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March 27, 2000



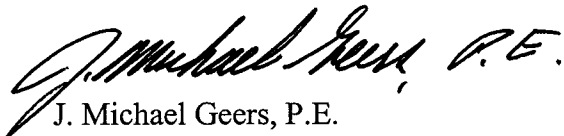
Mr. Maxwell
Emission Measurement Center (MD-19)
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Attention: Electric Utility Steam Generating Unit Mercury Test Program

Dear Mr. Maxwell,

Cinergy, as required in the Mercury Information Collection Request (ICR), has completed mercury speciation stack testing at our Wabash River Repowering Project. Enclosed please find one unbound and two bound copies of the final test report. Please call me at (513) 287-3839 or Paul Chu of EPRI at (650) 855-2812 if you have any questions.

Sincerely,


J. Michael Geers, P.E.

cc: Paul Chu, Electric Power Research Institute

**SOURCE EMISSIONS SURVEY
OF
WABASH RIVER REPOWERING PROJECT
HRSG
WEST TERRE HAUTE, INDIANA
FOR
CINERGY CORPORATION
AND
THE ELECTRIC POWER RESEARCH INSTITUTE**

OCTOBER 1999

FILE NUMBER 99-95WAB

TABLE OF CONTENTS

1	INTRODUCTION	1-1
1.1	<u>Summary of Test Program</u>	1-1
1.2	<u>Key personnel</u>	1-1
2	SOURCE AND SAMPLING LOCATION DESCRIPTIONS	2-1
2.1	<u>Process Description</u>	2-1
2.2	<u>Control Equipment Description</u>	2-1
2.3	<u>Flue Gas and Process Sampling Locations</u>	2-2
2.3.1	<i>Inlet Sampling Location</i>	2-2
2.3.2	<i>Stack Sampling Location</i>	2-2
2.3.3	<i>Coal Sampling Location</i>	2-3
3	SUMMARY AND DISCUSSION OF RESULTS	3-1
3.1	<u>Objectives and Test Matrix</u>	3-1
3.1.1	<i>Objective</i>	3-1
3.1.2	<i>Test Matrix</i>	3-1
3.2	<u>Field Test Changes and Problems</u>	3-3
3.3	<u>Handling of Non-Detects</u>	3-3
3.3.1	<i>A single analytical fraction representing a subset of a mercury species is not detected</i>	3-3
3.3.2	<i>All fractions representing a mercury species are not detected.</i>	3-3
3.3.3	<i>No mercury is detected for a species on all three test runs.</i>	3-4
3.3.4	<i>Mercury is detected on one or two of three runs.</i>	3-4
3.4	<u>Summary of Results</u>	3-5
4	SAMPLING AND ANALYTICAL PROCEDURES.....	4-1
4.1	<u>Emission Test Methods</u>	4-1
4.1.1	<i>Mercury</i>	4-2
4.2	<u>Process Test Methods</u>	4-4
4.3	<u>Sample Tracking and Custody</u>	4-4
5	QA/QC ACTIVITIES.....	5-1
6	DESCRIPTION OF TESTS.....	6-1
7	APPENDICES.....	7-1
A.	Source Emissions Calculations.....	A-1
B.	Field Data	B-1
C.	Calibration Data	C-1
D.	Analytical Data	D-1
E.	Unit Operational Data.....	E-1
F.	Chain of Custody Records	F-1
G.	Resumes.....	G-1

Figures

Figure 2-1 Description of sampling locations at Wabash River HRSG Stack	2-4
Figure 2-2 Description of sampling points Wabash River HRSG Stack	2-5
Figure 2-5 Description of coal sampling locations at Wabash River HRSG	2-6

Tables

Table 1-1 Test Program Organization	1-2
Table 3-1 Test Matrix for Mercury ICR Tests at Wabash River HRSG Stack	3-2
Table 3-2 Wabash River HRSG Stack Source Emissions Results	3-6
Table 3-4 Wabash River HRSG Stack Mercury Speciation Results	3-7
Table 3-5 Wabash River HRSG Stack Process Data	3-8
Table 5-1 Major Project Quality Control Checks	5-1
Table 5-2 Wabash River HRSG Matrix Spike Summary	5-2
Table 5-3 Wabash River HRSG Duplicate and Triplicate Analyses Summary	5-2
Table 5-4 QC Checklist and Limits for Methods 1 and 2	5-3
Table 5-5 QC Checklist and Limits for Method 5/17 Sampling	5-4
Table 5-6 QC Checklist and Limits for Ontario Hydro Mercury Speciation	5-5

