EVALUATION OF MERCURY EMISSIONS FROM COAL-FIRED FACILITIES WITH SCR AND FGD SYSTEMS

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ABSTRACT

CONSOL Energy Inc., Research & Development (CONSOL), with support from the U.S. Department of Energy, National Energy Technology Laboratory (DOE) is evaluating the effects of selective catalytic reduction (SCR) on mercury (Hg) capture in coal-fired plants equipped with an electrostatic precipitator (ESP) - wet flue gas desulfurization (FGD) combination or a spray dyer absorber – fabric filter (SDA-FF) combination. In this program CONSOL is determining mercury speciation and removal at 10 coal-fired facilities. The objectives are 1) to evaluate the effect of SCR on mercury capture in the ESP-FGD and SDA-FF combinations at coal-fired power plants, 2) evaluate the effect of catalyst degradation on mercury capture; 3) evaluate the effect of low load operation on mercury capture in an SCR-FGD system, and 4) collect data that could provide the basis for fundamental scientific insights into the nature of mercury chemistry in flue gas, the catalytic effect of SCR systems on Hg speciation and the efficacy of different FGD technologies for Hg capture.

This document, the first in a series of topical reports, describes the results and analysis of mercury sampling performed on a 684 MW unit burning a bituminous coal containing 4.7% sulfur; the unit is equipped with a plate-type SCR catalyst for NOx control and a forced-oxidation, wet lime FGD scrubber for SO_2 control. Four sampling tests were performed in August 2003. Flue gas mercury speciation and concentrations were determined at the SCR inlet, air heater outlet (ESP inlet), and at the stack (FGD outlet) using the Ontario Hydro method. Process stream samples for a mercury balance were collected to coincide with the flue gas measurements.

The results showed that the SCR/air heater combination oxidized nearly 90% of the elemental mercury. Mercury removal, on a coal-to-stack basis, was 72%; however, at this plant, 15% of the flue gas was by-passed around the FGD scrubber because of the scrubber's limited capacity. In the scrubber alone, the removal was calculated to be 84%. The mercury material balances were 106% to 119%, with an average of 110%.

These results appear to show that the SCR had a positive effect on mercury removal in the wet FGD system. In earlier programs, CONSOL sampled mercury at six plants with wet FGDs for SO_2 control without SCR catalysts. At those plants, an average of 61±15% of the mercury was in the oxidized form at the air heater outlet, and the average mercury removal was 66±8%.

The principal purpose of this work is to develop a better understanding of the potential Hg removal "co-benefits" achieved by NOx, and SO_2 control technologies. It is expected that this data will provide the basis for fundamental scientific insights into the nature of Hg chemistry in flue gas, the catalytic effect of SCR systems on Hg speciation and the efficacy of different FGD technologies for Hg capture. Ultimately, this insight could help to design and operate SCR and FGD systems to maximize Hg removal.

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LIST OF ABBREVIATIONS

acfm	-	actual cubic feet per minute (wet)
am	-	morning
Btu	-	heating value in British Thermal Units
cfm	-	cubic feet per minute
CO_2	-	carbon dioxide
CONSOL R&D	-	CONSOL Energy Inc., Research and Development
CVAA	-	cold vapor atomic absorption
DI	-	deionized water
dscf	-	dry standard cubic feet
dscfm	-	dry standard cubic feet per minute
EPA	-	U.S. Environmental Protection Agency
ESP	-	electrostatic precipitator
FGD	-	wet flue gas desulfurization
ft	-	feet
ft^2	-	square feet
ft^3	-	cubic feet
gm	-	grams
gpm	-	gallons per minute
gr	-	grains
GPRW	-	gypsum process return water
HCl	-	hydrochloric acid
Hg	-	mercury
Hg^{part}	-	mercury in particulate form
Hg^{total}	-	total mercury in particulate, oxidized, and elemental forms
Hg^{++}	-	mercury in oxidized form
Hg^{o}	-	mercury in elemental form
HNO_3	-	nitric acid
H_2O	-	water
hr	-	hour
ICP-AES	-	inductively coupled plasma-atomic emission spectrometer
in	-	inch
KCl	-	potassium chloride
$KMnO_4$	-	potassium permanganate
L	-	liter
lb	-	pound
m	-	meter
m^3	-	cubic meter
mg	-	milligram, 10^{-3} gram

LIST OF ABBREVIATIONS (continued)

min	-	minute
mL	-	milliliter
M	-	molar, mol/L
MM	-	million
mol	-	mole
ng	-	nanogram, 10^{-9} gram
N_2	-	molecular nitrogen
NIST	-	National Institute of Standards and Technology
NO	-	nitric oxide
NO_2	-	nitrogen dioxide
O_2	-	molecular oxygen
O_3	-	ozone
pm	-	afternoon
PM	-	particulate matter
ppb	-	parts per billion
ppm	-	parts per million
ppmv	-	parts per million by volume
PRSD	-	percent relative standard deviation
QA	-	quality assurance
QC	-	quality control
rpm	-	revolutions per minute
scf	-	standard cubic feet (68 °F and 29.92"Hg)
scfm	-	standard cubic feet per minute
SCR	-	Selective Catalytic Reduction
SRM	-	Standard Reference Material
temp	-	temperature
tph	-	tons per hour
wt	-	weight
V	-	volts
vs	-	versus
°F	-	temperature in degrees Fahrenheit
~	-	approximately
<	-	less than
>	-	more than
µg	-	microgram, 10^{-6} gram

INTRODUCTION

The CONSOL Energy Inc. Research and Development (CONSOL R&D) Exploratory and Environmental Research Group conducted a series of flue gas mercury (Hg), measurements during the week of August 18, 2003, under U. S. Department of Energy (DOE) Cooperative Agreement No. DE-FC26-02NT41589. The test program consisted of four sets of measurements across the combustion emission control system that consists of a selective catalytic reduction (SCR) unit, electrostatic precipitator (ESP), and magnesium-enhanced lime-based flue gas desulfurization (FGD).

The Hg measurements were made using the Ontario-Hydro Flue Gas Hg Speciation Method at the SCR inlet, Air Heater Outlet (upstream of the ESP), and the Stack. The test methods and results are documented in this report.

HOST UTILITY DESCRIPTION

The facility consists of two identical power generation units. Each unit consists of an opposed-wall, coal-fired boiler-generator rated at 684 MW output, with a cold-side ESP for particulate matter control. The plant typically burns high sulfur Pittsburgh seam coal. Each unit has a four-module magnesium-enhanced lime-based, wet FGD scrubber to control SO_2 emissions. In 2000, an ex-situ oxidation process was installed to produce wallboard grade gypsum, with dissolved magnesium ions in the oxidized liquor recovered as magnesium hydroxide. During normal operation, about 15% of the flue gas bypasses the FGD due to FGD scrubber capacity limitation. In 2003, plate-type SCR catalysts were installed for NOx emissions control; the SCR is operated during the ozone season only.

MERCURY SAMPLING RESULTS

I. Test Matrix

All tests were performed on Unit #1 at this facility. The Hg measurements consisted of a total of four tests over three days. The ASTM Method D-6784-02 (Ontario Hydro Method) was used to measure the concentration and speciation of mercury in the flue gas at three locations: the SCR inlet, the air heater outlet, and the stack. Solid and liquid process samples were obtained during the gas sampling periods to calculate a material balance. A schematic showing the sampling locations is in Figure 1. Laboratory analyses were performed by CONSOL R&D and are included in this report. A total of 12 Hg measurements were conducted over three testing days. Details of sampling conditions are provided later in this report. The test matrix is shown in Table 1.

Table 1. Sampling Test Matrix

Date	Activity	Hg Sampling			Process Sampling					
		SCR Inlet	Air Heater Outlet	Stack	Coal	Bottom Ash	Lime Slurry	Scrubber Sludge	Gypsum Plant Return Water	ESP Ash
08/18/03	Arrive, Setup	---	---	---	---	---	---	---	---	---
08/19/03	Setup/ Test 1	X	X	X	X	X	X	X	X	X
08/20/03	Test 2	X	X	X	X	X	X	X	X	X
	Test 3	X	X	X	X	X	X	X	X	X
08/21/03	Test 4	X	X	X	X	X	X	X	X	X
	Demobilize	---	---	---	---	---	---	---	---	---

II. Flue Gas Mercury Sampling Results

Figure 2 shows the mercury speciation for the four tests at each location. All tests were made isokinetically. A complete listing of Hg analyses is in Appendix A. The results at each location are discussed below.

A. SCR Inlet

Table 2 summarizes the Hg measurements at the SCR inlet. The results show that >99% of the mercury was in the gas phase with more than 90% of the mercury in the elemental form. The high percentage of gas-phase Hg is expected due to the gas temperature (678 °F) at this location. The high percentage of elemental Hg is also expected because the elemental form is the most thermodynamically stable form at this temperature.

During Test 2, the total mercury concentration was about 2.5 to 3 times higher than in the other three tests. The high concentration was observed for both the elemental and the oxidized fractions so it is unlikely that there was an inaccuracy in the analysis of the samples. No substantial increase was observed during Test 2 at any of the other gas sampling locations. The mercury mass balance, discussed later in this report, was higher for Test 2 (119%) than for the other tests (107% average), but the difference was not enough to explain the high mercury concentrations measured at the SCR inlet. Because mercury sampling and analysis is difficult and mercury behavior in large-scale combustion systems is not yet well understood, there are occasions when an unusual measurement is observed for reasons that are not apparent.

If the data from Test 2 are excluded, the average total mercury concentration at the SCR inlet was 12.8±1.1 µg/m^3; the mercury mass flow was 6.8±0.5 mg/sec. The mass flow of mercury in the feed coal averaged 5.72 mg/sec. Thus, the SCR inlet mercury mass flow was about 19% higher than the feed coal mercury mass flow. One possibility

is that some of the mercury is transferred from the flue gas to the combustion air in the air heater; CONSOL observed this in two different power plants burning different coals, where mercury concentrations of 0.25 to 2 µg/m^3 were measured in the combustion air exiting the air heater.[1] A steady-state recycling of mercury to the boiler would increase the mercury content of the flue gas upstream of the air heater.

Table 2. Flue Gas Hg Speciation at the SCR Inlet

Date	Test	Hg Concentration, µg/m^3 (dry std conditions)				Hg Flow, mg/sec			
		Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}	Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}
08/19/03	1	0.09	1.13	12.64	13.86	0.05	0.60	6.70	7.35
08/20/03	2	0.06	9.80	24.09	33.95	0.03	5.27	12.94	18.24
08/20/03	3	0.04	1.08	11.65	12.77	0.02	0.57	6.15	6.74
08/21/03	4	0.05	0.86	10.86	11.77	0.01	0.46	5.84	6.33
Average		0.06	3.22	14.81	18.09	0.03	1.72	7.91	9.66
Standard Deviation		0.02	4.39	6.23	10.61	0.01	2.36	3.37	5.73
PRSD		36.0	136.4	42.1	58.7	32.3	137.0	42.7	59.3
Average of Tests 1, 3, and 4		0.06	1.02	11.72	12.80	0.03	0.54	6.23	6.80
Standard Deviation		0.02	0.14	0.90	1.05	0.01	0.07	0.44	0.51
PRSD		39.9	14.1	7.6	8.2	39.6	13.3	7.0	7.5

B. Air Heater Outlet

Table 3 summarizes the Hg measurements at the air heater outlet. The results show that >95% of the mercury was in the gas phase, which is similar to the observation at the SCR inlet; the average gas temperature at the air heater outlet was 327 °F. Unlike the results at the SCR inlet, the data at the air heater outlet show that 88% of the mercury was in the oxidized form. This indicates that the SCR-air heater combination caused a substantial amount of the elemental mercury to be oxidized.

The mass flow of mercury at the air heater outlet averaged 6.0±1.4 mg/sec, which is 12% lower than the average of Tests 1, 3, and 4 measured at the SCR inlet. Between these two sampling locations are the SCR catalyst beds and the regenerative air heater. It is possible that mercury could be lost by absorption into the catalyst, or onto air heater ash deposits, resulting in a lower mercury concentration at the air heater outlet than at the SCR inlet. Also, as discussed in the previous section, mercury could be recycled back to the boiler in the combustion air. The mass flow of mercury at the air heater outlet was only 5% higher than the average mass flow of mercury in the feed coal.

[1] "Role of Coal Chlorine and Fly Ash on Mercury Species in Coal Combustion Ash," Final Technical Report to the Illinois Clean Coal Institute, ICCI-00-1/2.2C-2, April 2002, L-19219

Table 3. Flue Gas Hg Speciation at the Air Heater Outlet

Date	Test	Hg Concentration, µg/m^3 (dry std conditions)				Hg Flow, mg/sec			
		Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}	Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}
08/19/03	1	0.27	7.56	0.50	8.33	0.16	4.65	0.31	5.12
08/20/03	2	0.73	8.31	0.65	9.70	0.45	5.08	0.40	5.92
08/20/03	3	0.53	7.18	0.54	8.25	0.32	4.28	0.32	4.92
08/21/03	4	1.08	11.54	0.42	13.04	0.66	7.05	0.26	7.96
	Average	0.65	8.65	0.53	9.83	0.40	5.27	0.32	5.98
	Standard Deviation	0.34	1.98	0.10	2.24	0.21	1.23	0.06	1.39
	PRSD	52.3	23.0	18.1	22.8	52.9	23.4	18.5	23.2

C. Stack

Table 4 summarizes the Hg measurements at the stack (FGD outlet). At this location, >99% of the mercury was in the gas phase, because most of the particulate mercury was removed by the ESP; the average gas temperature at the stack was 149 °F. The mercury was about 55% oxidized and 45% elemental. Compared to the air heater exit concentration, the oxidized mercury was reduced by 83%, while the elemental mercury increased by 121%. This does not take into account the 15% flue gas bypass around the FGD, which is discussed in Section IV. This increase in elemental mercury concentration in wet scrubbers has been observed at other plants by CONSOL.[2] The mechanism causing this phenomenon has not been explained in the general literature; although researchers at Babcock and Wilcox Co. believe that they understand the mechanism, they have kept it proprietary in order to develop an additive to prevent its occurrence.[3]

Table 4. Flue Gas Hg Speciation at the Stack

Date	Test	Hg Concentration, µg/m^3 (dry std conditions)				Hg Flow, mg/sec			
		Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}	Hg^{part}	Hg^{++}	Hg^{0}	Hg^{total}
08/19/03	1	4.53×10^{-2}	0.94	0.86	1.85	0.03	0.64	0.58	1.25
08/20/03	2	4.27×10^{-3}	1.35	1.21	2.56	0.00	0.92	0.83	1.75
08/20/03	3	1.01×10^{-2}	1.25	1.19	2.45	0.01	0.84	0.80	1.65
08/21/03	4	4.29×10^{-3}	1.66	0.93	2.59	0.00	1.15	0.64	1.80
	Average	1.60×10^{-2}	1.30	1.05	2.36	0.01	0.89	0.71	1.61
	Standard Deviation	1.97×10^{-2}	0.30	0.18	0.35	0.01	0.21	0.12	0.25
	PRSD	123.4	22.8	17.1	14.7	123.0	23.8	16.7	24.8

[2] DeVito, M. S., Withum, J. A., and Statnick, R. M., "Flue Gas Measurements from Coal-Fired Boilers Equipped with Wet Scrubbers," Int. J. of Environmental Pollution 17(1/2), 2002, p. 126-142

[3] Jerry Ahmrein, Babcock and Wilcox Co., private communication.

III. Mercury Material Balance

The results of the material balance closure for mercury are summarized in Table 5. The closure is defined as the ratio (in percentage) of the sum of the Hg in the streams leaving the unit to the sum of the Hg in the streams entering the unit. There were three input streams to the unit: coal feed, lime slurry feed, and the gypsum process return water. Of these, the coal supplied nearly 99% of the mercury input to the unit. There were four output streams: the FGD slurry blowdown (sent to the gypsum processing unit), the boiler bottom ash, the ESP ash, and the flue gas exiting the stack. About 68% of the mercury left the unit in the FGD slurry blowdown, about 25% in the stack flue gas, and about 7% in the ESP ash.

The mercury mass balance closures for the four tests ranged from 101% to 119%, with the average being 110%; these satisfy CONSOL's criteria of individual test balances of 100±30% with an overall average of 100±20%. The two ESP hopper ash samples collected during Test 1 were mistakenly taken from Unit #2 instead of Unit #1 where the sampling program was performed, invalidating the Hg closure for Test 1. Disregarding the Test 1 balance, the balances for the remaining three tests were 106% to 119%, with an average of 113%. Unit #2 is identical to Unit #1, and both boilers burned the same coal; thus, the amount of Hg in the fly ash produced at both units should be similar.

Table 5. Summary of Mercury Material Balance.

	Hg flow rate (mg/sec)	Test #1 (Discarded)	Test #2	Test #3	Test #4
Streams Entering the Unit	Hg in coal feed =	6.07	5.42	5.41	5.98
	Hg in lime slurry feed =	2.79E-02	2.91E-02	3.00E-02	3.00E-02
	Hg in GPRW =	2.88E-02	2.88E-02	5.46E-02	2.88E-02
	Total In =	6.12	5.48	5.49	6.04
Streams Leaving the Unit	Hg in FGD blowdown =	4.74	4.33	4.05	4.02
	Hg in Bottom Ash =	8.54E-03	8.39E-03	8.44E-03	8.00E-03
	Hg in ESP Ash =	0.17	0.43	0.60	0.57
	Hg in stack =	1.25	1.75	1.65	1.80
	Total Out =	6.17	6.52	6.31	6.40
	Hg mass balance closure (OUT / IN) =	101%	119%	115%	106%
	Average of All Four Tests =	110%			
	Average for Three Tests (Test #2, #3, and #4)	113%			

IV. SCR/FGD System Hg Removal

Table 6 summarizes the flue gas Hg removal across the SCR/FGD system. Based on the mass flow rate of mercury in the stack compared to the air heater outlet (ESP inlet), 73% of the mercury was removed. Comparing the mercury at the stack to the feed coal, 72% of the mercury was removed.

Table 6. Flue Gas Hg Removal

Date	Test	System Mercury Reduction					
		Ontario Hydro Results, mg Hg^{total} /sec			Coal Feed Based Reduction, mg Hg^{total} /sec		
		Air Heater Outlet	Stack Emissions	% Reduction	Coal Feed	Stack Emissions	% Reduction
08/19/03	1	5.12	1.85	75.6	6.06	1.25	79.4
08/20/03	2	5.92	2.56	70.4	5.42	1.75	67.7
08/20/03	3	4.92	2.45	66.5	5.41	1.65	69.5
08/21/03	4	7.96	2.59	77.4	5.98	1.80	69.9
	Average	5.98	2.36	72.5	5.72	1.61	71.6
	Standard Deviation	1.39	0.35	5.0	0.35	0.26	5.3
	PRSD	23.2	14.7	6.9	6.1	16.4	7.3

At this plant, 15% of the flue gas exiting the ESP bypassed the FGD scrubbers and exited directly to the stack, due to the capacity limitations of the scrubbers. As a result, the comparison of stack to air heater outlet mercury mass flows is not an indication of the removal taking place in the FGD itself. To estimate the mercury removal in the FGD alone, the mass flow of mercury to the FGD inlet is calculated by subtracting the mercury captured in the ESP ash, and multiplying the result by 0.85 (the fraction of gas going to the FGD scrubber). The mass flow of mercury at the FGD exit is calculated by subtracting the net mercury loss in the FGD blowdown. This is illustrated in Figure 3. Using this calculation method, the removal in the FGD is estimated to be 84%.

V. Comparison of Results with Plants without SCR

In earlier programs (some of which were funded by the U.S. DOE), CONSOL sampled mercury at six plants with wet FGDs for SO_2 control, but without SCR catalysts.[2] At those plants, an average of 61±15% of the mercury was in the oxidized form at the air heater outlet, and the average mercury removal was 66±8%. Compared to the results reported here, the data suggest that the SCR had a positive effect on mercury removal in the wet FGD system at this plant. As additional plants are sampled under the program, this conclusion will be re-evaluated.

EXPERIMENTAL AND SAMPLING METHODS

I. Flue Gas Sampling Locations and Sampling Points

Three sampling locations, the SCR inlet, air heater outlet (upstream of the ESP), and stack outlet, were tested. Figure 1 is a flow schematic indicating the sampling locations.

A. SCR Inlet

Figure 4 is a schematic of the SCR inlet sampling location. The SCR inlet location consists of two vertically oriented ducts, designated as “Side A” and “Side B,” each measuring 12'-6" deep and 39’-2” wide. The ducts channel flue gas to two separate SCR reaction chambers. Each duct was sampled through a single test port, at a single, centrally located point.

Figure 5 is a photograph of the Hg sampling train on the SCR inlet. Hg measurements were conducted isokinetically.

B. Air Heater Outlet (ESP Inlet)

Figure 6 is a schematic of the Air Heater outlet sampling location. Flue gas is split in two ducts (Side A and Side B), each measuring approximately 8' deep and 46' wide. The sampling location is immediately downstream of the air heater ductwork attachment point and less than 36 inches from an upward turn of approximately 45-degrees to the ESP inlet plenum. The outside edges of the ductwork also flare outward at this point. Following a preliminary velocity traverse, the test team determined that a single point (located in ports P and K) was adequate to determine average flow.

Figure 7 is a photograph of the Hg sampling train on the Air Heater outlet. Hg measurements were conducted isokinetically.

C. Stack (FGD Outlet)

Figure 8 is a schematic of the Stack sampling location. The stack is 20 feet in diameter. Sampling was conducted through four sample access ports, each with four sample points, as determined by EPA Method 1, for a total of 16 traverse points.

Figure 9 is a photograph of the Hg sampling train on the stack. Hg measurements were conducted isokinetically. Because the stack was the only location where a full traverse was made, the volumetric gas flows at the other two locations were calculated for each test using the stack flow rate, corrected for temperature, pressure, moisture, and O_2 concentration (air in-leakage) differences.

II. Flue Gas Sampling Procedures

CONSOL R&D performed Hg flue gas determinations using the Ontario-Hydro sampling method. As a quality assurance/quality control (QA/QC) measure, samples of the coal, bottom ash, FGD lime slurry, FGD sludge, gypsum plant return water, and ESP ash,

were taken to determine a mercury balance across the system. A total of 12 Hg measurements were conducted over three days. Mercury measurements were a maximum of 120 minutes in duration. Due to high dust loading conditions, sampling times varied as discussed in the following sections. The shortened test durations had no effect on the measurements, because the results are based on the total amount of gas sampled, not the duration of the sampling test.

CONSOL R&D and plant personnel obtained process samples, concurrently with each test. Subsequent analyses were performed by CONSOL R&D and are included in this section.

A. SCR Inlet.

A preliminary pitot survey was conducted on August 18, 2003, and the flow was found to be laminar. Therefore, Hg measurements were conducted with the sampling nozzle oriented parallel to and directly into the flow. A single point was sampled through a single sample port in each duct.

Four Hg measurements were performed on the SCR inlet. The sample train was prepared in a Method 17 configuration using an in-stack 19 mm x 90 mm quartz-fiber thimble filter. The filter apparatus was connected to a heated probe that was attached to the impinger train with a Method 5 filter bypass piece.

Ideally each sampling run would have been a 120-minute duration. However, due to high particulate loading at this site, excessive vacuum, caused by filter particulate loading, forced the early termination of all test runs. Filters were changed to prolong the sampling, however, to maintain sample integrity, it was necessary to stop the tests. Runs 1 through 4 were 70, 100, 90, and 100 minutes, respectively.

B. Air Heater Outlet

Preliminary pitot surveys were conducted on August 18, 2003, and the flow was found to diverge toward the outside edge of the ducts. Flow was laminar nearer the center of the ducts so a single port was selected in each duct, through which a single point of average flow was sampled. Hg measurements were conducted with the sampling nozzle oriented parallel to and directly into the flow.

Four Hg measurements were performed on the Air Heater Outlet. The sample train was prepared in a Method 17 configuration using an in-stack 19 mm x 90 mm quartz-fiber thimble filter. The filter apparatus was connected to a heated probe that was attached to the impinger train with a flexible, heated, sample line.

Each duct was to be sampled for 60 minutes resulting in test durations of 120 minutes. However, due to high particulate loading at this site, excessive vacuum, caused by filter particulate loading, required the samplers to change filters during the test run. Only Run 1 lasted the full 120 minutes. To maintain sample integrity, it was necessary to stop tests 2 through 4 at 87, 93, and 80 minutes, respectively.

C. Stack

Preliminary pitot surveys were conducted on the August 18, 2003, and the flow was found to be laminar. Therefore, Hg measurements were conducted with the nozzle oriented horizontally, directly into the flow.

