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Comparison of Sampling Methods to Determine Total and Speciated Mercury in Flue Gas

CRADA 00-F038 Final Report

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Disclaimer

Introduction

The U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) and Frontier Geosciences, Inc. (FGS) collaborated in the investigation of sampling techniques that measure total and speciated forms of mercury (Hg) in flue gas. The FGS techniques investigated are referred to as the Frontier Sorbent Mercury Speciation (FSMS) method and the Sorbent Total Mercury (STM) method (Prestbo et al. 2001). Testing was conducted over five consecutive days during the week of March 27, 2000, on the 500 lb/hr pilot-scale coal combustion facility located at NETL-Pittsburgh.

As a standard for comparison with the FSMS and STM methods, a standardized, draft ASTM method (ASTM 1998), referred to as the Ontario-Hydro (O-H) method, was run simultaneously at the outlet of the pilot unit baghouse. For each O-H sample, two FSMS mercury speciation traps and one STM trap were run. Following sampling, FGS analyzed the FSMS and STM samples, and NETL analyzed the O-H samples. These analytical results from FGS and NETL were combined with sampling data to calculate flue gas mercury concentrations and were then compared. This report presents the results of that comparison.

Pilot Unit Description

The 500-lb/hr furnace system shown in Figure 1 consists of a wall-fired pulverized coal furnace equipped with a water cooled convection section, a recuperative air heater, spray dryer, baghouse, and associated ancillary equipment (fin-fan coolers, surge tanks, coal hoppers, blowers, pumps, etc). The 500-lb/hr combustor is an indirect-fired unit that typically operates under a 0.05 inches of water column draft. Coal is first pulverized offline in the Williams roller mill. The pulverized coal is transported through a series of hoppers before it is fed by an Acrison weight-loss differential feeder to the combustor. The combustor is a wall-fired, dry bottom type, which is capable of firing both coal and/or natural gas. The combustor's four wall-fired burners are equipped with secondary air registers that can be adjusted to improve combustion. All four burners are continuously monitored using a Lenox camera located in the combustor. This camera, the sight ports, and the on-line gas analyzers (O_2, NO_x, CO, and CO_2) optimize combustor performance. The overall system operating performance is also well characterized by online temperature readings, flow measurements, and four separate banks of continuous gas analyzers (O_2, NO_x, CO, SO_2 and CO_2) that are located along the flue gas path.

The flue gas exits the furnace and is cooled in the convective section, which consists of three water-cooled modules. Each module is designed to allow the cooling water to flow in four parallel paths. The flue gas exits the convective section at approximately 1,000 ^{o}F and enters the recuperative air heater, which is used to heat the secondary combustion air. The flue gas flows from the preheater, to a spray dryer, through a sorbent injection duct (SID) test section, and to the baghouse. The spray dryer was not in operation during testing. The SID and baghouse are heat-traced and insulated to minimize heat loss.

A wide range of flue gas temperatures at the spray dryer inlet, SID, and baghouse (downstream of preheater) can be obtained. The preheater flue-gas exit temperature can be adjusted by bypassing the secondary combustion air around the preheater and by venting the preheated combustion air (while maintaining a constant secondary air temperature). Typically, the secondary air temperatures

are kept in a narrow range (around 600 ^{o}F). If the desired downstream temperatures cannot be achieved with the desired secondary air temperature, the secondary air temperature can be adjusted to achieve the desired downstream temperatures. However, significantly changing secondary air temperatures can impact combustor performance (i.e., burner performance). Therefore, the combustor load can also be altered in conjunction with the options discussed above to obtain the desired downstream temperatures while maintaining reasonable system operating conditions.

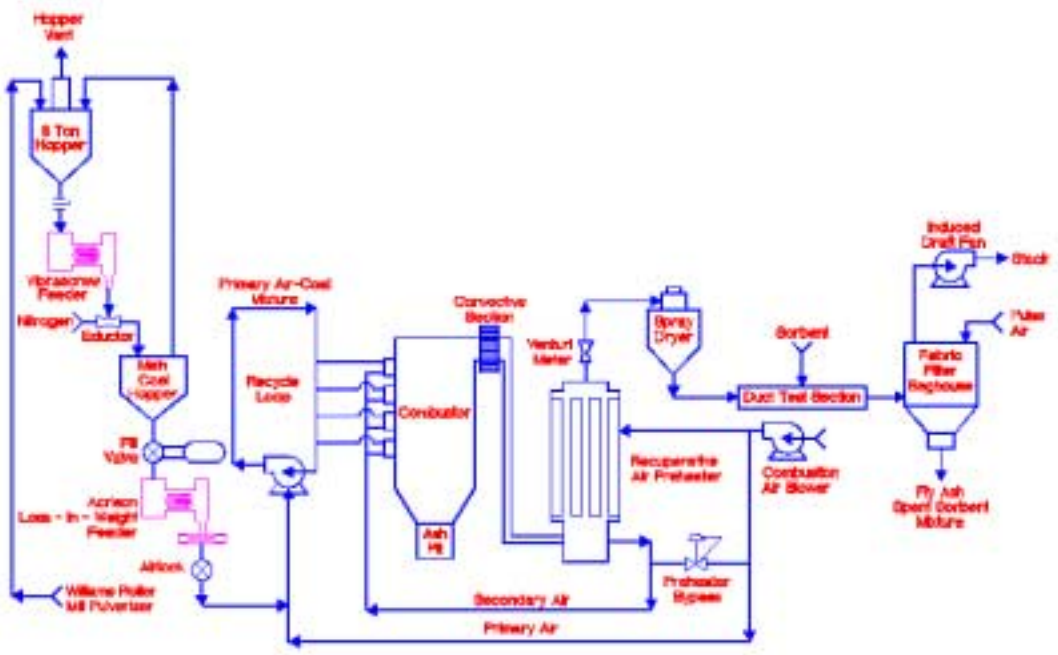


Figure 1. Schematic Diagram of the NETL 500-lb/hr Coal Combustion Test Facility

For some of the days of the test week, sorbent was injected upstream of the baghouse to remove mercury from the flue gas. The sorbent injection system consists of a hopper, screw feeder, scale, and an eductor that utilizes compressed air as the motive fluid. The fly ash and the injected sorbent are collected in a 6 ft-diameter, cylindrical, pulse-jet baghouse that contains 57 bags arranged in nine rows. The Goretex^{TM} Nomex^{TM} bags are 8 ft long and 4.5 in. in diameter. The baghouse bags are cleaned (pulsed) with 80 psi air when either the preset pressure drop is exceeded (the upper limit is typically set at 5.5 in. of water column with a deadband of two inches) or at regular time intervals. During this testing period, the bags were pulsed using the former method. The dislodged baghouse solids are collected in a lined, 55-gallon drum, which is weighed and sampled.

Operating Conditions

The sampling conducted under this CRADA occurred during 1 week of a 2-week test period devoted to the investigation of sorbent injection for mercury control. The major operating variables during this testing included the activated carbon (AC) injection rate (expressed as the AC/Hg mass ratio), baghouse temperature, and the type of activated carbon. The activated carbon injection rate could be varied without affecting other pilot unit conditions. However, adjustment of the baghouse

inlet temperature involved changing the operation of the secondary air preheater and, the coal firing rate, or both.

Table 1 lists the operating conditions of the pilot unit for each of the 5 days of the CRADA sampling. The table also shows the calculated mercury removals across the baghouse, based on flue gas sampling at the baghouse inlet and stack using the O-H method results. With a constant inlet mercury concentration, the different operating conditions resulted in different baghouse mercury removals and, therefore, different outlet mercury concentrations each day. The wide range of outlet concentrations gave a good basis for comparison of the mercury measurements methods. In addition, by sampling at the baghouse outlet, possible interferences due to fly ash were eliminated. The typical particulate loading after the baghouse was less than 1 mg/m^3.

Table 1. Daily Unit Operating Conditions

	03/27	03/28	03/29	03/30	03/31
Coal Feed Rate, lbs/hr	365	360	349	399	399
Average Baghouse Temperature, °F	245	244	272	272	276
Sorbent Injection (Y/N)	N	Y	Y	N	Y
AC/Hg Ratio	0	7,600	5,100	0	2,600
Average Hg removal efficiency, %	3	89	38	21	31
Baghouse Ash Carbon Content, %	0.82	1.54	1.34	1.91	2.21
Average Stack NO_x , ppm (dry)	359	358	356	357	325
Average Stack SO_2 , ppm (dry)	559	560	561	558	500
Stack Oxygen, % (dry)	8.4	8.5	8.5	8.5	9.0

In addition to temperature, baghouse parameters that can affect mercury removals include the fabric material, air-to-cloth ratio, and pulsing frequency. For these tests, the average baghouse operating conditions were not varied, but the air-to-cloth ratio varied with changes in the coal firing rate. For consistency, a single low-sulfur bituminous coal was fired in the combustor for all the testing. For each day of testing, coal was sampled at regular intervals and combined for a single analysis. Similarly, ash deposits from each day of testing at a given set of test parameters were collected, weighed and analyzed. Typically 60 to 70 percent of the ash in the coal is collected in the baghouse.

The combustor operating conditions can also have a significant effect on mercury removals. Throughout the testing, the combustor is intentionally operated to achieve high combustion efficiency with low unburned carbon levels in the fly ash. The pulverized coal is consistent and is typically sized at 75 percent through 200 mesh. The combustor operates in the range of 3 to 4 percent O_2 with a primary air/total air ratio greater than 20 percent. The resulting unburned carbon levels in fly ash under baseline operating conditions, shown in Table 1, are low. Even with AC injection, carbon levels in baghouse ash were generally less than 2 percent.

