarizes mercury test data collected during CBCP performance testing, and analyzes this data along with Phase I test data.
- Section 7 presents an estimate of mercury mass balance and removal efficiency at CBCP.
- Section 8 reviews results from studies of mercury control with carbon injection, and discusses the applicability of the carbon injection control technology at CBCP.
- Section 9 presents conclusions of the Phase I testing, as well as recommendations for Phase II.
- The Appendices contain Phase I test documentation and data.

2.1 CBCP Site Certification Condition

Condition II.2.c of the Site Certification requires CBCP to submit a test plan to determine whether substantial additional mercury can be removed via a carbon injection system. The condition is as follows:

> "CBCP shall conduct a test to determine whether substantial additional removal of mercury can be obtained through a carbon injection system for mercury removal, as described in Exhibit 74 of the administrative record for the Lee County Resource Recovery Facility, which feeds carbon reagent into the CFB exhaust stream prior to the baghouse. Within one hundred eighty (180) days after initial compliance testing, CBCP shall conduct a test on one CFB to compare mercury emissions to the atmosphere with and without carbon injection. The test program will include the testing of carbon injection between the boiler and the fabric filter. Carbon forms to be tested may include activated

carbon with or without additives and pulverized coal with or without additives. After consultation with the DEP, RESD, and EPRI, CBCP shall submit a mercury control test protocol to DEP for approval by December 1, 1993. Results of the test shall be submitted to the DEP within 90 days of completion."

2.2 Mercury Control Test Plan and Protocol

In fulfillment of this site certification condition, CBCP submitted a Mercury Control Test Plan and Protocol (Plan) to DEP on December 1, 1993. The Plan includes an analysis of the Lee County system and its potential applicability to CBCP, and a discussion of factors that CBCP believes are important to the testing of carbon injection at coal-fired combustion facilities. A copy of the Plan is contained in Appendix A.

The Plan was divided into two phases. Phase I testing was designed to produce baseline data to evaluate the feasibility of performing carbon injection for mercury control at CBCP. This data, analyzed in light of ongoing research by the Electric Power Research Institute (EPRI), would enable CBCP to determine whether or not carbon injection testing was feasible and, if feasible, to develop the Phase II testing protocol.

DEP reviewed the Plan and submitted comments from its Bureau of Air Regulation and from EPRI on January 6, 1994 (see Appendix B). CBCP originally planned to conduct Phase I testing in conjunction with CFB boiler performance testing, which was scheduled to commence in late January 1994. Pending agreement between the Bureau and EPRI on the appropriate testing procedure, Phase I testing was postponed until completion of boiler performance testing in July 1994.

Meanwhile, CBCP revised Phase I of the Plan to incorporate DEP and EPRI concerns, as well as lessons learned from the boiler performance testing. CBCP submitted the revised Plan (Appendix C) to DEP on July 1, 1994 and received no additional comments.

As part of the Plan, CBCP proposed that if mercury air emissions were measured at or below 3 $\mu g/Nm^3$ during Phase I testing, further testing, including carbon injection, should not be undertaken because a 3 $\mu g/Nm^3$ level approached the measurement limits of current test methods.

This Phase I report explores the following questions, all related to the objective of the Condition to achieve substantial additional removal of mercury.

- What are mercury emissions from CBCP with current controls?
- Is CBCP's rate of mercury emission already low enough to make carbon injection inappropriate?
- What percent removal efficiency of mercury is CBCP achieving, using a modeled mass balance?

- Given CBCP's design characteristics, is carbon injection an appropriate mercury control technology?

3.0 Phase I Test Methods

The Phase I study was designed to determine the fate of fuel mercury in CBCP CFB Boiler B, henceforth referred to as Unit 2. This section summarizes test methods employed for mercury testing of flue gas, coal, bed ash, and fly ash. It also describes the assumptions for mass balance calculations, as well as the quality assurance program followed during Phase I testing.

3.1 Air Emissions Testing

Air Consulting and Engineering, Inc. (ACE) of Gainesville, Florida, was selected to conduct mercury emission testing on the exhaust duct after the baghouse from Unit 2. All testing was performed using EPA Method 101A, and the test program consisted of three test runs, each with a sampling time duration of four hours. Phase I testing began on July 27, 1994; one test run was conducted each day for three consecutive days. Samples collected were analyzed by PPB Environmental Laboratories, Inc. (PPB) of Gainesville, Florida.

3.2 Coal, Bed Ash, and Fly Ash Testing

In accordance with the Plan, CBCP staff obtained hourly grab samples of Unit 2's coal, fly ash, and bed ash. Sampling commenced one hour prior to initiation of air emissions testing, continued through air emissions testing, and ended within one hour after air emissions testing was completed.

Coal samples were obtained from two of Unit 2's four coal feeders. The samples were obtained using a thief type sampler which extended across the entire feeder belt width. After collection in the thief, the samples were placed in clean, pre-numbered plastic sample jars supplied by Savannah Laboratories and Environmental Services, Inc. (Savannah), of Tallahassee, Florida, for analysis.

Bed ash samples were obtained from the Unit 2 ash conveyor. Bed ash was caught in clean, pre-numbered plastic jars supplied by Savannah.

Fly ash samples were obtained from Unit 2 by directing the fly ash to one of CBCP's two fly ash collectors in the fly ash silo. After opening a gate valve, fly ash was caught in a clean five gallon plastic bucket and scooped into clean, pre-numbered plastic sample jars supplied by Savannah.

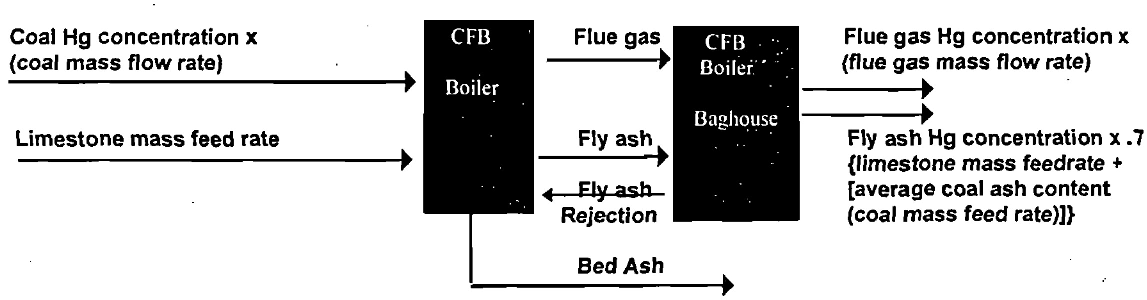
3.3 Mass Balance Calculations

Using the principle of conservation of mass, the amount of mercury entering the CFB boiler should equal the amount of mercury leaving the CFB boiler. To determine mercury removal efficiency, one would measure boiler inputs and outputs for mercury content and then divide the amount of mercury collected after combustion by the amount of mercury entering prior to combustion. In reality, limitations of mercury measurement methods make mass balance calculations fairly inexact. This section sets forth the mass balance calculation methodology and assumptions, while the discussion in Section 7.0 presents results.

Figure 3.1 illustrates inputs and outputs for the mass balance. CBCP's CFB boilers have four main inputs: coal for fuel, limestone for sulfur dioxide control, ammonia for nitrogen oxides control, and air for combustion. Of the four inputs, only coal has significant levels of mercury; therefore, mercury content measured in coal, as a function of measured mercury concentration and the coal mass feed rate, was used as the input value.

CBCP's boilers have three main outputs: fly ash, bed ash, and flue gas. The mercury concentrations of each output can be multiplied by the quantity of these substances produced during each run to estimate the total mass output per hour. Using EPA Method 101A, the quantity of flue gas released during air emissions testing can be determined. Total ash production can be estimated as the sum of the ash content of coal and reacted and unreacted limestone products. Mercury in ash was estimated by multiplying the quantity of ash produced by the mercury concentration of the ash. These assumptions are used to estimate the mass of mercury output per hour discussed in Section 7 of the report.

Figure 3.1: CBCP CFB Boiler Mercury Inputs and Outputs Model



3.4 Phase I Test Program Quality Assurance

To minimize inaccuracies in test methods, CBCP followed the recommendations of DEP, FCG and EPRI in developing QA/QC procedures and in strictly adhering to EPA test methods and protocols. To assure that method protocols were followed, CBCP retained a third party advisor, Mr. Michael White of Roy F. Weston, who also provided laboratory QA samples. A careful program of preparing, handling, and analyzing field blanks was also followed. Appendix D summarizes the QA results.

4.0 Phase I Test Data

During the course of Phase I testing, samples of coal, fly ash, bed ash and air emissions were obtained. All samples were analyzed for their mercury content and simple mass balances of mercury were estimated.

4.1 CBCP Operations Data

CBCP Unit 2 operated at or near full load and under normal operating conditions during Phase I testing. Key operations data included coal feed rate, boiler load, baghouse differential pressure, limestone feed rate, and flue gas temperature; these data were recorded by the facility's computer control system and are provided in Appendix E. Table 4.1 contains a summary of Unit 2 operations data averaged over each test run. The data demonstrates that, from one run to the next, operation of the facility was constant and stable.

TABLE 4.1 - CBCP OPERATIONS DATA SUMMARY

Test Run	Coal Feed Rate (lbs./Hr.)	Boiler Load (Klbs Steam/Hr.)	Baghouse Differential Pressure (In. Water Gauge)	Limestone Feed Rate (lbs./hr.)	Flue Gas Temp (°F)
Run 1 - July 27	88,300	662	4.35	10,029	358
Run 2 - July 28	85,400	656	4.30	9,407	350
Run 3 - July 29	84,300	663	4.24	9,300	342

4.2 Mercury Data

The following tables present mercury test results for three separate test runs. Because Run 3 was extended due to inclement weather and to failure of the sample probe heater, eleven sets of coal and ash samples were collected during that run versus seven samples for the first two runs. Analysis of the coal and ash samples was performed by Savannah; the entire report is provided in Appendix F.

4.2.1 Mercury in Coal Data

A grab sample was taken from coal feeders B1 and B4 once each hour during the air emissions testing, starting approximately one hour before each test run and continuing until the end of each test run. Tables 4.2.1A and 4.2.1B provide the results of the analysis of these samples.

TABLE 4.2.1A - MERCURY IN COAL DATA - COAL FEEDER B1

	Mercury Concentration (µg/g)											
Test	HR 0	HR 1	HR 2	HR 3	HR 4	HR 5	HR 6	HR 7	HR 8	HR 9	HR 10	AVG
Run 1 Jul 27	.044	.066	.082	.060	.069	.058	.050	NA	NA	NA	NA	0.061
Run 2 Jul 28	.046	.092	.050	.037	.032	.19	.035	NA	NA	NA	NA	0.069
Run 3 Jul 29	.060	.036	.067	.046	.040	<.030	<.030	<.030	<.030	<.030	<.030	0.031

NA - not available
Laboratory method detection limit is .030 µg/g

TABLE 4.2.1B - MERCURY IN COAL DATA - COAL FEEDER B4

	Mercury Concentration (µg/g)											
Test	HR 0	HR 1	HR 2	HR 3	HR 4	HR 5	HR 6	HR 7	HR 8	HR 9	HR 10	AVG
Run 1 Jul 27	.074	.069	.140	.060	.082	.069	.066	NA	NA	NA	NA	0.08
Run 2 Jul 28	.036	.042	.033	.033	.036	.044	.033	NA	NA	NA	NA	0.037
Run 3 Jul 29	.023	.031	.063	.055	.034	.120	.076	<.030	<.030	<.030	<.030	0.042

NA - not available
Laboratory method detection limit is .030 µg/g

4.2.2 Mercury in Fly Ash Data

A grab sample of fly ash was taken each hour during the air emission test, starting approximately one hour before each test run and continuing until the end of each test run. Sampling started approximately one hour before each test run and continued until the end of each test run. Analyses of these samples indicate that the average mercury concentration ranges from 0.346 to 0.556 µg/g.

TABLE 4.2.2 - MERCURY IN FLY ASH DATA

	Mercury Concentration (µg/g)											
Test	HR 0	HR 1	HR 2	HR 3	HR 4	HR 5	HR 6	HR 7	HR 8	HR 9	HR 10	AVG
Run 1 Jul 27	.54	.62	.51	.62	.51	.58	.51	NA	NA	NA	NA	0.556
Run 2 Jul 28	.22	.23	.62	.49	.70	.55	.61	NA	NA	NA	NA	0.489
Run 3 Jul 29	.47	.48	.45	.039	.27	.13	.30	.42	.41	.38	.46	0.346

NA - not available

4.2.3 Mercury in Bed Ash Data

A grab sample of bed ash was taken from Unit 2 during each hour of air emissions testing. Sampling started approximately one hour before each test run and continued until the end of each test run. Analyses of these samples indicate that the mercury concentration is less than Savannah's method detection limit of 0.03 μg/g.

4.2.4 Mercury in Flue Gas Data

Table 4.2.4 presents the results of the mercury in flue gas testing. In order to differentiate particulate and vapor phase mercury in the flue gas, the sample train nozzle and filter were analyzed separately from the impinger solutions. Values from the nozzle and filter reflect mercury particulate emissions, while values from the impingers reflect mercury vapor emissions.

The mercury content from the nozzle and filter used during Run 3 was measured at over four times the average mercury content from the nozzle and filter used during Runs 1 and 2. This anomaly could be partially due to the failure of the sample probe heater for a short time during Run 3. Even though sampling was discontinued while the heater was being repaired, probe and nozzle cooling immediately prior to detection and correction of the heater problem could have caused some mercury vapor to condense prematurely, which could result in a larger particulate mercury value than otherwise would be expected.

The entire ACE test report is provided in Appendix G and was submitted to DEP in September 1994.

TABLE 4.2.4 - PHASE I MERCURY IN FLUE GAS DATA

Parameter	Unit	Run 1 Jul 27 1300-1722	Run 2 Jul 28 0900-1306	Run 3 Jul 29 0937-1037, 1350-1721
Oxygen	Percent	5.3	5.6	5.4
Source Flow Rate	dscfm dscm	241,152 6,857	261,152 7,395	261,427 7,403
Sample Volume	dscf dscm	217.3 6.153	221.4 6.268	230.6 6.530
Mercury in Samples (μg)	Probe Nozzle Impingers Total	0.918 46.9 47.8	0.912 17.6 18.5	4.62 7.66 12.3
Mercury Emission Rate	μg/dscm lbs/hr x 10^{-3} lbs/MMBTU x 10^{-6}	7.77 7.05 6.35	2.96 2.89 2.47	1.88 1.84 1.55

5.0 Data Reduction and Validation

In order to perform mass balance calculations, mercury concentration in the inputs and outputs of Unit 2 has been converted to units of pounds per hour using measured or estimated mass flow rates for flue gas, coal and ash. This section describes the evaluation and reduction performed on each data set.

Much of the mercury test data collected during Phase I is near the measurement limit of current sampling and analysis capabilities. To evaluate the effect of sampling and analysis error on test data, the data were evaluated statistically.

The method detection limit for mercury in coal and ash samples in this test program is 0.03 µg/g. Values at or below the detection limit for air emissions, coal and fly ash were assigned a value of one-half the detection limit, following laboratory conventions.

5.1 Calculated Coal Mercury Content

The coal mercury input presented in Table 5.1 is the product of mercury concentration in samples of coal combusted during all tests and Unit 2's coal feed rates.

Calculated coal mercury input is presented for each test run. The mercury values derived from fifty samples of coal approximate a near normal distribution with a standard deviation of 0.033 µg/g. Calculations are shown in Appendix H.

Since Savannah analyzed the samples on a dry basis, the average mercury concentration results have been corrected for an average moisture content of six percent.

TABLE 5.1 - CALCULATED COAL MERCURY INPUT

Test Run	Average Mercury Concentration, µg/g	Average Coal Feed, lb/hr	Average Mercury Input, lb/hr x 10^{-3}
1	0.067	88,300	5.92
2	0.050	85,400	4.27
3	0.034	84,300	2.87
Average	0.050	86,000	4.35
Standard Deviation	0.033	-----	-----

5.2 Calculated Fly Ash Mercury Content

Total mercury captured in fly ash was estimated by multiplying estimated fly ash production rates by measured concentrations of mercury in fly ash. Fly ash production is a subpart of total ash production, which includes the ash content of coal and limestone products. Based on the CBCP CFB boiler performance testing, approximately seventy percent of total ash becomes fly ash and thirty percent becomes bed ash.

There is an approximately two to three day lag between the time coal ash content is sampled from a given batch of fuel, combustion of the fuel, and subsequent sampling of ash mercury content from that same fuel batch. To correct for that lag, the average percent of coal ash obtained in fuel samples collected between 7/24/94 and 7/30/94 was used to calculate fly ash mercury content for each test run. This average value was 11.57 percent ash in coal. Table 5.2 presents the calculated mercury content of fly ash.

TABLE 5.2 - CALCULATED FLY ASH MERCURY CONTENT

Test Run	Average Mercury Concentration	Average Percent of Ash in Coal, 7/24 to 7/30/94	Estimated Fly Ash Production, lb/hr	Estimated Total Mercury Output, lb/hr X 10^{-3}
1	0.556	11.57	14,172	7.88
2	0.489	11.57	13,501	6.60
3	0.346	11.57	13,337	4.61
Average	0.464	11.57	13,670	6.34
Std Deviation	0.166	-----	-----	-----

The twenty-five mercury concentration values from fly ash approximate a near normal distribution with a standard deviation of 0.166 µg/g.

5.3 Statistical Analysis Summary

Table 5.3 summarizes statistical data for coal and fly ash samples.

TABLE 5.3 - COAL AND FLY ASH STATISTICAL ANALYSIS RESULTS

	Adjusted Average (µg/g)	Standard Deviation (µg/g)	95% Conf. Interval (µg/g)
Coal	0.050	0.033	0.009
Fly Ash	0.445	0.166	0.065

5.4 Correction of Air Emission Data

Before using the flue gas mercury emission rates presented in Table 4.2.4 to calculate removal efficiency, the values were corrected to a constant oxygen level. Consistent with DEP's oxygen correction procedures, CBCP adjusted the mercury emissions rates to seven percent oxygen. Table 5.4 summarizes the corrected data.

TABLE 5.4 - OXYGEN CORRECTION FOR FLUE GAS MERCURY EMISSIONS

Test Run	Measured Oxygen, %	Uncorrected Mercury Emissions Rate, lb/hr X 10^{-3}	Uncorrected Mercury Emissions Rate, µg/Nm^3	Mercury Emissions Rate, lb/hr X 10^{-3} @ 7% O_2	Mercury Emissions Rate, µg/Nm^3 @ 7% O_2
1	5.3	7.05	7.77	6.28	6.92
2	5.6	2.89	2.96	2.63	2.69
3	5.4	1.84	1.88	1.65	1.69

6.0 Statistical Analysis of All Data for Cedar Bay Flue Gas Mercury Analysis

Sections 4 and 5 present mercury test data from Phase I testing. This section summarizes mercury test data collected during CBCP performance testing. By considering these additional data points, other statistical tests may be run.

6.1 Additional Data, Corrections, and Adjustments

The emissions data obtained during performance testing can be combined with Phase I test data because of the following factors: CFB boilers A, B, and C share the same design; all tests were conducted using EPA Method 101A; fuel characteristics were similar; operating conditions were consistent; flue gas temperatures were within the same range; and as shown in Table 6.1A, mercury emission rates were similar. As was done for Phase I test results, the performance test mercury emission rates have been corrected to seven percent oxygen.

TABLE 6.1A - SUMMARY OF PERFORMANCE TEST FLUE GAS MERCURY EMISSION RATES

CFB Boiler	Run	Uncorrected Mercury Emission Rate µg/Nm³	% Oxygen	Mercury Emission Rate µg/Nm³ @ 7% O_2
A	1	<.07	4.8	<.06
	2	<.06	4.8	<.05
	3	<.08	4.5	<.07
B	1	9.49	5.0	8.30
	2	NA	4.8	NA
	3	2.25	4.4	1.90
C	1	1.03	5.4	0.92
	2	1.45	5.3	1.29
	3	2.04	5.2	1.81
Avg.				1.80

NA - Sample destroyed before analysis was conducted

For calculation purposes, the values reported as less than a number are treated as that number. According to the table, the average mercury emission rate from performance testing was 1.80 µg/Nm³ with values ranging from 0.05 to 8.30 µg/Nm³. The average mercury emission rate during Phase I testing was 3.77 µg/Nm³, with values ranging from 1.69 to 6.92 µg/Nm³. These data were combined and are presented in Table 6.1B.

TABLE 6.1B - SUMMARY OF PERFORMANCE AND PHASE I TESTING MERCURY EMISSIONS RATES

Test	CFB Boiler	Run	Mercury Emissions Rate µg/Nm³ @ 7% O_2
Performance	A	1	.06
		2	.05
		3	.07
	B	1	8.30
		3	1.90
	C	1	0.92
		2	1.29
		3	181
Phase I	B	1	6.92
		2	2.69
		3	1.69
Average			2.34

Before conducting further statistical analysis, CBCP examined the presence or absence of outliers. Using the box plot method, in which the data are compared to inner and outer fences constructed from the data's interquartile range, the values 6.92 and 8.30 were identified as outliers. These values were removed from the data set, and the adjusted data set has an average flue gas mercury emissions rate of 1.16 µg/Nm³, a standard deviation of 0.96 µg/Nm³, and a range of 0.05 to 2.69 µg/Nm³. Table 6.1C shows the adjusted data set.

TABLE 6.1C - SUMMARY OF ADJUSTED MERCURY EMISSION RATES

Test	CFB Boiler	Run	Mercury Emissions Rate µg/Nm³ @ 7% O_2
Performance	A	1	.06
		2	.05
		3	.07
	B	3	1.90
	C	1	0.92
		2	1.29
		3	1.81
Phase I	B	2	2.69
		3	1.69
Average			1.16

6.2 Discussion

The additional data points summarized in Table 6.1C were examined to determine if carbon injection would be likely to yield substantial additional reduction of mercury emissions. The data were compared statistically, using a Student's t test, against the 3.0 µg/Nm³ level which was established in the Plan as the level below which further testing would not be warranted. Calculations are shown in Appendix H. The Student's t test confirmed that the probability of the CBCP CFB boiler mean mercury emission rate being below 3.00 μg/Nm^3 is greater than 99.5%. Because mercury emission rates at the plant are within in the range of the error from sampling and analysis, it is, it is doubtful that Phase II testing of carbon injection to control mercury emissions from the CBCP would yield meaningful information, let alone substantial additional reduction of mercury emissions.

7.0 Estimated Mercury Mass Balance and Removal Efficiency

The data collected during this test program can be used to estimate mercury removal efficiency by evaluating the mass balance of facility mercury emissions. According to the principle of conservation of mass, the mass of mercury entering the CFB boiler will equal the mass of mercury released. Sources of mercury release include fly ash, bed ash, and flue gas. For the purposes of this discussion, mercury in bed ash is assumed to be zero because all bed ash mercury concentrations were below the detection limit (see Section 4.2.3).

Phase I test data for coal, flue gas and fly ash were evaluated for conservation of mass. The coal input and flue gas output data are considered the most conservative data for calculating removal efficiency. Only data from runs 2 and 3 were used to estimate removal efficiency, consistent with the analysis presented in Section 6.1, which identified the value from Run 1 as an outlier. The most conservative estimated removal efficiency equation was used to produce values. The calculated total mercury content of fly ash, apparently over estimated for mass balance purposes, at least provides good evidence that significant mercury removal is being achieved at CBCP (see Appendix H for calculations).

TABLE 7.0 - ESTIMATED PHASE I MASS BALANCE MERCURY REMOVAL EFFICIENCY

	Total Mercury (lbs./hr. x 10^{-3})				Mercury Removal Efficiency Estimate, %
	Input Mercury	Output Mercury			
Test Run	Coal	Flue Gas	Fly Ash	Total	(Coal - Flue Gas) / Coal
Run 2	4.27	2.63	6.60	9.23	38
Run 3	2.87	1.65	4.61	6.26	43
Average	3.57	2.14	5.61	7.75	41

Estimated average mercury removal efficiency was 41 percent. As shown in Table 7.0, mercury in the boiler output is significantly greater than the mercury input in coal for all three test runs. These results highlight the difficulties in obtaining mercury data of sufficient accuracy to close a mass balance. Complete calculations are provided in Appendix H.

8.0 Other Studies in Mercury Emissions and Control

This section summarizes relevant mercury emissions control studies conducted by EPRI, FCG, and DOE. The results are reviewed for applicability of carbon injection testing at Cedar Bay.

8.1 Activated Carbon Injection Control EPRI Findings

EPRI has evaluated results from two pilot scale studies of carbon injection for mercury control. The tests were run with various coals, various amounts of carbon, and at various flue gas temperatures. [1]

EPRI found that the effectiveness of activated carbon injection in removing trace amounts of mercury from flue gas depends on the following factors:

- Coal type,
- Flue gas composition,
- Flue gas temperature,
- Mercury species present,
- Carbon properties and injection rate, and
- Operating conditions.

Of these factors, all but carbon properties and injection rate were monitored during Phase I testing.

8.2 FCG and EPRI Coal Mercury and Mercury Emissions Studies

As part of a recent study, FCG examined and evaluated data from samples of coal collected from July 1992 through January 1993 at electric generating units operated by FCG members in Florida.[2] The average mercury concentration of the samples analyzed was 0.100 μg/g, compared to a concentration of 0.050 μg/g measured at CBCP during Phase I studies. The measurement techniques and data precision for the two studies were comparable. Table 8.2A presents a comparison of the FCG data and the CBCP data.

TABLE 8.2A - COMPARISON OF FCG AND CBCP MERCURY IN COAL STUDIES

	Samples			Mercury (µg/g)	
	Single	Duplicate	Total	Mean	Std. Dev'n.
FCG Study	30	26	56	0.100	0.032
CBCP Study	50	0	50	0.050	0.033

FCG, as part of their study, also presented a summary of mercury-related findings from EPRI and DOE. This summary was intended to build a database of information on atmospheric emissions of mercury and other chemical substances from fossil fuel-fired steam generating units. Average flue gas mercury emissions rates with their corresponding ninety-five percent confidence intervals from the EPRI and DOE tests are included in Table 8.2B, along with the CBCP results. The EPRI and DOE results are grouped by type of particulate and SO_2 control system.

TABLE 8.2B - COMPARISON OF CBCP MERCURY EMISSIONS WITH EPRI AND DOE FINDINGS

Source	Control System	Number of Tests	Hg Emissions (µg/Nm³)	
			Mean	95% CI
EPRI/DOE	Electrostatic Precipitator	19	8.17	1.69
EPRI/DOE	Fabric Filter	5	6.98	9.48
EPRI/DOE	Electrostatic Precipitator with Fabric Filter	24	7.92	2.14
EPRI/DOE	Flue Gas Desulfurization	9	6.08	3.47
CBCP	CFB with Fabric Filter	9	1.16	0.63

CBCP mercury emissions are the lowest presented, which may be a result of lower coal mercury content, along with control technology differences. The data may indicate a better inherent mercury removal efficiency of the CFB/fabric filter control technology, when compared to the pulverized coal boilers at which most of the DOE and EPRI data was collected.

9.0 Conclusions

The Phase I study has determined that:

- Because CBCP mercury emissions are already low, additional substantial reduction of air emissions of mercury from CBCP boilers is unlikely.
- Due to the limitations of existing mercury sampling and analysis techniques at CBCP mercury emission rates, it is not currently feasible to accurately determine whether any additional mercury removal can be achieved via the carbon injection technology.
- The available research on carbon injection technology for mercury emission reduction indicates that it would not be effective at further reducing mercury emissions from CBCP due to the flue gas temperature.

9.1 Discussion

Given that mercury occurs as a vapor at ambient conditions and is widespread throughout the environment, the likelihood of interference and cross-contamination during testing is high, and obtaining accurate and precise data is inherently difficult. The errors from current sampling and analytical methods approach the range of actual mercury emission rates at CBCP.

Section 4 presented an average CGB boiler mercury air emission rate of 1.16 $\mu g/Nm^3$. A review of other mercury emission studies at coal-fired electric utility boilers, presented in Section 8, suggests that CBCP's mercury emission rate is low compared to other coal fired units.

A 41% mercury removal efficiency was estimated from Phase I test data, using the most accurate data and the most conservative removal efficiency equation from the modeled mass balance.

The CBCP plant is designed with CFB Boiler flue gas temperatures in the 330° - 360° F range. At those temperatures, the EPRI studies indicated that no measurable removal of mercury in vapor phase was achieved by carbon injection. As with temperatures, all other factors thought to influence the effectiveness of carbon injection and studied by EPRI are considered constant in terms of the CBCP plant design and Phase I testing data demonstrated this consistency. Therefore, given CBCP's design characteristics, carbon injection is not considered a viable mercury control technology. The results of the Phase I evaluation indicate that any additional substantial removal of mercury from CBCP flue gas is unlikely.

9.2 Phase II Proposal

The CBCP mercury emissions are currently at a level where variations in measured data are more likely related to the measurement variables than to actual mercury content. Current research indicates that substantial additional mercury removal at CBCP using carbon injection is unlikely to be measurable. CBCP believes that the Phase I study has demonstrated that substantial reductions in mercury emissions would not be achieved by carbon injection and that testing of this control technology would not provide additional useful information.

---

[1] Chang, Ramsay and David Owens, "Developing Mercury Removal Methods for Power Plants," Electric Power Research Institute Journal, July/August 1994.
[2] Florida Electric Power Coordinating Group, Inc., Mercury Task Force, "Overview: Mercury Emissions from Fossil-Fuel Fired Electric Generating Units," June 1994.

APPENDIX A

MERCURY CONTROL TEST PLANT AND PROTOCOL (PLAN) SUBMITTED TO DEP BY CEDAR BAY COGENERATION PROJECT ON DECEMBER 1, 1993

FILE COPY

December 1, 1993

Mr. Hamilton S. Oven, Jr.
Office of Siting Coordinator
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Oven:

The Cedar Bay Cogeneration Project ("CBCP") is pleased to submit the enclosed plan for testing the effectiveness of the carbon injection technology for mercury control at our facility. CBCP is aware of the concerns regarding the potential impacts of mercury in the environment, particularily in the Everglades, and we believe the results of our analysis and testing will be useful to the State of Florida.

As we discussed, CBCP is proposing a two-phased testing approach to help assure that the final results of the testing program are meaningful and conclusive. Given the limited amount of data available on mercury emissions from modern circulating fluidized bed coal combustion facilities such as CBCP, we have developed a Phase I testing program that will allow us to more accurately characterize mercury emissions from the facility. This base line data will provide information to develop an appropriate protocol for testing an activated carbon injection system. Such testing would constitute the Phase II testing program.

Please feel free to contact me at (301)-718-6937 with any questions you may have regarding this test plan. We look forward to your comments and assistance on this important project.

Sincerely,

Barrett Parker
Environmental Specialist

SP/mm

Enclosure

cc: J. Kelly, USGC
J. Stallwood, CBCP
S. Platisha, SBP Associates, Inc.

7500 Old Georgetown Road • Bethesda, Maryland 20814-6161 • 301-718-6800 • Fax 301-718-6900
An affiliate of U.S. Generating Company

Cedar Bay Cogeneration Project

Mercury Control Test Plan and Protocol

December 1993

Table of Contents

I. INTRODUCTION

A. Mercury Controls and Coal-Fired Combustion

Programs assessing the relative advantages and disadvantages of alternative pollution control devices on mercury collection from coal combustion have only recently begun. Test data is, however, available from programs to determine the best system of trace metals control from municipal waste combustors ("MWCs").[1] As will be detailed below in this test plan, equating mercury emissions and control from coal combustion with those from MWC facilities is difficult given the differences in combustion technology and the relatively low concentration of mercury in the flue gases generated by coal combustion.

B. CBCP Conditions of Certification

Condition II.2.c of the Conditions of Certification for the Cedar Bay Cogeneration Plant ("CBCP") requires a test plan to be submitted by CBCP to determine whether substantial additional mercury can be removed via a carbon injection system. The Condition of Certification reads as follows:

> "CBCP shall conduct a test to determine whether substantial additional removal of mercury can be obtained through a carbon injection system for mercury removal, as described in Exhibit 74 of the administrative record for the Lee County Resource Recovery Facility, which feeds carbon reagent into the CFB exhaust stream prior to the baghouse. Within one hundred eighty (180) days after initial compliance testing, CBCP shall conduct a test on one CFB to compare mercury emissions to the atmosphere with and without carbon injection. The test program will include the testing of carbon injection between the boiler and the fabric filter. Carbon forms to be tested may include activated carbon with or without additives and pulverized coal with or without additives. After consultation with the DEP, RESD, and EPRI, CBCP shall submit a mercury control test protocol to DEP for approval by December 1, 1993. Results of the test shall be submitted to the DEP within 90 days of completion."

II. ASSESSMENT OF CARBON INJECTION FOR CEDAR BAY

A. The Lee County System

The Condition of Certification requiring the submittal of this test plan references the carbon injection system for mercury removal as described in Exhibit 74 of the administrative record for the Lee County Resource Recovery Facility ("LRRF"). LRRF is a municipal waste combustor facility with two combustion units with a design combined processing capability of 1200 tons per day. The emissions control system will include, in addition to the carbon injection, a spray dryer and fabric filter for acid gas and particulate control, and a selective non-catalytic reduction system for nitrogen oxide emission reduction.[2]

B. Carbon Injection for Mercury Control at MWC Facilities

The Clean Air Act of 1990 requires the U.S. Environmental Protection Agency to promulgate mercury emission limits for MWC Facilities. Municipal solid waste contains elemental mercury in discarded items such as batteries, thermometers and mercury switches, and chemical compounds of mercury in items such as paints, pigments, plastics, and laboratory wastes. The State of Florida has recently promulgated rules that limit mercury emissions from MWC facilities.[3] Concerns with the environmental affects of mercury and the imposition of lower mercury emission limitations has resulted in increased attention to the activated carbon injection technology for mercury emissions control. Concentration of mercury in flue gases from MWC facilities is reported to be in the range of 200-1400 $\mu g/Nm^3$.

The recently-promulgated Florida regulation regarding mercury control at MWC facilities will ultimately limit the emissions of mercury from these facilities to less than 70 μg/dscm or 80 percent reduction of the mercury in the flue gas upstream of the mercury control device.[4]

LRRF selected activated carbon injection technology to reduce its potential mercury emissions based partially on experience with this technology at four European facilities and on testing completed at the Stanislaus County resource recovery facility in California. In addition to activated carbon injection and particulate control equipment, each of these facilities also have sorbent injection systems for the control of acid gas emissions. An EPA-sponsored study of the Stanislaus County, California, facility examined the impact of carbon type, feed rate, and feed location on mercury emissions. Based on the preliminary results from this testing, LRRF concluded that carbon injection systems can significantly reduce mercury emissions and that control efficiency at MWC facilities appears to be primarily related to activated carbon mass feed rate.[5]

C. Application of Carbon Injection to CFBs

CBCP is unaware of any application or testing of carbon injection technology at CFB facilities. Significant study and applications of carbon injection technology for mercury control at combustion facilities has primarily been focused on MWC facilities. MWC facilities with carbon injection such as LRRF differ from the CBCP CFB technology in their combustion and operational conditions and sulfur removal processes. Following is a description of some of these significant differences:

Fuel Characteristics

The type of fuel, its chemical composition, including mercury content and chemical form in which it occurs, determines, along with other factors, the uncontrolled and controllable rate of emission of mercury from combustion devices. Municipal solid waste ("MSW") contains elemental mercury in discarded items such as batteries, thermometers, and mercury switches, and chemical compounds of mercury in items such as paint, pigments, plastics, laboratory wastes. Since a substantial fraction of the total mercury in MSW exists as elemental mercury, it vaporizes easily during MSW combustion (@2000° - 2500°F) and forms elemental mercury vapor.

Mercury in the gaseous state is difficult to remove unless it is changed to a particulate form. Coal contains mercury in chemically combined form (as mercury compounds) and not as elemental mercury. The high proportion of elemental mercury in MSW and its gaseous state in the combustion/flue gases is responsible for the uncontrolled emission rate of mercury from MSW combustion being higher than from coal combustion. Concentration of mercury in MSW flue gases is reported to be in the range of 200-1400$\mu g/Nm^3$ or more, whereas in bituminous coal flue gases the mercury concentration is lower, at 20-135 $\mu g/Nm^3$.[6]

Combustion Zone Temperature

MWC facilities have mass-burn grates for movement and combustion of large solid waste fuel components with average combustion zone temperature of 2000 - 2500° F and local hot spots reaching even higher temperatures. The CFBs have relatively low temperatures of 1550 - 1650°F in the circulating fluidized beds. The higher temperatures in MWC facilities act to increase the potential volatilization of mercury and its compounds.

Particulate Loading

Because of the circulating bed of lime and ash, the dense particulate loading in the CFB flue gas provides a large surface area for adsorption/condensation of mercury compared to MSW combustors which are designed to limit elutriation of solids during combustion.

Fly Ash/Bottom Ash Distribution

Distribution of ash between fly ash (exiting boiler with flue gas) and bottom or bed ash is also different for the MSW and CFB combustors. Mercury retention and removal with bottom ash may be greater in the CFB than MSW combustor.

Air Pollution Control Systems

All of the MWC facilities utilizing carbon injection also have some type of spray-dry scrubber. The scrubbers cool the flue gases so that mercury can condense/absorb onto the carbon and other particulates present. Spray-dry scrubbers provide residence time and promote gas solids contacting. Without a spray-dry scrubber, carbon injection for mercury controlling a CFB is expected to be less effective.

CFBs inject limestone into the combustion zone where heat is released and throughout the steam generation gas path. This limestone is calcined ($Ca\,CO_3 \rightarrow Ca + CO_2$) in the CFB to generate highly porous quick lime, CaO. Sulfur dioxide in the flue gas diffuses into and attaches to the surfaces of the lime particles. Mercury vapor and some of its compounds will also diffuse into the lime pores and be absorbed or condensed as temperature reduces along the flue gas path.

D. EPRI and Carbon Injection for Mercury Control

The Electric Power Research Institute ("EPRI") has begun doing some pilot-scale testing of carbon injection for control of mercury at coal-fired power plants. The testing has not included any testing with the CFB technology.

A recently published EPRI study provided some data from a pilot scale test of carbon injection for mercury control at a coal-fired facility. Because the study included results from only a few tests runs, the results are considered to be preliminary. EPRI did offer the following preliminary conclusions based on this study:

- the injection of activated carbon holds promise for removing mercury vapor from coal-fired boilers.
- the amount of carbon injected is high compared to what is normally used in MSW plants
- the tests suggest mercury removal efficiency is dependent on flue gas temperature.

EPRI acknowledges the preliminary nature of these conclusions and points to the following areas that need further EPRI study:

- the impact of coal types on mercury removal efficiency
- the impact of activated carbon characteristics on mercury removal efficiency
- the impact of the type of collecting device on mercury control
- the limitations of the precision and accuracy of mercury sampling and analysis methods

Each of these areas is currently or will be undergoing further study by EPRI. EPRI also acknowledged uncertainty regarding the long-term stability of the collected mercury under actual landfill environments.[7]

E. Summary of Carbon Injection for Mercury Control at CFBs

There has been significant testing of and experience with carbon injection for mercury control at MSW facilities. For the MSW application, carbon injection appears to be a promising technology for effective control of mercury emissions.

Whether carbon injection technology for mercury control can be effective at coal-fired facilities, particularly CFBs, is less evident. The limited EPRI information show some promise, but not necessarily under the operating conditions expected at CFBs. In addition to uncertainties about the potential effectiveness of the technology on CFBs, there are also uncertainties regarding the precision and accuracy of mercury sampling and analysis methods available for measuring emissions from coal-fired sources.

Finally, CBCP and EPRI are not aware of any existing public data on mercury emissions from coal-fired CFBs, with or without carbon injection technology. As discussed in Section C of this paper, the inherent operating characteristics of the CFB technology at CBCP may act to limit mercury emissions to very low levels where additional control may not be cost effective and/or the precision or accuracy of test methods would not allow for an accurate assessment of control efficiency.