Four 120-minute sample runs were performed at the stack sampling location. A standard Method 5 sample train configuration was utilized for this location. Four ports, each with four sample points, were sampled for a total of sixteen sample points.

III. Ontario Hydro Flue Gas Hg Measurement Method

Flue gas Hg measurements were obtained using the Ontario-Hydro Hg speciation train. The sampling train schematic is shown in Figure 10.

Flue gas was extracted from the flue gas stream and pulled through a heated glass-lined probe and quartz filter. Total particulate matter mass loading was calculated from the solids collected prior to and in the filter. Probe and filter temperatures were maintained at 325 °F ±25 °F at the SCR Inlet and the Air Heater Outlet, and 250 °F ±25 °F at the Stack. Where particle interference was detected, the probe and filter temperature were maintained as close as practical to the flue gas temperature.

Mercury collected prior to and in the filter is assumed to be particulate Hg (Hg^{part}). The flue gas exits the quartz filter and passes through a series of chilled impingers. The first three impingers are filled with 100 ml of a 1M-potassium chloride (KCl) solution. It is assumed these impingers capture oxidized forms of Hg in the flue gas (Hg^{++}). The next impinger is filled with 100 ml of a 5% nitric acid and 10% H_2O_2 solution. The purpose of this impinger is to remove SO_2 from the flue gas to preserve the oxidizing strength of the permanganate impingers. Hg collected in this impinger is assumed to be the elemental form (Hg^0). The next two impingers are filled with 100 ml of an acidic potassium permanganate ($KMnO_4$) solution. It is assumed that these impingers collect elemental mercury (Hg^0). The next impinger is blank to catch any excess moisture. The gas exits the impinger train through a silica gel-filled impinger that removes the moisture from the flue gas. The train design results in the following species collection Hg sequence:

Table 7. Hg Speciation by Train Component

Train Component	Species Measured
Probe & Nozzle Rinse	Hg^{part}
Quartz Filter	Hg^{part}
KCl Impingers	Hg^{++}
HNO_3/H_2O_2 Impinger	Hg^0
$KMnO_4$ Impingers	Hg^0
HCl Rinse of $KMnO_4$ Impingers	Hg^0

The absorbing solutions were made fresh daily. The impingers were charged and the sampling components were transported to the required locations. The sampling trains were assembled, pre-heated, and checked for pitot and sample line leaks as detailed in EPA Methods 2 and 5, respectively. After passing the leak-check procedure, the sampling probes were inserted into their respective ducts, in-stack filters were allowed to heat to stack temperature, and sampling was initiated. Leak checks were also performed during port changes.

Oxygen readings were monitored at the outlet of the sampling train using a Teledyne Model Max 5 portable analyzer (electrochemical O_2 sensor). At the completion of the sampling period, the sample trains were checked for leaks, purged for 10 min, and then disassembled. The components were transported back to the lab trailer for recovery. The Hg concentration of the individual impinger solutions was determined by cold vapor atomic absorption spectroscopy (CVAA) as specified in the ASTM method. The concentration of Hg on the solids was determined by acid digestion followed by CVAA.

The amount of mercury collected in the impinger solutions was determined as outlined in EPA Method 29 and the Ontario-Hydro Draft Method. An aliquot of the impinger solution was acidified and the mercury was determined using cold vapor-atomic absorption spectroscopy. The atomic absorption spectrometer was calibrated with commercial mercury standard. The calibration was verified using NIST Standard 1641D. The calibration was reassessed periodically by analyzing a quality control standard. The instrument was recalibrated as required. Each sample matrix was analyzed as a set and an individual calibration curve was used for each set. Depending on sample type, selected samples were spiked with 2, 5, 10, or 15 ng/ml (ppb) of mercury and reanalyzed. Spike recovery must be within ±30% or the sample is diluted and reanalyzed. Selected samples were analyzed in duplicate. The duplicates must be within ±30% or the analyses were repeated.

Where sufficient solids were collected, particulate mercury was analyzed using a 0.5-1.0 gm ash sample. In cases where the particulate catch was low (primarily outlet filters) the entire filter sample was digested. The samples were digested with aqua-regia in pressure vessels prior to analysis by CVAA.

IV. Coal Sampling and Analysis

CONSOL R&D and plant personnel collected coal samples with each test run. Coal samples were analyzed using a direct mercury analyzer following the procedures of ASTM Method D6722. Detailed results of the coal analyses for each test are presented in Appendix B and summarized in Table 8.

Table 8. Analyses of Coal Samples

Sample ID	Plant 06-Coal-T1	Plant 06-Coal-T2	Plant 06-Coal-T3	Plant 06-Coal-T3
Analytical No.	32609	32610	32611	32612
Ash (dry, wt %)	9.62	9.49	9.56	9.11
Moisture (as det'd, wt%)	2.44	2.27	2.19	2.21
V.M. (dry, wt %)	39.51	39.75	39.89	40.17
Fixed C (dry, wt %)	50.87	50.76	50.55	50.72
HHV (Btu/lb)	13,296	13,361	13,375	13,454
MAF (Btu/lb)	14,711	14,762	14,789	14,803
Sulfur, total (dry, wt %)	4.48	4.69	4.85	4.87
Carbon (dry, wt %)	73.35	73.70	73.36	73.89
Hydrogen (dry, wt %)	4.97	5.50	4.99	4.98
Nitrogen (dry, wt %)	1.48	1.49	1.44	1.44
Chlorine (dry, wt %)	0.041	0.051	0.051	0.041
Oxygen (dry, wt %), by diff	6.06	5.58	5.75	5.67
Mercury (as det'd, ppm)	0.10	0.09	0.09	0.10
Major Ash Elements (dry, wt%)				
SiO_2	41.19	38.61	37.75	36.66
Al_2O_3	20.04	18.35	18.00	20.14
TiO_2	0.83	0.79	0.77	0.82
Fe_2O_3	29.98	31.40	33.43	32.82
CaO	2.72	2.55	2.4	2.86
MgO	0.72	0.66	0.63	0.68
Na_2O	0.66	0.45	0.43	0.48
K_2O	1.61	1.49	1.41	1.55
P_2O_5	0.26	0.19	0.21	0.23
SO_3	3.15	3.12	2.89	2.80

Unit #1 was equipped with six coal bins, each with several 6-inch ports welded to the bin. Shown in Figure 11 is a schematic of the coal bins and locations of ports where coal samples were collected. The two smaller circles (dashed line) inside each bin were the coal pipes at the bottom of each bin. Coal samples were collected from each bin using a sampling thief (Figure 12). This device was made of two concentric tubes, with openings in both. Sample material falls through the openings and collects inside the inner tube; the inner tube is then rotated to close the openings and “lock” the samples inside the inner tube.

Figure 13 shows a coal sample being retrieved from a coal bin using the sampling thief. The amount of coal collected from each bin was about 3-4 pounds. Each bin was sampled twice during each test. During Test 2, Coal Bin #1B was sampled only once,

because this bin was in maintenance while the second set of samples was being collected. Coal samples collected during each test were kept in a 5-gallon plastic bucket. Table 9 lists the coal bins sampled and the sampling times.

Table 9. List of coal samples

Test No.	Test Date	Coal Bin ID	Sampling Time		Sample ID
1	08/19/03	1A	11:45	13:34	Plant 06-Coal-T1
		1B	11:41	13:36	
		1C	11:52	13:39	
		1D	11:55	13:41	
		1E	12:01	13:46	
		1F	12:05	13:49	
2	08/20/03	1A	8:51	10:18	Plant 06-Coal-T2
		1B	8:53	---	
		1C	8:55	10:21	
		1D	8:59	10:24	
		1E	9:03	10:26	
		1F	9:06	10:28	
3	08/20/03	1A	13:03	14:10	Plant 06-Coal-T3
		1B	13:05	14:12	
		1C	13:10	14:15	
		1D	13:12	14:19	
		1E	13:15	14:25	
		1F	13:17	14:30	
4	08/21/03	1A	9:25	10:17	Plant 06-Coal-T4
		1B	9:27	10:21	
		1C	9:31	10:25	
		1D	9:33	10:27	
		1E	9:35	10:31	
		1F	9:37	10:35	

V. Process Sample Collection and Analysis

CONSOL R&D and Plant 6 personnel collected samples of the feed lime slurry, gypsum plant return water, the FGD scrubber blowdown, boiler bottom ash, and ESP ash with each test run. Solid samples were analyzed using a direct mercury analyzer following the procedures of ASTM Method D6722. The mercury in liquid samples was determined using cold vapor-atomic absorption spectroscopy. Detailed results of the process material analyses are presented in Appendix B.

A. Lime Slurry

The lime slurry samples were collected at the lime slurry sampling pipe welded to the discharge end of the lime slurry feed pump, as shown in Figure 14. Two samples were collected during each test. The volume of sample collected each time was 2.5 to 3.5 liters. The two lime samples collected in each test were stored in a 2-gallon plastic bucket. Table 10 lists the lime slurry samples and sampling times.

Table 10. Lime Slurry Samples.

Test No.	Test Date	Sampling Time	Sample ID
1	08/19/03	12:21	Plant-06-LmS-T1
		14:06	
2	08/20/03	9:27	Plant-06-LmS-T2
		10:30	
3	08/20/03	13:27	Plant-06-LmS-T3
		14:44	
4	08/21/03	9:44	Plant-06-LmS-T4
		10:43	

Each lime slurry sample was filtered to generate *solids* (i.e., filter cake) and *filtrate* samples for subsequent analyses. The analyses of the lime slurry solids and filtrate samples are listed in Tables 11 and 12, respectively. The amount of Hg detected in the lime slurry solids ranged from 0.24 to 0.26 ppm and there was essentially no Hg detected in the corresponding filtrate samples. These results show that the Hg species in the lime slurry were present in the solids phase of the slurry samples, not the liquid phase. This elevated level of Hg in the lime slurry (which is an input stream) was due to the process configuration, in which magnesium hydroxide slurry recovered from the gypsum plant is mixed with the pebble lime in the slaker.[4]

[4] U.S. Patent #6,572,832 B2, "Method of Removing Sulfur Dioxide from a Gaseous Stream in a Wet Scrubbing Unit," June 3, 2003.

Table 11. Analyses of Lime Slurry Solids Samples

Sample ID	Plant-06-LmS-T1	Plant-06-LmS-T2	Plant-06-LmS-T3	Plant-06-LmS-T4
Analytical No.	32634	32635	32636	32637
% solids, as det'd	35.18	34.10	33.95	34.39
% moisture, as det'd	4.96	4.05	4.30	4.48
Ash (dry, %)	72.44	72.99	72.89	73.87
Sulfur, total (dry, wt%)	1.45	1.28	1.36	2.12
Chlorine (dry, wt%)	<0.02	<0.02	<0.02	<0.02
Mercury (as det'd, ppm)	0.26	0.24	0.24	0.25
Major Ash Elements (dry, wt%)				
SiO_2	2.50	2.45	2.45	2.23
Al_2O_3	0.58	0.57	0.59	0.53
TiO_2	0.02	0.02	0.02	0.02
Fe_2O_3	0.21	0.22	0.22	0.19
CaO	38.04	37.22	37.05	40.12
MgO	28.68	29.29	29.94	25.39
Na_2O	<0.01	<0.01	<0.01	<0.01
K_2O	0.04	0.06	0.04	0.03
P_2O_5	<0.01	0.01	0.01	<0.01
SO_3	3.63	3.21	3.39	5.29

Table 12. Analyses of Lime Slurry Filtrate Samples.

Sample ID	Plant-06-LmS-T1	Plant-06-LmS-T2	Plant-06-LmS-T3	Plant-06-LmS-T4
Analytical No.	33482	33483	33484	33485
Ca (ppm)	1,480	1,440	1,440	1,430
Mg (ppm)	2.54	0.68	0.45	0.46
Na (ppm)	85.6	89.3	108	84.7
NO_3 as N (ppm)	< 0.5	< 0.5	< 0.5	< 0.5
Cl (ppm)	250	250	250	240
Hg (ppb)	< 1.0	< 1.0	<1.0	<1.0

B. Gypsum Plant Return Water Samples

The scrubber sludge was oxidized ex-situ in the gypsum plant about half a mile away from the FGD building. The gypsum was discharged onto a belt filter and washed to remove dissolved salts. The spent water was collected and returned to the FGD building as scrubber make-up water. This *gypsum plant return water* (GPRW) was collected from a one-inch pipe welded to the main return line as shown in Figure 15. Two 4-oz samples were collected during each test. Table 13 lists the water samples collected and the sampling times.

Table 13. List of Gypsum Plant Return Water Samples.

Test No.	Test Date	Sampling Time	Sample ID
1	8/19/2003	12:19	Plant-06-GPRW-T1-1
		13:56	Plant-06-GPRW-T1-2
2	8/20/2003	9:24	Plant-06-GPRW-T2-1
		10:34	Plant-06-GPRW-T2-2
3	8/20/2003	13:30	Plant-06-GPRW-T3-1
		14:47	Plant-06-GPRW-T3-2
4	8/21/2003	9:48	Plant-06-GPRW-T4-1
		10:53	Plant-06-GPRW-T4-2

The results of analyses of gypsum plant return water samples are listed in Table 14. Hg was detected at the ppb level in these samples.

Table 14. Analyses of Gypsum Plant Return Water Samples

Sample ID	Plant-06-GPRW-T1-1	Plant-06-GPRW-T1-2	Plant-06-GPRW-T2-1	Plant-06-GPRW-T2-2	Plant-06-GPRW-T3-1	Plant-06-GPRW-T3-2	Plant-06-GPRW-T4-1	Plant-06-GPRW-T4-2
Analytical No.	32626	32627	32628	32629	32630	32631	32632	32633
S, total (ppm)	573	553	536	544	547	548	528	548
Cl (ppm)	605	615	620	620	625	615	625	620
Hg (ppb)	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	1.8

C. Scrubber Blowdown Slurry

The scrubber slurry samples were collected at the “pH pots” near each module. Figure 16 is a picture of a pH pot. About one liter (2 x 500 ml) of scrubber slurry was collected each time and each scrubber module was sampled twice during each test. All slurry samples collected in one test were stored in a 2-gallon plastic bucket. Table 15 is a list of the scrubber slurry samples collected at the plant and the sampling times. There were four scrubber modules, A, B, C and D. Only A, B, and C were in operation during the tests.

Table 15. List of Scrubber Slurry Samples.

Test No.	Test Date	Moduel ID	Sampling Time	Sample ID
1	08/19/03	1A	12:22	Plant 06-FGD-T1
		1B	12:24	
		1C	12:25	
		1A	13:57	
		1B	13:58	
		1C	14:00	
2	08/20/03	1A	9:15	Plant 06-FGD-T2
		1B	9:17	
		1C	9:20	
		1A	10:31	
		1B	10:32	
		1C	10:33	
3	08/20/03	1A	13:33	Plant 06-FGD-T3
		1B	13:34	
		1C	13:35	
		1A	14:49	
		1B	14:50	
		1C	14:51	
4	08/21/03	1A	9:51	Plant 06-FGD-T4
		1B	9:52	
		1C	9:53	
		1A	10:48	
		1B	10:50	
		1C	10:50	

Tables 16 and 17 list the scrubber slurry solids (i.e., filter cake) analyses and filtrate samples analyses, respectively. The Hg detected in the scrubber slurry solids samples ranged from 0.61 to 0.73 ppm, while the amount of Hg detected in the corresponding filtrate portions were at the ppb levels, which indicates that essentially all of the Hg in the scrubber slurry was present in the slurry solids.

Table 16. Analyses of Scrubber Slurry Solids Samples.

Sample ID	Plant 06-FGD-T1	Plant 06-FGD-T2	Plant 06-FGD-T3	Plant 06-FGD-T4
Analytical No.	32622	32623	32624	32625
% Solids in org. slurry sample	19.06	18.90	18.65	19.91
% Solids in filtered cake	42.56	44.52	43.02	44.39
% Moisture in air-dried sample	12.15	12.23	11.36	13.17
Carbon (dry, %)	0.13	0.07	0.10	0.12
Sulfur, total (%)	19.27	18.78	19.05	19.29
Chlorine (dry, %)	0.114	0.137	0.082	0.076
Mercury (ppm)	0.73	0.64	0.65	0.61
Major Ash Element (%)				
SiO_2	2.57	2.04	2.13	1.90
Al_2O_3	0.55	0.46	0.50	0.46
TiO_2	0.02	0.02	0.02	0.02
Fe_2O_3	0.30	0.24	0.27	0.26
CaO	32.70	32.02	32.78	32.26
MgO	3.03	3.28	2.74	3.54
Na_2O	0.02	0.02	0.03	0.03
K_2O	0.06	0.06	0.06	0.05
P_2O_5	<0.01	<0.01	<0.01	<0.01
SO_3	48.18	46.94	47.63	48.22
UND	12.57	14.92	13.84	13.26

Table 17. Analyses of Scrubber Slurry Filtrate Samples.

Sample ID	Plant 06-FGD-T1	Plant 06-FGD-T2	Plant 06-FGD-T3	Plant 06-FGD-T4
Analytical No.	33478	33479	33480	33481
Ca (ppm)	60.0	63.2	56.9	58.2
Mg (ppm)	7,250	7,430	6,700	6,780
Na (ppm)	94.2	87.3	86.9	87.2
NO_3 as N (ppm)	<0.5	<0.5	<0.5	<0.5
Cl (ppm)	9,900	6,450	5,600	5,700
Hg (ppb)	< 1.0	1.0	< 1.0	2.5

D. Bottom Ash Samples

An FGD operator collected a bottom ash sample from an ash truck in the morning of Thursday, August 21, 2003. Figure 17 is a picture taken on that date while the bottom ash was being unloaded from the hydro bin into a truck. The bottom ash was emptied from the hydro bin every Monday and Thursday morning.

Table 18 shows the analysis of the bottom ash sample. The amount of Hg detected in this bottom ash sample was 0.010 ppm.

Table 18. Analysis of Bottom Ash Sample

Analytical No.	32621
Moisture (as det'd, %)	0.04
Sulfur, total (dry, %)	0.25
Carbon (dry, %)	0.21
Chlorine (dry, %)	<0.01
Mercury (as det'd, ppm)	0.01
Major Ash Element (dry, %)	
SiO_2	37.83
Al_2O_3	17.14
TiO_2	0.81
Fe_2O_3	39.10
CaO	3.29
MgO	0.69
Na_2O	0.33
K_2O	1.24
P_2O_5	0.18
SO_3	0.62

E. ESP Hopper Ash

There are two rows of ESP hoppers per unit. Each row of hoppers is equipped with a common ash transfer pipe beneath the hoppers, as shown in Figure 18.

After the ash drops into the transfer pipe, it is transferred pneumatically upwards to the ash silo located behind the FGD building. A sampling pot is attached to the end of a sampling line, connected to each transfer pipe, as shown in the picture on the left of Figure 19. Shown on the right side of Figure 19 is an enlarged view of a sampling pot. There is an air-actuated valve mounted in each ash sampling line. The valve can be opened or closed manually by pushing the corresponding button inside an electric panel mounted to the right of the sampling lines. Figure 20 is a picture of the electric panel controlling the operation of the air-actuated valves.

The two ESP ash samples collected during Test 1 were mistakenly collected from Sampling Pot #2 at Unit #2. All other ESP hopper ash samples were collected from Sampling Pot #2 at Unit #1. Listed in Table 19 are these ESP hopper ash samples. To compare the results of analyses, the plant also provided a split sample on August 21, which is listed at the bottom of the table as Plant 06 ESP Ash-U1.

Table 19. List of ESP hopper ash samples

Test No.	Test Date	Sample Time	Sample ID
1	8/19/2003	12:45	Plant-06 ESP Ash-U2-T1-1
		14:30	Plant-06 ESP Ash-U2-T1-2
2	8/20/2003	10:03	Plant-06 ESP Ash-U1-T2-1
		10:45	Plant-06 ESP Ash-U1-T2-2
3	8/20/2003	13:50	Plant-06 ESP Ash-U1-T3-1
		15:10	Plant-06 ESP Ash-U1-T3-2
4	8/21/2003	10:10	Plant-06 ESP Ash-U1-T4-1
		12:22	Plant-06 ESP Ash-U1-T4-2
	8/21/2003		Plant-06 ESP Ash-U1

Table 20 lists the analyses of the ESP hopper ash samples. The amount of Hg detected in the ash samples ranged from 0.03 to 0.13 ppm. The amount of Hg was correlated with the amounts of carbon present in the ash, with a least-squares r^2 of 0.946, as shown in Figure 21.

Table 20. Analyses of ESP Hopper Ash Samples

Sample ID	Plant-06	Plant-06	Plant-06	Plant-06	Plant-06	Plant-06	Plant-06	Plant-06	Plant-06
Test No.	1	1	2	2	3	3	4	4	
Test Date	08/19/03	08/19/03	08/20/03	08/20/03	08/20/03	08/20/03	08/21/03	08/21/03	08/21/03
Sample Time	12:45	14:30	10:03	10:45	13:50	15:10	10:10	12:22	
Analytical No.	32613	32614	32615	32616	32617	32618	32619	32620	32638
Ash (dry, %)	96.41	96.36	94.09	95.23	92.92	93.11	93.11	95.06	93.05
Moisture (as det. %)	0.19	0.17	0.40	0.31	0.31	0.34	0.33	0.27	0.39
Sulfur, total (dry, %)	0.50	0.40	0.50	0.50	0.60	0.60	0.70	0.60	0.60
Carbon, total (dry, %)	3.12	3.26	4.98	4.14	5.93	5.98	5.80	4.29	6.10
Chlorine (dry, %)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury (as det. ppm)	0.04	0.03	0.11	0.07	0.13	0.12	0.13	0.08	0.12
Major Ash Element (dry, %)									
SiO_2	38.00	41.69	36.61	35.57	37.27	36.47	35.83	37.99	35.52
Al_2O_3	17.43	20.01	16.60	16.01	17.22	16.84	16.64	18.50	16.57
TiO_2	0.83	0.91	0.79	0.77	0.83	0.81	0.80	0.84	0.79
Fe_2O_3	31.80	31.06	31.39	34.51	28.91	29.63	30.51	34.10	29.62
CaO	2.93	3.17	2.73	2.84	2.78	2.77	2.82	3.05	2.85
MgO	0.66	0.75	0.64	0.62	0.66	0.64	0.62	0.66	0.61
Na_2O	0.39	0.45	0.40	0.36	0.43	0.42	0.42	0.42	0.42
K_2O	1.37	1.61	1.34	1.23	1.40	1.35	1.33	1.42	1.32
P_2O_5	0.17	0.22	0.15	0.14	0.18	0.16	0.17	0.22	0.16
SO_3	1.24	1.20	1.47	1.35	1.71	1.65	1.90	1.69	1.74

QUALITY ASSURANCE/QUALITY CONTROL

The sampling and analysis QA/QC procedures are described below.

- Personnel specifically trained and experienced in power plant sampling methods, including the Ontario-Hydro Hg sampling method, conducted all sampling,
- The sampling equipment was maintained and calibrated as required,
- Consistent sample preparation and recovery procedures were used,
- Samples were logged and tracked under the direction of sample team Group Leader,
- Individual calibration curves were developed for each sample matrix,
- NIST Standard Reference Material (SRM) and lab QC samples were analyzed to verify calibration curves,
- Duplicates of selected samples were analyzed to assure repeatability,
- Analyses of selected "spiked" samples were analyzed to assure sample recovery, and
- Interim data were reviewed to assure sample completeness.

All samples were obtained using the procedures described in EPA Method 5 and the Ontario-Hydro Hg Speciation draft method. Data were recorded on standard forms, which are included in Appendix C. The field data were reduced using standard "in-house" spreadsheets. Copies of the summary sheets are included in Appendix C. To assure consistency, all of the Ontario-Hydro train components were prepared and recovered under the supervision of a senior technician experienced in the Ontario-Hydro Hg speciation lab techniques. Copies of the recovery sheets are included in Appendix A.

The Ontario-Hydro sampling train analysis consisted of eight sub-samples. Each sub-sample analysis consisted of developing a calibration curve (absorbance versus Hg concentration in solution), checks of field and lab blanks, calibration checks with SRM and lab standards, selected duplicates and selected sample spikes. The laboratory summaries for each of these runs are contained in Appendix A.

A total of ~199 individual Hg determinations were completed. This included 12 blank samples, 29 NIST SRM or lab QC checks, 15 sample spikes, and 15 duplicate analyses.

Blank Samples

A total of 10 blank liquid samples were analyzed. The average blank value was <1.1 ng/ml (ppb in solution). The average blank value is less than any individual detectable Hg^{part}, Hg^{++}, or Hg^{0} determination in ng/ml and, more importantly, is less than the Hg concentration detection limit (discussed later in this report). Consequently, in this report, blank concentrations were not subtracted out from any Hg determination.