Comparison of Flue Gas Mercury Measurements

A summary of the comparison for the FSMS and O-H methods is shown in Table 2. The units in Table 2 are micrograms per standard cubic meter ($\mu g/m^3$), 68 ^oF, and 1 atm and the values shown are averages of the total mercury concentrations and mercury species for each day.

Table 2. Method Comparison Average Results
($\mu g/m^3$)

Date	Total Hg		Elemental Hg		Oxidized Hg	
	FSMS	O-H	FSMS	O-H	FSMS	O-H
3/27/00	5.75	5.19	0.91	0.77	4.84	4.42
3/28/00	0.63	0.57	0.04	0.04	0.60	0.53
3/29/00	2.96	3.03	0.17	0.20	2.80	2.83
3/30/00	4.10	4.02	0.25	0.40	3.85	3.62
3/31/00	3.59	3.61	0.14	0.27	3.46	3.34

The three O-H samples were averaged for each day. Four FSMS samples were averaged on the first day, and six for the other days (i.e., two FSMS samples for each O-H sample). A complete listing of data compiled using the FSMS method is given in the Data Report prepared by FGS and included as Appendix A. A compilation by NETL researchers of the flue gas sampling results using the O-H method is provided in Appendix B. The agreement between the two methods for both total Hg and oxidized Hg is excellent. The relative percent difference is less than about 10 percent for total Hg for any day, and less than about 13 percent for oxidized Hg for any day. The agreement of the elemental Hg results is excellent at less than 19 percent difference for the first 3 days but not as good for the last 2 days, with a relative percent difference as high as 63 percent on 3/31/00. However, given the extremely low concentrations of less than $1\mu g/m^3$, the agreement is still excellent on an absolute basis.

A comparison of the total mercury concentrations measured by the three methods (FSMS, O-H, and STM) is given in Table 3. The individual values for all of the samples run each day are shown and the agreement among the three methods is very good.

Table 3. Method Intercomparison for Total Hg in Flue Gas
FSMS vs. O-H vs. STM ($\mu g/m^3$)

Sample ID	FSMS #1	FSMS #2	FSMS AVG.	O-H	STM
03/27 #1	5.27	na	5.27	5.19	na
03/27 #2	5.65	na	5.65	5.05	na
03/27 #3	6.22	5.86	6.04	5.33	5.22
03/28 #1	0.50	0.53	0.52	0.48	0.47
03/28 #2	0.71	0.71	0.71	0.61	0.61
03/28 #3	0.62	0.70	0.66	0.62	0.64
03/29 #1	2.94	2.89	2.92	3.09	3.23
03/29 #2	3.01	3.28	3.14	3.10	3.21
03/29 #3	2.77	2.85	2.81	2.92	2.75
03/30 #1	3.67	3.80	3.74	3.87	4.07
03/30 #2	4.45	4.19	4.32	4.04	4.48
03/30 #3	4.25	4.22	4.24	4.16	4.45
03/31 #1	2.96	3.27	3.17	3.38	3.47
03/31 #2	3.98	3.84	3.91	3.75	3.88
03/31 #3	3.62	3.77	3.69	3.70	3.85

These results are also shown graphically in Figure 2. In this parity plot, the total mercury concentrations as measured by the O-H method are on the x-axis and the values corresponding to the FSMS and STM method are plotted as the corresponding y-values.

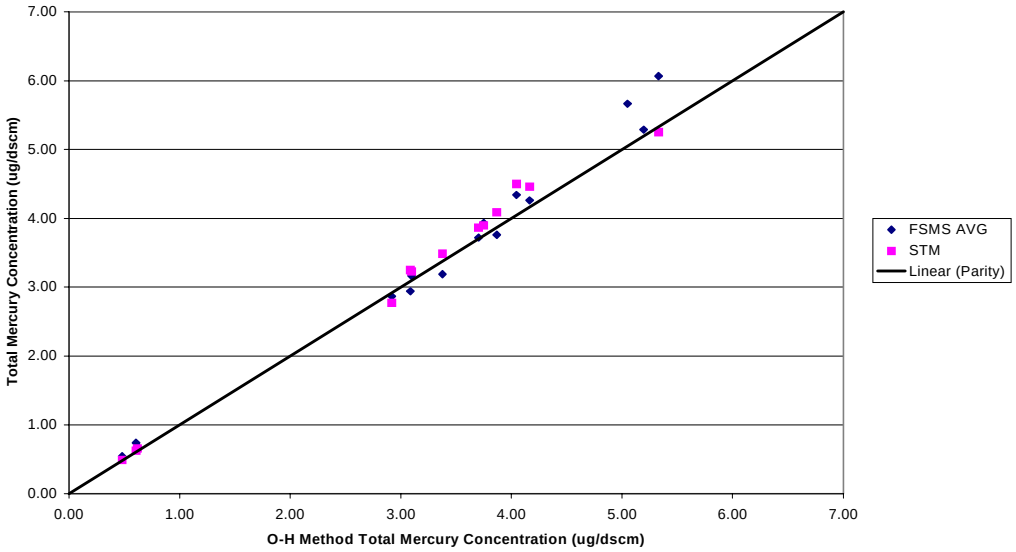


Figure 2. Parity Plot of Mercury Concentrations With the FSMS, STM, and O-H Methods

Comparison of Coal and Ash Analyses

Typically during a test period, samples of coal and ash deposits are collected and analyzed for mercury. These analyses are then combined with the flue gas measurements to calculate mercury mass balances around the system for each day of testing. While mass balances have shown a good accounting of the mercury in the system in previous studies, the average mass balance has been generally less than 100 percent. A high bias in the coal analysis has been suspected as the cause (Hargis, O'Dowd, and Pennline 2000). As a result of this past experience, FGS agreed to analyze a subset of the coal and ash samples collected during the CRADA test period, even though this was outside the scope of the original CRADA agreement. A comparison of the coal and ash analyses by FGS and the results obtained from the NETL contract laboratory (Geochemical) is given in Table 4.

The FGS results are consistently lower than those from Geochemical, particularly for the coal samples. Note that there are two columns of results for Geochemical. In addition to the original analysis, three of the coal samples were resubmitted for analysis. The results from these resubmitted samples were lower than the original Geochemical results but still higher than the corresponding FGS results.

The comparison of FGS and Geochemical results suggests a high bias in the Geochemical analyses. This could explain the low material balances previously calculated for this pilot unit. In order to accurately determine the effect of the differences in solids analyses between FGS and Geochemical, it would be necessary to submit a complete set of coal and ash samples for an entire test week to both laboratories. However, this level of effort is outside the scope of the CRADA effort.

Table 4. Comparison of FGS and Geochemical Analyses of Selected Solid Samples

	Sample		Geochemical		Frontier (FGS)
Date	Description	Sample ID	Initial Hg	Resubmit Hg	Hg
			Ppm	ppm	ppm
3/22/00	Daily Coal Composite	965-974	0.13	N/A	0.0695
3/23/00	Daily Coal Composite	978-985	0.12	N/A	0.0663
3/24/00	Daily Coal Composite	989-999	0.13	N/A	0.0673
3/28/00	Daily Coal Composite	1041-1054	0.10	0.09	0.0610
3/30/00	Daily Coal Composite	1071-1082	0.13	0.08	0.0559
3/31/00	Daily Coal Composite	1087-1098	0.11	0.08	0.0530
3/22/00	BH flyash-day	975-A BH	0.31	N/A	0.260
3/23/00	BH flyash-day	986-A BH	0.08	N/A	0.027
3/24/00	BH flyash-day	1000-A BH	0.19	N/A	0.144
3/28/00	BH flyash-day	1055-A BH	1.10	N/A	1.035
3/30/00	BH flyash-day	1083-A BH	0.14	N/A	0.099
3/30/00	BH flyash- sootblow	1085-A BH	0.09	N/A	0.047

References

ASTM, 1998, Standard Test Method for Elemental, Oxidized, Particle-bound, and Total Mercury in Flue Gas Generated From Coal-Fired Stationary Sources (Ontario-Hydro Method), draft.

Hargis, R.A., W.J. O'Dowd, and H.W. Pennline, 2000, Sorbent Injection for Mercury Removal in a Pilot-Scale Coal Combustion Unit, *Proceedings of 93rd Air and Waste Management Association Conference*.

Prestbo, E.M., et al., 2001, *Solid Sorbent Method: Results of a Performance Based Measurement System (PBMS) Validation Study*, Report to the EPA Air Pollution Prevention and Control Division, National Risk Management Research Laboratory, Research Triangle Park, NC.

Appendix A: Flue Gas Mercury Speciation Method Comparison

Frontier Sorbent Mercury Speciation (FSMS) Method vs
Ontario Hydro (OH) Method vs FGS Sorbent Total Mercury (STM) Method

Frontier Geosciences
Bob Brunette

This appendix has nine parts, described below. A brief summary of results follows the listing of the nine parts.