Based on the remaining uncertainties regarding CFB mercury emission and carbon injection control, CBCP is proposing a two-phased approach to analyzing the performance of this technology at CBCP.

The purpose of the first phase of this testing is to determine the baseline conditions at CBCP and to define a feasible Phase II carbon injection testing protocol. A combination of baseline mercury testing at CBCP and analysis of ongoing research by EPRI or other organization will allow CBCP to determine the best way to proceed with testing of carbon injection at CBCP, and if this further testing is warranted or possible.

Phase II of the test program is to conduct a test of carbon injection technology at the CBCP facility based on the protocol developed in Phase I. This test would, if feasible, either be done at full scale or at pilot scale.

III. PHASE I TEST PROGRAM - BASELINE CONDITIONS

A. Phase I Purpose

This phase of the test program is expected to include a combination of emissions tests and ash stream analysis. The purpose of this test phase is to produce a set of baseline data that will allow CBCP and DEP to determine the feasibility of on-site testing and the best way to proceed.

B. Phase I Test Plan

1. Coal and Ash Stream Analysis - As stated in Section II.C above, the relative distribution of bottom ash and fly ash in CFBs is different than it is for MWC facilities. The lower bed temperatures and relative speciation of mercury in the fuel for CFBs versus MWC facilities may result in a larger portion of the mercury remaining in the bottom ash stream. Therefore, CBCP will propose to conduct sampling of the ash streams to assist in evaluating this possibility. In addition, the ash stream analysis can be compared to the coal analysis for mercury to assist in determining (through mass balance) the fraction of total coal mercury that remains in the bottom and fly ash steams after combustion.

2. Ash Stream Test Protocol - A protocol for sampling and analysis of the ash streams will be developed in consultation with DEP. Sampling will be conducted to provide a representative sample of each ash stream for analysis using standard sampling procedures such as ASTM standard method D2234-76. A reputable laboratory will be contracted to provide sample analysis and assistance with the sampling protocol.

3. Air Emissions Analysis - Air emissions testing of mercury will be conducted as part of the Phase I program. Because of the design and operating conditions of the CFBs (see Section

II.C), mercury emissions may be inherently lower than can be expected from other coal combustion facilities. Very low emission levels would make the evaluation of the capture efficiency of additional control equipment (carbon injection) difficult, especially on a commercial scale facility with its inherent variability of gas stream concentrations at the up stream and down stream flue gas locations. In addition, very low emissions without carbon injection would make any additional expected control due to carbon injection less cost effective.

4. Air Emission Test Protocol - Selection of sampling and analysis procedures for determining mercury emissions from the CFBs is an important factor for the Phase I investigations. Because the CBCP Conditions of Certification require Method 101A or EPA Method 29 for demonstrating compliance with the facility mercury emission limitation, it is anticipated that one of these methods will be used for the Phase I testing. EPRI is currently undertaking a detailed investigation of mercury measurement techniques and their validation. Final selection of test methods will be done in consultation with DEP.

   CBCP Expects to conduct at least three 2-hour test runs to characterize these mercury emissions from the CFBs. CBCP anticipates this testing will take place in conjunction with the initial facility compliance testing.

5. Phase I Test Report - The results of the Phase I testing will be detailed in a final Phase I test report. The Phase I test report will include a detailed plan and protocol for Phase II testing.

IV. PHASE II TEST PROGRAM - CARBON INJECTION

A. Phase II Purpose

The purpose of Phase II of this test plan is to test according to the test protocol defined in Phase I. CBCP anticipates that this testing could include either a full scale test of the technology on one of the three CBCP coal-fired CFB units, or the extraction of a portion of the CFB flue gas as a slipstream from the duct entering the baghouse into a pilot plant to be located near the baghouse. The carbon injection technology would then be tested in the pilot plant.

B. Example Pilot Scale Test Plan Outline

During Phase I of this test program, CBCP will investigate the appropriate options available to conduct a full-scale test of carbon injection on one of the CFBs. A full-scale test would involve directly injecting carbon into the flue gas prior to the baghouse. Should the Phase I portion of this test program determine that a pilot-scale test is more appropriate, the likely test program and necessary test equipment would be as follows:

1. Test Program
   - Baseline Runs - Extract a portion (about 100-200 cfm) of the CFB flue gas as a slipstream from the duct entering the baghouse (see Figure 1). Operational conditions should be allowed to stabilize. Check main stream duct and slipstream duct

concentration of mercury. Sample and analyze mercury levels after the pilot plant bag filter. Carbon is not injected during these tests. Mercury is sampled and analyzed using methods defined in Phase I of the test program.

- Carbon Injection Runs - Carbon is injected at several preselected feed rates. For each carbon feed rate, mercury samples are collected and analyzed for mercury content before and after the bag filter.

- Effect of Carbon Source - An additional set of similar runs are made with a different brand of commercial activated carbon to evaluate if significantly different results are obtained with different carbon sources.

- Effect of CFB Load - The CFB unit providing the flue gas slipstream is run under reduced load (e.g. 70% of full load) conditions. Flue gas temperature will reduce by 10 - 40 degrees F under these conditions. Baseline and carbon injection runs are evaluated under these circumstances.

3. Test Equipment
   - Slipstream Duct - A short, straight run of 2 to 3 inch diameter insulated pipe to convey the flue gas slipstream (100 to 200 cfm @ 285 F) from the main flue gas duct to the pilot plant bag filter. Gases should be drawn isokinetically from the main duct so that the slipstream is fully-representative of the CFB flue gas. There should be no sharp bends or turns in this piping.

   - Activated Carbon Injection System - Carbon storage/feed silo, surge hopper, carbon metering and feeding subsystem, and injection into the slipstream.

   - Bag Filter - Design of the bag filter in the pilot plant should correspond closely with the main baghouse design (air-to-cloth ratio, type of cloth, cleaning mechanism etc.)

   - Induced Draft Fan - An induced draft fan of adequate capacity will be required to move the slipstream of flue gas through the pilot plant.

   - Exhaust Stack - Clean exhaust gas from the bag filter shall be released to the atmosphere through a short stack.

   - Instrumentation and Controls (I&C) - Adequate I&C shall be provided to afford a safe start-up, operation and shutdown of the pilot plant with minimal effect on the main CFB facility. A concurrent sampling and analytical system is required to ensure reliable sample and analysis at three points, with one at the slipstream extraction point, one at the pilot bag filter inlet, and one at the bag filter outlet.

4. Precautionary Measures - Since activated carbon is finely ground combustible material, all necessary safety precautions will be taken in the design and operation of the pilot plant.

5. Test Report - CBCP and the test contractor will prepare a test report detailing the information and data relating to these tests.

---

[1]ENSR Consulting and Engineering, "Cedar Bay Cogeneration Project Air Quality Analysis," February 1993.
[2]Malcolm Pirnie, Inc., "A Report on the Mercury Control System for the Lee County Resource Recovery Facility," April 1993.
[3]Rule 17-296.416, F.A.C.
[4]Ibid.
[5]Malcolm Pirnie, Inc., Ibid.
[6]U.S. Environmental Protection Agency, "Estimating Air Toxics Emissions from Coal and Oil Combustion Sources," EPA Report No. EPA-450/2-89-001, April 1989.
[7]Chang, R., Electric Power Research Institute, Others, "Pilot Scale Evaluation of Activated Carbon for the Removal of Mercury at Coal-fired Utility Power Plants"

APPENDIX B

COMMENTS SUBMITTED JANUARY 6, 1994 BY DEP'S BUREAU OF AIR REGULATION AND FROM EPRI ON THE PLAN

Florida Department of
Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

RECEIVED
JAN 10

January 6, 1994

Mr. Barrett Parker
U.S. Generating Company
7500 Old Georgetown Road
Bethesda, Maryland 20814-1616

Re: Cedar Bay Cogeneration Project, PA 88-24

Dear Mr. Parker:

The Department of Environmental Protection has reviewed the mercury testing protocol submitted by your company as required by the conditions of certification. I am attaching the comments of the Bureau of Air Regulation for your consideration. I will inform Mr. Harley that I included Method 29 in the Conditions based on a conversation with Ramsey Chang of EPRI.

We appreciate your providing this information to the Department.

Sincerely,

Hamilton S. Oven

Hamilton S. Oven, P.E.
Administrator, Siting
Coordination Office

cc: Mike Harley
Preston Lewis
Tom Atkeson

EPRI
Electric Power
Research Institute — Leadership in Science and Technology

January 14, 1994

Mr. Buck Oven
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Oven:

Scott Osbourn of Florida Power Corporation has requested that EPRI provide comments to the Cedar Bay Cogeneration Project Mercury Control Test Plan and Protocol. I have reviewed the Plan and summarized my major comments below:

Part II, Section C, Fuel Characteristics:

The form of mercury before combustion does not necessarily determine what it will be after combustion since mercury is expected to react with gas phase chemicals at high temperatures. The majority of mercury emitted from MSW plants is ionic mercury, not elemental since municipal waste is typically high in chloride content. The chloride reacts with elemental mercury during combustion and is emitted as mercuric chloride.

Mercury emissions from coal-fired power plants is normally in the range of 1 to 15 $\mu g/Nm^3$ rather than the 20 to 135 $\mu g/Nm^3$ discussed.

Part III, Section B, Phase I Test Plan:

It would be useful to include samples of baghouse ash (either directly from the bags or from the baghouse hopper) in the various ash samples to be obtained to get an overall mercury mass balance and an estimate of whether the baghouse is removing any mercury.

Method 29 is preferred over 101A since there is a potential for speciating mercury with 29 (although not validated). EPRI has also been refining Method 29 and has detail updated procedures. It is of utmost importance that any contractor selected for the sampling and analysis work has prior experience and is thoroughly familiar with potential problems.

Part IV, Section B, Test Program:

It is not clear how Phase I results would determine whether pilot or full-scale carbon injection tests are appropriate. Full-scale testing is normally preferred over pilot-scale if testing costs are similar. However, it is possible that total vapor phase mercury emissions at this particular site might be very low. If mercury concentrations are $<1\ \mu g/Nm^3$, there may not be any need for carbon injection testing since it would be difficult to determine control effectiveness. It is also highly unlikely that mercury concentrations at these levels are of any concern.

It is also recommended that if carbon injection tests are conducted, activated carbon samples containing collected mercury be collected and the long term stability of mercury in the collected ash be assessed. Various procedures to achieve this are possible and can be obtained by referring to earlier EPRI publications.

I hope these brief comments are useful to you. Please do not hesitate to call Scott or me if you have further questions.

Sincerely,

Ramsay Chang, Ph.D.
Project Manager, Particulate Control
Air Quality Control

RC:nl
RC.9750.L

c: Scott Osbourn, FPC
Ralph Roberson, SAI
Lee Zeugin, Hunton and Williams
George Offen, EPRI
Winston Chow, EPRI
Ian Torrens, EPRI

11

Florida Department of Environmental Protection

Memorandum

TO: Buck Oven

THROUGH: Clair Fancy

FROM: Mike Harley

DATE: December 21, 1993

SUBJECT: Mercury Stack Testing Protocol - Cedar Bay Cogeneration Project

We have reviewed the mercury testing protocol that was submitted by U.S. Generating Company.

General

The Department should review and approve each phase (Phase I and Phase II) of the test program to ensure that statistically valid data is obtained and important variables are not overlooked. For example, the protocol only mentions the influence of flue gas temperature in passing. The influence of flue gas temperature is one of the elements that must receive prominent attention in this study.

Test Methods

We do not know how or why EPA Method 29 was placed in the Site Certification or the original PSD permit. EPA Method 29 is a proposed EPA method which has not been adopted by the Department. The Department has adopted EPA Methods 101 and 101A for mercury. A permittee who wishes to use EPA Method 29 in lieu of one of the adopted mercury methods in Rule 17-297.400, F.A.C., must obtain approval to use an alternate sampling procedure. Such approval would be unlikely since EPA Method 29 is still a proposed/conditional method and several errors have been found.

EPA Method 101 has a significantly lower limit of detection and better precision than EPA Method 101A. But, there is a strong possibility that the flue gas from the circulating fluidized bed units at Cedar Bay will contain interfering agents that affect both EPA Method 101 and EPA Method 101A. The interfering agent For EPA Method 101 is sulfur dioxide which can prematurely deplete the iodine monochloride in the sampling solution. The interfering agent for EPA Method 101A is oxidizable organic matter which can prematurely deplete the potassium permanganate in the sampling solution.

Considering the potential interfering constituents of the flue gas, we recommend the use of EPA Method 101A for the initial testing. If the results of the sampling are at or below the minimum detectable level then the source testing should be repeated using EPA Method 101.

Sampling Locations

EPA Methods 101 and 101A are isokinetic test methods that require the use of traverse points located in accordance with EPA Method 1 or 1A. All of the ducts need to be large enough in diameter to permit the use of traverse points located in accordance with either EPA Method 1 or 1A, preferably EPA Method 1. The proposed 3" size for the slip stream duct is too small to allow isokinetic sampling of the duct using traverse points established pursuant to either EPA Method 1 or 1A.

All of the sampling ports should be located at least 8 diameters downstream and 10 diameters upstream of any bend, expansion, or contraction in the stack or any visible flame. It may be necessary to extend the length of the slipstream duct and the baghouse stack.

In addition, the slipstream duct needs to be located at a point which will ensure that the slipstream will be a representative aliquot of the main flue gas stream.

cc: M. Hewett
M. Costello

APPENDIX C

REVISED PLAN SUBMITTED TO DEP ON JULY 1, 1994

Cedar Bay Generating Company, Limited Partnership

FILE COPY

July 7, 1994

Mr. Hamilton S. Oven
Siting Coordinator
Florida Department of Environmental Protection
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

File No.: 6.3.26.2

RE: CBGC Carbon Injection Testing Update and Request for Concurrence

Dear Mr. Oven:

The Cedar Bay Generating Company, Limited Partnership ("CBGC") is pleased to provide your office with an update concerning CBGC's progress in planning the carbon injection testing. In addition, as described below, CBGC requests concurrence from your office on the appropriate baseline concentration level that would trigger phase two testing and on the proposed testing schedule.

Carbon injection testing is required according to Section II.A.2.c. of the Conditions of Certification. As you may recall, CBGC proposed a two-phased approach, which was approved by your office on January 6, 1994, for conducting this testing. During the phase one testing air emissions, fuel, and ash will be sampled for mercury and mercuric compounds, in order to provide a set of baseline data. Upon completion of this testing, CBGC will review and analyze the data to determine whether there is a potential for measuring the effectiveness of carbon injection. CBGC believes that a baseline of 3.00 or more micrograms per cubic meter of exhaust gas would demonstrate the potential for measuring the effectiveness of carbon injection. If the potential exists, CBGC will continue preparations for phase two testing. However, if the potential does not exist, phase two testing will not be conducted.

Compliance Testing Results

Initial mercury emissions compliance testing was conducted on the exhaust gases from each of CBGC's circulating fluidized bed ("CFB") boiler using EPA Method 101A. Results from these two hour test runs indicated very low mercury emission rates, ranging from less than 0.06 to 9.49 micrograms per cubic meter of exhaust gas. The average mercury emissions rate from all runs was found to be 2.48 micrograms per cubic meter of exhaust gas. These results, summarized in Table I, and all other CFB boiler emissions were determined on June 28, 1994, to be in compliance with the emissions limitations given in the Conditions of Certification.

	CFB Boiler Baghouse	CFB Boiler Baghouse	CFB Boiler Baghouse
Run	**1**	**2**	**3**
1	<0.07	9.49	1.03
2	<0.06	irrecoverable[i]	1.45
3	<0.08	2.25	2.04
Average	<0.07	5.87	1.51

TABLE I. MERCURY EMISSIONS IN MICROGRAMS PER CUBIC METER OF EXHAUST GAS

As stated in CBGC's test protocol, there are several reasons why the coal fired circulating fluidized bed boilers could be expected to inherently have very low mercury emissions. The initial results, particularly for CFB boilers 1 and 3, contain emission levels that would make the task of determining whether there is a potential for measuring the effectiveness of carbon injection difficult, if not impossible, to perform. Based on findings presented to the DEP on June 29, 1994, by the Mercury Task Force of the Florida Electric Power Coordinating Group, Incorporated, CBGC suggests that phase two testing not be required should mercury emissions from phase one testing demonstrate a concentration of less than 3.00 micrograms per cubic meter of exhaust gas. CBGC understands that the Electric Power Research Institute ("EPRI") presentation during this meeting documented that other independent variables could cause fluctuations in the test results that would mask differences in mercury emissions caused by carbon injection control.

Phase One Testing

As mentioned in previous correspondence, phase one testing is scheduled to commence the week of July 25, 1994. Barring unforeseen delays, phase one testing should be complete within the 180 day timeframe given in the Conditions of Certification. During phase one activities, air emissions, coal, and ash will be analyzed for mercury and mercuric compounds. Air emissions sampling using EPA Method 101A, as requested by DEP, will be conducted by personnel from Air Consulting & Engineering, Incorporated ("ACE"), while concurrent with air emissions testing, coal and ash samples will be collected during the test period by CBGC personnel, thoroughly mixed with other similar samples, and analyzed by an independent laboratory in accordance with EPA Method 7471. A copy of ACE's testing protocol has been sent to your office for review.

[i] Note that sample 2 from CFB baghouse 2 was irrecoverable, as the sample container was dropped and the sample destroyed.

Because the initial compliance testing showed that exhaust gases from CFB boiler baghouse 2 had the highest mercury emissions, CBGC plans to conduct phase one testing on CFB boiler baghouse 2. CBGC also plans to double the test run duration time from two to four hours per test run. Results from phase one testing are expected within forty-five days of test completion.

Phase Two Testing

After reviewing comments from DEP and EPRI, CBGC has changed the phase two testing protocol from pilot to full scale testing. Should the phase one testing results warrant phase two testing, CBGC has located a manufacturer of carbon injection systems who can supply a temporary system and sulfur-impregnated, activated carbon within eight weeks of notification to proceed. CBGC plans to issue that notification upon determining that a potential for measuring the effectiveness of carbon injection exits.

Based on recommendations from EPRI, CBGC has selected three carbon injection rates, ranging from approximately 4 to 40 pounds of carbon per hour. Should phase two testing be required, CBGC plans to conduct it after emerging from the planned fall outage, which is currently scheduled to end around November 10, 1994. Allowing phase two testing to proceed then would enable CBGC to install and to test the carbon injection system while maintaining electrical production during the peak summer season. CBGC trusts that this schedule is acceptable and asks for your office's concurrence.

Should you or your staff have questions or comments concerning this update or CBGC's proposed schedule, please contact me at (301) 718-6937.

Sincerely,

Barrett Parker
Environmental Specialist

BP/mm

cc: R Pace, RESD
C. Kirts, FDEP
C. Fancy, FDEP
J. Stallwood, CBGC
J. Garvey, CBGC
J. Kelly, CBGC

APPENDIX D

PHASE I QUALITY ASSURANCE RESULTS

Appendix D

Phase I Quality Assurance Results

Reference Method 101A Compliance
Mr. White monitored the ACE field testing team during the air emissions testing and completed a reference method checklist to assure ACE compliance with EPA Method 101A. He concluded that ACE properly followed the method with no observed exceptions. Mr. White's test summary letter and reference method checklist are provided in the attached documentation.

Quality Assurance Sample Results
Table 1 provides the results of the analysis performed on the Phase I quality assurance samples. Certificates of Analysis for the coal and fly ash audit samples are also provided in the attached documentation, along with a letter that discusses the audit results for the impinger spike samples from Mr. White. In his opinion, the samples "demonstrated excellent precision and acceptable accuracy at 122 and 126%." The range reflects the current level of precision of the test methods.

Since Savannah analyzed the fly ash sample on a dry basis, the mercury content of the fly ash audit sample has been corrected to 5% moisture.

PHASE I AUDIT SAMPLE RESULTS

Audit Sample	Lab	Certified or Expected Hg Content	Analyzed Hg Content	Analyzed Hg Content as Percent of Certified
Impinger Solution 1	PPB	3.0 μg	3.66 μg	122%
Impinger Solution 2	PPB	3.0 μg	3.74 μg	126%
Coal Sample	Savannah	0.138 μg/g	0.11 μg/g	80%
Fly Ash Sample	Savannah	0.141 μg/g	0.12 μg/g	88%

Field Blank Results

The test program included several types of blank samples to assess mercury contribution from the sample media as well as matrix interferences.

A field bias sampling train blank was prepared prior to initiation of emissions sampling. In order to determine the potential effect of the sampling train on emissions results, sampling train equipment was field-assembled; the probe was sealed; the sampling train was connected to transport equipment; the train was placed on the stack sampling platform for a prescribed time; the train and transport equipment were leak checked; and the train and sampling equipment underwent routine sample recovery procedures, as if emissions had been sampled. During individual emissions test runs, absorbing solution and deionized water blanks were collected in the field and analyzed. Standard laboratory blanks were also collected and analyzed with each batch of samples.

Analysis of the field bias sampling train blank indicated the presence of 10.7 μg of mercury. Since this blank value was significant when compared to the test results, CBCP requested a reanalysis to verify the blank value. This reanalysis, performed on September 15, 1994, confirmed a blank value of 10.7 μg of mercury. This amount of mercury could be attributed to various factors: residual contamination in the sample train glassware; laboratory or field contamination; or a matrix interference. The field blank value was not subtracted from the reported values, consistent with EPA Method 101A.

Ambient air was drawn into the sample train for only a brief time in order to leak check the sample train. Therefore, CBCP believes it is unlikely that the field bias sample was due to ambient mercury contamination near the stack platform.

If mercury in the field bias sample resulted from residual contamination in the sample train, this contamination would have been removed by the collection of the field bias sample itself. Collecting the field bias sample included rinsing and cleaning the sample train after it was brought down from the stack platform. Therefore, the subsequent test runs, which were conducted using the same sample train, would not have been affected by any residual contamination contained in the sample train prior to the field bias test.

Finally, because an analysis of the absorbing solution blank yielded a mercury value below the method detection limit, it is unlikely that a contaminated absorbing solution is the source of the mercury in the field bias sample. However, it should be noted that the absorbing solution blank sample was collected in the field on Friday, July 29, 1994 and the field bias samples were collected on Wednesday, July 27, 1994. The absorbing solution used for the field bias blank on Wednesday was prepared separately from the absorbing solution analyzed as a blank sample on Friday. Wednesday's absorbing solution could have been the potential source of mercury in the field bias blank. If indeed Wednesday's absorbing solution were contaminated, this contamination could have caused a high bias in Run 1's test results.

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LETTER REPORT

August 22, 1994

Mr. Stephen Platisha
SBP Associates
3914 Randall Avenue
Minneapolis, MN 55416

Subject: Letter Report - Mercury Audit Results (Project No. 10783-001-001)

Dear Mr. Platisha:

The purpose of this correspondence is to provide final summary of the external audit results. WESTON has received verbal notification from Dr. Charles Simon of ACE regarding the results for the impinger spike samples. The following is a brief description of the procedures for the preparation and delivery of the spikant.

The spiking solution was prepared from a standard stock of 1000 ppm (μg/mL) mercury in solution. The solution was prepared by diluting 300 μL of the stock solution to 100 mL to yield a spiking solution concentration of 3.0 ppm. All procedures were carried out in the laboratory by qualified technicians using Class A glassware. The solution was shipped to the field by Federal Express for receipt on July 29th. Two samples were prepared by pipeting a known volume (1.0 mL) with a Class A pipet, into 100 mL of potassium permanganate solution. The reported analytical results should be in the range of 3.0 micrograms.

Telephone discussions with Dr. Simon indicated the results to be reported at 3.66 and 3.74 total micrograms. The samples demonstrated excellent precision and acceptable accuracy at 122 and 126%. If requested, an aliquot of the remaining volume of the original spiking solution will be sent to ACE for additional analysis.

I have included a fax copy of the certification page for the mercury in coal standard. You already have the certification page for the mercury in flyash sample I gave to you in the field. Please contact me if you have any questions of other technical concerns.

Sincerely,
ROY F. WESTON, INC.

Michael O. White
Senior Technical Manager

cc: B. Parker, US Generating Company
Enclosure (1)

COMMISSION OF THE EUROPEAN COMMUNITIES

COMMUNITY BUREAU OF REFERENCE - BCR N°s. 324, 326 and 327

CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCR No. 181

COKING COAL

Element	Mass fraction based on dry mass		No. of accepted sets of results (p)
	Certified value (1)	Uncertainty (2)	
C	848.3 mg/g	± 1.7 mg/g	11
H	54.0 mg/g	± 0.6 mg/g	11
N	17.8 mg/g	± 0.4 mg/g	9
Cl	1.38 mg/g	± 0.06 mg/g	11
As	27.7 µg/g	± 1.2 µg/g	20
Cd	0.061 µg/g	± 0.003 µg/g	11
Hg	0.138 µg/g	± 0.011 µg/g	11
Pb	2.59 µg/g	± 0.18 µg/g	10
Se	1.15 µg/g	± 0.08 µg/g	11
V	12.0 µg/g	± 0.4 µg/g	10
Zn	8.4 µg/g	± 0.5 µg/g	19

Hg 0.138 µg/g ± 0.011 µg/g

Property	Values based on dry mass		No. of accepted sets of results (p)
	Certified value (1)	Uncertainty (2)	
Ash content (ISO 1171) (3)	18.5 g/kg	± 0.2 g/kg	6
Gross calorific value	36.43 MJ/kg	± 0.09 MJ/kg	8

(1) *This value is the unweighted mean of the means of p accepted sets of results.*
(2) *The uncertainty is expressed as the 95% confidence interval. It is applicable when the reference material is used for calibration purposes.*
(3) *Year of issue 1978: confirmed 1981.*

When the reference material is used to assess the performance of a method, the user should refer to the recommendations laid down in the last chapter (instructions for use) of the certification report.

DESCRIPTION OF THE SAMPLE

The material is in powder form (particle size: 63-212 µm) supplied in a sealed hard glass ampoule under Argon. One ampoule contains appr. 20 g.

Brussels, December 1986

BCR
for certified true copy

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 1633b

Constituent Elements in Coal Fly Ash

This Standard Reference Material (SRM) is intended for use in the evaluation of analytical methods for the determination of constituent elements in coal fly ash or materials with a similar matrix. SRM 1633b is a bituminous coal fly ash that was sieved through a nominal sieve opening of 90 μm (170 mesh) and then blended to assure homogeneity. A unit of SRM 1633b consists of 75 g of powdered material.

The certified values for the constituent elements are given in Table 1. The values, except for Hg, are based on measurements using one definitive method or two or more independent and reliable analytical techniques. Noncertified values for a number of elements are given in Table 2 as additional information on the composition of the material. The noncertified values should not be used for calibration or quality control. Analytical methods used for the certification of this SRM are given in Table 3 along with analysts and cooperating laboratories. All values are based on measurements using a dry sample weight of at least 250 mg.

NOTICE AND WARNING TO USERS

Expiration of Certification: This certification is valid for 5 years from the date of shipment from NIST. Should any of the certified values change before the expiration of the certification, the purchaser will be notified by NIST.

Stability: This material is considered to be stable; however, its stability has not been rigorously assessed. NIST will monitor this material and will report any substantive changes in certification to the purchaser.

Use: A minimum dry sample weight (see Instructions for Drying) of 250 mg should be used for analytical determinations to be related to the certified values on this Certificate of Analysis.

To obtain the certified values, sample preparation procedures should be designed to affect complete dissolution. If volatile elements (e.g., Hg, As, Se) are to be determined, precautions should be taken in the dissolution of SRM 1633b to avoid volatilization losses.

Statistical consultation was provided by S.B. Schiller of the NIST Statistical Engineering Division.

The overall direction and coordination of the analyses were under the chairmanship of R.R. Greenberg of the NIST Inorganic Analytical Research Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane.

Gaithersburg, MD 20899
June 22, 1993

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

Instructions for Drying: When non-volatile elements are being determined, this material should be dried to constant weight before using. Recommended procedures for drying are: 1) Vacuum drying for 24 h at ambient temperature using a cold trap at or below -50 °C and a pressure not greater than 0.2 mm Hg (30 Pa); 2) drying for 2 h in an oven of 105 °C. Samples of the dried material weighing at least 250 mg should be used for analysis. When not in use, the material should be kept in a tightly sealed bottle. Volatile elements should be determined on an as-received basis, and corrected to dry weight. Correction should be based on a separate determination of moisture, using one of the above drying procedures.

Source and Preparation of the Material: The fly ash was supplied by a coal fired power plant and is the product of Pennsylvania and West Virginia coals. It was selected as a typical bituminous coal fly ash and is not intended as a fly ash from a specific coal or combustion process. The material was air dried, sieved, and blended for 24 h, before being placed in a series of bulk containers. X-ray fluorescence and inductively coupled plasma atomic emission analyses were performed on ten grab samples taken from the bulk for a preliminary homogeneity assessment before proceeding with bottling the material in 75 g units.

Analysis: The homogeneity of the bottled material was assessed by X-ray fluorescence spectrometry and instrumental neutron activation analysis, using selected elements as indicators. In some cases, statistically significant differences between samples were seen, and the variance due to material inhomogeneity is included in the overall uncertainties of the certified values. The estimated relative standard deviation for material inhomogeneity is less than 1% for those elements for which homogeneity was assessed, except Th, for which material inhomogeneity was estimated to be 2%.

Certified Values and Uncertainties: The certified values are weighted means of results of two or more independent analytical methods, or the means of results from a single definitive method, except for mercury. Mercury certification is based on cold vapor atomic absorption spectrometry measurements performed at NIST. The weights for the weighted means were computed according to the iterative procedure of Paule and Mandel (NBS Journal of Research 87, 1982, pp. 377-385). The stated uncertainty includes allowances for measurement imprecision, material variability, and differences among analytical methods. Each uncertainty is the sum of the half-width of a 95% prediction interval, and includes an allowance for the systematic error among the methods used. In the absence of systematic error, a 95% prediction interval predicts where the true concentrations of 95% of the samples of this SRM lie.

Table 1. Certified Values

Element	wt %		
Aluminum	15.05	±	0.27
Calcium	1.51	±	0.06
Iron	7.78	±	0.23
Magnesium	0.482	±	0.008
Potassium	1.95	±	0.03
Silicon	23.02	±	0.08
Sodium	0.201	±	0.003
Sulfur	0.2075	±	0.0011
Titanium	0.791	±	0.014

Element	mg/kg		
Arsenic	136.2	±	2
Barium	709	±	27
Cadmium	0.784	±	[illegible]
Chromium	198.2	±	[illegible]
Copper	112.8	±	[illegible]
Lead	68.2	±	
Manganese	131.8	±	
Mercury	0.141	±	
Nickel	120.6	±	
Selenium	10.26	±	
Strontium	1041	±	1
Thorium	25.7	±	
Uranium	8.79	±	
Vanadium	295.7	±	

Table 2. Noncertified Values

Element	mg/kg
Antimony	6
Bromine	2.9
Cerium	190
Cobalt	50
Cesium	11
Dysprosium	17
Europium	4.1
Gadolinum	13
Hafnium	6.8
Holmium	3.5
Lanthanum	94
Lutetium	1.2
Neodymium	85

Element	mg/kg
Phosphorus	2300
Rubidium	140
Scandium	41
Samarium	20
Tantalum	1.8
Terbium	2.6
Thallium	5.9
Thulium	2.1
Tungsten	5.6
Ytterbium	7.6
Zinc	210

Table 3. Analytical Methods Used for Certification Analyses of SRM 1633b

Element	Certification Methods
Al	INAA, XRF
As	FIA-HAAS, INAA
Ba	ICP-MS, INAA
Ca	ICP, INAA, XRF
Cd	ETAAS, IDTIMS
Cr	FAAS, INAA
Cu	FAAS, ICP-MS
Fe	INAA, XRF
Hg	CVAAS
K	FAES, INAA, XRF
Mg	ICP, IDTIMS
Mn	FAAS, INAA
Na	FAES, INAA
Ni	ETAAS, ICP
Pb	ETAAS, ICP-MS
Rb	FAES, INAA
S	IDTIMS
Sb	ETAAS, INAA
Se	FIA-HAAS, INAA
Si	GRAV, XRF
Sr	FAES, INAA, IDTIMS
Th	ICP-MS, INAA
Ti	INAA, XRF
U	ICP-MS, INAA
V	ICP, INAA

ID-TIMS - Isotope dilution thermal ionization mass spectrometry, mixed acid digestion.
ICP-MS - Inductively coupled plasma mass spectrometry; mixed acid digestion.
INAA - Instrumental neutron activation analysis.
XRF - Wavelength dispersive X-ray fluorescence on fused borate discs.
ICP-AES - Inductively coupled plasma atomic emission spectrometry; mixed acid digestion.
ETAAS - Electrothermal atomic absorption spectrometry; mixed acid digestion.
CVAAS - Cold vapor atomic absorption spectrometry.
FIA-HAAS - Flow injection analyses - Hydride generation atomic absorption spectrometry.
FAAS - Flame atomic absorption spectrometry; mixed acid digestion except for Au, leached with $HBr-Br_2$.
GRAV - Gravimetry; sodium carbonate fusion.

Most information values were determined by INAA only; P was determined by ICP-AES and XRF, Tl was determined by ICP-MS, and Zn was determined by FAAS and ICP-AES.

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LETTER REPORT

August 15, 1994

Mr. Stephen Platisha
SBP Associates
3914 Randall Avenue
Minneapolis, MN 55416

Subject: Letter Report - Technical Oversight Cedar Bay Cogeneration Project Phase I - Mercury Emissions Testing (Project No. 10783-001-001)

Dear Mr. Platisha:

This Letter Report summarizes the results of the observations performed at the Cedar Bay Cogeneration Facility (CBCF) located near Jacksonville, Florida on July 27 through 29.

In general, all testing observed was performed in accordance with the EPA Reference methodologies required for the program. The field test team was experienced and competent at the procedures used. The equipment, designed and manufactured by ACE, proved to be reliable for the most part. The technical team operated in a conscientious and professional manner throughout the program.

Representatives from the City and State were onsite for much of the testing and offered guidance and recommendations for completion of the program.

WESTON appreciates the confidence you have shown in our capabilities by requesting our services. Please contact Jim Serne or me if you have any questions of other technical concerns.

Sincerely,

ROY F. WESTON, INC.

Michael O. White

Michael O. White
Senior Technical Manager

cc: B. Parker, US Generating Company
Enclosures (2)

WESTON
MANAGERS DESIGNERS/CONSULTANTS

LETTER REPORT
TECHNICAL OVERSIGHT DURING
PHASE I MERCURY TESTING

SCOPE OF WORK

WESTON was contracted to perform observation of mercury testing at the outlet to the control device on Unit 2 at the Cedar Bay Cogeneration facility located in Jacksonville, Florida. The testing was performed by Air Consulting and Engineering, Inc. (ACE) from Gainesville, Florida. A total of three runs, each 4-hours in duration, were performed in accordance to the requirements cited in EPA Reference Method 101A. Process stream samples (coal, bed ash and fly ash) were also collected on an hourly basis beginning one hour before the start of the flue gas testing and continuing for one hour after the completion of the flue gas testing.

SCHEDULE OF EVENTS

Setup was completed on the morning of Wednesday July 27th. One 4-hour run was performed on each day (Wednesday, Thursday and Friday). A pretest meeting was held on Wednesday. The demobilization was completed on Friday afternoon. All staff were offsite Friday by 1900 hrs.

Wednesday, July 27th

The pretest meeting was attended by representatives from WESTON, U.S. Generating Company, ACE and the facility. The intent of this meeting was to outline the program objectives, schedule, assign responsibilities and address any technical questions. The personnel in attendance included: Michael White-WESTON, Steve Platisha-SBA Associates, Inc., Barrett Parker-U.S. Generating Company, Steve Neck and Tom Bartley-ACE, and several representatives from the facility including Vic Bailey (Control Room Supervisor), Jim Butler and Lee Atkins (process stream samplers). Process operational conditions were defined and communication mechanisms between the test team and the Control Room were established.

WESTON discussed the general requirements of the sampling procedures to be performed. Clarification was sought regarding the use of an unheated Teflon line from the exit to the filter to the inlet to the impingers. The meeting was temporarily interrupted while this issue was discussed over the phone with a member of the state regulatory agency, Mr. Jeff Winter. Following a short discussion and clarification on Method 101A specifications, Mr. Winter approved the use of the Teflon line. The field crew was instructed to collect a field bias blank, and appropriate method blanks prior to the field sampling. WESTON also provided ACE with copies of the Observer Field Checklists and dry gas meter auditing instructions.

No other major technical issues were discussed during the pretest meeting.

ACE completed the dry gas meter audit between 1030 and 1130. The results of the audit showed the ACE meter to be within 2 percent agreement. This was well within the recommended 5 percent difference. The ACE test crew was prepared for testing by 1145. Process stream sampling began at 1200. The flue gas sampling began at 1300. All flue gas testing for the first Run was completed at approximately 1730.

The were some initial concerns over maintaining an effective seal at the sample port. This was a difficult task due to the high negative pressure (-24 in H_2O) and long probe length (about 13 foot). Eventually a polyethylene plate was fabricated to assist in a more complete seal. This was further enhanced through wrapping the probe with port rags.

The Observer raised a question over the consistent probe traverse point markings. At the conclusion of the run, the exact points were identified and it was agreed the probe would be re-marked to more clearly identify the points. No major data qualioty impact was suspected.

The run was completed within the isokinetic ratio requirements of $\pm 10\%$.

The sample recovery procedures were also observed. No major deviations from the method requirements were noted. The analyst was careful to use appropriate safety ware (gloves and glasses) while handling the sample train components. A very slight buildup of particulate was noted on the filter. Small particles, that may have been port scrapings, were also noted.

Overall, no significant problems were encountered during the preparation, collection and recovery of Run 1 samples.

Thursday, July 28th

Run 2 started at 0900 and was completed by 1306. No major problems or deviations were noted during this sample run. The WESTON Observer raised a question regarding probe heating capability towards the end of Run 2. The construction and insulation of the port made it difficult to assess the actual probe temperature. All filter temperatures were within method requirements. The Test Team agreed to perform a thorough inspection of the probe heater and replace the probe if deemed necessary.

The run was completed within the isokinetic ratio requirements of $\pm 10\%$.

No major problems or technical issues were encountered.

Friday, July 29th

Run 3 started at 0932 and ended at 1721. Several problems were encountered during the sampling that resulted in delays during the test day. The Test Team changed the sample probe before the run started. A replacement probe was cracked during site setup. The final probe was fully functional with sufficient heat and leak checked before the sample run.

Shortly into the sample run, testing was halted to repair a heater box temperature circuit. Shortly after the heater box was repaired, testing was further postponed due to thunderstorms and lightening events. The sample train was sealed, properly heated and impingers iced during the test delays.

No further problems were encountered during the third sample run. The run was completed within the isokinetic ratio requirements of $\pm 10\%$.

On this sample day, WESTON provided a series of quality control samples to SBA and the Test Team. One NIST sample of trace elements in coal flyash was provided, along with a European standard coal sample. Each of these samples were of known mercury content. The Test Team received an impinger mercury field spike. This was accomplished by adding 1.0 mL of standard solution to a volume of 100 mL of impinger solution (potassium permanganate). The spike was prepared in the laboratory and shipped to the field. Results of the QC analyses are not yet available.

SUMMARY

The staff provided by ACE to perform the mercury testing appeared thorough and capable. The trailer and equipment were adequate for the job. The minimal amount of delay time encountered that was attributed to the field crew (only one significant delay in three days of testing) was a good indicator of ACE's technical abilities.

The sample duct configuration (vertical sampling through a three-foot nipple and into a nine-foot duct) required skillful maneuvering of the long glass-lined probe. The weather conditions and access to the sample location also contributed to the difficulty of the job.

WESTON observed all leak checks and the majority of all other sample train setup, operation and recovery procedures to ensure the collection of valid, representative samples. To the best of their ability, the Test Team appeared committed to meeting all project requirements in a cost effective and quality conscientious manner. In the judgement of the WESTON Observer, all samples were collected in accordance to the method requirements and should be considered valid and representative of the source tested.

