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J. R. (Dick) Robertson, P.E.
Generation Environmental Manager

May 3, 2000

Mr. William Grimley
Emissions Measurement Center
Interstate 40 and Page Road
4930 Old Page Road
Room Number E-108
Durham, North Carolina 27709

Attn: Electric Utility Steam Generating Unit Mercury Test Program

Dear Mr. Grimley,

Enclosed are three copies of the speciated mercury stack test report for Unit 1 at TXU Electric's Big Brown Electric Station. This report was required by the Environmental Protection Agency Electric Utility Steam Generating Unit Information Collection Request. TXU appreciates EPA granting additional time for the completion of this report.

If you have any questions, please contact Mr. David Lamb at (214) 812-8482.

Sincerely,

J. R. Robertson

Dwl:sm
Enclosures

Cc: Barry Boswell BBSES (no enclosure)
Bobby McNeeley BBSES

EP-09 Route
SHS
UMB
FCB
DWL

AIR-BBSES-EPA – Mercury ICR

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(972) 931-7127

SOURCE EMISSIONS SURVEY
OF
TXU ELECTRIC
BIG BROWN STEAM ELECTRIC STATION
UNIT NUMBER 1 BAGHOUSE B INLET DUCT
AND STACK
FAIRFIELD, TEXAS

NOVEMBER 1999

FILE NUMBER 99-182

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1 INTRODUCTION

1.1 Summary of Test Program

METCO Environmental, Dallas, Texas, conducted a source emissions survey of TXU Electric, Big Brown Steam Electric Station, located near Fairfield, Texas, on November 8, 9, and 10, 1999. The purpose of these tests was to meet the requirements of the EPA Mercury Information Request. Speciated mercury concentrations at the Unit Number 1 Baghouse B Inlet Duct, speciated mercury emissions at the Unit Number 1 Stack, and mercury and chlorine content of the fuel were determined. The sulfur, ash, and Btu content of the fuel were also determined.

The sampling followed the procedures set forth in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Appendix A, Methods 1, 2, 3B, 4, 5, 17, and 19; in the Ontario Hydro Method, Revised July 7, 1999; and ASTM Methods D2234, D6414-99, E776/300.0, D-4239, D-3174, and D-3286.

1.2 Key personnel

Mr. Bill Hefley of METCO Environmental was the onsite project manager. Mr. Shane Lee, Mr. Mike Bass, Mr. Jason Conway, Mr. Scott Hart, and Mr. Jason Brown of METCO Environmental performed the testing.

Mr. David Lamb of TXU Electric acted as the utility representative, performing process monitoring and sampling.

Table 1-1
Test Program Organization

Organization	Individual	Responsibility	Phone Number
Project Management and Oversight			
METCO	Bill Mullins	Project Director	(972) 931-7127
Project Team			
METCO	Bill Hefley	Project Manager	(972) 931-7127
Utility			
TXU Electric	David Lamb	Utility Representative	(214) 812-8482
QA/QC			
METCO	Jim Monfries	Quality Assurance Manager	(972) 931-7127

2 SOURCE AND SAMPLING LOCATION DESCRIPTIONS

2.1 Process Description

Big Brown Unit Number 1 is a super critical combined circulation steam generator, designed to deliver steam at a rate of 4,025,000 pounds per hour (max. continuous) at 1,005 °F and 3,825 psig (superheater outlet) to a 575 MW turbogenerator. The steam generator is of the divided furnace type, consisting of a tangentially fired, center wall furnace with economizer, superheater and reheater surfaces.

2.2 Control Equipment Description

2.2.1 Precipitators

The cold side electrostatic precipitators (ESPs) were manufactured by Research Cottrell as part of the original boiler installation and have a nominal control efficiency of 98 + %. All ESPs are operated at full voltage during normal unit operation in order to reduce the particulate load to the Compact Hybrid Particulate Collector (COPAHC) baghouse located downstream of the ESP. Flue gas conditioning agents (sulfur trioxide and ammonia) are fed to the flue gas stream upstream of the ESP system to enhance ash resistivity and cohesiveness and aid in particulate removal. A microprocessor based rapper/vibrator program cleans the ESP plates on a routine basis. On each boiler, fly ash is collected in 32 hoppers and sent to two fly ash silos via two pneumatic systems rated at 35 tons of ash per hour. Each 72,000 cubic foot fly ash silo is equipped with two dustless rotary unloaders and silo exhaust emissions are captured by baghouses on top of the silos.

2.2.2 *Baghouses*

The COHPAC baghouses, manufactured by Research Cottrell, were retrofitted to the flue gas stream in 1995 and 1996 and have an air-to-cloth ratio of approximately 15 to 1. The baghouse is located downstream and in series with the ESP system. There are four modules per unit and each module consists of eight compartments with 312 bags each (2,496 bag per module). The bags are 20 feet long and arranged in eleven concentric circles within the compartments. The baghouses are individually controlled by an Allen Bradley Programmable Logic Controller. The baghouse has an automatic pulse jet cleaning cycle set to clean the bags based on plant specified conditions. A single baghouse compartment is cleaned in an off-line mode almost continuously. The baghouse is protected from high temperature and high baghouse pressure drop with a system of normally closed dampers. Should the baghouse temperature exceed 385 °F, dilution dampers open instantaneously to allow cooler outside air to mix with the flue gas to protect the bags. The dampers will close when the temperature is reduced to 375 °F. If the baghouse differential pressure exceeds 11 i.w.c., the bypass dampers will open to protect the bags. Ash collected from the cleaning of the bags is conveyed pneumatically to two fly ash silos as described previously.

2.3 Flue Gas and Process Sampling Locations

2.3.1 *Inlet Sampling Location*

The sampling location on the Unit Number 1 Baghouse B Inlet Duct is 60 feet above the ground. The sampling locations are located 68 feet 1 inch (3.48 equivalent duct diameters) downstream from a bend in the duct and 16 feet 9 inches (0.86 equivalent duct diameters) upstream from a bend in the duct.

