TXU

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

May 26, 2000

Mr. William Grimley
Emissions Measurement Center
Interstate 40 and Page Road
4930 Old Page Road
Room Number E-108
Durham, NC 27709
Attn: Electric Utility Steam Generating Unit Mercury Test Program

RE: Electric Utility Steam Generating Unit Information Collection Request

Dear Mr. Grimley,

Enclosed are three copies each of the speciated mercury emission test reports for TXU Electric's Monticello Units 1 and 3 as required in the Electric Utility Steam Generating Unit Information Collection Request. Please note that TXU Electric is a new company name and that previous EPA Mercury Information Collection Request information was submitted under the name of TU Electric.

If you require further information, please contact Mr. David Lamb at (214) 812-8482

Sincerely,

David Lamb

for J. R. Robertson

dwl

C: w/o enclosures

Steve Payton	EP18
John Carlson	EP16
Ken Smith	MOSES

C: with enclosures

Rob Holliday	MOSES
Paul Chu	EPRI

EP09 Route Copy

JRR
SHS
FCB
UAB
DWL

File: Air - MOSES - EPA - Mercury ICR

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

SOURCE EMISSIONS SURVEY
OF
TXU ELECTRIC
MONTICELLO STEAM ELECTRIC STATION
UNIT NUMBER 3
MT. PLEASANT, TEXAS

FEBRUARY 2000

FILE NUMBER 99-183

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1 INTRODUCTION

1.1 Summary of Test Program

METCO Environmental, Dallas, Texas, conducted a source emissions survey of TXU Electric, Monticello Steam Electric Station, Unit Number 3, located near Mt. Pleasant, Texas, on February 23 and 24, 2000. The purpose of these tests was to meet the requirements of the EPA Mercury Information Request. Speciated mercury concentrations at the Unit Number 3 Scrubber Inlet Duct, speciated mercury emissions at the Unit Number 3 Scrubber Outlet, speciated mercury emissions at the Unit Number 3 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. Steve Bornsen of METCO Environmental was the onsite project manager. Mr. Mike Bass, Mr. Shane Lee, Mr. Scott Hart, Mr. Jason Brown, Mr. Jason Conway, Mr. John Betz, and Mr. Kieran McGeagh, of METCO Environmental performed the testing.

Mr. David Lamb of TXU Electric acted as the utility representative. Mr. Rob Holiday of TXU Electric performed 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
TXU Electric	Rob Holiday	Process Monitoring & Sampling.	(903) 577-5204
QA/QC			
METCO	Jim Monfries	Quality Assurance Manager	(972) 931-7127

2 SOURCE AND SAMPLING LOCATION DESCRIPTIONS

2.1 Process Description

Unit Number 3 was constructed by Babcock and Wilcox and placed in commercial operation on August 8, 1978. The boiler is an opposed fired, Carolina type Universal Pressure (UP) boiler with a balanced draft furnace designed for a high slagging Texas lignite fuel. Unit Number 3 was designed to combust 640 tons of lignite per hour and is rated at 750 megawatts. The UP boiler is a once-through type steam generator. High pressure water enters the economizer and high pressure superheated steam leaves the superheater. There is no recirculation of water or steam within the unit. Main steam temperature is controlled by firing rate and reheat temperature is controlled by attemperation at high loads and excess air at low loads.

The maximum continuous rating for the boiler is 5,524,000 lbs/hr main steam flow at a pressure of 3,850 psig and 1,010 °F at the secondary superheater outlet. At this load the reheat steam flow is 4,793,000 lbs/hr at 652 psig and 1,005 °F. The turbine throttle pressure is 3,675 psig, which is 5% overpressure on the turbine, rated at 3,500 psig. The furnace enclosure is 90 feet wide, 57 feet deep and 200 feet high from the centerline of the lower header to the roof. The hopper slope is 50 degrees with a 4 foot wide throat. The 15 foot arch and convection pass floor have a constant 35 degree slope.

The coal is fed by gravimetric feeders to ten MPS type pulverizers and then is pneumatically conveyed with heated primary air to 70 dual register burners located in compartmented windboxes on the front and rear walls.

There are five MPS type pulverizers on each side of the unit. Each pulverizer supplies one horizontal row of seven dual register burners forming one compartment. Each compartment is equipped with dampers and air foils in the inlet ducts to control and measure the air flow to that compartment. The unit has standard Class I or FPS ignitors firing number 2 fuel oil.

2.2 Control Equipment Description

Combustion gasses flow from the furnace through the convection pass containing the primary and secondary superheaters, reheater, and economizer, then through an air heater, electrostatic precipitator (ESP), and flue gas desulfurization (FGD) systems prior to exiting the stack. The ESP system is a cold side ESP constructed by Research Cottrell with a rigid frame design and an in-line arrangement. The ESP has 10 fields and 52 transformer rectifier sets and a specific collection area of 900. Ammonia flue gas condition is provided at the ESP inlet as needed. The ESP system is operated automatically so that all transformer rectifier sets receive maximum power while avoiding sparking and grounds in order to reduce the ash load to the FGD system. The FGD system bypass dampers are operated automatically to maintain maximum scrubbing of SO2 emissions in all three towers while maintaining proper mist eliminator differential pressure and/or minimum stack temperature.

2.3 Flue Gas and Process Sampling Locations

2.3.1 Inlet Sampling Location

The sampling location on the Unit Number 3 Scrubber Inlet Duct is approximately 75 feet above the ground. The sampling locations are located in a transition area of the duct.

2.3.2 Outlet Sampling Location

The sampling location on the Unit Number 3 Scrubber Outlet Duct is 100 feet above the ground. The sampling locations are located in a transition area of the duct.

2.3.3 Stack Sampling Location

The sampling location on the Unit Number 3 Stack is 365 feet 6 inches above the ground. The sampling locations are located 242 feet 5 inches (8.91 stack diameters) downstream from the inlet to the stack and 94 feet 7 inches (3.48 stack diameters) upstream from the outlet to the stack.