WESTON

Date 7-27-94		Time 1153		Stack Therm. — °F	
Auditee ACE		Auditor Malik/WESTON		% Error —	
Location [illegible]		Meter Box No. 1		M_{inlet} Therm. — °F	
P_{bar} 29.79		Pretest Y 1.013		% Error —	
$\Delta H_@$ 1.93		K' 0.0004917		M_{outlet} Therm. — °F	
Audit Device No. 7		ASTM Therm. — °F		% Error —	
		Filter Therm. — °F		Condensor Therm. — °F	
		% Error —		% Error —	

Orifice gauge reading $\Delta H_@$ in. H_2O	Dry gas meter reading V_i/V_f ft^3	Meter temperatures T_i/T_f inlet	outlet	Duration of run θ min.
2.15	593.932	79		10
	601.674	80		

Dry Gas meter volume V_m, ft_3	Meter temperature average t_m, ft_3	$V_{m_{std}}$ a dry gas meter, ft^3	$V_{m_{std}}$ b orifice meter, ft^3	Percent difference, %	Acceptability
7.742	79.5	7.731 7.7160X	7.690 ft³ 0.217776 m³	Known-meas / Known - 0.5%	<5% less than 5%
	539.5	= 0.218939 m³			

a)

Calculate $V_{m_{std}}$ from dry gas meter (English):

$$V_m\ Y\ \frac{17.64\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{(t_m + 460^oF)} = (7.742)\ (1.013)\ \frac{17.64\ (29.79 + \frac{2.15}{13.6})}{(79.5 + 460^oF)}$$

b)

Calculate $V_{m_{std}}$ from critical orifice (metric):

$$\frac{K'P_c\theta}{\sqrt{T_o}} = \frac{(\quad)\ (\quad)\ (\quad)}{\sqrt{\quad}}\ \left\{\frac{mm\ Hg\ x\ min}{^oC}\right\}$$

WESTON

Date	7-27-94	Time	1100	Stack Therm.	— °F
Auditee	ACE	Auditor	M White	% Error	—
Location	[illegible]	Meter Box No.	1	M_{inlet} Therm.	— °F
P_{bar}	[illegible]	Pretest Y	1.013	% Error	—
$\Delta H_@$	1.99	K'	~~0.~~0.004917	M_{outlet} Therm.	— °F
Audit Device No.	7	ASTM Therm.	— °F	% Error	—
$T_o = 23°C$		Filter Therm.	— °F	Condensor Therm.	— °F
		% Error	—	% Error	—

Orifice gauge reading $\Delta H_@$ in. H_2O	Dry gas meter reading V_i/V_f ft^3	Meter temperatures T_i/T_f inlet	outlet	Duration of run θ min.
2.15	572.810	73		~~10~~ 15.0
	584.370	76		

Dry Gas meter volume V_m, ft_3	Meter temperature average t_m, ft_3	$V_{m_{std}}$ a dry gas meter, ft^3	$V_{m_{std}}$ b orifice meter, ft^3	Percent difference, %	Acceptability
11.560	74.5	11.651	11.535	-1.0	within 5%

a)

Calculate $V_{m_{std}}$ from dry gas meter (English):

$$V_m\,Y\,\frac{17.64\left(P_{bar}+\frac{\Delta H}{13.6}\right)}{(t_m+460°F)} = (11.56)\ (1.013)\ \frac{17.64\left(29.?+\frac{2.15}{13.6}\right)}{(74.5+460°F)}$$

b)

Calculate $V_{m_{std}}$ from critical orifice (metric):

$$\frac{K'P_c\theta}{\sqrt{T_o}} = \frac{(\quad)\ (\quad)\ (\quad)}{\sqrt{\quad}}\ \left\{\frac{mm\ Hg\ x\ min}{°C}\right\}$$

WESTON

Date 7-27-94	Time 1152	Stack Therm. — °F
Auditee ACEI	Auditor MWhite	% Error —
Location [illegible]	Meter Box No. 1	M_{inlet} Therm. — °F
P_{bar} 29.99 = 762 mm	Pretest Y 1.013	% Error —
$\Delta H_@$ 1.99	K' 0.0004917	M_{outlet} Therm. — °F
Audit Device No. 7	ASTM Therm. — °F	% Error —
T_{amb} = ~~23~~ 23°C	Filter Therm. — °F	Condensor Therm. — °F
	% Error —	% Error —

Orifice gauge reading $\Delta H_@$ in. H_2O	Dry gas meter reading V_i/V_f ft^3	Meter temperatures T_i/T_f inlet	outlet	Duration of run θ min.
2.15	586.200	78		10
	593.932	79		

Dry Gas meter volume V_m, ft_3	Meter temperature average t_m, ft_3	V_{m} std a dry gas meter, ft^3	V_m std b orifice meter, ft^3	Percent difference, %	Acceptability
7.732	78.5 (25.8°C)	7.735 ✓	7.690	-0.6%	less than 5%

a)

Calculate $V_{m_{std}}$ from dry gas meter (English):

$$V_m Y \frac{17.64\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{(t_m + 460^\circ F)} = (7.732)(1.013) \frac{17.64\left(29.99 + \frac{2.15}{13.6}\right)}{(78.5 + 460^\circ F)}$$

b)

Calculate $V_{m_{std}}$ from critical orifice (metric):

$$\frac{K' P_c \theta}{\sqrt{T_o}} = \frac{(\quad)(\quad)(\quad)}{\sqrt{\quad}} \left\{\frac{mm\ Hg\ x\ min}{^{\circ}C}\right\}$$

INSTRUCTIONS FOR USE OF ENVIRONMENTAL PROTECTION AGENCY METHOD 5 DRY GAS METER PERFORMANCE TEST DEVICE

OTE: All procedures referred to are from revised Method 5 published in the Federal Register, Volume 12, Number 160, Part II, Thursday, August 18, 1977, pp. 41776-41782 and references contained therein. This revised method should be adhered to in all details in the use of this quality assurance performance device.

QUIPMENT: The participant in this study should possess the following equipment, including the performance test device supplied by EPA.

Quantity	Item
1	Method 5/Source Sampling Meter Box
1	Stopwatch, preferably calibrated in decimal minutes
1	Thermometer, ambient range
1	Barometer. If unavailable, call nearest National Weather Service and request the ABSOLUTE barometric pressure. (Corrected for temperature and acceleration due to gravity, but not corrected for altitude.)
1	Performance Test Device. A calibrated flow orifice housed in quick-connect coupling and identified with an engraved three-digit serial number. **WARNING: THE DEVICE MUST NOT BE DISASSEMBLED UNDER ANY CIRCUMSTANCES.** Use these devices at room temperature.

OCEDURE:

1 Calibration of Vacuum Gauge - The vacuum pressure gauge on the meter box must be calibrated in the range of use (11-22" Hg) against a standard (Hg Manometer) to ensure accurate results.

2 Remove the performance test device from its case and insert it into the gas inlet quick-connect coupling on the source sampling meter box.

3 Turn the power to the meter box on and start the pump.

4 Adjust the coarse flow rate control valve and the fine flow rate control valve to give a reading of 19" Hg (vacuum reading).
CAUTION: The vacuum reading must be accurate and stable for the test period.

5 Allow the orifice and source sampling meter box to warm up for 45 minutes with flow controls adjusted as described in Step 3 before starting quality assurance runs.

PROCEDURE: (continued)

6 Make triplicate quality assurance runs. For each run, record initial and final dry gas meter volumes, dry gas meter inlet and outlet temperatures, internal orifice pressure drop (ΔH), ambient temperature, and barometric pressure. Run duration should be slightly greater than 15 minutes. The following procedure is recommended. Fifteen minutes after a run is started, the participant watches the dry gas meter needle closely. As the needle reaches the zero (12 o'clock) position, the pump and stopwatch are stopped simultaneously. The dry gas meter volume and time are recorded.

This complete run procedure is performed three times to provide the required triplicate quality assurance runs.

7 Calculate the corrected dry gas volume for each run using equation 5.1 of the above-referenced Method 5. For each replicate, record the corrected dry gas volume in dry standard cubic meters, the sampling time in decimal minutes, the barometric pressure in mm Hg, and the ambient temperature in degrees Celcius.

NOTE 1: If you calculate dry gas volume in English Units, use the following conversion factor to obtain the volume in metric units:

1 cu m = 0.02832 cu ft

NOTE 2: If your stopwatch is not in decimal minutes, be sure to convert (e.g. 15 minutes 20 seconds is reported as 15.33 minutes).

8 After recording the requested data on the enclosed data sheet, return the data sheet and the performance test device to:

WESTON

OBSERVATION CHECKLIST FOR REFERENCE METHODS
1-5, 5a-5f, MM5, 8, 12, 13, 17, 101, 101A, 102, 104, and 108

Facility: Cedar Bay Cogeneration Location: ~~Unit~~ Jacksonville, FL

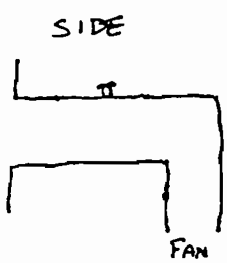
Source: Unit 2 Sampling Location: Fabric Filter outlet

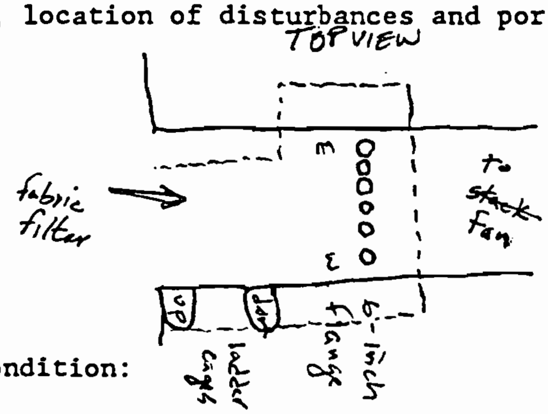
Test Team: ACE Team Leader: Steve Neck

Test Date Interval: Wed. 7 / 27 / 94 to Fri 7 / 29 / 94

Observer: Michael White Affiliation: WESTON

A. Sketch of sample location (if different from pretest report). Include: duct dimensions, location of disturbances and ports, X-section showing sampling points.





1~~12~~2.4 x 106"
4 10-minute points/port
6 ports
240 minutes/run
working west to east starting all the way in and working way out.

B. Stack or duct condition:

1. Material of construction: Brick ____; Concrete ____; ss ____; carbonsteel ✓; other ____

2. External corrosion None

3. Leaks None obvious

4. Internal corrosion unknown

5. Cake or pile up of particulate in sampling port area None seen; removed before test already clear

6. Insulation Metal / Fiberglass; thickness 3/8 (assumed)

7. All ports accessible yes

8. Nipple: a. ID 6 in
b. Length ~ 4' 35.5 measured
c. Capped flange
d. Flush with inside wall unknown
e. Corrosion or particulate cake ____;
removed before test Clear at test time

9. Duct dimensions: Round diameter ___—___
rectangular L ___106___ W ___126.4___
equivalent diameter ______

10. Facilities for movement of sampling train:
Monorail ___—___ Skateboard and rail ___-___
Other ___Manual movement - vertical support with saw-horses___

C. Method 1, 1A sampling points:

1. Distance from nearest upstream disturbance: ______ in., ft
___~1___ diameter.

2. Distance from nearest downstream disturbance: ______ in., ft
___~1___ diameter.

3. Number of sampling points required: ___24___; actual ___24 points___

4. Ports and points at sampling location:
Circular: No. of ports ___N/A___, points/port ______

Rectangular: Grid configuration ___24___ No. of ports ___6___
Points/port ___4___ Points located centroid of area ___yes___

5. First and last traverse point for ducts
>24 in. diameter ≥1.0 inch from wall ___~~NA~~ ok___ yes; ______no
12-24 in. diameter ≥0.5 inch from wall ___NA___ yes; ______no

6. Cyclonic flow verification, ≤20°: ______; ______ average null point angle.
Method used ______

7. Method 1A small duct (4 to 12 in. equivalent diameter). Does standard pitot tube/sampling probe configuration meet the requirements of Figure 1A-1. ___N/A___ Yes ______ No
If not, then are the minimum distance met: ______ Yes ______No

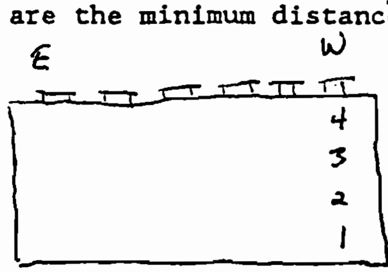


Diagram of sampling/flow measurement location

8. Describe velocity profile of sampling plane.

D. Method 2--Velocity:

1. Pitot tube: type "S" ✓, standard ______, cp ______

2. Type S pitot tube complies with construction requirements yes (Note: check configuration as part of probe (see G-5)).

3. Measurement gauge: manometer ✓, magnehelic —, range(s) 0-10 scale division(s) ______. Has gauge proper sensitivity for - p range being measured yes.

4. Have magnehelic gauges been calibrated against manometers NA

5. Static pressure determination:
   a. Type S pitot tube openings parallel to gas flow N/A
   b. Static pressure tap ______
   c. Manometer type: inclined —, U tube ✓ required
   d. Fluid: gauge oil ______, water ______, mercury ______

6. Temperature measurement: thermocouple on probe ✓ temperature readout digital.

E. Method 3--Dry Mol Weight, Gas; Diluent Concentration;

1. Multipoint ✓, single point —, integrated bag ______ grab sample ✓, other ______, type of bag ______ type of probe SS to teflon

2. Pump: One way squeeze bulb —, diaphragm ✓ other ______, sampling rate LPM Squeeze/min:

3. Configuration of bag in sample train:
   Prior to pump (i.e., M106 train) n/a.
   After the pump (i.e., M-3 train) ✓.

4. Is there a particulate filter in line no

5. Type of condenser Knockout flask

6. Analysis: Orsat ✓ for CO_2, Fyrite —, instrumental ✓ for O_2 from bag line from stack ______

7. Reagents: Fresh OK Expiration date unk.

8. Fuel Bituminous F_o Range Bituminous 1.083-1.230

Expected F_o Ranges

Anthracite/Lignite	1.015-1.130	Natural Gas	1.600-1.836
Bituminous ✓	1.083-1.230	Wood Bark	1.000-1.120
Distillate Oil	1.260-1.413	Municipal Garbage	1.043-1.177
Residual Oil	1.210-1.370	Other______	

9. Analytical audit (when audit gases are available)

N/A

1. Audit cylinder supplied by ________________ vendor ____________
   audit bag supplied by __________________ vendor ______________

2. Sample introduced into analyzer: from cylinder ___ from bag ___

3. Audit results

	Low conc.	High conc.
a. date of last analysis	N/A	N/A
b. cylinder No.		
c. audit gas (es)		
d. balance gas		
e. cylinder construction		
f. cylinder pressure before audit		
g. cylinder pressure after audit		
h. measured concentration % CO_2		
actual (tag) concentration % CO_2		
audit accuracy %		
allowable accuracy %		
(pass) (fail) audit		
i. measured concentration % O_2		
actual (tag) concentration % CO_2		
audit accuracy %		
allowable accuracy %		
(pass) (fail) audit		
j. measured concentration % CO		
actual (tag) concentration % CO_2		
audit accuracy %		
allowable accuracy %		
(pass) (fail) audit		

$$\text{Actual Accuracy} = \frac{\text{Measured Conc.} - \text{Actual Conc.}}{\text{Actual Conc.}} \times 100$$

F. Method 4--Moisture:

1. Estimate of moisture: previous data %

2. Procedure to be used: condenser N/A, impinger set —
wet bulb/dry bulb —, other ______

3. Preliminary run: conducted N/A, estimated ✓

G. Method 5--Particulate:

1. Calibration sheets to be submitted prior to test:

nozzle field, orifice ✓, DGM ✓, pitot tube visual,
thermocouple/thermometers ✓, magnehelic gauge N/A,
filter ID and tare weights N/A,
other —

N/A a. ~~If sheets not available, contact EPA Task Manager for authorization to proceed. Authorization to proceed: yes ____, no ____
Date ______ Time ______ Task Manager ______~~

N/A b. ~~If no DGM Calibration sheets, but "Y" and H@ valves are on console - proceed with field orifice/DGM audit. "Yc" must be withing ± 3% of valve before tests are to commence.~~

2. Nozzle: design buttonhood, material SS.

3. Probe: heated ✓, water cooled No.

4. Probe liner: borosilicate ✓, quartz —,
stainless steel —, Inconel 600 —, Incoloy 825 —,
PTFE —, other —, length 13 ft.

5. a. Pitot tube, nozzle, thermocouple, integrated Orsat line, proper configuration and separation (>3/4" separation) OK

acceptable as witnessed

Bottom view: Showing minimum pitot-nozzle separation.

b. Condition of probe assembly acceptable

6. Particulate collection temperature required:

a. Subpart N/A

b. Probe temperature: (250 ± 25°F), 320 ± 25°F, ≤320°F, other 248 ± 25 °F

c. Filter box temperature: 250 ± 25°F, 320 ± 25°F, ≤320°F, other 248 ± °F

d. Gas filtration temperature measured at back of filter holder: 250 ± 25°F, 320 ± 25°f, ≤320°F, 248 ± 25 °F

e. Other M 101A req

7. Run time/minimum sample volume required 4 hrs target

a. Applicable subpart or method N/A

b. Minimum sample volume required N/A dscf, dscm

c. Minimum run time required 240 minutes

d. Total number of points 24 actual

e. Minutes per point 10 minutes

f. Total run time actual 240 minutes

8. Number of impingers: Four, condenser NO,

Impinger medium: $KMnO_4$, volume in each impinger ~~100~~ TBD 50, 100, 100

Drying medium: Silicagel: ✓, Drierite ______,

Weight triple beam.

9. Barometer: aneroid: ✓, mercury –

Calibrated against: UNK. to observer BP consistant with weather stations

Airport: location N/A, PB N/A, in. Hg sea level or station elevation ______ ft, Sampling location elevation ______ ft, Δ ft ______, Δ in. Hg ± ______ (0.10 in. Hg/100 ft)

10. Control console:
Manufacturer: ACE Model No. ______

a. Unit No.______, orifice ΔH @ ______ Meter "Y" ______ calibration date ______

b. Condition of sampling equipment: designed and fabricated by ACE. sufficient and acceptable.

c. Dry gas meter field check:

- Field audit conducted with calibrated orifice -

Operate metering system for 10 minutes at the ΔH @ value. Record the volume metered, DGM temperature and barometric pressure.

Final: DGM reading ______ ft^3 Temp ______ °F BP ______ in. Hg

Initial: DGM reading ______ ft^3 Temp ______ °F BP ______ in. Hg

Net: V_m = ______ ft^3 Avg T_m = ______ °F + 460 = ______ °R

$$Y_c = \frac{10}{V_m}\left[\frac{0.0319\ (TM + 460)}{BP}\right]^{1/2} = \frac{10}{(\quad)}\left[\frac{0.0319\ (\quad)}{(\quad)}\right]^{1/2}$$

Y_c = 0.97 Y = ______

1.03 Y = ______

Criteria: $0.97\ Y \le Y_c \le 1.03\ Y$, system meets ______ exceeds ______

Units not meeting this criteria should be considered questionable and corrective action initiated. Contact EPA Task Manager.

11. Nomograph/calculator check: not performed

a. Nomograph:

If ΔH @ = 1.80, TM = 100°F, %H_2O = 10% P_s/P_m = 1.00, C = ______ (0.95)

If C = 0.95, TS = 200°F, DN = 0.375, Δp reference = ______ (0.118)

Align Δp = 1.0 with ΔH = 10; and lock nomograph set p = 0.01
Read ΔH ______ (0.01) Nomograph o.k. ______

b. Calculator:

Calculate ΔH/Δp using the following equation:

$$\frac{\Delta H}{\Delta p} = 846.72\ C_p^{\ 2}\ \Delta H@\ \frac{(P_s)\ (T_m)}{(P_m)\ (T_s)}\ \frac{M_{wd}\ (1 - B_{ws})^2}{M_{wd}\ (1 - B_{ws}) + (18B_{ws})}\ D_n^{\ 4}$$

Parameters for calculator check

Item	Dimensions	Given	Calculated
a. Orifice meter coefficient, $\Delta H@$	in. H_2O	1.80	
b. Pitot tube coefficient, C_p	dimensionless	0.84	
c. Abs. stack pressure, $P_s = PB + P_{ST}$	in. Hg	29.96	
d. Abs. meter pressure, $P_m \pm PB$	in. Hg	29.92	
e. Abs. meter temperature, $T_m = t_m + 460$	°R	560	
f. Abs. stack temperature, $T_s = t_s + 460$	°R	760	
g. Dry molecular weight, M_{WD}	lb/lb-mole	30	
h. Moisture content, $B_{ws} = \%H_2O/100$	dimensionless	0.10	
i. Exact nozzle diameter, D_n	in.	0.375	
j. Average velocity head, Δp	in. H_2O	0.1	
k. K factor = $\Delta H/\Delta p$		13.24	(_____)
l. ΔH calc for Δp 0.1	in. H_2O	1.324	(_____)

Calculator equation set-up o.k. ______________

12. Nomograph/calculator setup: Not performed by observer

a.
H@ = _____ | C_p correction factor if C_p = 0.85 ± 0.02
C_p = _____ | $C_p 2/0.85^2$ = ______ C_pC
P_s = _____ | C Factor x C_pC = C_c
P_m = _____ | K Factor: Δp ref = ____; ____ calc. constant
T_m = _____ | Average Δp = _____
T_s = _____ | ΔH calc. = _____
M_d = _____ | Nomograph set up o.k. _____
%M = _____ | Calculator set up o.k. _____
C Factor _____
Dn desired _____, Actual _____ in.

13. Cooling system, impinger ✓, condenser _____, close coupled _____; separate with umbilical line Teflon, heated _____, unheated ✓

14. Impinger contents (1) 50 ml $KMnO_4$ (2) 100 ml $KMnO_4$ (3) 100 ml $KMnO_4$ (4) mt (5) silica gel

15. Silicone grease light

16. Filter medium type glass fiber; Filter No. on filter N/A Yes _____ No

17. Cyclone and flask used (optional) NO

18. Filter holder: Borosilicate glass yes, Other __________

Filter support:

Glass frit with silicon rubber gasket ________, glass frit ________

Stainless steel screen ___________, Neoprene rubber gasket ________

Other Teflon frit Viton o-ring

19. Brushed: Nylon bristles ~~Teflon~~ ______, Other Teflon ______

20. Sample containers: glass ✓, amber ✓, clear ✓ for HCl
polyethylene _____, Teflon _____, Other ______

21. Cap liner: Teflon ✓, Other ______

22. Petri dishes: polystyrene N/A, glass _____, polyethylene _____,
Other ______.

23. Acetone: vendor N/A, catalog No. ______,
type ______, lot no. ______, density, ______,
container ______, blank value ______% (should be
<0.001%)

24. Distilled water ACE provided

H. Additional requirements for methods: 5a-f, MM5, 8, 12, 13, 17, 101, 101A, 102, 103, 104, and 108

1. Method 5a. Asphalt processing and asphalt roofing industry.

N/A

a. Sample gas temperature at exit of filter holder maintained at 108°F ± 18°F (42 ± 10°C).

b. Borosilicate glass sample bottles with Teflon cap liners ______.

c. Glass probe liners ______.

d. 1,1,1-trichloroethane (TCD) reagent grade blank ≤0.001% ______.
Vendor ______, Catalog No. ______.
Lot No. ______, Density ______.

e. Cyclone and flask used ______.

f. Silicone grease TCE resistant ______.

g. Probe, cylinder, filter holder and impingers rinsed with TCE ______.

h. Note if any color or film in impinger catch ______.

2. Methods 5b and 5f. Nonsulfuric acid particulate matter.

N/A a. Gas temperature at probe exit and filter holder exit shall be maintained at 160°C ± 5°C (320°F ± 25°F).

N/A 3. Method 5c. To be added when promulgated.

N/A 4. Method 5d. Positive pressure fabric filters.

a. Method 1 siting criteria are usually not amenable. Use procedures as delineated in Section 4.1.2.

b. Short stack: Extension added ______
Egg crate straightening vanes installed ______.

N/A

c. Min. sample time 240 min ______

5. Method 5e

a. Min sample time 120 min ______

N/A b. Min sample volume to be collected 2.55 ____ dscm, 90 ____ dscf

c. Gas temperature exiting filter holder 120 ± 14°C (248 ± 25°F)

d. Impinger collection medium 0.1N NaOH ______

Recovery

a. Glass sample bottles ______

b. Glass funnels ______

N/A c. Rinse probe, nozzle, front of filter holder with water. Do not brush ______, separate sample ______.

d. Subsequent to step c rinse, brush with acetone, separate sample ______

e. Measure liquid volume or weight at all three impingers. Rinse three times with 0.1 N NaOH. Place rinsings and impinger contents in same sample container.

f. Use new acetone free impingers for each run. Do not reuse acetone washed impingers from previous runs ______.

6. Method MM5

a. Protocol followed: ASME dioxin ______, SW846 0010-SV______

b. 1. Minimum volume required ______ ft^3, M^3

N/A 2. How calculated, i.e.,

$$M^3 = MDL\ ng \times \frac{1}{\frac{\%}{100}} \times \frac{1}{R} \times \frac{1}{C} = (\qquad) \frac{1}{(\quad)} \left(\frac{1}{\quad}\right) \left(\frac{1}{\quad}\right) =$$

MDL = Analytical MDL in ng

% = % used for analysis of final sample

R/100 = % recovery

C = ng/m^3 expected in dry flue gas

$M^3 \times 35.31 = ft^3$ = ______ x 35.31 = ______

c. 1. Run time required __________ min

2. Run time =

$$\frac{\left(\frac{\overline{\Delta H} \text{ sampling}}{\Delta H@}\right)^{1/2} \times 0.75 \text{ dscfm} \times \left(\frac{528}{29.92} (x) \frac{P_s}{T_M}\right)^{1/2}}{V_{mstd}} = 0 \text{ min}$$

N/A

$$\frac{\left(\overline{\qquad}\right)^{1/2} \times (0.75) \left[\frac{528}{29.92} \left(\overline{\qquad}\right)\right]^{1/2}}{(\qquad)} = \text{min}$$

T_m = estimated meter temp = ________

$\Delta H@$ = $\Delta H@$ of meter console = __________

P_s = PB ± PST = _____ ± _____ = ________

$\overline{\Delta H}$ = estimated ΔH average = _______

V_{mstd} = volume required = _________ ft^3

d. Umbilical between filter and condensor: length _________, heated to 120°C (250°F) _________, Teflon lined ____________, glass close coupled ____________.

e. Filter gasket is Teflon __________.

f. All connections grease free _________.

7. Method 8. H_2SO_4 Mist, SO_3 and SO_2.

a. Reagents

N/A

1. Isopropanol 80% passes KI test __________________.

2. Hydrogen peroxide 3% _______, 6% ______, 10% __________.

b. Sampling train

1. Fossil fuel fired steam generators

N/A

a. Heated filter at 320°F between probe and first impinger ______________.

b. Glass fiber filter between first and second impingers.

c. Glass lined probe heated to 320°F ________________.

d. Sample rate ≤1 cfm _________.

2. Sulfuric acid plants.

   a. Glass lined probe heated to prevent condensation ______________.

   b. Glass fiber filter between first and second impinger ____________.

   c. Sample rate ≤1 cfm ______________.

n/a

c. Impinger module

Impinger No.	Type	Medium	Volume/wt
1	Standard GS	80% IPA	100 mL
2	Modified GS	H_2O_2	100 mL
3	Standard GS	H_2O_2	100 mL
4	Modified GS	Empty	------
5	Modified GS	Silica gel	200 gm

n/a

d. For moisture determination impingers are weighed prior to and after each run __________________.

n/a

e. Post test

1. After final leak check, drain ice bath and purge the train with SO_2 free air for 15 min at average flow rate ______.

2. Sample recovery

   a. IPA and filter between impingers in same bottle ______________. Rinse probe and front FH with 80% IPA and add to container.

   b. Second and third impinger content collected. Separately ______________, together ____________________ Rinsed with distilled water ____________________

8. Method 12 Lead. Same as M-5 with the following additions:

a. Impinger medium, 0.1N HNO_3 ______________________________

b. Filter same as for M-5 with assay for Pb ______________________

c. Borosilicate glass containers ______________________________

d. Probe, nozzle and front half of filter holder rinse with 0.1N HNO_3 ______________________________

e. Impingers and connecting glassware rinsed with 0.1N HNO_3

f. Filter and 0.1N HNO_3 blank collected ______________________

n/a

9. Method 13 Fluoride. Same as M-5 with the following additions:

a. Filter location: between probe and impingers ____________, between impingers 3 and 4 _________.

b. Filter support screen: between probe and impingers; must be 20 mesh stainless steel screen ______________________________

N/A

c. Filter:

1. Between probe and impingers DO NOT USE GLASS FIBER Whatman No. 1 ____________; membrane filter ____________, type ________________ must withstand up to 275°F, (135°C) ____________________

2. Low F blank: determined prior to test program ___________ ($\leq$0.015 mg F/cm^2) ______________ g filter.

3. Meets collection efficiency of 95% DOP 0, 0.3 um _________

4. Between impingers 3 and 4 must be Whatman No. 1 __________

d. Filter box temperature--hot enough to prevent condensation on filter but not to exceed 248 ± 25°F (120 ± 14°C) _____________

e. Sampling rating not to exceed 1 CFM (281 pm) _______________

f. Impinger medium: distilled deionized water, low F blank ______________

g. Recovery

1. Sample bottles--DO NOT USE GLASS, must be either polyethylene _____________, polypropylene _______________

2. Probe and impingers rinsed with distilled deionized water ___________________

3. Impinger catch/rinse and probe rinse combined ___________, separate _________________

4. Filter: recovered separately ____________, added to probe wash ____________, added to impinger catch and wash samples ______________.

5. Blank filter and water collected: Combined ________________, separate _____________________

10. Method 17 Instack Filter.

a. Filter holder: stainless steel _________, glass ____________

b. Glass fiber filter: MAT _______, thimble _______, type _______

c. Leak check and train after in stack filter holder with nozzle plugged and preheated in gas stream for at least 5 min. Retighten if necessary to pass leak check.

1. Filter holder temp. stabilization time ______________ min

2. Leak check at stack temp. ____________ o.k.

N/A

d. Filter holder instack at all times during sampling ____________ (Note: Must not be out of stack at point nearest port.)

e. Check cross section blockage by filter holder probe assembly. Criteria ≤5%. Actual __________________.

Area of probe and filter holder with nozzle and pitot tube at duct centerline - PA ___________, duct area, DA - ____________ Percentage blockage - PA/DA x 100 - _________________ of stack

f. Temperature operational limit--do not exceed limit set forth in applicable subpart, e.g., Subpart BB recovery boiler--400°F (205°C) Subpart __________________, temperature ______________

11. Method 101 Mercury from chlor-alkalai plants. (Checks are the same as Method 5 with the following additions:)

1. Precleaning: All glass train components rinsed with 50% HNO_3, tap water, 0.1 M ICl, tap water, distilled deionized water as stated by ACE

2. Glass components required: probe ✓, sample containers ✓, impingers and connections ✓, funnel ✓, graduated cylinder ✓, wash bottles (Teflon optional) ✓.

N/A 3. Impinger contents: 1, 2, and 3. 100 mL 0.1 M ICl ___________.
4. Silica gel __________________.

4. Recovery

a. Recovery area free of mercury contamination ______________

n/A b. Rinse probe with 2-50 mL portions of 0.1 M ICl ______________

c. Rinse entire train with DDI water (≤200 mL) ______________

d. Blanks collected ______________.

12. Method 101A. Particulate and gaseous mercury from sewage sludge incinteration.

a. Sampling train as M-101. ✓

b. Absorbing reagent 4% $KMnO_4$ w/v in 10% H_2SO_4 ✓ daily.

c. Precleaning--all glass components rinsed with 50% HNO_3, tap water, 8N HCl, then distilled deionized water O-yes. Prior to each run KMnO4, DI rinse prior to each run. Same glassware each run

d. Impinger absorbing reagent volumes 50, 100, 100, mL one 50mL, two 100 mL, Run 1 ✓, Run 2 ✓, Run 3 ✓.

e. Recovery:

1. All glass sample bottles and graduated cylinders precleaned as above, prior to and between runs yes.

2. All components rinsed with 250-400 mL 4% $KMNO_4$ yes.

3. If brown residue on impinger walls, rinse with 8N/HCl ______ Rinse ~~added to impinger contents~~ Kept separate.

4. Filter placed in Front half sample bottles and 20-40 mL Fresh $KMNO_4$ added Run 1 ✓, Run 2 ✓, Run 3 ______.

13. Method 102 Hydrogen Streams

n/A a. Velocity reading converted from hydrogen to air stream ______.

b. ΔH reading corrected from air to hydrogen ______________.

14. Method 104 Beryllium
(Checks are the same as those for Method 5 with the following additions)

1. Precleaning: All glass components acid (1:1 V:V, HCl:water) soaked for 2 hours. If glassware is out of use for more than 2 days between runs, repeat precleaning ______________.

2. Glass components required: Probe ______________________,
Filter holder ______________, Graduated cylinder ______________,
Funnels __________________, Sample containers ________________.

N/A

3. Recovery: Enitre train rinsed with water and acetone ________.

15. Method 108 Arsenic.

1. Gas stream temp. exit filter holder 250 ± 25°F.

2. Recovery 0.1N NaOH--wash probe and impingers.

3. Polyethylene/polypropylene sample containers.

16. General notes:

Facility cedar bay Cogeneration
Source unit 2 B
Sampling Location Fabric filter outlet
Process Conditions Full load

I. Test Run Observations

-- denotes missed witnessing that item
R - Recommended
M - Mandatory

Item		Test Run 1	Test Run 2	Test Run 3	Test Run 4
Date		7/27	7/28	7/29	
Test team run code No.		7/27			
1. Train set up	filter ID	N/A	N/A	N/A	
	filter weight	N/A	N/A	N/A	
	filter checked for holes	no	--	--	
	filter centered	--	--	--	
	nozzle no.	.250	.25	.25	
	nozzle clean	yes	yes	yes	
	nozzle damaged (in.)	NO	NO	~~yes~~ NO	
	nozzle undamaged	OK	OK	OK	
	probe liner clean	yes	yes	yes	
	probe markings correct, measured	--	yes	yes	
	probe heated along entire length, ft	13 ft	13	13	
	impingers charged	yes	yes	yes	
	impingers iced	yes	yes	yes	
	meter box leveled	yes	yes	yes	
	pitot manometer zeroed	--	yes	--	
	orifice manometer zeroed	--	yes	--	
	filter box or holder at temp.	yes	yes	yes	
	all ball joints lightly greased	--	yes	yes	
	all openings capped	yes	yes	yes	
2. Train leak check at nozzle: ($\leq$0.02 cfm @ 15 in. Hg initial. Intermediate and final at highest Vacuum during test run.) Conduct for 1 min	initial (R) LC CFM	--	pass	pass	
	initial (R) VAC in. Hg	--	15	--	
	intermediate (R) LC	--	--	--	
	intermediate (R) VAC	--	--	--	
	intermediate (R) LC	--	--	--	
	intermediate (R) VAC	--	--	--	
	intermediate (R) LC	--	--	--	
	intermediate (R) VAC	--	--	--	
	final (M) LC	pass	pass		
	final (M) VAC	--	--		
3. Pitot lines leak check: (hold 3 in. H_2O on manometer for 15 sec.)	initial positive line (R)	--	pass	pass	
	initial negative line (R)	--	pass	pass	
	final positive line (M)	--	pass	--	
	final negative line (M)	--	pass	--	
	pitot tube undamaged	yes	yes	yes	

Date

R - Recommended M - Mandatory Test team run code No.	Test Run 1	Test Run 2	Test Run 3	Test Run 4
4. M-3 bag initial leak check (M) line check Tedlar bag: should hold 2 to 4 in. H_2O pressure for 10 minutes or	OK	OK	OK	
zero flow meter reading on continuous evacuation or	--	--	--	
Completely fill bag and let stand overnight--no deflation.	N/A	N/A	N/A	
M-3 sampling train check: M-3 config. initial (M)	OK	OK	OK	
(should hold 10 in. vacuum final (M)	--	--	--	
for 1/2 min.)	--	--	--	
M106 config. zero flow	N/A	N/A	N/A	N/A
Purge sample train with stack gas	OK	OK	OK	
Constant rate sampling 1pm	N/A	OK	OK	
5. Clock time test started All times approximate				
(7/27)(7/28)( )( ) port start	~1300	~0900	0932	
1 W1 W1 end	1340 ~~1400~~	0940	1019	
(7/27)(7/28)( )( ) port start	~1340	940	1019	
2 W2 W2 end	~1420	1020	13--	
(7/27)(7/28)( )( ) port start	~1420	1100	--	
3 W3 W3 end	~1500	1140	--	
(7/27)(7/28)( )( ) port start	~1500	1140 ~~1220~~	--	
4 E3 E3 end	~1540	1220 ~~1300~~	--	
(7/27)(7/28)( )( ) port start	~1540	1220 ~~1340~~	--	
5 E2 E2 end	~1600	1300	--	
(7/27)(7/28)( )( ) port start	~1640	1300 ~~1340~~	--	
6 E1 E1 end Actual	1722	~~1400~~	~1710	
Net sampling time minutes	240	240	240	
Minimum sampling time of 240 minute met	yes	yes	yes	
6. Dry gas meter volume: (W1) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
(W2) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
(W3) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
(W4) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
(W5) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
(W6) ( ) ( ) ( ) port initial	--	--	--	
final	--	--	--	
Net sample volume ft				
Minimum sample volume of ____ dscf collected				

Date R - Recommended M - Mandatory Test team run code No.	Test Run 1	Test Run 2	Test Run 3	Test Run 4
7. Train operation during run — Nozzle changed during run - NOT ALLOWED	yes	yes	yes	
pitch and yaw of probe o.k.	yes	yes	yes	
nozzle not scraped on nipple 36 in. nipple - difficult	yes	yes	yes	
effective seal around probe - 24 in. - difficult	yes	yes	yes	
probe moved at proper time	yes	yes	yes	
probe heated	ok	--	yes !	
calculator constants or nomograph changed when TS and/or TM changes significantly	-- ok	OK	OK	
average time to set isokinetics after probe moved to next point Min	<1.0	<1 min	<1 min	
Average values: impinger temperature <68°F	-- n/a	ok	ok	
XAD Module <68°F	N/A	N/A	N/A	
probe temperature: 250 + 25°F, 320 + 25°F, °F	N/A	N/A	N/A	
highest meter vacuum in Hg	~12	~15	~13	
Post filter gas stream temperature 250°F + 25, <320°F, 320 + 32°F, °F	N/A	N/A	N/A	
Filter box temperature 320 + 25°F, 250°F + 25, <320°F, °F circle one	ok	ok	OK	
stack temperature	330	380		
barometric P taken and value	29.97	29.94		
was probe ever disconnected from filter holder while in stack?	No	NO	No	
was filter changed during run?	NO	NO	NO	
Check on sample volume collected per point or port	NO	NO	NO	
was silica gel changed during run?	NO	NO	NO	
was any particulate lost?	NO	NO	NO	
Accurate reading or setting of Δp	OK	OK	OK	
ΔH	OK	OK	OK	
meter temperature	OK	OK	OK	
stack temperature	OK	OK	OK	
meter vacuum	OK	OK	OK	
time per point	OK	OK	OK	
impinger temperature	OK	OK	OK	
filter box temperature	OK	OK	OK	

Date

R - Recommended M - Mandatory Test team run code No.		Test Run 1	Test Run 2	Test Run 3	Test Run 4
8. Post test:	- All openings sealed	OK	OK	oK	
	- recovery area clean sheltered	OK	OK	oK	
	- filter handled with gloves, forceps	OK	OK	--	
	- petri dish sealed, labeled	N/A	N/A	N/A	
	- any sample lost	drops	None	none	
	- color of collected water, soln.	KMnO4	KMnO4	KMnO4	
	- opacity of collected water, soln.	dark	dark	dark	
	- water measured mL gms	~300	~300	~300	
	- silica gel weighed, net gms	~50	~50	~50	
	- condition - color	good	good	good	
	% spent	75	75	75	
	- probe cooled sufficiently	yes	yes	yes	
	- nozzle removed and brushed	yes	yes	yes	
	- probe brushed 6 times 3x	yes	yes	yes	
	- nozzle brushes clean	yes	yes	--	
	- wash bottles clean Kept in zip lock bag	yes	yes	yes	
	- acetone clean	N/A	N/A	N/A	
	- M-8 15 minute purge	N/A	N/A	N/A	
	- water/solution clean	yes	yes	yes	
	- blank taken: acetone, water, other	yes	yes	yes	
Probe brush and extension clean.		yes	yes	yes	
Sample containers:	Clean	yes	yes	yes	
	Capped	yes	yes	yes	
	Labeled tape label	yes	yes	yes	
	Sealed teflon tape	~~no~~/yes	~~no~~/yes	~~no~~/yes	
	Liquid level marked	yes	yes	yes	
Filter	Color of material	light brown	light	light	
	Material thickness	minor	minor	minor	
Probe Wash	Color of liquid	KMnO4	KMnO4	KMnO4	
	Color of particulate	KMnO4	None	none	
	Amount of particulate	minor	minor	minor	
9. Post test Orsat Analysis of integrated bag sample Orsat analyzer - Analyzer leak check (levels should not fall below cap. tubing and not more than 0.2 mL in burrette for 2 min.)	Initial (M)	—	—	—	
	Final (M)	—	—	—	
Orsat samples:	Each bag analyzed 3 times	--	--	--	
	% CO_2 agrees within 0.2%	--	--	--	
	% O_2 agrees within 0.2%	N/A	N/A	N/A	
	% CO agrees within 0.2 %	N/A	N/A	N/A	
Analysis at end of test. Orsat analyzer checked against air (20.9 + 0.3)		N/A	N/A	N/A	

Date

R - Recommended
M - Mandatory

Test team run code No.	Test Run 1	Test Run 2	Test Run 3	Test Run 4
Orsat Analysis: CO_2 %	Not calculated --	--	--	
O_2 %	--	--	--	
CO%	--	--	--	
$Fo = \left(\frac{20.9 - \% O_2}{\% CO_2}\right)$	--	--	--	
	--	--	--	
Fuel	--	--	--	
F_o range for fuel	--	--	--	
Orsat analysis valid	--	--	--	
Orsat solutions changed when calculated F_o exceeds fuel type range	N/A	N/A	N/A	
10. All samples locked up	yes	yes	yes	
All sampling components clean and sealed	yes	yes	yes	
All data sheets submitted to observer	yes	yes	yes	
- Orsat	N/A	N/A	N/A	
- Run sampling data sheet	yes	yes	yes	
- Particulate recovery	N/A	N/A	N/A	
- Process data	N/A	N/A	N/A	
- Charts	N/A	N/A	N/A	
- Calibration sheets	yes	yes	yes	
Observer signed and dated all data sheets	No	NO	NO	
- Visible emissions evaluation conducted by M-9 and sheets submitted	N/A	N/A	N/A	
Opacity, average M-9/transmissometer	N/A	N/A	N/A	
Run Isokinetics calculated by team or observer	yes	yes	~~No~~/yes	
Run Isokinetics %	108	98	102	

Check on volume pulled per port or point

Not calculated by observer

$$\left(\frac{\Delta H}{\Delta H@}\right)^{1/2} (0.75 \text{ dscfm}) \; \frac{29.92}{528} \left(\frac{TM + 460}{PM + \;\; H/13.6}\right)^{1/2} (\theta \text{ min}) = \_\_\_\_ \text{ ft}^3$$

Meter volume end ______________

Meter volume start ____________

Net ft^3 ____________________

Sample ft^3 approximately calculated ft^3 Yes _____, No _____

1. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

2. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

3. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

4. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

5. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

6. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

7. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

8. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

9. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

10. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

11. $\left[\_\_\_\right]^{1/2} (0.75) \left[\frac{29.92}{528} \;\; \_\_\_\_\right]^{1/2}$ _____ min = ______ ft^3

J. NOTES: Care should be taken, when sampling for organic compounds, to follow stringent quality control guidelines to avoid contamination of the sample and sampling train. Take note of any occurrences which could bias the sample in any manner.