2.3.2 *Stack Sampling Location*

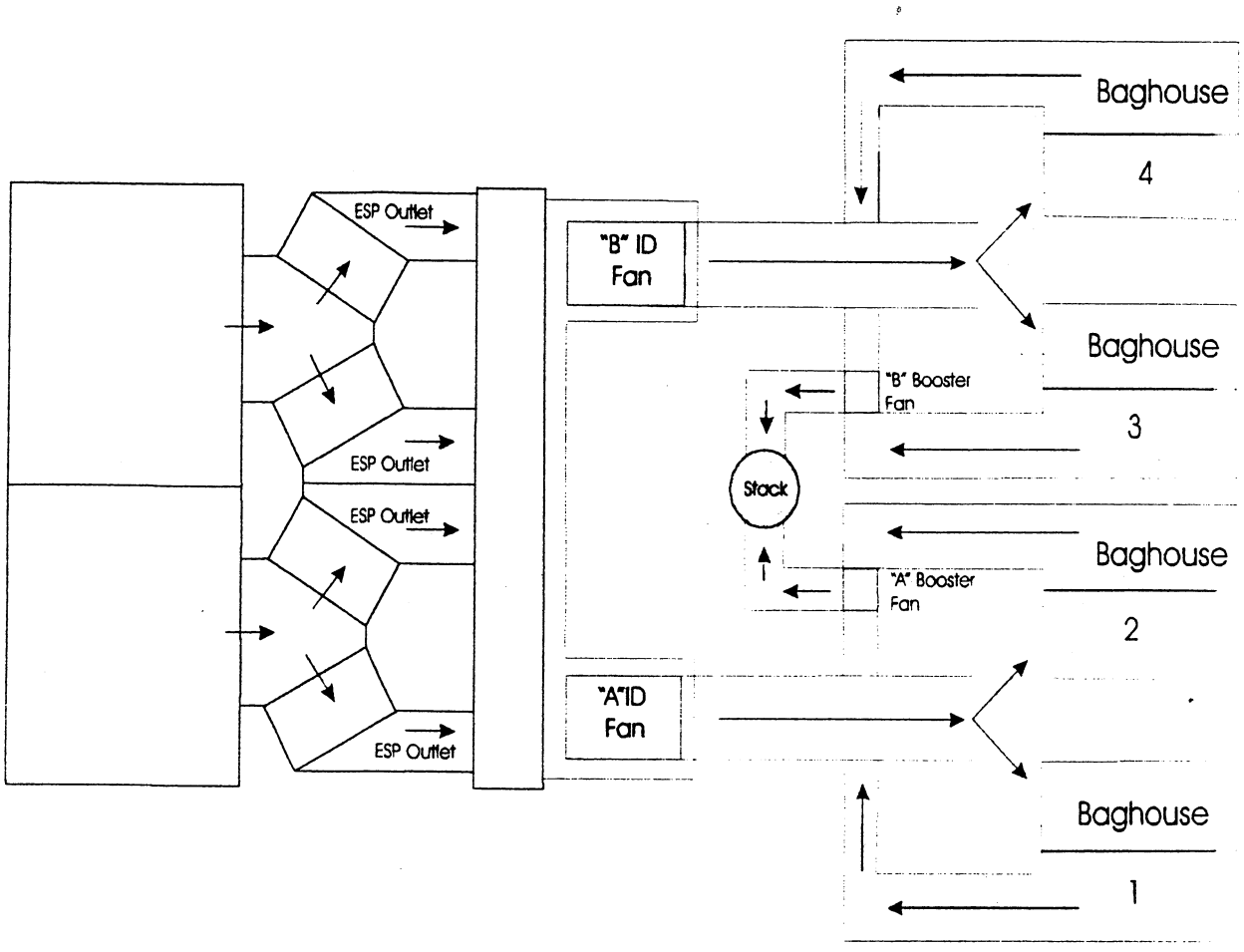
The sampling location on the Unit Number 1 Stack is 263 feet 6 inches above the ground. The sampling locations are located 220 feet 9 5/8 inches (8.91 stack diameters) downstream from the inlet to the stack and 136 feet 6 inches (5.51 stack diameters) upstream from the outlet of the stack.

2.3.3 *Lignite Sampling Location*

The lignite sampling locations are located at the gravimetric feeders to each of the individual mills.

Figure 2-1
Process Description

Big Brown SES Unit 1 or 2 Flue Gas Flow Path Diagram



DWL January 20, 2000
K:\EIA\MAR\MERCURY\BBSES STACK TEST\DRAWINGS\BBSES 1 & 2 FLUE GAS FLOW PATH.CDR

Figure 2-2
Description of sampling locations at Big Brown Unit Number 1 Baghouse B Inlet Duct