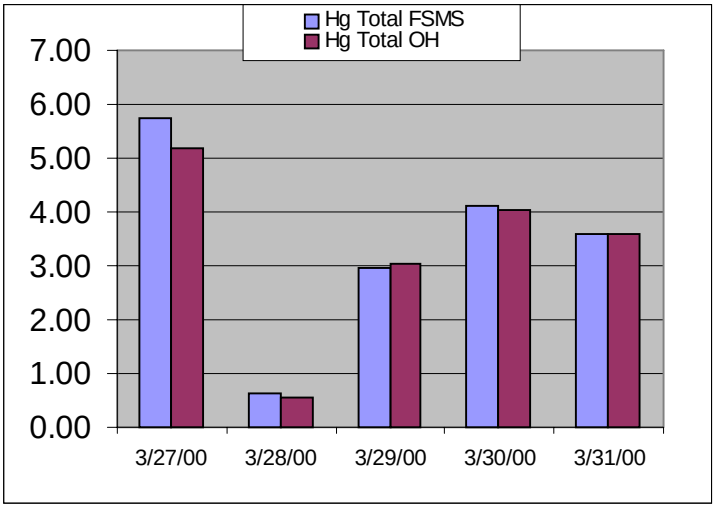
Summary of Results

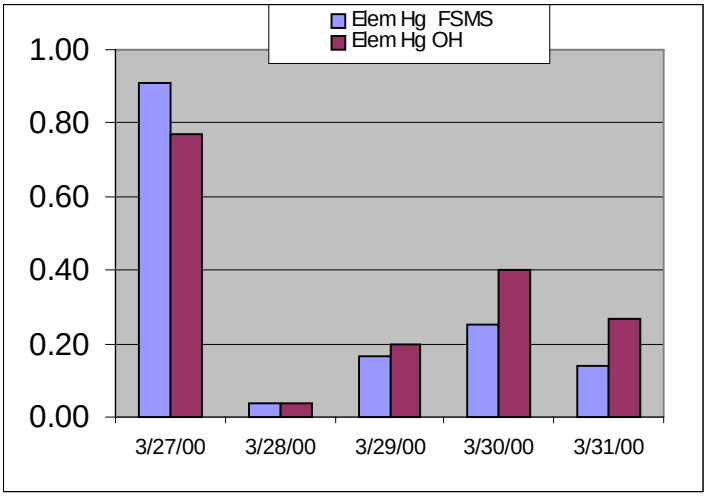
Summary of Coal Hg Results. The coal Hg measurements reported a 63.2 ng Hg/gram +/- 6.9 ng Hg/g (11.0% RSD). These measurements indicate that the coal fed to the system throughout the course of the study was homegenous and provided a good baseline for this test.

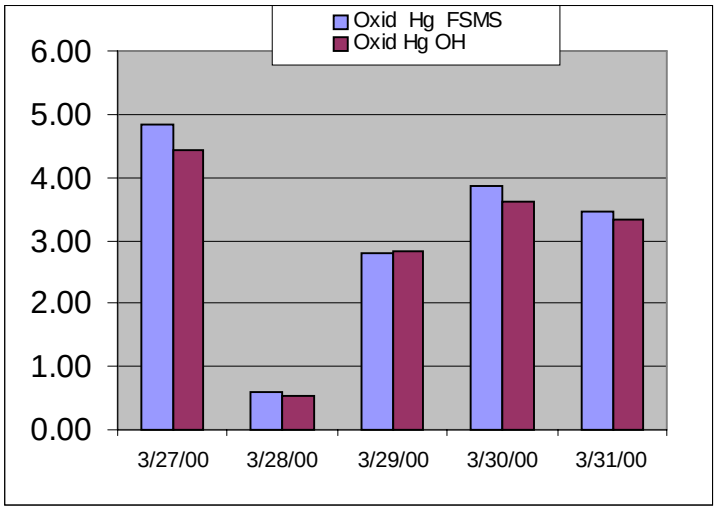
Summary of Fly Ash and "Inlet" Hg Results. The fly ash results were not homogenous and if all of the samples were all taken from the same location, could indicate a Hg sorbtion property that we've seen at only a few other plants.

Summary of FSMS Versus OH Results. Averaging the results for each method throughout each day, and then calculating a relative percent difference, you can see in Table 1 that the comparison is particularly excellent for both the total Hg value and the oxidized Hg value. The relative percent difference for these values ranged from 0.6% to 12.7% RPD. This is truly excellent considering that the data was collected by people trained to operate (albeit a simple system) for essentially a 2-hour session. This demonstrates the robustness of the technique and shows that field operators can be trained clean techniques easily in the field.

Elemental Hg values ranged from 12.6% to 63.3% RPD between the FSMS and the OH techniques. It is apparent that the low Hg(0) concentrations in relation to the Hg(II) concentrations were the cause of this. Typically, we've seen about 40% Hg(II) in coal flue gas. Nevertheless, the comparison of the Hg(0) concentrations were good considering the < 0.5ug Hg/m^3. The Estimated Minimum Detection Limit for Hg(0) for the FSMS method was 0.023 µg Hg/m^3. It would be interesting to compare this to the EMDL of the OH Hg(0) method and compare the blank to signal ratio.







Appendix A: Coal Results

Table 1. DOE "As Received" Coal Hg Concentrations

Lab Dat Set ID	Coal Sample ID	grams/digest	ng/digest	As Received (ng/g)	Average (ng/g)
THg8-000726-1	1-1064	0.4883	36.76	75.28	69.5
THg8-000726-1	1-1064 MD	0.4959	33.61	67.77	
THg4-000828-1	1-1064	0.4981	33.92	68.06	
THg4-000828-1	1-1064 MD	0.4949	33.18	67.01	
THg8-000726-1	2-1073	0.4973	34.24	68.85	66.3
THg4-000828-1	2-1073 MD	0.5027	32.11	63.83	
THg8-000726-1	3-1085	0.5188	36.76	70.85	67.3
THg4-000828-1	3-1085 MD	0.5081	32.39	63.71	
THg8-000726-1	4-1155	0.5180	31.09	60.02	61.0
THg4-000828-1	4-1155 MD	0.5019	31.15	62.03	
THg8-000726-1	5-1178	0.5231	29.67	56.72	55.9
THg4-000828-1	5-1178 MD	0.4985	27.47	55.07	
THg8-000726-1	6-1191	0.4913	25.42	51.73	53.0
THg4-000828-1	6-1191 MD	0.5043	27.43	54.35	
			Overall Average >	**63.2**	
			Overall Standard Deviaton >	**6.9**	
			Overall Relative Standard Deviation >	**11.0%**	

Table 2A: Estimated Minimum Detection Limit Coal Hg Results - Analysis THg8-000726-1

Lab Dat Set ID	Sample ID	grams/digest	ng/digest	ng/g
THg4-000828-1	PBC 1	0.5000	1.9538	0.0782
THg4-000828-1	PBC 2	0.5000	1.5373	0.0615
THg4-000828-1	PBC 3	0.5000	1.6725	0.0669
			Average >	**0.0688**
			SD >	**0.0085**
			Estimated MDL >	**0.025 ng/g**
			EMDL >	**0.00003 µg/g**

Table 2b: Estimated Minimum Detection Limit Coal Hg Results- Analysis THg8-000828-1

Lab Dat Set ID	Sample ID	grams/digest	ng/digest	Ng/gram
	PBC 1	0.5000	0.084	0.167
	PBC 2	0.5000	0.090	0.180
	PBC 3	0.5000	0.449	*0.898
			Average >	**0.1737**
			SD >	**0.0089**
			Estimated MDL >	**0.027 ng/g**
			EMDL >	**0.00003 µg/g**

Table 3: DOE Coal Hg Matrix Duplicate

Lab Dat Set ID	Coal Sample ID	grams/digest	ng/digest	ng/gram	RPD
THg8-000726-1	1-1064	0.4883	36.76	75.28	
THg8-000726-1	1-1064 MD	0.4959	33.61	67.77	10.5%
THg4-000828-1	1-1064	0.4981	33.92	68.06	
THg4-000828-1	1-1064 MD	0.4949	33.18	67.01	1.6%
THg8-000726-1	2-1073	0.4973	34.24	68.85	
THg4-000828-1	2-1073 MD	0.5027	32.11	63.83	7.6%
THg8-000726-1	3-1085	0.5188	36.76	70.85	
THg4-000828-1	3-1085 MD	0.5081	32.39	63.71	10.6%
THg8-000726-1	4-1155	0.5180	31.09	60.02	
THg4-000828-1	4-1155 MD	0.5019	31.15	62.03	3.3%
THg8-000726-1	5-1178	0.5231	29.67	56.72	
THg4-000828-1	5-1178 MD	0.4985	27.47	55.07	3.0%
THg8-000726-1	6-1191	0.4913	25.42	51.73	
THg4-000828-1	6-1191 MD	0.5043	27.43	54.35	4.9%

Table 4: DOE Coal Hg Matrix Spike Recovery (100ng Hg/sample Matrix Spike)

Lab Data Set ID	Sample ID	Grams/Digest	Matrix Spike Hg Spiking Level	Un-Spiked Sample ng Hg/gram	Amt Spiked Per Gram ng Hg/gram	Measured Spike Rec. ng Hg/gram	Expected Spike Rec. ng Hg/gram	Net Recovery ng Hg/g	Matrix Spike Rec. %	MS/MSD RPD
THg8-000726-1	1064 MS	0.5144	100.0	na	194.40	226.62	265.93	155.10	85.2%	5.42%
THg8-000726-1	1064 MSD	0.5106	100.0	na	195.85	218.44	263.62	146.91	82.9%	na
THg8-000726-1	1064	0.4883	na	75.28	na	na	na	na	na	na
THg8-000726-1	1064 MD	0.4959	na	67.77	na	na	na	na	na	na
THg8-000726-1	D17 MS	0.4910	100.0	na	203.67	206.62	246.52	163.77	83.8%	5.38%
THg8-000726-1	D17 MSD	0.5113	100.0	na	195.58	215.67	235.17	172.82	91.7%	na
THg8-000726-1	D17	0.4998	na	46.13	na	na	na	na	na	na
THg8-000726-1	D17 MD	0.5187	na	39.59	na	na	na	na	na	na
THg4-000828-1	#1064 MS	0.4955	100.0	**na**	201.8163471	236.36	269.35	168.83	87.8%	na
THg4-000828-1	#1064	0.4981	na	68.06	na	na	na	na	na	na
THg4-000828-1	#1064 MD	0.4949	na	67.01	na	na	na	na	na	na

Table 5: Standard Reference Material Recovery – Mercury

IMPORTANT NOTE: SRM 1630a

SRM 1630a was made recently as the original SRM 1630 was exhausted. This latest latest batch of 1630a had only a reference value for Hg which was 106 μg Hg/Kg (± 23 μg Hg/Kg) since December 99. Recently (09/07/00) NIST released a certified value for Hg of 93.8 μg Hg/Kg (± 3.7 μg Hg/Kg). Frontier has found that the recovered value for this standard measures is in this range of 106 μg Hg/Kg (± 23 μg Hg/Kg).