Include: (1) General comments; (2) Changes to pretest agreement with justification; (3) Any abnormal occurrences during test program. (Additional page(s) attached: Yes ______, No ✓ .)

Run 1: No significant problems noted during field effort. Some initial concerns over in-leakage from ambient air for 1st port. Reconfigured duct sealing method to resolve issue. Observed what may have been port scraping on filter.

Run 2: No major problems encountered. Questions of probe heat during last port. More particulate than expected

Run 3: ~~Cracked probe~~ Probe won't heat. Replaced. Cracked tip. Return to original probe - heat OK - Rain delay. No further problems noted during testing.

General Comments

ACE's technical staff appeared thorough and capable. The trailer and equipment were adequate for the job. Only one significant delay in 3 days is quite good considering the duct configuration. The team was committed to "doing whatever it takes" to complete the task in a quality conscientious manner. Several innovative techniques were noted

Michael O. White — Signature of Observer

WESTON — Affiliation of Observer

7/29/14 — Date

______ Signature of Team Representative

______ Date

during the testing. Data sheets were clear and legible. No major deviations to the reference method were noted. Stainless steel nozzle and unheated flexline from filter to impingers is permitted.

APPENDIX E

UNIT 2 OPERATIONS DATA

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 27 JUL 94

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	O004Z921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
00:10	85.294	658.96	284.23	4.750	350.70	42.904
00:20	85.269	662.86	284.79	5.020	353.60	41.962
00:30	85.107	664.07	285.32	5.330	350.10	39.747
00:40	85.387	665.19	285.13	5.360	349.20	40.787
00:50	85.205	665.18	285.70	5.650	350.50	41.327
01:00	85.471	666.08	286.16	6.020	350.60	41.337
HOUR 1	------	------	------	------	------	------
AVERAGE	85.289	663.72	285.22	5.355	350.78	41.344
01:10	84.911	661.82	285.13	6.340	351.20	40.742
01:20	84.937	661.06	284.46	6.750	343.70	40.468
01:30	84.850	660.02	284.43	7.040	348.30	39.874
01:40	85.049	660.62	284.51	7.500	349.60	39.724
01:50	84.804	658.29	283.93	7.840	352.60	39.176
02:00	84.805	657.03	283.55	8.210	353.80	38.579
HOUR 2	------	------	------	------	------	------
AVERAGE	84.893	659.81	284.33	7.280	349.87	39.761
02:10	84.911	654.93	283.68	8.580	357.60	38.152
02:20	84.486	654.65	284.27	9.000	355.40	38.345
02:30	83.551	651.34	282.29	9.250	349.00	37.728
02:40	80.632	622.87	278.23	8.800	350.00	32.363
02;50	80.589	630.49	278.73	8.850	348.30	33.551
03:00	80.453	625.59	277.59	9.300	347.20	32.872
HOUR 3	------	------	------	------	------	------
AVERAGE	82.437	639.98	280.80	8.963	351.25	35.502

03:10	79.967	614.55	275.09	8.950	347.90	29.983
03:20	78.949	618.73	275.05	8.970	355.10	28.620
03:30	78.929	624.56	275.46	9.140	358.30	28.458
03:40	78.821	620.29	274.87	9.320	353.40	27.156
03:50	78.186	623.29	275.40	9.560	349.00	27.980
04:00	76.135	609.55	273.89	9.460	341.30	25.500
HOUR 4	------	------	------	------	------	------
AVERAGE	78.498	618.50	274.96	9.233	350.83	27.949
04:10	76.082	609.79	274.42	9.690	339.80	26.740
04:20	76.237	609.44	273.97	6.420	343.10	27.389
04:30	76.036	608.68	273.87	5.460	347.10	27.533
04:40	76.070	609.67	273.85	5.500	352.80	27.785
04:50	76.291	609.63	273.64	4.670	351.70	27.503
05:00	77.921	623.56	274.99	3.100	359.10	29.961
HOUR 5	------	------	------	------	------	------
AVERAGE	76.439	611.79	274.12	5.807	348.93	27.819
05:10	81.395	640.65	278.42	3.410	368.50	33.187
05:20	83.978	663.42	281.07	3.650	370.50	37.181
05:30	84.291	667.73	282.25	3.900	363.40	37.021
05:40	84.544	665.44	280.07	4.050	361.80	36.045
05:50	86.473	669.51	279.49	4.520	365.70	35.785
06:00	87.518	677.16	280.87	4.900	361.60	36.885
HOUR 6	------	------	------	------	------	------
AVERAGE	84.700	663.98	280.36	4.072	365.25	36.017

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 27 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW O004Z921 ACFM
06:10	87.830	662.57	281.04	4.990	378.60	34.258
06:20	87.866	664.22	281.50	4.020	375.50	34.591
06:30	87.872	662.79	280.96	4.170	370.30	34.412
06:40	87.811	657.96	280.02	4.430	369.20	34.419
06:50	87.476	654.57	278.78	4.730	368.40	34.526
07:00	87.865	657.84	278.86	5.190	365.70	33.590
HOUR 1	------	------	------	------	------	------
AVERAGE	87.787	659.99	280.19	4.588	371.28	34.299
07:10	87.794	655.56	278.46	5.460	369.90	33.514
07:20	87.898	657.22	278.20	4.470	366.40	33.295
07:30	87.737	660.78	278.45	4.340	365.70	33.729
07:40	87.897	656.81	278.06	4.880	366.10	33.148
07:50	87.981	656.79	278.82	5.430	360.60	33.309
08:00	87.767	657.35	279.34	4.890	354.90	33.053
HOUR 2	------	------	------	------	------	------
AVERAGE	87.846	657.42	278.55	4.912	363.93	33.341
08:10	87.756	655.01	279.20	4.130	354.30	30.790
08:20	87.900	659.99	280.24	4.420	350.00	29.472
08:30	87.654	656.83	280.31	4.930	346.50	29.998
08;40	88.004	658.95	280.96	4.390	347.40	30.947
08:50	87.952	655.94	279.42	4.560	345.50	29.138
09:00	88.100	659.68	280.64	4.770	341.20	29.940
HOUR 3	------	------	------	------	------	------
AVERAGE	87.894	657.73	280.13	4.533	347.48	30.048

09:10	88.110	662.37	281.19	4.990	347.50	31.120
09:20	87.944	661.48	281.35	5.660	338.30	31.367
09:30	87.834	662.50	281.54	4.320	344.90	31.862
09:40	88.063	660.91	281.38	3.490	345.00	32.133
09:50	87.830	658.87	280.83	3.600	345.00	32.195
10:00	87.791	658.48	280.61	3.810	351.70	32.621
HOUR 4	------	------	------	------	------	------
AVERAGE	87.929	660.77	281.15	4.312	345.40	31.883
10:10	88.260	663.35	281.28	3.980	348.70	33.889
10:20	88.264	663.25	280.99	4.240	351.40	34.162
10:30	88.509	664.16	281.11	4.510	350.80	34.448
10:40	88.147	663.48	280.81	4.760	347.00	34.683
10:50	88.429	665.47	280.75	5.020	348.60	34.795
11:00	88.319	662.22	280.30	5.480	352.60	34.232
HOUR 5	------	------	------	------	------	------
AVERAGE	88.321	663.65	280.87	4.665	349.85	34.368
11:10	88.316	664.87	280.39	4.480	356.30	34.805
11:20	88.205	665.03	280.57	3.530	356.70	34.845
11:30	88.283	664.72	281.17	3.660	354.90	34.903
11:40	88.322	665.50	280.39	3.930	357.10	35.258
11:50	88.434	664.88	280.91	4.100	356.00	35.257
12:00	88.303	665.63	281.57	4.340	356.00	35.530
HOUR 6	------	------	------	------	------	------
AVERAGE	88.310	665.10	280.83	4.007	356.17	35.100

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 27 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW O004Z921 ACFM
12:10	88.303	665.63	281.57	4.340	356.00	35.530
12:20	88.390	664.84	281.69	4.610	360.10	35.901
12:30	88.278	664.08	282.31	4.820	358.00	35.954
12:40	88.329	663.40	282.47	5.090	359.00	36.408
12:50	88.268	663.36	282.07	5.350	359.40	36.861
13:00	88.556	662.78	282.22	4.130	360.90	37.118
HOUR 1	------	------	------	------	------	------
AVERAGE	88.354	664.02	282.06	4.723	358.90	36.295
13:10	88.194	664.48	283.54	3.500	360.60	37.599
13:20	88.240	665.74	284.77	3.730	358.90	38.186
13:30	88.455	666.44	284.41	3.950	365.70	38.403
13:40	88.182	665.66	284.15	4.070	360.90	38.239
13:50	88.184	666.99	284.09	4.360	360.00	38.485
14:00	88.734	665.82	282.91	4.540	359.30	38.215
HOUR 2	------	------	------	------	------	------
AVERAGE	88.331	665.85	283.98	4.025	360.90	38.188
14:10	88.342	665.88	283.50	4.750	362.30	38.351
14:20	88.408	664.27	282.78	4.990	356.30	38.210
14:30	88.266	663.75	282.99	5.530	360.10	38.320
14;40	88.278	664.84	282.55	4.550	355.00	38.687
14:50	88.362	662.02	282.08	3.540	358.70	38.653
15:00	88.405	662.52	281.64	3.600	354.90	38.832
HOUR 3	------	------	------	------	------	------
AVERAGE	88.344	663.88	282.59	4.493	357.88	38.509

15:10	88.332	664.94	282.01	3.810	366.00	39.311
15:20	88.388	661.85	281.52	4.020	356.90	39.119
15:30	88.249	664.75	281.51	4.140	361.90	39.456
15:40	88.295	662.31	281.36	4.430	362.90	39.077
15:50	88.370	663.53	281.58	4.640	354.90	39.239
16:00	88.306	662.76	282.21	4.880	358.90	39.070
HOUR 4	------	------	------	------	------	------
AVERAGE	88.323	663.36	281.70	4.320	360.25	39.212
16:10	88.406	659.64	281.28	5.060	362.90	38.562
16:20	88.167	659.09	281.85	5.400	360.70	38.538
16:30	88.399	658.09	281.70	4.060	358.60	38.323
16:40	88.345	658.38	281.88	3.550	352.00	38.211
16:50	88.374	657.81	280.78	3.780	358.00	38.248
17:00	88.208	656.93	280.46	3.960	356.70	38.020
HOUR 5	------	------	------	------	------	------
AVERAGE	88.316	658.32	281.32	4.302	358.15	38.317
17:10	88.110	658.03	280.69	4.100	359.00	38.425
17:20	88.383	657.56	280.30	4.350	356.40	39.361
17:30	88.347	657.08	279.99	4.500	355.10	40.108
17:40	88.171	655.04	279.96	4.680	354.30	40.135
17:50	88.222	655.20	279.58	4.850	352.90	40.473
18:00	88.449	656.54	280.09	5.040	352.50	40.792
HOUR 6	------	------	------	------	------	------
AVERAGE	88.280	656.58	280.10	4.587	355.03	39.882

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT

27 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW 0004Z921 ACFM
18:10	88.309	654.77	279.90	5.610	352.20	41.185
18:20	88.347	654.95	280.87	4.330	350.40	41.676
18:30	88.254	657.02	280.88	3.460	350.60	41.768
18:40	87.999	659.43	280.99	3.560	351.50	42.273
18:50	87.408	657.62	281.12	3.760	352.00	43.420
19:00	87.361	653.91	281.09	4.000	343.70	44.719
HOUR 1	------	------	------	------	------	------
AVERAGE	87.946	656.28	280.81	4.120	350.07	42.507
19:10	87.311	653.15	280.65	4.140	341.70	44.844
19:20	87.253	653.30	280.91	4.310	346.80	44.707
19:30	87.405	650.31	281.04	4.510	346.10	45.044
19:40	87.289	651.80	281.55	4.700	344.70	45.719
19:50	87.468	654.77	282.18	4.880	343.80	46.453
20:00	87.543	654.04	282.27	5.020	342.60	46.351
HOUR 2	------	------	------	------	------	------
AVERAGE	87.378	652.98	281.43	4.593	344.28	45.520
20:10	87.299	652.03	281.35	5.470	344.70	46.127
20:20	87.326	657.14	282.55	4.620	346.10	46.242
20:30	87.445	659.23	283.05	3.710	342.70	46.295
20:40	87.303	655.73	282.38	3.650	347.10	45.959
20:50	87.508	655.68	281.80	3.800	347.30	45.993
21:00	87.418	654.12	281.42	3.970	346.30	45.816
HOUR 3	------	------	------	------	------	------
AVERAGE	87.383	655.65	282.09	4.203	345.70	46.072
21:10	87.282	655.84	282.34	4.150	344.00	45.587
21:20	87.317	656.85	282.80	4.410	344.90	45.901
21:30	86.942	655.75	281.98	4.450	344.70	46.981
21:40	87.474	654.61	283.73	4.560	341.90	46.699
21:50	87.297	659.60	284.26	4.710	343.70	46.009
22:00	87.581	659.30	284.12	4.910	346.50	43.858
HOUR 4	------	------	------	------	------	------
AVERAGE	87.315	656.99	283.20	4.532	344.28	45.839
22:10	86.909	661.63	284.77	5.410	347.60	43.850
22:20	86.363	648.16	282.63	4.160	344.20	42.146
22:30	86.589	654.91	283.00	3.490	344.70	43.322
22:40	86.557	651.79	282.85	3.640	343.60	40.757
22:50	86.528	650.35	282.65	3.810	344.50	41.430
23:00	86.391	651.04	283.13	4.020	345.50	42.268
HOUR 5	------	------	------	------	------	------
AVERAGE	86.556	653.06	283.17	4.088	345.02	42.296
23:10	86.346	651.75	282.35	4.220	345.50	43.443
23:20	86.281	650.07	282.67	4.290	348.50	43.767
23:30	86.431	653.49	282.90	4.540	347.50	43.819
23:40	86.496	649.77	281.79	4.670	347.10	44.596
23:50	86.349	653.54	282.46	4.890	347.00	44.874
00:00	86.331	650.43	282.73	5.060	345.40	45.148
HOUR 6	------	------	------	------	------	------
AVERAGE	86.381	651.51	282.57	4.612	346.83	44.275

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC		FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW 0004Z921 ACFM
00:10	86.363	645.92	281.95	5.510		347.50	45.932
00:20	86.258	648.25	282.07	4.440		344.10	46.045
00:30	86.598	653.16	282.85	3.560		345.90	40.505
00:40	86.406	651.48	282.49	3.660		347.90	42.117
00:50	86.375	650.43	282.13	3.830		345.80	43.771
01:00	86.433	650.85	282.20	3.990	soot blow	348.60	44.675
HOUR 1	------	------	------	------	12:30	------	------
AVERAGE	86.405	650.02	282.28	4.165		346.63	43.841
01:10	86.438	651.08	282.50	4.260		347.70	44.985
01:20	86.459	649.04	282.38	4.440	soot blow	348.40	45.439
01:30	86.357	653.80	281.72	4.730	1:15	351.10	44.987
01:40	86.415	654.01	282.09	4.960		346.10	44.037
01:50	86.566	652.43	281.60	5.490		340.10	44.527
02:00	86.617	649.59	281.15	4.550		341.50	45.384
HOUR 2	------	------	------	------		------	------
AVERAGE	86.475	651.66	281.91	4.738		345.82	44.893
02:10	86.638	653.46	281.66	3.760		340.10	46.241
02:20	86.156	652.75	280.65	3.840		340.10	46.023
02:30	86.348	653.29	280.37	4.030		336.50	46.586
02:40	86.272	657.00	281.80	4.190		338.80	46.686
02:50	86.658	659.47	282.11	4.380		336.80	47.082
03:00	86.473	655.94	282.78	4.560		336.40	46.991
HOUR 3	------	------	------	------		------	------
AVERAGE	86.424	655.32	281.56	4.127		338.12	46.602
03:10	86.551	654.58	282.42	4.740		335.40	47.286
03:20	86.465	658.58	282.74	4.910		339.10	47.816
03:30	86.197	660.95	282.96	5.150		337.40	47.891
03:40	86.459	656.88	282.27	5.270		339.10	48.315
03:50	86.340	657.83	282.47	3.920		341.00	48.104
04:00	86.507	659.31	283.24	3.470		338.60	48.736
HOUR 4	------	------	------	------		------	------
AVERAGE	86.420	658.02	282.68	4.577		338.43	48.025
04:10	86.324	663.35	284.09	3.670		336.60	48.686
04:20	86.456	663.81	283.82	3.830		338.10	48.656
04:30	86.491	671.10	283.67	4.040		342.20	48.812
04:40	86.221	677.95	284.51	4.170		337.00	48.232
04:50	86.522	676.58	284.41	4.360		339.60	48.673
05:00	86.523	681.29	285.81	4.550		338.30	48.857
HOUR 5	------	------	------	------		------	------
AVERAGE	86.423	672.35	284.39	4.103		338.63	48.653
05:10	86.404	681.71	286.34	4.690		339.10	48.949
05:20	85.799	680.32	286.41	4.840		337.30	49.560
05:30	85.526	676.75	285.34	5.070		340.30	50.178
05:40	85.693	678.97	286.00	5.450		341.10	49.752
05:50	85.736	676.51	285.58	4.360		341.00	48.780
06:00	85.817	672.31	283.94	3.520		339.20	47.449
HOUR 6	------	------	------	------		------	------
AVERAGE	85.829	677.76	285.60	4.655		339.67	49.111

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 28 JUL 94

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	O004Z921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
06:10	85.818	673.39	283.65	3.570	340.10	47.434
06:20	85.475	662.20	283.47	3.710	341.30	46.607
06:30	85.867	653.94	282.50	3.850	339.80	46.308
06:40	85.707	656.69	282.60	4.030	339.80	47.377
06:50	85.593	659.00	283.53	4.170	339.60	47.888
07:00	85.651	657.84	283.86	4.400	337.10	47.875
HOUR 1	------	------	------	------	------	------
AVERAGE	85.685	660.51	283.27	3.955	339.62	47.248
07:10	85.777	656.37	283.04	4.540	338.60	47.964
07:20	85.989	658.07	283.38	4.670	339.90	47.551
07:30	85.822	656.46	283.13	4.880	340.80	46.659
07:40	85.690	656.66	282.27	4.990	338.10	46.442
07:50	85.927	658.18	282.78	5.460	340.60	47.434
08:00	85.590	660.88	283.36	4.800	339.50	47.323
HOUR 2	------	------	------	------	------	------
AVERAGE	85.799	657.77	282.99	4.890	339.58	47.229
08:10	85.539	657.35	282.96	3.620	340.60	46.772
08:20	85.768	657.27	282.61	3.450	341.10	45.983
08:30	85.484	662.43	283.15	3.630	342.60	44.068
08;40	85.204	660.14	283.66	3.790	345.00	43.233
08:50	85.670	655.75	282.52	4.020	341.70	42.790
09:00	85.464	659.21	282.96	4.100	343.00	43.289
HOUR 3	------	------	------	------	------	------
AVERAGE	85.521	658.69	282.98	3.768	342.33	44.356

09:10	85.735	659.41	282.94	4.590	344.00	42.969
09:20	85.622	657.93	282.44	4.130	346.80	43.356
09:30	85.551	660.83	283.43	3.510	343.90	44.005
09:40	85.609	658.66	283.08	3.630	345.30	42.768
09:50	85.620	653.53	281.83	3.790	344.00	40.933
10:00	85.506	653.83	283.22	3.890	345.20	41.261
HOUR 4	------	------	------	------	------	------
AVERAGE	85.607	657.37	282.82	3.923	344.87	42.549
10:10	85.593	649.57	282.69	4.060	347.20	41.329
10:20	85.390	653.71	283.14	4.180	347.80	42.520
10:30	85.649	654.22	282.31	4.400	347.00	43.178
10:40	85.699	652.32	280.63	4.580	345.30	43.130
10:50	85.600	655.96	282.46	4.810	345.40	43.677
11:00	85.686	659.28	282.96	4.960	348.70	44.095
HOUR 5	------	------	------	------	------	------
AVERAGE	85.603	654.18	282.36	4.498	346.90	42.988
11:10	85.577	656.12	281.66	5.110	351.50	43.231
11:20	85.503	657.22	282.61	5.350	349.50	43.547
11:30	85.414	659.54	283.95	4.000	350.00	44.102
11:40	85.443	658.98	282.82	3.440	348.90	44.424
11:50	85.489	666.90	286.19	3.700	349.70	46.114
12:00	85.562	662.31	286.33	3.820	350.60	45.669
HOUR 6	------	------	------	------	------	------
AVERAGE	85.498	660.18	283.93	4.237	350.03	44.514

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 28 JUL

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW 0004Z921 ACFM
18:10	85.820	655.36	285.03	3.850	343.10	45.755
18:20	85.971	654.76	284.59	4.080	346.70	45.604
18:30	86.047	656.91	284.71	4.300	346.90	46.281
18:40	86.086	659.98	285.70	4.620	347.00	46.553
18:50	85.959	658.77	285.56	4.860	349.90	46.950
19:00	86.125	655.84	284.60	5.090	348.90	46.942
HOUR 1	------	------	------	------	------	------
AVERAGE	86.001	656.94	285.03	4.467	347.08	46.347
19:10	86.122	655.64	284.72	5.630	346.10	46.385
19:20	85.912	658.14	284.83	4.460	346.50	46.147
19:30	86.052	659.22	284.84	3.910	346.40	45.381
19:40	86.244	660.85	285.21	3.990	347.00	45.598
19:50	85.927	660.80	285.03	4.250	348.70	45.056
20:00	86.159	660.53	284.45	4.500	344.70	44.307
HOUR 2	------	------	------	------	------	------
AVERAGE	86.069	659.20	284.85	4.457	346.57	45.479
20:10	86.073	661.34	284.68	4.710	347.40	44.266
20:20	86.053	664.31	285.02	4.940	348.50	44.271
20:30	86.053	660.56	284.86	5.500	347.20	43.913
20:40	86.134	659.75	284.90	4.950	350.90	43.589
20:50	86.131	658.80	284.23	4.070	348.90	43.317
21:00	85.880	659.41	285.01	3.880	348.90	43.269
HOUR 3	------	------	------	------	------	------
AVERAGE	86.054	660.70	284.78	4.675	348.63	43.771
21:10	85.970	658.61	284.85	4.100	348.90	42.858
21:20	85.782	657.59	285.13	4.290	352.90	42.623
21:30	85.999	657.10	285.02	4.530	351.40	42.582
21:40	85.951	656.30	284.90	4.800	351.90	42.758
21:50	86.075	656.30	283.95	4.980	352.10	43.153
22:00	86.159	658.25	284.72	5.570	351.50	43.852
HOUR 4	------	------	------	------	------	------
AVERAGE	85.989	657.36	284.76	4.712	351.45	42.971
22:10	86.089	660.59	285.01	4.790	348.60	44.519
22:20	86.072	660.28	285.37	4.000	352.50	45.037
22:30	86.099	658.44	283.29	4.010	349.50	45.055
22:40	86.107	660.26	283.98	4.230	348.90	45.494
22:50	86.110	658.34	283.05	4.470	352.80	45.624
23:00	85.869	661.40	283.78	4.710	350.80	46.173
HOUR 5	------	------	------	------	------	------
AVERAGE	86.058	659.89	284.08	4.368	350.52	45.317
23:10	85.840	660.83	283.52	5.020	351.10	45.984
23:20	86.143	660.33	283.17	5.580	346.90	45.836
23:30	86.128	659.93	283.22	4.730	352.60	45.917
23:40	85.893	660.23	283.14	3.970	348.90	45.690
23:50	85.834	657.58	282.81	4.080	350.70	45.109
00:00	86.063	658.92	282.81	4.350	350.40	45.368
HOUR 6	------	------	------	------	------	------
AVERAGE	85.983	659.64	283.11	4.622	350.10	45.651

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW 0004Z921 ACFM
12:10	85.457	657.72	285.44	3.960	350.80	45.518
12:20	85.071	652.83	285.56	4.050	347.80	45.041
12:30	84.538	652.89	285.75	4.190	349.10	44.305
12:40	84.895	655.00	285.62	4.410	352.40	45.735
12:50	84.662	653.52	285.26	4.610	349.50	46.292
13:00	84.653	651.19	283.72	4.750	348.60	47.010
HOUR 1	------	------	------	------	------	------
AVERAGE	84.879	653.86	285.23	4.328	349.70	45.650
13:10	84.439	650.49	283.90	4.930	348.10	47.314
13:20	84.848	648.86	283.63	5.060	347.80	48.295
13:30	84.727	648.98	284.33	5.440	350.00	48.332
13:40	84.695	646.51	283.72	4.120	350.50	47.945
13:50	84.822	646.40	283.48	3.470	350.30	47.661
14:00	84.718	644.27	282.54	3.670	349.90	47.521
HOUR 2	------	------	------	------	------	------
AVERAGE	84.716	647.59	283.60	4.448	349.43	47.845
14:10	84.680	645.52	283.02	3.820	350.30	47.439
14:20	84.549	642.40	283.14	3.940	349.70	47.206
14:30	84.976	644.25	283.10	4.110	349.10	47.315
14:40	85.234	648.30	283.77	4.300	353.80	47.764
14:50	85.245	647.00	283.67	4.470	351.60	47.779
15:00	85.036	645.14	282.87	4.650	349.00	47.718
HOUR 3	------	------	------	------	------	------
AVERAGE	84.953	645.43	283.26	4.215	350.58	47.537
15:10	85.115	646.83	282.69	4.810	353.30	47.917
15:20	85.468	652.47	284.62	5.030	352.50	48.153
15:30	85.614	648.77	284.14	5.480	350.70	48.091
15:40	85.571	648.21	283.58	4.730	352.80	48.086
15:50	85.579	648.84	283.64	3.810	355.10	47.203
16:00	86.031	650.13	284.61	3.790	356.20	46.889
HOUR 4	------	------	------	------	------	------
AVERAGE	85.563	649.21	283.88	4.608	353.43	47.723
16:10	86.044	646.32	284.01	3.970	356.80	47.848
16:20	85.741	649.92	283.14	4.490	355.30	45.232
16:30	86.076	653.02	283.47	4.330	359.10	42.327
16:40	86.034	651.76	283.16	3.980	354.40	43.612
16:50	85.918	656.38	283.20	4.020	358.70	45.086
17:00	85.895	659.87	284.94	4.350	358.80	46.289
HOUR 5	------	------	------	------	------	------
AVERAGE	85.951	652.88	283.65	4.190	357.18	45.066
17:10	86.008	650.51	283.40	4.660	352.60	45.936
17:20	85.910	653.13	283.35	4.870	348.30	46.337
17:30	86.031	651.93	283.82	4.990	344.20	45.848
17:40	85.872	654.55	284.13	5.580	342.00	45.254
17:50	86.069	653.44	284.30	4.830	343.70	45.428
18:00	85.999	656.27	285.26	3.900	340.80	45.767
HOUR 6	------	------	------	------	------	------
AVERAGE	85.982	653.30	284.04	4.805	345.27	45.762

soot blow 4:15

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 29 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW O004Z921 ACFM
00:10	85.886	659.77	282.56	4.610	348.30	43.228
00:20	85.884	659.84	282.82	4.830	347.30	42.100
00:30	85.912	658.15	282.67	5.290	350.70	42.931
00:40	86.090	660.79	282.89	5.290	347.00	44.455
00:50	85.976	660.40	282.02	4.190	348.70	45.098
01:00	85.999	659.67	282.81	3.970	350.00	45.804
HOUR 1	------	------	------	------	------	------
AVERAGE	85.958	659.77	282.63	4.697	348.67	43.936
01:10	86.087	659.84	282.75	4.200	348.90	43.515
01:20	86.302	660.85	283.14	4.460	350.40	43.025
01:30	86.028	663.25	283.43	4.740	348.20	44.392
01:40	85.928	662.58	283.49	4.980	351.30	44.725
01:50	86.057	665.90	283.86	5.390	349.70	45.440
02:00	86.037	662.90	284.30	4.430	352.50	45.587
HOUR 2	------	------	------	------	------	------
AVERAGE	86.073	662.55	283.49	4.700	350.17	44.447
02:10	86.008	665.03	284.91	3.970	354.20	46.329
02:20	85.991	664.55	284.31	4.170	351.10	46.582
02:30	86.002	664.78	284.41	4.410	353.10	47.291
02;40	86.081	663.93	284.85	4.730	352.20	47.893
02:50	85.999	665.83	285.42	4.940	350.70	48.152
03:00	86.081	668.58	286.97	5.560	348.40	49.284
HOUR 3	------	------	------	------	------	------
AVERAGE	86.027	665.45	285.14	4.630	351.62	47.589

03:10	85.645	669.64	286.97	4.510	351.90	50.122
03:20	85.544	666.87	286.76	3.880	352.30	50.143
03:30	85.551	665.51	285.23	4.030	350.10	50.396
03:40	85.579	667.66	285.31	4.220	349.80	50.588
03:50	84.761	667.14	285.50	4.480	346.30	50.231
04:00	84.659	666.02	284.78	4.680	347.50	50.558
HOUR 4	------	------	------	------	------	------
AVERAGE	85.290	667.14	285.76	4.300	349.65	50.340
04:10	84.831	666.84	284.90	4.880	345.70	50.383
04:20	84.630	667.95	284.49	5.450	347.70	50.672
04:30	84.523	668.31	284.13	4.470	347.90	50.770
04:40	84.613	668.41	282.56	3.830	347.90	50.627
04:50	84.805	666.49	283.54	3.950	346.20	50.684
05:00	84.528	666.95	282.76	4.140	347.70	50.836
HOUR 5	------	------	------	------	------	------
AVERAGE	84.655	667.49	283.73	4.453	347.18	50.662
05:10	84.624	666.42	283.05	4.430	347.70	51.238
05:20	83.664	657.77	281.76	4.570	348.60	50.907
05:30	83.806	659.58	282.24	4.840	347.40	50.854
05:40	83.640	659.66	282.29	5.300	344.50	50.732
05:50	83.673	660.04	282.59	4.830	346.50	50.529
06:00	83.548	658.49	281.91	3.850	347.50	50.485
HOUR 6	------	------	------	------	------	------
AVERAGE	83.826	660.33	282.31	4.637	347.03	50.791

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 29 JUL 94

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	O004Z921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
06:10	83.711	661.09	283.21	3.740	346.40	50.387
06:20	83.743	661.89	283.43	3.900	347.90	50.052
06:30	83.640	662.04	284.12	4.100	349.00	50.086
06:40	83.868	662.00	284.08	4.350	348.40	50.301
06:50	83.765	662.20	284.84	4.590	346.50	50.034
07:00	83.624	663.65	284.94	4.820	348.00	49.703
HOUR 1	------	------	------	------	------	------
AVERAGE	83.725	662.14	284.10	4.250	347.70	50.094
07:10	83.864	662.29	286.07	4.990	345.90	49.316
07:20	83.591	662.67	285.52	5.460	346.20	49.208
07:30	83.627	664.23	285.23	4.460	346.40	49.555
07:40	83.566	663.44	283.28	3.630	342.80	49.068
07:50	83.458	663.41	282.96	3.700	345.60	48.679
08:00	83.752	662.24	282.53	3.870	346.90	48.768
HOUR 2	------	------	------	------	------	------
AVERAGE	83.643	663.05	284.26	4.352	345.63	49.099
08:10	83.658	663.06	282.82	4.060	347.00	48.645
08:20	83.678	661.21	283.40	4.280	343.70	47.024
08:30	83.748	660.38	283.37	4.660	344.50	43.978
08;40	83.571	662.69	283.23	3.990	344.30	45.645
08:50	83.667	661.45	282.35	3.580	346.40	46.464
09:00	83.693	660.74	283.71	3.770	344.70	47.664
HOUR 3	------	------	------	------	------	------
AVERAGE	83.669	661.59	283.15	4.057	345.10	46.570

09:10	83.859	661.73	284.07	3.980	346.40	48.233
09:20	83.546	660.64	283.88	4.160	343.80	48.159
09:30	83.774	658.09	283.04	4.300	344.40	48.329
09:40	83.473	657.70	283.14	4.550	344.50	47.417
09:50	83.594	659.95	283.58	4.730	347.30	47.798
10:00	83.760	658.50	284.16	4.970	350.10	47.565
HOUR 4	------	------	------	------	------	------
AVERAGE	83.668	659.43	283.64	4.448	346.08	47.917
10:10	83.525	657.34	284.15	5.280	345.70	47.489
10:20	83.739	656.69	284.29	4.180	347.00	47.674
10:30	83.800	651.89	283.54	3.460	348.80	47.055
10:40	83.672	650.44	283.06	3.700	350.80	47.033
10:50	83.937	649.98	282.41	3.820	347.40	47.268
11:00	83.656	657.05	284.47	4.100	352.10	48.214
HOUR 5	------	------	------	------	------	------
AVERAGE	83.722	653.90	283.65	4.090	348.63	47.456
11:10	83.788	654.97	283.28	4.510	355.10	48.291
11:20	83.636	666.40	284.99	5.030	352.50	49.264
11:30	83.603	666.05	283.75	4.130	347.30	50.042
11:40	83.815	665.68	283.26	3.650	343.80	50.037
11:50	83.740	665.04	281.95	3.800	344.60	48.754
12:00	83.644	666.98	283.18	3.960	342.60	48.349
HOUR 6	------	------	------	------	------	------
AVERAGE	83.704	664.19	283.40	4.180	347.65	49.123

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 29 JUL 94

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	O004Z921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
12:10	83.513	666.41	284.29	4.130	340.70	47.968
12:20	87.869	669.31	284.63	4.390	340.30	48.013
12:30	84.833	675.27	287.20	4.680	338.00	49.330
12:40	84.442	672.24	284.41	4.840	337.10	47.962
12:50	84.433	661.97	281.33	4.990	335.50	46.886
13:00	84.404	662.44	282.60	5.500	334.20	38.850
HOUR 1	------	------	------	------	------	------
AVERAGE	84.916	667.94	284.08	4.755	337.63	46.501
13:10	84.241	659.29	283.30	4.510	334.50	31.969
13:20	84.390	660.97	284.11	3.500	336.10	49.255
13:30	84.056	660.75	284.13	3.450	334.90	48.382
13:40	84.308	660.27	283.02	3.580	334.10	44.141
13:50	84.454	662.97	282.32	3.760	334.00	44.934
14:00	84.433	664.61	282.97	3.910	335.20	46.585
HOUR 2	------	------	------	------	------	------
AVERAGE	84.314	661.48	283.31	3.785	334.80	44.211
14:10	84.651	661.16	283.22	4.100	338.10	47.928
14:20	84.509	661.86	283.17	4.250	334.70	48.966
14:30	84.534	661.48	283.24	4.490	335.60	49.453
14:40	84.294	664.51	283.38	4.640	336.80	50.897
14:50	84.317	660.83	282.93	4.780	332.60	51.024
15:00	84.398	661.11	283.72	4.970	334.30	50.777
HOUR 3	------	------	------	------	------	------
AVERAGE	84.451	661.83	283.28	4.538	335.35	49.841

15:10	84.402	664.43	283.87	5.380	335.50	51.007
15:20	84.550	663.70	284.44	4.400	336.90	51.261
15:30	84.399	663.27	284.52	3.420	335.70	50.363
15:40	84.348	662.47	283.30	3.320	335.60	48.635
15:50	84.386	664.18	284.39	3.430	337.10	48.880
16:00	84.344	664.28	285.63	3.620	339.30	49.077
HOUR 4	------	------	------	------	------	------
AVERAGE	84.405	663.72	284.36	3.928	336.68	49.871
16:10	84.557	663.68	285.74	3.810	338.80	49.283
16:20	84.550	663.36	285.97	3.980	343.30	47.452
16:30	84.695	662.47	285.73	4.200	341.70	45.123
16:40	85.422	667.00	286.43	4.490	342.40	48.023
16:50	85.609	672.63	287.21	4.760	341.40	49.536
17:00	85.776	671.58	287.05	4.960	342.30	50.582
HOUR 5	------	------	------	------	------	------
AVERAGE	85.102	666.79	286.36	4.367	341.65	48.333
17:10	85.683	669.63	287.08	5.520	345.40	50.516
17:20	85.884	670.03	286.55	4.480	344.90	52.881
17:30	85.832	668.08	286.86	3.590	346.70	52.702
17:40	85.938	671.24	286.73	3.600	346.80	51.287
17:50	85.947	673.57	286.86	3.810	348.70	50.933
18:00	85.851	674.94	287.05	4.000	346.50	50.595
HOUR 6	------	------	------	------	------	------
AVERAGE	85.856	671.25	286.85	4.167	346.50	51.486