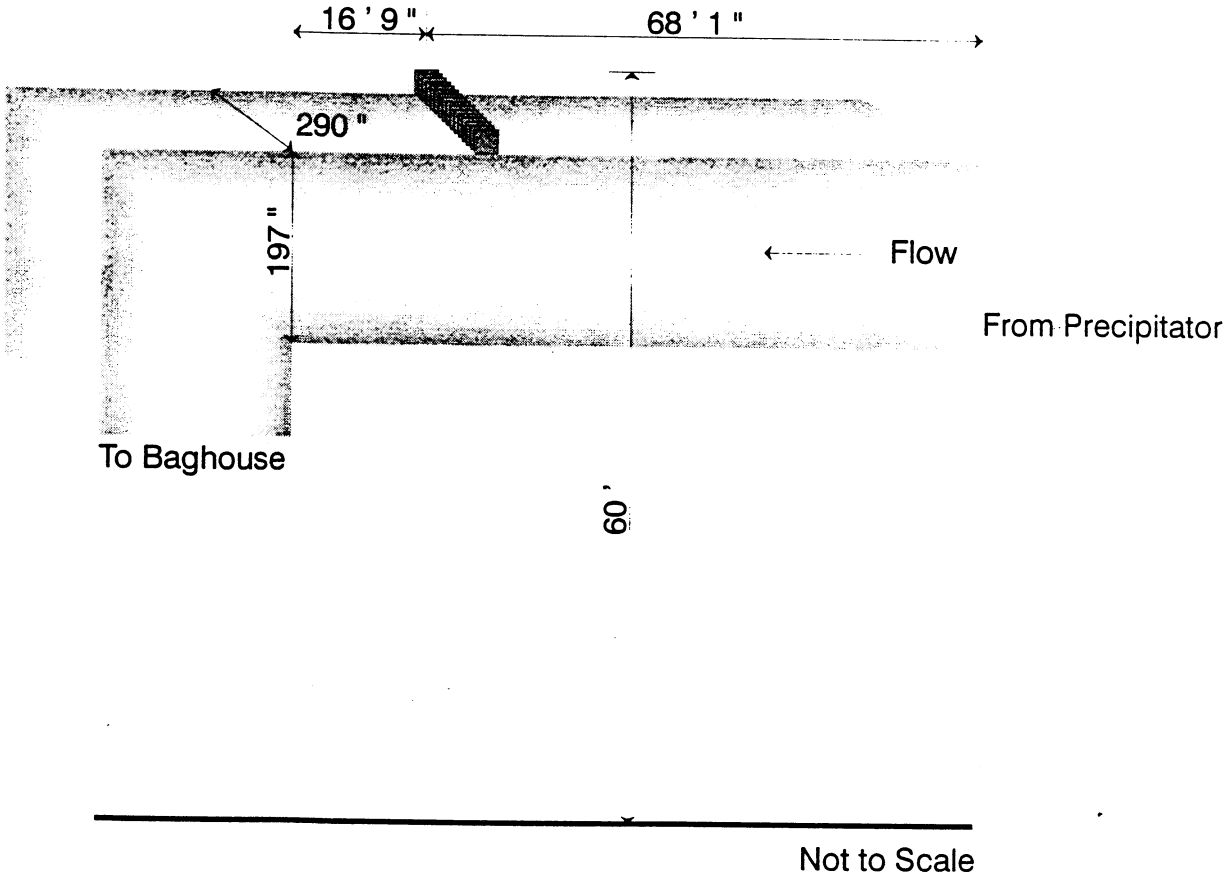


Figure 2-3
Description of sampling points at Big Brown Unit Number 1 Baghouse B Inlet Duct

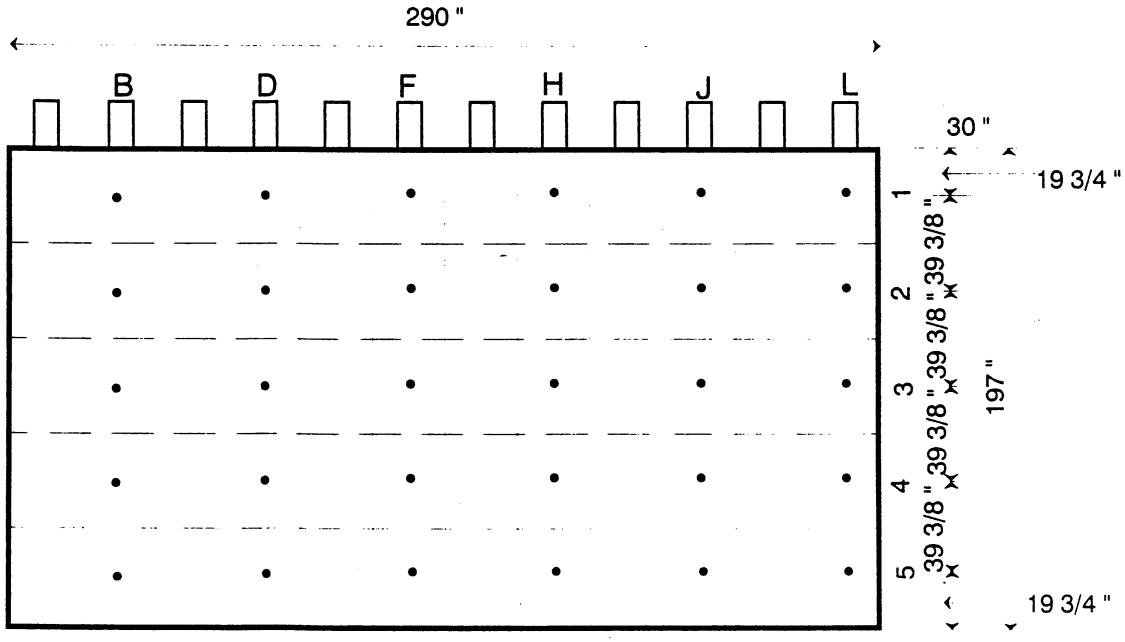
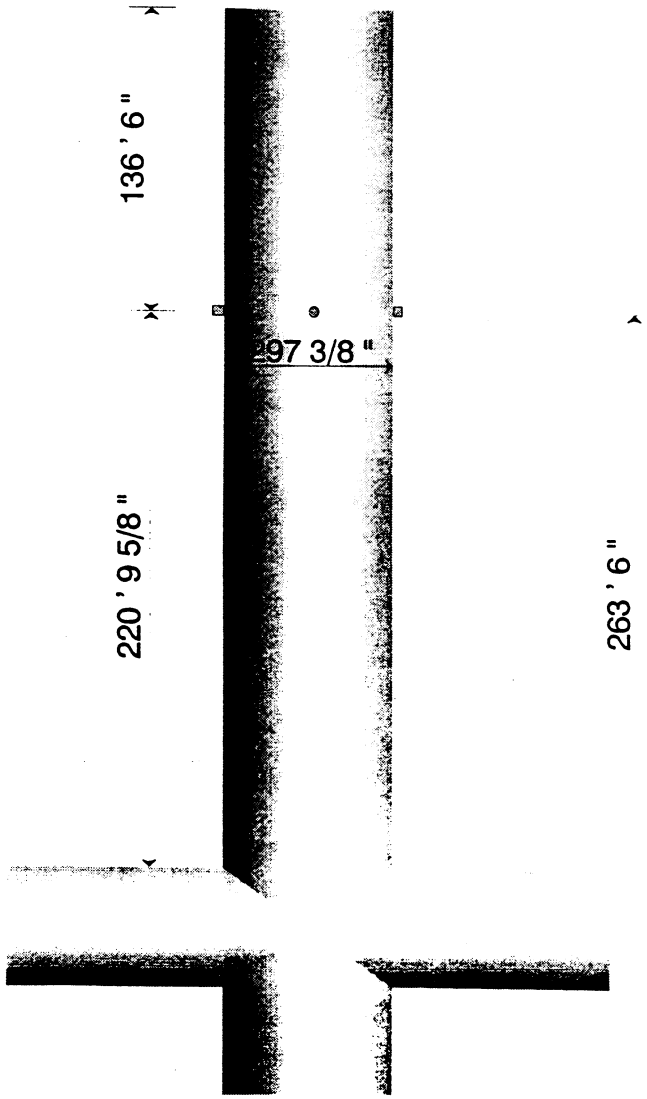
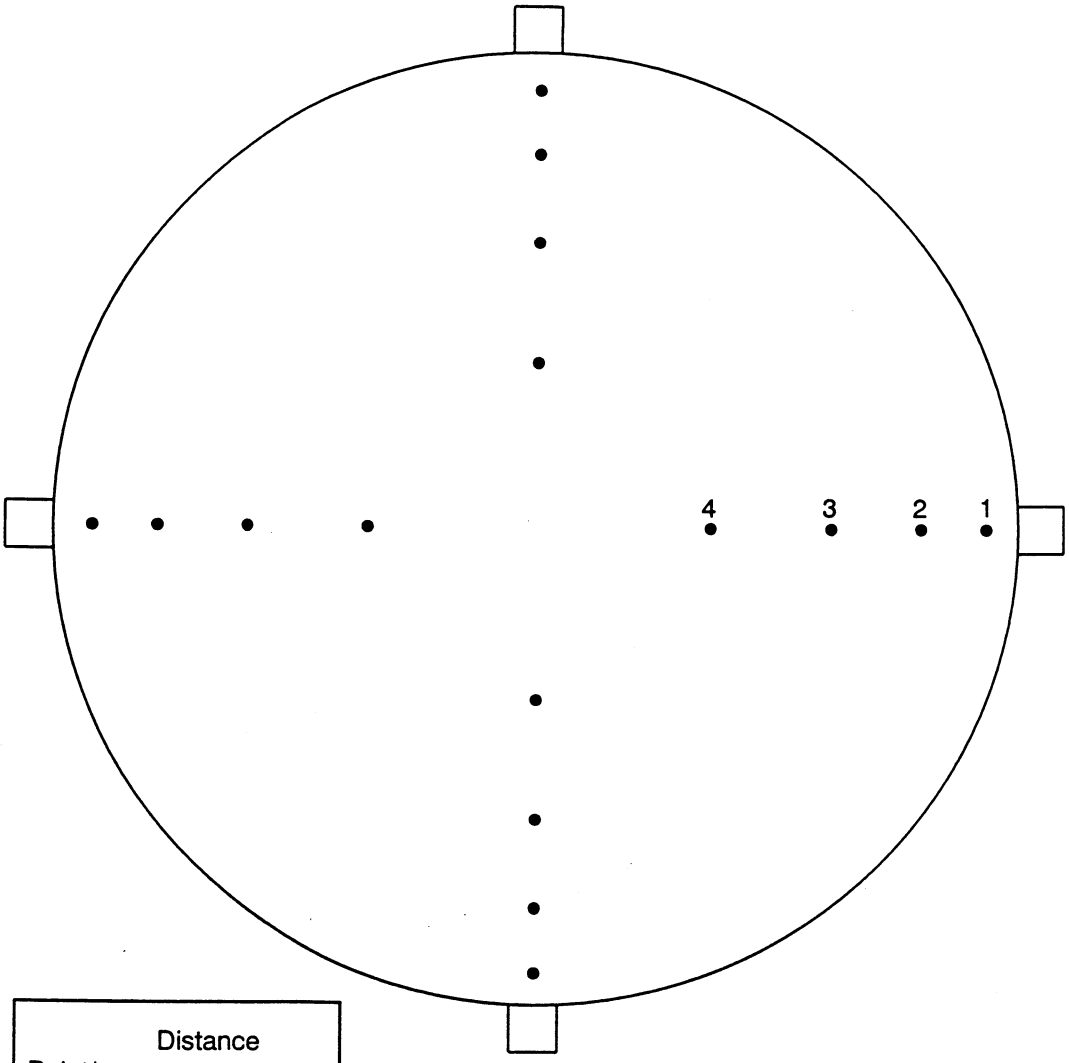