1 INTRODUCTION

1.1 Summary of Test Program

METCO Environmental, Dallas, Texas, conducted a source emissions survey of the Wabash River Repowering Project, located in West Terre Haute, Indiana, for Cinergy Corporation and the Electric Power Research Institute. The test was conducted on October 11 and 12, 1999. The purpose of these tests was to meet the requirements of the EPA Mercury Information Collection Request (ICR). Speciated mercury concentrations at HRSG 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, D2361-95, D-0516, D-3174, and D-3286. The test was also conducted in accordance with the Sampling and Analytical Test Plan and the Quality Assurance Project Plan previously submitted to, and approved by the US EPA.

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. J. Michael Geers of Cinergy Corporation was the utility representative. Mr. Tracy Osborn of Cinergy Corporation performed process monitoring and sampling.

Mr. Paul Chu was the Electric Power Research Institute project manager.

Table 1-1 Test Program Organization

Organization	Individual	Responsibility	Phone Number
<i>Project Team</i> METCO	Bill Hefley	Project Manager	(972) 931-7127
<i>Utility</i> Cinergy Corp.	J. Michael Geers Tracy Osborn	Utility Representative Utility Site Representative	(513) 287-3839
<i>QA/QC</i> EPRI	Paul Chu	Project Manager	(650) 855-2812

2 SOURCE AND SAMPLING LOCATION DESCRIPTIONS

2.1 Process Description

Wabash River HRSG is a repowered coal fired unit, whereby the boiler was removed from service and the steam turbine was converted for use in a combined cycle arrangement. A new advanced combustion turbine, exhausting to a Heat Recovery Steam Generator, combines with the repowered steam turbine and the gasification facility to increase the net electric power generating capability from 94 megawatts to 262 megawatts (net) while reducing the sulfur dioxide emissions by approximately 98%, and NO_x emissions 90%.

2.2 Control Equipment Description

Gasification is a partial oxidation process in which the coal is reacted with oxygen and steam and converted to a synthesis gas (consisting mainly of hydrogen, carbon monoxide, and carbon dioxide). Oxygen is controlled to maintain a sub-stoichiometric ratio (less oxygen than theoretically required), thus sulfur is generally converted to H₂S. The hot raw syngas goes through additional processing (cooling, particulate removal, and sulfur removal) to produce a middle-Btu grade gas. This syngas is then combusted in a combustion turbine.

At the Wabash River gasifier, the significant "gas treatment" steps are as follows:

1. Hot gas filtration with a barrier filter for particulate removal.
2. Water scrubber for gas cooling, as well as removal of some contaminants.
3. Amine scrubber for removal of reduced-sulfur species.

The treated syngas is then combusted in a combustion turbine.

2.3 Flue Gas and Process Sampling Locations

2.3.1 Inlet Sampling Location

The gas at the gasification facility is a high-pressure, reducing environment. This makes the Ontario Hydro mercury speciation method ineffective. Gasification is a partial oxidation process in which the coal is reacted with oxygen and steam and converted to a synthesis gas (consisting mainly of hydrogen, carbon monoxide, and carbon dioxide). Oxygen is controlled to maintain a sub-stoichiometric ratio (less oxygen than theoretically required), thus sulfur is generally converted to H₂S. The hot raw syngas goes through additional processing (cooling, particulate removal, and sulfur removal) to produce a middle-Btu grade gas. This syngas is then combusted in a combustion turbine. The Ontario Hydro mercury speciation method is applicable only for an oxidizing environment and at close to or below atmospheric pressure. The presence of H₂S (not present in conventional pulverized coal-fired boilers) reacts with the oxidants in the sampling train impingers, degrading the oxidizing/collection efficiency of the sampling method. Mercury speciation measurements were therefore limited to the combustion turbine stack.