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 29 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW O004Z921 ACFM
18:10	85.820	675.42	286.87	4.170	346.70	50.602
18:20	85.745	675.88	286.83	4.440	349.90	50.647
18:30	85.826	672.11	286.65	4.690	348.40	50.557
18:40	85.876	670.07	285.93	4.860	348.30	50.741
18:50	85.815	666.57	285.65	5.030	348.40	51.138
19:00	85.980	668.64	285.73	5.440	351.40	50.819
HOUR 1	------	------	------	------	------	------
AVERAGE	85.844	671.45	286.28	4.772	348.85	50.751
19:10	85.728	668.15	285.56	4.320	352.80	50.958
19:20	85.724	665.56	284.26	3.580	350.20	51.123
19:30	85.754	667.81	284.02	3.790	349.80	51.121
19:40	86.009	665.04	284.05	3.940	347.60	51.085
19:50	85.866	664.90	283.93	4.140	349.50	37.425
20:00	85.857	663.16	283.36	4.370	347.70	25.438
HOUR 2	------	------	------	------	------	------
AVERAGE	85.823	665.77	284.20	4.023	349.60	44.525
20:10	85.722	664.51	283.64	4.540	347.90	41.045
20:20	85.889	668.31	283.54	4.750	349.70	43.798
20:30	85.898	664.80	284.25	5.060	350.80	45.343
20:40	86.006	662.38	283.96	5.480	347.50	46.814
20:50	85.751	663.86	283.53	4.740	348.50	47.899
21:00	85.661	662.20	284.04	3.740	348.90	48.096
HOUR 3	------	------	------	------	------	------
AVERAGE	85.821	664.34	283.83	4.718	348.88	45.499

21:10	85.725	666.42	283.68	3.810	348.50	49.285
21:20	85.660	660.15	283.59	4.090	349.40	48.576
21:30	85.899	663.15	283.48	4.210	353.40	48.259
21:40	85.472	660.70	283.36	4.390	348.10	47.963
21:50	85.364	662.83	282.22	4.550	347.00	47.729
22:00	85.439	667.21	283.53	4.510	344.20	47.294
HOUR 4	------	------	------	------	------	------
AVERAGE	85.593	663.41	283.31	4.260	348.43	48.184
22:10	85.228	666.20	283.41	4.820	341.70	46.420
22:20	85.500	666.65	283.69	5.010	341.60	45.291
22:30	85.278	668.50	283.78	5.560	341.80	44.842
22:40	85.220	670.55	283.13	4.450	341.10	45.187
22:50	85.446	668.67	284.58	3.550	339.70	45.242
23:00	85.378	664.74	283.47	3.610	339.30	44.608
HOUR 5	------	------	------	------	------	------
AVERAGE	85.342	667.55	283.68	4.500	340.87	45.265
23:10	85.304	668.27	283.82	3.870	338.70	45.575
23:20	85.475	667.05	283.35	4.070	341.10	45.626
23:30	85.342	664.19	283.66	4.340	339.80	44.814
23:40	85.216	668.49	284.25	4.540	343.30	46.279
23:50	85.519	662.03	283.42	4.740	341.80	45.433
00:00	85.185	663.63	283.17	5.030	339.40	46.191
HOUR 6	------	------	------	------	------	------
AVERAGE	85.340	665.61	283.61	4.432	340.68	45.653

APPENDIX F

SAVANNAH LABORATORIES AND ENVIRONMENTAL SERVICES, INC.'S REPORT OF COAL AND ASH SAMPLE ANALYSES

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES. INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T4-02345

Received: 29 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-1	COAL-0.0-1-B1	07-27-94/1155
02345-2	COAL-0.0-1-B4	07-27-94/1158
02345-3	COAL-1.0-1-B1	07-27-94/1303
02345-4	COAL-1.0-1-B4	07-27-94/1300
02345-5	COAL-2.0-1-B1	07-27-94/1400

PARAMETER	02345-1	02345-2	02345-3	02345-4	02345-5
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.044	0.074	0.066	0.069	0.082
Prep or Extraction Date	08.02.94	08.02.94	08.02.94	08.02.94	08.02.94
Date Analyzed	08.03.94	08.03.94	08.03.94	08.03.94	08.03.94
Batch ID	0802R	0802R	0802R	0802R	0802R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.
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Jacksonville, FL 32226-6324

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Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-6	COAL-2.0-1-B4	07-27-94/1402
02345-7	FASH-0.0-1	07-27-94/1158
02345-8	BASH-0.0-1	07-27-94/1155
02345-9	FASH-1.0-1	07-27-94/1259
02345-10	BASH-1.0-1	07-27-94/1300

PARAMETER	02345-6	02345-7	02345-8	02345-9	02345-10
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.14	0.54	<0.030	0.62	<0.030
Prep or Extraction Date	08.02.94	08.02.94	08.02.94	08.02.94	08.02.94
Date Analyzed	08.03.94	08.03.94	08.03.94	08.03.94	08.03.94
Batch ID	0802R	0802R	0802R	0802R	0802R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

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Cedar Bay Generating Co.
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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-11	FASH-2.0-1	07-27-94/1359
02345-12	BASH-2.0-1	07-27-94/1400
02345-13	COAL-3.0-1-B1	07-27-94/1502
02345-14	COAL-3.0-1-B4	07-27-94/1459
02345-15	COAL-4.0-1-B1	07-27-94/1558

PARAMETER	02345-11	02345-12	02345-13	02345-14	02345-15
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.51	<0.030	0.060	0.060	0.069
Prep or Extraction Date	08.02.94	08.02.94	08.02.94	08.02.94	08.02.94
Date Analyzed	08.03.94	08.03.94	08.03.94	08.03.94	08.03.94
Batch ID	0802R	0802R	0802R	0802R	0802R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

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LOG NO: T4-02345

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Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-16	COAL-4.0-1-B4	07-27-94/1601
02345-17	COAL-5.0-1-B1	07-27-94/1703
02345-18	COAL-5.0-1-B4	07-27-94/1700
02345-19	FASH-3.0-1	07-27-94/1458
02345-20	BASH-3.0-1	07-27-94/1500

PARAMETER	02345-16	02345-17	02345-18	02345-19	02345-20
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.082	0.058	0.069	0.62	<0.030
Prep or Extraction Date	08.02.94	08.02.94	08.02.94	08.02.94	08.02.94
Date Analyzed	08.03.94	08.03.94	08.03.94	08.03.94	08.03.94
Batch ID	0802R	0802R	0802R	0802R	0802R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

346 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T4-02345

Received: 29 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-21	FASH-4.0-1	07-27-94/1558
02345-22	BASH-4.0-1	07-27-94/1600
02345-23	FASH-5.0-1	07-27-94/1655
02345-24	BASH-5.0-1	07-27-94/1700
02345-25	COAL-6.0-1-B1	07-27-94/1800

PARAMETER	02345-21	02345-22	02345-23	02345-24	02345-25
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.51	<0.030	0.58	<0.030	0.050
Prep or Extraction Date	08.04.94	08.04.94	08.04.94	08.04.94	08.04.94
Date Analyzed	08.04.94	08.04.94	08.04.94	08.04.94	08.04.94
Batch ID	0804R	0804R	0804R	0804R	0804R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

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Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-26	COAL-6.0-1-B4	07-27-94/1803
02345-27	FASH-6.0-1	07-27-94/1752
02345-28	BASH-6.0-1	07-27-94/1800
02345-29	COAL-0.0-2-B1	07-28-94/0800
02345-30	COAL-0.0-2-B4	07-28-94/0800

PARAMETER	02345-26	02345-27	02345-28	02345-29	02345-30
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.066	0.51	<0.030	0.046	0.036
Prep or Extraction Date	08.04.94	08.04.94	08.04.94	08.04.94	08.04.94
Date Analyzed	08.04.94	08.04.94	08.04.94	08.04.94	08.06.94
Batch ID	0804R	0804R	0804R	0804R	0804R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

LOG NO: T4-02345

Received: 29 JUL 94

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P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-31	COAL-1.0-2-B1	07-28-94/0900
02345-32	COAL-1.0-2-B4	07-28-94/0900
02345-33	FASH-0.0-2	07-28-94/0800
02345-34	BASH-0.0-2	07-28-94/0800
02345-35	FASH-1.0-2	07-28-94/0900

PARAMETER	02345-31	02345-32	02345-33	02345-34	02345-35
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.092	0.042	0.22	<0.030	0.23
Prep or Extraction Date	08.04.94	08.04.94	08.04.94	08.04.94	08.04.94
Date Analyzed	08.06.94	08.06.94	08.06.94	08.06.94	08.06.94
Batch ID	0804R	0804R	0804R	0804R	0804R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

Received: 29 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-36	BASH-1.0-2	07-28-94/0900
02345-37	COAL-2.0-2-B1	07-28-94/1000
02345-38	COAL-2.0-2-B4	07-28-94/1000
02345-39	COAL-3.0-2-B1	07-28-94/1100
02345-40	COAL-3.0-2-B4	07-28-94/1100

PARAMETER	02345-36	02345-37	02345-38	02345-39	02345-40
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	<0.030	0.050	0.033	0.037	0.033
Prep or Extraction Date	08.04.94	08.04.94	08.04.94	08.04.94	08.04.94
Date Analyzed	08.06.94	08.06.94	08.06.94	08.06.94	08.06.94
Batch ID	0804R	0804R	0804R	0804R	0804R

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-41	COAL-4.0-2-B1	07-28-94/1200
02345-42	COAL-4.0-2-B4	07-28-94/1200
02345-43	BASH-2.0-2	07-28-94/1000
02345-44	FASH-2.0-2	07-28-94/1000
02345-45	BASH-3.0-2	07-28-94/1100

PARAMETER	02345-41	02345-42	02345-43	02345-44	02345-45
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.032	0.036	<0.030	0.62	<0.030
Prep or Extraction Date	08.09.94	08.09.94	08.09.94	08.09.94	08.09.94
Date Analyzed	08.12.94	08.12.94	08.12.94	08.12.94	08.12.94

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

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P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-46	FASH-3.0-2	07-28-94/1100
02345-47	BASH-4.0-2	07-28-94/1200
02345-48	FASH-4.0-2	07-28-94/1200
02345-49	COAL-5.0-2-B1	07-28-94/1300
02345-50	COAL-5.0-2-B4	07-28-94/1300

PARAMETER	02345-46	02345-47	02345-48	02345-49	02345-50
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.49	<0.030	0.70	0.19	0.044
Prep or Extraction Date	08.09.94	08.09.94	08.09.94	08.09.94	08.09.94
Date Analyzed	08.12.94	08.12.94	08.12.94	08.12.94	08.12.94

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

Received: 29 JUL 94

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Cedar Bay Generating Co.
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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-51	COAL-6.0-2-B1	07-28-94/1400
02345-52	COAL-6.0-2-B4	07-28-94/1400
02345-53	BASH-5.0	07-28-94/1300
02345-54	FASH-5.0	07-28-94/1300
02345-55	BASH-6.0	07-28-94/1400

PARAMETER	02345-51	02345-52	02345-53	02345-54	02345-55
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.035	0.033	<0.030	0.55	<0.030
Prep or Extraction Date	08.09.94	08.09.94	08.09.94	08.09.94	08.09.94
Date Analyzed	08.12.94	08.12.94	08.12.94	08.12.94	08.12.94

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02345

Received: 29 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02345-56	FASH-6.0	07-28-94/1400

PARAMETER	02345-56
Mercury (7470/7471)	
Mercury (7470/7471), mg/kg dw	0.61
Prep or Extraction Date	08.09.94
Date Analyzed	08.12.94

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

Janet B. Pruitt

Final Page Of Report

SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax (904) 878-9504
☐ 414 Southwest 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

P.O. NUMBER:
PROJECT NUMBER:
PROJECT NAME: Mercury Test - Phase I
CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 301 718 6937
CLIENT ADDRESS: 9640 Eastport Rd.
CITY, STATE, ZIP CODE: Jacksonville, Fl
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER: Barrett Parker

PAGE 1 OF 3

REQUIRED ANALYSES: MERCURY

☐ STANDARD TAT
☐ EXPEDITED TAT *
REPORT DUE DATE
* SUBJECT TO RUSH FEES

SAMPLING DATE	SAMPLING TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	NUMBER OF CONTAINERS SUBMITTED (MERCURY)
7/27	1155	COAL-0.0-1-B1		X			
7/27	1158	COAL-0.0-1-B4		X			
7/27	1303	COAL-1.0-1-B1		X			
7/27	1300	COAL-1.0-1-B4		X			
7/27	1400	COAL-2.0-1-B1		X			
7/27	1402	COAL-2.0-1-B4		X			
7/27	1158	FASH-0.0-1 m		X			
7/27	1155	BASH-0.0-1		X			
7/27	1259	FASH-1.0-1		X			
7/27	1300	BASH-1.0-1		X			
7/27	1359	FASH-2.0-1		X			
7/27	1400	BASH-2.0-1		X			

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES [signature]	7/22/94	1600	EMPTY BOTTLES			[signature]	7/28	1600
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
[signature]	07/29/94	0930	☑ YES ☐ NO		T402345	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax (912) 352-0165
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☐ 414 Southwest 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

P.O. NUMBER:
PROJECT NUMBER:
PROJECT NAME: Mercury Test - Phase I
CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 301-718-6437
CLIENT ADDRESS:
CITY, STATE, ZIP CODE:
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER:

PAGE 2 OF 3

REQUIRED ANALYSES: MERCURY

☐ STANDARD TAT
☐ EXPEDITED TAT *
REPORT DUE DATE ______
* SUBJECT TO RUSH FEES

Sampling Date	Sampling Time	Sample Identification	Aqueous Matrix	Nonaqueous Matrix	Oil Matrix	Air Matrix	Number of Containers Submitted: Mercury
7/27	1502	COAL-3.0- 1 -B1		X			
7/27	1459	COAL-3.0- 1 -B4		X			
7/27	1558	COAL-4.0- 1 -B1		X			
7/27	1601	COAL-4.0- 1 -B4		X			
7/27	1703	COAL-5.0- 1 -B1		X			
7/27	1700	COAL-5.0- 1 -B4		X			
7/27	1458	FASH-3.0- 1		X			
7/27	1500	BASH-3.0 - 1		X			
7/27	1558	FASH-4.0 - 1		X			
7/27	1606	BASH-4.0 - 1		X			
7/27	1655	FASH-5.0 - 1		X			
7/27	1700	BASH-5.0 - 1		X			

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES [signature]	7/22/94	1600	EMPTY BOTTLES			[signature]	7/25	1600
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
[signature]	07/29/94	0936	☒ YES ☐ NO		T4-02345	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

- 5102 LaRoche Avenue, Savannah, GA 31404 — Phone: (912) 354-7858 — Fax (912) 352-0165
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- 414 Southwest 12th Avenue, Deerfield Beach, FL 33442 — Phone: (305) 421-7400 — Fax (305) 421-2584
- 900 Lakeside Drive, Mobile, AL 36693 — Phone: (205) 666-6633 — Fax (205) 666-6696
- 6712 Benjamin Road, Suite 100, Tampa, FL 33634 — Phone: (813) 885-7427 — Fax (813) 885-7049

P.O. NUMBER:
PROJECT NUMBER:
PROJECT NAME: Mercury Test - Phase I
PAGE 3 OF 3

CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 301-718-6937
CLIENT ADDRESS: 9640 Eastport Rd.
CITY, STATE, ZIP CODE: Jacksonville, Fl
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER: Barrett Parker

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES: MERCURY

☐ STANDARD TAT
☐ EXPEDITED TAT *
REPORT DUE DATE ______
* SUBJECT TO RUSH FEES

DATE	TIME	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS SUBMITTED
7/27	1800	COAL-6.0-1-B1	
7/27	1803	COAL-6.0-1-B4	
7/27	1752	FASH-6.0-1	
7/27	1800	BASH-6.0-1	
7/28	0800	COAL-0.0-2-B1	
7/28	0800	COAL-0.0-2-B4	
7/28	0900	COAL-1.0-2-B1	
7/28	0900	COAL-1.0-2-B4	
7/28	0800	FASH-0.0-2	
7/28	0806	BASH-0.0-2	
7/28	0900	FASH-1.0-2	
7/28	0900	BASH-1.0-2	

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES [signature]	7/20/94	1600	EMPTY BOTTLES			[signature]	7/28	1600
RECEIVED BY: (SIGNATURE)	**DATE**	**TIME**	**RELINQUISHED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
[signature]	07/29/94	0930	☑ YES ☐ NO		T402345	

SL SAVANNAH LABORATORIES
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- [ ] 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax (912) 352-0165
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- [ ] 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER	PROJECT NUMBER	PROJECT NAME
		Mercury Test - Phase I

CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 301-718-6937 / 32226-6324
CLIENT ADDRESS: 9640 Eastport Rd
CITY, STATE, ZIP CODE: Jacksonville, Fl
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER: Barrett Parker

PAGE 1 OF 2

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES

- [ ] STANDARD TAT
- [ ] EXPEDITED TAT *

REPORT DUE DATE ____
* SUBJECT TO RUSH FEES

NUMBER OF CONTAINERS SUBMITTED

SAMPLING DATE	SAMPLING TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX
7/28	1000	COAL-2.0-2-B1		X		
7/28	1000	COAL-2.0-2-B4		X		
7/28	1100	COAL-3.0-2-B1		X		
7/28	1100	COAL-3.0-2-B4		X		
7/28	1200	COAL-4.0-2-B1		X		
7/28	1200	COAL-4.0-2-B4		X		
7/28	1000	BASH-2.0-2		X		
7/28	1000	FASH-2.0-2		X		
7/28	1100	BASH-3.0-2		X		
7/28	1100	FASH-3.0-2		X		
7/28	1200	BASH-4.0-2		X		
7/28	1200	FASH-4.0-2		X		

EMPTY BOTTLES

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
Knight	7/28/94	1600	EMPTY BOTTLES			[signature]	7/28/94	1600
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
[signature]	07/29/94	0930	[x] YES [ ] NO		T4 02345	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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- [ ] 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax (904) 878-9504
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- [ ] 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
- [ ] 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER:
PROJECT NUMBER:
PROJECT NAME: Mercury Test - Phase I

CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 301-718-6937
CLIENT ADDRESS: 9640 Eastport Rd.
CITY, STATE, ZIP CODE: Jacksonville, Fl 32226-6324
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER:

PAGE 2 OF 2

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES — NUMBER OF CONTAINERS SUBMITTED

- [ ] STANDARD TAT
- [ ] EXPEDITED TAT *

REPORT DUE DATE ______

* SUBJECT TO RUSH FEES

SAMPLING DATE	SAMPLING TIME	SAMPLE IDENTIFICATION
7/28	1300	COAL - 5.0 - 2 - B1
7/28	1300	COAL - 5.0 - 2 - B4
7/28	1400	COAL - 6.0 - 2 - B1
7/28	1400	COAL - 6.0 - 2 - B4
7/28	1300	BASH - 5.0
7/28	1300	FASH - 5.0
7/28	1400	BASH - 6.0
7/28	1400	FASH - 6.0

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES [signature]	7/27/94	1600	EMPTY BOTTLES			[signature]	7/28/94	1600
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
[signature]	07/29/94	0930	[x] YES [ ] NO		T402345	

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-1	COAL-0.0-3-B1	07-29-94/0800
02358-2	COAL-0.0-3-B4	07-29-94/0800
02358-3	COAL-1.0-3-B1	07-29-94/0900
02358-4	COAL-1.0-3-B4	07-29-94/0900
02358-5	COAL-2.0-3-B1	07-29-94/1000

PARAMETER	02358-1	02358-2	02358-3	02358-4	02358-5
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.060	0.023	0.036	0.031	0.067
Prep or Extraction Date	08.15.94	08.15.94	08.15.94	08.15.94	08.15.94
Date Analyzed	08.17.94	08.17.94	08.17.94	08.17.94	08.17.94
Batch ID	0815R	0815R	0815R	0815R	0815R
Percent Solids, %	94 %	94 %	94 %	94 %	93 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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& ENVIRONMENTAL SERVICES, INC.

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LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-6	COAL-2.0-3-B4	07-29-94/1000
02358-7	FASH-0.0-3	07-29-94/0800
02358-8	FASH-1.0-3	07-29-94/0900
02358-9	FASH-2.0-3	07-29-94/1000
02358-10	BASH-0.0-3	07-29-94/0800

PARAMETER	02358-6	02358-7	02358-8	02358-9	02358-10
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.063	0.47	0.48	0.45	<0.030
Prep or Extraction Date	08.15.94	08.15.94	08.15.94	08.15.94	08.15.94
Date Analyzed	08.17.94	08.17.94	08.17.94	08.17.94	08.17.94
Batch ID	0815R	0815R	0815R	0815R	0815R
Percent Solids, %	92 %	100 %	100 %	100 %	100 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02358

Received: 30 JUL 94

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Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-11	BASH-1.0-3	07-29-94/0900
02358-12	BASH-2.0-3	07-29-94/1000
02358-13	COAL-3.0-3-B1	07-29-94/1100
02358-14	COAL-3.0-3-B4	07-29-94/1100
02358-15	COAL-4.0-3-B1	07-29-94/1200

PARAMETER	02358-11	02358-12	02358-13	02358-14	02358-15
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	<0.030	<0.030	0.046	0.055	0.040
Prep or Extraction Date	08.15.94	08.15.94	08.15.94	08.15.94	08.15.94
Date Analyzed	08.17.94	08.17.94	08.17.94	08.17.94	08.17.94
Batch ID	0815R	0815R	0815R	0815R	0815R
Percent Solids, %	100 %	100 %	94 %	93 %	94 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02358

Received: 30 JUL 94

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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-16	COAL-4.0-3-B4	07-29-94/1200
02358-17	FASH-3.0-3	07-29-94/1100
02358-18	FASH-4.0-3	07-29-94/1200
02358-19	FASH-5.0-3	07-29-94/1300
02358-20	BASH-3.0-3	07-29-94/1100

PARAMETER	02358-16	02358-17	02358-18	02358-19	02358-20
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.034	0.039	0.27	0.13	<0.030
Prep or Extraction Date	08.15.94	08.15.94	08.15.94	08.15.94	08.15.94
Date Analyzed	08.17.94	08.17.94	08.17.94	08.17.94	08.17.94
Batch ID	0815R	0815R	0815R	0815R	0815R
Percent Solids, %	94 %	100 %	100 %	100 %	100 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02358

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Cedar Bay Generating Co.
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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-21	BASH-4.0-3	07-29-94/1200
02358-22	BASH-5.0-3	07-29-94/1300
02358-23	COAL-5.0-3-B1	07-29-94/1300
02358-24	COAL-5.0-3-B4	07-29-94/1300
02358-25	COAL-6.0-3-B1	07-29-94/1400

PARAMETER	02358-21	02358-22	02358-23	02358-24	02358-25
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	<0.030	<0.030	<0.030	0.12	<0.030
Prep or Extraction Date	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Date Analyzed	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Batch ID	0819R	0819R	0819R	0819R	0819R
Percent Solids, %	100 %	100 %	93 %	95 %	94 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-26	COAL-6.0-3-B4	07-29-94/1400
02358-27	COAL-7.0-3-B1	07-29-94/1500
02358-28	COAL-7.0-3-B4	07-29-94/1500
02358-29	COAL-8.0-3-B1	07-29-94/1600
02358-30	COAL-8.0-3-B4	07-29-94/1600

PARAMETER	02358-26	02358-27	02358-28	02358-29	02358-30
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.076	<0.030	<0.030	<0.030	<0.030
Prep or Extraction Date	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Date Analyzed	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Batch ID	0819R	0819R	0819R	0819R	0819R
Percent Solids, %	95 %	94 %	93 %	96 %	94 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-31	FASH-6.0-3	07-29-94/1400
02358-32	FASH-7.0-3	07-29-94/1500
02358-33	FASH-8.0-3	07-29-94/1600
02358-34	BASH-6.0-3	07-29-94/1400
02358-35	BASH-7.0-3	07-29-94/1500

PARAMETER	02358-31	02358-32	02358-33	02358-34	02358-35
ercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.30	0.42	0.41	<0.030	<0.030
Prep or Extraction Date	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Date Analyzed	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Batch ID	0819R	0819R	0819R	0819R	0819R
Percent Solids, %	100 %	100 %	100 %	100 %	100 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

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LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-36	BASH-8.0-3	07-29-94/1600
02358-37	COAL-9.0-3-B1	07-29-94/1700
02358-38	COAL-9.0-3-B4	07-29-94/1700
02358-39	COAL-10.0-3-B1	07-29-94/1800
02358-40	COAL-10.0-3-B4	07-29-94/1800

PARAMETER	02358-36	02358-37	02358-38	02358-39	02358-40
Mercury (7470/7471)					
Mercury (7470/7471), mg/kg dw	<0.030	<0.030	<0.030	<0.030	<0.030
Prep or Extraction Date	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Date Analyzed	08.19.94	08.19.94	08.19.94	08.19.94	08.19.94
Batch ID	0819R	0819R	0819R	0819R	0819R
Percent Solids, %	100 %	94 %	94 %	94 %	93 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

2846 Industrial Plaza Drive (32301) • P.O. Box 13056 • Tallahassee, FL 32317-3056 • (904) 878-3994 • Fax (904) 878-9504

LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-41	FASH-9.0-3	07-29-94/1700
02358-42	FASH-10.0-3	07-29-94/1800
02358-43	BASH-9.0-3	07-29-94/1700
02358-44	BASH-10.0-3	07-29-94/1800
02358-45	Mercury Round Robin Consol	07-29-94

PARAMETER	02358-41	02358-42	02358-43	02358-44	02358-45
rcury (7470/7471)					
Mercury (7470/7471), mg/kg dw	0.38	0.46	<0.030	<0.030	0.11
Prep or Extraction Date	08.22.94	08.22.94	08.22.94	08.22.94	08.22.94
Date Analyzed	08.22.94	08.22.94	08.22.94	08.22.94	08.22.94
Batch ID	0822R	0822R	0822R	0822R	0822R
Percent Solids, %	100 %	100 %	100 %	100 %	100 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

SL *SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.*

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LOG NO: T4-02358

Received: 30 JUL 94

Mr. Kevin Grant
Cedar Bay Generating Co.
P.O. Box 26324
Jacksonville, FL 32226-6324

CC: Mr. Barrett Parker

Project: Mercury Test-Phase I
Sampled By: Client

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE/ TIME SAMPLED
02358-46	Fly Ash Std.	07-29-94

PARAMETER	02358-46
Mercury (7470/7471)	
Mercury (7470/7471), mg/kg dw	0.13
Prep or Extraction Date	08.22.94
Date Analyzed	08.22.94
Batch ID	0822R
Percent Solids, %	95 %

Method: EPA SW-846
HRS Certification #'s:81291,87279,E81005,E87052
FDEP CompQAP No. 890142G

For

Janet B. Pruitt

Final Page Of Report

SL **SAVANNAH LABORATORIES**
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue, Savannah, GA 31404 — Phone: (912) 354-7858 — Fax (912) 352-0165
2846 Industrial Plaza Drive, Tallahassee, FL 32301 — Phone: (904) 878-3994 — [illegible]4) 878-9504
414 Southwest 12th Avenue, Deerfield Beach, FL 33442 — Phone: (305) 421-7400 — [illegible]5) 421-2584
900 Lakeside Drive, Mobile, AL 36693 — Phone: (205) 666-6633 — Fax (205) 666-6696
6712 Benjamin Road, Suite 100, Tampa, FL 33634 — Phone: (813) 885-7427 — Fax (813) 885-7049

LYSIS REQUEST AND CHAIN OF CUSTODY RECORD

UMBER	PROJECT NUMBER	PROJECT NAME	PAGE	OF
		Mercury Test – Phase I	1	2

T NAME: edar Bay Generating Co. — TELEPHONE/FAX NO.: 904 751 4000

T ADDRESS: 0 Eastport Rd. — CITY, STATE, ZIP CODE: Jacksonville, Fl 32226-6324

LER(S) NAME(S): — CLIENT PROJECT MANAGER: Barrett Parker

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES: Mercury

NUMBER OF CONTAINERS SUBMITTED

☐ STANDARD TAT
☐ EXPEDITED TAT *

REPORT DUE DATE ____________

* SUBJECT TO RUSH FEES

SAMPLING E	TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	Mercury
9	0800	COAL-0.0-3-B1		X	
29	0800	COAL-0.0-3-B4		X	
9	0900	COAL-1.0-3-B1		X	
9	0900	COAL-1.0-3-B4		X	
9	1000	COAL-2.0-3-B1		X	
9	1000	COAL-2.0-3-B4		X	
9	800	FASH-0.0-3		X	
29	900	FASH-1.0-3		X	
9	1000	FASH-2.0-3		X	
9	0800	BASH-0.0-3		X	
9	0900	BASH-1.0-3		X	
9	1000	BASH-2.0-3		X	

UISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
PTY BOTTLES [signature]	7/28/94	1635	EMPTY BOTTLES			[signature]	7/29/94	7:00pm
VED BY: (SIGNATURE)	**DATE**	**TIME**	**RELINQUISHED BY: (SIGNATURE)**	**DATE**	**TIME**	**RECEIVED BY: (SIGNATURE)**	**DATE**	**TIME**

FOR SAVANNAH LABORATORY USE ONLY

VED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
mes French	7/30/94	1030	☑ YES ☐ NO		T402358	

ORIGINAL

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

- 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax (912) 352-0165
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- 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT NUMBER:
PROJECT NAME: Mercury Test – Phase I
PAGE 2 OF 2

CLIENT NAME: Cedar Bay Generating Co.
TELEPHONE/FAX NO.: 904 751 4000
CLIENT ADDRESS: ...0 Eastport Rd.
CITY, STATE, ZIP CODE: Jacksonville, Fl 32226
SAMPLER(S) NAME(S):
CLIENT PROJECT MANAGER: Barrett Parker

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES: Mercury

☐ STANDARD TAT
☐ EXPEDITED TAT *
REPORT DUE DATE ____________
* SUBJECT TO RUSH FEES

NUMBER OF CONTAINERS SUBMITTED

SAMPLING DATE	SAMPLING TIME	SAMPLE IDENTIFICATION	AQUEOUS	NONAQUEOUS	OIL	AIR
..9	1100	COAL-3.0-3-B1		✓		
..9	1100	COAL-3.0-3-B4		✓		
..9	1200	COAL-4.0-3-B1		✓		
..29	1200	COAL-4.0-3-B4		✓		
..29	1100	FASH-3.0-3		✓		
..29	1200	FASH-4.0-3		✓		
..9	1300	FASH-5.0-3		✓		
..29	1100	BASH-3.0-3		✓		
..29	1200	BASH-4.0-3		✓		
..29	1300	BASH-5.0-3		✓		
..9	1300	COAL-5.0-3-B1		✓		
..29	1300	COAL-5.0-3-B4		✓		

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES	7/28/94	1635	EMPTY BOTTLES				7/29/94	7:00pm

RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
Thomas French	7/30/94	1030	☑ YES ☐ NO		T4-02358	

ORIGINAL

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414 Southwest 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax (305) 421-2584
900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

LYSIS REQUEST AND CHAIN OF CUSTODY RECORD

ORIGINAL

UMBER: | PROJECT NUMBER: | PROJECT NAME: Mercury Test – Phase I

PAGE 1 OF 2

T NAME: lar Bay Generating Co. | TELEPHONE/FAX NO.: 904-751-4000

T ADDRESS: 0 Eastport Rd. | CITY, STATE, ZIP CODE: Jacksonville, Fl 32226

LER(S) NAME(S): | CLIENT PROJECT MANAGER: Barrett Parker

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES: MERCURY

NUMBER OF CONTAINERS SUBMITTED

☐ STANDARD TAT
☐ EXPEDITED TAT *

REPORT DUE DATE ____________

* SUBJECT TO RUSH FEES

SAMPLING E	TIME	SAMPLE IDENTIFICATION
1	1400	COAL-6.0-3-B1
9	1400	COAL-6.0-3-B4
1	1500	COAL-7.0-3-B1
9	1500	COAL-7.0-3-B4
9	1600	COAL-8.0-3-B1
1	1600	COAL-8.0-3-B4
1	1400	FASH-6.0-3
24	1500	FASH-7.0-3
9	1600	FASH-8.0-3
9	1400	BASH-6.0-3
9	1500	BASH-7.0-3
9	1600	BASH-8.0-3

UISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
PTY BOTTLES [signature]	7/28/94	1635	EMPTY BOTTLES			[signature]	7/29/94	7:00pm
'ED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

'ED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
mas Fuel	7/30/94	1030	☑ YES ☐ NO		T4-02358	

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

☐ 5102 LaRoche Avenue, Savannah, GA 31404 Phone: (912) 354-7858 Fax (912) 352-0165
☐ 2846 Industrial Plaza Drive, Tallahassee, FL 32301 Phone: (904) 878-3994 Fax (904) 878-9504
☐ 414 Southwest 12th Avenue, Deerfield Beach, FL 33442 Phone: (305) 421-7400 Fax (305) 421-2584
☐ 900 Lakeside Drive, Mobile, AL 36693 Phone: (205) 666-6633 Fax (205) 666-6696
☐ 6712 Benjamin Road, Suite 100, Tampa, FL 33634 Phone: (813) 885-7427 Fax (813) 885-7049

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

NUMBER	PROJECT NUMBER	PROJECT NAME
		Mercury Test - Phase I

PAGE 2 OF 2

CLIENT NAME: ...Bay Generating Co. TELEPHONE/FAX NO.: 904-751-4000

CLIENT ADDRESS: ...10 Eastport Rd., CITY, STATE, ZIP CODE: Jacksonville, Fl 32226

SAMPLER(S) NAME(S): CLIENT PROJECT MANAGER: Barrett Parker

MATRIX TYPE: AQUEOUS MATRIX / NONAQUEOUS MATRIX / OIL MATRIX / AIR MATRIX

REQUIRED ANALYSES: Mercury

NUMBER OF CONTAINERS SUBMITTED

☐ STANDARD TAT

☐ EXPEDITED TAT *

REPORT DUE DATE ____________

* SUBJECT TO RUSH FEES

SAMPLING DATE	SAMPLING TIME	SAMPLE IDENTIFICATION
...29	1700	Coal - 9.0 - 3 - B1
.../29	1700	COAL - 9.0 - 3 - B4
...29	1800	COAL - 10.0 - 3 - B1
...9	1800	COAL - 10.0 - 3 - B4
.../29	1700	FASH - 9.0 - 3
.../29	1800	FASH - 10.0 - 3
...29	1700	BASH - 9.0 - 3
...29	1800	BASH - 10.0 - 3
...9	—	Mercury Bound Bobis Consol
...29	—	Fly Ash Std.

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
EMPTY BOTTLES [signature]	7/28/94	1635	EMPTY BOTTLES			[signature]	7/29/94	7:00pm
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	CUSTODY SEAL NO.	S.L. LOG NO.	LABORATORY REMARKS
Thomas [signature]	7/30/94	1030	☑ YES ☐ NO		T4-02358	

ORIGINAL

APPENDIX G

AIR CONSULTING AND ENGINEERING, INC.'S REPORT OF MERCURY IN FLUE GAS SUBMITTED TO DEP IN SEPTEMBER 1994

SOURCE TEST REPORT
FOR
CEDAR BAY COGENERATION PROJECT
FDEP SITE CERTIFICATION PA 88-24A

MERCURY EMISSIONS

ON

UNIT 2

JULY 27-29, 1994

PREPARED FOR:

CEDAR BAY COGENERATION, INC.
JACKSONVILLE, FLORIDA

PREPARED BY:

AIR CONSULTING AND ENGINEERING, INC.
2106 NW 67TH PLACE, SUITE 4
GAINESVILLE, FLORIDA 32606

376-94-06

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ACE AIR CONSULTING & ENGINEERING, INC.
2106 N.W. 67th Place • Suite 4 • Gainesville, Florida • 32606
(904) 335-1889 FAX (904) 335-1891

REPORT CERTIFICATION

To the best of my knowledge, all applicable field and analytical procedures comply with Florida Department of Environmental Protection requirements and all test data and plant operating data are true and correct.

Charles G. Simon, Ph.D.

9/8/94
Date

1.0 INTRODUCTION

On July 27-29, 1994, Air Consulting and Engineering, Inc. (ACE) conducted mercury (Hg) emission testing on the exhaust duct after the baghouse from Unit-2 at the Cedar Bay Cogeneration Project, Inc. (CBCP) facility in Jacksonville, Florida. Testing was undertaken to gather baseline emission data for the unit. The unit is permitted under site certification PA-88-24A.

United States Environmental Protection Agency (EPA) Method 101A was used for for Hg emission measurements.

Mr. Kevin Grant of CBCP coordinated testing and provided production data.

Mr. Michael White of Roy F. Weston, Inc. (Weston) provided Hg audit samples and acted as the Quality Assurance officer during field sampling.

2.0 SUMMARY AND DISCUSSION OF RESULTS

Mercury emissions averaged 4.20 µg/dscm, or 3.46 x 10^{-6} lbs./MMBTU. Table 1 summarizes Hg emissions and flue gas parameters. Complete emission data, field data, and laboratory data are presented in Appendices A, B, and C, respectively.

Analyses of reagent and rinse solutions showed no detectable Hg (Appendix C), but a field blank collected prior to the first sample run yielded a total of 10.7 µg of Hg. This blank value is significant compared to the test values of 47.8,18.5 and 12.3 µg Hg for runs 1, 2 and 3, respectively. No blank corrections were made when calculating the Hg concentration and emission values reported in Table 1.

Two field audit samples prepared by Michael White of Weston yielded Hg values of 3.66 and 3.74 µg (Appendix C).

Table 1. Summary of Mercury Emissions
Cedar Bay Cogeneration Project, Inc.
Jacksonville, Florida
Unit-2 Baghouse Outlet
Test Dates: July 27-29, 1994

	$\%O_2$	source flow rate		sample volume		Total µg Hg in sample	µg Hg/dscm	*Hg emission rate	
		dscfm	dscmm	dscf	dscm			lbs./hr. $(x10^{-3})$	lbs./MMBTU $(x\ 10^{-6})$
Run 1 July 27 1300-1722	5.3	241,152	6857	217.3	6.153	47.8	7.77	7.05	6.35
Run 2 July 28 0900-1306	5.6	261,152	7395	221.4	6.268	18.5	2.96	2.89	2.47
Run 3 July 29 0937-1037 and 1350-1721	5.4	261,427	7403	230.6	6.530	12.3	1.88	1.84	1.55
						Averages	4.20	3.93	3.46

*F factor based emission rate calculated using F = 9780 dscf/MMBTU for bituminous coal.

3.0 PROCESS DESCRIPTION AND OPERATION

The CBCP Unit-2 is a bituminous coal-fired power boiler employing ammonia injection and a baghouse for emissions control. It is permitted at a maximum firing rate of 104,000 lbs of coal per hour.

A summary of average production during testing is presented in Table 2. Complete production data is presented in Appendix E.

Table 2. CBCP Unit-2 production data during Hg emission testing.