NIST SRM Checks

Twenty-nine NIST SRM checks were conducted throughout the Hg determinations. Two standards were used in the determinations as detailed in Table 21.

Table 21. NIST SRM Analyses

NIST SRM	Standard Value	Sample Fraction	Samples Analyzed	Average Result (ng/ml or ng/mg)	Percent of Standard	Standard Deviation (ng/ml)	Percent Relative Standard Deviation
1641D	8.0 ng/ml	Ontario Hydro Liquids	28	8.27	103%	0.52	6.3%
1633B	0.141 ng/mg	Ontario Hydro Filters	1	.015	106%	NA	NA

The result of this QA/QC procedure was an average Hg determination that was 103% of the standard, with a 6.3% standard deviation.

Spike Sample Recoveries

A total of 16 samples were spiked with a 2, 5, or 10 ppb Hg standard and then re-analyzed to determine the percent spike recovery. The result of this QA/QC procedure was an average spike recovery of 94.3% recovery with a 4.1% standard deviation.

Duplicate Analyses

A total of 16 duplicate analyses were conducted periodically throughout the Hg determinations. The result of this QA/QC procedure was an average Hg determination that was within 2.8% of the original Hg determination, with a 4.6% standard deviation.

Flue Gas Hg Concentration Detection Limits

For liquid samples, the flue gas Hg concentration was calculated using the following equation:

$$Hg\left[\mu g / m^3\right] = \frac{\left(C_{imp}\ x V_{imp}\right)}{\left(V_{gas}\ x 1000\right)}$$

where:
- C_{imp} = Hg concentration of impinger solution [ng/mL (ppb)]
- V_{imp} = Liquid volume of impinger solution [mL]
- V_{gas} = Flue gas sample volume [dry standard m^3]
- 1000 = Conversion factor [1000 ng per µg]

The flue gas Hg detection limit is reduced when the flue gas sample volume is increased or liquid volume of impinger solution is decreased. The CVAA is calibrated between 0 and 20 ng/ml. Over this range, the calibration curve between absorbance and concentration is linear. The lowest concentration standard used to develop the calibration curve is 0.500 ng/ml. In addition, the detection limit of the liquid CVAA

analysis was <1.0 ng/ml. The prescribed sampling and recovery procedures result in final liquid volumes varying between 50 and 712 ml. The volume of flue gas collected varied between 1.175 and 2.145 dscm. The sampling variables result in sample-specific flue gas detection limit. The flue gas Hg detection limit for each sample matrix are listed in Table 22.

Table 22. Flue Gas Hg Detection Limits

Matrix	Maximum Liquid Volume [ml]	Minimum Gas Volume [dscm]	Flue Gas Detection Limit [$\mu g/m^3$]
Probe Rinse	150	1.175	0.13
KCl Impinger	712	1.175	0.61
HNO_3/H_2O_2 Impingers	182	1.175	0.15
$KMnO_4$ Impingers	250	1.175	0.21
HCl Rinse	50	1.175	0.04

Depending on the matrix, the flue gas Hg detection limit ranged from 0.04 to 0.61 $\mu g/m^3$. When compared with the total Hg concentrations ranging from 1.85 to 33.95 $\mu g/m^3$, the flue gas detection limit is low enough to be insignificant in the flue gas calculations.

Mercury Material Balance Calculation Method

To calculate the material balance for Hg, the following parameters were used:

(1) Fifteen percent (15%) of the flue gas bypassed the FGD.
(2) Bottom ash accounted for fifteen percent (15%) of the total ash from coal and the fly ash accounted for the remaining 85%.
(3) The FGD removed 98.5% of the SO_2 entering the FGD.
(4) FGD blowdown rate was 1,200 gpm
(5) GPRW flow rate was 850 gpm

During normal operation, about 15% of the flue gas bypasses the FGD. Based on the U.S. Department of Energy, Energy Information Administration's (EIA) by- year 2002 Annual Steam-Electric Plant Operation and Design Data, the amounts of flyash and bottom ash generated at the whole plant (two units combined) were 319.1 and 57.3 thousand lb, respectively. Based on these two numbers, the percentage of bottom ash was 15.2% of the total ash produced at the plant. For material balance calculation, a round number of 15% was used for the amount of bottom ash generated during testing, and 85% for fly ash.

Listed in the following table are the annual average coal sulfur contents and SO_2 emissions obtained from EIA and EPA's databases.[5] Based on the coal sulfur contents

[5] U.S. Department of Energy, Energy Information Administration, Annual Steam-Electric Plant Operation and Design Data, EIA-767 Data Files,

in EIA's fuel quality databases and the EPA unit-specific SO_2 emissions databases, the SO_2 removals for years 1999, 2000, and 2001 were calculated to be 83.4%, 82.5%, and 80.8%, respectively. The three-year average SO_2 removal was 82.2%. Since 15% of the flue gas bypassed the FGD, the average SO_2 removal efficiency by the FGD was 96.8% (i.e., 82.2% divided by 85%). A slightly higher (than 96.8%) SO_2 removal efficiency was assumed to account for the small amounts of sulfur in the bottom ash and ESP hopper ash. Information provided by CarmeuseNA indicated that the about 98-99% of the SO_2 entering the FGD was removed.[6] For the material balance calculation an SO_2 removal efficiency of 98.5% was assumed.

Year	S in Coal (tons)[1]	SO_2 Emissions (tons)[2]	Coal S based Removal (%)
2001	61,257	23,528	80.8%
2000	66,550	23,357	82.5%
1999	59,310	19,752	83.4%
		Average =	82.2%

Plant personnel provided the following information: the flow rate of FGD blowdown per module was 150-400 gpm and the flow rate of gypsum plant return water (GPRW) to each module was 50-300 gpm.[7] CarmeuseNA provided the design FGD blowdown rate and GPRW flow rate of 1,250 gpm and 900 gpm, respectively.[8] Since the rated capacity of this unit is 684 MW and the plant was run at about 650 MW during the testing, to calculate the material balance for Hg, the FGD blowdown rate and the GPWR flow rate were assumed to be 1,200 GPM and 850 gpm, respectively.

HHttp://www.eia.doe.gov/cneaf/electricity/page/eia767.htmlH

[6] Personal communication with K Smith, December 1, 2003.

[7] Email responses from K Smith (CarmeuseNA) on December 3, 2003 and plant personnel on December 5, 2003.

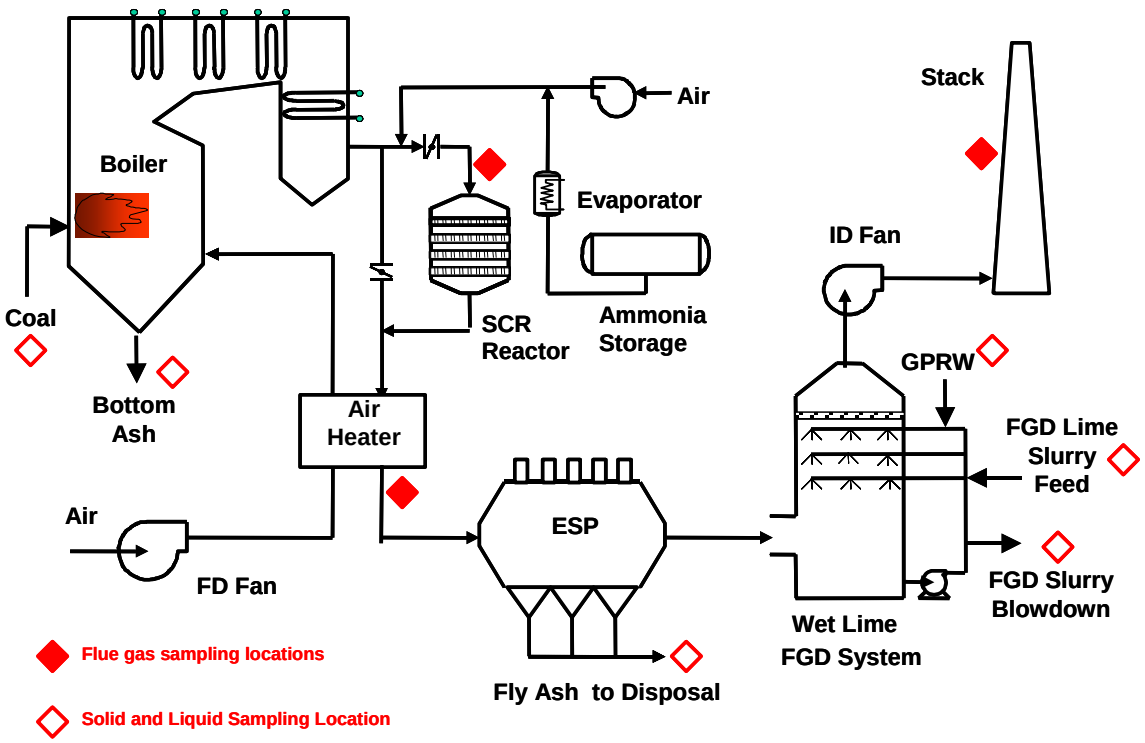


Figure 1. Plant Schematic Showing the Sampling Locations

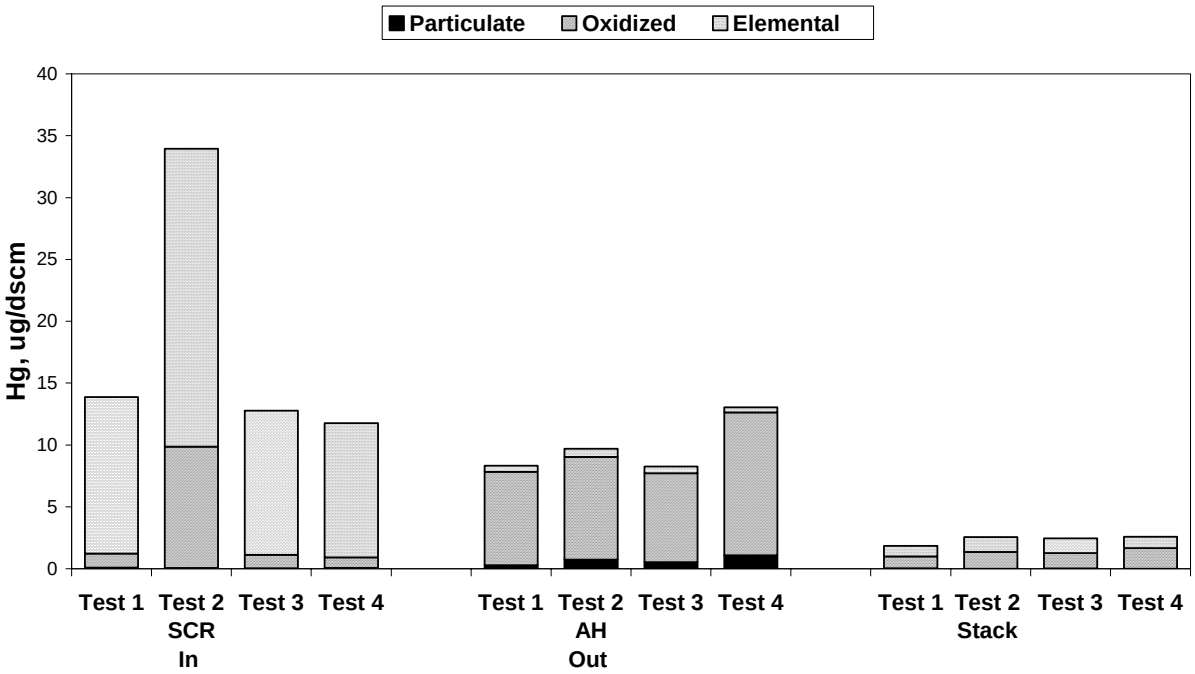
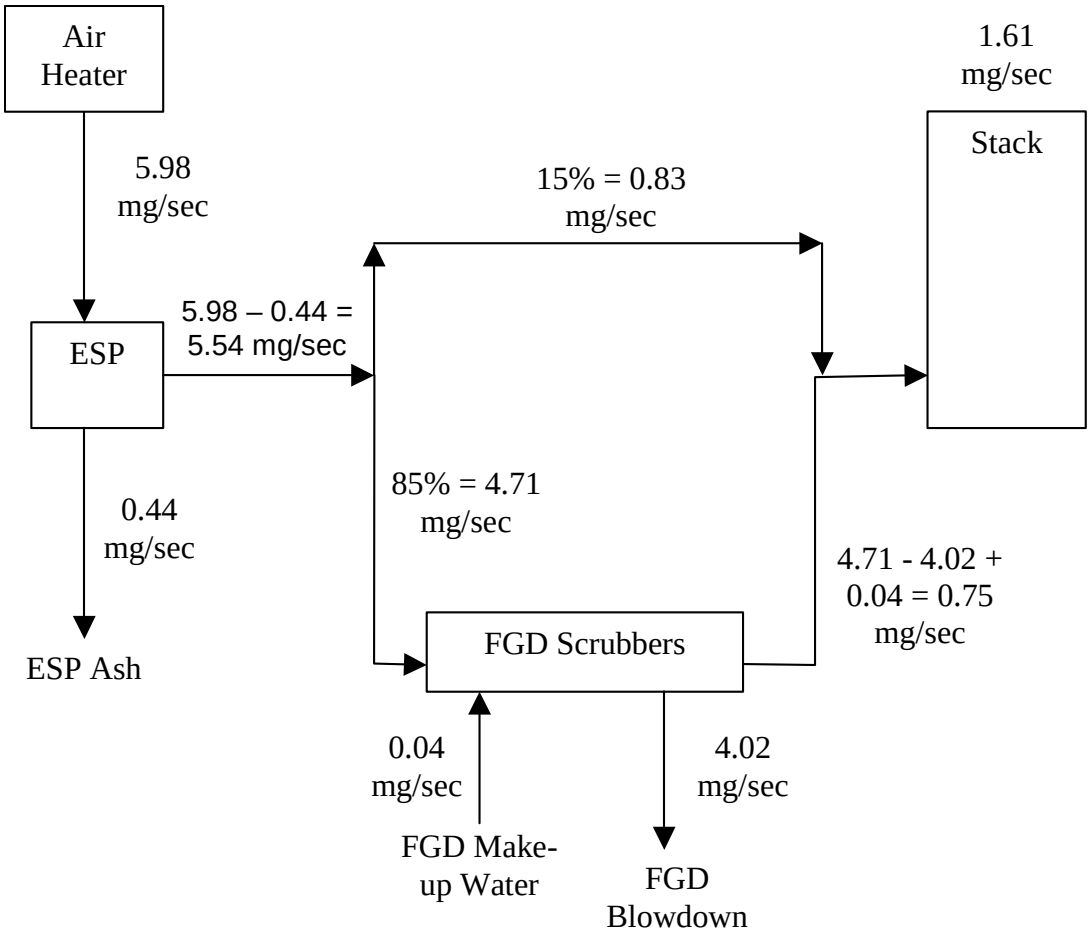
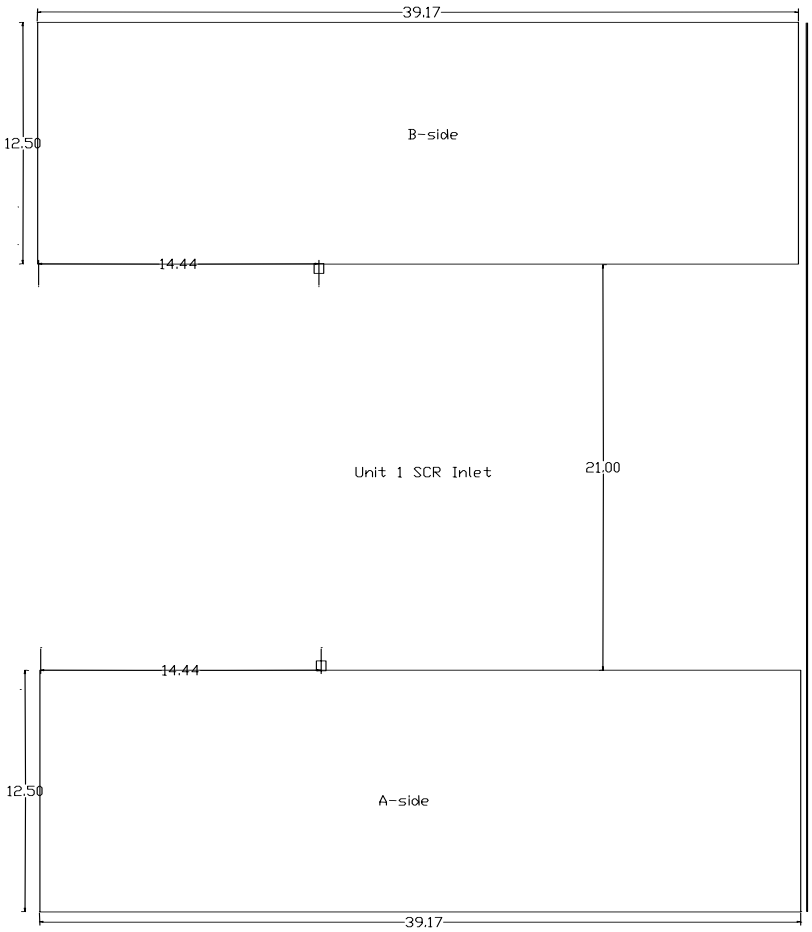


Figure 2. Mercury Speciation



% Removal in FGD = 1 – 0.75 / 4.71 = 84 %

Figure 3. Calculation of Mercury Removal in the FGD



NOTES:
Sample a single point, at the center of each duct, for 60 minutes, 120 minute total test using glass-lined 8-ft. sample probe with an in-stack filter arrangement.

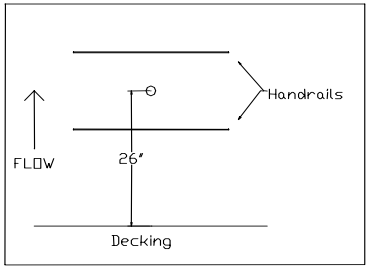


Figure 4. SCR Inlet Sampling Location

Figure 5. SCR Inlet Hg Sampling Train

Notes:
Sample Single Points in Ports K and P at Duct Centerline.