Results: SRM 1630a Trace Mercury in Coal Reference Value = 0.106 ug Hg/g +/- 0.023ug Hg/g					
Lab Data Set	**Reference Value ng Hg/gram**	**Measured Value ng Hg/gram**	**% Moisture**	**Dry Basis Measured Value ng Hg/gram**	**Actual Recovery %**
THg8-000726-1	93.8	91.3	2.02	93.2	99.3%
THg4-000828-1	93.8	80.6	2.02	82.3	87.7%

*Used NIST value

Appendix A: Ash Results

Table 1: DOE "Inlet" Sample Hg Concentrations

Lab Dat Set ID	NETL Sample ID	NETL Sample Description	grams/digest	ng/digest	As Received (ng/gram)	Average (ng/gram)
THG2-000829-1	13-1089	1089 Inlet #1	0.2478	9.56	38.59	na
THG2-000829-1	14-1090	1090 Inlet #2	0.2498	23.83	95.39	na
THG2-000829-1	15-1091	1091 Inlet #3	0.2582	29.47	114.15	na
THG2-000829-1	16-1096	1096 Inlet #8	0.2503	104.29	416.66	385.18
THG2-000829-1	16-1096 MD	1096 Inlet #8 MD	0.2462	87.08	353.70	na
THG2-000829-1	17-1098	1098 Inlet #10	0.2497	13.74	55.04	na
THG2-000829-1	18-1099	1099 Inlet #11	0.2544	47.62	187.20	na

Table 2: DOE Fly Ash Sample Hg Concentrations

Lab Dat Set ID	NETL Sample ID	NETL Sample Description	Grams/digest	ng/digest	As Received (ng/gram)
THG2-000829-1	7-1194 Fly Ash	1194-(975-A-00-02)	0.2470	63.89	258.67
THG2-000829-1	8-1196 Fly Ash	1196-(986-A-00-02)	0.2505	6.89	27.49
THG2-000829-1	9-1198 Fly Ash	1198-(1000-A-00-02)	0.2458	35.39	143.98
THG2-000829-1	10-1206 Fly Ash	1206-(1055-A-00-02)	0.2534	262.36	1035.35
THG2-000829-1	11-1210 Fly Ash	1210-(1083-A-00-02)	0.2526	24.90	98.59
THG2-000829-1	12-1211 Fly Ash	1211-(1085-A-00-02)	0.2485	11.59	46.65

Table 3: Fly Ash Prep Blank/Estimated Detection Limit

Lab Dat Set ID	Prep Blank ID	grams/digest	ng/digest	(ng/gram)	
THG2-000829-1	PBA-1	0.2500	0.17	0.66	
THG2-000829-1	PBA-2	0.2500	0.13	0.50	
THG2-000829-1	PBA-3	0.2500	0.08	0.34	
			Average Prep Blank >	0.50	**ng Hg/gram**
			Standard Deviation >	0.16	**ng Hg/gram**
			Estimated Minimum Detection Limit >	0.32	**ng Hg/gram**

Table 4: DOE Fly Ash Hg Matrix Spike Recovery (250ng Hg/sample Matrix Spike)

Lab Data Set ID	Sample ID	Grams /Digest	Matrix Spike Hg Spiking Level	Un-Spiked Sample ng Hg/gram	Amt Spiked Per Gram ng Hg/gram	Measured Spike Rec. ng Hg/gram	Expected Spike Rec.ng Hg/gram	Net Recovery ng Hg/g	MatrixSpike Rec. %
THG2-000829-1	16-1096	0.2503	na	416.66	na	na	na	na	na
THG2-000829-1	16-1096 MD	0.2462	na	353.7	na	na	na	na	na
THG2-000829-1	16-1096 MS +1015. ng/g	0.2464	250.0	na	1014.61	1281.01	#####	895.82	91.5%

Table 5: Standard Reference Material Recovery

Results: SRM 1633b Trace Constituents In Coal Fly Ash
Certified Value For Hg = 141 ug Hg/g +/- 19 ug Hg/g

	Reference	Measured	Actual
	Value	Value	Recovery
Lab Data Set	ng Hg/gram	ng Hg/gram	%
THg8-000726-1	141.00	130.83	92.8%

Appendix A: Total Hg and Elemental Hg Results

Table 1: Iodated Carbon (Total Hg and Elemental Hg Results)

Sample ID	Instrument Corrected		IC Field Blank Corrected	
	ICA	ICB	ICA	ICB
0327 FSMS#1	37.4567	0.4556	36.8765	
0327 FSMS#2	41.4202	0.4048	40.8400	
0327 FSMS#3	23.6314		23.0511	
0327 FSMS#4	30.1619	0.4860	29.5816	
0327 FSMS#5	163.5128	1.0675	162.9325	0.487
0328 FSMS#1	0.8434		0.2631	
0328 FSMS#2	1.1069		0.5266	
0328 FSMS#3	15.2806		14.7004	
0328 FSMS#4	2.3557		1.7755	
0328 FSMS#5	2.1764		1.5961	
0328 FSMS#6	21.1802		20.6000	
0328 FSMS#7	1.6714		1.0911	
0328 FSMS#8	1.9121		1.3318	
0328 FSMS#9	20.5331		19.9528	
0329 FSMS#1	5.2607		4.6805	
0329 FSMS#2	7.3602		6.7799	
0329 FSMS#3	103.3012		102.7210	
0329 FSMS#4	5.7346		5.1544	
0329 FSMS#5	6.7257		6.1454	
0329 FSMS#6	107.0281		106.4478	
0329 FSMS#7	1.6314	1.3110	1.0512	0.731
0329 FSMS#8	4.9053		4.3251	
0329 FSMS#9	59.6182		59.0380	
0330 FSMS#1	7.7131		7.1328	
0330 FSMS#2	7.6798		7.0995	
0330 FSMS#3	134.4184		133.8382	
0330 FSMS#4	7.5910		7.0108	
0330 FSMS#5	10.8982		10.3179	
0330 FSMS#6	145.5164		144.9361	
0330 FSMS#7	8.2680		7.6877	
0330 FSMS#8	9.8994		9.3191	
0330 FSMS#9	147.6250		147.0447	
0331 FSMS#1	1.0543		0.4741	
0331 FSMS#2	6.2703		5.6901	
0331 FSMS#3	113.2213		112.6411	
0331 FSMS#4	4.4947		3.9144	
0331 FSMS#5	6.1927		5.6124	
0331 FSMS#6	126.0950		125.5147	

0331 FSMS#7	4.6278		4.0476	
0331 FSMS#8	7.2803		6.7000	
0331 FSMS#9	116.9946		116.4144	

Table 2: IC Total Hg Prep Blanks

Sorbent Total Hg Lab Prep Blanks	
PBIC-1	0.3672
PBIC-2	0.4575
PBIC-3	0.4137
PBIC-4	0.4109

IC Prep Blank Average > 0.4123

SD > 0.0369

Estimated MDL > 0.004 µg Hg/m^3

(Based on a 30L sample Volume)

Table 3: IC Total Hg Field Blanks

Sorbent Total Hg Field Blanks	
IC-A-0331-BLANK	0.9041
IC-A-0331-FB	0.5734
IC-A 0331 FB	0.4994
IC-A 0330 Blank	0.3440

Field Blank Average > 0.5802

SD > 0.2361

Estimated MDL > 0.0236 ug Hg/m^3

(Based on a 30L sample Volume)