Date	time	coal flow (K lb./Hr.)	main steam flow (K lb./Hr.)	gross generation (MW)	*MMBTUH
Run-1					
July 27	1300-1722	88.32	662.5	282.3	1021
Run-2					
July 28	0900-1306	85.40	656.4	283.6	1027
Run-3					
July 29	0937-1037	84.45	286.6	284.4	988
and	1350-1721				

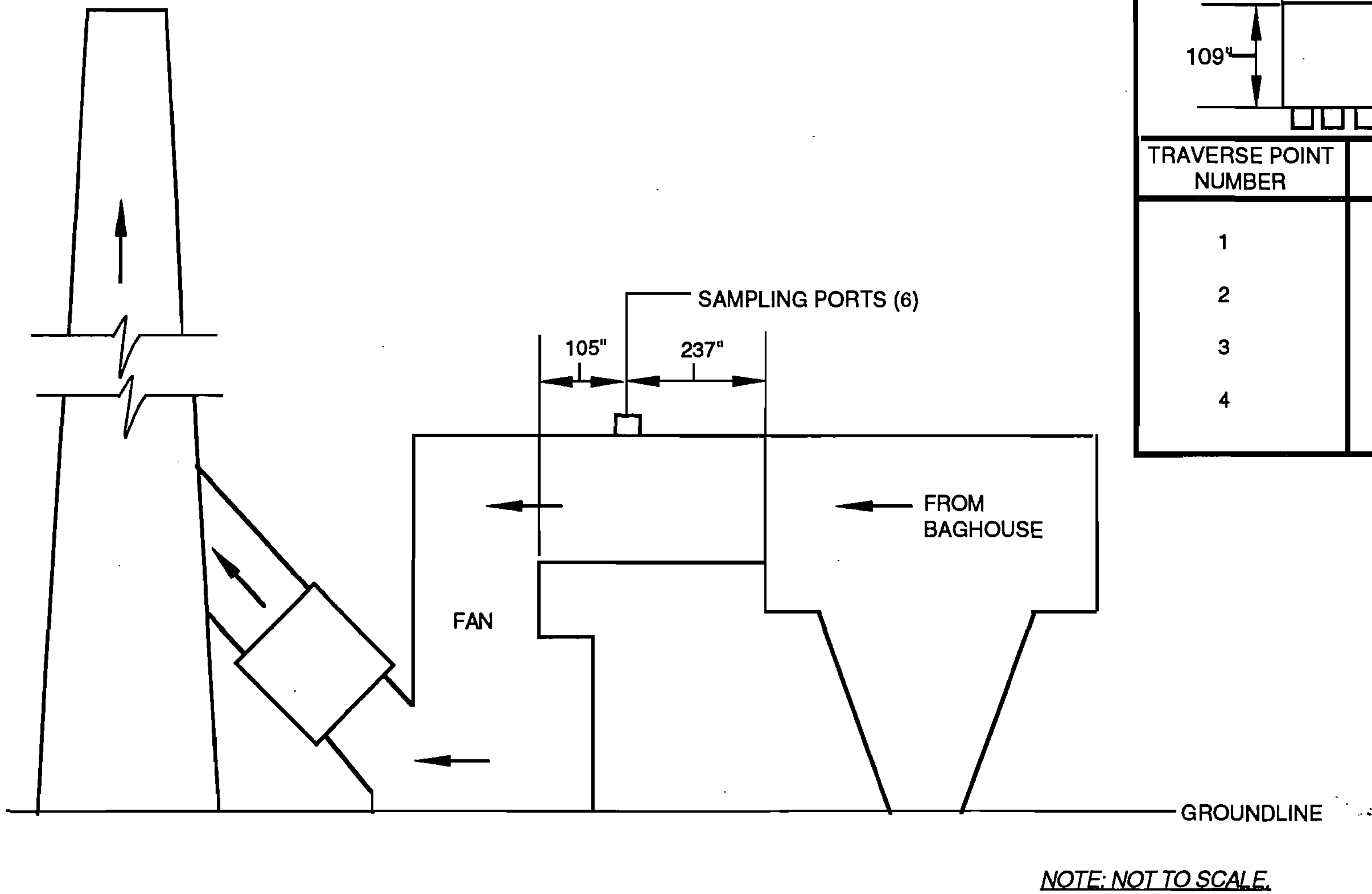
*Based on values of 11,562, 12,030 and 11,700 BTU/lb of coal for July 27, 28 and 29, respectively.

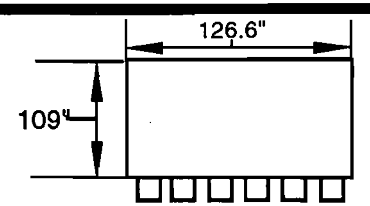
4.0 SAMPLING POINT LOCATION

Figure 1 is a schematic of the Unit-2 baghouse outlet showing individual sampling point locations.

5.0 FIELD AND ANALYTICAL PROCEDURES

Complete copies of EPA Methods 101 and 101A are included in Appendix F.





TRAVERSE POINT NUMBER	INCHES INSIDE STACK WALL
1	13.63
2	40.88
3	68.13
4	95.38

FIGURE 1.
SAMPLING POINT LOCATION
UNIT 2 EXHAUST DUCT
CEDAR BAY GENERATING COMPANY
JACKSONVILLE, FLORIDA

ACE
AIR CONSULTING
& ENGINEERING, INC.

APPENDIX A

COMPLETE EMISSION DATA WITH SAMPLE CALCULATIONS

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

Plant: Cedar Bay Generating Company
Location: Jacksonville, Florida
Date: 07/27/94
Stack: Unit Number 2 - Hg | Run: 1 From 1300 to 1722

Y Factor	1.013		Nozzle Diameter	0.250	In
Total Time	240	Min	Nozzle Area	0.000341	Ft^2
Stack Area	95.820	Ft^2	Barometric Pressure	29.97	In Hg
Stack Temperature	330.3	°F	Meter Temperature	100.0	°F
Stack Pressure	28.27	In Hg	Meter Orifice Diff	3.238	In H_2O
Stack Avg √ Vel Head	1.037	In H_2O	Meter Volume	225.391	CF
			F Factor	9780.0	
			Condensate Volume	417.5	ml

1. Volume Water Vapor Sampled 19.652 SCF
2. Volume Standard Dry Gas Sampled 217.268 SCF or 6.152 SCM
3. Total Standard Sample Volume 236.920 SCF
4. Percent Moisture 8.295
5. Percent Dry Air 91.705
6. Molecular Weight of Dry Flue Gas 30.292
7. Molecular Weight of Wet Flue Gas 29.272
8. Specific Gravity Flue Gas 1.01
9. Percent Oxygen [O_2] 5.30
10. Percent Carbon Dioxide [CO_2] 13.00
11. Percent Excess Air 32.578
12. Velocity of Flue Gas 72.757 FPS
13. Actual Volumetric Flow Rate 418295.6 ACFM
14. Dry Volumetric Flow Rate 383599.3 ACFMD
15. Standard Volumetric Flow Rate 242152.3 SCFMD or 6857 SCMMD
16. Emission Concentration 7.77 ug/SCM
17. Emission Concentration 4.50 ug/ACM
18. Emission Concentration 4.85×10^{-10} lbs/SCFD
19. Emission Rate 0.00705 lbs/Hr
20. Emission Rate 6.36×10^{-6} lbs/MMBTU
21. Percent Isokinetic 105.1

Probe/Nozzle Wash 0.918 ug
Impingers 46.9 ug
Total 47.8 ug

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

Plant: Cedar Bay Generating Company
Location: Jacksonville, Florida
Date: 07/28/94
Stack: Unit Number 2 - Hg Run: 2 From 0900 to 1306

Y Factor	1.013		Nozzle Diameter	0.250	In
Total Time	240	Min	Nozzle Area	0.000341	Ft^2
Stack Area	95.820	Ft^2	Barometric Pressure	29.96	In Hg
Stack Temperature	323.1	°F	Meter Temperature	92.1	°F
Stack Pressure	29.84	In Hg	Meter Orifice Diff	3.400	In H_2O
Stack Avg √ Vel Head	1.088	In H_2O	Meter Volume	226.391	CF
			F Factor	9780.0	
			Condensate Volume	434.6	ml

1. Volume Water Vapor Sampled	20.457 SCF	
2. Volume Standard Dry Gas Sampled	221.359 SCF	or 6.268 SCM
3. Total Standard Sample Volume	241.815 SCF	
4. Percent Moisture	8.460	
5. Percent Dry Air	91.540	
6. Molecular Weight of Dry Flue Gas	30.464	
7. Molecular Weight of Wet Flue Gas	29.410	
8. Specific Gravity Flue Gas	1.02	
9. Percent Oxygen [O_2]	5.60	
10. Percent Carbon Dioxide [CO_2]	14.00	
11. Percent Excess Air	35.839	
12. Velocity of Flue Gas	73.790 FPS	
13. Actual Volumetric Flow Rate	424232.3 ACFM	
14. Dry Volumetric Flow Rate	388343.9 ACFMD	
15. Standard Volumetric Flow Rate	261150.7 SCFMD	or 7395 SCMMD
16. Emission Concentration	2.96 ug/SCM	
17. Emission Concentration	1.83 ug/ACM	
18. Emission Concentration	1.85×10^{-10} lbs/SCFD	
19. Emission Rate	0.00289 lbs/Hr	
20. Emission Rate	2.47×10^{-6} lbs/MMBTU	
21. Percent Isokinetic	99.3	

Probe/Nozzle Wash	0.912 ug
Impingers	17.6 ug
Total	18.5 ug

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

Plant: Cedar Bay Generating Company
Location: Jacksonville, Florida
Date: 07/29/94 — 0932 to 1037
Stack: Unit Number 2 - Hg — Run: 3 From 1350 to 1721

Y Factor	1.013		Nozzle Diameter	0.250	In
Total Time	240	Min	Nozzle Area	0.000341	Ft^2
Stack Area	95.820	Ft^2	Barometric Pressure	30.06	In Hg
Stack Temperature	320.2	°F	Meter Temperature	88.7	°F
Stack Pressure	29.60	In Hg	Meter Orifice Diff	3.534	In H_2O
Stack Avg √ Vel Head	1.088	In H_2O	Meter Volume	233.538	CF
			F Factor	9780.0	
			Condensate Volume	435.2	ml

1.	Volume Water Vapor Sampled	20.485 SCF
2.	Volume Standard Dry Gas Sampled	230.596 SCF or 6.530 SCM
3.	Total Standard Sample Volume	251.081 SCF
4.	Percent Moisture	8.159
5.	Percent Dry Air	91.841
6.	Molecular Weight of Dry Flue Gas	30.456
7.	Molecular Weight of Wet Flue Gas	29.440
8.	Specific Gravity Flue Gas	1.02
9.	Percent Oxygen [O_2]	5.40
10.	Percent Carbon Dioxide [CO_2]	14.00
11.	Percent Excess Air	34.008
12.	Velocity of Flue Gas	73.956 FPS
13.	Actual Volumetric Flow Rate	425189.2 ACFM
14.	Dry Volumetric Flow Rate	390499.4 ACFMD
15.	Standard Volumetric Flow Rate	261427.1 SCFMD or 7403 SCMMD
16.	Emission Concentration	1.88 ug/SCM
17.	Emission Concentration	1.17 ug/ACM
18.	Emission Concentration	1.17×10^{-10} lbs/SCFD
19.	Emission Rate	0.00184 lbs/Hr
20.	Emission Rate	1.55×10^{-6} lbs/MMBTU
21.	Percent Isokinetic	103.4

Probe/Nozzle Wash	4.62 ug
Impingers	7.66 ug
Total	12.3 ug

Plant: Cedar Bay Generating Company
Date: 07/27/94
Stack: Unit Number 2 - Hg
Run Number: 1

Average √ Velocity Head = 1.037
Velocity Head Inputs:

0.7200	0.7700	0.8000	0.7900	0.8200	0.8100
0.7200	0.7500	1.1000	1.1000	1.1000	1.1000
1.1000	1.2000	0.7400	0.7500	1.4000	1.3000
1.2000	1.2000	1.2000	1.2000	1.0000	1.0000
1.6000	1.7000	1.4000	1.4000	1.2000	1.2000
1.1000	1.3000	1.3000	1.3000	1.2000	1.1000
0.9700	1.0000	1.1000	1.5000	1.5000	1.4000
1.0000	1.1000	0.7400	0.7500	0.8000	0.7900

Average Orifice Pressure = 3.238
Orifice Pressure Inputs:

2.1600	2.3100	2.4000	2.3700	2.4600	2.4300
2.1600	2.2500	3.3000	3.3000	3.3000	3.3000
3.3000	3.6000	2.2200	2.2500	4.2000	3.9000
3.6000	3.6000	3.6000	3.6000	3.0000	3.0000
4.8000	5.1000	4.2000	4.2000	3.6000	3.6000
3.3000	3.9000	3.9000	3.9000	3.6000	3.3000
2.9000	3.0000	3.3000	3.0000	4.5000	4.2000
3.0000	3.3000	2.2000	2.2000	2.4000	2.4000

Average Stack Temperature = 330.3
Stack Temperature Inputs:

329.0	323.0	329.0	332.0	333.0	334.0
326.0	332.0	333.0	329.0	334.0	332.0
330.0	332.0	330.0	330.0	335.0	331.0
335.0	330.0	335.0	329.0	322.0	323.0
332.0	335.0	332.0	335.0	331.0	333.0
334.0	336.0	333.0	332.0	333.0	331.0
332.0	330.0	320.0	325.0	328.0	331.0
330.0	331.0	330.0	325.0	322.0	325.0

Average Meter Temperature = 100.0
Meter Temperature Inputs:

80.0	80.0	81.0	82.0	83.0	85.0
87.0	89.0	91.0	92.0	93.0	93.0
95.0	96.0	98.0	99.0	100.0	100.0
101.0	101.0	102.0	103.0	105.0	105.0
105.0	105.0	106.0	106.0	107.0	107.0
108.0	108.0	108.0	107.0	108.0	108.0
108.0	108.0	108.0	107.0	106.0	106.0
106.0	106.0	105.0	105.0	105.0	105.0

Plant: Cedar Bay Generating Company
Date: 07/28/94
Stack: Unit Number 2 - Hg
Run Number: 2

Average √ Velocity Head = 1.088
Velocity Head Inputs:

1.1000	1.0000	0.8000	0.8500	0.8000	1.0000
0.7800	0.7500	1.1000	1.1000	1.2000	1.2000
1.3000	1.2000	1.0000	0.9800	1.2000	1.2000
1.5000	1.5000	1.5000	1.5000	1.1000	1.1000
1.5000	1.4000	1.3000	1.4000	1.6000	1.4000
1.1000	1.2000	1.5000	1.4000	1.4000	1.3000
1.2000	1.2000	1.1000	1.1000	1.3000	1.1000
1.3000	1.3000	1.2000	1.2000	1.0000	1.0000

Average Orifice Pressure = 3.400
Orifice Pressure Inputs:

3.0000	2.7000	2.2000	2.3000	2.2000	2.7000
2.1000	2.0000	3.0000	3.0000	3.2000	3.2000
3.5000	3.2000	2.7000	2.7000	3.2000	3.2000
4.1000	4.1000	4.1000	4.1000	3.0000	3.0000
4.3000	4.0000	3.8000	4.2000	4.8000	4.2000
3.2000	3.6000	4.5000	4.2000	4.2000	3.9000
3.6000	3.6000	3.3000	3.3000	3.9000	3.3000
3.9000	3.9000	3.6000	3.6000	2.9000	2.9000

Average Stack Temperature = 323.1
Stack Temperature Inputs:

321.0	321.0	321.0	320.0	322.0	322.0
320.0	322.0	320.0	321.0	322.0	323.0
323.0	323.0	323.0	322.0	323.0	323.0
323.0	323.0	324.0	324.0	325.0	322.0
322.0	324.0	324.0	326.0	326.0	326.0
325.0	325.0	323.0	326.0	325.0	325.0
325.0	324.0	324.0	324.0	324.0	323.0
323.0	322.0	322.0	322.0	322.0	322.0

Average Meter Temperature = 92.1
Meter Temperature Inputs:

67.0	68.0	68.0	70.0	72.0	74.0
76.0	78.0	80.0	82.0	83.0	84.0
86.0	87.0	88.0	91.0	92.0	93.0
93.0	93.0	95.0	95.0	96.0	97.0
97.0	98.0	98.0	99.0	99.0	100.0
101.0	101.0	101.0	101.0	101.0	101.0
102.0	102.0	103.0	102.0	102.0	101.0
101.0	101.0	101.0	101.0	100.0	100.0

Plant: Cedar Bay Generating Company
Date: 07/29/94
Stack: Unit Number 2 - Hg
Run Number: 3

Average √ Velocity Head = 1.088
Velocity Head Inputs:

0.9600	0.9300	0.7500	0.7500	0.7500	0.6500
0.9600	0.7900	1.1000	1.1000	1.1500	1.1500
1.2500	1.2500	0.9000	0.9000	1.4500	1.4500
1.5500	1.5500	1.5500	1.5500	1.1000	1.2000
1.3000	1.3000	1.1000	1.5000	1.3000	1.3000
1.2000	1.2000	1.5000	1.4000	1.3000	1.3000
1.5000	1.2000	1.0000	1.3000	1.3000	1.3000
1.2000	1.2000	1.2000	1.3000	1.2000	1.3000

Average Orifice Pressure = 3.534
Orifice Pressure Inputs:

2.7500	2.7000	2.1500	2.1500	2.1500	1.9000
2.8000	2.3000	3.2000	3.1500	3.3000	3.3000
3.5500	3.5500	2.6000	2.6000	4.1500	4.1500
4.4500	4.4500	4.4500	4.4500	3.1500	3.4500
3.7000	3.7000	3.2000	4.5000	3.9000	3.9000
3.6000	3.6000	4.5000	4.2000	3.9000	3.9000
4.5000	3.6000	3.0000	3.9000	4.0000	4.0000
3.8000	3.8000	3.8000	4.0000	3.8000	4.0000

Average Stack Temperature = 320.2
Stack Temperature Inputs:

324.0	324.0	324.0	324.0	325.0	326.0
326.0	326.0	322.0	317.0	317.0	318.0
317.0	318.0	315.0	316.0	319.0	318.0
318.0	319.0	320.0	320.0	320.0	319.0
319.0	320.0	320.0	318.0	318.0	320.0
318.0	319.0	319.0	320.0	320.0	320.0
321.0	321.0	322.0	320.0	319.0	322.0
322.0	322.0	320.0	320.0	320.0	320.0

Average Meter Temperature = 88.7
Meter Temperature Inputs:

70.0	71.0	72.0	73.0	75.0	76.0
77.0	78.0	80.0	72.0	72.0	72.0
74.0	76.0	78.0	80.0	81.0	83.0
86.0	87.0	89.0	91.0	92.0	93.0
95.0	95.0	96.0	97.0	98.0	98.0
99.0	99.0	99.0	99.0	99.0	99.0
99.0	99.0	100.0	100.0	99.0	98.0
98.0	98.0	99.0	99.0	99.0	99.0

Sample Calculations Run 1

Plant: Cedar Bay Generating Company
Date: 07/27/94
Stack: Unit Number 2 - Hg

Vwv Volume Water Vapor Sampled
Vwv = 0.04707 X 417.500 = 19.652 SCF

VMstd Volume Standard Dry Gas Sampled
VMstd = 17.64 X 225.391 X 1.013 X
[29.97 + (3.238 / 13.6)] / (100.0 + 460) = 217.268 SCF

Vt Total Standard Sample Volume
Vt = 19.652 + 217.268 = 236.920 SCF

W Percent Water = (19.652 / 236.920) X 100 = 8.3 %

FDA Percent Dry Air = (1 - 0.083) X 100 = 91.7 %

Md Molecular Weight of Dry Stack Gas
Md = (0.44 X 13.00 %CO_2) + (0.32 X 5.30 %O_2) +
[0.28 X (81.70 %N_2+ 0.00 %CO)] = 30.29

MS Molecular Weight of Wet Stack Gas
MS = (30.292 X 0.917) + (18 X 0.083) = 29.272

SG Specific Gravity Stack Gas
SG = 29.272 / 28.84 = 1.01

Ea Percent Excess Air
Ea = [(5.30 %O_2)-(0.00 %CO / 2)] X 100

(.264 X (81.70 %N_2)) - ((5.30 %O_2)+(0.00 %CO / 2))
EA = 32.578

Vs Velocity of Stack
Vs = (85.49 X 0.84 X 1.037) X [(330.3 +460) /(28.27 X 29.27)]$^{1/2}$
Vs = 72.757

Qa Actual Volumetric Flow
Qa = (95.820 X 72.757 X 60) = 418295.6 ACFM

Qd = Dry Volumetric Flow
Qd = (418295.6 X 0.917) = 383599.3 ACFMD

Qsd Standard Volumetric Flow
Qsd = 418295.6 X 0.917 X [528 / (330.3 +460)] X
(28.27 / 29.92) = 242152.3 SCFMD

Sample Calculations Run 1

Plant: Cedar Bay Generating Company
Date: 07/27/94
Stack: Unit Number 2 - Hg

ESTP Emission Concentration
gr/SCF = [0.01543 X (0.0 + 0.0478)] / (217.268)
gr/SCF = 3.4×10^{-6}

Lbs/SCF Emission Rate
Lbs/SCF = (3.4×10^{-6} / 7000) = 4.9×10^{-10}

Lbs/Hr Emission Rate
Lbs/Hr = (3.4×10^{-6}/ 7000) X 242152.3 X 60 = 7.05 $\times 10^{-3}$

Lbs/MM BTU Emission Rate
Lbs/MM = 4.9×10^{-10} X 9780.000000 X (20.9
/ (20.9 - 5.300 $\%O_2$)) = 6.4×10^{-6}

I Percent Isokinetic
I = 100 X (330.3 +460) X [(.002669 X 417.5) + (225.391 X 1.013 /
(100.0 + 460)) X (29.97 + (3.238 / 13.6))] /
(60 X 240.00 X 72.757 X 28.27 X 0.000341)
I = 105.1 %

APPENDIX B

FIELD DATA SHEETS

6221

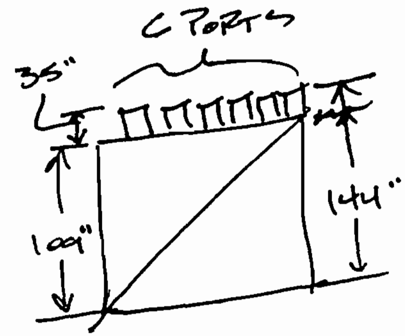
STACK SAMPLING FIELD DATA SHEET

ACE AIR CONSULTING & ENGINEERING, INC.

2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

TEST 1-Hg
PAGE 1 OF 3

PLANT CEDAR BAY GEN. CO
SOURCE UNIT 2
PLANT LOCATION JACKSONVILLE, FL.
TYPE OF SAMPLING TRAIN EPA 101A
TYPE OF SAMPLES Hg
DATE 7/27/94 RUN NO. 1
TIME START 1300 TIME END 1722
SAMPLE TIME 24 / 10 (min/pt)= 240 Total min
ASSUMED MOISTURE 10 % FDA .90
NOMOGRAPH C 1.3.0 PITOT CORR. .84
P_b 29.94 "Hg P_s (-1.7 Hg) 28.27 "Hg
WEATHER CLEAR TEMP. 90's °F
METER BOX NO. 1 H 1.99 Y 1.013
NOZZLE CAL. .250 .250 .249 = .250
STACK DIMENSIONS 126.6"W x 109"H
STACK AREA 95.829 ft² EFFECTIVE 95.829 ft²
STACK HEIGHT ~60 ft. (TO PLATFORM)
STACK DIAMETER: UPSTRM. 257" DNSTRM. 105"
PORT SIZE 6 in. NIPPLE LENGTH 30 in.
U CORD LENGTH 200'
REMARKS: READINGS TAKEN EVERY 5 MIN.
JEFFERY WINTERS / BILL GASTON - BES
MORT BENJAMIN / STAN MAZUR



1-1 13.63
2 40.88
3 68.13
4 95.38

376 94 06

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 827.291 ft³
INITIAL 601.900 ft³
NET 225.391 ft³
FILTER NO. R-1 IMP. VOL. GAIN 372 ml.
SIL GEL NO. SPECIAL WT. GAIN 45.5 ml.
TOTAL CONDENSATE 417.5 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					13.0
% O_2					5.3
% CO					
% N_2					

F_0 = 1.083-1.230 F_0 RANGE = 1.200
ORSAT ANALYZER SN/CH

LEAK CHECKS
PRE .008 cfm 20 "Hg POST .003 cfm 15 "Hg
METER BOX/PUMP ✓ GAS SAMPLE SYST. ✓
ORSAT BAG ✓
PITOT TUBE NO. 125 PRE-TEST ok
POST-TEST(+) 2.8/0.001 15 H_2O/Sec
POST-TEST(−) 3.1/0.001 15 H_2O/Sec
PYROMETER NO. ATK-6
BOX OPERATOR CH PROBE HOLDER SC/TB

15.24

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. F	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1	5.2	1305	605.75	.72	2.16	2.16	329	234	63	80	7.0
1		1310	609.53	.77	2.31	2.31	323	226	57	80	7.5
2	5.0	1315	613.57	.80	2.40	2.40	329	226	56	81	7.5
2		1320	617.62	.79	2.37	2.37	332	232	57	82	8.0
3	5.4	1325	621.57	.82	2.46	2.46	260 333	230	56	83	7.5
3		1330	625.61	.81	2.43	2.43	334	229	58	86	7.5

2...
217.8
28.35 B- 4.3✓

AIR CONS[...]ING & ENGINEE[...] INC.

Cedar Bay 7/29/11

601.9

TEST 1-Hg
PAGE 2 OF 3

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP (°F)	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4	5.5	1335	629.53	.72	2.16	2.16	326	231	57	87	7.5
4	5.3	1340	633.34	.75	2.25	2.25	332	231	57	89	7.0
		(	(31.44)	(.879)							
2-1	5.1	1351	637.75	1.1	3.30	3.30	333	243	62	91	9.0
1	5.2	1356	642.99	1.1	3.30	3.30	329	230	56	92	9.0
2		1401	646.81	~~.75~~ 1.1	~~2.25~~ 3.30	~~2.25~~ 3.30	334	232	56	93	8.0
2	5.1	1406	651.50	1.1	3.30	3.30	332	240	57	93	9.0
3	5.2	1411	656.16	1.1	3.30	3.30	330	248	57	95	9.0
3		1416	660.96	1.2	3.60	3.60	332	252	60	96	9.0
4	5.1	1421	665.81	.74	2.22	2.22	330	243	59	98	9.0
4	5.2	1426	670.02	.75	2.25	2.25	330	255	61	99	9.0
	105→	(65.0	(68.12)	(1.01)							
3-1	5.2	1438	674.19	1.4	4.20	4.20	335	257	53	100	10.0
1	5.3	1443	679.99	1.3	3.90	3.90	331	253	49	100	10.5
2		1448	685.06	1.2	3.60	3.60	335	253	49	101	10.5
2	5.1	1453	689.97	1.2	3.60	3.60	330	245	49	101	9.5
3		1458	694.90	1.2	3.60	3.60	335	255	52	102	9.5
3	(Pt #3 sampled twice)	1503	699.95	1.2	3.60	3.60	329	245	52	103	9.5
4		1508	704.81	1.0	3.00	3.00	322	249	53	105	9.0
4	5.2	1513	709.542	1.0	3.00	3.00	323	254	53	105	9.0
		(62.4	(107.64)	(1.09)							
4-1	5.2	1520	714.91	1.6	4.80	4.80	332	231	54	105	11.0
1	5.2	1525	720.61	1.7	~~7~~5.10	5.10	335	234	52	105	12.0
2		1530	726.11	1.4	4.20	4.20	332	231	52	106	11.0
2		1535	731.46	1.4	4.20	4.20	335	249	54	106	11.0
3		1540	736.68	~~1.5~~ 1.2	~~4.50~~ 3.60	~~4.50~~ 3.60	331	242	54	107	11.0
3		1545	741.70	1.2	X3.60	3.60	333	239	54	107	10.0

AIR CONS G
& ENGINEEF NC.

Cedar Ery 11/29/17

TEST 1-Hg

PAGE 3 OF 3

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft^3)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O") CALC.	METER ORIFICE PRESS. DIFF. ("H_2O") ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP (°F)	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4	5.1	1550	746.61	1.1	3.30	3.30	334	250	55	108	9.5
4	5.4	1555	751.57	1.3	3.90	3.90	336	250	55	108	9.5
		(142.53	149.07)	(1.164)							
5.1	7.3	1604	756.31	1.3	3.90	3.90	333	251	48	108	10.0
1		1609	761.57	1.3	3.90	3.90	332	243	48	107	10.0
2	5.2	1614	766.54	1.2	3.60	3.60	333	252	49	108	10.0
2	5.3	1619	771.51	1.1	3.30	3.30	331	250	49	108	10.0
3		1624	776.50	.97	2.91	2.9	332	257	49	108	10.0
3	5.3	1629	781.50	1.0	3.00	3.0	330	250	49	108	10.0
4	5.3	1634	786.40	1.1	3.3	3.3	320	256.	50	108	9.5
4		1639	791.25	.99	3.0	3.0	325	240	50	107	9.5
	1017.→	(187.2	189.35)	(1.057)							
6-1	5.4	1647	796.55	1.5	4.5	4.5	328	251	54	106	10.0
1	5.4	1652	801.99	1.4	4.2	4.2	331	255	51	106	10.0
2	5.4	1657	806.65	1.0	3.0	3.0	330	247	51	106	8.5
2		1702	811.15	1.1	3.3	3.3	331	251	52	106	8.5
3	5.3	1707	815.24	.74	2.22	2.2	330	248	52	105	8.0
3		1712	819.17	.75	2.25	2.2	325	248	51	105	7.0
4		1717	823.—	.80	2.40	2.4	322	250	48	105	7.5
4		1722	827.291	.79	2.37	2.4	325	250	46	105	7.5
		(225.8	)	(.996)							
									( )		
		(1.033)	(240)	(146)	(.0003409)	($\sqrt{\frac{290}{1.0}}$)	($\frac{29.97}{28.27}$)	($\frac{555}{790}$)	=	%I =	

STACK S[redacted]LING FIELD DATA SHEET

ACE[redacted] AIR CONSULTING & ENGINEERING, INC.

2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

TEST [redacted]-Hg
PAGE 1 OF 3

PLANT CEDAR BAY GEN. CO.
SOURCE UNIT 2
PLANT LOCATION JACKSONVILLE, FL.
TYPE OF SAMPLING TRAIN EPA-101A
TYPE OF SAMPLES Hg
DATE 7/28/94 RUN NO. 2
TIME START 0900 TIME END 1306
SAMPLE TIME 24 / 10 (min/pt)= 240 Total min
ASSUMED MOISTURE 8 % FDA .92
NOMOGRAPH C_f 1=2.9 PITOT CORR. .84
P_b 29.96 "Hg P_s 29.84 (-1.65") Hg
WEATHER CLEAR TEMP. 80-90 °F
METER BOX NO. 1 H 1.99 Y 1.013
NOZZLE CAL. .250 .250 .249 = .250
STACK DIMENSIONS 126.6"W x 109"H
STACK AREA 95.829 ft² EFFECTIVE 95.829 ft²
STACK HEIGHT ~60 ft. (TO PLATFORM
STACK DIAMETER: UPSTRM. 237" DNSTRM. 105"
PORT SIZE 6 in. NIPPLE LENGTH 38 in.
U CORD LENGTH 200'
REMARKS:

2.86
4.51

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 1053.991 ft³
INITIAL 827.600 ft³
NET 226.391 ft³
FILTER NO. RUN 2 IMP. VOL. GAIN 390 ml.
SIL GEL NO. SPECIAL WT. GAIN 44.6 ml.
TOTAL CONDENSATE 434.6 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					14.0
% O_2					5.6
% CO					
% N_2					

F_0 = 1.083-1.230 F_0 RANGE = 1.0929
ORSAT ANALYZER CH/SN

LEAK CHECKS
PRE 0.000 cfm 15 "Hg POST 0.013 cfm 14.5 "Hg
METER BOX/PUMP ✓ GAS SAMPLE SYST. ✓
ORSAT BAG ✓
PITOT TUBE NO. 125 PRE-TEST OK
POST-TEST(+) 3.2/0.001 15 H_2O/Sec
POST-TEST(-) 3.5/0.001 15 H_2O/Sec
PYROMETER NO. ATK-6
BOX OPERATOR CH PROBE HOLDER SU/TB

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP F	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1	5.4	0900	831.02	1.1	2.97	3.0	321	260	60	67	9.0
21		0905	836.27	1.0	2.70	2.7	321	261	49	68	8.5
22	5.8	0910	840.16	.80	2.16	2.2	321	259	49	68	7.5
2		0915	844.–	.85	2.3	2.3	320	271	53	70	7.5
3	5.7	0920	847.89	~~1.00~~ .80	~~3.00~~	2.2 ~~3.00~~	322	259	56	72	6.5
3		0925	852.10	1.0	2.70	2.7	322	250	58	74	8.0

AIR CONS... & ENGINEE... INC.

Cedar Ra.

7/28/94

TEST 2-Hg

PAGE 2 OF 3

2.86 / 4.5   827.6

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP (°F)	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4	5.4	0930	856.11	.78	2.11	2.1	320	241	58	76	7.5
4		0935	859.78	.75	2.03	2.0	322	247	60	78	7.0
		(33.79	/ 32.18)	(.939)							
2-1	5.7 0946	~~0941~~	863.70	1.1	2.97	3.0	320	244	59	80	8.5
1	0951	~~0946~~	867.99	1.1	2.97	3.0	321	240	58	82	8.5
2	5.6 0956	~~0951~~ ~~0947~~	872.60	1.2	3.24	3.2	322	239	58	83	9.0
2	1001	~~0956~~	877.19	1.2	3.24	3.2	323	245	58	84	9.0
3	5.8 1006	~~1001~~	881.82	1.3	3.51	3.5	323	248	59	86	9.5
3	1011	~~1006~~	886.60	1.2	3.24	3.2	323	256	60	87	9.5
4	5.6 1016	~~1011~~	891.00	1.0	2.70	2.7	323	254	56	88	8.0
4	1021	~~1016~~	895.07	.98	2.65	2.7	322	241	52	91	8.0
		(71.68	/ 67.47)	(1.052)							
3-1	5.6	1027	899.42	1.2	3.24	3.2	323	272	51	92	9.0
1		1032	904.39	1.2	3.24	3.2	323	273	50	93	9.0
2	5.8	1037	908.81	1.5	4.05	4.1	323	276	51	93	10.5
2		1042	914.01	1.5	4.05	4.1	323	264	50	93	10.5
3	5.6	1047	919.22	1.5	4.05	4.1	324	262	51	95	10.5
3		1052	924.34	1.5	4.05	4.1	324	259	51	95	10.5
4	5.5	1057	929.11	~~1.5~~ 1.1	2.97	3.0	325	260	51	96	10.0
4		1102	933.79	1.1	2.97	3.0	322	273	52	97	9.5
	(111.41)	(113.0	/ 106.19)	(1.148)							
4-1	5.5	1109	938.65	1.5	4.05	4.13	322	272	48	97	10.5
1		1114	943.81	1.4	4.00	4.0	324	279	47	98	11.0
2	5.6	1119	948.37	1.3	3.77	3.8	324	265	49	98	10.5
2		1124	953.99	1.4	4.20	4.2	326	263	49	99	10.5
3	5.6	1129	959.75	1.6	4.78	4.8	326	265	49	99	12.0
3		1134	965.14	1.4	4.19	4.2	326	252	48	100	11.0

1.021

AIR CONS[illegible]G & ENGINEER[illegible]NC.

C las Pay
7/28/94

TEST 2-Hg
PAGE 3 OF 3

1.044   120   2.56 / 4.54   827.6

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP (°F)	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4	5.6	1139	970.30	1.1	3.19	3.2	325	265	47	101	10.0
4		1144	975.03	1.2	3.49	3.6	325	263	47	101	10.5
		(153.94/	147.43)	(1.137)							
5-1	5.6	1150	979.93	1.5	4.49	4.5	323	263	49	101	11.5
1		1155	985.37	1.4	4.19	4.2	326	268	47	101	11.5
2	5.6	1200	990.91	1.4	4.19	4.2	325	273	47	101	11.0
2		1205	995.83	1.3	3.89	3.9	325	274	48	101	10.5
3	5.5	1210	1000.90	1.2	3.58	3.6	325	262	48	102	10.0
3		1215	5.84	1.2	3.58	3.6	324	269	48	102	10.0
4	5.5	1220	10.70	1.1	3.29	3.3	324	263	47	103	10.0
4		1225	15.38	1.1	3.29	3.3	324	263	50	102	10.0
		(189189/	187.78)	(.979)							
6-1	5.3	1231	20.21	1.3	3.89	3.9	324	272	50	102	10.0
1		1236	25.12	1.1	3.29	3.3	323	270	47	101	9.5
2	5.5	1241	30.01	1.3	3.89	3.9	323	271	49	101	10.0
2		1246	35.23	1.3	3.89	3.9	322	268	48	101	10.5
3		1251	40.37	1.2	3.58	3.6	322	270	48	101	10.5
3	5.4	1256	45.40	1.2	3.58	3.6	322	271	48	101	10.0
4		1301	49.61	~~.9~~ 1.0	~~2.7~~ 2.9	~~2.7~~ 2.9	322	270	48	100	8.5
4	5.6	1306	53.991	1.0	2.72	2.9	322	269	48	100	8.5
		(	/)	(1.083)							
		(240)(1.0443)(.0003409)(146)($\sqrt{\frac{782}{1.021}\left(\frac{29.92}{29.84}\right)}$)($\frac{560}{782}$)(.92) = 230 % I =									

STACK SAMPLING FIELD DATA SHEET

ACE AIR CONSULTING & ENGINEERING, INC.

2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

PLANT CEDAR BAY GEN. CO.
SOURCE UNIT 2
PLANT LOCATION JACKSONVILLE, FL.
TYPE OF SAMPLING TRAIN EPA-101A
TYPE OF SAMPLES Hg
DATE 7/29/94 RUN NO. 3
TIME START 0932 TIME END 1721
SAMPLE TIME 24 / 10 (min/pt) = 240 Total min
ASSUMED MOISTURE 10 % FDA .90
NOMOGRAPH C_f 1 = 2.86 PITOT CORR. .84
P_b 30.06 "Hg P_s 29.60 (-1.65") "Hg
WEATHER CLEAR TEMP 80's-90's °F
METER BOX NO. 1 H 1.99 Y 1.013
NOZZLE CAL. .250 .250 .249 = .250
STACK DIMENSIONS 126.6"W x 109"H
STACK AREA 95.829 ft² EFFECTIVE 95.829 ft²
STACK HEIGHT ~60 ft. (TO PLATFORM)
STACK DIAMETER: UPSTRM. 237" DNSTRM. 105"
PORT SIZE 6 in. NIPPLE LENGTH 35 in.
U CORD LENGTH 200'
REMARKS:

233.538
- 2.023
231.515

2.86
4.46

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 288.940 ft³
* 0.100 ft³ * 0.124 INITIAL 55.402 ft³
* 1.522 NET 233.538 ft³
* 0.277
FILTER NO. RUN-3 IMP. VOL. GAIN 380 ml.
SIL GEL NO. SPECIAL WT. GAIN 55.2 ml.
TOTAL CONDENSATE 435.2 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					14.0
% O_2					5.4
% CO					
% N_2					

F_O = 1.083-1.230 F_O RANGE = 1.1071
ORSAT ANALYZER SN/CH

LEAK CHECKS
PRE 0.001 cfm 10 "Hg POST 0.000 cfm 17 "Hg
METER BOX/PUMP ✓ GAS SAMPLE SYST. ✓
ORSAT BAG ✓
PITOT TUBE NO. 125 PRE-TEST OK
POST-TEST(+) 4.9 / 0-15" H_2O/Sec
POST-TEST(−) 5.8 / 1.02 / 15" H_2O/Sec
PYROMETER NO. ATK-6
BOX OPERATOR CH PROBE HOLDER SL/TB

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1	5.4 ~~4.8~~ 5.4	0937	60.01	.96 ~~1.4~~	2.75	2.75	324	270	54	70	9
1	~~4~~ 940	0942	63.64	.93	2.66	2.7	324	271	52	71	9
2	5.3 ~~5.8~~	0947	67.—	.75	2.15	2.15	324	270	52	72	7
2	5.4	0952	71.16	.75	2.15	2.15	324	290	53	73	7
3	5.4 1013	~~0957~~	74.91	.75	2.15	2.15	325	278	53	75	7
3	5.4 1018	1002	78.65	.65	1.86	1.9	326	286	50	76	7.0

Barrett

301-[redacted]8-6901

Phwi.E: 2oBL ...8/RAIN

RESUM 1350

92.6825

AIR CONS[redacted]G & ENGINEER[redacted]NC.