2.3.2 Stack Sampling Location

The sampling location on the HRSG Stack is 191 feet 2 inches above the ground. The sampling locations are located 120 feet 11 inches (6.75 stack diameters) downstream from the inlet to the stack and 36 feet 11 inches (2.06 stack diameters) upstream from the outlet to the stack.

2.3.3 Coal Sampling Location

The Repowering Project combusts a coal water slurry rather than the pulverized coal utilized by most conventional electric generating units. The water used to make the coal water slurry is recycled from the pollution control equipment. Because the control equipment removes mercury, the recycled water contains elevated levels of mercury. The coal sampling locations were chosen prior to the rod mill, which is located ahead of the slurry tank. Sampling before the rod mill prevents biased results. The coal samples were collected approximately 8 hours prior to the mercury sampling on the HRSG Stack in order to be representative of the syngas that was fired at the time of testing.

Figure 2-1
Description of sampling locations at Wabash River HRSG Stack

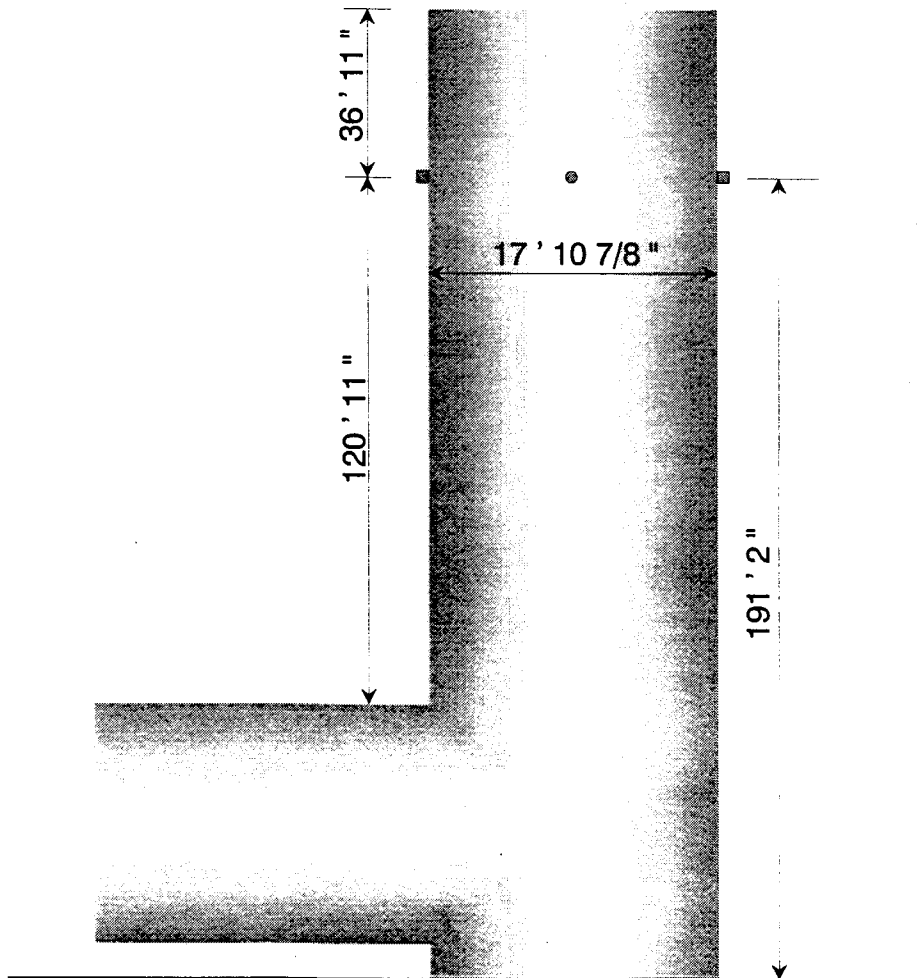
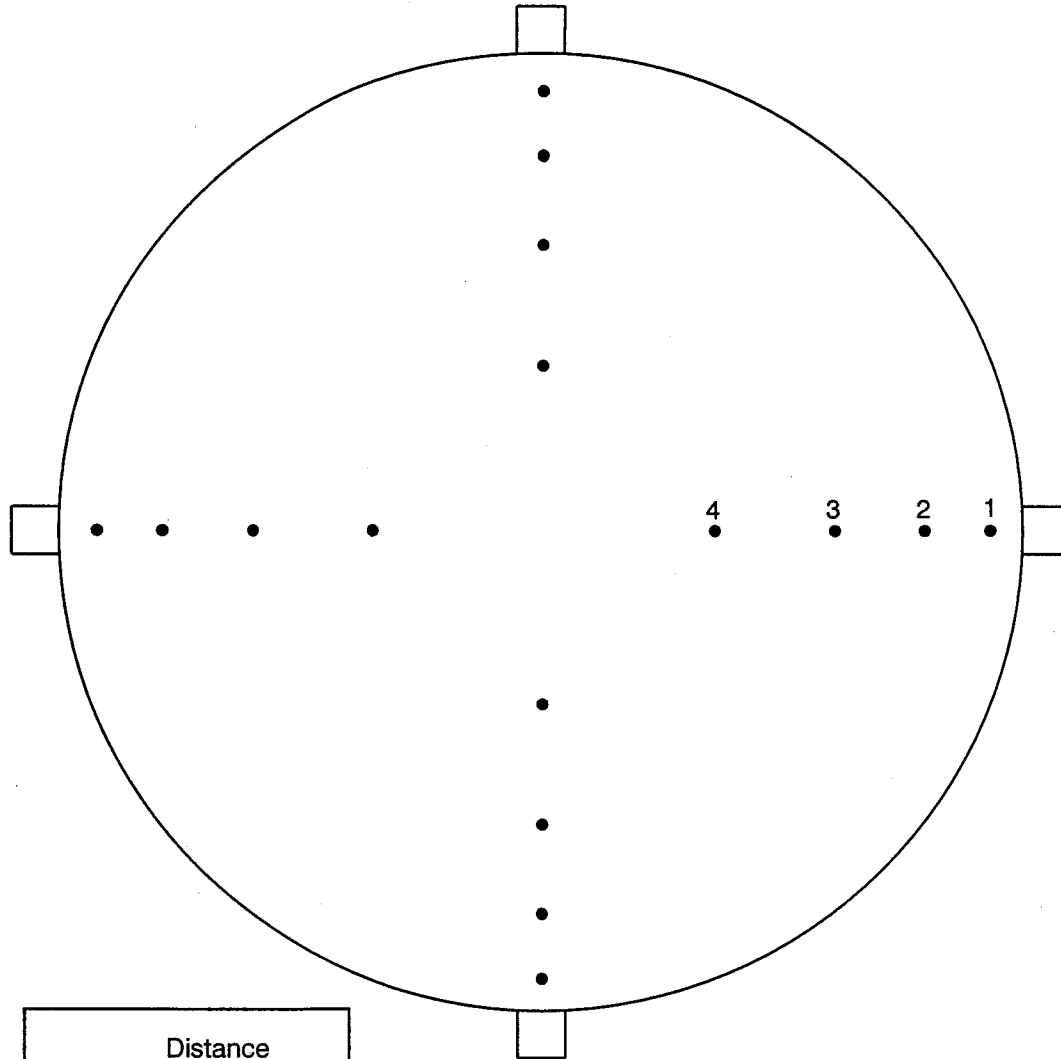