2.3.4 Lignite Sampling Location

The lignite sampling locations are located at the gravimetric feeders immediately downstream from the pulverizer silos.

Figure 2-1
Description of sampling locations at the Monticello Unit Number 3 Scrubber Inlet Duct

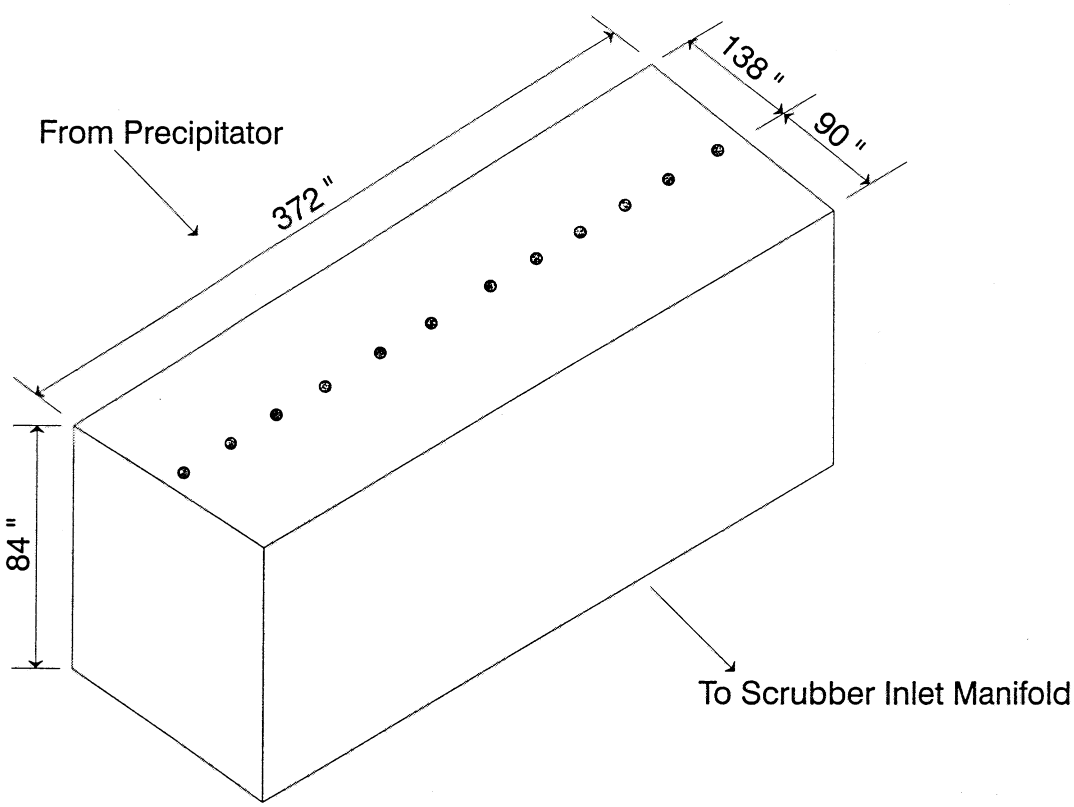


Figure 2-2
Description of sampling points at the Monticello Unit Number 3 Scrubber Inlet Duct

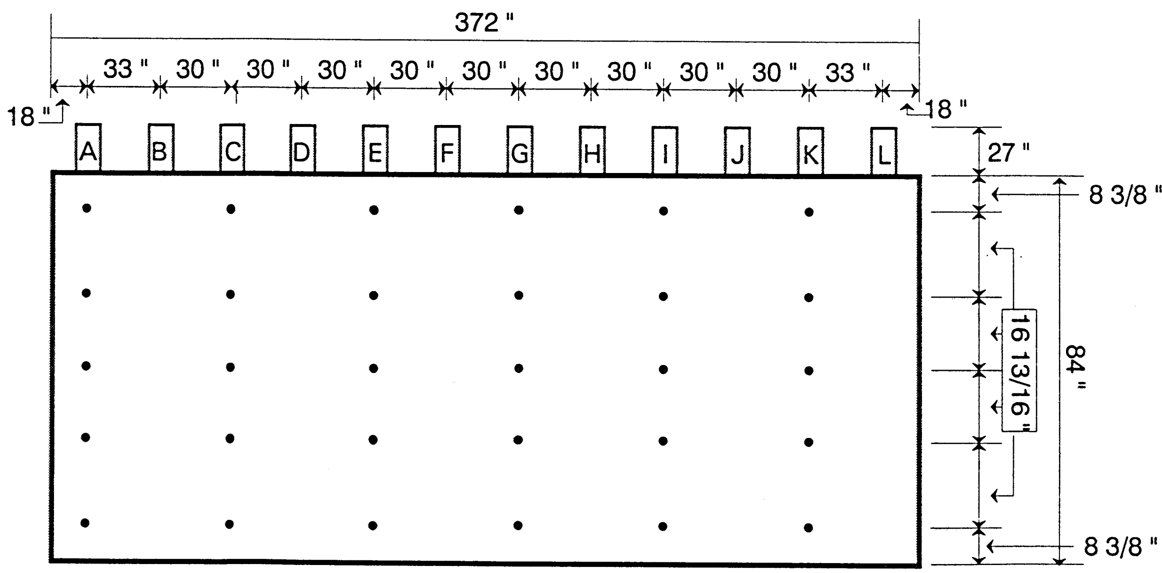


Figure 2-3
Description of sampling locations at the Monticello Unit Number 3 Scrubber Outlet Duct