Appendix A: Hg (II) (Oxidized) Hg Data

Table 1: FSMS Method (Oxidized Hg) Results

KCl Trap Sample ID	Instrument Corrected		KCl Blank Corrected		Hg(II) Sum
	KClA	KClB	KClA	KClB	KClA+KClB
0327 FSMS#1	182.1740	2.2455	182.0764	2.1480	184.2244
0327 FSMS#2	201.4908	2.3246	201.3932	2.2271	203.6203
0327 FSMS#3	135.3431	2.6582	135.2455	2.5606	137.8061
0327 FSMS#4	155.9434	2.2017	155.8459	2.1041	157.9500
0328 FSMS#1	14.67629	0.15485	14.5787	0.0573	14.6360
0328 FSMS#2	16.02706	0.59414	15.9295	0.4966	16.4261
0328 FSMS#4	18.56569	0.50171	18.4681	0.4041	18.8723
0328 FSMS#5	22.26134	0.39117	22.1638	0.2936	22.4574
0328 FSMS#7	17.10878	0.07862	17.0112	-0.0189	16.9923
0328 FSMS#8	21.98982	0.19678	21.8923	0.0992	21.9915
0329 FSMS#1	87.8334	0.7237	87.7358	0.6262	88.3620
0329 FSMS#2	90.2227	0.8629	90.1251	0.7653	90.8904
0329 FSMS#4	85.8785	1.2736	85.7809	1.1760	86.9569
0329 FSMS#5	104.5587	0.8915	104.4612	0.7939	105.2550
0329 FSMS#7	50.8675	0.2006	50.7699	0.1030	50.8729
0329 FSMS#8	55.4688	1.1363	55.3712	1.0388	56.4100
0330 FSMS#1	111.0751	1.0134	110.9775	0.9159	111.8934
0330 FSMS#2	121.7185	1.2021	121.6209	1.1045	122.7255
0330 FSMS#4	123.5250	1.2355	123.4274	1.1379	124.5653
0330 FSMS#5	131.2758	1.5709	131.1783	1.4733	132.6516
0330 FSMS#7	116.5054	1.2011	116.4078	1.1036	117.5114
0330 FSMS#8	134.0996	1.7110	134.0020	1.6134	135.6154
0331 FSMS#1	97.0251	1.3431	96.9275	1.2455	98.1730
0331 FSMS#2	109.7718	0.8652	109.6742	0.7677	110.4419
0331 FSMS#4	106.6910	1.2997	106.5935	1.2021	107.7955
0331 FSMS#5	122.5873	1.0933	122.4898	0.9957	123.4855
0331 FSMS#7	99.3456	0.7892	99.2481	0.6916	99.9397
0331 FSMS#8	110.6407	0.7783	110.5431	0.6808	111.2239

Table 2: KCI FSMS Prep Blank and EMDL

KCl Preparation Blank Summary	
PB-KCL1	0.0775
PB-KCL2	0.0319
PB-KCL3	0.0297
PB-KCL4	0.0297
Average >	0.0422
SD >	0.0236
Estimated Detection Limit (HgII)>	0.002m^3

* Based on a 30L sample volume

Table 3: KCI Filed Blank and EMDL

KCl Field Blank Summary	
KCl-A 0330 Blank	0.1253
KCl-B 0330 Blank	0.0558
KCl-A 0331 FB	0.0992
KCl-B 0331 FB	0.1101
Average >	0.0976
SD >	0.0299
Estimated Detection Limit (HgII)>	0.003 m^3

* Based on a 30L sample volume

Appendix A: Sample Volume Data

Table 1: Mass Flow Meter Volume Offset Correction

Sample ID	MFM #	Zer0 Offset	Totalizer Sample Vol	Start Time	End Time	Total Sample Time	Total Sample Time (min)	Offset Correction	Offset Cor Volume
0327 FSMS#1	FGS#1	-0.007	42.5	13:25	14:54:00	1:29:00	89.00	0.6	43.1
0327 FSMS#2	FGS#2	-0.029	42.0	13:28	14:55:00	1:27:00	87.00	2.5	44.5
0327 FSMS#3	FGS#1	0.029	30.1	15:42	17:42:32	2:00:32	120.53	-3.5	26.6
0327 FSMS#4	FGS#2	-0.024	30.00	15:44	17:45:45	2:01:45	121.75	2.9	32.9
0327 THg#5	FGS#3	-0.029	28.80	15:46	17:43:50	1:57:50	117.83	3.4	32.2
0328 FSMS#1	FGS#1	-0.019	28.10	9:28	11:26:45	1:58:45	118.75	2.3	30.4
0328 FSMS#2	FGS#2	-0.03	29.00	9:29	11:35:20	2:06:20	126.33	3.8	32.8
0328 THg#3	FGS#3	-0.024	29.20	9:30	11:30:45	2:00:45	120.75	2.9	32.1
0328 FSMS#4	FGS#1	-0.003	29.30	11:52	14:41:00	2:49:00	169.00	0.5	29.8
0328 FSMS#5	FGS#2	-0.029	30.00	12:01	14:42:30	2:41:30	161.50	4.7	34.7
0328 THg#6	FGS#3	-0.029	30.10	12:02	14:45:00	2:43:00	163.00	4.7	34.8
0328 FSMS#7	FGS#1	-0.0055	29.30	15:02	17:18:00	2:16:00	136.00	0.7	30.0
0328 FSMS#8	FGS#2	-0.029	30.00	15:02	17:23:00	2:21:00	141.00	4.1	34.1
0328 THg#9	FGS#3	-0.024	28.70	15:02	17:19:00	2:17:00	139.00	3.3	32.0
0329 FSMS#1	FGS#1	-0.017	29.80	8:36	11:15:30	2:39:30	159.50	2.7	32.5
0329 FSMS#2	FGS#2	-0.029	30.00	8:36	11:18:00	2:42:00	162.00	4.7	34.7
0329 THg#3	FGS#3	-0.021	29.30	8:36	11:16:30	2:40:30	160.50	3.4	32.7
0329 FSMS#4	FGS#1	-0.001	31.30	11:35	14:33:00	2:58:00	178.00	0.2	31.5
0329 FSMS#5	FGS#2	-0.028	30.00	11:35	14:32:00	2:57:00	177.00	5.0	35.0
0329 THg#6	FGS#3	-0.023	30.00	11:35	14:32:00	2:57:00	177.00	4.1	34.1
0329 FSMS#7	FGS#1	0.0015	19.70	14:53	16:35:00	1:42:00	103.00	0.2	19.5
0329 FSMS#8	FGS#2	-0.028	19.00	14:53	16:36:00	1:43:00	103.00	2.9	21.9
0329 THg#9	FGS#3	-0.0205	20.00	14:53	16:35:00	1:42:00	102.00	2.1	22.1
0330 FSMS#1	FGS#1	-0.018	30.30	8:35	11:25:00	2:50:00	170.00	3.1	33.4

0330 FSMS#2	FGS#2	-0.03	30.00	8:36	11:28:00	2:52:00	172.00	5.2	35.2
0330 THg#3	FGS#3	-0.025	29.60	8:37	11:26:00	2:49:00	169.00	4.2	33.8
0330 FSMS#4	FGS#1	0	30.40	11:50	14:23:00	2:33:00	153.00	0.0	30.4
0330 FSMS#5	FGS#2	-0.033	30.00	11:50	14:25:10	2:35:10	155.17	5.1	35.1
0330 THG#6	FGS#3	-0.025	29.40	11:50	14:25:00	2:35:00	155.00	3.9	33.3
0330 FSMS#7	FGS#1	0	30.30	14:45	17:09:00	2:24:00	144.00	0.0	30.3
0330 FSMS#8	FGS#2	-0.0295	31.00	14:45	17:11:00	2:26:00	146.00	4.3	35.3
0330 THg#9	FGS#3	-0.027	30.10	14:45	17:09:00	2:24:00	144.00	3.9	34.0
0331 FSMS#1	FGS#1	-0.025	30.20	8:14	10:57:00	2:43:00	163.00	4.1	34.3
0331 FSMS#2	FGS#2	-0.026	31.00	8:13	11:01:00	2:48:00	168.00	4.4	35.4
0331 THg#3	FGS#3	-0.0235	29.50	8:13	10:58:00	2:45:00	165.00	3.9	33.4
0331 FSMS#4	FGS#1	0.003	29.30	11:15	13:54:00	2:39:00	159.00	0.5	28.8
0331 FSMS#5	FGS#2	-0.0285	30.00	11:15	13:56:00	2:41:00	161.00	4.6	34.6
0331 THg#6	FGS#3	-0.026	28.70	11:15	13:55:00	2:40:00	175.00	4.6	33.3
0331 FSMS#7	FGS#1	-0.0045	29.00	14:30	16:32:00	2:02:00	122.00	0.5	29.5
0331 FSMS#8	FGS#2	-0.0255	29.00	14:30	16:33:00	2:03:00	123.00	3.1	32.1
0331 THg#9	FGS#3	-0.022	28.40	14:30	16:33:00	2:03:00	123.00	2.7	31.1

Table 2: Sample Volume Stack Gas Constituent

Sample ID	Start Time	End Time	02 Conc	C02 Conc	02 K Factor	C02 K Factor	Stack Gas CF	uncorrect Vol	Gas Corr Vol
0327 FSMS#1	13:25	14:54:00	8.3	10.6	1	0.74	0.972	42.5	41.3
0327 FSMS#2	13:28	14:55:00	8.3	10.6	1	0.74	0.972	42.0	40.8
0327 FSMS#3	15:42	17:42:32	8.4	10.6	1	0.74	0.972	30.1	29.3
0327 FSMS#4	15:44	17:45:45	8.4	10.6	1	0.74	0.972	30.0	29.2
0327 THg	15:46	17:43:50	8.4	10.6	1	0.74	0.972	28.8	28.0
0328 FSMS#1	9:28	11:26:45	8.5	10.6	1	0.74	0.972	28.1	27.3
0328 FSMS#2	9:29	11:35:20	8.5	10.6	1	0.74	0.972	29.0	28.2
0328 THg3	9:30	11:30:45	8.5	10.6	1	0.74	0.972	29.2	28.4
0328 FSMS#4	11:52	14:41:00	8.6	10.5	1	0.74	0.973	29.3	28.5
0328 FSMS#5	12:01	14:42:30	8.6	10.5	1	0.74	0.973	30.0	29.2
0328 THg6	12:02	14:45:00	8.6	10.5	1	0.74	0.973	30.1	29.3