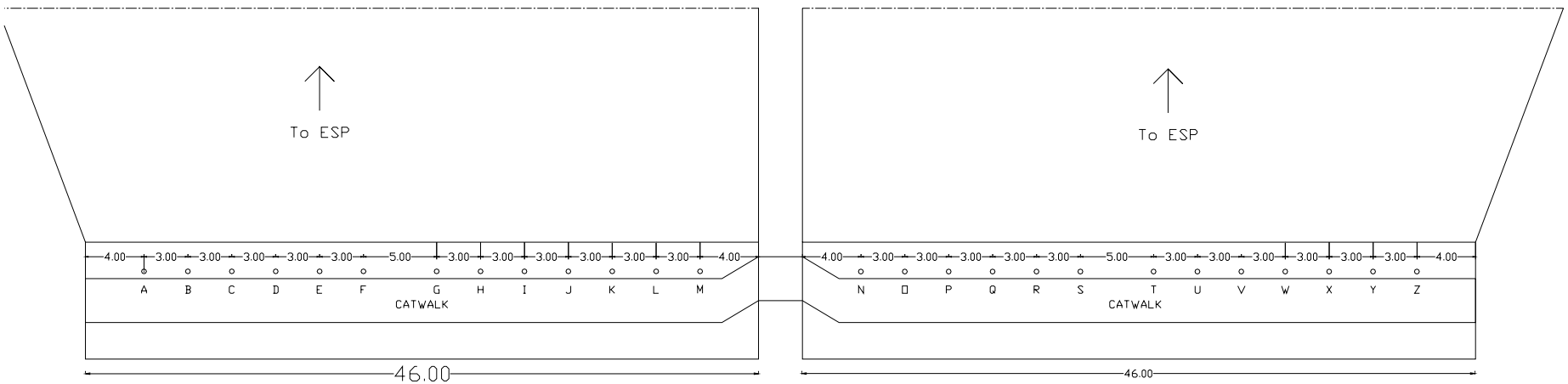


Figure 6. Air Heater Outlet Sampling Location Schematic

Figure 7. Air Heater Outlet Sampling Location

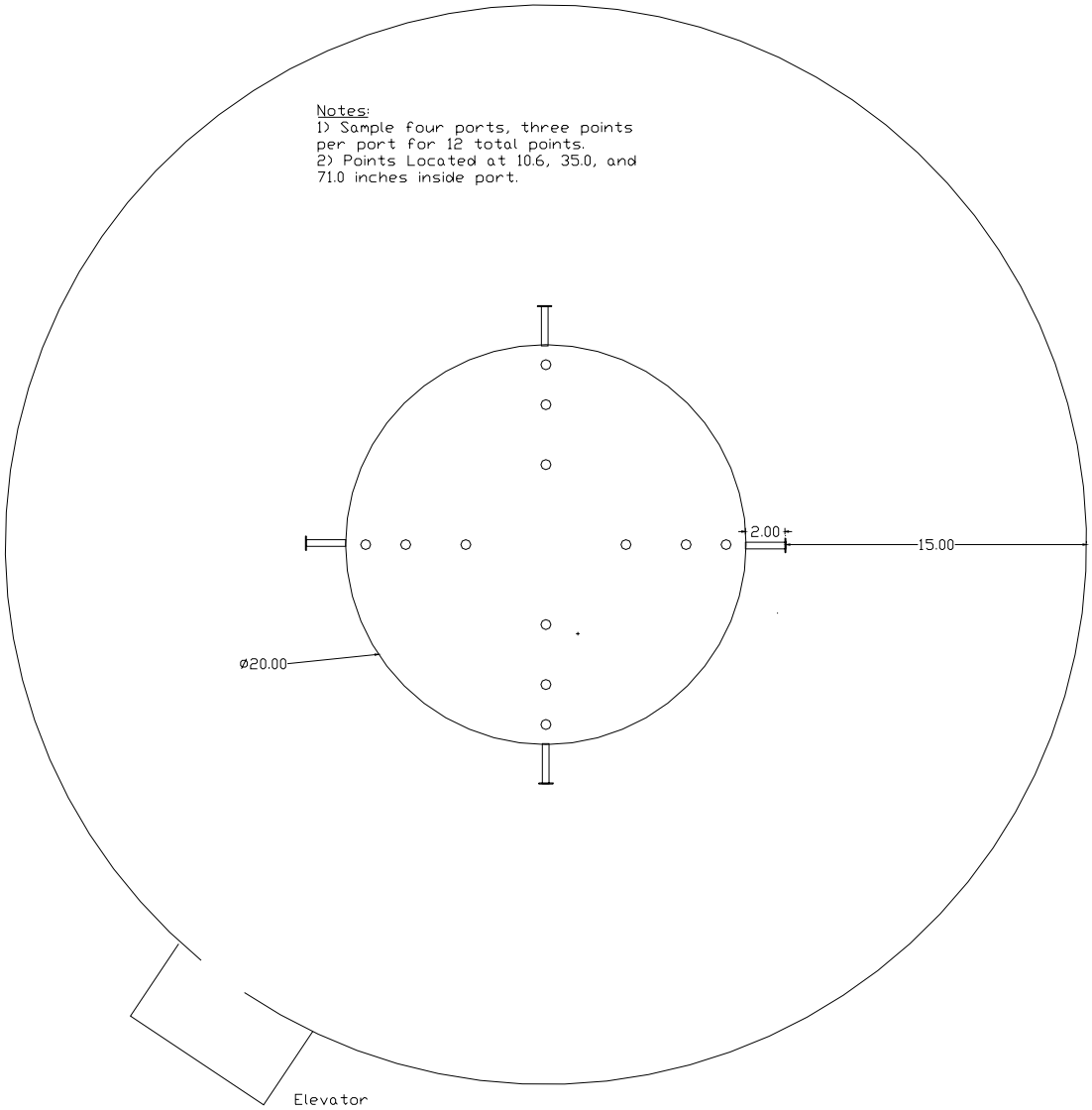


Figure 8. Stack Sampling Location Schematic

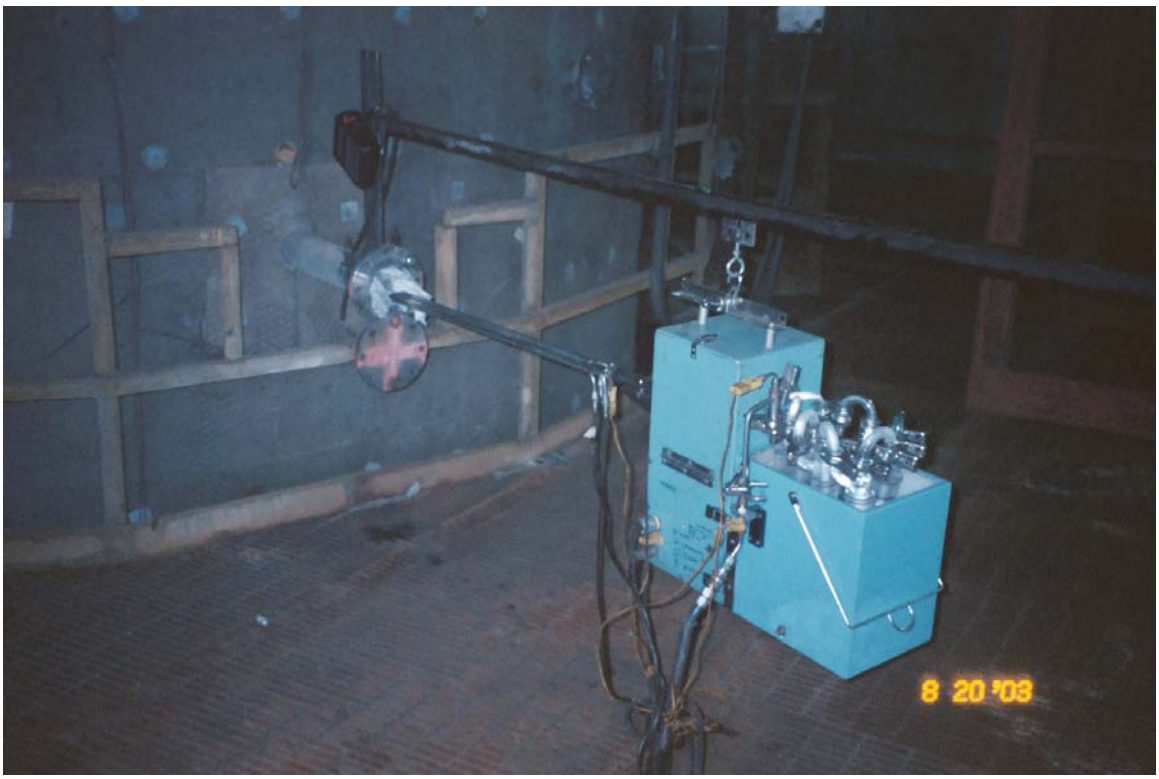


Figure 9. Stack Sampling Train

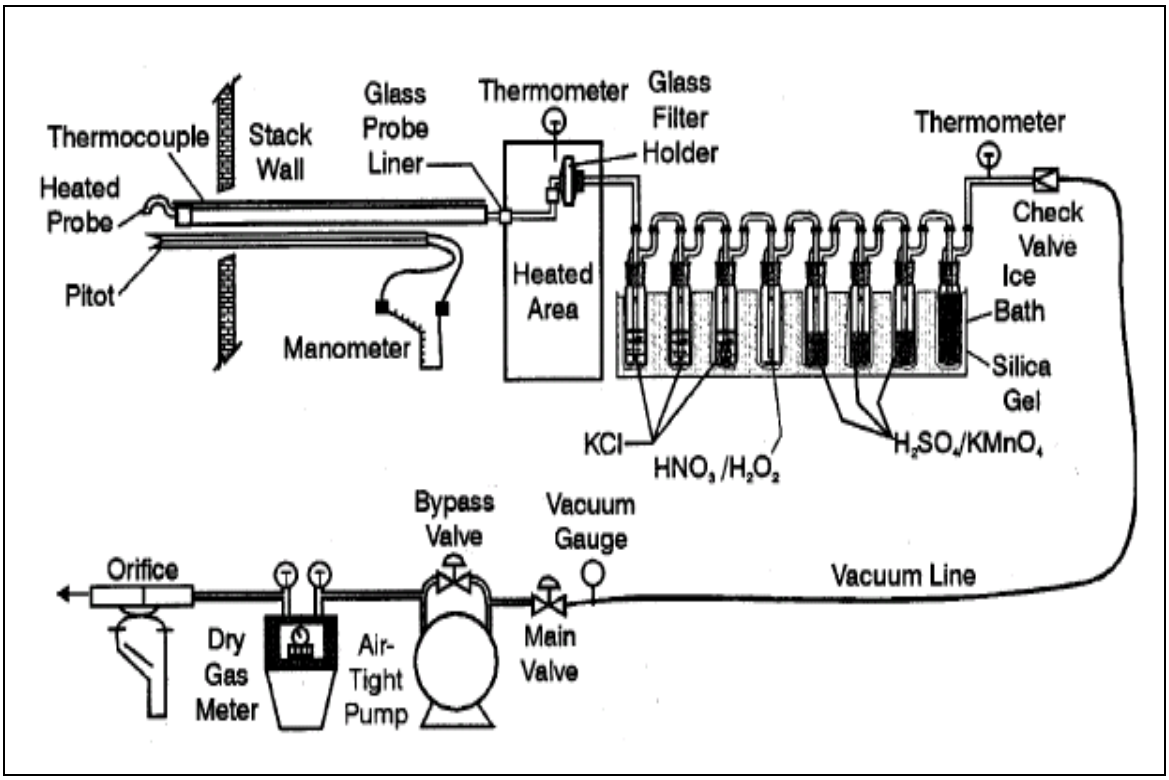


Figure 10. The Ontario Hydro Method

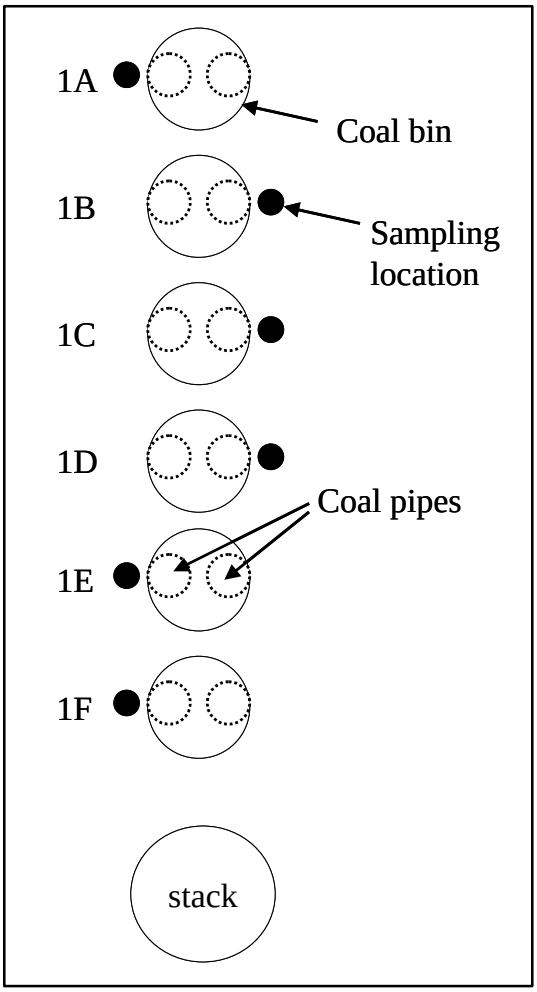


Figure 11. Coal sampling locations

Figure 12. Picture of the sampling “thief”

Figure 13. Collecting a coal sample.

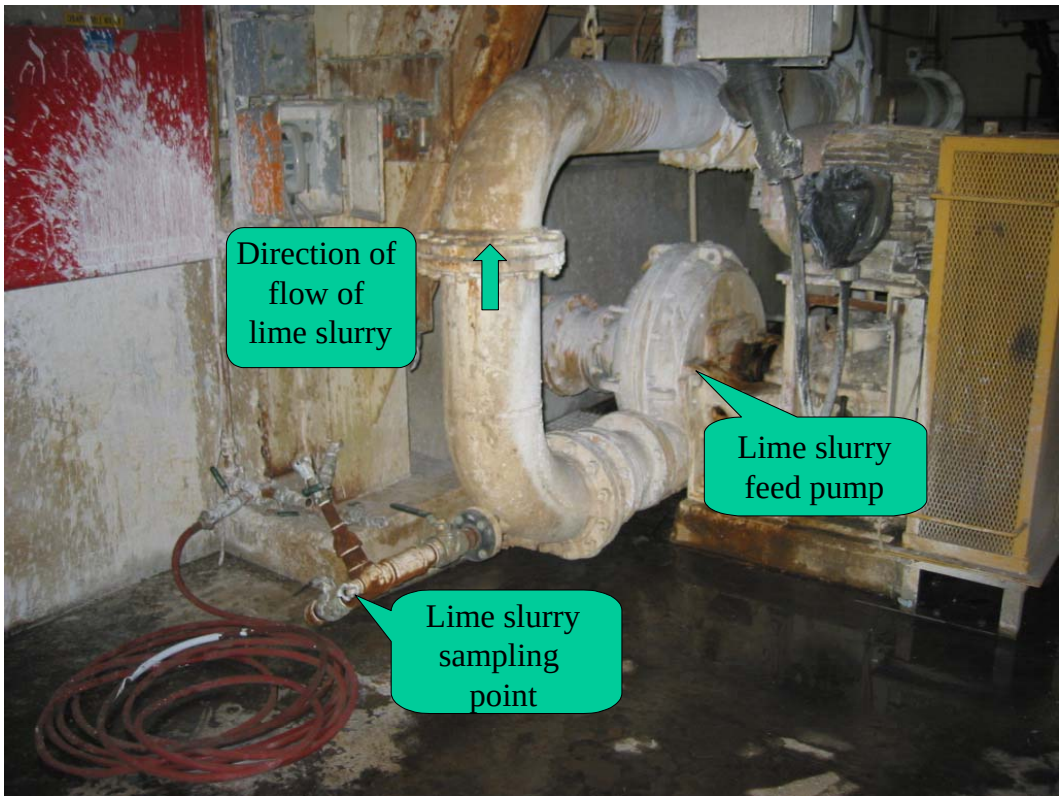


Figure 14. Lime slurry sampling location.

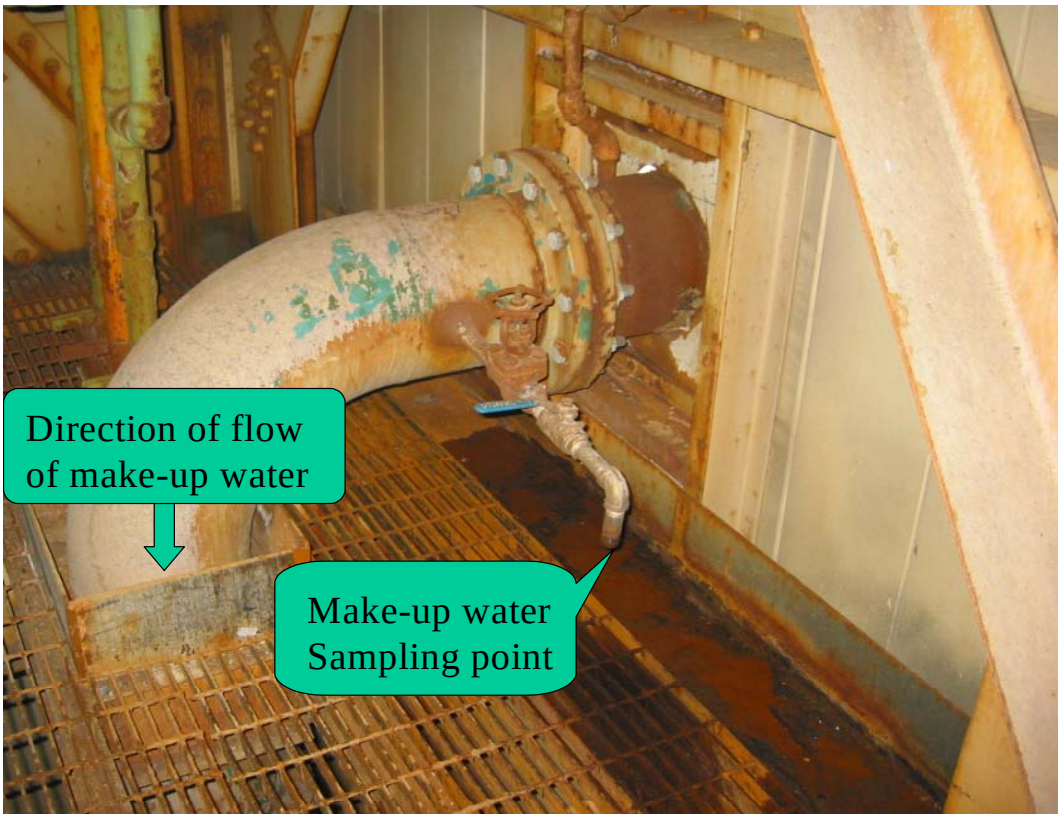


Figure 15. Sampling Location for Gypsum Plant Return Water.

Figure 16. Scrubber pH Pot for Slurry Sampling

Figure 17. Bottom ash sampling location.

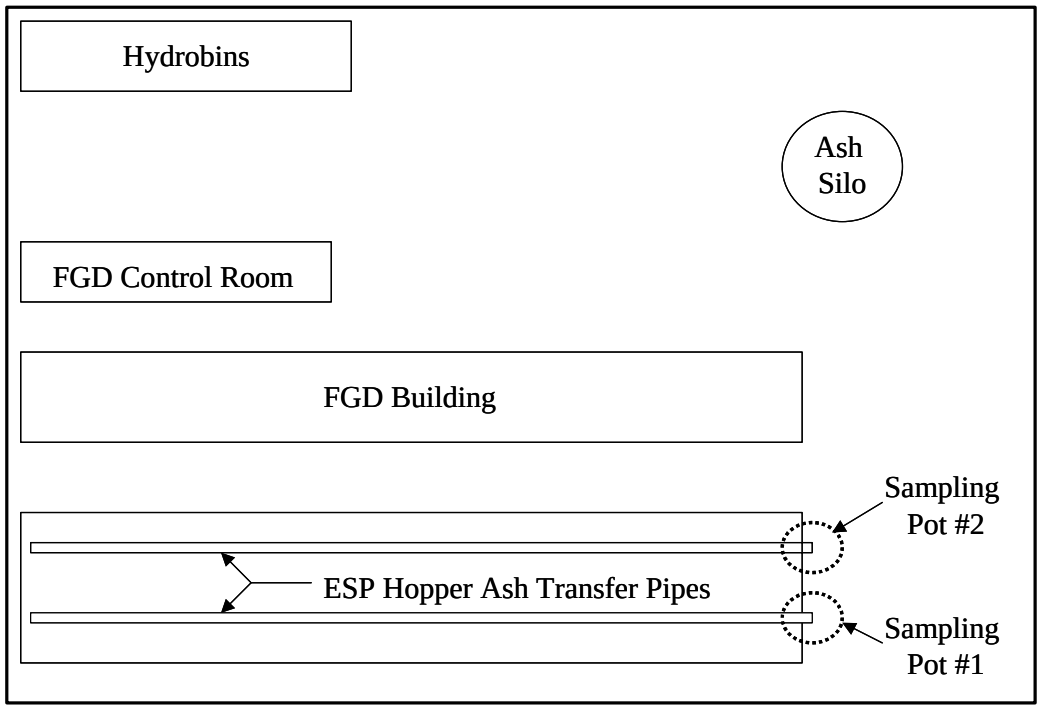


Figure 18. Equipment layout in the ESP area.

Figure 19. Left: ESP Hopper Ash Sampling Locations. Right: Sampling Pot.

Figure 20. Control Panel to Operate the Sampling Pots.

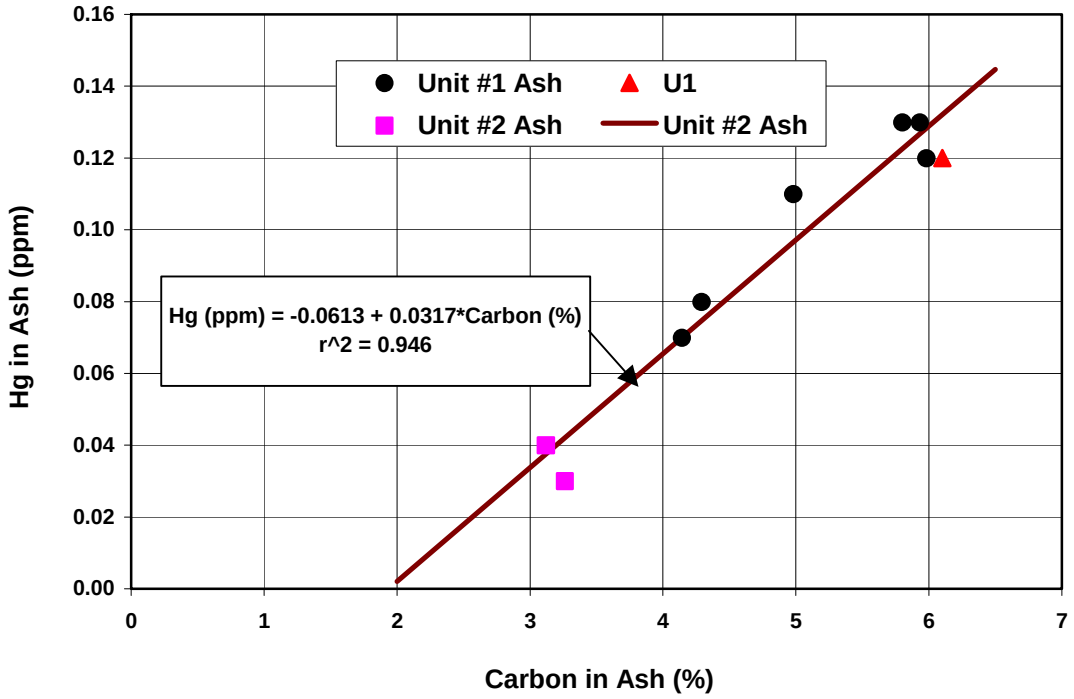


Figure 21. Plot of Hg versus carbon in the ESP ash samples.

APPENDIX A

Flue Gas Hg Data

- Summary of Ontario-Hydro Impinger Analyses Data Sheets
- Recovery Data Sheets

SCR/FGD MERCURY SAMPLING PROGRAM - PLANT 6

Ontario Hydro Hg Sampling Train Recovery Data

Date: 8-19-03 Test ID: 1

SCR Inlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32498						
1	Probe & Filter Rinse	32424				109		
2	KCl Impingers	32425	300	150	82	532		
3	HNO_3/H_2O_2 Impinger	32426	100	75	0	175		
4	$KMnO_4$ Impingers	32427	200	50	-2	248		
5	$KMnO_4$ Acid Rinse	32428		50	0	50		
6	Silica Gel				16.8 g		NA	NA

Total Particulate Wt. 10.0842 grams Condensate Total 93.8 mL

Filter 8.6842

Air Heater Outlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32499						
1	Probe & Filter Rinse	32429				126		
2	Heated Line Rinse	32430				115		
3	KCl Impingers	32431	300	150	113	563		
4	HNO_3/H_2O_2 Impinger	32432	100	75	3	178		
5	$KMnO_4$ Impingers	32433	200	50	-5	245		
6	$KMnO_4$ Acid Rinse	32434		50	0	50		
7	Silica Gel				19.0 g		NA	NA

Total Particulate Wt. 8.8621 grams Condensate Total 127.0 mL

Filter 8.8296

Stack:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32500						
1	Probe & Filter Rinse	32435				98		
2	KCl Impingers	32436	300	150	253	703		
3	HNO_3/H_2O_2 Impinger	32437	100	75	3	178		
4	$KMnO_4$ Impingers	32438	200	50	-5	245		
5	$KMnO_4$ Acid Rinse	32439		50	0	50		
6	Silica Gel				16.4 g		NA	NA

Total Particulate Wt. 0.0057 grams Condensate Total 264.4 mL

Filter 0.0019

Recovered By: J. Bedillion Date: 8-19-03

SCR/FGD MERCURY SAMPLING PROGRAM - PLANT 6

Ontario Hydro Hg Sampling Train Recovery Data

Date: 8-20-03 Test ID: 2

SCR Inlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32501						
1	Probe & Filter Rinse	32440				127		
2	KCl Impingers	32441	300	150	115	565		
3	HNO_3/H_2O_2 Impinger	32442	100	75	0	175		
4	$KMnO_4$ Impingers	32443	200	50	-2	248		
5	$KMnO_4$ Acid Rinse	32444		50	0	50		
6	Silica Gel				18.3 g		NA	NA

Total Particulate Wt. 11.9580 grams Condensate Total 128.3 mL

Filter 10.6950

Air Heater Outlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32502						
1	Probe & Filter Rinse	32445				113		
2	Heated Line Rinse	32446				149		
3	KCl Impingers	32447	300	150	86	536		
4	HNO_3/H_2O_2 Impinger	32448	100	75	0	175		
5	$KMnO_4$ Impingers	32449	200	50	0	250		
6	$KMnO_4$ Acid Rinse	32450		50	0	50		
7	Silica Gel				15.3 g		NA	NA

Total Particulate Wt. 7.2021 grams Condensate Total 98.3 mL

Filter 7.1075

Stack:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32503						
1	Probe & Filter Rinse	32451				100		
2	KCl Impingers	32452	300	150	231	681		
3	HNO_3/H_2O_2 Impinger	32453	100	75	5	180		
4	$KMnO_4$ Impingers	32454	200	50	-2	248		
5	$KMnO_4$ Acid Rinse	32455		50	0	50		
6	Silica Gel				16.9 g		NA	NA

Total Particulate Wt. 0.0087 grams Condensate Total 242.9 mL

Filter 0.0013

Recovered By: [illegible] Date: 8-20-03

SCR/FGD MERCURY SAMPLING PROGRAM - PLANT 6

Ontario Hydro Hg Sampling Train Recovery Data

Date: 8-20-03 Test ID: 3

SCR Inlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32504						
1	Probe & Filter Rinse	32456				123		
2	KCl Impingers	32457	300	150	110	560		
3	HNO_3/H_2O_2 Impinger	32458	100	75	0	175		
4	$KMnO_4$ Impingers	32459	200	50	-2	248		
5	$KMnO_4$ Acid Rinse	32460		50	0	50		
6	Silica Gel				18.1 g		NA	NA

Total Particulate Wt. 12.2725 grams Condensate Total 123.1 mL

Filter 10.9707

Air Heater Outlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32505						
1	Probe & Filter Rinse	32461				150		
2	Heated Line Rinse	32462				85		
3	KCl Impingers	32463	300	150	89	539		
4	HNO_3/H_2O_2 Impinger	32464	100	75	0	175		
5	$KMnO_4$ Impingers	32465	200	50	-2	248		
6	$KMnO_4$ Acid Rinse	32466		50	0	50		
7	Silica Gel				16.8 g		NA	NA

Total Particulate Wt. 5.4194 grams Condensate Total 100.8 mL

Filter 5.2629

Stack:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32506						
1	Probe & Filter Rinse	32467				95		
2	KCl Impingers	32468	300	150	261	711		
3	HNO_3/H_2O_2 Impinger	32469	100	75	3	178		
4	$KMnO_4$ Impingers	32470	200	50	-3	247		
5	$KMnO_4$ Acid Rinse	32471		50	0	50		
6	Silica Gel				14.5 g		NA	NA

Total Particulate Wt. 0.6148 grams Condensate Total 272.5 mL

0.0043

Recovered By: J. Bedellion Date: 8-20-03

SCR/FGD MERCURY SAMPLING PROGRAM - PLANT 6

Ontario Hydro Hg Sampling Train Recovery Data

Date: 8-21-03 Test ID: 4

SCR Inlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32507						
1	Probe & Filter Rinse	32472				88		
2	KCl Impingers	32473	300	150	118	568		
3	HNO_3/H_2O_2 Impinger	32474	100	75	0	175		
4	$KMnO_4$ Impingers	32475	200	50	-2	248		
5	$KMnO_4$ Acid Rinse	32476		50	0	50		
6	Silica Gel				21.2 g		NA	NA

Total Particulate Wt. 16.6926 grams Condensate Total 134.2 mL

Filter 15.8884

Air Heater Outlet:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32508						
1	Probe & Filter Rinse	32477				149		
2	Heated Line Rinse	32478				120		
3	KCl Impingers	32479	300	150	84	534		
4	HNO_3/H_2O_2 Impinger	32480	100	75	0	175		
5	$KMnO_4$ Impingers	32481	200	50	0	250		
6	$KMnO_4$ Acid Rinse	32482		50	0	50		
7	Silica Gel				13.4 g		NA	NA

Total Particulate Wt. 8.5501 grams Condensate Total 94.3 mL

Filter 7.9115

Stack:

Bottle #	Description	Analytical No.	Initial Vol mL	Rinse Vol mL	Gain mL	Final Vol mL	ppb Hg	Total ug of Hg
S	Filter/Solids	32509						
1	Probe & Filter Rinse	32483				91		
2	KCl Impingers	32484	300	150	262	712		
3	HNO_3/H_2O_2 Impinger	32485	100	75	7	182		
4	$KMnO_4$ Impingers	32486	200	50	-3	247		
5	$KMnO_4$ Acid Rinse	32487		50	0	50		
6	Silica Gel				16.3 g.		NA	NA

Total Particulate Wt. 0.0086 grams Condensate Total 279.3 mL

Filter 0.0024

Recovered By: J. Bedillion Date: 8-21-03

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *Plant 6 ⌐ SCR T-1*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED 08/27/03
DATE COMPLETED 09/17/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032498**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	95.68

ULTIMATE	(Dry)%
Carbon	3.96
Ash	95.68

MAJOR ASH ELEM	(Dry)%
SiO2	39.36
Al2O3	18.35
TiO2	0.87
Fe2O3	28.30
CaO	2.86
MgO	0.71
Na2O	0.45
K2O	1.53
P2O5	0.22
SO3	1.12
UND	6.23

MISC. (As Det.)