Figure 2-4
Description of sampling locations at Big Brown Unit Number 1 Stack



Not to Scale

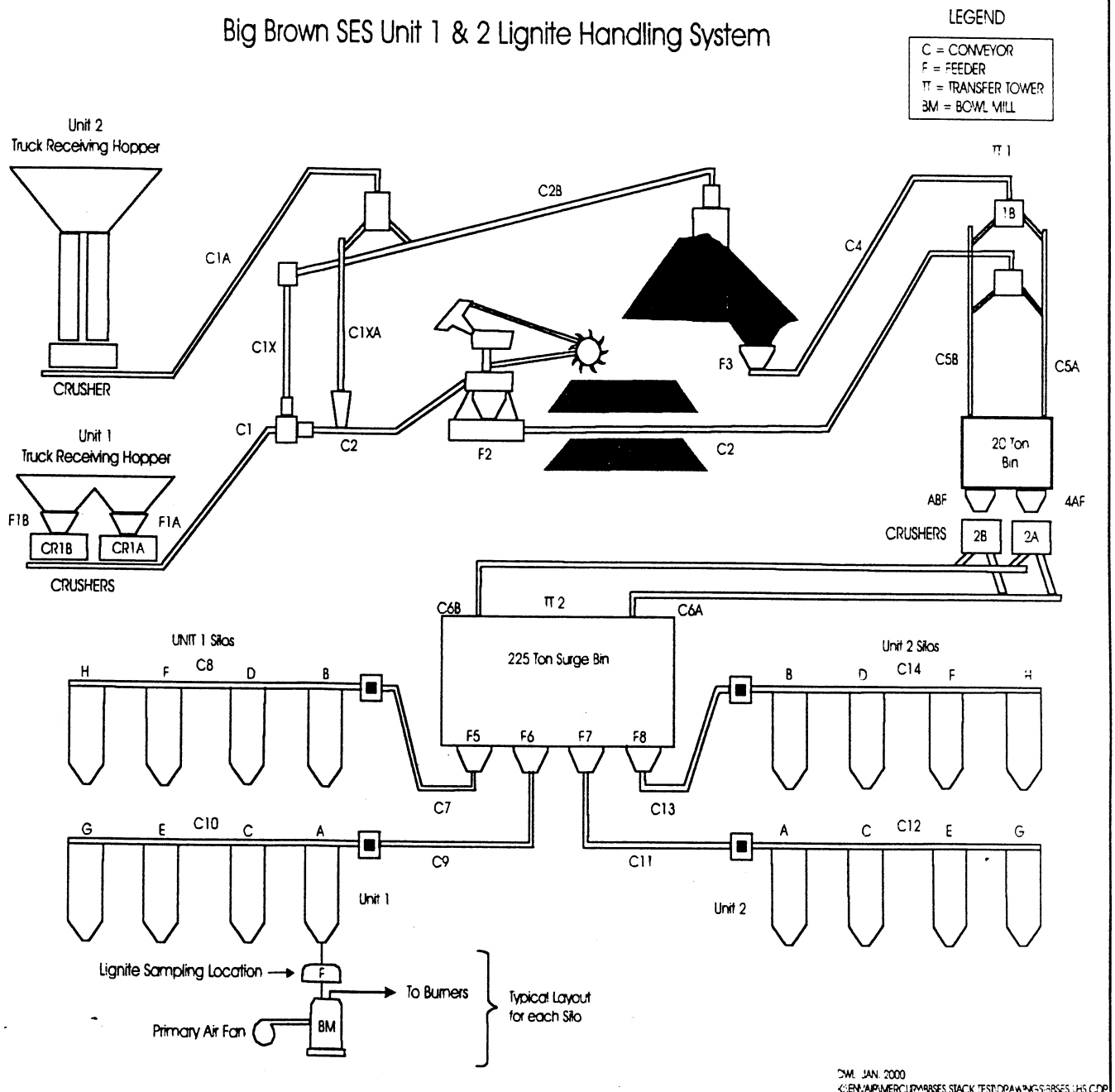
Figure 2-5
Description of sampling points at Big Brown Unit Number 1 Stack