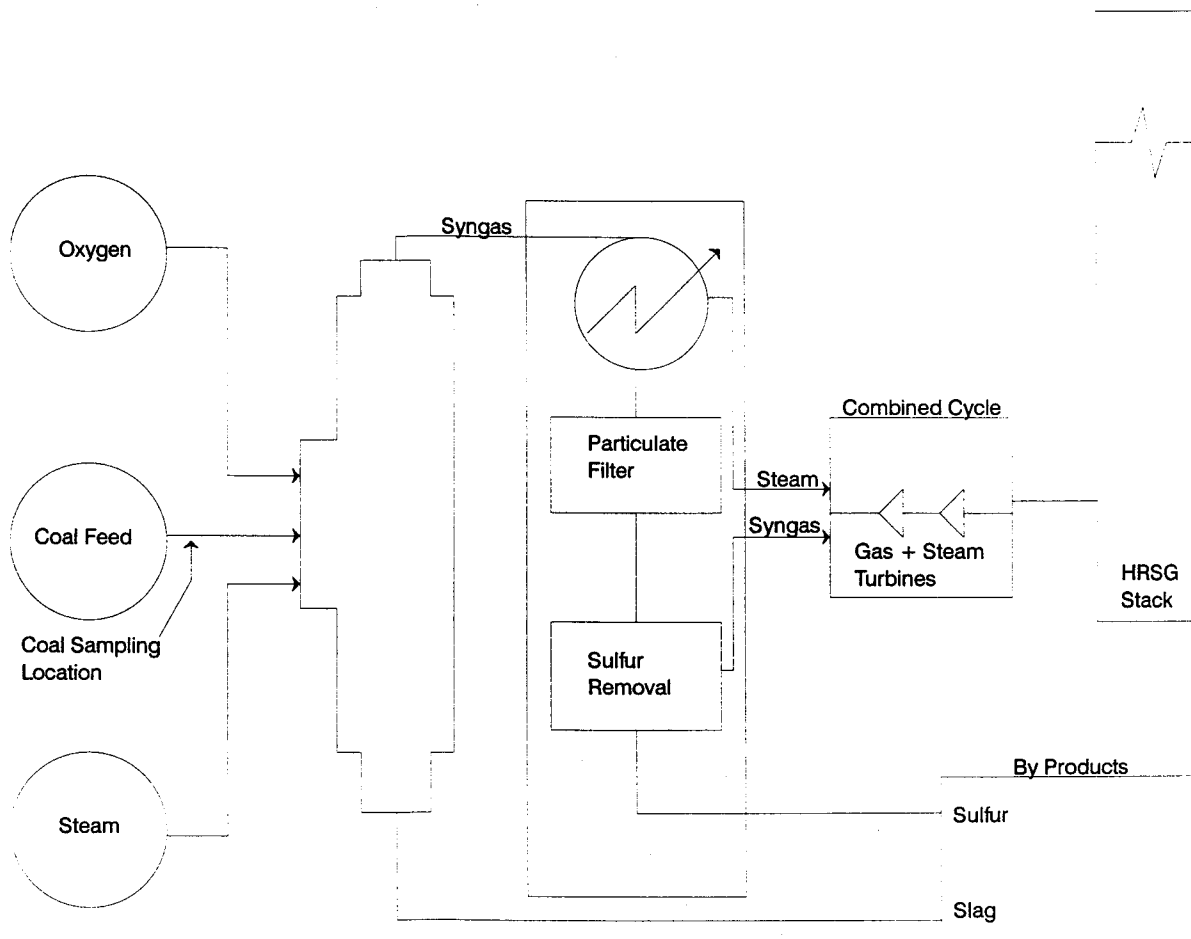
Figure 2-2
Description of sampling points Wabash River HRSG Stack