0328 FSMS#7	15:02	17:18:00	8.4	10.6	1	0.74	0.973	29.3	28.5
0328 FSMS#8	15:02	17:23:00	8.4	10.6	1	0.74	0.973	30.0	29.2
0328 THg#9	15:02	17:19:00	8.4	10.6	1	0.74	0.973	28.7	27.9
0329 FSMS#1	8:36	11:15:30	8.5	10.6	1	0.74	0.972	29.8	29.0
0329 FSMS#2	8:36	11:18:00	8.5	10.6	1	0.74	0.972	30.0	29.2
0329 THg#3	8:36	11:16:30	8.5	10.6	1	0.74	0.972	29.3	28.5
0329 FSMS#4	11:35	14:33:00	8.6	10.5	1	0.74	0.973	31.3	30.4
0329 FSMS#5	11:35	14:32:00	8.6	10.5	1	0.74	0.973	30.0	29.2
0329 THg#6	11:35	14:32:00	8.6	10.5	1	0.74	0.973	30.0	29.2
0329 FSMS#7	14:53	16:35:00	8.5	10.6	1	0.74	0.973	19.7	19.2
0329 FSMS#8	14:53	16:36:00	8.5	10.6	1	0.74	0.973	19.0	18.5
0329 THg#9	14:53	16:35:00	8.5	10.6	1	0.74	0.973	20.0	19.5
0330 FSMS#1	8:35	11:25:00	8.2	10.9	1	0.74	0.972	30.3	29.4
0330 FSMS#2	8:36	11:28:00	8.2	10.9	1	0.74	0.972	30.0	29.2
0330 THg#3	8:37	11:26:00	8.2	10.9	1	0.74	0.972	29.6	28.8
0330 FSMS#4	11:50	14:23:00	8.6	10.6	1	0.74	0.972	30.4	29.6
0330 FSMS#5	11:50	14:25:10	8.6	10.6	1	0.74	0.972	30.0	29.2
0330 THG#6	11:50	14:25:00	8.6	10.6	1	0.74	0.972	29.4	28.6
0330 FSMS#7	14:45	17:09:00	8.5	10.6	1	0.74	0.972	30.3	29.5
0330 FSMS#8	14:45	17:11:00	8.5	10.6	1	0.74	0.972	31.0	30.1
0330 THg#9	14:45	17:09:00	8.5	10.6	1	0.74	0.972	30.1	29.3
0331 FSMS#1	8:14	10:57:00	9.2	10.3	1	0.74	0.973	30.2	29.4
0331 FSMS#2	8:13	11:01:00	9.2	10.3	1	0.74	0.973	31.0	30.2
0331 THg#3	8:13	10:58:00	9.2	10.3	1	0.74	0.973	29.5	28.7
0331 FSMS#4	11:15	13:54:00	8.9	10.4	1	0.74	0.973	29.3	28.5
0331 FSMS#5	11:15	13:56:00	8.9	10.4	1	0.74	0.973	30.0	29.2
0331 THg#6	11:15	13:55:00	8.9	10.4	1	0.74	0.973	28.7	27.9
0331 FSMS#7	14:30	16:32:00	9.0	10.4	1	0.74	0.973	29.0	28.2
0331 FSMS#8	14:30	16:33:00	9.0	10.4	1	0.74	0.973	29.0	28.2
0331 THg#9	14:30	16:33:00	9.0	10.4	1	0.74	0.973	28.4	27.6

Table 3: Overall Stack Gas Volume Correction Data

Sample ID	Zero Offset	Full Scale	Zero Offset as % of Full Scale	Totalizer Sample Vol	Offset Cor Volume	RPD Total vs Offset	Gas Corr Vol	RPD Total vs Gas Cor	Stack Gas CF	Totalizer Sample Vol	Offset Cor Volume	Gas Corr Vol	Offset & Gas Cor Vol
0327 FSMS#1	-0.007	2	0.4%	42.5	43.1	1.5%	41.3	2.8%	0.972	42.5	43.1	41.3	41.9
0327 FSMS#2	-0.029	2	1.5%	42.0	44.5	5.8%	40.8	2.8%	0.972	42.0	44.5	40.8	43.3
0327 FSMS#3	0.029	2	1.5%	30.1	26.6	12.3%	29.3	2.8%	0.972	30.1	26.6	29.3	25.9
0327 FSMS#4	-0.024	2	1.2%	30.0	32.9	9.3%	29.2	2.8%	0.972	30.0	32.9	29.2	32.0
0327 THg	-0.029	2	1.5%	28.8	32.2	11.2%	28.0	2.8%	0.972	28.8	32.2	28.0	31.3
0328 FSMS#1	-0.019	2	1.0%	28.1	30.4	7.7%	27.3	2.8%	0.972	28.1	30.4	27.3	29.5
0328 FSMS#2	-0.03	2	1.5%	29.0	32.8	12.3%	28.2	2.8%	0.972	29.0	32.8	28.2	31.9
0328 THg3	-0.024	2	1.2%	29.2	32.1	9.5%	28.4	2.8%	0.972	29.2	32.1	28.4	31.2
0328 FSMS#4	-0.003	2	0.2%	29.3	29.8	1.7%	28.5	2.8%	0.973	29.3	29.8	28.5	29.0
0328 FSMS#5	-0.029	2	1.5%	30.0	34.7	14.5%	29.2	2.8%	0.973	30.0	34.7	29.2	33.7
0328 THg6	-0.029	2	1.5%	30.1	34.8	14.6%	29.3	2.8%	0.973	30.1	34.8	29.3	33.9
0328 FSMS#7	-0.0055	2	0.3%	29.3	30.0	2.5%	28.5	2.8%	0.973	29.3	30.0	28.5	29.2
0328 FSMS#8	-0.029	2	1.5%	30.0	34.1	12.8%	29.2	2.8%	0.973	30.0	34.1	29.2	33.2
0328 THg#9	-0.024	2	1.2%	28.7	32.0	11.0%	27.9	2.8%	0.973	28.7	32.0	27.9	31.2
0329 FSMS#1	-0.017	2	0.9%	29.8	32.5	8.7%	29.0	2.8%	0.972	29.8	32.5	29.0	31.6
0329 FSMS#2	-0.029	2	1.5%	30.0	34.7	14.5%	29.2	2.8%	0.972	30.0	34.7	29.2	33.7
0329 THg#3	-0.021	2	1.1%	29.3	32.7	10.9%	28.5	2.8%	0.972	29.3	32.7	28.5	31.8
0329 FSMS#4	-0.001	2	0.1%	31.3	31.5	0.6%	30.4	2.8%	0.973	31.3	31.5	30.4	30.6
0329 FSMS#5	-0.028	2	1.4%	30.0	35.0	15.3%	29.2	2.8%	0.973	30.0	35.0	29.2	34.0
0329 THg#6	-0.023	2	1.2%	30.0	34.1	12.7%	29.2	2.8%	0.973	30.0	34.1	29.2	33.1
0329 FSMS#7	0.0015	2	0.1%	19.7	19.5	0.8%	19.2	2.8%	0.973	19.7	19.5	19.2	19.0
0329 FSMS#8	-0.028	2	1.4%	19.0	21.9	14.1%	18.5	2.8%	0.973	19.0	21.9	18.5	21.3
0329 THg#9	-0.0205	2	1.0%	20.0	22.1	9.9%	19.5	2.8%	0.973	20.0	22.1	19.5	21.5
0330 FSMS#1	-0.018	2	0.9%	30.3	33.4	9.6%	29.4	2.9%	0.972	30.3	33.4	29.4	32.4
0330 FSMS#2	-0.03	2	1.5%	30.0	35.2	15.8%	29.2	2.9%	0.972	30.0	35.2	29.2	34.2
0330 THg#3	-0.025	2	1.3%	29.6	33.8	13.3%	28.8	2.9%	0.972	29.6	33.8	28.8	32.9
0330 FSMS#4	0	2	0.0%	30.4	30.4	0.0%	29.6	2.8%	0.972	30.4	30.4	29.6	29.6
0330 FSMS#5	-0.033	2	1.7%	30.0	35.1	15.7%	29.2	2.8%	0.972	30.0	35.1	29.2	34.2