Hg	0.010 ng/mg

AS DETERMINED MOISTURE: 0.34 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

Approved for transmittal _____

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 SCR IN 8-19
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032424

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Gw

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 SCR IN 8-19
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032425

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	2.3		

Note: All units mg/L unless specified

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 SCR IN 8-19
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032426

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.3		

Note: All units mg/L unless specified

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 SCR IN 8-19
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032427

		WATER ANALYSIS		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Hg	ng/ml	58.8		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 SCR IN 8-19
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032428

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

GW

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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *Plant 6 AIR HEATER OUT T-1*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED *08/27/03*
DATE COMPLETED *09/17/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032499**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	95.01

MISC. (As Det.)	
Hg	0.052 ng/mg

ULTIMATE	(Dry)%
Carbon	3.78
Ash	95.01

MAJOR ASH ELEM	(Dry)%
SiO2	40.67
Al2O3	19.20
TiO2	0.93
Fe2O3	24.91
CaO	2.84
MgO	0.75
Na2O	0.49
K2O	1.65
P2O5	0.27
SO3	1.72
UND	6.57

AS DETERMINED MOISTURE: 0.85 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

Approved for transmittal

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032429

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sw

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER HEATED LINE
ANALYTICAL NUMBER 032430

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

gen

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032431

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	22.9		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032432

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SAW

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION *Plant 6* T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER KMNO4
ANALYTICAL NUMBER 032433

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Hg	ng/ml	2.6		

Note: All units mg/L unless specified

GWS

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 AIR HEATER OUT 8-19
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032434

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sen

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RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *STACK T-1*

SAMPLE NUMBER 3" FILTER

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032500**

ANALYSIS REPORT

MISC. (As Det.)

Hg	94.8 ng/filter

DISTRIBUTION:
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J. LOCKE

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 STACK 8-19
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032435

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.5		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 STACK 8-19
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032436

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	2.6		

Note: All units mg/L unless specified

gw

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 STACK 8-19
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032437

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 STACK 8-19
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032438

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	6.4		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-1 STACK 8-19
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032439

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

CONSOL ENERGY INC.
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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *SCR T-2*

SAMPLE NUMBER THIMBLE 2"

DATE LOGGED 08/27/03
DATE COMPLETED 09/17/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032501**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	94.38

ULTIMATE	(Dry)%
Carbon	5.56
Ash	94.38

MAJOR ASH ELEM	(Dry)%
SiO2	38.34
Al2O3	17.81
TiO2	0.84
Fe2O3	29.46
CaO	2.79
MgO	0.68
Na2O	0.43
K2O	1.46
P2O5	0.20
SO3	1.16
UND	6.83

MISC. (As Det.)

Hg	0.008 ng/mg

AS DETERMINED MOISTURE: 0.39 %

DISTRIBUTION:
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J. LOCKE

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 SCR IN 8-20-AM
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032440

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	7.5		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 SCR IN 8-20-AM
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032441

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	26.4		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 SCR IN 8-20-AM
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032442

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	4.4		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 SCR IN 8-20-AM
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032443

		WATER ANALYSIS		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Hg	ng/ml	149.3		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 SCR IN 8-20-AM
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032444

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	25.4		

Note: All units mg/L unless specified

CONSOL ENERGY INC.
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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 - *AIR HEATER OUT T-2*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED 08/27/03
DATE COMPLETED 09/17/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032502**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	92.42

ULTIMATE	(Dry)%
Carbon	6.04
Ash	92.42

MAJOR ASH ELEM	(Dry)%
SiO2	39.49
Al2O3	18.68
TiO2	0.90
Fe2O3	25.59
CaO	2.72
MgO	0.72
Na2O	0.50
K2O	1.59
P2O5	0.24
SO3	2.01
UND	7.56

MISC. (As Det.)

Hg 0.132 ng/mg

AS DETERMINED MOISTURE: 1.10 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032445

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER HEATED LINE
ANALYTICAL NUMBER 032446

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
		-------- WATER ANALYSIS ---------		
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032447

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	19.7		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032448

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER KMN03
ANALYTICAL NUMBER 032449

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	2.5		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 AIR HEATER OUT 8-20-AM
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032450

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *STACK T-2*

SAMPLE NUMBER 3" FILTER

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032503**

ANALYSIS REPORT

MISC. (As Det.)

Hg	8.8 ng/filter

DISTRIBUTION:
J. WITHUM
J. LOCKE

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 STACK 8-20-AM
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032451

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	2.6		

Note: All units mg/L unless specified

Sw

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 STACK 8-20-AM
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032452

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
		-------- WATER ANALYSIS ---------		
Hg	ng/ml	3.7		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 STACK 8-20-AM
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032453

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 STACK 8-20-AM
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032454

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	9.1		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-2 STACK 8-20-AM
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032455

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sev

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *Plant 6* *SCR T-3*

SAMPLE NUMBER THIMBLE 2"

DATE LOGGED *08/27/03*
DATE COMPLETED *09/17/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032504**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	92.30

ULTIMATE	(Dry)%
Carbon	7.07
Ash	92.30

MAJOR ASH ELEM	(Dry)%
SiO2	37.00
Al2O3	17.23
TiO2	0.80
Fe2O3	31.03
CaO	2.84
MgO	0.64
Na2O	0.41
K2O	1.37
P2O5	0.18
SO3	1.21
UND	7.29

MISC. (As Det.)

Hg 0.005 ng/mg

AS DETERMINED MOISTURE: 0.46 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

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CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 SCR IN 8-20-PM
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032456

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.4		

Note: All units mg/L unless specified

SW

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 SCR IN 8-20-PM
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032457

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	2.6		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 SCR IN 8-20-PM
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032458

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	6.6		

Note: All units mg/L unless specified

Sw

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 SCR IN 8-20-PM
SAMPLE NUMBER KMN03
ANALYTICAL NUMBER 032459

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Hg	ng/ml	66.3		

Note: All units mg/L unless specified

Sw

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 SCR IN 8-20-PM
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032460

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
		-------- WATER ANALYSIS ---------		
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *AIR HEATER OUT T-~~2~~3*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED 08/27/03
DATE COMPLETED 09/17/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032505**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	90.34

ULTIMATE	(Dry)%
Carbon	8.16
Ash	90.34

MAJOR ASH ELEM	(Dry)%
SiO2	38.35
Al2O3	18.29
TiO2	0.87
Fe2O3	24.85
CaO	2.68
MgO	0.69
Na2O	0.49
K2O	1.55
P2O5	0.23
SO3	1.99
UND	10.01

MISC. (As Det.)

Hg	0.208 ng/mg

AS DETERMINED MOISTURE: 1.15 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

Approved for transmittal _____

CONSOL ENERGY INC.
RESEARCH & DEVELOPMENT
ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032461

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sal

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER HEATED LINE
ANALYTICAL NUMBER 032462

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032463

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	17.4		

Note: All units mg/L unless specified

Sen

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032464

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.4		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032465

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.7		

Note: All units mg/L unless specified

Sew

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 AIR HEATER OUT 8-20-PM
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032466

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *STACK T-3*

SAMPLE NUMBER 3" FILTER

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032506**

ANALYSIS REPORT

MISC. (As Det.)

Hg 20.7 ng/filter

DISTRIBUTION:
J. WITHUM
J. LOCKE

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 PROBE 8-20-PM
SAMPLE NUMBER STACK
ANALYTICAL NUMBER 032467

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	3.0		

Note: All units mg/L unless specified

SW

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 KCL 8-20-PM
SAMPLE NUMBER STACK
ANALYTICAL NUMBER 032468

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	3.2		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 HNO3/H2O2 8-20-PM
SAMPLE NUMBER STACK
ANALYTICAL NUMBER 032469

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sew

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 KMNO3 8-20-PM
SAMPLE NUMBER STACK
ANALYTICAL NUMBER 032470

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	8.9		

Note: All units mg/L unless specified

Sal

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-3 FINAL 8-20-PM
SAMPLE NUMBER STACK
ANALYTICAL NUMBER 032471

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sw

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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *SCR T-4*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032507**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	93.54

ULTIMATE	(Dry)%
Carbon	5.89
Ash	93.54

MAJOR ASH ELEM	(Dry)%
SiO2	37.64
Al2O3	17.68
TiO2	0.83
Fe2O3	29.25
CaO	2.83
MgO	0.65
Na2O	0.46
K2O	1.42
P2O5	0.19
SO3	1.36
UND	7.69

MISC. (As Det.)

Hg	<0.005	ng/mg

AS DETERMINED MOISTURE: 0.48 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 SCR IN 8-21
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032472

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Seal

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 SCR IN 8-21
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032473

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	2.3		

Note: All units mg/L unless specified

Sul

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 SCR IN 8-21
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032474

	-------- WATER ANALYSIS ---------			
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	2.1		

Note: All units mg/L unless specified

Sal

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 SCR IN 8-21
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032475

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	68.8		

Note: All units mg/L unless specified

Sew

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 SCR IN 8-21
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032476

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	3.4		

Note: All units mg/L unless specified

Sol

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *AIR HEATER OUT T-4*

SAMPLE NUMBER THIMBLE 1"

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032508**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	93.46

ULTIMATE	(Dry)%
Carbon	4.49
Ash	93.46

MAJOR ASH ELEM	(Dry)%
SiO2	39.86
Al2O3	18.85
TiO2	0.91
Fe2O3	24.02
CaO	2.73
MgO	0.71
Na2O	0.53
K2O	1.64
P2O5	0.25
SO3	2.45
UND	8.05

MISC. (As Det.)

Hg 0.151 ng/mg

AS DETERMINED MOISTURE: 1.11 %

DISTRIBUTION:
J. WITHUM
J. LOCKE

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032477

		WATER ANALYSIS		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sal

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER HEATED LINE
ANALYTICAL NUMBER 032478

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032479

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	25.3		

Note: All units mg/L unless specified

Sel

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032480

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

See

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032481

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	1.1		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 AIR HEATER OUT 8-21
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032482

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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ANALYTICAL LABORATORY
4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *STACK T-4*

SAMPLE NUMBER 3" FILTER

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032509**

ANALYSIS REPORT

MISC. (As Det.)

Hg 9.2 ng/filter

DISTRIBUTION:
J. WITHUM
J. LOCKE

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 STACK 8-21
SAMPLE NUMBER PROBE
ANALYTICAL NUMBER 032483

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	3.9		

Note: All units mg/L unless specified

SW

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 STACK 8-21
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032484

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	4.5		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 STACK 8-21
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032485

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 STACK 8-21
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032486

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	7.1		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 T-4 STACK 8-21
SAMPLE NUMBER FINAL
ANALYTICAL NUMBER 032487

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6

SAMPLE NUMBER 1" THIMBLE

DATE LOGGED 08/29/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-99 -36
ANALYTICAL NUMBER **032569**

ANALYSIS REPORT

MISC. (As Det.)

Hg	<0.005	ng/mg

DISTRIBUTION:
J. LOCKE
J. WITHUM

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6

SAMPLE NUMBER 2" THIMBLE

DATE LOGGED 08/29/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-99 -36
ANALYTICAL NUMBER **032570**

ANALYSIS REPORT

MISC. (As Det.)

Hg	0.14 ng/mg

DISTRIBUTION:
J. LOCKE
J. WITHUM

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CONSOL ENERGY INC.
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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION Plant 6 *BLANK*

SAMPLE NUMBER 3" FILTER

DATE LOGGED 08/29/03
DATE COMPLETED 09/18/03
PROJECT NUMBER 1621-99 -36
ANALYTICAL NUMBER **032568**

ANALYSIS REPORT

MISC. (As Det.)

Hg	<5	ng/filter

DISTRIBUTION:
J. LOCKE
J. WITHUM

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 1-4
SAMPLE NUMBER HCL/HNO3
ANALYTICAL NUMBER 032488

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 1-2
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032489

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 1-4
SAMPLE NUMBER HNO3/H2O2
ANALYTICAL NUMBER 032490

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sal

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 1-2
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032491

ANALYSIS	UNITS	WATER ANALYSIS VALUE	VALUE	DUP AVG
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

See

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 3-4
SAMPLE NUMBER KCL
ANALYTICAL NUMBER 032492

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
	-------- WATER ANALYSIS ---------			
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sel

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 BLANK TEST 3-4
SAMPLE NUMBER KMN04
ANALYTICAL NUMBER 032493

ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
		-------- WATER ANALYSIS ---------		
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 LAB BLANK IMP
SAMPLE NUMBER KCL 1-2-3
ANALYTICAL NUMBER 032494

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sw

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 LAB BLANK IMP
SAMPLE NUMBER H2O2/HNO3 (4)
ANALYTICAL NUMBER 032495

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

Sol

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SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 LAB BLANK IMP
SAMPLE NUMBER KMNO4 5-6
ANALYTICAL NUMBER 032496

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	VALUE	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SW

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: LOCKE/WITHUM

PROJECT NUMBER 1621-87 -

DATE LOGGED 08/27/03
DATE COMPLETED 09/18/03

DESCRIPTION Plant 6 LAB BLANK IMP
SAMPLE NUMBER FINAL 5-6
ANALYTICAL NUMBER 032497

		-------- WATER ANALYSIS ---------		
ANALYSIS	**UNITS**	**VALUE**	**VALUE**	**DUP AVG**
Hg	ng/ml	<1.0		

Note: All units mg/L unless specified

SWJ

APPENDIX B

Process Material Data

- Coal Analysis Data Sheets
- Ash Analysis Data Sheets

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DESCRIPTION *PLANT 06 COAL*

SAMPLE NUMBER T1

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032609**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	9.62
Volatile Matter	39.51
Fixed Carbon	50.87
Sulfur, Total	4.48
BTU/lb	13296
MAF BTU/lb	14711

ULTIMATE	(Dry)%
Carbon	73.35
Hydrogen	4.97
Nitrogen	1.48
Chlorine	0.041
Sulfur, Total	4.48
Ash	9.62
Oxygen (DIFF)	6.06

MAJOR ASH ELEM	%
Ignited at 750 C	
SiO2	41.19
Al2O3	20.04
TiO2	0.83
Fe2O3	29.98
CaO	2.72
MgO	0.72
Na2O	0.66
K2O	1.61
P2O5	0.26
SO3	3.15
UND	-1.16

MISC. (As Det.)

Hg 0.10 PPM

AS DETERMINED MOISTURE: 2.44 %

DISTRIBUTION:
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DESCRIPTION *PLANT 06 COAL*

SAMPLE NUMBER T2

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032610**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	9.49
Volatile Matter	39.75
Fixed Carbon	50.76
Sulfur, Total	4.69
BTU/lb	13361
MAF BTU/lb	14762

ULTIMATE	(Dry)%
Carbon	73.70
Hydrogen	5.00
Nitrogen	1.49
Chlorine	0.051
Sulfur, Total	4.69
Ash	9.49
Oxygen (DIFF)	5.58

MAJOR ASH ELEM	%
Ignited at 750 C	
SiO2	38.61
Al2O3	18.35
TiO2	0.79
Fe2O3	31.40
CaO	2.55
MgO	0.66
Na2O	0.45
K2O	1.49
P2O5	0.19
SO3	3.12
UND	2.39

MISC. (As Det.)

Hg 0.09 PPM

AS DETERMINED MOISTURE: 2.27 %

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DESCRIPTION *PLANT 06 COAL*

SAMPLE NUMBER T3

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032611**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	9.56
Volatile Matter	39.89
Fixed Carbon	50.55
Sulfur, Total	4.85
BTU/lb	13375
MAF BTU/lb	14789

ULTIMATE	(Dry)%
Carbon	73.36
Hydrogen	4.99
Nitrogen	1.44
Chlorine	0.051
Sulfur, Total	4.85
Ash	9.56
Oxygen (DIFF)	5.75

MAJOR ASH ELEM	%
Ignited at 750 C	
SiO2	37.75
Al2O3	18.00
TiO2	0.77
Fe2O3	33.43
CaO	2.40
MgO	0.63
Na2O	0.43
K2O	1.41
P2O5	0.21
SO3	2.89
UND	2.08

MISC. (As Det.)

Hg <0.09 PPM

AS DETERMINED MOISTURE: 2.19 %

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DESCRIPTION *PLANT 06 COAL*

SAMPLE NUMBER T4

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032612**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	9.11
Volatile Matter	40.17
Fixed Carbon	50.72
Sulfur, Total	4.87
BTU/lb	13454
MAF BTU/lb	14803

ULTIMATE	(Dry)%
Carbon	73.89
Hydrogen	4.98
Nitrogen	1.44
Chlorine	0.041
Sulfur, Total	4.87
Ash	9.11
Oxygen (DIFF)	5.67

MAJOR ASH ELEM	%
Ignited at 750 C	
SiO2	36.66
Al2O3	20.14
TiO2	0.82
Fe2O3	32.82
CaO	2.86
MgO	0.68
Na2O	0.48
K2O	1.55
P2O5	0.23
SO3	2.80
UND	0.96

MISC. (As Det.)

Hg -0.10 PPM
Hg

AS DETERMINED MOISTURE: 2.21 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U2-T1-1

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032613**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	96.41
Sulfur, Total	0.50

MISC. (As Det.)	
Hg	0.04

ULTIMATE	(Dry)%
Carbon	3.12
Chlorine	<0.01
Sulfur, Total	0.50
Ash	96.41

MAJOR ASH ELEM	(Dry)%
SiO2	38.00
Al2O3	17.43
TiO2	0.83
Fe2O3	31.80
CaO	2.93
MgO	0.66
Na2O	0.39
K2O	1.37
P2O5	0.17
SO3	1.24
UND	5.18

AS DETERMINED MOISTURE: 0.19 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U2-T1-2

DATE LOGGED *09/04/03*
DATE COMPLETED *10/03/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032614**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	96.36
Sulfur, Total	0.40

MISC. (As Det.)	
Hg	0.03 PPM

ULTIMATE	(Dry)%
Carbon	3.26
Chlorine	<0.01
Sulfur, Total	0.40
Ash	96.36

MAJOR ASH ELEM	(Dry)%
SiO2	41.69
Al2O3	20.01
TiO2	0.91
Fe2O3	31.06
CaO	3.17
MgO	0.75
Na2O	0.45
K2O	1.61
P2O5	0.22
SO3	1.20
UND	-1.07

AS DETERMINED MOISTURE: 0.17 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T2-1

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032615**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	94.09
Sulfur, Total	0.50

MISC. (As Det.)	
Hg	0.11

ULTIMATE	(Dry)%
Carbon	4.98
Chlorine	<0.01
Sulfur, Total	0.50
Ash	94.09

MAJOR ASH ELEM	(Dry)%
SiO2	36.61
Al2O3	16.60
TiO2	0.79
Fe2O3	31.39
CaO	2.73
MgO	0.64
Na2O	0.40
K2O	1.34
P2O5	0.15
SO3	1.47
UND	7.88

AS DETERMINED MOISTURE: 0.40 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T2-2

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032616**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	95.23
Sulfur, Total	0.50

MISC. (As Det.)	
Hg	0.07

ULTIMATE	(Dry)%
Carbon	4.14
Chlorine	<0.01
Sulfur, Total	0.50
Ash	95.23

MAJOR ASH ELEM	(Dry)%
SiO2	35.57
Al2O3	16.01
TiO2	0.77
Fe2O3	34.51
CaO	2.84
MgO	0.62
Na2O	0.36
K2O	1.23
P2O5	0.14
SO3	1.35
UND	6.60

AS DETERMINED MOISTURE: 0.31 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T3-1

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032617**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	92.92
Sulfur, Total	0.60

MISC. (As Det.)	
Hg	0.13

ULTIMATE	(Dry)%
Carbon	5.93
Chlorine	<0.01
Sulfur, Total	0.60
Ash	92.92

MAJOR ASH ELEM	(Dry)%
SiO2	37.27
Al2O3	17.22
TiO2	0.83
Fe2O3	28.91
CaO	2.78
MgO	0.66
Na2O	0.43
K2O	1.40
P2O5	0.18
SO3	1.71
UND	8.61

AS DETERMINED MOISTURE: 0.31 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T3-2

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032618**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	93.11
Sulfur, Total	0.60

MISC. (As Det.)	
Hg	0.12 PPM

ULTIMATE	(Dry)%
Carbon	5.98
Chlorine	<0.01
Sulfur, Total	0.60
Ash	93.11

MAJOR ASH ELEM	(Dry)%
SiO2	36.47
Al2O3	16.84
TiO2	0.81
Fe2O3	29.63
CaO	2.77
MgO	0.64
Na2O	0.42
K2O	1.35
P2O5	0.16
SO3	1.65
UND	9.26

AS DETERMINED MOISTURE: 0.34 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T4-1

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032619**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	93.11
Sulfur, Total	0.70

MISC. (As Det.)	
Hg	0.13 PPM

ULTIMATE	(Dry)%
Carbon	5.80
Chlorine	<0.01
Sulfur, Total	0.70
Ash	93.11

MAJOR ASH ELEM	(Dry)%
SiO2	35.83
Al2O3	16.64
TiO2	0.80
Fe2O3	30.51
CaO	2.82
MgO	0.62
Na2O	0.42
K2O	1.33
P2O5	0.17
SO3	1.90
UND	8.96

AS DETERMINED MOISTURE: 0.33 %

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1-T4-2

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032620**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	95.06
Sulfur, Total	0.60

MISC. (As Det.)	
Hg	0.08 PPM

ULTIMATE	(Dry)%
Carbon	4.29
Chlorine	<0.01
Sulfur, Total	0.60
Ash	95.06

MAJOR ASH ELEM	(Dry)%
SiO2	37.99
Al2O3	18.50
TiO2	0.84
Fe2O3	34.10
CaO	3.05
MgO	0.66
Na2O	0.42
K2O	1.42
P2O5	0.22
SO3	1.69
UND	1.11

AS DETERMINED MOISTURE: 0.27 %

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SOUTH PARK, PENNSYLVANIA 15129

TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION PLEASANTS UNIT #1 SCRUBBER SLUDGE FILTRATE
SAMPLE NUMBER PLANT 06-FGD-T1
ANALYTICAL NUMBER 033478

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		60.0		
Magnesium		7250		
Sodium		94.2		
Chloride		9900		
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	<1.0		

Note: All units mg/L unless specified

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *PLANT 06 LIME SLURRY SOLIDS*

SAMPLE NUMBER LMS-T1

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032634

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	72.44
Total Sulfur	1.45

ULTIMATE	(Dry)%
Chlorine	<0.02
Ash	72.44

MAJOR ASH ELEM	(Dry)%
SiO2	2.50
Al2O3	0.58
TiO2	0.02
Fe2O3	0.21
CaO	38.04
MgO	28.68
Na2O	<0.01
K2O	0.04
P2O5	<0.01
SO3	3.63
UND	26.30

MISC. (As Det.)