<u>Point*</u>	<u>Distance from Wall</u>
1	6 7/8 "
2	22 9/16 "
3	41 11/16 "
4	69 3/8 "

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

Figure 2-5
Description of coal sampling locations at Wabash River HRSG



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 fuel mercury and chlorine content during the stack tests.
3. 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 Wabash River HRSG Stack**

Sampling Location	No. of Runs	Species Measured	Sampling Method	Sample Run Time	Analytical Method	Analytical Laboratory
Stack	3	Speciated Hg	Ontario Hydro	128 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
Rod Mills	3	Hg, Cl, Sulfur, Ash, and Btu/lb in coal	ASTM D2234	1 grab sample per run	ASTM D6414-99 (Hg), ASTM D2361-95 (Cl), ASTM D-0516 (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 may be cases where certain fractions of a test do not show detectable mercury levels. This section addresses how non-detects will be 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 rinse 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 $\mu\text{g}/\text{Nm}^3$.

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 highest 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 Wabash River HRSG are listed in the following tables.

**Table 3-2
Wabash River HRSG Stack Source Emissions Results**

Run Number	1	2	3
Test Date	10/12/99	10/12/99	10/12/99
Test Time	0900-1125	1210-1438	1525-1827
Stack Gas Properties			
Flow Rate - ACFM	1,484,607	1,458,829	1,449,109
Flow Rate - DSCFM*	807,574	815,708	796,034
% Water Vapor - % Vol.	14.47	14.46	13.79
CO ₂ - %	9.2	9.0	9.2
O ₂ - %	13.6	14.0	13.6
% Excess Air @ Sampling Point	198	219	198
Temperature - °F	359	335	353
Pressure - "Hg	29.41	29.34	29.25
Percent Isokinetic	103.5	99.7	103.6
Volume Dry Gas Sampled - DSCF*	69.917	66.479	68.960

* 29.92 "Hg, 68 °F (760 mm Hg, 20 °C)

Table 3-4 Wabash River HRSG Stack Mercury Speciation Results

Run Number	1	2	3	Average
Test Date	10/12/99	10/12/99	10/12/99	
Test Time	0900-1125	1210-1438	1525-1827	
Stack Mercury Speciation				
<i>Particulate mercury – µg</i>	<0.09	<0.10	0.02	----
µg/dscm	<0.05	<0.05	0.01	<0.02
lbs/10 ¹² Btu	<0.06	<0.07	0.01	<0.03
lbs/hr	<1.38E-04	<1.62E-04	3.05E-05	<6.02E-5
% of total Hg	----	----	0.3	0.3
<i>Oxidized mercury – µg</i>	<1.67	<1.68	<1.76	----
µg/dscm	<0.84	<0.89	<0.90	<0.90
lbs/10 ¹² Btu	<1.03	<1.10	<1.09	<1.09
lbs/hr	<2.55E-3	<2.73E-3	<2.69E-3	<2.73E-3
% of total Hg	----	----	----	----
<i>Elemental mercury – µg</i>	5.10	4.90	5.39	----
µg/dscm	2.57	2.60	2.76	2.64
lbs/10 ¹² Btu	3.24	3.23	3.23	3.23
lbs/hr	0.008	0.008	0.008	0.008
% of total Hg	100.0	100.0	99.7	99.7
<i>Total mercury – µg</i>	5.10	4.90	5.41	----
µg/dscm	2.57	2.60	2.77	2.65
lbs/10 ¹² Btu	3.24	3.23	3.23	3.23
lbs/hr	0.008	0.008	0.008	0.008
Coal Analysis				
Mercury - ppm dry	0.064	0.068	0.070	0.067
Chlorine - ppm dry	600	600	600	600
Moisture - %	14.8	15.7	15.9	15.5
Sulfur - % dry	2.72	2.75	2.89	2.79
Ash - % dry	13.0	12.7	13.1	12.9
HHV - Btu/lb as fired	10,510	10,570	10,550	10,543
Coal flow - lb/hr as fired	234,600	234,400	234,600	234,467
Unit Heat Input – 10 ⁶ Btu/hr	2,465.6	2,477.6	2,475.0	2,472.7
Total Mercury Mass Rates				
lb/hr input in coal	0.015	0.016	0.016	0.016
lb/hr emitted	0.008	0.008	0.008	0.008

Note: Values reported as less than values represent detection limits.

**Table 3-5
Wabash River HRSG Stack Process Data**

Run Number	1	2	3
Test Date	10/12/99	10/12/99	10/12/99
Test Time	0900-1125	1210-1438	1525-1827
Unit Operation			
Unit Load - MW net	180.6	177.7	174.9
Rod Mills in Service	1	1	1
Coal Flow – tons/hr	117.3	117.2	117.3
Syngas Flow – lb/sec	111.4	110.5	108.8
Steam Flow – klbs/hr	33.9	35.0	31.6
HRSG CEMS data			
CO ₂ - %	8.2	8.1	8.1
NO _x – ppm dry	23.1	21.8	23.2
SO ₂ – ppm dry	19.8	22.6	21.9
Opacity - %	11.6	11.9	11.9
Stack Gas Flow – kscfm	966	952	937
Stack Gas Temperature - °F	350.0	350.3	349.8

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, D2361-95, D-0516, D-3174, and D-3286.

A preliminary velocity traverse was made at each of the four ports at the 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 4.7 degrees. Alternate procedures would be required if the angle of cyclonic flow was greater than 20 degrees. Four traverse points were sampled from each of the four ports, for a total of sixteen traverse points.

The sampling train was 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.

An integrated orsat sample was 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. Samples of five-minute duration were taken isokinetically at each of the sixteen traverse points for a total sampling time of 128 minutes. Data was recorded at five-minute intervals. Reagent blanks were submitted.