Point*	Distance from Wall
1	9 1/2 "
2	31 1/4 "
3	57 11/16 "
4	96 1/16 "

*Calculated as one-half of an eight point traverse.

Figure 2-6
Description of lignite sampling locations at Big Brown Unit Number 1



DWL JAN. 2000

3 SUMMARY AND DISCUSSION OF RESULTS

3.1 Objectives and Test Matrix

3.1.1 Objective

The objective of the tests was to collect the information and measurements required by the EPA Mercury ICR. Specific objectives listed in order of priority are:

1. Quantify speciated mercury emissions at the stack.
2. Quantify speciated mercury concentrations in the flue gas at the inlet.
3. Quantify fuel mercury and chlorine content during the stack and inlet tests.
4. Provide the above information for use in developing boiler, fuel, and specific control device mercury emission factors.

3.1.2 Test Matrix

The test matrix is presented in Table 1. The table includes a list of test methods to be used. In addition to speciated mercury, the flue gas measurements include moisture, flue gas flow rates, carbon dioxide, and oxygen.

Table 3-1
Test Matrix for Mercury ICR Tests at Big Brown Unit Number 1

Sampling Location	No. of Runs	Species Measured	Sampling Method	Sample Run Time	Analytical Method	Analytical Laboratory
Stack	3	Speciated Hg	Ontario Hydro	160 min	Ontario Hydro	TestAmerica
Stack	3	Moisture	EPA 4	Concurrent	Gravimetric	METCO
Stack	3	Flue Gas Flow	EPA 1 & 2	Concurrent	Pitot Traverse	METCO
Stack	3	O_2 & CO_2	EPA 3B	Concurrent	Orsat	METCO
Inlet	3	Speciated Hg	Ontario Hydro	150 min	Ontario Hydro	TestAmerica
Inlet	3	Moisture	EPA 4	Concurrent	Gravimetric	METCO
Inlet	3	Flue Gas Flow	EPA 1 & 2	Concurrent	Pitot Traverse	METCO
Inlet	3	O_2 & CO_2	EPA 3B	Concurrent	Orsat	METCO
Coal Feeders	3	Hg, Cl, Sulfur, Ash, and Btu/lb in coal	ASTM D2234	1 grab sample every 30-minutes per mill per run	ASTM D6414-99 (Hg), ASTM E776/300.0 (Cl), ASTM D-4239 (S), ASTM D-3174 (Ash), and ASTM D-3286 (Btu/lb)	TestAmerica and Philip Services

3.2 Field Test Changes and Problems

No deviations were made from the approved sampling and analytical test plan.

3.3 Summary of Results

The results of the tests performed at Big Brown Unit Number 1 are listed in the following tables.

Table 3-2
Big Brown Unit Number 1 Source Emissions Results

Run Number	1	2	3
Test Date	11/09/99	11/09/99	11/10/99
Test Time	1030-1353	1450-1810	0805-1122
Inlet Gas Properties			
Flow Rate - ACFM	1,107,781	1,111,005	1,131,089
Flow Rate – DSCFM*	603,050	608,329	620,510
% Water Vapor - % Vol.	14.67	13.53	13.79
CO_2 - %	14.6	14.6	14.2
O_2 - %	5.6	5.2	5.2
% Excess Air @ Sampling Point	36	32	32
Temperature - °F	362	367	365
Pressure – "Hg	29.61	29.57	29.64
Percent Isokinetic	98.3	100.6	98.5
Volume Dry Gas Sampled – DSCF*	48.701	50.315	50.245
Stack Gas Properties			
Flow Rate – ACFM	2,402,583	2,425,129	2,390,269
Flow Rate – DSCFM*	1,384,316	1,380,399	1,372,896
% Water Vapor - % Vol.	12.40	12.78	13.47
CO_2 - %	13.6	13.2	13.4
O_2 - %	6.0	6.8	6.4
% Excess Air @ Sampling Point	39	47	43
Temperature - °F	333	339	328
Pressure – "Hg	29.45	29.44	29.53
Percent Isokinetic	97.5	98.9	101.4
Volume Dry Gas Sampled – DSCF*	72.002	72.814	74.212

* 29.92 "Hg, 68 °F (760 mm Hg, 20 °C)

Table 3-3
Big Brown Unit Number 1 Mercury Removal Efficiency (Baghouse Only)

Run Number	1	2	3	Average
Test Date	11/09/99	11/09/99	11/10/99	
Test Time	1030-1353	1450-1810	0805-1122	
Total mercury				
Inlet – lbs/10^{12} Btu	30.34	27.48	26.05	27.96
Stack – lbs/10^{12} Btu	30.08	31.05	29.24	30.12
Removal efficiency - %	(Note)	(Note)	(Note)	(Note)
Particulate mercury				
Inlet – lbs/10^{12} Btu	1.87	0.39	0.10	0.79
Stack – lbs/10^{12} Btu	8.47E-3	4.43E-3	8.45E-3	7.12E-3
Removal efficiency - %	99.5	98.9	91.6	99.1
Oxidized mercury				
Inlet – lbs/10^{12} Btu	6.00	7.45	10.17	7.87
Stack – lbs/10^{12} Btu	11.93	12.71	13.31	12.65
Removal efficiency - %	(Note)	(Note)	(Note)	(Note)
Elemental mercury				
Inlet – lbs/10^{12} Btu	22.48	19.64	15.78	19.30
Stack – lbs/10^{12} Btu	18.14	18.33	15.92	17.46
Removal efficiency - %	19.3	6.7	(Note)	9.5

Note: A negative removal efficiency is not calculated when the inlet concentrations are not equal to or greater than the outlet concentrations. This unit is equipped with an ESP followed in series with a baghouse. Mercury testing was conduced only on the last control device (baghouse) and the data above does not reflect total removal efficiency of all control equipment.