Hg	0.26 PPM
% SOLIDS	35.18

AS DETERMINED MOISTURE: 4.96 %

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 LIME SLURRY FILTRATE
SAMPLE NUMBER PLANT 06-LMS-T1
ANALYTICAL NUMBER 033482

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		1480		
Magnesium		2.54		
Sodium		85.6		
Chloride		250		
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	<1.0		

Note: All units mg/L unless specified

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *PLANT 06 SCRUBBER SLUDGE SOLIDS*

SAMPLE NUMBER FGD-T1

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032622

ANALYSIS REPORT

PROXIMATE	(Dry)%
Total Sulfur	19.27

ULTIMATE	(Dry)%	
Carbon	0.13	0.11
Chlorine	0.114	0.10

MAJOR ASH ELEM	(Dry)%	
SiO2	2.57	2.26
Al2O3	0.55	0.48
TiO2	0.02	✓
Fe2O3	0.30	0.26
CaO	32.70	28.73
MgO	3.03	2.66
Na2O	0.02	✓
K2O	0.06	0.05
P2O5	<0.01	✓
SO3	48.18	42.33
UND	12.57	23.19

Interference Pkt

MISC. (As Det.)	
Hg	0.73 PPM
% SOLIDS	42.56

✓ *AS DETERMINED MOISTURE: 12.15 %*

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 SCRUBBER SLUDGE FILTRATE
SAMPLE NUMBER PLANT 06-FGD-T2
ANALYTICAL NUMBER 033479

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		63.2		
Magnesium		7430		
Sodium		87.3		
Chloride		6450		
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	1.0		

Note: All units mg/L unless specified

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DESCRIPTION *PLANT 06 LIME SLURRY SOLIDS*

SAMPLE NUMBER LMS-T2

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032635

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	72.99
Total Sulfur	1.28

ULTIMATE	(Dry)%
Chlorine	<0.02
Ash	72.99

MAJOR ASH ELEM	(Dry)%
SiO2	2.45
Al2O3	0.57
TiO2	0.02
Fe2O3	0.22
CaO	37.22
MgO	29.29
Na2O	<0.00 <0.01
K2O	0.06
P2O5	0.01
SO3	3.21
UND	26.95

MISC. (As Det.)

Hg	0.24 PPM
% SOLIDS	34.10

AS DETERMINED MOISTURE: 4.05 %

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 JNIT #1 LIME SLURRY FILTRATE
SAMPLE NUMBER PLANT 06-LMS-T2
ANALYTICAL NUMBER 033483

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		1440		
Magnesium		0.68		
Sodium		89.3		
Chloride		250	250	250
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	<1.0		

Note: All units mg/L unless specified

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4000 BROWNSVILLE ROAD, SOUTH PARK, PA 15129

DESCRIPTION *PLANT 06 SCRUBBER SLUDGE SOLIDS*

SAMPLE NUMBER FGD-T2

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032623

Interim

ANALYSIS REPORT

PROXIMATE	(Dry)%
Total Sulfur	18.78

MISC. (As Det.)	
Hg	0.64 PPM
% SOLIDS	44.52

ULTIMATE	(Dry)%	
Carbon	0.07	0.06
Chlorine	0.137	0.12

MAJOR ASH ELEM	(Dry)%	
SiO2	2.04	1.74
Al2O3	0.46	0.4
TiO2	0.02	0.02
Fe2O3	0.24	0.21
CaO	32.02	28.10
MgO	3.28	2.88
Na2O	0.02	0.02
K2O	0.06	0.05
P2O5	~~<0.00~~	<0.01
SO3	46.94	41.20
UND	14.92	26.33

AS DETERMINED MOISTURE: 12.23 %

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 SCRUBBER SLUDGE FILTRATE
SAMPLE NUMBER PLANT 06-FGD-T3
ANALYTICAL NUMBER 033480

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		56.9		
Magnesium		6700		
Sodium		86.9		
Chloride		5600		
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	<1		

Note: All units mg/L unless specified

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ANALYTICAL LABORATORY
SOUTH PARK, PENNSYLVANIA 15129

TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 LIME SLURRY FILTRATE
SAMPLE NUMBER PLANT 06-LMS-T3
ANALYTICAL NUMBER 033484

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		1440		
Magnesium		0.45		
Sodium		108		
Chloride		250		
Nitrate as N	PPM	<0.5		
MERCURY	ng/ml	<1.0		

Note: All units mg/L unless specified

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DESCRIPTION *PLANT 06 LIME SLURRY*

SAMPLE NUMBER LMS-T3

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032636**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	72.89
Total Sulfur	1.36

MISC. (As Det.)	
Hg	0.24 PPM
% SOLIDS	33.95

ULTIMATE	(Dry)%
Chlorine	<0.02
Ash	72.89

MAJOR ASH ELEM	(Dry)%
SiO2	2.45
Al2O3	0.59
TiO2	0.02
Fe2O3	0.22
CaO	37.05
MgO	29.94
Na2O	<0.01
K2O	0.04
P2O5	0.01
SO3	3.39
UND	26.29

AS DETERMINED MOISTURE: 4.30 %

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DESCRIPTION *PLANT 06 SCRUBBER SLUDGE SOLIDS*

SAMPLE NUMBER FGD-T3

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032624

ANALYSIS REPORT

PROXIMATE	(Dry)%
Total Sulfur	19.05

MISC. (As Det.)	
Hg	0.65 PPM
% SOLIDS	43.02

ULTIMATE	(Dry)%
Carbon	0.10
Chlorine	0.082

MAJOR ASH ELEM	(Dry)%
SiO2	2.13
Al2O3	0.50
TiO2	0.0
Fe2O3	0.27
CaO	32.78
MgO	2.74
Na2O	0.03
K2O	0.06
P2O5	~~<0.00~~ <0.01
SO3	47.63
UND	13.84

AS DETERMINED MOISTURE: 11.36 %

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DESCRIPTION *PLANT 06 SCRUBBER SLUDGE*

SAMPLE NUMBER FGD-T4

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032625**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Total Sulfur	19.29

MISC. (As Det.)	
Hg	0.61 PPM
% SOLIDS	44.39

ULTIMATE	(Dry)%
Carbon	0.12
Chlorine	0.076

MAJOR ASH ELEM	(Dry)%
SiO2	1.90
Al2O3	0.46
TiO2	0.02
Fe2O3	0.26
CaO	32.26
MgO	3.54
Na2O	0.03
K2O	0.05
P2O5	<0.00
SO3	48.22
UND	13.26

AS DETERMINED MOISTURE: 13.17 %

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 SCRUBBER SLUDGE FILTRATE
SAMPLE NUMBER PLANT 06-FGD-T4
ANALYTICAL NUMBER 033481

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		58.2		
Magnesium		6780		
Sodium		87.2		
Chloride		5700		
Nitrate as N	ppm	<0.5		
MERCURY	ng/ml	2.5		

Note: All units mg/L unless specified

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DESCRIPTION *PLANT 06 LIME SLURRY*

SAMPLE NUMBER LMS-T4

DATE LOGGED *09/04/03*
DATE COMPLETED 10/23/03
PROJECT NUMBER 1621-87 -
ANALYTICAL NUMBER **032637**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	73.87
Total Sulfur	2.12

ULTIMATE	(Dry)%
Chlorine	<0.02
Ash	73.87

MAJOR ASH ELEM	(Dry)%
SiO2	2.23
Al2O3	0.53
TiO2	0.02
Fe2O3	0.19
CaO	40.12
MgO	25.39
Na2O	<0.01
K2O	0.03
P2O5	<0.01
SO3	5.29
UND	26.20

MISC. (As Det.)

Hg	0.25 PPM
% SOLIDS	34.39

AS DETERMINED MOISTURE: 4.48 %

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TO: S. TSENG/JAW/JEL

PROJECT NUMBER 1621-87 -

DATE LOGGED 10/16/03
DATE COMPLETED / /

DESCRIPTION Plant 6 UNIT #1 LIME SLURRY FILTRATE
SAMPLE NUMBER PLANT 06-LMS-T4
ANALYTICAL NUMBER 033485

		-------- WATER ANALYSIS ---------		
ANALYSIS	UNITS	VALUE	VALUE	DUP AVG
Calcium		1430		
Magnesium		0.46		
Sodium		84.7		
Chloride		240		
Nitrate as N	PPM	<0.5		
MERCURY	ng/ml	<1.0		

Note: All units mg/L unless specified

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DESCRIPTION *PLANT 06 ESP HOPPER ASH*

SAMPLE NUMBER U1

DATE LOGGED *09/04/03*
DATE COMPLETED *09/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032638**

ANALYSIS REPORT

PROXIMATE	(Dry)%
Ash	93.05
Sulfur, Total	0.60

MISC. (As Det.)	
Hg	0.12 PPM

ULTIMATE	(Dry)%
Carbon	6.10
Chlorine	<0.01
Sulfur, Total	0.60
Ash	93.05

MAJOR ASH ELEM	(Dry)%
SiO2	35.52
Al2O3	16.57
TiO2	0.79
Fe2O3	29.62
CaO	2.85
MgO	0.61
Na2O	0.42
K2O	1.32
P2O5	0.16
SO3	1.74
UND	10.40

AS DETERMINED MOISTURE: 0.39 %

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DESCRIPTION *PLANT 06 BOTTOM ASH*

SAMPLE NUMBER BOTTOM ASH

DATE LOGGED *09/04/03*
DATE COMPLETED *10/23/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER 032621

ANALYSIS REPORT

PROXIMATE	(Dry)%
Total Sulfur	0.25

MISC. (As Det.)

Hg	0.01 PPM

ULTIMATE	(Dry)%
Carbon	0.21
Chlorine	<0.01

MAJOR ASH ELEM	(Dry)%
SiO2	37.83
Al2O3	17.14
TiO2	0.81
Fe2O3	39.10
CaO	3.29
MgO	0.69
Na2O	0.33
K2O	1.24
P2O5	0.18
SO3	0.62
UND	-1.23

AS DETERMINED MOISTURE: 0.04 %

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T1-1

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032626**

ANALYSIS REPORT

PROXIMATE (As Det)%			ULTIMATE (As Det)%	
Sulfur, Total	573.00		Chlorine	605.000
			Sulfur, Total	573.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T1-2

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032627**

ANALYSIS REPORT

PROXIMATE (As Det)%		ULTIMATE (As Det)%	
Sulfur, Total	553.00	Chlorine	615.000
		Sulfur, Total	553.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T2-1

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032628**

ANALYSIS REPORT

PROXIMATE (As Det)%		ULTIMATE (As Det)%	
Sulfur, Total	536.00	Chlorine	620.000
		Sulfur, Total	536.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T2-2

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032629**

ANALYSIS REPORT

PROXIMATE (As Det)%			ULTIMATE (As Det)%	
Sulfur, Total	544.00		Chlorine	620.000
			Sulfur, Total	544.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T3-1

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032630**

ANALYSIS REPORT

PROXIMATE (As Det)%		ULTIMATE (As Det)%	
Sulfur, Total	547.00	Chlorine	625.000
		Sulfur, Total	547.00

MISC. (As Det.)

Hg	1.4 ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T3-2

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032631**

ANALYSIS REPORT

PROXIMATE (As Det)%			ULTIMATE (As Det)%	
Sulfur, Total	548.00		Chlorine	615.000
			Sulfur, Total	548.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T4-1

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032632**

ANALYSIS REPORT

PROXIMATE (As Det)%		ULTIMATE (As Det)%	
Sulfur, Total	528.00	Chlorine	625.000
		Sulfur, Total	528.00

MISC. (As Det.)

Hg	<1.0	ng/ml

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DESCRIPTION *PLANT 06 GYPSUM PLANT RETURN WATER*

SAMPLE NUMBER GPRW-T4-2

DATE LOGGED *09/04/03*
DATE COMPLETED *11/12/03*
PROJECT NUMBER *1621-87 -*
ANALYTICAL NUMBER **032633**

ANALYSIS REPORT

PROXIMATE (As Det)%		ULTIMATE (As Det)%	
Sulfur, Total	548.00	Chlorine	620.000
		Sulfur, Total	548.00

MISC. (As Det.)

Hg	1.8 ng/ml

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APPENDIX C

Mercury Sampling Data

- Field Data Sheets
- Mercury Measurement Data Sheets

PLANT 6 Hg SAMPLING PROGRAM - ONTARIO HYDRO SAMPLING TRAIN DATA

Location		SCR-1	AHO-1	STACK-1	SCR-1	AHO-1	STACK-1	SCR-1	AHO-1	STACK-1	SCR-1	AHO-1	STACK-1
Date		8/19/03	8/19/03	8/19/03	8/20/03	8/20/03	8/20/03	8/20/03	8/20/03	8/20/03	8/21/03	8/21/03	8/21/03
Start Time		11:35	11:37	11:35	8:45	8:45	8:50	13:00	13:02	12:55	9:20	9:18	9:20
Stop Time		14:05	14:23	14:19	10:46	10:37	11:05	15:16	14:56	15:10	12:15	10:56	11:20
Test Number		1	1	1	2	2	2	3	3	3	4	4	4
Sample Type		OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg	OH-Hg
Y factor of dry gas meter	-	0.978	1.014	0.993	0.978	1.014	0.993	0.978	1.014	0.993	0.978	1.014	0.993
Gas Volume	- ft^3	47.40	64.90	78.05	65.09	48.19	76.89	62.11	50.84	77.07	65.63	44.56	80.42
Delta H of dry gas meter	- " H_2O	1.37	1.18	1.41	1.37	1.15	1.40	1.32	1.10	1.39	1.21	1.10	1.54
Meter Temperature	- °F	122.9	99.9	87.3	120.9	94.3	87.1	132.2	108.1	93.6	123.7	97.7	89.3
C Factor of pitot tube	-	0.833	0.801	0.827	0.833	0.801	0.827	0.833	0.801	0.827	0.833	0.801	0.827
Nozzle Diameter	- inches	0.313	0.212	0.157	0.313	0.212	0.157	0.313	0.212	0.157	0.313	0.212	0.157
A n (area of nozzle)	- ft^2	0.00053	0.00025	0.00013	0.00053	0.00025	0.00013	0.00053	0.00025	0.00013	0.00053	0.00025	0.00013
Area of Stack	- ft^2	979.3	736.0	314.2	979.3	736.0	314.2	979.3	736.0	314.2	979.3	736.0	314.2
H_2O Weight	- gm	93.8	127.0	264.4	128.3	98.3	242.9	123.1	100.8	272.5	132.2	98.3	272.5
Sample Time	- minutes	70	120	120	100	87	120	96	93	120		80	120
Barometric Pressure	- " Hg	29.48	29.48	29.48	29.47	29.47	29.47	29.46	29.46	29.46	29.42	29.42	29.42
Static Pressure	- " H_2O	-12.13	-27.50	-1.56	-12.20	-27.30	-2.15	-12.20	-28.30	-2.00	-12.74	-28.50	-2.21
% Oxygen	-	3.1	5.6	7.0	2.9	5.1	6.8	3.1	5.1	6.9	3.1	5.2	7.1
% Carbon Dioxide	-	17.1	14.6	13.2	17.0	15.0	13.4	16.9	14.9	13.3	16.8	14.9	13.1
%, N_2 + CO	-	79.8	79.8	79.8	80.1	79.9	79.8	80.1	80.0	79.8	80.1	79.9	79.8
Stack Temp (Dry Bulb)	- °F	681	335	152	679	330	150	679	342	152	674	327	149
Stack Temp (Wet Bulb)	- °F												
"S" sample (rms vel head)	- " H_2O	0.325	0.983	3.042	0.317	0.935	3.059	0.302	0.930	3.043	0.274	0.963	3.189
Dust Wt.	- gm	10.0842	8.8621	0.0057	11.9580	7.2021	0.0087	12.2725	5.4194	0.0148	16.6926	8.5501	0.0086
Sample Volume	- DSCF	41.50	61.30	73.90	57.16	45.96	72.80	53.48	47.28	72.09	57.24	42.16	75.74
Sample Volume	- dscm	1.175	1.736	2.093	1.619	1.301	2.062	1.515	1.339	2.041	1.621	1.194	2.145
ABS ST PRES	- " Hg	28.59	27.46	29.37	28.57	27.46	29.31	28.56	27.38	29.31	28.48	27.32	29.26
ABS ST TEMP	- °R	1141	795	612	1139	790	610	1139	802	612	1134	787	609
H_2O - % by Vol	- vapor	9.6	8.9	14.4	9.6	9.2	13.6	9.8	9.1	15.1	9.8	9.9	14.5
Water Volume	- std ft^3	4.42	5.98	12.45	6.04	4.63	11.44	5.80	4.75	12.83	6.23	4.63	12.83
Dry Molecular Weight	- lb/lb-mole	30.86	30.56	30.39	30.84	30.60	30.41	30.82	30.59	30.40	30.82	30.59	30.38
Wet Molecular Weight	- lb/lb-mole	29.62	29.44	28.60	29.61	29.45	28.73	29.56	29.44	28.53	29.56	29.35	28.59
% EXCESS AIR	-	17.5	36.2	50.1	16.2	31.9	48.0	16.9	31.8	48.7	16.9	32.7	50.7
Dry Mole Frac.	-	0.904	0.911	0.856	0.904	0.908	0.864	0.902	0.909	0.849	0.902	0.901	0.855
Wet Mole Frac.	-	0.096	0.089	0.144	0.096	0.092	0.136	0.098	0.091	0.151	0.098	0.099	0.145
Gas Velocity, Direct	- ft/sec	47.13	67.32	105.21	46.52	65.44	105.26	45.45	65.86	105.50	43.25	66.56	107.74
ACFM	-	2,769,225	2,972,724	1,983,497	2,733,509	2,889,877	1,984,329	2,670,710	2,908,375	1,988,813	2,541,563	2,939,486	2,031,153
DSCFM	-	1,106,511	1,651,212	1,438,492	1,094,412	1,610,571	1,453,924	1,066,198	1,592,851	1,427,194	1,016,383	1,623,241	1,472,272
DSCFM (rounded)		1,106,500	1,651,200	1,438,500	1,094,400	1,610,600	1,453,900	1,066,200	1,592,900	1,427,200	1,016,400	1,623,200	1,472,300
DSCMM		31,336	46,762	40,738	30,994	45,611	41,175	30,195	45,110	40,418	28,784	45,970	41,695
Excess Air Free DSCFM	-	940,270	1,208,782	954,636	940,461	1,217,561	978,790	910,605	1,204,165	956,015	867,573	1,219,372	972,826
CALCULATED FIRING RATE:													
Dry	- lb/min	7,217	9,278	7,327	7,164	9,275	7,456	6,966	9,211	7,313	6,595	9,269	7,395
Wet	- lb/min	7,397	9,510	7,510	7,330	9,490	7,629	7,122	9,418	7,477	6,744	9,479	7,562
Dry	- lb/hr	433,006	556,660	439,622	429,840	556,489	447,358	417,947	552,684	438,789	395,706	556,164	443,713
Wet	- lb/hr	443,836	570,582	450,617	439,824	569,414	457,749	427,305	565,059	448,614	404,648	568,733	453,740
CALCULATED FIRING RATE:													
Dry	- tons/hr	216.5	278.3	219.8	214.9	278.2	223.7	209.0	276.3	219.4	197.9	278.1	221.9
Wet	- tons/hr	221.9	285.3	225.3	219.9	284.7	228.9	213.7	282.5	224.3	202.3	284.4	226.9
HEAT INPUT:													
MM Btu/hr	-	5,757	7,401	5,845	5,743	7,435	5,977	5,590	7,392	5,869	5,324	7,483	5,970
PARTICULATE LOADING:													
Grains/DSCF	-	3.750	2.231	0.001	3.228	2.418	0.002	3.541	1.769	0.003	4.500	3.129	0.002
lb/hr	-	35,574	31,581	15	30,290	33,394	23	32,371	24,155	39	39,216	43,548	22
lb/MM Btu	-	6.18	4.27	0.00	5.27	4.49	0.00	5.79	3.27	0.01	7.37	5.82	0.00
Ash Production	lb/hr	41,655	53,551	42,292	40,792	52,811	42,454	39,956	52,837	41,948	36,049	50,667	40,422
Fly Ash		35,574	31,581	15	30,290	33,394	23	32,371	24,155	39	39,216	43,548	22
Bottom Ash		6,081	21,970	42,277	10,502	19,416	42,431	7,585	28,681	41,909	-3,167	7,118	40,400
		85.4%	59.0%	0.0%	74.3%	63.2%	0.1%	81.0%	45.7%	0.1%	108.8%	86.0%	0.1%
% ISOKINETIC	-	98	93	100	96	99	98	96	96	98	#DIV/0!	98	100

G:\RDAPPRES\STACK\ICCIHg-01\EDWARDS\OH-DATA.WK2

			0.1	0.1	0.1	0.09	0.09	0.09	0.09	0.09	0.09	0.1	0.1	0.1
			10.44	9.00	8.16	9.43	8.30	7.39	9.42	8.33	7.38	10.39	9.14	8.04

Date			8/19/03	8/19/03	8/19/03	8/20/03	8/20/03	8/20/03	8/20/03	8/20/03	8/20/03	8/21/03	8/21/03	8/21/03
COAL DATA:														
% Carbon			73.35	73.35	73.35	73.70	73.70	73.70	73.36	73.36	73.36	73.89	73.89	73.89
% Hydrogen			4.97	4.97	4.97	5.00	5.00	5.00	4.99	4.99	4.99	4.98	4.98	4.98
% Nitrogen			1.48	1.48	1.48	1.49	1.49	1.49	1.44	1.44	1.44	1.44	1.44	1.44
% Sulfur			4.48	4.48	4.48	4.69	4.69	4.69	4.85	4.85	4.85	4.87	4.87	4.87
% Oxygen			6.06	6.06	6.06	5.58	5.58	5.58	5.75	5.75	5.75	5.67	5.67	5.67
% Ash			9.62	9.62	9.62	9.49	9.49	9.49	9.56	9.56	9.56	9.11	9.11	9.11
% Volatile Matter			39.51	39.51	39.51	39.75	39.75	39.75	39.89	39.89	39.89	40.17	40.17	40.17
Btu/lb			13296	13296	13296	13361	13361	13361	13375	13375	13375	13454	13454	13454
CARBON CONVERSION			99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%	99.50%
CALCULATED FEED			470272	600579	472321	461293	598988	481609	447500	591175	472813	423029	598133	477331
F-Factor			9,799	9,799	9,799	9,825	9,825	9,825	9,774	9,774	9,774	9,778	9,778	9,778
Moisture			2.44%	2.44%	2.44%	2.27%	2.27%	2.27%	2.19%	2.19%	2.19%	2.21%	2.21%	2.21%

% Water Vapor Calculation:													
BAR		29.48	29.48	29.48	29.47	29.47	29.47	29.46	29.46	29.46	29.42	29.42	29.42
DUCT		-12.13	-27.5	-1.56	-12.2	-27.3	-2.15	-12.2	-28.3	-1.999	-12.74	-28.5	-2.205
DRY		681.1	334.8	151.5	679	330	150.1	679.1	341.7	151.9	673.6	326.8	149.1
WET		0	0	0	0	0	0	0	0	0	0	0	0
Press, ATMS		14.04	13.48	14.42	14.03	13.48	14.39	14.02	13.44	14.39	13.98	13.42	14.37
Intermediate result		11.14	10.59	11.52	11.13	10.59	11.50	11.13	10.55	11.50	11.09	10.52	11.47
Intermediate result		681.10	334.80	151.50	679.00	330.00	150.10	679.10	341.70	151.90	673.60	326.80	149.10
Intermediate result		-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80	-7.80
Intermediate result		6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Intermediate result		2533.69	1245.46	563.58	2525.88	1227.60	558.37	2526.25	1271.12	565.07	2505.79	1215.70	554.65
Intermediate result		6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08	6.08
Intermediate result		2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89	2.89
Intermediate result		63.6	1488.1	1947.7	73.2	1505.4	1958.6	74.0	1472.5	1951.8	103.6	1534.9	1968.2
Intermediate result		7121	10042	11293	7140	10080	11310	7140	9996	11296	7194	10123	11324
Percent Water Vapor		0.89	14.82	17.25	1.02	14.93	17.32	1.04	14.73	17.28	1.44	15.16	17.38
	% CO_2	17.0600	14.6000	13.1800	17.0000	15.0000	13.3600	16.8500	14.9000	13.3000	16.8300	14.9000	13.1100
	ppm	170600	146000	131800	170000	150000	133600	168500	149000	133000	168300	149000	131100
	lb/dscf	1.82E-02	1.58E-02	1.43E-02	1.82E-02	1.62E-02	1.45E-02	1.80E-02	1.61E-02	1.44E-02	1.80E-02	1.61E-02	1.42E-02
	lb/hr	1211355	1561952	1235257	1194578	1562997	1264694	1154247	1536298	1236144	1099111	1565404	1257914
	lb/hr Carbon	330370	425987	336888	325794	426272	344916	314795	418990	337130	299758	426928	343067
	lb/hr Coal	450402	580759	459289	442054	578388	468001	429109	571143	459556	405681	577789	464295
ppm Hg in Coal		0.1	0.1	0.1	0.09	0.09	0.09	0.09	0.09	0.09	0.1	0.1	0.1
Gas Phase Hg Conc., $\mu g/m^3$		10.44	9.00	8.16	9.43	8.30	7.39	9.42	8.33	7.38	10.39	9.14	8.04
Gas Phase Hg Conc., $\mu g/m^3$		10.86	9.39	8.52	9.70	8.63	7.73	9.67	8.61	7.73	10.65	9.50	8.42