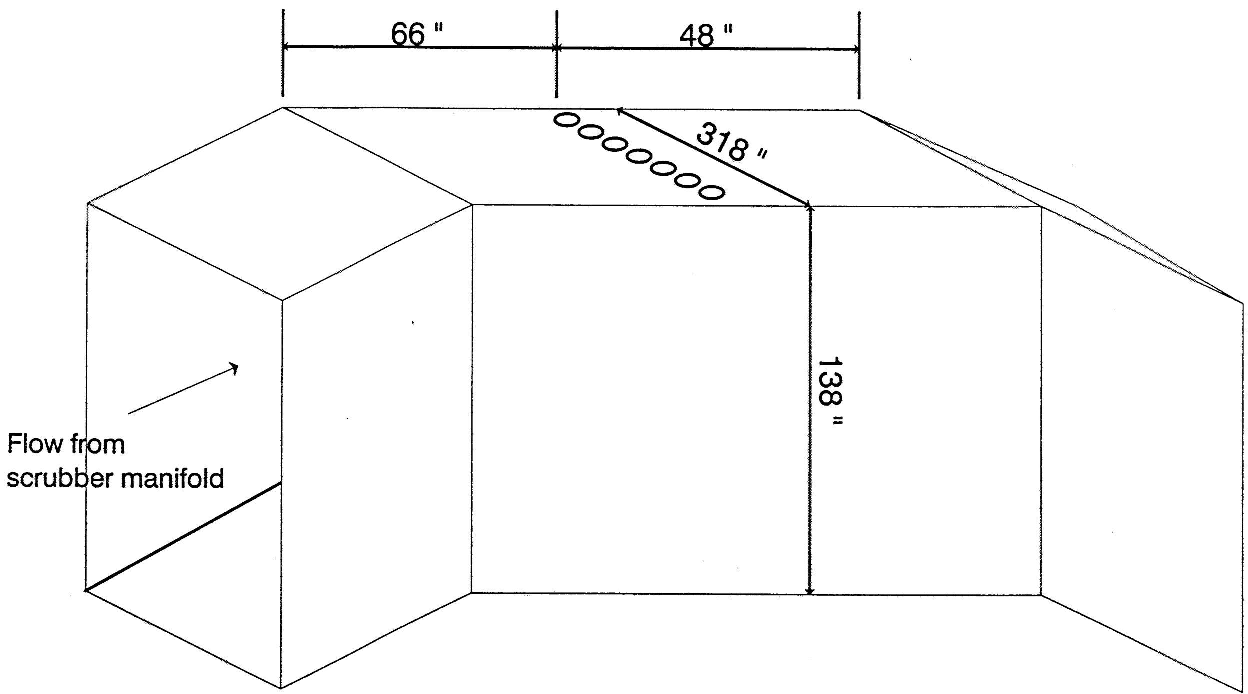


Figure 2-4
Description of sampling points at the Monticello Unit Number 3 Scrubber Outlet Duct

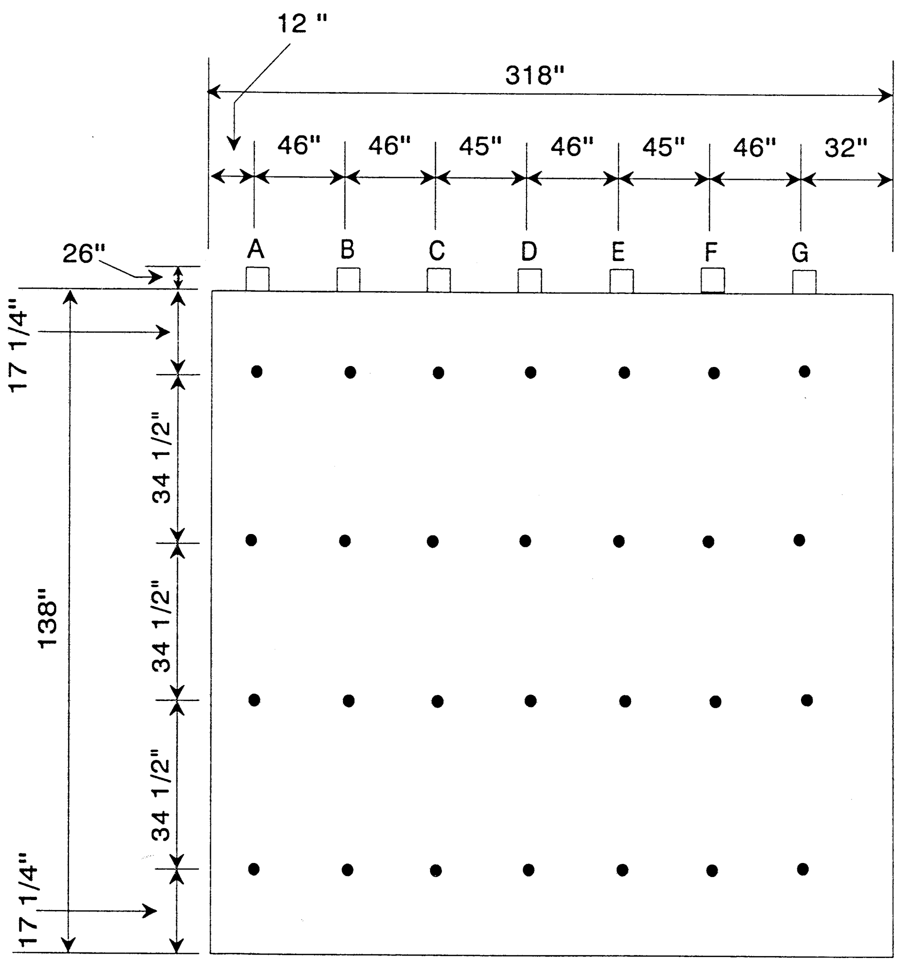


Figure 2-5
Description of sampling locations at the Monticello Unit Number 3 Stack