Table 3-4
Big Brown Unit Number 1 Mercury Speciation Results

Run Number	1	2	3	Average
Test Date	11/09/99	11/09/99	11/10/99	
Test Time	1030-1353	1450-1810	0805-1122	
B Inlet Mercury Speciation				
Particulate mercury – µg	3.06	0.67	0.17	—
µg/dscm	2.22	0.47	0.12	0.94
lbs/10^{12} Btu	1.87	0.39	0.10	0.79
% of total Hg	6.2	1.4	0.4	2.7
Oxidized mercury – µg	9.84	12.96	17.66	—
µg/dscm	7.14	9.10	12.41	9.55
lbs/10^{12} Btu	6.00	7.45	10.17	7.87
% of total Hg	19.8	27.1	39.0	28.6
Elemental mercury - µg	36.86	34.15	27.39	—
µg/dscm	26.73	23.97	19.25	23.32
lbs/10^{12} Btu	22.48	19.64	15.78	19.30
% of total Hg	74.1	71.5	60.6	68.7
Total mercury – µg	49.76	47.78	45.22	—
µg/dscm	36.08	33.54	31.78	33.80
lbs/10^{12} Btu	30.34	27.48	26.05	27.96
Stack Mercury Speciation				
Particulate mercury – µg	0.02	0.01	0.02	—
µg/dscm	9.81E-3	4.85E-3	9.52E-3	8.06E-3
lbs/10^{12} Btu	8.47E-3	4.43E-3	8.45E-3	7.12E-3
% of total Hg	<0.1	<0.1	<0.1	<0.1
Oxidized mercury – µg	28.17	28.72	31.52	—
µg/dscm	13.82	13.93	15.00	14.25
lbs/10^{12} Btu	11.93	12.71	13.31	12.65
% of total Hg	39.7	40.9	45.5	42.0
Elemental mercury - µg	42.82	41.42	37.70	—
µg/dscm	21.00	20.09	17.94	19.68
lbs/10^{12} Btu	18.14	18.33	15.92	17.46
% of total Hg	60.3	59.0	54.4	57.9
Total mercury – µg	71.01	70.15	69.24	—
µg/dscm	34.83	34.02	32.95	33.93
lbs/10^{12} Btu	30.08	31.05	29.24	30.12
Coal Analysis				
Mercury – ppm dry	0.287	0.290	0.287	0.288
Mercury – lbs/10^{12} Btu	43.7	44.9	43.6	44.1
Chlorine – ppm dry	100	100	200	133
Moisture - %	25.0	25.5	26.1	25.5
Sulfur - % dry	1.01	1.03	1.00	1.01
Ash - % dry	23.7	23.0	21.0	22.6
HHV - Btu/lb as fired	6,520	6,500	6,690	6,570
Coal flow – lbs/hr as fired	913,200	924,800	890,600	909,533
Total Heat Input – 10^6 Btu/hr	5,954.1	6,011.2	5,958.1	5,974.5
Total Mercury Mass Rates				
lbs/hr input in coal	0.26	0.27	0.26	0.26
lbs/hr at Baghouse Inlet	0.18	0.17	0.16	0.17
lbs/hr emitted	0.18	0.19	0.17	0.18

Table 3-5
Big Brown Unit Number 1 Process Data

Run Number	**1**	**2**	**3**
Test Date	11/09/99	11/09/99	11/10/99
Test Time	1030-1353	1450-1810	0805-1122
Unit Operation			
Unit Load – MW gross	576	576	576
Coal Mills in Service	All	All	All
Coal Flow - tons/hr	456.6	462.4	445.3
Steam Flow – klbs/hr	4,045.5	4,030.8	4,032.3
CEMS Data			
NO_x – ppm (dry)	245.25	245.6	246.35
SO_2 – ppm (dry)	1,045.5	1,055.5	957.5
CO_2 - % (dry)	13.3	13.2	13.4
O_2 - % (dry)	5.85	5.80	5.85
Opacity - %	6.6	6.1	6.6
Stack Gas flow – wscfh	98,5000,000	98,100,000	98,850,000
Stack Gas Moisture - %	13.55	13.95	12.80
Fabric Filter Data			
Baghouse B Δ Pressure - $"H_2O$	7.2	7.4	7.4
Baghouse B Inlet Temperature - °F	347	352	343
Baghouse B Outlet Temperature - °F	335	341	331

4 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Emission Test Methods

The sampling followed the procedures set forth in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Appendix A, Methods 1, 2, 3B, 4, 5, 17, and 19; in the Ontario Hydro Method, Revised July 7, 1999; and ASTM Methods D2234, D6414-99, E776/300.0, D-4239, D-3174, and D-3286.

A preliminary velocity traverse was made at six ports at the inlet sampling location, in order to determine the uniformity and magnitude of the flow prior to testing. All traverse points were checked for cyclonic flow and the average angle was equal to 10.9 degrees. Alternate procedures would be required if the angle of cyclonic flow were greater than 20 degrees. Five traverse points were sampled from each of the six ports, for a total of thirty traverse points.

A preliminary velocity traverse was made at each of the four ports at the stack sampling locations, in order to determine the uniformity and magnitude of the flow prior to testing. All traverse points were checked for cyclonic flow and the average angle was equal to 1.0 degrees. Alternate procedures would be required if the angle of cyclonic flow were greater than 20 degrees. Four traverse points were sampled from each of the four ports for a total of sixteen traverse points.

The sampling trains were leak-checked at the end of the nozzle at 15 inches of mercury vacuum before each test, and again after each test at the highest vacuum reading recorded during each test. This was done to predetermine the possibility of a diluted sample.

The pitot tube lines were checked for leaks before and after each test under both a vacuum and a pressure. The lines were also checked for clearance and the manometer was zeroed before each test.

Integrated orsat samples were collected and analyzed according to EPA Method 3B during each test.

4.1.1 Mercury

Triplicate samples for mercury were collected. The samples were taken according to EPA Methods 1, 2, 3B, 4, 5, and 17; and the Ontario Hydro Method, Revised July 7, 1999. For each run at the inlet sampling location, samples of five-minute duration were taken isokinetically at each of the thirty traverse points for a total sampling time of 150 minutes. For each run at the stack sampling location, samples of ten-minute duration were taken isokinetically at each of the sixteen traverse points for a total sampling time of 160 minutes. Data was recorded at five-minute intervals. Reagent blanks and field blanks were submitted.