	Test 1	Test 1	Test 1	Test 2 SCR	Test 2 AH O	Test 2 Stac	Test 3	Test 3	Test 3	Test 4	Test 4	Test 4
Filter Solids	SCR In1	Air Htr Out	Stack	SCR Inl	Air Htr Out	Stack	SCR Inl	Air Htr Out	Stack	SCR Inl	Air Htr Out	Stack
Filter solids wt, g	10.0842	8.8621		11.9580	7.2021		12.2725	5.4194		16.6926	8.5501	
Filter Hg, ng/mg or ng/filter	0.01	0.052	94.8	0.008	0.132	8.8	0.005	0.132	20.7	<0.005	0.151	9.2
total µg	0.101	0.461	0.095	0.096	0.951	0.009	0.061	0.715	0.021	<0.083	1.291	0.009
µg/m³	0.09	0.27	0.05	0.06	0.73	0.00	0.04	0.53	0.01	<0.051	1.08	0.00
Probe												
Probe Rinse volume, ml	109	126	98	127	113	100	123	150	95	88	149	91
Analytical Hg, ng/ml	<1.0	<1.0	1.5	7.5	<1.0	2.6	1.4	<1.0	3.0	<1.0	<1.0	3.9
µg/dscm	<0.09	<0.07	0.07	0.59	<0.09	0.13	0.11	<0.11	0.14	<0.05	<0.12	0.17
Heated Umbilical Line												
Heated Umbilical Line Rinse volume, ml	#N/A	115	#N/A	#N/A	149	#N/A	#N/A	85	#N/A	#N/A	120	#N/A
Analytical Hg, ng/ml		<1.0			<1.0			<1.0			<1.0	
µg/dscm		<0.07			<0.11			<0.06			<0.10	
KCl Impingers												
KCl volume, ml	532	563	703	565	536	681	560	539	711	568	534	712
Analytical Hg, ng/ml	2.3	22.9	2.6	26.4	19.7	3.7	2.6	17.4	3.2	2.3	25.3	4.5
µg/dscm	1.04	7.43	0.87	9.21	8.11	1.22	0.96	7.00	1.11	0.81	11.31	1.49
Nitric Acid/Peroxide Impingers												
Nitric/Peroxide volume, ml	175	175	178	175	175	180	175	175	178	175	175	182
Analytical Hg, ng/ml	1.3	<1.0	<1.0	4.4	<1.0	<1.0	6.6	1.4	<1.0	2.1	<1.0	<1.0
µg/dscm	0.19	<0.10	<0.09	0.48	<0.13	<0.09	0.76	0.18	<0.09	0.23	<0.15	<0.08
$KMnO_4$ Impingers												
$KMnO_4$ volume, ml	248	245	245	248	250	248	248	248	247	248	250	247
Analytical Hg, ng/ml	58.8	2.6	6.4	149.0	2.5	9.1	66.3	1.7	8.9	68.8	1.1	7.1
µg/dscm	12.41	0.37	0.75	22.83	0.48	1.09	10.86	0.31	1.08	10.53	0.23	0.82
KMnO4 Acid Rinse												
$KMnO_4$-Acid Rinse volume, ml	50	50	50	50	50	50	50	50	50	50	50	50
Analytical Hg, ng/ml	<1.0	<1.0	<1.0	25.4	<1.0	<1.0	<1.0	<1.0	<1.0	3.4	<1.0	<1.0
µg/dscm	<0.04	<0.03	<0.02	0.78	<0.04	<0.02	<0.03	<0.04	<0.02	0.10	<0.04	<0.02
Particulate	0.09	0.27	0.05	0.06	0.73	0.00	0.04	0.53	0.01	0.05	1.08	0.00
Oxidized Fraction	1.13	7.56	0.94	9.80	8.31	1.35	1.08	7.18	1.25	0.86	11.54	1.66
Elemental Fraction	12.64	0.50	0.86	24.09	0.65	1.21	11.65	0.54	1.19	10.86	0.42	0.93
Total µg/dscm	13.86	8.33	1.85	33.95	9.70	2.56	12.77	8.25	2.45	11.77	13.04	2.59
ppm Hg in Bottom Ash	0	0	0	0	0	0	0	0	0	0	0	0
µg/m³	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ppm Hg in Baghouse Ash												
µg/m³												
	13.86	8.33	1.85	33.95	9.70	2.56	12.77	8.25	2.45	11.77	13.04	2.59

Test 2
SCR

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	2	METER BOX	N-4	CAL. DATA: delta H	1.881	Comments:	
PLANT	Plant 3	PITOT TUBE DESC	E-4	Y	.978	128.3 gm H_2O	
LOCATION	Unit 1 SCR Inlet	PROBE LENGTH [ft]	8	C(p)	.833		
DATE	8/20/03	NOZZLE ID [inch]	.313	FILTER BOX SETTING	325		
OPERATOR(S)	GLC/BPS	%H_2O (Assumed)	10%	PROBE HTR SETTING	325		
AMBIENT TEMP [°F]		FILTER ID	1+2 (unique)	DUCT X-SECTION	circ ?	rect ?	other:
BAR. PRESS. [" Hg]	29.47	K FACTOR	4.40	DUCT DIMENSIONS	39.17'x12.5'	DUCT AREA	979.3 ft^2

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP (6) [oF] Inlet	METER TEMP (7) [oF] outlet	STACK TEMP (1) [°F]	PROBE TEMP (2) [°F]	FILTER BOX (3) [°F]	LAST IMP TEMP (4) [°F]	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
START	845	0					716.00								
-1		10	~~20~~	0.32	1.4	-7	722.73	116	116	667	324	255	66	2.6	17.3
		20		0.34	1.5	-4	729.50	118	116	669	322	254	69	2.7	17.2
A-SIDE		30	-13.4	0.34	1.5	-4.5	736.32	120	117	670	324	253	68	2.7	17.2
FILTER 1 (unique)		40		0.34	1.5	-5	743.0	122	118	668	324	252	68	2.9	17.0
		50													
STOP	925	60					743.0								
leak check	N/A														
START	946						744.13								
-1		70		0.31	1.3	-6	750.73	122	121	686	323	253	61	3.1	16.8
		80		0.30	1.3	-7	756.98	123	121	686	322	252	61	3.1	16.9
B-SIDE		90		0.31	1.3	-9	763.30	124	122	686	322	252	62	3.2	16.8
FILTER 2 (Traverse)		100	-11.07	0.31	1.3	-11	769.65	124	122	687	322	254	63	3.1	16.7
		110		0.30	1.3	-13.5	775.96	125	123	686	322	253	65	3.1	16.8
STOP	1046	120		0.30	1.3	-17	782.22	125	123	684	322	253	67	2.9	17.0
leak check															
		120	-12.2	0.317	1.37		65.09	120.9		679				2.94	17.0

Sample Train Leak Checks: Pre Test 0 ft^3 @ 10 in. Hg; Post Test 0 ft^3 @ 10 in. Hg

Pitot Tube Leak Checks: PreTest 0 @ 10 in. H_2O; Post Test 0 @ 10 in. H_2O

CONSOL ENERGY

NOTE: Purge for 10 minutes at end of sampling.

Test 1 SCR

SAMPLING AND SPECIATION FIELD DATA SHEET

Page 1 of 1

TEST ID	SCR-1	METER BOX	N-4	CAL. DATA: delta H	1.881
PLANT	Plant 3	PITOT TUBE DESC	E-4	Y	0.978
LOCATION	Unit 1 SCR Inlet	PROBE LENGTH [ft]	5	C(p)	0.833
DATE	8/10/07	NOZZLE ID [inch]	~~0.312~~ 0.313	FILTER BOX SETTING	325
OPERATOR(S)	GLC/BPS	%H_2O (Assumed)	8	PROBE HTR SETTING	325
AMBIENT TEMP [°F]		FILTER ID	1 + 3	DUCT X-SECTION	circ ? / rect ? / other:
BAR. PRESS. [" Hg]	29.48	K FACTOR	4.332	DUCT DIMENSIONS	39.17'x12.5' DUCT AREA 979.31 ft^2

Comments: One point per port
10 minutes per reading
Tm assumed 100°F

93.8 gm H_2O

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] inlet (6)	METER TEMP [oF] outlet (4)	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
		0					658.30								
-1		10		0.31	1.35	-8.	664.85	120	120	690	322	253	61	2.9	17.0
		20		0.31	1.35	-11	671.19	121	120	691	323	253	61	2.8	17.2
B		30		0.31	1.3	-15	677.43	123	120	690	322	253	60	3.1	16.9
FILTER 1		40	-10.79	0.31	1.2	-18	68552	124	121	689	323	254	62	3.0	17.0
		50					27.22								
		60													
leak check															
						START	687.30								
-1		70		0.35	1.5	-9	694.00	126	123	672	323	253	59	3.4	16.7
		80	-13.46	0.35	1.5	-13	700.72	128	124	668	321	254	61	3.5	16.5
A	1405	90		0.34	1.4	-17	707.50	127	124	668	322	254	66	3.4	16.6
FILTER 3		100													
		110													
		120										10 min AIR PURGE			
leak check				PM3								LEAK TEST OK			
			-12.13	0.325	1.371		47.40	122.9		681.1				3.14	16.8

LEAK CHECK OK

Sample Train Leak Checks: Pre Test <0.01 ft^3 @ 10 in. Hg; Post Test <0.01 ft^3 @ 18 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7 in. H_2O; Post Test OK @ 7 in. H_2O

CONSOL ENERGY

NOTE: Purge for 10 minutes at end of sampling.

2.66

Test 3 SCR

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	SCR INLET #2	METER BOX	N-4	CAL. DATA: delta H	1.881	Comments:	100.8 gm H_2O
PLANT	Plant 3	PITOT TUBE DESC	E-4	Y	.978		
LOCATION	Unit 1 SCR Inlet	PROBE LENGTH [ft]	8	C(p)	.833		
DATE	8/20/03	NOZZLE ID [inch]	0.313	FILTER BOX SETTING	325		
OPERATOR(S)	GLC/BAS	%H_2O (Assumed)	10%	PROBE HTR SETTING	325		
AMBIENT TEMP [°F]		FILTER ID	29 & 28	DUCT X-SECTION	circ ?	rect ?	other:
BAR. PRESS. [" Hg]	29.46	K FACTOR	4.40	DUCT DIMENSIONS	39.17'x12.5'	DUCT AREA	979.3 ft^2

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP (6) [oF] inlet	METER TEMP (7) [oF] outlet	(1) STACK TEMP [°F]	(2) PROBE TEMP [°F]	(3) FILTER BOX [°F]	(4) LAST IMP TEMP [°F]	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
START	1300	0					793.30								
-1		10		0.30	1.30	-5	799.83	130	128	686	284	254	67	3.1	16.8
		20		0.30	1.3	-5	806.30	131	129	687	322	252	60	3.1	16.8
B-SIDE		30		0.30	1.3	-5	812.72	133	130	688	323	254	60	3.2	16.7
FILTER		40	-11.28	0.3	1.3	-5.5	819.13	134	131	686	322	252	61	3.0	16.9
29		50		0.3	1.3	-5.5	825.52	134	131	688	322	253	63	3.0	16.9
STOP	1400	60		0.3	1.3	-6	832.10	134	131	689	322	253	65	3.3	16.6
leak check	N/A														
START	1440						833.10								
-1		70		0.31	1.4	-7	839.72	133	133	667	322	253	63	3.0	16.9
		80		0.31	1.4	-8.5	846.28	134	132	667	321	252	65	2.9	17.0
A-SIDE		90		0.3	1.3	-11	852.62	135	133	667	322	253	66	2.9	17.0
FILTER 28		100	-14.46	0.3	1.3	-16		135	133	667	322	254	68	3.0	16.9
STOP	1516	110					856.41								
		120													
leak check				RMS	PUMP SHUTDOWN DUE TO HI TEMP O/L										
		96	-12.87	0.302	1.32		62.11	132.2		679.2				3.05	16.85

Sample Train Leak Checks: Pre Test ~.02 ft^3 @ 10 in. Hg; Post Test ~0.01 ft^3 @ 16 in. Hg

Pitot Tube Leak Checks: PreTest 0 @ 7 in. H_2O; Post Test 0 @ 7 in. H_2O

CONSOL ENERGY

NOTE: Purge for 10 minutes at end of sampling.

Pre Leak Test A-Side ~.03 ft^3 @ 10" Hg

Post Leak - A Side - <.03

Test 4 SCR

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	4
PLANT	Plant 3
LOCATION	Unit 1 SCR Inlet
DATE	8/21/03
OPERATOR(S)	BS
AMBIENT TEMP [°F]	188
BAR. PRESS. [" Hg]	29.4

METER BOX	4
PITOT TUBE DESC	E-4
PROBE LENGTH [ft]	8
NOZZLE ID [inch]	.313
%H_2O (Assumed)	10
FILTER ID	5
K FACTOR	4.469

CAL. DATA: delta H	1.881
Y	.978
C(p)	.833
FILTER BOX SETTING	325
PROBE HTR SETTING	325
DUCT X-SECTION	circ ? rect ? other:
DUCT DIMENSIONS	39.17'x12.5' DUCT AREA 979.3 ft^2

Comments:

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] (6) inlet	(7) outlet	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	CO_2 [% vol]
	0920	S 0					863.80								
S -1	~~0920~~	10		0.30	1.32	11	870.38	120	120	665	324	254	56	3.1	16.8
FILTER	0940	STOP 20	-14.56	0.30	1.32	16	876.70	120	120	665	324	253	56	2.8	17.1
#5	1015	S 30		0.30	1.32	9	~~880.30~~ 881.00	122	122	661	322	254	64	3.1	16.8
#7		40		0.30	1.32	13	~~887.23~~ 893.44	123	123	662	323	253	63	2.9	17.0
	1045	STOP	-14.45	0.30	1.32	18	899.28	123	123	661	322	253	64	2.9	17.0
		60													
leak check															
FILTER							~~900.10~~ 900.80								
#9-1	1106	70		0.25	1.10	9	906.96	125	124	683	322	254	60	3.2	16.7
		STOP	-10.94	0.25	1.10	14	912.98	127	126	685	322	253	60	3.3	16.6
#11	1145	S 90		0.25	1.10	9	~~913.85~~ 915.00	126	126	683	323	255	65	3.3	16.6
		100	-10.61	0.25	1.10	14	~~921.12~~ 927.06	126	126	685	323	253	65	3.0	16.8
	1215	STOP		0.25	1.10	18	932.50	126	126	686	322	254	68	3.0	16.9
		120													
leak check				PMS											
		100	-12.74	0.274	1.21		65.63	123.7		679.6				3.06	16.83

Sample Train Leak Checks: Pre Test <0.01 ft^3 @ 8 in. Hg; Post Test <0.01 ft^3 @ 10 in. Hg *

Pitot Tube Leak Checks: PreTest OK @ 7 in. H_2O; Post Test OK @ 9 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Time?

Test 1 AHO

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	AHO-1	METER BOX	N-3	CAL. DATA: delta H	1.917	Comments: Wait for Soot Blowers between ports	
PLANT	Plant 3	PITOT TUBE DESC	E.5	Y	1.014		
LOCATION	Unit 1 Air Heater Outlet	PROBE LENGTH [ft]	10	C(p)	0.801		
DATE	8-19-03	NOZZLE ID [inch]	0.212	FILTER BOX SETTING	NA		
OPERATOR(S)	JL JS	%H_2O (Assumed)	8	PROBE HTR SETTING	295		
AMBIENT TEMP [°F]		FILTER ID	2	DUCT X-SECTION	circ ? / rect ? / other:		
BAR. PRESS. [" Hg]	29.48	K FACTOR	1.208	DUCT DIMENSIONS	46'x8'	DUCT AREA	736 ft^2

127.0 gm H_2O

8% 10%

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] (6) inlet	METER TEMP [oF] (7) outlet	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F]	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
	~~11:39~~	0	~~[illegible]~~				131.800								
B-K -1	11:47	10		1.3	1.6	7.0	137.94	90	90	349	299	NA	68	7.0	13.5
↓		20	28.2	1.0	1.2	8.0	143.40	96	92	349	303		54		
~~leak check~~		30		1.0	1.2	9.0	148.81	100	93	351	300		57		
		40	~~[illegible]~~ 28.3	1.0	1.2	11.0	154.13	102	95	350	300		60	[illegible]	[illegible]
↓		50 30		1.0	1.2	13.0	158.55	103	92	352	303		60		
↓	12:37	60 40	27.87	1.0	1.2	16.0	164.873	104	96	352	305		62		
leak check ~~leak check~~				0.008 cfm @ 16.0" Hg											
	13:~~[illegible]~~20						165.300								
A-P -1	13:33	70 60	-27.2	0.92	1.1	6.0	170.65	100	99	318	299		68	5.7	14.4
↓		80 80	-26.97	0.92	1.1	7.0	175.94	104	100	319	297		52		
~~leak check~~		90		0.92	1.1	8.0	181.25	108	101	319	300		53	4.8	15.3
↓		100	-26.85	0.92	1.1	9.5	186.54	108	102	319	297		55		
↓		110 90		.92	1.1	12.0	191.84	109	102	319	299		59	4.4	15.5
↓	14:23	125 80	-26.77	.92	1.1	14.0	197.129	109	103	320	306	↓	56		
~~leak check~~															
				RMS											
		120	-27.5	0.983	1.18		64.902	99.9		334.8				5.6	14.6

Sample Train Leak Checks: Pre Test 0.005 ft^3 @ 12.0 in. Hg; Post Test 0.008 ft^3 @ 14.0 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7.0 in. H_2O; Post Test OK @ 7.0 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Test 2
AHO

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	AHO-2	METER BOX	N-3	CAL. DATA: delta H	1.917	Comments:	98.3 gm H_2O
PLANT	Plant 3	PITOT TUBE DESC	E-5	Y	1.014		
LOCATION	Unit 1 Air Heater Outlet	PROBE LENGTH [ft]	10'	C(p)	0.801		
DATE	8-20-03	NOZZLE ID [inch]	0.212	FILTER BOX SETTING	NA		
OPERATOR(S)	JL JS	%H_2O (Assumed)	9	PROBE HTR SETTING	295		
AMBIENT TEMP [°F]	88	FILTER ID	6-8	DUCT X-SECTION	circ ?	rect ?	other:
BAR. PRESS. [" Hg]	29.47	K FACTOR	1.190	DUCT DIMENSIONS	46'x8'	DUCT AREA	736 ft^2

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] inlet	METER TEMP [oF] outlet	STACK TEMP [°F]	PROBE TEMP [°F]	FILTER BOX [°F]	LAST IMP TEMP [°F]	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
	08425	0	-26.3	0.977			202.425								
A-K -1	0855	10		0.97	1.2	6.0	208.22	82	80	311	295	NA	67	4.4	15.6
2	0905	20		0.97	1.2	8.0	213.738	89	83	313	304		55		
leak check	0915	30	-26.41	0.97	1.2	10.5	219.29	94	86	314	300		62		
	0925	40		0.97	1.2	14.0	224.83	97	88	317	300		65	4.2	15.8
1	0930	~~30~~ 45		0.97	1.2	17.0	227.497	99	90	318	300		65		
2		~~40~~ 60													
leak check				0.003@	16" Hg	change filter									
	0955				1.10		227.900								
B- -1	10:05	~~20~~ 35	-28.17	0.90	~~0.90~~	6.0	233.147	94	96	340	301		64	5.9	14.2
2	10:15	~~30~~ 45		0.90	1.10	7.0	238.49	101	96	341	305		57		
leak check	10:25	~~40~~ 55		0.90	1.10	10.0	243.801	104	97	349	302		58	5.9	14.2
	10:35	~~50~~ 65	-28.42	0.90	1.10	13.0	249.18	105	98	347	300		62		
1	10:37	~~60~~ 67		0.90	1.10	16.0	251.015	107	99	350	304		65		
2		~~70~~ 80													
leak check															
				RMS											
		87	-27.3	0.935	1.15		48.187	94.3		330				5.1	15.0

Sample Train Leak Checks: Pre Test 0.003 ft^3 @ 16 in. Hg; Post Test 0.012 ft^3 @ 16.0 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7.0 in. H_2O; Post Test OK @ 7.0 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Test 3
AHO

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	AHO-3	METER BOX	N-3	CAL. DATA: delta H	1.917
PLANT	Plant 3	PITOT TUBE DESC	E-5	Y	1.014
LOCATION	Unit 1 Air Heater Outlet	PROBE LENGTH [ft]	10'	C(p)	0.801
DATE	8-20-03	NOZZLE ID [inch]	0.212	FILTER BOX SETTING	NA
OPERATOR(S)	JL JS	%H_2O (Assumed)	9	PROBE HTR SETTING	295
AMBIENT TEMP [°F]		FILTER ID	10,12,16	DUCT X-SECTION	circ ? rect ? other:
BAR. PRESS. [" Hg]	29.46	K FACTOR	1.190	DUCT DIMENSIONS	46'x8' DUCT AREA 736 ft^2

Comments: Filter 10 - 276.700 - 30.300
start Filter 12 277.0003 ↑ subtract from B-side volume
123.1 gm H_2O

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] inlet	METER TEMP [oF] outlet	STACK TEMP [°F]	PROBE TEMP [°F]	FILTER BOX [°F]	LAST IMP TEMP [°F]	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
	1300	0	-28.51				257.000								
B- -1	1310	10		0.95	1.1	6.0	263.345	101	100	354	302	NA	68	5.6	14.4
	1320	20		0.95	1.1	9.0	268.715	104	100	355	301		67		
leak check	1330	30		0.95	1.1	13.5	273.840	108	101	356	297		66		
	1335/1346	40		0.95	1.1	12.5/16.0	~~[illegible]~~	110	102	355	305		67		
	1407	~~20~~ 50	-29.5	0.95	1.1	8.0	285.080	111	105	353	301		61	5.8	14.3
	1417	~~40~~ 60		0.95	1.1	10.0	290.455	114	107	351	305		60		
leak check				0.000 @ 16" Hg	(Filter 10)	/ Filter 12	initial	: 0.000	@ 10" Hg		Post	Final	0.002 @ 15" Hg		
	1433	60					291.000								
A-K -1	1443	~~70~~ 80	-27.5	0.90	1.1	7.0	296.230	111	108	318	302		66	4.7	15.3
	1453	~~80~~ 90		0.90	1.1	9.0	301.603	115	109	329	297		61		
leak check		90	-22.84	0.90	1.1	13.0	306.975	117	110	323	302		63	4.4	15.6
	1456	~~100~~ 93		0.90	1.1	17.00	308.680	118	111	323	297		65		
		~~[illegible]~~													
		~~[illegible]~~													
leak check															
				RMS											
		93	-28.3	0.930	1.1		50.835	108.1		341.7				5.1	14.9

Sample Train Leak Checks: Pre Test 0.004 ft^3 @ 10.0 in. Hg; Post Test 0.002 ft^3 @ 17.0 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7.0 in. H_2O; Post Test OK @ 7.0 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	AHO-4	METER BOX	N-3	CAL. DATA: delta H	1.917	Comments:	A side 40 minutes
PLANT	Plant 3	PITOT TUBE DESC	E-5	Y	1.014		
LOCATION	Unit 1 Air Heater Outlet	PROBE LENGTH [ft]	10'	C(p)	0.801		
DATE	8-21-03	NOZZLE ID [inch]	0.212	FILTER BOX SETTING	NA		
OPERATOR(S)	JL JS	%H_2O (Assumed)	9	PROBE HTR SETTING	295		
AMBIENT TEMP [°F]		FILTER ID	13.20	DUCT X-SECTION	circ ? / rect ? / other:		
BAR. PRESS. [" Hg]	29.40	K FACTOR	1.193	DUCT DIMENSIONS	46'x8'	DUCT AREA	736 ft²

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft³]	METER TEMP [oF] inlet	METER TEMP [oF] outlet	STACK TEMP [°F]	PROBE TEMP [°F]	FILTER BOX [°F]	LAST IMP TEMP [°F]	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
	0918	0					314.90								
A-K -1	0928	10	-27.9	0.95	1.1	7.0	321.678	90	88	316	295	NA	66	4.8	15.2
	0938	20		0.95	1.1	9.0	326.915	96	90	313	301		61	4.4	15.6
~~leak check~~	0948	30	-29.34	0.95	1.1	12.0	333.295	95	91	314	297		65	4.5	15.5
chg. filter	0958	40		0.95	1.1	15.0	337.697	102	95	314	299		65	4.5	15.7
chg ports				0.95	1.1	17.0	—	103	95	315	299		65		
							22.797								
leak check			0.008@16"Hg		Pre #20 0.000@10.0"Hg										
	10:16	40	~~-28.4~~	~~0.98~~	~~1.1~~	~~6.0~~	338.095	~~100~~	~~98~~	331	294		~~68~~	~~5.8~~	~~14.3~~
B -1	10:26	50	28.4	0.98	1.1	6.0	343.860	100	98	~~346~~	~~296~~		68	5.8	14.3
	10:36	60		0.98	1.1	7.0	349.186	105	98	346	296		60	5.7	14.3
~~leak check~~	10:46	70	-28.6	0.98	1.1	11.0	354.542	107	99	346	302		61	5.9	14.2
	10:56	80		0.98	1.1	15.0	359.856	108	101	346	297		64	5.9	14.2
~~1~~		~~80~~													
~~2~~		~~80~~													
~~leak check~~															
				RMS											
		80	-28.5	0.963	1.1		44.563	97.9		326.8				5.2	14.9