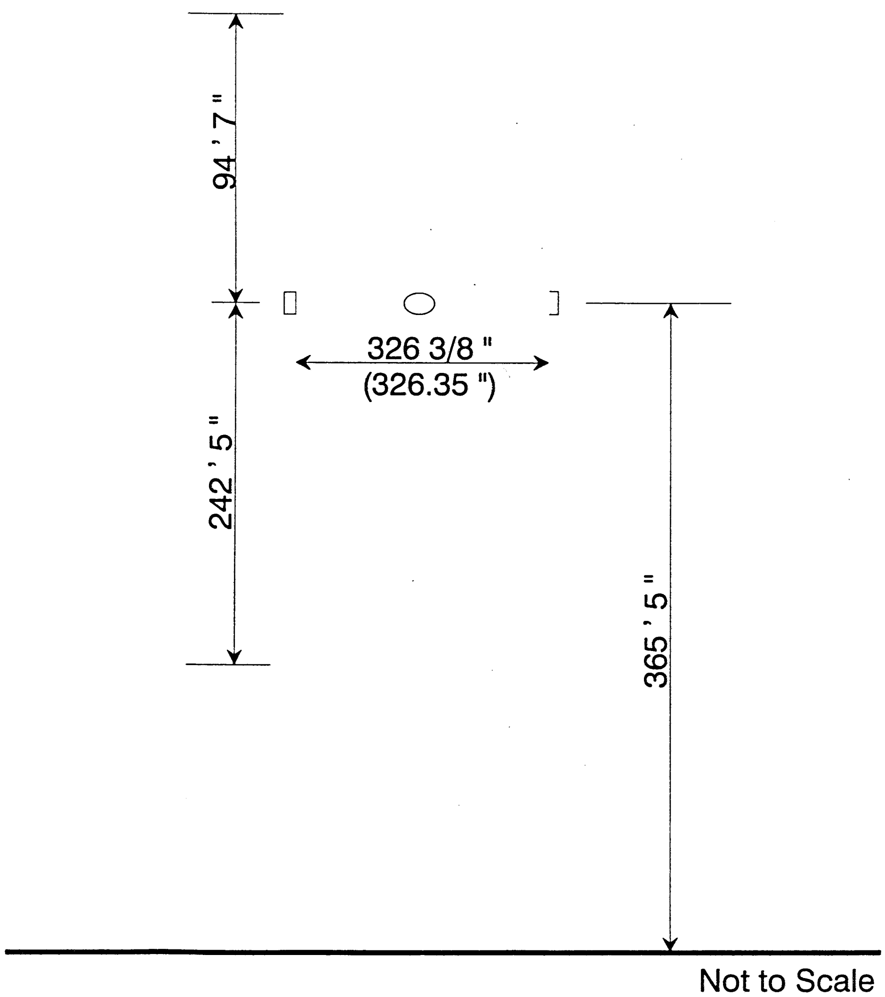
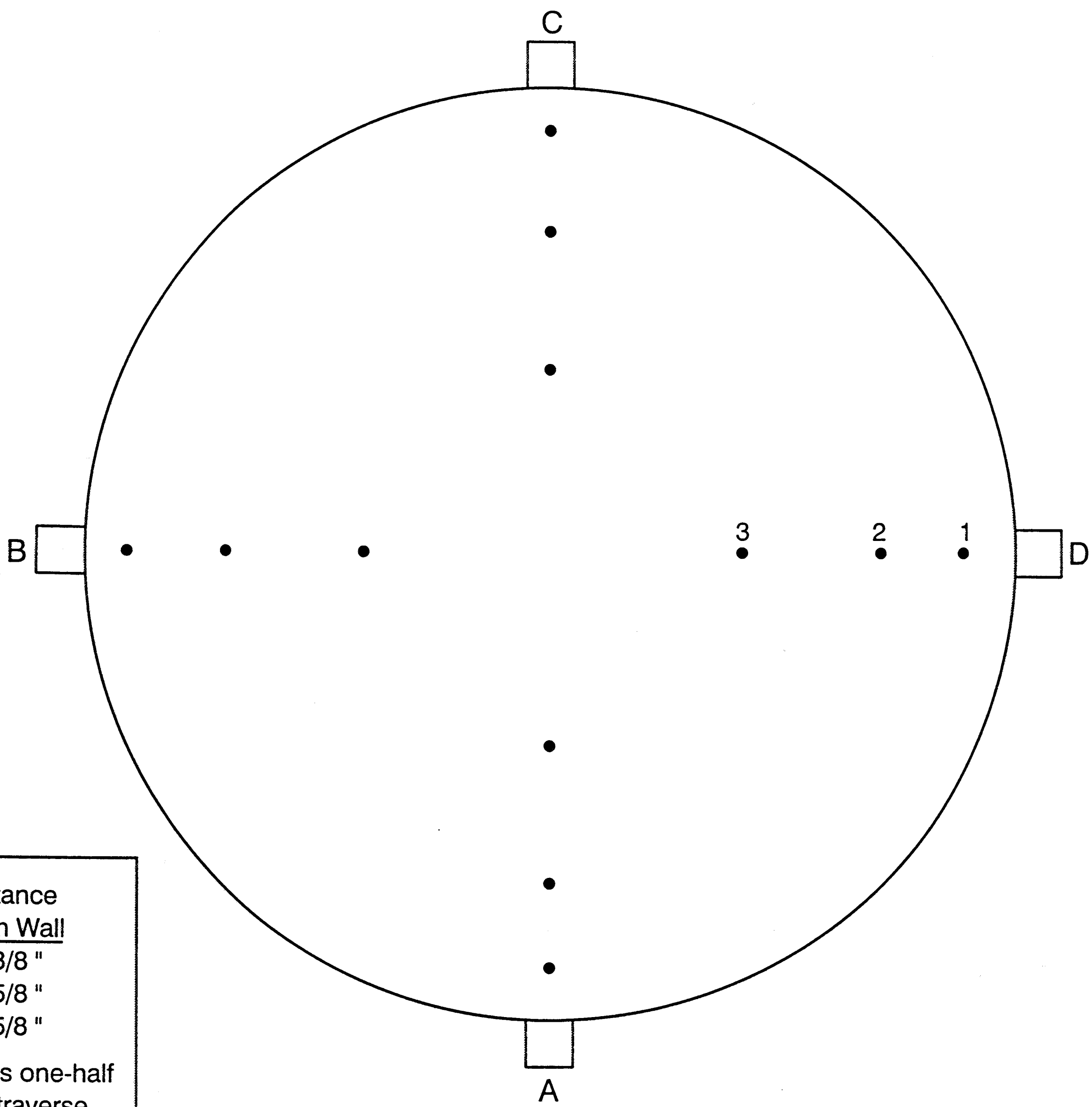