The "front-half" of the sampling train at the inlet sampling location contained the following components:

Teflon Coated Nozzle
In-stack Quartz Fiber Thimble and Backup Filter and Teflon Coated Support
Heated Glass Probe @ > 248°F

The "front-half" of the sampling train at the outlet sampling location contained the following components:

Teflon Coated Nozzle
In-stack Quartz Fiber Filter and Teflon Coated Support
Heated Glass Probe @ > 248°F

The "back-half" of the sampling train at both sampling locations contained the following components:

Impinger Number	Impinger Type	Impinger Contents	Amount	Parameter Collected
1	Modified Design	1 mol/L KCL	100 ml	Oxidized Mercury and Moisture
2	Modified Design	1 mol/L KCL	100 ml	Oxidized Mercury and Moisture
3	Greenburg-Smith Design	1 mol/L KCL	100 ml	Oxidized Mercury and Moisture
4	Modified Design	5% HNO_3 and 10% H_2O_2	100 ml	Elemental Mercury and Moisture
5	Modified Design	4% $KMnO_4$ and 10% H_2SO_4	100 ml	Elemental Mercury and Moisture
6	Modified Design	4% $KMnO_4$ and 10% H_2SO_4	100 ml	Elemental Mercury and Moisture
7	Greenburg-Smith Design	4% $KMnO_4$ and 10% H_2SO_4	100 ml	Elemental Mercury and Moisture
8	Modified Design	Silica	200 g	Moisture

All glassware was cleaned prior to use according to the guidelines outlined in EPA Method 29, Section 5.1.1 and the Ontario Hydro Method, Revised July 7, 1999, Section 13.2.15. All glassware connections were sealed with Teflon tape.

At the conclusion of each test, the filter and impinger contents were recovered according to procedures outlined in the Ontario Hydro Method, Revised July 7, 1999, Section 13.2.

Mercury samples were analyzed by Cold Vapor Atomic Absorption and Fluorescence Spectroscopy.

4.2 Process Test Methods

ASTM D2234 method of coal sampling was followed. For each test run, a grab sample of coal was collected from each gravimetric feeder to each of the individual mills at thirty-minute intervals. One composite sample was prepared for analysis from the individual feeder samples. Each sample was analyzed for mercury, chlorine, sulfur, ash, and Btu content by ASTM Methods D6414-99, E766/300.0, D-4239, D-3174, and D-3286, respectively.

4.3 Sample Tracking and Custody

Samples and reagents were maintained in limited access, locked storage at all times prior to the test dates. While on site, they were at an attended location or in an area with limited access. Off site, METCO and TestAmerica provided limited access, locked storage areas for maintaining custody.

Chain of custody forms are located in Appendix F. The chain of custody forms provide a detailed record of custody during sampling, with the initials noted of the individuals who loaded and recovered impinger contents and filters, and performed probe rinses.

All samples were packed and shipped in accordance with regulations for hazardous substances.

5 QA/QC ACTIVITIES

The major project quality control checks are listed in Table 5-1. Matrix Spike Summaries are listed in Table 5-2. Duplicate and Triplicate Analyses Summaries are listed in Table 5-3. Additional method-specific QC checks are presented in Table 5-4 (Methods 1 and 2), Table 5-5 (Method 5/17 sampling), and Table 5-6 (Ontario Hydro sample recovery and analysis). These tables also include calibration frequency and specifications.

Table 5-1
Major Project Quality Control Checks

QC Check	*Information Provided*	*Results*
Blanks		
Reagent blank	Bias from contaminated reagent	No Mercury was detected
Field blank	Bias from handling and glassware	No Mercury was detected
Spikes		
Matrix spike	Analytical bias	Sample results were between 75% - 125% recovery
Replicates		
Duplicate analyses	Analytical precision	Results were < 10% RPD
Triplicate analyses	Analytical precision	Results were < 10% RPD

Table 5-2
Unit Number 1 Matrix Spike Summary

Sampling Location	*Run Number*	*Container*	*Results (µg)*	*True Value (µg)*	*Recovery (%)*
Inlet Duct	1	1B	0.0485	0.050	97
Inlet Duct	1	4	4.80	4.10	117
Inlet Duct	2	2	1.05	1.00	105
Inlet Duct	2	5	27.64	28.5	97
Inlet Duct	3	4	2.56	2.50	102
Stack	2	3	38.27	38.50	99
Reagent Blank	-----	12B	0.160	0.150	107

Table 5-3
Unit Number 2 Duplicate and Triplicate Analyses Summary

Sampling Location	Run Number	Container	Results (µg)	Duplicate Results (µg)	RPD	Triplicate Results (µg)	RPD
Inlet Duct	1	1A	3.05	2.96	3.0	-----	-----
		1B	0.013	0.013	0	——	——
		2	<0.300	<0.300	0	——	——
		3	9.84	9.92	0.8	10.00	1.7
		4	<0.820	<0.820	0	——	——
		5	36.86	34.44	6.8	——	——
	2	1A	0.667	0.690	3.4	0.691	3.5
		1B	<0.010	<0.010	0	——	——
		2	<0.200	<0.200	0	——	——
		3	12.96	12.96	0	——	——
		4	1.09	1.07	1.9	——	——
		5	33.06	33.63	1.7	——	——
	3	1A	0.152	0.150	1.3	——	——
		1B	0.020	0.020	0	0.020	0
		2	<0.220	<0.220	0	——	——
		3	17.66	17.60	0.3	——	——
		4	1.19	1.20	0.8	——	——
		5	26.20	25.60	2.3	——	——
Stack	1	1A	0.018	0.017	2.0	——	——
		2	<0.310	<0.310	0	——	——
		3	28.17	27.31	3.1	——	——
		4	1.26	1.25	0.8	1.25	0.8
		5	41.56	39.79	4.3	——	——
	2	1A	0.013	0.013	0	——	——
		2	<0.094	<0.094	0	<0.094	0
		3	28.72	27.99	2.6	——	——
		4	1.60	1.61	0.6	——	——
		5	39.82	40.04	0.6	39.60	0.6
	3	1A	0.020	0.021	2.9	——	——
		2	<0.094	<0.094	0	——	——
		3	31.52	30.74	2.5	——	——
		4	1.26	1.30	3.6	1.32	4.7
		5	36.44	35.52	2.6	——	——