Sample Train Leak Checks: Pre Test <0.01 ft³ @ 9 in. Hg; Post Test 0.008 ft³ @ 16.0 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7 in. H_2O; Post Test OK @ 7.0 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Test 1 Stack

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	1 Pleasants	METER BOX	2	CAL. DATA: delta H	1.982	Comments:	264.4 gm H_2O
PLANT	Plant 3	PITOT TUBE DESC	E-6	Y	0.993		
LOCATION	Unit 1 Stack	PROBE LENGTH [ft]	8' +	C(p)	0.827		
DATE	8/19/03	NOZZLE ID [inch]	0.157	FILTER BOX SETTING	250		
OPERATOR(S)	KC, RMO	%H_2O (Assumed)		PROBE HTR SETTING	250		
AMBIENT TEMP [°F]		FILTER ID	1	DUCT X-SECTION	circ ? / rect ? / other:		
BAR. PRESS. [" Hg]	29.40	K FACTOR	0.456	DUCT DIMENSIONS	240" ID	DUCT AREA	314.2 ft^2

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] (6) inlet	METER TEMP [oF] (7) outlet	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
		0					967.40								
-10.6	11:35	10		2.6	1.18	3		76	76	149	246	245	50	7.1	13.1
S -35.0	11:45	20	-2.143	3.5	1.60	4	980.44	81	77	149	243	250	51	7.0	13.2
-71.0	11:55	30		3.6	1.65	4	987.44	86	79	151	250	252	53	7.1	13.1
leak chk	12:06						987.80								
								99360							
-10.6	12:20	40		2.5	1.15	3	998.60	88	81	150	242	251	52	7.2	13.0
-35.0	12:30	50		3.0	1.40	4	999.91	91	83	152	248	251	52	7.1	13.1
W -71.0	12:40	60		2.5	1.15	4	1006.07	94	85	151	248	252	53	7.2	13.1
leak chk	12:45						1006.42								
-10.6	13:24	70		2.5	1.15	4	1012.63	88	86	152	246	250	56	7.1	13.1
N -35.0	13:34	80	-1.604	3.0	1.40	4	1019.16	93	87	153	246	252	58	7.0	13.2
-71.0	13:44	90		3.5	1.60	4	1026.05	95	88	153	249	251	62	6.9	13.3
leak chk	13:49						1026.40								
-10.6	13.59	100		3.0	1.40	4	1032.78	95	89	152	243	251	50	6.9	13.3
E -35.0	14.09	110	-.931	3.5	1.60	4.5	1039.65	98	90	153	253	252	50	6.9	13.3
-71.0	14:19	120		3.5	1.60	5.0	1046.51	99	91	153	246	252	52	6.9	13.3
Done	14:29	120	-1.56	3.042	1.407		1048.05	87.3		151.5				7.03	13.10

Sample Train Leak Checks: Pre Test <0.01 ft^3 @ 10 in. Hg; Post Test <0.01 ft^3 @ 9 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 8 in. H_2O; Post Test OK @ 7 in. H_2O

CONSOL ENERGY

NOTE: Purge for 10 minutes at end of sampling.

412-915 2243

Test 2 Stack

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	2	METER BOX	2	CAL. DATA: delta H	1.982
PLANT	Plant 3	PITOT TUBE DESC	E-6	Y	0.993
LOCATION	Unit 1 Stack	PROBE LENGTH [ft]	8	C(p)	0.827
DATE	8/20/03	NOZZLE ID [inch]	0.157	FILTER BOX SETTING	250
OPERATOR(S)	KC	%H_2O (Assumed)		PROBE HTR SETTING	250
AMBIENT TEMP [°F]		FILTER ID	3	DUCT X-SECTION	circ ? / rect ? / other:
BAR. PRESS. [" Hg]	> 29.47	K FACTOR	0.46	DUCT DIMENSIONS	240" ID
				DUCT AREA	314.2 ft^2

Comments: 242.9 gm H_2O

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] inlet (6)	METER TEMP [oF] outlet (7)	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
		0					54.20								
-10.6	8:50	10		2.7	1.2	4	60.02	76	74	148	243	252	47	7.2	13.1
E -35.0	9:00	20	-2.699	3.0	1.4	4	66.45	80	75	148	248	250	49	6.7	13.5
-71.0	9:10	30		3.5	1.6	4	73.27	85	77	149	249	250	56	6.7	13.5
leak chk	9:20						73.75								
-10.6	9:25	40		2.5	1.15	3.5	79.60	87	80	150	247	250	53	6.8	13.4
N -35.0	9:35	50	-1.443	3.5	1.6	4	86.29	91	82	152	242	251	53	6.9	13.3
-71.0	9:45	60		3.5	1.6	4	93.06	93	84	151	246	251	53	6.9	13.3
leak chk	9:50						93.63								
-10.6	10:00	70		2.5	1.15	4	99.69	93	86	150	250	251	52	6.9	13.3
-35.0	10:10	80	-2.265	2.7	1.2	4	105.75	95	87	151	253	251	52	6.9	13.3
W -71.0	10:20	90		3.5	1.6	4.5	112.47	97	89	151	250	251	53	6.7	13.4
leak chk	10:31						112.95								
-10.6	10:45	100	[redacted]	2.5	1.15	4	119.09	94	89	150	249	251	54	6.9	13.3
S -35.0	10:55	110	-2.02	3.5	1.6	4.5	125.87	97	90	150	252	251	55	6.8	13.4
-71.0	11:05	120		3.5	1.6	5	132.62	99	91	151	247	251	59	6.7	13.5
		120	-2.15	3.059	1.404		76.89	87.1		150.1				6.83	13.36

Sample Train Pre Test <0.01 ft^3 @ 12 in. Hg
Leak Checks: Post Test <0.01 ft^3 @ 12 in. Hg

Pitot Tube PreTest OK @ 9 in. H_2O
Leak Checks: Post Test OK @ 9 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Test 3 Stack

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	3	METER BOX	2	CAL. DATA: delta H	1.902	Comments:	272.5 gm H_2O
PLANT	Plant 3	PITOT TUBE DESC	E-6A	Y	0.993		
LOCATION	Unit 1 Stack	PROBE LENGTH [ft]	8'	C(p)	0.827		
DATE	8-20-03	NOZZLE ID [inch]	0.157	FILTER BOX SETTING	250		
OPERATOR(S)	KRC	%H_2O (Assumed)		PROBE HTR SETTING	250		
AMBIENT TEMP [°F]		FILTER ID	2	DUCT X-SECTION	circ ?	rect ?	other:
BAR. PRESS. [" Hg]	29.46	K FACTOR	0.46	DUCT DIMENSIONS	240" ID	DUCT AREA	314.2 ft²

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft³]	METER TEMP [oF] inlet (6)	METER TEMP [oF] outlet (7)	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
		0					141.20								
S -10.6	12:55	10		2.7	1.2	3	147.20	87	86	150	247	249	50	7.1	13.1
-35.0	13:05	20	-2.005	3.0	1.4	3.5	153.51	91	86	151	244	251	53	6.8	13.4
-71.0	13:15	30		3.2	1.45	4	160.01	94	87	152	246	252	54	6.7	13.4
leak chk	13:26						160.43								
-10.6	13:30	40		2.7	1.2	3.5	166.60	94	89	151	252	251	51	6.9	13.3
W -35.0	13:40	50	-2.215	3.0	1.4	4.0	172.95	97	89	152	246	251	48	6.8	13.4
-71.0	13:50	60		3.2	1.45	4.0	179.44	99	91	152	252	251	47	6.9	13.3
leak chk	14:01						180.56								
-10.6	14:05	70		2.7	1.2	4.0	186.79	99	91	153	247	251	47	6.9	13.3
N -35.0	14:15	80	-1.848	3.0	1.4	4.0	193.20	100	92	154	253	251	46	6.9	13.3
-71.0	14:25	90		3.4	1.55	4.0	199.83	101	93	153	249	251	47	6.9	13.3
leak chk	14:37						200.21								
-10.6	14:50	100		2.7	1.2	4.0	206.54	97	93	151	252	250	46	7.1	13.1
E -35.0	15:00	110	-1.929	3.5	1.6	4.0	213.32	101	94	152	247	252	46	6.9	13.3
-71.0	15:10	120		3.5	1.6	4.0	220.13	102	94	152	244	252	49	6.9	13.3
		120	-1.999	3.04	1.388		77.07	93.63		151.9				6.9	13.3

Sample Train Leak Checks: Pre Test <0.01 ft³ @ 9 in. Hg; Post Test <0.01 ft³ @ 10 in. Hg

Pitot Tube Leak Checks: PreTest OK @ 7 in. H_2O; Post Test OK @ 8 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Test 4
Stack

ONTARIO HYDRO Hg SAMPLING AND SPECIATION FIELD DATA SHEET

TEST ID	4	METER BOX	2	CAL. DATA: delta H	1.982	Comments:	
PLANT	Plant 3	PITOT TUBE DESC	E-6A	Y	0.993		
LOCATION	Unit 1 Stack	PROBE LENGTH [ft]	8'	C(p)	0.827		
DATE	Aug 21, 2003	NOZZLE ID [inch]	0.157	FILTER BOX SETTING	250		
OPERATOR(S)	KRC	%H_2O (Assumed)		PROBE HTR SETTING	250		
AMBIENT TEMP [°F]		FILTER ID	4	DUCT X-SECTION	circ ?	rect ?	other:
BAR. PRESS. [" Hg]	29.42	K FACTOR	0.48	DUCT DIMENSIONS	240" ID	DUCT AREA	314.2 ft^2

TRAVERSE POINT [port-inch]	CLOCK TIME (24-hr)	SAMPLE TIME [minute]	STATIC PRES [" H_2O]	PITOT HEAD [" H_2O]	METER DIFF PRESSURE [" H_2O]	METER VACUUM [" Hg]	METER READING [ft^3]	METER TEMP [oF] inlet	METER TEMP [oF] outlet	STACK TEMP [°F] (1)	PROBE TEMP [°F] (2)	FILTER BOX [°F] (3)	LAST IMP TEMP [°F] (4)	METER EXHAUST O_2 [% vol]	METER EXHAUST CO_2 [% vol]
		0					226.13								
-10.6	9:20	10		3.0	1.45	4.0	232.22	78	77	149	251	249	46	7.3	12.9
E -35.0	9:30	20	-2.00	3.6	1.70	4.0	239.01	83	78	149	252	249	53	7.0	13.2
-71.0	9:40	30		3.6	1.70	4.5	245.97	87	80	150	246	252	59	7.2	13.0
leak chk	9:52						246.30								
-10.6	9:55	40		2.5	1.20	4.0	252.52	89	82	149	249	251	55	7.3	12.9
N -35.0	10:05	50	-2.17	3.4	1.65	4.5	259.48	92	84	149	251	251	53	7.1	13.1
-71.0	10:15	60		3.4	1.65	4.5	266.58	95	86	149	244	251	54	7.1	13.1
leak chk	10:26						266.80								
-10.6	10:26	70		2.5	1.20	4.0	272.92	95	87	149	251	251	53	7.2	13.0
W -35.0	10:36	80	-2.02	3.2	1.50	4.0	279.52	97	89	150	250	252	50	7.0	13.2
-71.0	10:46	90		3.4	1.65	4.75	286.47	98	90	150	244	252	49	7.1	13.1
leak chk	10:57						286.70								
-10.6	11:00	100		3.0	1.45	4.5	293.44	98	91	147	241	251	51	7.1	13.1
S -35.0	11:10	110	-2.05	3.4	1.65	5.0	300.40	100	92	149	248	251	54	6.8	13.4
-71.0	11:20	120		3.4	1.65	5.0	307.33	101	93	149	243	251	57	6.9	13.3
	11:22	120	-2.205	3.189	1.538		80.42	89.25		149.1				7.09	13.11

Sample Train Leak Checks: Pre Test 0.01 ft^3 @ 17 in. Hg; Post Test 0.01 ft^3 @ 11 in. Hg

Pitot Tube Leak Checks: PreTest ok @ 7 in. H_2O; Post Test ok @ 7 in. H_2O

CONSOL ENERGY.

NOTE: Purge for 10 minutes at end of sampling.

Plant : 6

Axial Flow Check

Location	Stack	Duct Ht, "	ft	Barometric	29.35
Date	8/18/03	Duct ID,"	20 ft	Static	-2.82
Time	1640-1710	Duct Area	314.16 ft^2	Dry Bulb	
Tube I.D.	S-19A	% O_2		Wet Bulb	
C-Factor		% CO_2		% H_2O	
Operator(s)		% N_2		W.M.Wt	

	PORT/ POINT	DISTANCE [" From Wall]	TEMP [°F]	DELTA P ["H_2O]	VELOCITY [Ft/Sec]	Null Angle	
N	A - 1	10.5	156	+2.976		~0	
	A - 2	35	155	3.928		~0	-3.878
	A - 3	71	155	4.331		~0	
W	B-1		152	2.763		~0	
	B-2		154	3.455		~0	-1.487
	B-3		154	3.880		~0	
S	C-1			2.153		~0	
	C-2			3.698		~0	-2.633
	C-3			3.845		~0	
	D-1			2.957		~0	
	D-2			3.976		~0	-3.375
	D-3			4.203		~0	
	Average		154.3	3.6			
	Maximum						
	Minimum						
	SDEV						

DATA SUMMARY	
Velocity, [fps]	
acfm	
scfm	
dscfm	
Ex Air Free cfm	
Est. MM Btu/hr Heat Input	
Est. Firing Rate, lb/hr	

N-2
$\Delta H = 1.982$
$Y = 0.993$

26" offset

APPENDIX D

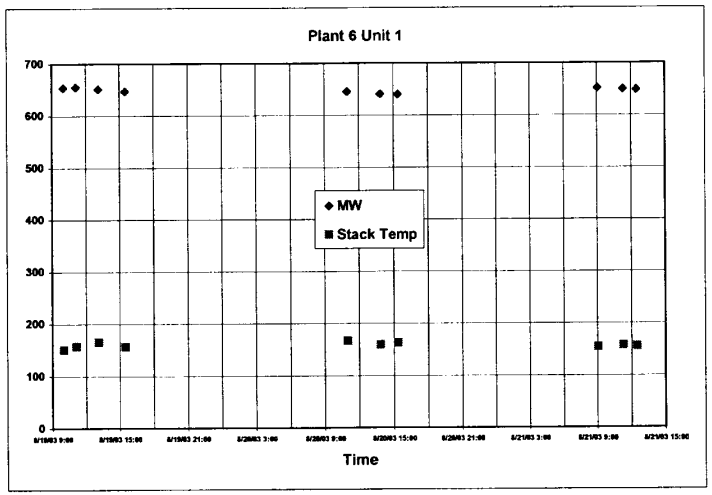
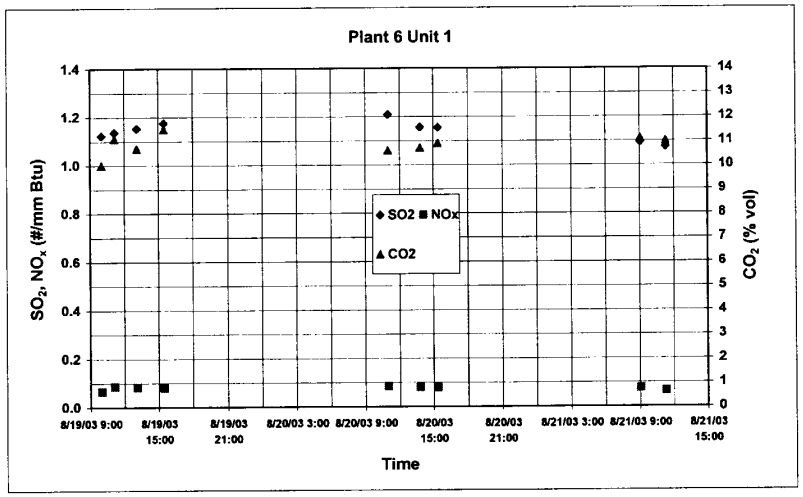
Plant 6 Process Data

Plant 6, Unit #1 Hourly Emissions Data

Time	Gross Generation	SO_2 Concentration	SO_2 Emissions	NO_x Concentration	NO_x Emissions Rate	NO_x Emissions	CO_2 Concentration	CO_2 Emissions	Flue Gas Flowrate
	(MW)	(ppm)	(pounds)	(ppm)	(#/mm Btu)	(pounds)	(vol. %)	(tons)	(ACFH)
8/19/2003 6:00	653	401.7	6,289.2	36.8	0.074	422.6	10.7	586.0	94,315,500
8/19/2003 7:00	654	397.5	6,268.7	37.5	0.076	433.1	10.6	584.7	95,002,500
8/19/2003 8:00	653	417.4	6,909.9	42.7	0.086	513.4	10.7	612.5	99,727,000
8/19/2003 9:00	652	406.4	6,665.5	40.8	0.083	491.9	10.6	608.1	98,802,000
8/19/2003 10:00	649	407.3	6,903.9	38.8	0.079	483.9	10.6	628.5	102,110,000
8/19/2003 11:00	647	410.4	6,781.7	38.4	0.078	465.8	10.6	612.7	99,545,000
8/19/2003 12:00	649	412.0	6,981.6	39.1	0.079	488.3	10.7	634.2	102,081,500
8/19/2003 13:00	647	413.9	6,713.6	34.6	0.069	412.1	10.8	612.7	97,713,000
8/19/2003 14:00	648	414.9	6,771.2	37.8	0.076	452.4	10.7	610.8	98,313,000
8/19/2003 15:00	648	416.2	6,691.4	38.7	0.077	455.8	10.8	607.3	96,851,000
8/19/2003 16:00	648	418.5	6,738.9	36.8	0.073	432.8	10.8	608.3	97,002,500
8/19/2003 17:00	648	414.5	6,839.1	35.1	0.071	427.3	10.7	617.5	99,395,500
8/19/2003 18:00	647	414.1	6,578.8	34.6	0.069	399.9	10.7	594.6	95,704,500
8/20/2003 6:00	646	403.2	6,382.6	37.4	0.074	431.3	10.8	598.0	95,361,000
8/20/2003 7:00	645	402.3	6,308.6	35.7	0.071	409.9	10.8	592.4	94,465,500
8/20/2003 8:00	645	418.3	6,644.0	39.9	0.079	462.0	10.8	600.0	95,683,000
8/20/2003 9:00	643	420.3	6,645.4	38.7	0.078	449.9	10.7	591.7	95,248,000
8/20/2003 10:00	644	417.9	6,814.8	40.3	0.081	481.8	10.7	610.3	98,235,500
8/20/2003 11:00	642	417.9	6,587.8	38.5	0.078	444.3	10.6	584.5	94,963,500
8/20/2003 12:00	641	418.2	6,879.9	38.2	0.077	457.8	10.6	609.9	99,103,000
8/20/2003 13:00	640	413.2	6,877.6	37.7	0.076	457.1	10.6	617.1	100,268,500
8/20/2003 14:00	641	427.1	6,502.9	39.2	0.079	433.7	10.7	563.3	91,720,500
8/20/2003 15:00	641	430.3	6,524.7	39.6	0.080	437.4	10.7	561.0	91,344,000
8/20/2003 16:00	643	430.1	6,547.3	40.4	0.081	444.6	10.7	563.2	91,703,500
8/20/2003 17:00	646	421.5	6,507.3	40.6	0.082	452.2	10.6	565.8	93,002,500
8/20/2003 18:00	647	421.1	6,582.6	40.9	0.083	463.5	10.6	572.9	94,167,500
8/21/2003 6:00	647	411.4	6,351.5	45.5	0.091	506.6	10.7	571.2	93,004,500
8/21/2003 7:00	650	414.5	6,436.8	44.7	0.090	504.0	10.7	574.5	93,548,500
8/21/2003 8:00	649	411.7	6,474.9	39.0	0.080	489.7	11.0	598.2	94,742,500
8/21/2003 9:00	647	406.3	6,381.3	37.4	0.078	473.1	10.9	591.9	94,613,500
8/21/2003 10:00	649	405.7	6,357.9	37.5	0.077	470.6	11.0	596.0	94,406,500
8/21/2003 11:00	652	410.1	6,442.4	38.3	0.079	483.4	11.0	597.5	94,635,000
8/21/2003 12:00	654	401.1	6,689.7	41.2	0.082	503.5	10.8	630.0	100,471,500
8/21/2003 13:00	639	387.6	6,330.0	41.1	0.082	493.1	10.8	616.9	98,380,500
8/21/2003 14:00	638	399.2	6,498.2	40.8	0.080	483.9	10.9	620.6	98,060,500
8/21/2003 15:00	636	399.4	6,527.8	40.6	0.081	487.4	10.8	617.4	98,458,000
8/21/2003 16:00	627	391.4	6,271.6	38.3	0.076	452.5	10.9	610.9	96,527,000
8/21/2003 17:00	632	400.9	6,342.3	38.0	0.074	439.0	11.0	608.7	95,301,000
8/21/2003 18:00	630	405.2	6,431.5	37.4	0.073	434.5	11.0	610.7	95,617,000

Test ID	Gross Generation (MW)	SO2 Emissions (pounds)	NOx Emissions (#/mm Btu)	CO2 Emissions (tons)	Flue Gas Flowrate (ACFt)	Carbon Emissions (tons)
Test #1	647.8	6,787.9	0.076	615.5	98,900,700	167.87
Test #2	643.5	6,779.3	0.075	596.6	96,032,500	162.72
Test #3	641.2	6,750.8	0.073	582.9	94,827,900	158.97
Test #4	648.2	6,723.9	0.073	606.5	96,501,400	165.40

The following data were taken at the FGD Control Room at Plant 6 during the tests.

Time	8/19/03 10:01	8/19/03 11:08	8/19/03 13:07	8/19/03 15:30			8/20/03 11:00	8/20/03 13:50	8/20/03 15:25	8/21/03 9:05	8/21/03 11:18	8/21/03 12:30
Generation (MW)	654.36	655.51	651.94	647.30			646.0	640.75	640.46	651.79	649.55	648.22
Stack Temp (°F)	150.05	157.51	165.25	156.03			166.78	158.82	162.64	154.23	157.1	154.93
SO2 (#/mm Btu)	1.123	1.137	1.154	1.176			1.208	1.156	1.155	1.093	1.074	-
NOx (#/mm Btu)	0.065	0.086	0.083	0.080			0.084	0.080	0.078	0.076	0.064	-
CO2 (vol %)	10.0	11.1	10.7	11.5			10.6	10.7	10.9	11.1	11.0	-
Flow (kSCFM)	1,775.7	1,624.1	1,700.0	1,500.3			1,711.8	1,521.0	1,559.8	1,519.1	1,564.5	-
Heat (mm Btu/hr)	6,371.8	6,009.3	6,080.6	6,663.2			6,048.2	5,427.0	5,689.7	5,525.6	5,736.6	-
CO (ppm)	186.02	91.19	85.71	-			907.89	1,083.70	1,118.17	1,155.69	1,476.33	838.60

Time	8/20/03 11:00	8/20/03 13:50	8/20/03 15:25	8/21/03 9:05	8/21/03 11:18	8/21/03 12:30
Generation (MW)	646.0	640.75	640.46	651.79	649.55	648.22
Stack Temp (°F)	166.78	158.82	162.64	154.23	157.1	154.93
SO2 (#/mm Btu)	1.208	1.156	1.155	1.093	1.074	-
NOx (#/mm Btu)	0.084	0.080	0.078	0.076	0.064	-
CO2 (vol %)	10.6	10.7	10.9	11.1	11.0	-
Flow (kSCFM)	1,711.8	1,521.0	1,559.8	1,519.1	1,564.5	-
Heat (mm Btu/hr)	6,048.2	5,427.0	5,689.7	5,525.6	5,736.6	-
CO (ppm)	907.89	1,083.70	1,118.17	1,155.69	1,476.33	838.60