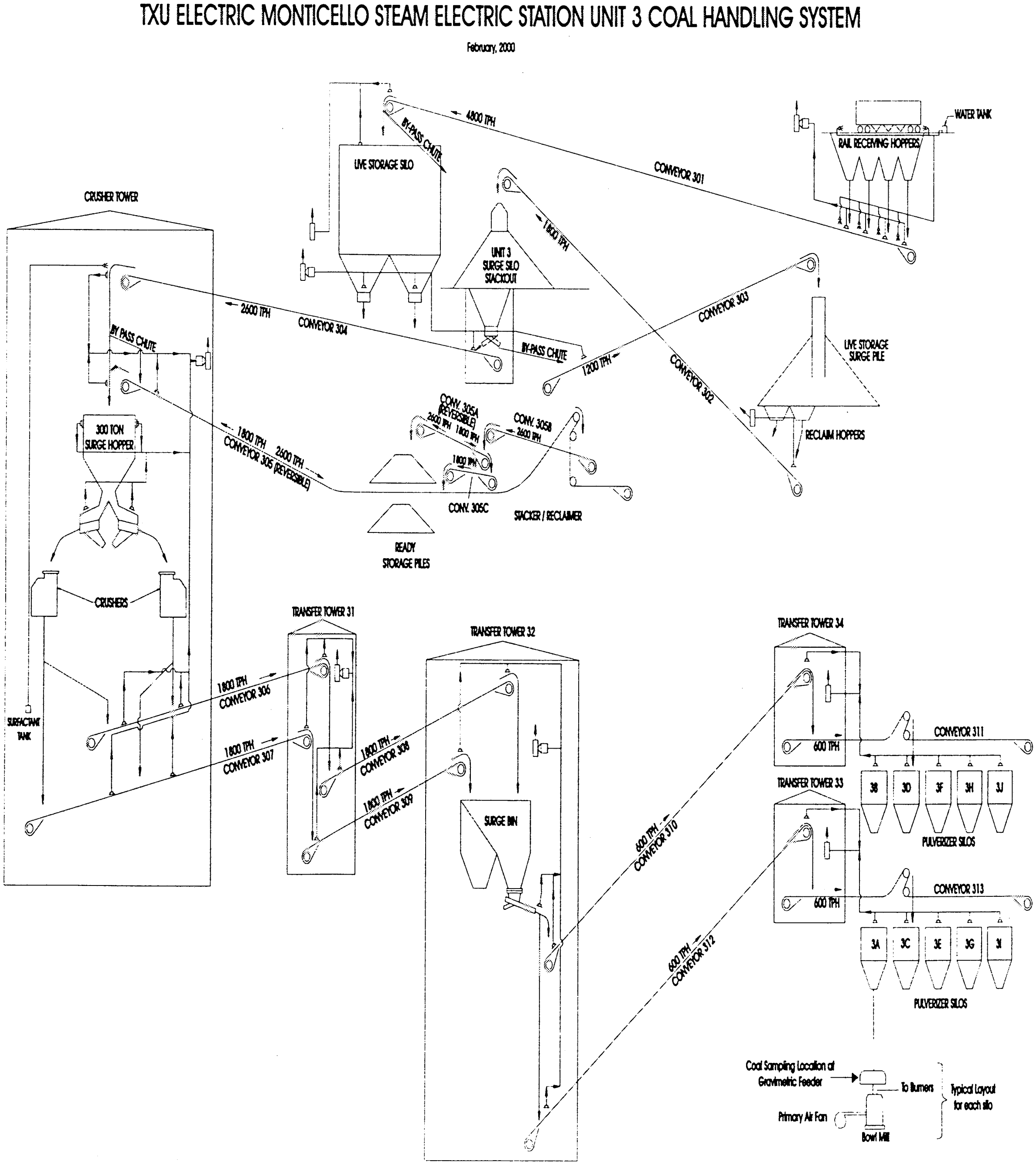
Figure 2-6
Description of sampling points at the Monticello Unit Number 3 Stack



Point*	Distance from Wall
1	14 3/8 "
2	47 5/8 "
3	96 5/8 "

*Calculated as one-half of a six point traverse.

Figure 2-7
Description of lignite sampling locations at Monticello Unit Number 3



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 concentrations in the flue gas at the inlet.
2. Quantify speciated mercury concentrations in the flue gas at the outlet.
3. Quantify speciated mercury emissions at the stack.
4. Quantify fuel mercury and chlorine content during the inlet, outlet, and stack tests.
5. 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 Monticello Unit Number 3

Sampling Location	No. of Runs	Species Measured	Sampling Method	Sample Run Time	Analytical Method	Analytical Laboratory
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
Outlet	3	Speciated Hg	Ontario Hydro	140 min	Ontario Hydro	TestAmerica
Outlet	3	Moisture	EPA 4	Concurrent	Gravimetric	METCO
Outlet	3	Flue Gas Flow	EPA 1 & 2	Concurrent	Pitot Traverse	METCO
Outlet	3	O_2 & CO_2	EPA 3B	Concurrent	Orsat	METCO
Stack	3	Speciated Hg	Ontario Hydro	120 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
Gravimetric Feeders	3	Hg, Cl, Sulfur, Ash, and Btu/lb in coal	ASTM D2234	1 grab sample every 60-minutes per feeder 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 Handling of Non-Detects

This section addresses how data will be handled in cases where no mercury is detected in an analytical fraction. It should be noted that the analytical method specified in the Ontario Hydro Method has a very low detection limit, which is expected to be well below flue gas levels for most cases if the laboratory uses normal care and state of the art analytical equipment. However, there were cases where certain fractions of a test did not show detectable mercury levels. This section addresses how non-detects were handled in calculating and reporting mercury levels.