0330 THG#6	-0.025	2	1.3%	29.4	33.3	12.4%	28.6	2.8%	0.972	29.4	33.3	28.6	32.4
0330 FSMS#7	0	2	0.0%	30.3	30.3	0.0%	29.5	2.8%	0.972	30.3	30.3	29.5	29.5
0330 FSMS#8	-0.0295	2	1.5%	31.0	35.3	13.0%	30.1	2.8%	0.972	31.0	35.3	30.1	34.3
0330 THg#9	-0.027	2	1.4%	30.1	34.0	12.1%	29.3	2.8%	0.972	30.1	34.0	29.3	33.0
0331 FSMS#1	-0.025	2	1.3%	30.2	34.3	12.6%	29.4	2.7%	0.973	30.2	34.3	29.4	33.4
0331 FSMS#2	-0.026	2	1.3%	31.0	35.4	13.2%	30.2	2.7%	0.973	31.0	35.4	30.2	34.4
0331 THg#3	-0.0235	2	1.2%	29.5	33.4	12.3%	28.7	2.7%	0.973	29.5	33.4	28.7	32.5
0331 FSMS#4	0.003	2	0.2%	29.3	28.8	1.6%	28.5	2.7%	0.973	29.3	28.8	28.5	28.0
0331 FSMS#5	-0.0285	2	1.4%	30.0	34.6	14.2%	29.2	2.7%	0.973	30.0	34.6	29.2	33.7
0331 THg#6	-0.026	2	1.3%	28.7	33.3	14.7%	27.9	2.7%	0.973	28.7	33.3	27.9	32.3
0331 FSMS#7	-0.0045	2	0.2%	29.0	29.5	1.9%	28.2	2.7%	0.973	29.0	29.5	28.2	28.8
0331 FSMS#8	-0.0255	2	1.3%	29.0	32.1	10.3%	28.2	2.7%	0.973	29.0	32.1	28.2	31.3
0331 THg#9	-0.022	2	1.1%	28.4	31.1	9.1%	27.6	2.7%	0.973	28.4	31.1	27.6	30.3

Appendix A: Data Compilation

Table 1. Frontier Sorbent Mercury Speciation and Total Hg Data Compilation

		Uncorrected Sample Volume			Offset & Gas Corrected Volume		
Sample Vol (liters)	Cor Sample Vol (liters)	Total Hg (μg Hg/m^3)	Hg(0) (μg Hg/m^3)	Hg(II) (μg Hg/m^3)	Total Hg (μg Hg/m^3)	Hg(0) (μg Hg/m^3)	Hg(II) (μg Hg/m^3)
42.5	41.9	5.20	0.87	4.34	5.27	0.88	4.40
42.0	43.3	5.82	0.97	4.85	5.65	0.94	4.71
30.1	25.9	5.34	0.77	4.58	6.22	0.89	5.33
30.0	32.0	6.25	0.99	5.27	5.86	0.92	4.94
28.8	31.3	5.67	na	na	5.22	na	na
28.1	29.5	0.53	0.01	0.53	0.50	0.01	0.50
29.0	31.9	0.58	0.02	0.57	0.53	0.02	0.52
29.2	31.2	0.50	na	na	0.47	na	na
29.3	29.0	0.70	0.06	0.65	0.71	0.06	0.66
30.0	33.7	0.80	0.05	0.76	0.71	0.05	0.67
30.1	33.9	0.68	na	na	0.61	na	na
29.3	29.2	0.62	0.04	0.59	0.62	0.04	0.59
30.0	33.2	0.78	0.04	0.74	0.70	0.04	0.67
28.7	31.2	0.70	na	na	0.64	na	na
29.8	31.6	3.12	0.16	2.97	2.94	0.15	2.80
30.0	33.7	3.26	0.23	3.04	2.89	0.20	2.70
29.3	31.8	3.51	na	na	3.23	na	na
31.3	30.6	2.94	0.16	2.78	3.01	0.17	2.85
30.0	34.0	3.71	0.20	3.52	3.28	0.18	3.10
30.0	33.1	3.55	na	na	3.21	na	na
20.0	19.0	2.63	0.09	2.55	2.77	0.09	2.69
19.7	21.3	3.08	0.22	2.87	2.85	0.20	2.66
19.0	21.5	3.11	na	na	2.75	na	na
30.3	32.4	3.93	0.24	3.70	3.67	0.22	3.46
30.0	34.2	4.33	0.24	4.10	3.80	0.21	3.60
29.6	32.9	4.52	na	na	4.07	na	na
30.4	29.6	4.33	0.23	4.10	4.45	0.24	4.22
30.0	34.2	4.77	0.34	4.43	4.19	0.30	3.89
29.4	32.4	4.93	na	na	4.48	na	na
30.3	29.5	4.13	0.25	3.88	4.25	0.26	4.00
31.0	34.3	4.68	0.30	4.38	4.22	0.27	3.96
30.1	33.0	4.89	na	na	4.45	na	na
30.2	33.4	3.27	0.02	3.26	2.96	0.01	2.95
31.0	34.4	3.75	0.18	3.57	3.37	0.17	3.21
29.5	32.5	3.82	na	na	3.47	na	na
29.3	28.0	3.81	0.13	3.69	3.98	0.14	3.85
30.0	33.7	4.30	0.19	4.12	3.84	0.17	3.68
28.7	32.3	4.37	na	na	3.88	na	na
29.0	28.8	3.59	0.14	3.45	3.62	0.14	3.48
20.0	31.3	5.90	0.34	5.57	3.77	0.21	3.56
28.4	30.3	4.10	na	na	3.85	na	na

Appendix A: Frontier Sorbent Mercury Speciation Method Versus Ontario Hydro Versus Sorbent Total Hg Method Results

Page 1. FSMS Versus OH 03/27/00

	Uncorrected Sample Volume			Offset & Gas Corrected Sample Vol		
	Hg Total	Elem Hg	Oxid Hg	Hg Total	Elem Hg	Oxid Hg
	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)
0327 FSMS#1	5.20	0.87	4.34	5.27	0.88	4.40
DOE OH	5.19	0.52	4.67	5.19	0.52	4.67
0327 FSMS#2	5.82	0.97	4.85	5.65	0.94	4.71
DOE OH	5.05	0.80	4.25	5.05	0.80	4.25
0327 FSMS#3	5.34	0.77	4.58	6.22	0.89	5.33
0327 FSMS#4	6.25	0.99	5.27	5.86	0.92	4.94
0327 THg	5.67	na	na	5.22	na	na
DOE OH	5.33	1.00	4.33	5.33	1.00	4.33
Average FSMS>	5.65	0.90	4.76	5.75	0.91	4.84
Average DOE OH >	5.19	0.77	4.42	5.19	0.77	4.42
RPD (FSMS vs OH) >	8.6%	14.9%	7.5%	10.2%	16.2%	9.2%

Page 2. FSMS Versus OH 03/28/00

	Uncorrected Sample Volume			Offset and Gas Corrected Sample Vol		
	Hg Total	Elem Hg	Oxid Hg	Hg Total	Elem Hg	Oxid Hg
	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)
0328 FSMS#1	0.53	0.01	0.53	0.50	0.01	0.50
0328 FSMS#2	0.58	0.02	0.57	0.53	0.02	0.52
0328 THg3	0.50	na	na	0.47	na	na
DOE OH	0.48	0.04	0.44	0.48	0.04	0.44
0328 FSMS#4	0.70	0.06	0.65	0.71	0.06	0.66
0328 FSMS#5	0.80	0.05	0.76	0.71	0.05	0.67
0328 THg6	0.68	na	na	0.61	na	na
DOE OH	0.61	0.05	0.56	0.61	0.05	0.56
0328 FSMS#7	0.62	0.04	0.59	0.62	0.04	0.59
0328 FSMS#8	0.78	0.04	0.74	0.70	0.04	0.67
0328 THg#9	0.70	na	na	0.64	na	na
DOE OH	0.62	0.02	0.60	0.62	0.02	0.60
Average FSMS>	0.67	0.04	0.64	0.63	0.04	0.60
Average DOE OH >	0.57	0.04	0.53	0.57	0.04	0.53
RPD (FSMS vs OH) >	16.0%	1.3%	18.0%	10.1%	3.9%	12.0%

Page 3: FSMS Versus OH 03/29/00

	Uncorrected Sample Volume			Offset & Gas Corrected Sample Vol		
	Hg Total	Elem Hg	Oxid Hg	Hg Total	Elem Hg	Oxid Hg
	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)
0329 FSMS#1	3.12	0.16	2.97	2.94	0.15	2.80
0329 FSMS#2	3.26	0.23	3.04	2.89	0.20	2.70
0329 THg#3	3.51	na	na	3.23	na	na
DOE OH	3.09	0.25	2.83	3.09	0.25	2.83
0329 FSMS#4	2.94	0.16	2.78	3.01	0.17	2.85
0329 FSMS#5	3.71	0.20	3.52	3.28	0.18	3.10
0329 THg#6	3.55	na	na	3.21	na	na
DOE OH	3.10	0.16	2.94	3.10	0.16	2.94
0329 FSMS#7	2.63	0.09	2.55	2.77	0.09	2.69
0329 FSMS#8	3.08	0.22	2.87	2.85	0.20	2.66
0329 THg#9	3.11	na	na	2.75	na	na
DOE OH	2.92	0.19	2.73	2.92	0.19	2.73
Average FSMS>	3.12	0.18	2.96	2.96	0.17	2.80
Average DOE OH >	3.04	0.20	2.83	3.04	0.20	2.83
RPD (FSMS vs OH) >	2.9%	12.3%	4.2%	2.6%	18.7%	1.2%