-1.5 x2

2.86
4.45

RGSUM 96.151

Cedar Bay 7/29/94

55.4oz

TES[redacted]3-Hg

PAGE X 2 OF 3

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. (°F)	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4		1023	82.57	.96 .56	2.75 1.00	2.8 1.60	326	305	49	77	7.0
4	LEAK ✓ AT	1028	86.553	.79	2.26	2.3	326	289	51	78	8.5
	86.553	(32.5	31.15)	(.900)							
2-1	86.653	1037	90.303	1.1	3.15	3.2	322	268	56	80	8.0
1	*0.100 ft³	1042	96.653	1.1	3.15	3.15	317	268	49	72	9
2		1047	102.–	1.15	3.3	3.3	317	278	43	72	9
2	DOWN 1037	1052	106.70	1.15	3.3	3.3	318	255	41	72	9
3		1057	111.46	1.25	3.55	3.55	317	250	42	74	10.5
3	5.5	1102	116.28	1.25	3.55	3.55	318	251	44	76	10.5
4		1107	120.5	.90	2.6	2.6	315	252	44	78	8
4		1112	124.60	.90	2.6	2.6	316	267	45	80	8
		(	)	(1.047)							
3-1			129.44	1.45	4.15	4.15	319	187	48	81	10
1		1441	134.50	1.45	4.15	4.15	318	210	45	83	10
2		1446	139.74	1.55	4.45	4.45	318	258	46	86	11
2		1451	145.05	1.55	4.45	4.45	319	257	47	87	11
3	5.4	1456	150.42	1.55	4.45	4.45	320	255	47	89	11
3		1501	155.80	1.55	4.45	4.45	320	251	47	91	11
4	LC 10	1506	160.57	1.1	3.15	3.15	320	251	48	92	9
4	165.400	1511	165.276	1.2	3.45	3.45	319	252	48	93	9
	-.124	(113.08	109.874)	(1.192)							
4-1		1520	171.0	1.3	3.7	3.7	319	254	47	95	10
1		1525	175.85	1.3	3.7	3.7	320	254	47	95	10
2	cf = 5.6	1530	180.77	1.1	3.15	3.2	320	251	49	96	9.5
2	302 →	1535	186.25	1.5	4.50	4.5	318	251	50	97	10.5
3	5.6	1540	191.58	1.3	3.93	3.9	318	254	51	98	10.5
3		1545	196.80	1.3	3.93	3.9	320	247	52	98	10.5

AIR CONS[illegible] & ENGINEER[illegible]C.

Cedar [illegible] 7/29/94

TEST 3-Hg

PAGE 3 OF 3

57.425 3.0 ~~3.86~~ 4.8 55.402

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft^3)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP (°F)	SAMPLE BOX TEMP (°F)	LAST IMPINGER TEMP (°F)	DRY GAS METER TEMP (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
4		1550	202.01	1.2	3.60	3.6	318	253	51	~~1~~99	10.0
4		1555	206.84	1.2	3.60	3.6	319	247	52	99	10.0
	5.4	(153.7	19.44)	(1.128)							
5-1		1604	211.80	1.5	4.50	4.5	319	254	52	99	~~8.0~~ 10.5
1	5.4	1609	216.99	1.4	4.20	4.2	320	256	51	99	11.0
2		1614	222.33	1.3	3.90	3.9	320	254	52	99	10.5
2	5.5	1619	227.50	1.3	3.90	3.9	320	250	53	99	10.5
3		1624	232.81	1.5	4.50	4.5	321	250	53	99	11.0
3	5.4	1629	238.00	1.2	3.60	3.6	321	253	54	99	~~1~~10.5
4		1634	242.78	1.0	3.00	3.0	322	253	54	100	9.5
4	DEDUCT (2.023ft³)	1639	247.73	1.3	3.90	3.9	320	252	54	100	10.0
	TOTAL	(194.87	190.31)	(1.144)							
6-1	FOR LEAKV	1646	252.80	1.3	~~3~~4.03	4.0	319	244	55	99	10.5 ~~7.5~~
1	cf = 3.2	1651	257.99	1.3	4.03	4.0	322	244	54	98	10.5
2	5.4	1656	263.20	1.2	3.84	3.8	322	244	55	98	10.5
2		1701	268.30	1.2	3.84	3.8	322	234	55	98	10.5
3	5.5	1706	273.56	1.2	3.84	3.8	320	234	57	99	10.5
3		1711	278.63	1.3	4.03	4.0	320	229	58	99	10.5
4	5.4	1716	283.81	1.2	3.84	3.8	320	235	58	99	10.5
4		1721	288.940	1.3	4.03	4.0	320	233	58	99	10.5
	5.4	(235.11	231.52)	(1.118)							
	~289.4										

$$(1.088)(240)(.0003409)(146)\left(\frac{\sqrt{780}}{1.021}\right)\left(\frac{29.92}{29.60}\right)(.92)\left(\frac{355}{780}\right) = 23[illegible]$$

APPENDIX C

LABORATORY ANALYSIS

ppb

E N V I R O N M E N T A L   L A B O R A T O R I E S ,   I N C .

RECEIVED

AUG 1994

A.C.E.

August 16, 1994

Mr. Peter Burnette
Air Consulting & Engineering
2106 N.W. 67th Place, Suite 4
Gainesville, FL 32606

Dear Peter:

Enclosed are the results of our analyses of the Cedar Bay samples received August 4, 1994. Samples were analyzed by EPA 101 A.

If you have any questions concerning this report, please do not hesitate to give me a call.

Sincerely,

M. Kelly Bergdoll

M. Kelly Bergdoll
Project Manager

MKB:mmb

Enclosures

6821 SW ARCHER ROAD, GAINESVILLE, FLORIDA 32608 Tel. (904) 377-2349 ppb

ENVIRONMENTAL LABORATORIES, INC.

RESULTS OF ANALYSES

Mr. Peter Burnette
Air Consulting & Engineering
2106 N.W. 67th Place, Suite 4
Gainesville, Florida 32606

Project No.: 86-026 ACE

Date: August 16, 1994

DHRS#: 82282, E82001

Table 1. Cedar Bay Samples Received August 4, 1994

PPB No.	Sample ID	Mercury, total ug	volume, mL	
109010	PreTest Bias A	5.75	850	
109011	PreTest Bias B	4.93	820	
109012	Run 1 nozzle to filter	0.918	248	
109013	Run 1 sample to impinger	46.8	1068	.043 ug/ml
109014	Run 1 HCL residue rinse	0.102	68	
109015	Run 2 nozzle to filter	0.912	240	.004
109016	Run 2 sample to impinger	17.6	1130	.015
109017	Run 2 HCL residue rinse	<0.018	44	
109018	Run 3 nozzle to filter	4.62	300	.015
109019	Run 3 sample to impinger	7.49	946	
109020	Run 3 HCL residue rinse	0.174	60	
109021	KMnO4 rinse solution	<0.048	120	
109022	DI H_2O blank	<0.1 (ug/L)	NA	
109023	Audit Sample	3.66	118	
109024	Audit Sample	3.74	128	

M Kelly Bugdall
Project Manager

APPENDIX D

QUALITY ASSURANCE
AND
CHAIN OF CUSTODY

STANDARD METER CALIBRATION
Meter Number 691751 - N

Air Consulting and Engineering, Inc. (ACE) uses a dry gas meter for the calibration standard. This meter has been calibrated against a wet test meter in triplicate. This data was used to generate a standard meter calibration curve (see next page). Field meter calibrations are corrected to this curve using the following formula:

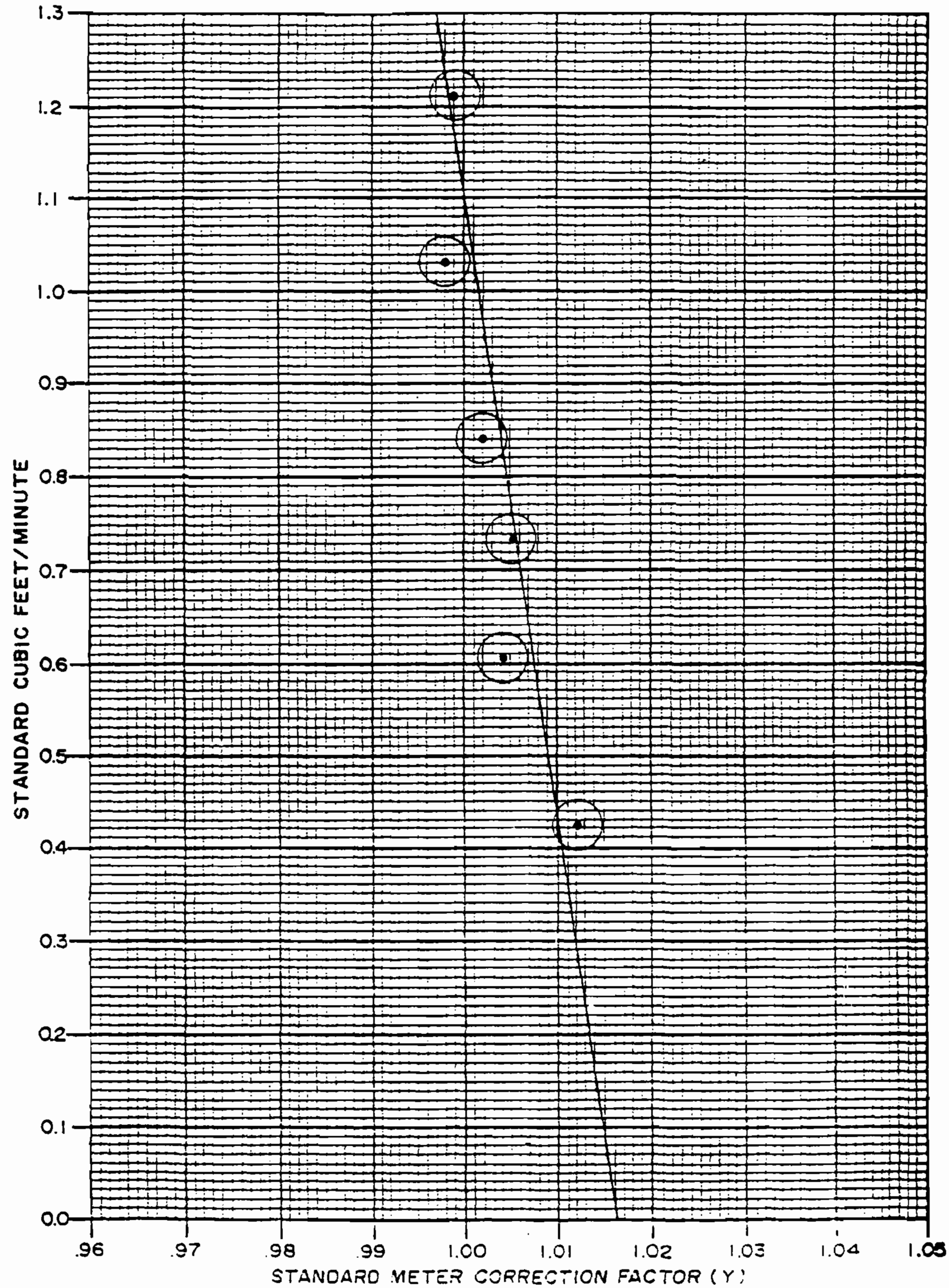
$Y_a \times Y_s = Y$

Y_a = actual ratio of field meter to standard meter

Y_s = ratio of standard meter to wet test meter at a given flow rate (from Calibration Curve)

Y = corrected ratio of field meter

The dry standard meter was calibrated on June 18, 1992, and has been rechecked and verified annually. The latest verification was May 9, 1994.



STANDARD METER CALIBRATION CURVE

JUNE 18, 1992

SERIAL NUMBER 691751

(CHECKED ON APRIL 29, 1993)

AIR CONSULTING and ENGINEERING

(Rechecked May 9, 1994)

AIR CONSULTING & ENGINEERING — STANDARD METER CALIBRATION

DATE 6-18-92

LEAK CHECK 0.000 CFM at 15 In. Hg.

METER SERIAL NUMBER 691751

BAROMETRIC PRESSURE 30.02 In. Hg.

STD GAS METER TEMPERATURE 72 °F / ASTM GLASS THERMOMETER TEMPERATURE 72 °F

WET ΔH	STD ΔH	GAS VOLUME, WET TEST METER			GAS VOLUME, STD GAS METER			TEMP. WET TEST METER (°F)	TEMP. OF STD. METER (°F)	TIME (Minutes)
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3			
-.1	-.77	2.582	8.223	5.641	833.849	839.437	5.588	72	72	13
-.1	-.77	8.223	13.372	5.149	839.437	844.538	5.101	72	72	12
-.1	-.77	13.372	18.491	5.119	844.538	849.602	5.064	72	72	12
-.2	-1.2	9.012	14.502	5.490	850.124	855.602	5.478	72	72	9
-.2	-1.2	14.502	19.988	5.486	855.602	861.078	5.476	72	72	9
-.2	-1.2	19.988	25.445	5.457	861.078	866.532	5.454	72	72	9
-.3	-1.6	6.026	11.192	5.166	867.112	872.274	5.162	72	72	7
-.3	-1.6	11.192	16.356	5.164	872.274	877.435	5.161	72	72	7
-.3	-1.6	16.356	21.501	5.145	877.435	882.578	5.143	72	72	7
-.4	-2.0	3.241	9.158	5.917	884.329	890.266	5.937	72	72	7
-.4	-2.0	9.158	14.229	5.071	890.266	895.363	5.097	72	72	6
-.4	-2.0	14.229	19.324	5.095	895.363	900.476	5.113	72	72	6
-.5	-2.8	0.149	5.338	5.189	901.310	906.546	5.236	72	72	5
-.5	-2.8	5.338	10.526	5.188	906.546	911.774	5.228	72	72	5
-.5	-2.8	10.526	15.719	5.193	911.774	917.024	5.250	72	72	5
-.6	-3.6	3.468	9.512	6.044	944.113	950.211	6.098	71	71	5
-.6	-3.6	9.512	15.586	6.074	950.211	956.347	6.136	71	71	5
-.6	-3.6	15.586	21.660	6.074	956.347	962.487	6.140	71	71	5

SCFM											
0.432	1.011	0.607	1.005	0.735	1.005	0.842	1.002	1.033	0.998	1.207	1.000
0.427	1.011	0.607	1.005	0.735	1.005	0.842	1.000	1.033	0.999	1.213	0.999
0.425	1.012	0.604	1.003	0.732	1.004	0.846	1.001	1.034	0.996	1.213	0.998
0.428	1.012	0.606	1.004	0.734	1.005	0.843	1.001	1.033	0.998	1.211	0.999

George F. Gebel

Air Consulting and Engineering

AIR CONSULTING & ENGINEERING — STANDARD METER CALIBRATION

DATE 5-9-94 LEAK CHECK 0.000 CFM at 14 In. Hg.

METER SERIAL NUMBER 691751 BAROMETRIC PRESSURE 30.11 In. Hg.

STD GAS METER TEMPERATURE 74 °F/ ASTM GLASS THERMOMETER TEMPERATURE 74 °F

WET ΔH	STD ΔH	GAS VOLUME, WET TEST METER			GAS VOLUME, STD GAS METER			TEMP. WET TEST METER (°F)	TEMP. OF STD. METER (°F)	TIME (Minutes)
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3			
-0.2	-1.3	817.000	822.672	5.672	936.328	942.004	5.676	74	75	13
-.72	-8.6	0.000	5.094	5.094	949.832	955.102	5.270	74	77	6

CALIBRATED BY: [signature]

SCFM	Y Old Value	Y New Value	% Change
0.434	1.010	1.004	0.6
0.845	1.004	0.993	1.1

air consulting and engineering

EPA METHOD 5 PARAGRAPH 7.1.2.2

AIR CONSULTING & ENGINEERING — ANNUAL METER CALIBRATION

DATE 6-23-94 LEAK CHECK 0.000 CFM at 11 in. Hg.

METER BOX NUMBER 1 BAROMETRIC PRESSURE 30.04 in. Hg.

DRY GAS METER TEMPERATURE 83 °F/ASTM GLASS THERMOMETER TEMPERATURE 83 °F

ΔHS	AVERAGE ΔHD	GAS VOLUME, STANDARD METER INITIAL	GAS VOLUME, STANDARD METER FINAL	GAS VOLUME, STANDARD METER ACTUAL ft^3	GAS VOLUME, DRY GAS METER INITIAL	GAS VOLUME, DRY GAS METER FINAL	GAS VOLUME, DRY GAS METER ACTUAL ft^3	TEMP. STD. METER	TEMP. OF DRY METER	TIME (Minutes)	TIMER
.05	.5	556.448	562.575	6.127	505.722	511.862	6.140	81	89	16	16
.11	1.0	630.826	636.075	5.249	579.855	585.145	5.290	80	90	10	10
.21	1.5	636.075	641.201	5.126	585.145	590.287	5.142	82	90	8	8
.23	2.0	641.201	647.223	6.022	590.287	596.310	6.023	83	90	8	8
.35	3.0	647.223	654.466	7.243	596.310	603.531	7.221	84	90	8	8
.47	4.0	654.466	661.071	6.605	603.531	610.074	6.543	85	91	6	6

	DELTA H	Ya	SCFM	Ys	Y
	1.918	1.011	0.375	1.013	1.024
	2.031	1.008	0.515	1.009	1.017
	2.059	1.008	0.627	1.006	1.014
	1.997	1.008	0.735	1.004	1.012
	2.078	1.007	0.882	1.000	1.007
	1.878	1.011	1.071	0.996	1.006
MEAN:	1.993	1.009		1.005	1.013

CALIBRATED BY: Fred Baumann

AIR CONSULTING & ENGINEERING, inc. POST TEST CALIBRATION

DATE 8-10-94 METER BOX NUMBER 1 LEAK CHECK 0.00 CFM at 12 in. Hg.

CLIENT Cedar Bay Gen. Co. SOURCE UNIT #2 THERMOCOUPLE NUMBER 125 PYROMETER NUMBER ATK6

FLIGHT SERVICE Pb 30.08 in. Hg. ACE BAROMETER Pb 30.08 in. Hg.

ASTM GLASS THERMOMETER 228 °F / THERMOCOUPLE 330 °F ASTM GLASS THERMOMETER 88 °F / METER TEMP 88 °F

ΔHS	AVERAGE ΔHD	GAS VOLUME, STANDARD METER			GAS VOLUME, DRY GAS METER			TEMP. STANDARD METER	TEMP. OF DRY METER	TIME (Minutes)	MAX. VACUUM In. Hg.
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3				
-.35	3.0	107.240	113.794	6.554	318.108	324.766	6.658	88°	86°	7	12
-.35	3.0	113.838	120.385	6.547	324.711	331.257	6.546	88°	86°	7	12
-.35	3.0	120.618	127.165	6.547	331.492	338.032	6.540	88°	86°	7	12

CALIBRATED BY: [signature]

	DELTA H	Ya	SCFM	Ys	Y
	1.984	0.974	0.907	1.000	0.973
	1.988	0.989	0.906	1.000	0.989
	1.988	0.990	0.906	1.000	0.990
MEAN:	1.986	0.984		1.000	0.984

ACE AIR CONSULTING & ENGINEERING, INC.

PRE TEST "Y"= 1.013 IS POST TEST CAL. ACCEPTABLE YES ✓ NO ____ INITIALS [initials]

AIR CONSULTING & ENGINEERING, INC. PYROMETER CALIBRATION

DATE 10/22/93 PYROMETER NUMBER Atk-6

SOURCE (SPECIFY)	GLASS THERMOMETER WITH NBS MERCURY (°F)	PYROMETER (°F)	DEGREE DIFFERENCE	PERCENT DIFFERENCE
ICE BATH	35	36	1	0.2
AMBIENT	71	71	0	0
HOT OVEN	350	352	2	0.2

FDER - MAXIMUM 5° DIFFERENCE

EPA $\left[\frac{(\text{REF. TEMP. °F} + 460°) - (\text{PYROMETER TEMP. °F} + 460°)}{\text{REF. TEMP. °F} + 460°}\right] 100 \leq 1.5\%$

CALIBRATED BY: [signature]

AIR CONSULTING & ENGINEERING, INC. — PITOT TUBE CALIBRATION

DATE CALIBRATED 4-7-94   PITOT TUBE 125

IS PITOT TUBE ASSEMBLY LEVEL YES   ARE PITOT TUBE OPENINGS DAMAGED NO

α_1 = 1 °(<10°), α_2 = 1.5 °(<10°), β_1 = 2 °(<5°), β_2 = 1 °(<5°)

γ = 0 ° θ = 2 °   A = 1.179 in. = (Pa + Pb)

z = A sin γ = .021 in.; <0.32/<1/8 in.

w = A sin θ = .041 in.; <0.08/<1/32 in.

P_a .5901 in. P_b .5889 in. D_t .375

WAS CALIBRATION REQUIRED NO

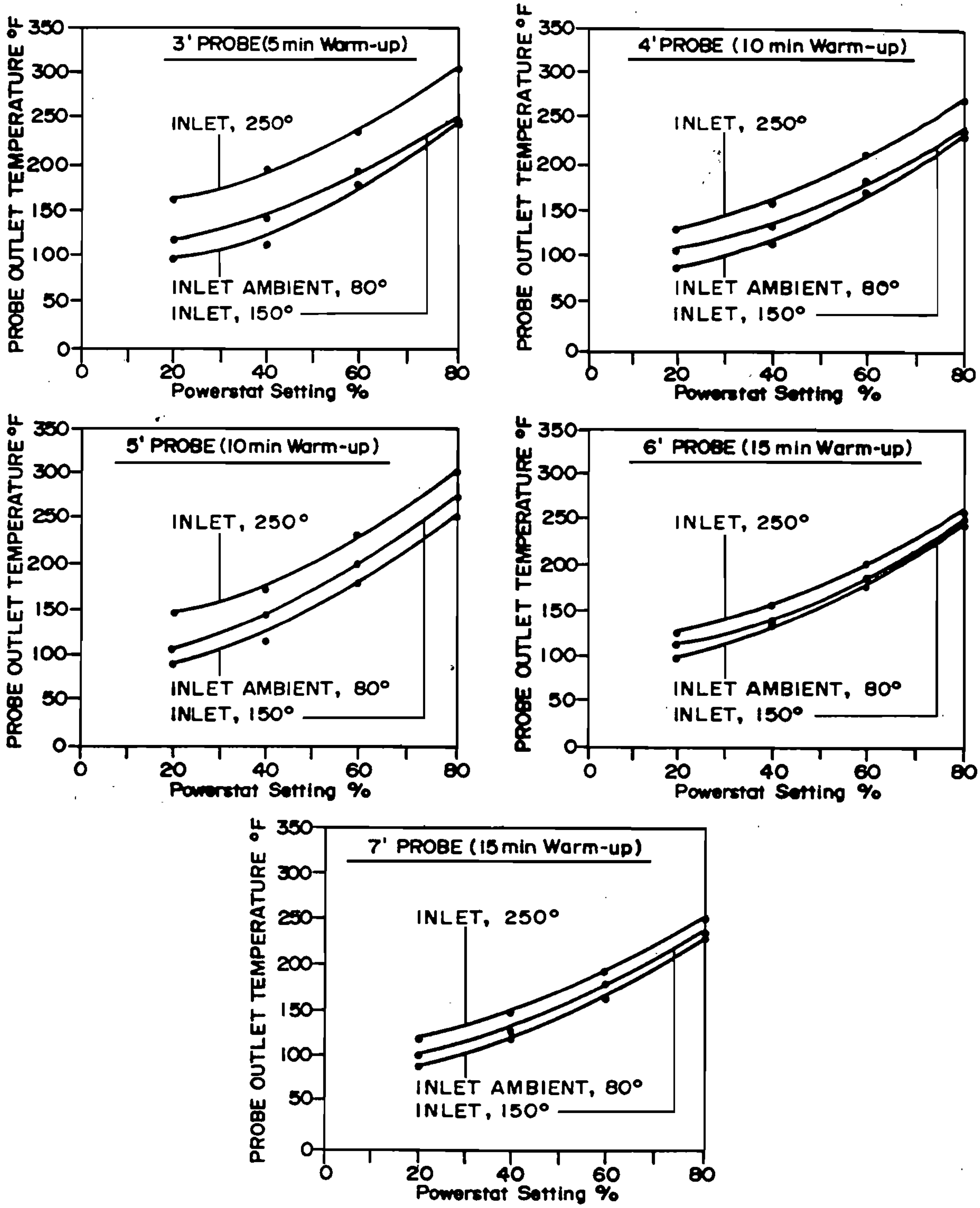
THERMOCOUPLE CALIBRATION

SOURCE (SPECIFY)	ASTM GLASS THERMOMETER WITH MERCURY (°F)	PYROMETER (°F)	DEGREE DIFFERENCE	PERCENT DIFFERENCE
ICE BATH	39	39	0	0
AMBIENT	71	71	0	0
HOT OVEN	525	528	3	.30

CALIBRATED BY: S.L. Carter

FDER-MAXIMUM 5° DIFFERENCE

EPA $\left[\frac{(\text{REF. TEMP. °F} + 460°) - (\text{PYROMETER TEMP. °F} + 460°)}{\text{REF. TEMP. °F} + 460°}\right] 100 \le 1.5\%$



NOTE: Flow rate held constant at 0.75; 50% change in flow rate has little effect on probe temperature.

PROBE GRAPH	AIR CONSULTING and ENGINEERING

ENVIRONMENTAL LABORATORIES, INC.
6821 SW Archer Road, Gainesville, FL 32608
(904) 377-2349

CHAIN-OF-CUSTODY RECORD

PROJ. NO. / NAME: CEDAR BAY GEN. CO. UNIT-2

SITE NAME & ADDRESS: C.O. / AIR CONSULTING & ENGINEERING, INC.

SAMPLERS: (Signature) S. CARTER, T. BARTLEY, C. HODGE, S. NECK

IDENTITY PARAMETERS DESIRED AND NO. OF CONTAINERS: MERCURY EPA 101A

SAMPLE FIELD ID. NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION / NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	MERCURY EPA 101A							Remarks or Observations
PRE-TEST BIAS	7/27	—			NOZZLE TO FILTER		1								
PRE-TEST BIAS	7/27	—			SAMPLE LINE TO 1st, 2nd & 3rd IMP.		1								~~200ml Knudoy Rinse~~
RUN-1	7/27	—			NOZZLE TO FILTER		1								Knudoy Rinse
"	7/27	—			SAMPLE LINE TO IMPS		2								200ml Knudoy Rinse
"	7/27	—			HCL RESIDUE RINSE		1								
RUN-2	7/28	—			NOZZLE TO FILTER		1								
"	7/28	—			SAMPLE LINE TO IMPS		2								
"	7/28	—			HCL RESIDUE RINSE		1								
RUN-3	7/29	—			NOZZLE TO FILTER		1								
"	7/29	—			SAMPLE LINE TO IMPS		2								
"	7/29	—			HCL RESIDUE RINSE		1								

PRESERVATION
- CF Chilled-Filtered
- SF Sulfuric-Filtered
- NF Nitric-Filtered
- C Chilled
- S Sulfuric
- N Nitric
- B Basic/NaOH
- Z Zinc
- T Thiosulfate
- H HCL
- Ot Other (see Remarks)

Precleaned Containers Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
ACE - C. SNEERINGER	7/27 —	ACE - C. HODGE			
Relinquished by: (Signature)	**Date / Time**	**Received by: (Signature)**	**Relinquished by: (Signature)**	**Date / Time**	**Received by: (Signature)**
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by: (Signature)**			

Matrix Types
- S Salt or Sediment
- SW Surface Water
- GW Ground Water
- Ot Other (See Remarks)
- WW Wastewater
- SL Sludge or Solid Waste
- DW Drinking Water
- T Animal Tissue
- MW Marine Water
- P Plant Tissue

cdb ENVIRONMENTAL LABORATORIES, INC.
6821 SW Archer Road, Gainesville, FL 32608
(904) 377-2349

CHAIN-OF-CUSTODY RECORD

PROJ. NO. / NAME: CEDAR BAY GEN. CO. UNIT. 2

SITE NAME & ADDRESS: CO/AIR CONSULTING & ENGINEERING, INC.

SAMPLERS: *(Signature)*

SAMPLE FIELD ID. NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION / NUMBER	SAMPLE MATRIX	NUMBER OF CONTAINERS	MERCURY EPA 101A								Remarks or Observations
BLANK	7/29	—			KMnO4 RINSE SOLUTION		1									
BLANK	7/29	—			DI H_2O		1									
AUDIT	7/29	—			SPIKE (FROM WESTON REP.)		1									(1) ml used for spiking

IDENTITY PARAMETERS DESIRED AND NO. OF CONTAINERS

PRESERVATION
CF Chilled-Filtered
SF Sulfuric-Filtered
NF Nitric-Filtered
C Chilled
S Sulfuric
N Nitric
B Basic/NaOH
Z Zinc
T Thiosulfate
H HCL
Ot Other (see Remarks)

Precleaned Containers Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
ACE-C. GNEERINGER	7/27 —	ACE-C. HODGE			
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*			

Matrix Types
S Salt or Sediment; SW Surface Water; GW Ground Water; Ot Other (See Remarks)
WW Wastewater; SL Sludge or Solid Waste; DW Drinking Water
T Animal Tissue; MW Marine Water; P Plant Tissue

APPENDIX E

PRODUCTION DATA

7/27/94

SEP-07-94 11:24 FROM: USGen ID: PAGE 5

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT

7/27

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	00042921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
12:10	88.303	665.63	281.57	4.340	356.00	35.530
12:20	88.390	664.84	281.69	4.610	360.10	35.901
12:30	88.278	664.08	282.31	4.820	358.00	35.954
12:40	88.329	663.40	282.47	5.090	359.00	36.408
12:50	88.268	663.36	282.07	5.350	359.40	36.861
13:00	88.555	662.78	282.22	4.130	360.90	37.118
HOUR 1	------	------	------	------	------	------
AVERAGE	88.354	664.02	282.06	4.723	358.90	36.295
13:10	88.194	664.48	283.54	3.500	360.60	37.599
13:20	88.240	665.74	284.77	3.730	358.90	38.186
13:30	88.455	666.44	284.41	3.950	365.70	38.403
13:40	88.182	665.66	284.15	4.070	360.90	38.239
13:50	88.184	666.99	284.09	4.360	360.00	38.485
14:00	88.734	665.82	282.91	4.540	359.30	38.215
HOUR 2	------	------	------	------	------	------
AVERAGE	88.331	665.85	283.98	4.025	360.90	38.188
14:10	88.342	665.88	283.50	4.750	362.30	38.351
14:20	88.408	664.27	282.78	4.990	356.30	38.210
14:30	88.266	663.75	282.99	5.530	360.10	38.320
14:40	88.278	664.84	282.55	4.550	355.00	38.687
14:50	88.362	662.02	282.08	3.540	358.70	38.653
15:00	88.405	662.52	281.64	3.600	354.90	38.832
HOUR 3	------	------	------	------	------	------
AVERAGE	88.344	663.88	282.59	4.493	357.88	38.509
15:10	88.332	664.94	282.01	3.810	366.00	39.311
15:20	88.388	661.85	281.52	4.020	356.90	39.119
15:30	88.249	664.75	281.51	4.140	361.90	39.456
15:40	88.295	662.31	281.36	4.430	362.90	39.077
15:50	88.370	663.53	281.58	4.640	354.90	39.239
16:00	88.306	662.76	282.21	4.880	358.90	39.070
HOUR 4	------	------	------	------	------	------
AVERAGE	88.323	663.36	281.70	4.320	360.25	39.212
16:10	88.406	659.64	281.28	5.060	362.90	38.562
16:20	88.167	659.09	281.85	5.400	360.70	38.538
16:30	88.399	658.09	281.70	4.060	358.60	38.323
16:40	88.345	658.38	281.88	3.550	352.00	38.211
16:50	88.374	657.81	280.78	3.780	358.00	38.248
17:00	88.208	656.93	280.46	3.960	356.70	38.020
HOUR 5	------	------	------	------	------	------
AVERAGE	88.316	658.32	281.32	4.302	358.15	38.317

17:10	88.110	658.03	280.69	4.100	359.00	38.425
17:20	88.383	657.56	280.30	4.350	356.40	39.361
17:30	88.347	657.08	279.99	4.500	355.10	40.108
17:40	88.171	655.04	279.96	4.680	354.30	40.135
17:50	88.222	655.20	279.58	4.850	352.90	40.473
18:00	88.449	656.54	280.09	5.040	352.50	40.792
HOUR 6	------	------	------	------	------	------
AVERAGE	88.280	656.58	280.10	4.587	355.03	39.882

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT

	COAL FLOW	MAIN STEAM FLOW	GROSS GENERATION	BAGHOUSE D/P	FLUE GAS TEMP	AMMONIA FLOW
	TCFLOW1B	MSTMFX1B	TGBE0001	U2AI541X	U2AI543D	00047921
TIME	KLBH	KLBH	MW	INWC	DEGF	ACFM
06:10	85.818	673.39	283.65	3.570	340.10	47.434
06:20	85.475	662.20	283.47	3.710	341.30	46.607
06:30	85.867	653.94	282.50	3.850	339.80	46.308
06:40	85.707	656.69	282.60	4.030	339.80	47.377
06:50	85.593	659.00	283.53	4.170	339.60	47.888
07:00	85.651	657.84	283.86	4.400	337.10	47.875
HOUR 1	------	------	------	------	------	------
AVERAGE	85.685	660.51	283.27	3.955	339.62	47.248
07:10	85.777	656.37	283.04	4.540	338.60	47.964
07:20	85.989	658.07	283.38	4.670	339.90	47.551
07:30	85.822	656.46	283.13	4.880	340.80	46.659
07:40	85.690	656.56	282.27	4.990	338.10	46.442
07:50	85.927	658.18	282.78	5.460	340.60	47.434
08:00	85.590	660.88	283.36	4.800	339.50	47.323
HOUR 2	------	------	------	------	------	------
AVERAGE	85.799	657.77	282.99	4.890	339.58	47.229
08:10	85.539	657.35	282.96	3.620	340.60	46.772
08:20	85.758	657.27	282.61	3.450	341.10	45.983
08:30	85.484	662.43	283.15	3.630	342.60	44.068
08:40	85.204	660.14	283.66	3.790	345.00	43.233
08:50	85.670	655.75	282.52	4.020	341.70	42.790
09:00	85.464	659.21	282.96	4.100	343.00	43.289
HOUR 3	------	------	------	------	------	------
AVERAGE	85.521	558.69	282.98	3.768	342.33	44.356
09:10	85.735	659.41	282.94	4.590	344.00	42.969
09:20	85.622	657.93	282.44	4.130	346.80	43.356
09:30	85.551	660.83	283.43	3.510	343.90	44.005
09:40	85.609	658.66	283.08	3.630	345.30	42.768
09:50	85.620	653.53	281.83	3.790	344.00	40.933
10:00	85.505	653.83	283.22	3.890	345.20	41.261
HOUR 4	------	------	------	------	------	------
AVERAGE	85.607	657.37	282.82	3.923	344.87	42.549
10:10	85.593	649.57	282.69	4.060	347.20	41.329
10:20	85.390	653.71	283.14	4.180	347.80	42.520
10:30	85.649	654.22	282.31	4.400	347.00	43.178
10:40	85.699	652.32	280.63	4.580	345.30	43.130
10:50	85.600	655.96	282.46	4.810	345.40	43.677
11:00	85.686	659.28	282.96	4.960	348.70	44.095
HOUR 5	------	------	------	------	------	------
AVERAGE	85.603	654.18	282.36	4.498	346.90	42.988

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11:10	85.577	656.12	281.66	5.110	351.50	43.231
11:20	85.503	657.22	282.61	5.350	349.50	43.547
11:30	85.414	659.54	283.95	4.000	350.00	44.102
11:40	85.443	658.98	282.82	3.440	348.90	44.424
11:50	85.489	666.90	286.19	3.700	349.70	46.114
12:00	85.562	662.31	286.33	3.820	350.60	45.669
HOUR 6	------	------	------	------	------	------
AVERAGE	85.498	660.18	283.93	4.237	350.03	44.514

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 28 JUL 94

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2A1541X INWC	FLUE GAS TEMP U2A1543D DEGF	AMMONIA FLOW 00042921 ACFM
12:10	85.457	657.72	285.44	3.960	350.80	45.518
12:20	85.071	652.83	285.56	4.050	347.80	45.041
12:30	84.538	652.39	285.75	4.190	349.10	44.305
12:40	84.895	655.00	285.62	4.410	352.40	45.735
12:50	84.662	653.52	285.36	4.610	349.50	46.292
13:00	84.653	651.19	283.72	4.750	348.60	47.010
HOUR 1	------	------	------	------	------	------
AVERAGE	84.879	653.86	285.23	4.328	349.70	45.650
13:10	84.439	650.49	283.90	4.930	343.10	47.314
13:20	84.848	648.86	283.63	5.060	347.80	48.295
13:30	84.727	648.98	284.33	5.440	350.00	48.332
13:40	84.695	646.51	283.72	4.720	350.50	47.945
13:50	84.822	646.40	282.48	3.470	350.30	47.661
14:00	84.718	644.27	282.54	3.670	349.90	47.521
HOUR 2	------	------	------	------	------	------
AVERAGE	84.716	647.59	283.60	4.448	349.43	47.845
14:10	84.680	645.52	283.02	3.820	350.30	47.439
14:20	84.549	642.40	283.14	3.940	349.70	47.206
14:30	84.976	644.25	283.10	4.110	349.10	47.315
14:40	85.234	648.30	283.77	4.300	353.80	47.764
14:50	85.245	647.00	283.67	4.470	351.60	47.779
15:00	85.036	645.14	282.87	4.650	349.00	47.718
HOUR 3	------	------	------	------	------	------
AVERAGE	84.953	645.43	283.26	4.215	350.58	47.537
15:10	85.115	646.83	282.69	4.810	353.30	47.917
15:20	85.468	652.47	284.62	5.030	352.50	48.152
15:30	85.614	648.77	284.14	5.480	350.70	48.091
15:40	85.571	646.21	283.58	4.730	352.80	48.036
15:50	85.579	648.84	283.64	3.810	355.10	47.303
16:00	84.031	650.13	284.61	3.790	356.20	46.839
HOUR 4	------	------	------	------	------	------
AVERAGE	85.563	649.71	283.89	4.608	353.43	47.723
16:10	86.044	646.32	284.01	3.970	356.90	47.648
16:20	85.741	649.92	283.14	4.490	355.30	46.232
16:30	86.076	653.02	283.47	4.330	359.10	42.317
16:40	86.624	651.76	283.16	3.980	354.40	43.612
16:50	85.918	655.38	283.20	4.020	353.70	45.066
17:00	85.895	659.87	284.94	4.350	363.80	46.289
HOUR 5	------	------	------	------	------	------
AVERAGE	85.951	652.88	283.65	4.190	357.18	45.066
17:10	86.008	650.51	283.40	4.660	352.60	45.926
17:20	85.510	659.13	283.35	4.870	349.30	46.337
17:30	86.031	651.93	283.82	4.990	344.20	45.848
17:40	85.872	654.55	284.13	5.560	347.00	45.254
17:50	86.069	652.44	284.3[illegible]	4.820	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	284.2[illegible]	[illegible]	[illegible]	[illegible]

soot blow 4:15

J:\INBOX\BPARKER\TEMP\MRCDATA.TXT 8/5/94

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2A1543D DEGF	AMMONIA FLOW 0CC4Z921 ACFM
06:10	83.711	661.09	283.21	3.740	346.40	50.387
06:20	83.743	661.89	283.43	3.900	347.90	50.052
06:30	83.640	662.04	284.12	4.100	349.00	50.086
06:40	83.868	662.00	284.08	4.350	348.40	50.301
06:50	83.765	662.20	284.34	4.590	346.50	50.034
07:00	83.624	663.65	284.94	4.820	348.00	49.703
HOUR 1	------	------	------	------	------	------
AVERAGE	83.725	662.14	284.10	4.250	347.70	50.094
07:10	83.854	662.29	286.07	4.990	345.90	49.316
07:20	83.591	662.67	285.52	5.460	346.20	49.208
07:30	83.627	664.23	285.23	4.460	346.40	49.555
07:40	83.555	663.44	283.28	3.630	342.80	49.068
07:50	83.453	663.41	282.96	3.700	345.60	48.679
08:00	83.752	662.24	282.53	3.870	346.90	48.768
HOUR 2	------	------	------	------	------	------
AVERAGE	83.643	663.05	284.26	4.352	345.63	49.099
08:10	83.658	663.06	282.82	4.060	347.00	48.645
08:20	83.678	661.21	283.40	4.280	343.70	47.024
08:30	83.748	660.38	283.37	4.660	344.50	43.978
08:40	83.571	662.69	283.23	3.990	344.30	45.645
08:50	83.667	661.45	282.35	3.580	346.40	46.464
09:00	83.693	660.74	283.71	3.770	344.70	47.664
HOUR 3	------	------	------	------	------	------
AVERAGE	83.669	661.59	283.15	4.057	345.10	46.570
09:10	83.859	661.73	284.07	3.980	346.40	48.233
09:20	83.546	660.64	283.88	4.160	343.80	48.159
09:30	83.774	658.09	283.04	4.300	344.40	48.329
09:40	83.473	657.70	283.14	4.550	344.50	47.417
09:50	83.594	659.95	283.58	4.730	347.30	47.798
10:00	83.760	658.50	284.16	4.970	350.10	47.565
HOUR 4	------	------	------	------	------	------
AVERAGE	83.668	659.43	283.64	4.448	346.08	47.917
10:10	83.525	657.34	284.15	5.280	345.70	47.489
[illegible]	[illegible]	656.69	284.29	4.180	347.00	47.674
[illegible]	[illegible]	[illegible]	[illegible]	3.460	348.80	47.055