3.3.1 A single analytical fraction representing a subset of a mercury species is not detected.

When more than one sample component is analyzed to determine a mercury species (such as analyzing the probe rinse and filter catch separately to determine total particulate mercury) and one fraction is not detected, it will be counted as zero. Total mercury for that species will be the sum of the detected values of the remaining fraction(s). For example, if the probe rinse had ND < 0.05 μg and the filter had 1.5 μg, total particulate mercury would be reported as 1.5 micrograms.

3.3.2 All fractions representing a mercury species are not detected.

If all fractions used to determine a mercury species are not detected, the total mercury for that species will be reported as not detected, at the sum of the detection limits of the individual species.

For example, if the probe rinses were not detected at 0.003 µg and the filter catch were not detected at 0.004 µg, the reported particulate mercury would be reported as ND <0.007 µg. This is expected to represent a small fraction (<1%) of the total mercury, even under worse case scenario of 1 µg/Nm^3.

3.3.3 No mercury is detected for a species on all three test runs.

When all three test runs show no detectable levels of mercury for a mercury species, that mercury species will be reported as not detected at less than the average detection limit. For example, if three results for elemental mercury are ND < 0.10, ND <0.13, and ND < 0.10, the results would be reported as ND < 0.13 (the highest of the three detection levels).

In calculating total mercury, a value of zero will be used for that species. For example, if particulate mercury were ND < 0.11 µg, oxidized mercury were 2.0 µg, and elemental mercury were 3.0 µg, total mercury would be reported as 5.0 µg.

In calculating the percentage of mercury in the other two species, a value of zero will be used. For the example listed in the preceding paragraph, the results would be reported as 0% particulate mercury, 40% oxidized mercury, and 60% elemental mercury.

3.3.4 Mercury is detected on one or two of three runs.

If mercury is detected on one or two of three runs, average mercury will be calculated as the average of the detected value(s) and half of the detection limits for the non-detect(s).

Example 1: The results for three runs are 0.20, 0.20, and ND < 0.10. The reported value would be calculated as the average of 0.20, 0.20, and 0.05, which is 0.15 µg. Example 2: The results for three runs are 0.14, ND < 0.1, and ND < 0.1. The average of 0.14, 0.05, and 0.05 is calculated to be 0.08. Since this is below the detection limit of 0.1, the reported value is ND < 0.1.

3.4 Summary of Results

The results of the tests performed at Monticello Unit Number 3 are listed in the following tables.

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Table 3-2 Monticello Unit Number 3 Source Emissions Results

Run Number	1	2	3
Test Date	02/23/00	02/24/00	02/24/00
Test Time	1550-1851	0835-1105	1210-1440
Inlet Gas Properties			
Flow Rate – ACFM	905,311	909,246	907,773
Flow Rate – DSCFM*	503,621	502,289	503,960
% Water Vapor - % Vol.	10.17	11.90	11.49
CO_2 - %	10.0	10.0	9.4
O_2 - %	9.4	9.4	9.6
% Excess Air @ Sampling Point	79	79	81
Temperature - °F	354	347	347
Pressure – "Hg	28.46	28.57	28.58
Percent Isokinetic	90.5	99.5	99.4
Volume Dry Gas Sampled – DSCF*	51.835	56.837	56.990
Outlet Gas Properties			
Flow Rate – ACFM	888,844	840,509	840,620
Flow Rate – DSCFM*	632,970	607,864	604,707
% Water Vapor - % Vol.	19.22	18.80	19.14
CO_2 - %	10.8	10.8	10.8
O_2 - %	9.0	9.0	9.0
% Excess Air @ Sampling Point	74	74	74
Temperature - °F	138	135	136
Pressure – "Hg	29.76	29.92	29.94
Percent Isokinetic	92.2	100.4	101.9
Volume Dry Gas Sampled – DSCF*	55.391	57.913	58.479
Stack Gas Properties			
Flow Rate – ACFM	3,395,958	3,324,307	3,320,480
Flow Rate – DSCFM*	2,156,707	2,198,772	2,215,971
% Water Vapor - % Vol.	19.91	17.30	17.17
CO_2 - %	8.8	11.0	10.8
O_2 - %	10.4	8.0	8.2
% Excess Air @ Sampling Point	94	59	62
Temperature - °F	194	192	192
Pressure – "Hg	29.28	29.44	29.66
Percent Isokinetic	104.1	101.7	101.6
Volume Dry Gas Sampled – DSCF*	73.707	73.375	73.919

* 29.92 "Hg, 68 °F (760 mm Hg, 20 °C)

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Table 3-3
Monticello Unit Number 3 Scrubber Mercury Removal Efficiency

Run Number	1	2	3	Average
Test Date	02/23/00	02/24/00	02/24/00	
Test Time	1550-1851	0835-1105	1210-1440	
Total mercury				
Inlet - lb/10^{12} Btu	33.24	34.62	38.38	35.41
Outlet - lb/10^{12} Btu	44.81	23.27	19.92	29.33
Removal efficiency - %	-----	32.8	48.1	17.2
Particulate mercury				
Inlet - lb/10^{12} Btu	0.14	0.08	0.09	0.10
Outlet - lb/10^{12} Btu	7.10	2.53	0.73	3.45
Removal efficiency - %	-----	-----	-----	-----
Oxidized mercury				
Inlet - lb/10^{12} Btu	11.89	14.25	18.63	14.92
Outlet - lb/10^{12} Btu	17.23	2.64	2.29	7.39
Removal efficiency - %	-----	81.5	87.7	50.5
Elemental mercury				
Inlet - lb/10^{12} Btu	21.19	20.30	19.62	20.37
Outlet - lb/10^{12} Btu	20.47	18.13	16.91	18.50
Removal efficiency - %	3.4	10.7	13.8	9.2

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 in series with a FGD. Mercury testing was conduced only on the last control device (FGD) and the data above does not reflect total removal efficiency of all control equipment.