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 contained the following components:

<u>Impinger Number</u>	<u>Impinger Type</u>	<u>Impinger Contents</u>	<u>Amount</u>	<u>Parameter Collected</u>
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 ₂ O ₂	100 ml	Elemental Mercury and Moisture
5	Modified Design	4% KMnO ₄ and 10% H ₂ SO ₄	100 ml	Elemental Mercury and Moisture
6	Modified Design	4% KMnO ₄ and 10% H ₂ SO ₄	100 ml	Elemental Mercury and Moisture
7	Greenburg-Smith Design	4% KMnO ₄ and 10% H ₂ SO 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 conveyer belt immediately upstream of the rod mill. One composite sample was prepared for analysis. Each sample was analyzed for mercury, chlorine, sulfur, ash, and Btu content by ASTM Methods D6414-99, D2361-95, D-0516, 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

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

Table 5-2 Wabash River HRSG Matrix Spike Summary

<i>Sampling Location</i>	<i>Run Number</i>	<i>Container</i>	<i>Results (ug)</i>	<i>True Value (ug)</i>	<i>Recovery (%)</i>
Stack	Blank Train	5	4.74	4.65	102

Table 5-3 Wabash River HRSG Duplicate and Triplicate Analyses Summary

<i>Sampling Location</i>	<i>Run Number</i>	<i>Container</i>	<i>Results (ug)</i>	<i>Duplicate Results</i>		<i>Triplicate Results</i>	
				<i>(ug)</i>	<i>RPD</i>	<i>(ug)</i>	<i>RPD</i>
Stack	1	1A	<0.01	<0.01	0	----	----
		2	<0.08	<0.08	0	----	----
		3	<1.67	<1.67	0	----	----
		4	<0.78	<0.78	0	----	----
		5	5.10	5.20	2.0	----	----
	2	1A	<0.01	<0.01	0	----	----
		2	<0.09	<0.09	0	----	----
		3	<1.68	<1.68	0	----	----
		4	<0.64	<0.64	0	----	----
		5	4.90	4.95	1.1	----	----
	3	1A	0.02	0.02	0	----	----
		2	<0.06	<0.06	0	----	----
		3	<1.76	<1.76	0	----	----
		4	<0.60	<0.60	0	----	----
		5	5.39	5.44	0.8	----	----

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
<i>Pre-mobilization checks</i>		
Gas meter/orifice check	Before test series, $Y_D \pm 5\%$ (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	
<i>On-site pre-test checks</i>		
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
<i>During testing</i>		
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	
<i>Post test checks</i>		
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, $Y_D \pm 5\%$	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
<i>Pre-mobilization activities</i>		
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
<i>On-site pre-test activities</i>		
Determine SO ₂ concentration	If >2500 ppm, add more HNO ₃ -H ₂ O ₂ solution	Ontario Hydro Section 13.1.13
Prepare KCl solution	Prepare batch as needed	Ontario Hydro Section 8.5
Prepare HNO ₃ -H ₂ O ₂ solution	Prepare batch as needed	Ontario Hydro Section 8.5
Prepare H ₂ SO 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
<i>Sample recovery activities</i>		
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 ₂ O 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 permanganate 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
<i>Blank samples</i>		
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 ₂ O ₂ solution	One reagent blank per batch.	Ontario Hydro Section 13.2.12
H ₂ SO 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
<i>Laboratory activities</i>		
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 1:00 p.m. on Monday, October 11, 1999. After meeting with plant personnel and attending a brief safety meeting, the equipment was moved onto the HRSG Stack. The preliminary data was collected. The equipment was secured for the night. All work was completed at 7:00 p.m.

On Tuesday, October 12, work began at 6:30 a.m. The equipment was prepared for testing. The preliminary data was collected to verify reference method set-up. The first test for mercury began at 9:00 a.m. Testing continued until the completion of the third test at 6:27 p.m.

The samples were recovered. The equipment was moved off of the stack 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 the Cinergy Corporation, Wabash River Repowering Project, HRSG Stack, located in West Terre Haute, Indiana, for the Electric Power Research Institute, were completed at 8:00 p.m. on Tuesday, October 12, 1999.


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

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**