11:10	83.788	654.97	283.28	4.510	355.10	48.291
11:20	83.636	666.40	284.99	5.030	352.50	49.264
11:30	83.603	666.05	283.75	4.130	347.30	50.042
11:40	83.815	665.68	283.26	3.650	343.80	50.037
11:50	83.740	665.04	281.95	3.800	344.60	48.754
12:00	83.644	666.98	283.18	3.960	342.60	48.349
HOUR 6	------	------	------	------	------	------
AVERAGE	83.704	664.19	283.40	4.180	347.65	49.123

CEDAR BAY MERCURY CONTROL TEST, BOILER 1B -- 6 HOUR REPORT 29

TIME	COAL FLOW TCFLOW1B KLBH	MAIN STEAM FLOW MSTMFX1B KLBH	GROSS GENERATION TGBE0001 MW	BAGHOUSE D/P U2AI541X INWC	FLUE GAS TEMP U2AI543D DEGF	AMMONIA FLOW 0004Z921 ACFM
12:10	83.513	666.41	284.29	4.130	340.70	47.968
12:20	87.869	669.31	284.63	4.390	340.30	48.013
12:30	84.833	675.27	287.20	4.680	338.00	49.330
12:40	84.442	672.24	284.41	4.840	337.10	47.962
12:50	84.433	661.97	281.33	4.990	335.50	46.886
13:00	84.404	662.44	282.60	5.500	334.20	38.850
HOUR 1	------	------	------	------	------	------
AVERAGE	84.916	667.94	284.08	4.755	337.63	46.501
13:10	84.241	659.29	283.30	4.510	334.50	31.969
13:20	84.390	660.97	284.11	3.500	336.10	49.255
13:30	84.056	660.75	284.13	3.450	334.90	48.382
13:40	84.308	660.27	283.02	3.580	334.10	44.141
13:50	84.454	662.97	282.32	3.760	334.00	44.934
14:00	84.433	664.61	282.97	3.910	335.20	46.585
HOUR 2	------	------	------	------	------	------
AVERAGE	84.314	661.48	283.31	3.785	334.80	44.211
14:10	84.651	661.16	283.22	4.100	338.10	47.928
14:20	84.509	661.86	283.17	4.250	334.70	48.966
14:30	84.534	661.48	283.24	4.490	335.60	49.453
14:40	84.294	664.51	283.38	4.640	336.80	50.897
14:50	84.317	660.83	282.93	4.780	332.60	51.024
15:00	84.398	661.11	283.72	4.970	334.30	50.777
HOUR 3	------	------	------	------	------	------
AVERAGE	84.451	661.83	283.28	4.538	335.35	49.841
15:10	84.402	664.43	283.87	5.380	335.50	51.007
15:20	84.550	663.70	284.44	4.400	336.90	51.261
15:30	84.399	663.27	284.52	3.420	335.70	50.363
15:40	84.348	662.47	283.30	3.320	335.60	48.635
15:50	84.336	664.18	284.39	3.430	337.10	48.880
16:00	84.344	664.28	285.63	3.620	339.30	49.077
HOUR 4	------	------	------	------	------	------
AVERAGE	84.405	663.72	284.36	3.928	336.68	49.871
16:10	84.557	663.68	285.74	3.810	338.80	49.283
16:20	84.550	663.36	285.97	3.980	343.30	47.452
16:30	84.695	662.47	285.73	4.200	341.70	45.123
16:40	85.422	667.00	286.43	4.490	342.40	48.023
16:50	85.609	672.63	287.21	4.760	341.40	49.536
17:00	85.776	671.58	287.05	4.960	342.30	50.582
HOUR 5	------	------	------	------	------	------
AVERAGE	85.102	666.79	286.36	4.367	341.65	48.333

17:10	85.683	669.63	287.08	5.520	345.40	50.516
17:20	85.884	670.03	286.55	4.480	344.90	52.881
17:30	85.832	668.08	286.86	3.590	346.70	52.702
17:40	85.938	671.24	286.73	3.600	346.80	51.287
17:50	85.947	673.57	286.86	3.810	348.70	50.933
18:00	85.851	674.94	287.05	4.000	346.50	50.595
HOUR 6	------	------	------	------	------	------
AVERAGE	85.856	671.25	286.85	4.167	346.50	51.486

APPENDIX F

EPA METHOD 101 AND 101A

METHOD 101

DETERMINATION OF PARTICULATE AND GASEOUS MERCURY EMISSIONS FROM CHLOR-ALKALI PLANTS—AIR STREAMS

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of particulate and gaseous mercury (Hg) emissions from chlor-alkali plants and other sources (as specified in the regulations), where the carrier-gas stream in the duct or stack is principally air.

1.2 Principle. Particulate and gaseous Hg emissions are withdrawn isokinetically from the source and collected in acidic iodine monochloride (ICl) solution. The Hg collected (in the mercuric form) is reduced to elemental Hg, which is then aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry.

2. Range and Sensitivity

2.1 Range. After initial dilution, the range of this method is 0.5 to 120 μg Hg/ml. The upper limit can be extended by further dilution of the sample.

2.2 Sensitivity. The sensitivity of this method depends on the recorder/spectrophotometer combination selected.

3. Interfering Agents

3.1 Sampling. SO_2 reduces ICl and causes premature depletion of the ICl solution.

3.2 Analysis. ICl concentrations greater than 10^{-4} molar inhibit the reduction of the Hg (II) ion in the aeration cell. Condensation of water vapor on the optical cell windows causes a positive interference.

4. Precision and Accuracy

The following estimates are based on collaborative tests, wherein 13 laboratories performed duplicate analyses on two Hg-containing samples from a chlor-alkali plant and on one laboratory-prepared sample of known Hg concentration. The concentration ranged from 2 to 65 μg Hg/ml.

4.1 Precision. The estimated within-laboratory and between-laboratory standard deviations are 1.6 and 1.8 μg Hg/ml, respectively.

4.2 Accuracy. The participating laboratories that analyzed a 64.3-μg Hg/ml (in 0.1 M ICl) standard obtained a mean of 63.7 μg Hg/ml.

5. Apparatus

5.1 Sampling Train. A schematic of the sampling train is shown in Figure 101-1; it is similar to the Method 5 train (mention of Method 5 refers to Parts 60 of 40 CFR). The sampling train consists of the following components:

5.1.1 Probe Nozzle, Pitot Tube, Differential Pressure Gauge, Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5, Sections 2.1.1, 2.1.3, 2.1.4, 2.1.8, 2.1.9, and 2.1.10, respectively.

5.1.2 Probe Liner. Borosilicate or quartz glass tubing. The tester may use a heating system capable of maintaining a gas temperature of 120±14°C (248±25°F) at the probe exit during sampling to prevent water condensation.

Note: Do not use metal probe liners.

5.1.3 Impingers. Four Greenburg-Smith impingers connected in series with leak-free ground glass fittings or any similar leak-free noncontaminating fittings. For the first, third, and fourth impingers, the tester may use impingers that are modified by replacing the tip with a 13-mm-ID (0.5-in.) glass tube extending to 13 mm (0.5 in.) from the bottom of the flask.

5.1.4 Acid Trap. Mine Safety Appliances air line filter, Catalog number 81857, with acid absorbing cartridge and suitable connections, or equivalent.

5.2 Sample Recovery. The following items are needed:

5.2.1 Glass Sample Bottles. Leakless, with Teflon-lined caps, 1000- and 100-ml.

5.2.2 Graduated Cylinder. 250-ml.

5.2.3 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

5.2.4 Funnel. Glass, to aid in sample recovery.

5.3 Sample Preparation and Analysis. The following equipment is needed:

5.3.1 Atomic Absorption Spectrophotometer. Perkin-Elmer 303, or equivalent, containing a hollow-cathode mercury lamp and the optical cell described in Section 5.3.2.

5.3.2 Optical Cell. Cylindrical shape with quartz end windows and having the dimensions shown in Figure 101-2. Wind the cell with approximately 2 meters of 24-gauge nichrome heating wire, and wrap with fiberglass insulation tape or equivalent; do not let the wires touch each other.

5.3.3 Aeration Cell. Constructed according to the specifications in Figure 101-3. Do not use a glass frit as a substitute for the blown glass bubbler tip shown in Figure 101-3.

5.3.4 Recorder. Matched to output of the spectrophotometer described in Section 5.3.1.

5.3.5 Variable Transformer. To vary the voltage on the optical cell from 0 to 40 volts.

5.3.6 Hood. For venting optical cell exhaust.

5.3.7 Flowmetering Valve.

PLANT ______________
LOCATION ______________
OPERATOR ______________
DATE ______________
RUN NO. ______________
SAMPLE BOX NO. ______________
FILTER BOX NO. ______________
METER ΔH@ ______________
C FACTOR ______________
PITOT TUBE COEFFICIENT, C_p ______________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ______________
BAROMETRIC PRESSURE ______________
ASSUMED MOISTURE, % ______________
PROBE LENGTH, m (ft) ______________
NOZZLE IDENTIFICATION NO. ______________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ______________
PROBE HEATER SETTING* ______________
LEAK RATE, m^3/min (cfm) ______________
PROBE LINER MATERIAL ______________
STATIC PRESSURE, mm Hg (in. Hg) ______________
FILTER NO.* ______________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in. Hg)	STACK TEMPERATURE (T_S) °C (°F)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER* TEMPERATURE, °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

*IF APPLICABLE

Fig. 101-4. Mercury field data.

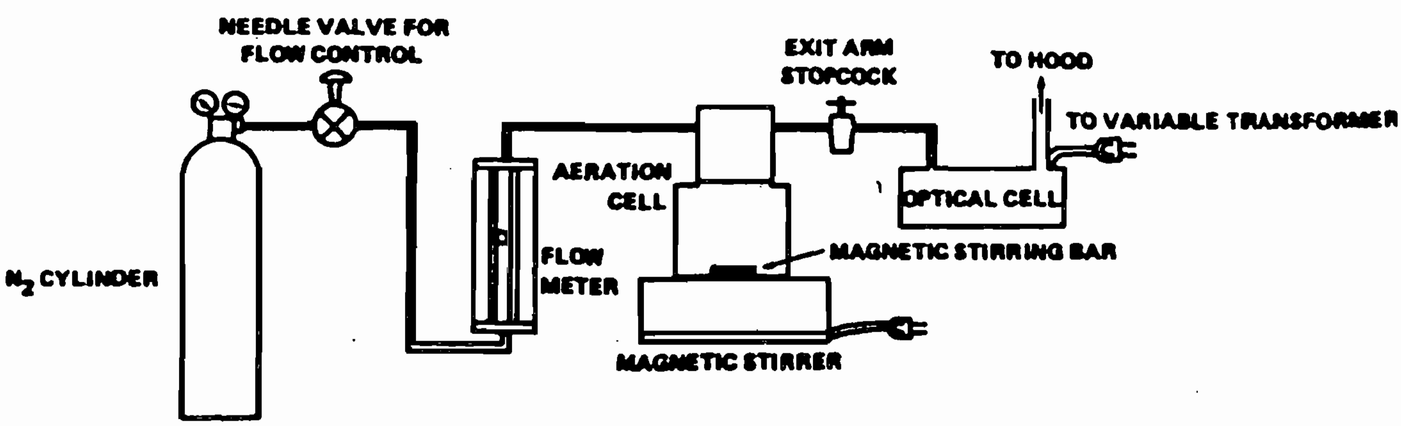

Figure 101-5. Schematic of aeration system.

6.1 Sampling and Recovery. The reagents used in sampling and recovery are as follows:

6.1.1 Water. Deionized distilled, meeting ASTM Specifications for Type I Reagent Water--ASTM Test Method D1193-77 (incorporated by reference--see Section 1.6). If high concentrations of organic matter are not expected to be present, the analyst may eliminate the $KMnO_4$ test for oxidizable organic matter. Use this water in all dilutions and solution preparations.

6.1.2 Nitric Acid (HNO_3), 50 Percent (V/V). Mix equal volumes of concentrated HNO_3 and deionized distilled water, being careful to slowly add the acid to the water.

6.1.3 Silica Gel. Indicating type, 6- to 16-mesh. If previously used, dry at 175°C (350°F) for 2 hours. The tester may use new silica gel as received.

6.1.4 Potassium Iodide (KI) Solution, 25 Percent. Dissolve 250 g of KI in deionized distilled water and dilute to 1 liter.

6.1.5 Iodine Monochloride (ICl) Stock Solution, 1.0 M. To 800 ml of 25 percent KI solution, add 800 ml of concentrated hydrochloric acid (HCl). Cool to room temperature. With vigorous stirring, slowly add 135 g of potassium iodate (KIO_3) and stir until all free iodine has dissolved. A clear orange-red solution occurs when all the KIO_3 has been added. Cool to room temperature and dilute to 1800 ml with deionized distilled water. Keep the solution in amber glass bottles to prevent degradation.

6.1.6 Absorbing Solution, 0.1 M ICl. Dilute 100 ml of the 1.0 M ICl stock solution to 1 liter with deionized distilled water. Keep the solution in amber glass bottles and in darkness to prevent degradation. This reagent is stable for at least 2 months.

6.2 Sample Preparation and Analysis. The reagents needed are listed below:

6.2.1 Tin (II) Solution. Prepare fresh daily and keep sealed when not being used. Completely dissolve 20 g of tin (II) chloride [or 25 g of tin (II) sulfate] crystals (Baker Analyzed reagent grade or any other brand that will give a clear solution) in 25 ml of concentrated HCl. Dilute to 250 ml with deionized distilled water. Do not substitute HNO_3, H_2SO_4, or other strong acids for the HCl.

6.2.2 Mercury Stock Solution, 1 mg Hg/ml. Prepare and store all mercury standard solutions in borosilicate glass containers. Completely dissolve 0.1354 g of mercury (II) chloride in 75 ml of deionized distilled water in a 100 ml glass volumetric flask. Add 10 ml of concentrated HNO_3, and adjust the volume to exactly 100 ml with deionized distilled water. Mix thoroughly. This solution is stable for at least 1 month.

6.2.3 Sulfuric Acid, 5 Percent (V/V). Dilute 25 ml of concentrated H_2SO_4 to 500 ml with deionized distilled water.

6.2.4 Intermediate Mercury Standard Solution, 10 μg Hg/ml. Prepare fresh weekly. Pipet 5.0 ml of the mercury stock solution (6.2.2) into a 500-ml glass volumetric flask and add 20 ml of the 5 percent H_2SO_4 solution. Dilute to exactly 500 ml with deionized distilled water. Thoroughly mix the solution.

After the sampling train has been assembled, turn on and set the probe, if applicable, at the desired operating temperature. Allow time for the temperatures to stabilize. Place crushed ice around the impingers.

7.1.4 Leak-Check Procedures. Follow the leak-check procedures outlined in Method 5, Sections 4.1.4.1 (Pretest Leak Check), 4.1.4.2 (Leak Checks During Sample Run), and 4.1.4.3 (Post-Test Leak Check).

7.1.5 Mercury Train Operation. Follow the general procedure given in Method 5, Section 4.1.5. For each run, record the data required on a data sheet such as the one shown in Figure 101-4.

7.1.6 Calculation of Percent Isokinetic. Same as Method 5, Section 4.1.6.

7.2 Sample Recovery. Begin proper cleanup procedure as soon as the probe is removed from the stack at the end of the sampling period.

Allow the probe to cool. When it can be safely handled, wipe off any external particulate matter near the tip of the probe nozzle and place a cap over it. Do not cap off the probe tip tightly while the sampling train is cooling. Capping would create a vacuum and draw liquid out from the impingers.

Before moving the sampling train to the cleanup site, remove the probe from the train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the impinger. Use either ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe and impinger assembly to a cleanup area that is clean, protected from the wind, and free of Hg contamination. The ambient air in laboratories located in the immediate vicinity of Hg-using facilities is not normally free of Hg contamination.

Inspect the train before and during assembly, and note any abnormal conditions. Treat the sample as follows:

7.2.1 Container No. 1 (Impinger and Probe). Using a graduated cylinder, measure the liquid in the first three impingers to within ±1 ml. Record the volume of liquid present (e.g., see Figure 5-3 of Method 5). This information is needed to calculate the moisture content of the effluent gas. (Use only glass storage bottles and graduated cylinders that have been precleaned as in Section 7.1.3.) Place the contents of the first three impingers into a 1000-ml glass sample bottle.

Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover the Hg (and any condensate) from the probe nozzle, probe fitting, and probe liner as follows: Rinse these components with two 50-ml portions of 0.1 M ICl. Next, rinse the probe nozzle, fitting and liner, and each piece of connecting glassware between the probe liner and the back half of the third impinger with a maximum of 400 ml of deionized distilled water. Add all washings to the 1000-ml glass sample bottle containing the liquid from the first three impingers.

After all washings have been collected in the sample container, tighten the lid on the container to prevent leakage during shipment to the laboratory. Mark the height

8. Calibration and Standards

Before use, clean all glassware, both new and used, as follows: brush with soap and water, liberally rinse with tap water, soak for 1 hour in 50 percent HNO_3, and then rinse with deionized distilled water.

8.1 Flow Calibration. Assemble the aeration system as shown in Figure 101-5. Set the outlet pressure on the aeration gas cylinder regulator to a minimum pressure of 500 mm Hg (10 psi), and use the flowmetering valve and a bubble flowmeter or wet test meter to obtain a flow rate of 1.5±0.1 liters/min through the aeration cell. After the flow calibration is complete, remove the bubble flowmeter from the system.

8.2 Optical Cell Heating System Calibration. Using a 50-ml graduated cylinder, add 50 ml of deionized distilled water to the bottle section of the aeration cell and attach the bottle section to the bubbler section of the cell. Attach the aeration cell to the optical cell; and while aerating at 1.5 liters/min, determine the minimum variable transformer setting necessary to prevent condensation of moisture in the optical cell and in the connecting tubing. (This setting should not exceed 20 volts.)

8.3 Spectrophotometer and Recorder Calibration. The mercury response may be measured by either peak height or peak area.

Note: The temperature of the solution affects the rate at which elemental Hg is released from a solution and, consequently, it affects the shape of the absorption curve (area) and the point of maximum absorbance (peak height). Therefore, to obtain reproducible results, bring all solutions to room temperature before use.

Set the spectrophotometer wavelength at 253.7 nm, and make certain the optical cell is at the minimum temperature that will prevent water condensation. Then set the recorder scale as follows: Using a 50-ml graduated cylinder, add 50 ml of deionized distilled water to the aeration cell bottle and pipet 5.0 ml of the working mercury standard solution into the aeration cell.

Note: Always add the Hg-containing solution to the aeration cell after the 50 ml of deionized distilled water.

Place a Teflon-coated stirring bar in the bottle. Before attaching the bottle section to the bubbler section of the aeration cell, make certain that (1) the aeration cell exit arm stopcock (Figure 101-3) is closed (so that Hg will not prematurely enter the optical cell when the reducing agent is being added), and (2) there is no flow through the bubbler. If conditions (1) and (2) are met, attach the bottle section to the bubbler section of the aeration cell. Pipet 5 ml of stannous chloride solution into the aeration cell through the side arm, and immediately stopper the side arm. Stir the solution for 15 sec, turn on the recorder, open the aeration cell exit arm stopcock, and then immediately initiate aeration with continued stirring. Determine the maximum absorbance of the standard and set this value to read 90 percent of the recorder full scale.

8.4 Calibration Curve. After setting the recorder scale, repeat the procedure in Section 8.3 using 0.0-, 1.0-, 2.0-, 3.0-, 4.0-, and 5.0-ml aliquots of the working standard solution (final amount of Hg in the aeration cell is 0, 200, 400, 600, 800, and 1000 ng, respectively). Repeat this procedure on each aliquot size until two consecutive peaks agree within 3 percent of their average value. (**Note:** To prevent Hg carryover

$$m_{Hg} = \frac{C_{Hg(AC)}\,(D.F.)\,V_f 10^{-3}}{S} \qquad \text{(Equation 101-1)}$$

Where:

$C_{Hg(AC)}$ = Total nanograms of mercury in aliquot analyzed (reagent blank subtracted).

D.F. = Dilution factor for the Hg-containing solution (before adding to the aeration cell; e.g., D.F. = 250/2 if the source samples were diluted as described in Section 7.3.2.)

V_f = Solution volume of original sample, 1000 ml for samples diluted as described in Section 7.2.1.

10^{-3} = Conversion factor, μg/ng.

S = Aliquot volume added to aeration cell, ml.

9.5 Mercury Emission Rate. Calculate the Hg emission rate R in g/day for continuous operations using Equation 101-2. For cyclic operations, use only the time per day each stack is in operation. The total Hg emission rate from a source will be the summation of results from all stacks.

$$R = K\,\frac{m_{Hg} v_s A_s (86{,}400 \times 10^{-6})}{[V_{m(std)} + V_{w(std)}](T_s/P_s)} \qquad \text{(Equation 101-2)}$$

Where:

A_s = Stack cross-sectional area, m^2 (ft^2).

86,400 = Conversion factor, sec/day.

10^{-6} = Conversion factor, g/μg.

T_s = Absolute average stack gas temperature, °K (°R).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

K = 0.3858 °K/mm Hg for metric units.

= 17.64 °R/in. Hg for English units.

v_s = Average gas velocity, m/sec (ft/sec).

$V_{m(std)}$ = Dry gas sample volume at standard conditions, scm (scf).

$V_{w(std)}$ = Volume of water vapor at standard conditions, scm (scf).

9.6 Isokinetic Variation and Acceptable Results. Same as Method 5, Sections 6.11 and 6.12, respectively.

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METHOD 101A

DETERMINATION OF PARTICULATE AND GASEOUS MERCURY EMISSIONS FROM SEWAGE SLUDGE INCINERATORS

Introduction

This method is similar to Method 101, except acidic potassium permanganate solution is used instead of acidic iodine monochloride for collection.

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of particulate and gaseous mercury (Hg) emissions from sewage sludge incinerators and other sources as specified in the regulations.

1.2 Principle. Particulate and gaseous Hg emissions are withdrawn isokinetically from the source and collected in acidic potassium permanganate ($KMnO_4$) solution. The Hg collected (in the mercuric form) is reduced to elemental Hg, which is then aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry.

2. Range and Sensitivity

2.1 Range. After initial dilution, the range of this method is 20 to 800 ng Hg/ml. The upper limit can be extended by further dilution of the sample.

2.2 Sensitivity. The sensitivity of the method depends on the recorder/spectrophotometer combination selected.

3. Interfering Agents

3.1 Sampling. Excessive oxidizable organic matter in the stack gas prematurely depletes the $KMnO_4$ solution and thereby prevents further collection of Hg.

3.2 Analysis. Condensation of water vapor on the optical cell windows causes a positive interference.

4. Precision

Based on eight paired-train tests, the within-laboratory standard deviation was estimated to be 4.8 μg Hg/ml in the concentration range of 50 to 130 μg Hg/m^3.

5. Apparatus

5.1 Sampling Train and Sample Recovery. Same as Method 101, Sections 5.1 and 5.2, respectively, except for the following variations:

5.1.1 Probe Liner. Same as Method 101, Section 5.1.2, except that if a filter is used ahead of the impingers, the tester must use the probe heating system to minimize the condensation of gaseous Hg.

Analyzed reagent grade or any other brand that will give a clear solution) in 25 ml of concentrated HCl. Dilute to 250 ml with deionized distilled water. Do not substitute HNO_3, H_2SO_4, or other strong acids for the HCl.

6.2.2 Sodium Chloride--Hydroxylamine Solution. Dissolve 12 g of sodium chloride and 12 g of hydroxylamine sulfate (or 12 g of hydroxylamine hydrochloride) in deionized distilled water and dilute to 100 ml.

6.2.3 Hydrochloric Acid (HCl), 8 N. Dilute 67 ml of concentrated HNO_3 to 100 ml with deionized distilled water (slowly add the HCL to the water).

6.2.4 Nitric Acid, 15 Percent (V/V). Dilute 15 ml of concentrated HNO_3 to 100 ml with deionized distilled water.

6.2.5 Mercury Stock Solution, 1 mg Hg/ml. Prepare and store all mercury standard solutions in borosilicate glass containers. Completely dissolve 0.1354 g of mercury (II) chloride in 75 ml of deionized distilled water. Add 100 ml of concentrated HNO_3, and adjust the volume to exactly 100 ml with deionized distilled water. Mix thoroughly. This solution is stable for at least 1 month.

6.2.6 Intermediate Mercury Standard Solution, 10 µg Hg/ml. Prepare fresh weekly. Pipet 5.0 ml of the mercury stock solution (Section 6.2.5) into a 500-ml volumetric flask and add 20 ml of 15 percent HNO_3 solution. Adjust the volume to exactly 500 ml with deionized distilled water. Thoroughly mix the solution.

6.2.7 Working Mercury Standard Solution, 200 ng Hg/ml. Prepare fresh daily. Pipet 5.0 ml from the "Intermediate Mercury Standard Solution" (Section 6.2.6) into a 250-ml volumetric flask. Add 5 ml of 4 percent $KMnO_4$ absorbing solution and 5 ml of 15 percent HNO_3. Adjust the volume to exactly 250 ml with deionized distilled water. Mix thoroughly.

6.2.8 Potassium Permanganate, 5 Percent (W/V). Dissolve 5 g of $KMnO_4$ in deionized distilled water and dilute to 100 ml.

6.2.9 Filter. Whatman No. 40 or equivalent.

7. Procedure

7.1 Sampling. The sampling procedure is the same as Method 101, except for changes due to the use of $KMnO_4$ instead of ICl absorbing solution and the possible use of a filter. These changes are as follows:

7.1.1 Preliminary Determinations. The preliminary determinations are the same as those given in Method 101, Section 7.1.2, except for the absorbing solution depletion sign. In this method, high oxidizable organic content may make it impossible to sample for the desired minimum time. This problem is indicated by the complete bleaching of the purple color of the $KMnO_4$ solution. In these cases, the tester may divide the sample run into two or more subruns to insure that the absorbing solution would not be depleted. In cases where an excess of water condensation is encountered, collect two runs to make one sample.

7.1.2 Preparation of Sampling Train. The preparation of the sampling train is brown deposits on the glassware using the minimum amount of 8 N HCl required; and add this HCl rinse to this sample container.

After all washings have been collected in the sample container, tighten the lid on the container to prevent leakage during shipment to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

7.2.2 Container No. 2 (Silica Gel). Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. Transfer the silica gel from its impinger to its original container and seal. The tester may use as aids a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g; record this weight.

7.2.3 Container No. 3 (Filter). If a filter was used, carefully remove it from the filter holder, place it in a 100-ml glass sample bottle, and add 20 to 40 ml of 4 percent $KMnO_4$. If it is necessary to fold the filter, be sure that the particulate cake is inside the fold. Carefully transfer to the 150-ml sample bottle any particulate matter and filter fibers that adhere to the filter holder gasket by using a dry Nylon bristle brush and a sharp-edged blade. Seal the container. Label the container to clearly identify its contents. Mark the height of the fluid level to determine whether leakage occurs during transport.

7.2.4 Container No. 4 (Filter Blank). If a filter was used, treat an unused filter from the same filter lot used for sampling in the same manner as Container No. 3.

7.2.5 Container No. 5 (Absorbing Solution Blank). For a blank, place 500 ml of 4 percent $KMnO_4$ absorbing solution in a 1000-ml sample bottle. Seal the container.

7.3 Sample Preparation. Check liquid level in each container to see if liquid was lost during transport. If a noticeable amount of leakage occurred, either void the sample or use methods subject to the approval of the Director to account for the losses. Then follow the procedures below.

7.3.1 Containers No. 3 and No. 4 (Filter and Filter Blank). If a filter was used, place the contents, including the filter, or Containers No. 3 and No. 4 in separate 250-ml beakers and heat the beakers on a steam bath until most of the liquid has evaporated. Do not take to dryness. Add 20 ml of concentrated HNO_3 to the beakers, cover them with a glass, and heat on a hot plate at 70°C for 2 hours. Remove from the hot plate and filter the solution through Whatman No. 40 filter paper. Save the filtrate for Hg analysis. Discard the filter.

7.3.2 Container No. 1 (Impingers, Probe, and Filter Holder). Filter the contents of Container No. 1 through Whatman 40 filter paper to remove the brown MnO_2 precipitate. Wash the filter with 50 ml of 4 percent $KMnO_4$ absorbing solution and add this wash to the filtrate. Discard the filter. Combine the filtrates from Containers No. 1 and No. 3 (if applicable), and dilute to a known volume with deionized distilled water. Mix thoroughly.

colorless. Now add 5 ml of tin (II) solution to the aeration bottle through the side arm, and immediately stopper the side arm. Stir the solution for 15 seconds, turn on the recorder, open the aeration cell exit arm stopcock, and immediately initiate aeration with continued stirring. Determine the maximum absorbance of the standard and set this value to read 90 percent of the recorder full scale.

9. Calculations

9.1 Dry Gas Volume, Volume of Water Vapor and Moisture Content, Stack Gas Velocity, Isokinetic Variation and Acceptable Results, and Determination of Compliance. Same as Method 101, Sections 9.1, 9.2, 9.3, 9.6, and 9.7, respectively, except use data obtained from this test.

9.2 Total Mercury. For each source sample, correct the average maximum absorbance of the two consecutive samples whose peak heights agreed within ±3 percent of their average for the contribution of the field blank. Then calculate the total Hg content in µg in each sample. Correct for any dilutions made to bring the sample into the working range of the spectrophotometer.

9.3 Mercury Emission Rate. Calculate the Hg emission rate R in g/day for continuous operations using Equation 101A-1. For cyclic operations, use only the time per day each stack is in operation. The total Hg emission rate from a source will be the summation of results from all stacks.

$$R = K \frac{m_{Hg}\, v_s\, A_s\, (86{,}400 \times 10^{-6}}{[V_{m(std)} + V_{w(std)}\, (T_s/P_s)} \qquad \text{(Equation 101A-1)}$$

Where:

m_{Hg} = Total Hg content in each sample, µg.

v_s = Average stack gas velocity, m/sec (fps).

A_s = Stack cross-sectional area, m^2 (ft^2).

86,400 = Conversion factor, sec/day.

10^{-6} = Conversion factor, g/µg.

$V_{m(std)}$ = Dry gas sample volume at standard conditions, corrected for leakage (if any), m^3 (ft^3).

$V_{w(std)}$ = Volume of water vapor at standard conditions, m^3 (ft^3).

T_s = Absolute average stack gas temperature, °K (°R).

P_s = Absolute stack gas pressure, mm Hg (in.Hg).

K = 0.3858 °K/mm Hg for metric units.

= 17.64 °R/in. Hg for English units.

APPENDIX G

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

Air Consulting and Engineering

Steve Neck
Field Team Leader

J. Colleen Hodge
Field Sample Recovery

Sidney Carter
Thomas Bartley
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Field Participants

Charles G. Simon
Report Preparation

Candace V. Taylor
Computer Analysis
Document Production

PPB Environmental Services

M. Kelly Bergdoll
Mercury Analysis

Cedar Bay Cogeneration Project

Kevin Grant
Production Data

Barrett Parker
Project Director

Roy F. Weston , Inc.

Michael O. White
Quality Assurance

City of Jacksonville Regulatory and Environmental Services Department

Jeffrey Winters
William Gaston
Observers

Florida Department of Environmental Protection

Mort Benjamin
Stan Mazur
Observers

APPENDIX H

SAMPLE CALCULATIONS.

Appendix H

Sample Calculations

1. Section 5.1 - Calculated Coal Mercury Input

$$\text{Average Mercury Input} = \text{Average Mercury Concentration} \times \left(\text{Average Coal Feed}\right)$$

$$= 0.067\ \frac{\mu g\ Hg}{g\ coal} \times \left(\frac{\frac{lb\ Hg}{10^6\ lb\ coal}}{\frac{\mu g\ Hg}{g\ coal}}\right) \times 88{,}300\ \frac{lb\ coal}{hr} = 5.92 \times 10^{-3}\ \frac{lb\ Hg}{hr}$$

2. Section 5.2 - Calculated Fly Ash Mercury Content

a) Estimated Fly Ash Production

$$= .7 \times \left[\text{Coal Feed Rate} \times \left(\text{Average Ash \% of Coal}\right) + \text{Limestone Feed Rate}\right]$$

$$= .7 \times \left[88{,}300\ \frac{lb\ coal}{hr} \times \left(.1157\ \frac{lb\ ash}{lb\ coal}\right) + 10{,}029\ \frac{lb\ limestone}{hr} \times \left(\frac{1\ lb\ ash}{1\ lb\ limestone}\right)\right] = 14{,}172\ \frac{lb}{hr}$$

b) Estimated Mercury Output

$$= \text{Average Mercury Concentration} \times \left(\text{Estimated Fly Ash Production}\right)$$

$$= .556\ \frac{\mu g\ Hg}{g\ fly\ ash} \times \left(\frac{\frac{lb\ Hg}{10^6\ lb\ fly\ ash}}{\frac{\mu g\ Hg}{g\ fly\ ash}}\right) \times 14{,}172\ \frac{lb\ flyash}{hr} = 7.88 \times 10^{-3}\ \frac{lb\ Hg}{hr}$$

3. Section 5.3 - Coal Statistical Analysis Results

mean coal mercury value $= 0.050\ \frac{\mu g\ Hg}{g\ coal}$

standard deviation $= 0.033\ \frac{\mu g\ Hg}{g\ coal}$

95% confidence interval $= x \pm \frac{1.96 \times \sigma}{\sqrt{n}}$

$$= 0.050 \pm \frac{1.96\ (0.033)}{\sqrt{50}}$$

$$= 0.050 \pm .009$$

4. Section 5.3 - Fly Ash Statistical Analysis Results

$$\text{mean fly ash sampling value} = 0.445\ \frac{\mu g\ Hg}{g\ \text{flyash}}$$

$$\text{standard deviation} = 0.166\ \frac{\mu g\ Hg}{g\ \text{flyash}}$$

$$\text{95\% confidence interval} = \bar{x} \pm \frac{1.96 \times \sigma}{\sqrt{n}}$$

$$= 0.445 \pm \frac{1.96\ (0.166)}{\sqrt{25}}$$

$$= 0.445 \pm .065$$

5. Section 5.4 - Correction to 7% Oxygen Factor

$$\text{Correction to 7\% } O_2 \text{ Factor} = \frac{20.9 - 7.0}{20.9 - \text{measured } O_2\%}$$

$$\text{Corrected Mercury Emissions Rate} = 7.05 \times 10^{-3}\ \frac{lb\ Hg}{hr} \times \left(\frac{20.9 - 7.0}{20.9 - 5.3}\right) = 6.28 \times 10^{-3}\ \frac{lb\ Hg}{hr}$$

$$\text{Corrected Mercury Emissions Rate} = 7.77 \times 10\text{-}3\ \frac{\mu g\ Hg}{Nm^3} \times \left(\frac{20.9 - 7.0}{20.9 - 5.3}\right) = 6.92 \times 10^{-3}\ \frac{\mu g\ Hg}{Nm^3}$$

6. Section 6.1 - Box Plot Method for Determining Outliers

Data set	=	.05, .06, .07, .92, 1.29, 1.69, 1.81, 1.90, 2.69, 6.92, 8.30
Median	=	1.69
Lower quartile	=	$(n + 1)/4 = (11 + 1)/4 = 3 \therefore Q_L = .07$
Upper quartile	=	$3(n+ 1)/4 = 3(11 + 1)/4 = 9 \therefore Q_U = 2.69$
Inner quartile range (IQR)	=	$Q_U - Q_L = 2.69 - .07 = 2.62$
Inner fence range	=	Q_L - 1.5 IQR to Q_U + 1.5 IQR
	=	.07 - 1.5 x (2.62) to 2.69 x (2.62)
	=	-3.86 to 6.62
Outer fence range	=	Q_L -3 IQR to Q_U + 3 IQR
	=	.07 -3 x (2.62) to 2.69 +3 x (2.62)
	=	-7.79 to 10.55

Since values lying between inner and outer fences are suspected outliers, 6.90 and 8.30 should be removed from the data set.

7. Section 6.2 - Student's T Testing

Use student's t statistic to provide information about the sample mean since the number of values, 9, is less than 30.

Null hypotheses - $H_0: \mu >/3.0$, Alternative hypotheses - $H_a: \mu < 3.0$

at $\alpha = .005$ and degrees of freedom = 8, $t_{critical} = 3.355$

so reject H_0 if $t_{test} > 3.355$

$$t\ test = \frac{\overline{y} - \mu_o}{\frac{s}{\sqrt{n}}} = \frac{3.0 - 1.16}{\frac{.96}{\sqrt{9}}} = 5.75$$

Since 5.75 exceeds 3.355, reject H_0 and accept H_a. This means that the probability of the average mercury emissions exceeding 3.0 $\frac{\mu g}{Nm^3}$ is less than 0.5 percent.

8. Section 7.0 - Model Mass Balance Equations

a) Input Mercury = Output Mercury, or
Mercury in coal = Mercury in Fly ash plus Mercury in Flue Gas

Note that the mass balance model does not close - $4.27 \neq 2.63 + 6.60$. Even so, estimated mercury removal efficiency values can be determined.

$$\text{Estimated Mercury Removal Efficiency} = \frac{\text{Mercury in Coal - Mercury in Flue Gas}}{\text{Mercury in Coal}} = \frac{4.27 - 2.63}{4.27} = 38\%$$

$$= \frac{\text{Mercury in Ash}}{\text{Mercury in Ash + Mercury in Flue Gas}} = \frac{6.60}{6.60 + 2.63} = 72\%$$

$$= \frac{\text{Mercury in Ash}}{\text{Mercury in Coal}} = \frac{6.60}{4.27} = 155\%$$

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6

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Total 1	Total 1	Total

DIM SHIPMENT (Chargeable Weight)
[ ] ______ lbs.
L x W x H

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4 [ ] B.S.C.
2 [ ] On-Call Stop 5 [ ] Station

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[ ] Cash Received
[ ] Return Shipment
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Street Address
City State Zip
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