Table 3-4
Monticello Unit Number 3 Mercury Speciation Results

Run Number	1	2	3	Average
Test Date	02/23/00	02/24/00	02/24/00	
Test Time	1550-1851	0835-1105	1210-1440	
Inlet Mercury Speciation				
Particulate mercury – µg	0.182	0.111	0.130	-----
µg/dscm	0.12	0.07	0.08	0.09
lb/10^{12} Btu	0.14	0.08	0.09	0.10
% of total Hg	0.4	0.2	0.2	0.3
Oxidized mercury – µg	15.6	20.5	26.4	-----
µg/dscm	10.63	12.74	16.36	13.24
lb/10^{12} Btu	11.89	14.25	18.63	14.92
% of total Hg	35.8	41.2	48.5	41.8
Elemental mercury - µg	27.8	29.2	27.8	-----
µg/dscm	18.94	18.14	17.23	18.10
lb/10^{12} Btu	21.19	20.30	19.62	20.37
% of total Hg	63.7	58.6	51.1	57.8
Total mercury – µg	43.6	49.8	54.4	-----
µg/dscm	29.70	30.94	33.71	31.45
lb/10^{12} Btu	33.24	34.62	38.38	35.41
Outlet Mercury Speciation				
Particulate mercury – µg	10.3	3.84	1.12	------
µg/dscm	6.57	2.34	0.68	3.20
lb/10^{12} Btu	7.10	2.53	0.73	3.45
% of total Hg	15.8	10.9	3.7	10.1
Oxidized mercury – µg	25.0	4.0	3.5	-----
µg/dscm	15.94	2.44	2.11	6.83
lb/10^{12} Btu	17.23	2.64	2.29	7.39
% of total Hg	38.5	11.3	11.5	20.4
Elemental mercury – µg	29.7	27.5	25.9	-----
µg/dscm	18.94	16.77	15.64	17.12
lb/10^{12} Btu	20.47	18.13	16.91	18.50
% of total Hg	45.7	77.9	84.9	69.5
Total mercury – µg	65.0	35.3	30.5	-----
µg/dscm	41.44	21.53	18.42	27.13
lb/10^{12} Btu	44.81	23.27	19.92	29.33

Table 3-4 continued
Monticello Unit Number 3 Mercury Speciation Results

Run Number	1	2	3	Average
Test Date	02/23/00	02/24/00	02/24/00	
Test Time	1550-1851	0835-1105	1210-1440	
Stack Mercury Speciation				
Particulate mercury – µg	0.370	0.275	0.359	-----
µg/dscm	0.18	0.13	0.17	0.16
lbs/10^{12} Btu	0.22	0.13	0.17	0.17
% of total Hg	0.8	0.7	0.8	0.8
Oxidized mercury – µg	7.99	0.67	10.8	-----
µg/dscm	3.83	0.32	5.16	3.10
lb/10^{12} Btu	4.69	0.32	5.23	3.41
% of total Hg	17.9	1.7	23.7	14.4
Elemental mercury – µg	36.2	38.3	34.4	-----
µg/dscm	17.34	18.43	16.43	17.40
lb/10^{12} Btu	21.25	18.39	16.65	18.76
% of total Hg	81.1	97.7	75.4	84.7
Total mercury – µg	44.6	39.2	45.6	-----
µg/dscm	21.37	18.87	21.79	20.68
lb/10^{12} Btu	26.19	18.82	22.07	22.36
Lignite Analysis				
Mercury - ppm dry	0.388	0.375	0.482	0.415
Mercury - lb/10^{12} Btu	49.78	60.34	72.88	61.00
Chlorine - ppm dry	100	200	100	133
Moisture - %	22.4	25.0	24.8	24.1
Sulfur - % dry	0.66	0.57	0.63	0.62
Ash - % dry	19.8	25.2	22.1	22.4
HHV - Btu/lb as fired	6,740	6,180	6,570	6,497
Coal flow - lb/hr as fired	1,222,000	1,314,000	1,274,000	1,270,000
Total Heat Input – 10^6 Btu/hr	8,236.3	8,120.5	8,370.2	8,242.3
Total Mercury Mass Rates				
lb/hr input in coal	0.41	0.49	0.61	0.50
lb/hr at FGD inlet*	0.27	0.28	0.32	0.29
lb/hr at FGD outlet*	0.37	0.19	0.17	0.24
lb/hr at stack*	0.22	0.15	0.18	0.18

* Calculated based on the Total Heat Input (10^6 Btu/hr)

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Table 3-5
Monticello Unit Number 3 Process Data

Run Number	**1**	**2**	**3**
Test Date	02/23/00	02/24/00	02/24/00
Test Time	1550-1851	0835-1105	1210-1440
Unit Operation			
Unit Load - MW net	772	767	770
Coal Mills in Service	All	All	All
Coal Flow - tons/hr	611	657	637
CEMS data			
NO_x – ppm	112.8	109.7	108.8
SO_2 – ppm	171.7	170.0	159.7
CO_2 - %	11.4	11.8	11.8
O_2 - %	7.7	7.4	7.5
Opacity - %	12.8	8.6	9.5
Stack Gas Flow – mcfh	1,556.3	1,533.9	1,535.2
Stack Gas Temperature - °F	200.7	200.6	200.2
Stack Gas Moisture - % H_2O	16.4	17.5	17.0
FGD data			
B Tower Δ Pressure - "H_2O	1.7	1.8	1.8
B Tower Inlet SO_2 – ppm	470.8	510.4	458.9
B Tower Inlet Gas Temperature - °F	367.9	358.1	358.3
B Tower Outlet Gas Temperature - °F	140.9	143.0	142.1

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 each of the six ports sampled at the inlet sampling location, in order to determine the uniformity and magnitude of the flow prior to testing. Several traverse points were checked for cyclonic flow and none was found to be present. 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 seven ports at the outlet 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 3.0 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 seven ports for a total of twenty-eight 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.