Table 5-4
QC Checklist and Limits for Methods 1 and 2

Quality Control Activity	Acceptance Criteria and Frequency	Reference
Measurement site evaluation	>2 diameters downstream and 0.5 diameters upstream of disturbances	Method 1, Section 2.1
Pitot tube inspection	Inspect each use for damage, once per program for design tolerances	Method 2, Figures 2-2 and 2-3
Thermocouple	+/- 1.5% (°R) of ASTM thermometer, before and after each test mobilization	Method 2, Section 4.3
Barometer	Calibrate each program vs. mercury barometer or vs. weather station with altitude correction	Method 2, Section 4.4

Table 5-5
QC Checklist and Limits for Method 5/17 Sampling

Quality Control Activity	Acceptance Criteria and Frequency	Reference
Pre-mobilization checks		
Gas meter/orifice check	Before test series, Y_D +/- 5% (of original Y_D)	Method 5, Section 5.3
Probe heating system	Continuity and resistance check on element	
Nozzles	Note number, size, material	
Glassware	Inspect for cleanliness, compatibility	
Thermocouples	Same as Method 2	
On-site pre-test checks		
Nozzle	Measure inner diameter before first run	Method 5, Section 5.1
Probe heater	Confirm ability to reach temperature	
Pitot tube leak check	No leakage	Method 2, Section 3.1
Visible inspection of train	Confirm cleanliness, proper assembly	
Sample train leak check	≤0.02 cf at 15" Hg vacuum	Method 5, Section 4.1.4
During testing		
Probe and filter temperature	Monitor and confirm proper operation	
Manometer	Check level and zero periodically	
Nozzle	Inspect for damage or contamination after each traverse	Method 5, Section 5.1
Probe/nozzle orientation	Confirm at each point	
Post test checks		
Sample train leak check	≤0.02 cf at highest vacuum achieved during test	Method 5, Section 4.1.4
Pitot tube leak check	No leakage	Method 2, Section 3.1
Isokinetic ratio	Calculate, must be 90-110%	Method 5, Section 6
Dry gas meter calibration check	After test series, Y_D +/- 5%	Method 5, Section 5.3
Thermocouples	Same as Method 2	
Barometer	Compare w/ standard, +/- 0.1" Hg	

Table 5-6 QC Checklist and Limits for Ontario Hydro Mercury Speciation

Quality Control Activity	Acceptance Criteria and Frequency	Reference
Pre-mobilization activities		
Reagent grade	ACS reagent grade	Ontario Hydro Section 8.1
Water purity	ASTM Type II, Specification D 1193	Ontario Hydro Section 8.2
Sample filters	Quartz; analyze blank for Hg before test	Ontario Hydro Section 8.4.3
Glassware cleaning	As described in Method	Ontario Hydro Section 8.10
On-site pre-test activities		
Determine SO_2 concentration	If >2500 ppm, add more HNO_3-H_2O_2 solution	Ontario Hydro Section 13.1.13
Prepare KCl solution	Prepare batch as needed	Ontario Hydro Section 8.5
Prepare HNO_3-H_2O_2 solution	Prepare batch as needed	Ontario Hydro Section 8.5
Prepare H_2SO_4-$KMnO_4$ solution	Prepare daily	Ontario Hydro Section 8.5
Prepare HNO_3 rinse solution	Prepare batch as needed; can be purchased premixed	Ontario Hydro Section 8.6
Prepare hydroxylamine solution	Prepare batch as needed	Ontario Hydro Section 8.6
Sample recovery activities		
Brushes and recovery materials	No metallic material allowed	Ontario Hydro Section 13.2.6
Check for $KMnO_4$ Depletion	If purple color lost in first two impingers, repeat test with more HNO_3-H_2O_2 solution	Ontario Hydro Section 13.1.13
Probe cleaning	Move probe to clean area before cleaning	Ontario Hydro Section 13.2.1
Impinger 1,2,3 recovery.	After rinsing, add permanganate until purple color remains to assure Hg retention	Ontario Hydro Section 13.2.8
Impinger 5,6,7 recovery.	If deposits remain after HNO_3 rinse, rinse with hydroxylamine sulfate. If purple color disappears after hydroxylamine sulfate rinse, add more permangante until color returns	Ontario Hydro Section 13.2.10
Impinger 8	Note color of silica gel; if spent, regenerate or dispose.	Ontario Hydro Section 13.2.11
Blank samples		
0.1 N HNO_3 rinse solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
KCl solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
HNO_3-H_2O_2 solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
H_2SO_4-$KMnO_4$ solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
Hydroxylamine sulfate solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
Unused filters	Three from same lot.	Ontario Hydro Section 13.2.12
Field blanks	One per set of tests at each test location.	Ontario Hydro Section 13.4.1
Laboratory activities		
Assess reagent blank levels	Target <10% of sample value or <10x instrument detection limit. Subtract as allowed.	Ontario Hydro Section 13.4.1
Assess field blank levels	Compare to sample results. If greater than reagent blanks or greater than 30% of sample values, investigate. Subtraction of field blanks not allowed.	Ontario Hydro Section 13.4.1
Duplicate/triplicate samples	All CVAAS runs in duplicate; every tenth run in triplicate. All samples must be within 10% of each other; if not, recalibrate and reanalyze.	Ontario Hydro Section 13.4.1

6 DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 3:00 p.m. on Monday, November 8, 1999. After meeting with plant personnel and attending a brief safety meeting, the equipment was moved onto the Unit Number 1 Baghouse B Inlet Duct and Stack. The equipment was secured for the night. All work was completed at 7:00 p.m.

On Tuesday, November 9, work began at 7:00 a.m. The equipment was prepared for testing. The preliminary data was collected. The first set of tests for mercury began at 10:30 a.m. Testing continued until the completion of the second set of tests at 6:10 p.m. The samples were recovered. The equipment was secured for the night. All work was completed at 7:45 p.m.

On Wednesday, November 10, work began at 7:00 a.m. The equipment was prepared for testing. The third set of tests for mercury began at 8:05 a.m. and was completed at 11:22 a.m.

The samples were recovered. The equipment was moved off of the sampling locations and loaded into the sampling van. The samples and the data were transported to METCO Environmental's laboratory in Dallas, Texas, for analysis and evaluation.

Operations at TXU Electric, Big Brown Steam Electric Station, Unit Number 1 Baghouse B Inlet Duct and Stack, located near Fairfield, Texas, were completed at 1:30 p.m. on Wednesday, November 10, 1999.

Billy J. Mullins, Jr. P.E.
President

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7 APPENDICES

A. Source Emissions Calculations
B. Field Data
C. Calibration Data
D. Analytical Data
E. Unit Operational Data
F. Chain of Custody Records
G. Resumes