Several traverse points were checked for cyclonic flow and none was found to be present. Alternate procedures would be required if the angle of cyclonic flow were greater than 20 degrees. Three traverse points were sampled from each of the four ports for a total of twelve 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 outlet sampling location, samples of five-minute duration were taken isokinetically at each of the twenty-eight traverse points for a total sampling time of 140 minutes.

For each run at the stack sampling location, samples of ten-minute duration were taken isokinetically at each of the twelve traverse points for a total sampling time of 120 minutes. Data was recorded at five-minute intervals. Reagent blanks and field blanks were submitted.

The “front-half” of the sampling train at each of the FGD inlet sampling location contained the following components:

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

The “front-half” of the sampling train at each of the FGD outlet and stack sampling locations contained the following components:

Teflon Coated Nozzle
Heated Glass Probe @ > 248°F
Heated Quartz Fiber Filter @ > 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

A modified ASTM D2234 method of coal sampling was followed. For each test run, a grab sample of coal was collected from each coal 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	Low Mercury was detected
Field blank	Bias from handling and glassware	Low 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 3 Matrix Spike Summary

Sampling Location	*Run Number*	*Container*	*Results (µg)*	*True Value (µg)*	*Recovery (%)*
Inlet	1	1A	0.052	0.050	104
Inlet	3	3	17.9	18.8	95
Inlet	3	4	0.848	0.824	103
Outlet	2	5	21.0	21.0	100
Outlet	3	3	6.62	6.23	106
Outlet	3	4	0.404	0.428	95
Stack	1	1A	0.100	0.100	100
Stack	1	4	0.413	0.442	95
Stack	3	3	10.4	10.1	101
Stack	3	4	0.339	0.367	92
Stack	3	5	20.1	18.8	107

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

Sampling Location	*Run Number*	*Container*	*Results (µg)*	*Duplicate Results (µg)*	*RPD*	*Triplicate Results (µg)*	*RPD*
Scrubber Inlet	1	1A	0.117	0.118	<1.0	-----	-----
		2	0.065	0.065	<1.0	-----	-----
		3	15.6	15.6	<1.0	-----	-----
		4	0.625	0.625	<1.0	-----	-----
		5	27.2	27.7	1.6	-----	-----
	2	1A	0.069	0.068	2.2	-----	-----
		2	0.042	0.042	<1.0	-----	-----
		3	20.5	20.3	<1.0	-----	-----
		4	0.651	0.655	<1.0	0.643	1.3
		5	28.5	28.1	1.5	------	------
	3	1A	0.128	0.128	<1.0	-----	-----
		2	<0.003	<0.003	<1.0	<0.003	<1.0
		3	26.4	25.7	2.5	-----	-----
		4	0.432	0.430	<1.0	-----	-----
		5	27.4	27.2	<1.0	-----	-----
Scrubber Outlet	1	1A	0.436	0.423	3.0	-----	-----
		2	9.82	9.82	<1.0	-----	-----
		3	25.0	24.8	<1.0	-----	-----
		4	<0.022	<0.022	<1.0	-----	-----
		5	29.7	29.5	<1.0	28.9	2.8
	2	1A	0.620	0.612	1.2	-----	-----
		2	3.22	3.19	<1.0	-----	-----
		3	4.00	3.97	<1.0	-----	-----
		4	0.595	0.595	<1.0	0.564	5.3
		5	26.9	27.6	2.3	-----	-----
	3	1A	0.209	0.204	2.8	-----	-----
		2	0.912	0.902	1.1	0.888	2.7
		3	3.48	3.41	1.8	-----	-----
		4	0.045	0.042	5.9	-----	-----
		5	25.9	25.7	<1.0	-----	-----
Stack	1	1A	0.163	0.162	<1.0	-----	-----
		2	0.207	0.221	6.7	-----	-----
		3	7.99	8.14	1.8	-----	-----
		4	0.126	0.121	3.9	-----	-----
		5	36.1	36.1	<1.0	-----	-----
	2	1A	0.230	0.226	1.7	-----	-----
		2	0.045	0.045	<1.0	-----	-----
		3	0.667	0.667	<1.0	-----	-----
		4	0.102	0.110	7.8	0.110	7.4
		5	38.2	37.6	1.7	38.6	1.1
	3	1A	0.309	0.311	<1.0	-----	-----
		2	0.050	0.048	3.9	0.047	7.1
		3	10.8	11.0	1.9	-----	-----
		4	0.042	0.042	<1.0	-----	-----
		5	34.4	35.0	1.6	-----	-----

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

* Although the inlet and outlet sampling locations did not meet the requirements of EPA Method 1, three-dimensional flow testing as described in EPA Method 1 was not performed. A preliminary velocity traverse was made at each of the ten ports at the outlet sampling location, in order to determine the uniformity and magnitude of the flow prior to testing. Several traverse points were checked for cyclonic flow at the scrubber inlet sampling location and none was found to be present. All traverse points were checked for cyclonic flow at the scrubber outlet sampling location and the average angle was equal to 3.0 degrees.

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

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6 DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 9:00 a.m. on Wednesday, February 23, 2000. After meeting with plant personnel and attending a brief safety meeting, the equipment was moved onto the Unit Number 3 sampling locations. The equipment was prepared for testing. The preliminary data was collected. The first set of tests for mercury began at 3:50 p.m. and was completed at 6:51 p.m. The samples were recovered. The equipment was secured for the night. All work was completed at 8:30 p.m.

On Thursday, February 24, work began at 7:15 a.m. The equipment was prepared for testing. The second set of tests for mercury began at 8:35 a.m. Testing continued until the completion of the third set of tests at 2:40 p.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, Monticello Steam Electric Station, Unit Number 3 Scrubber Inlet Duct, Outlet Duct, and Stack, located near Mount Pleasant, Texas, were completed at 4:30 p.m. on Thursday, February 24, 2000.

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