Page 4. FSMS Versus OH 03/30/00

	Uncorrected Sample Volume			Offset & Gas Corrected Sample Vol		
	Hg Total	Elem Hg	Oxid Hg	Hg Total	Elem Hg	Oxid Hg
	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)
0330 FSMS#1	3.93	0.24	3.70	3.67	0.22	3.46
0330 FSMS#2	4.33	0.24	4.10	3.80	0.21	3.60
0330 THg#3	4.52	na	na	4.07	na	na
US DOE OH	3.87	0.32	3.54	3.87	0.32	3.54
0330 FSMS#4	4.33	0.23	4.10	4.45	0.24	4.22
0330 FSMS#5	4.77	0.34	4.43	4.19	0.30	3.89
0330 THg#6	4.93	na	na	4.48	na	na
US DOE OH	4.04	0.44	3.60	4.04	0.44	3.60
0330 FSMS#7	4.13	0.25	3.88	4.25	0.26	4.00
0330 FSMS#8	4.68	0.30	4.38	4.22	0.27	3.96
0330 THg#9	4.89	na	na	4.45	na	na
US DOE OH	4.16	0.45	3.71	4.16	0.45	3.71
Average FSMS>	4.36	0.27	4.10	4.10	0.25	3.85
Average DOE OH >	4.02	0.40	3.62	4.02	0.40	3.62
RPD (FSMS vs OH) >	8.0%	40.7%	12.5%	1.8%	47.0%	6.3%

Page 5. FSMS Versus OH 03/31/00

	Uncorrected Sample Volume			Offset & Gas Corrected Sample Vol		
	Hg Total	Elem Hg	Oxid Hg	Hg Total	Elem Hg	Oxid Hg
	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)	(µg Hg/m^3)
0331 FSMS#1	3.27	0.02	3.26	2.96	0.01	2.95
0331 FSMS#2	3.75	0.18	3.57	3.37	0.17	3.21
0331 THg#3	3.82	na	na	3.47	na	na
US DOE OH	3.38	0.27	3.10	3.38	0.27	3.10
0331 FSMS#4	3.81	0.13	3.69	3.98	0.14	3.85
0331 FSMS#5	4.30	0.19	4.12	3.84	0.17	3.68
0331 THg#6	4.37	na	na	3.88	na	na
US DOE OH	3.75	0.26	3.49	3.75	0.26	3.49
0331 FSMS#7	3.59	0.14	3.45	3.62	0.14	3.48
0331 FSMS#8	5.90	0.34	5.57	3.77	0.21	3.56
0331 THg#9	4.10	na	na	3.85	na	na
US DOE OH	3.70	0.27	3.43	3.70	0.27	3.43
Average FSMS>	4.10	0.17	3.94	3.59	0.14	3.46
Average DOE OH >	3.61	0.27	3.34	3.61	0.27	3.34
RPD (FSMS vs OH) >	12.8%	46.7%	16.6%	0.6%	62.2%	3.4%

Appendix A—FSMS Versus OH Summary Results

Table 1. Method Comparison Average Results—by Day

		Hg Total	Elem Hg	Oxid Hg	
	Ave FSMS	5.75	0.91	4.84	n=4
	Ave OH	5.19	0.77	4.42	n=3
3/27/00	RPD	10.2%	16.2%	9.2%	
	Ave FSMS	0.63	0.04	0.60	n=6
	Ave OH	0.57	0.04	0.53	n=3
3/28/00	RPD	10.1%	3.9%	12.0%	
	Ave FSMS	2.96	0.17	2.80	n=6
	Ave OH	3.04	0.20	2.83	n=3
3/29/00	RPD	2.6%	18.7%	1.2%	
	Ave FSMS	4.10	0.25	3.85	n=6
	Ave OH	4.02	0.40	3.62	n=3
3/30/00	RPD	1.8%	47.0%	6.3%	
	Ave FSMS	3.59	0.14	3.46	n=6
	Ave OH	3.61	0.27	3.34	n=3
3/31/00	RPD	0.6%	62.2%	3.4%	

Table 2. Method Comparison: FSMS Versus OH by Individual Run

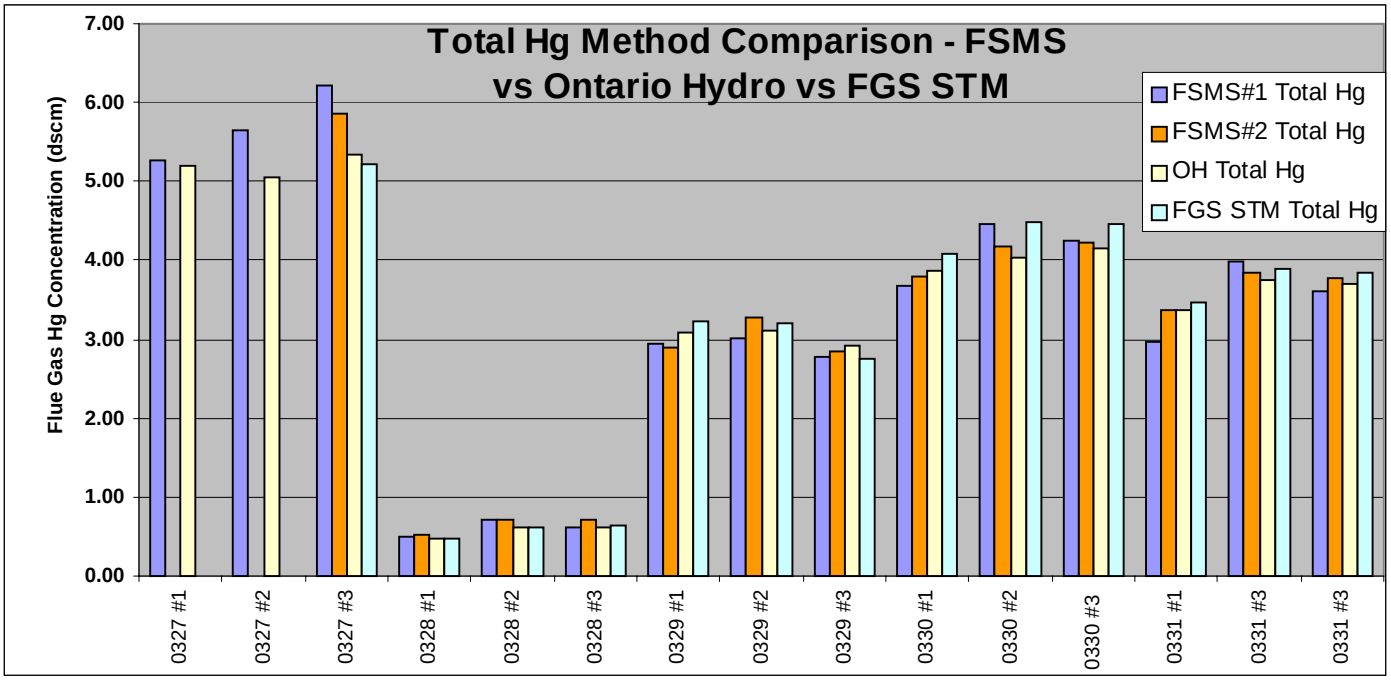
	Hg Total	Elem Hg	Oxid Hg
0327 FSMS#1	5.27	0.88	4.40
DOE OH	5.19	0.52	4.67
RPD	1.6%	51.4%	6.0%
0327 FSMS#2	5.65	0.94	4.71
DOE OH	5.05	0.80	4.25
RPD	11.1%	16.4%	10.2%
0327 FSMS#3	6.22	0.89	5.33
0327 FSMS#4	5.86	0.92	4.94
DOE OH	5.33	1.00	4.33
RPD	12.5%	9.7%	17.1%
0327 FSMS#4	5.72	1.07	4.65
DOE OH	5.33	1.00	4.33
RPD	7.1%	6.6%	7.2%
0328 FSMS#1	0.50	0.01	0.50
0328 FSMS#2	0.53	0.02	0.52
DOE OH	0.48	0.04	0.44
RPD	7.7%	103.5%	15.1%
0328 FSMS#4	0.71	0.06	0.66
0328 FSMS#5	0.71	0.05	0.67
DOE OH	0.61	0.05	0.56
RPD	15.5%	8.2%	17.1%
0328 FSMS#7	0.62	0.04	0.59
0328 FSMS#8	0.70	0.04	0.67
DOE OH	0.62	0.02	0.60
RPD	6.5%	63.8%	4.7%
0329 FSMS#1	2.94	0.15	2.80
0329 FSMS#2	2.89	0.20	2.70
DOE OH	3.09	0.25	2.83
RPD	5.7%	35.6%	2.9%
0329 FSMS#4	3.01	0.17	2.85
0329 FSMS#5	3.28	0.18	3.10
DOE OH	3.10	0.16	2.94
RPD	1.4%	8.7%	1.1%
0329 FSMS#7	2.77	0.09	2.69
0329 FSMS#8	2.85	0.20	2.66
DOE OH	2.92	0.19	2.73
RPD	3.8%	24.5%	2.1%
0330 FSMS#1	3.67	0.22	3.46
0330 FSMS#2	3.80	0.21	3.60
US DOE OH	3.87	0.32	3.54
RPD	3.5%	39.7%	0.3%
0330 FSMS#4	4.45	0.24	4.22
0330 FSMS#5	4.19	0.30	3.89
US DOE OH	4.04	0.44	3.60
RPD	6.7%	48.0%	11.9%
0330 FSMS#7	4.25	0.26	4.00
0330 FSMS#8	4.22	0.27	3.96
US DOE OH	4.16	0.45	3.71
RPD	1.8%	51.3%	6.9%
0331 FSMS#1	2.96	0.01	2.95
0331 FSMS#2	3.37	0.17	3.21
US DOE OH	3.38	0.27	3.10
RPD	6.6%	100.2%	0.6%
0331 FSMS#4	3.98	0.14	3.85
0331 FSMS#5	3.84	0.17	3.68
US DOE OH	3.75	0.26	3.49
RPD	4.2%	51.7%	7.5%
0331 FSMS#7	3.62	0.14	3.48
0331 FSMS#8	3.77	0.21	3.56
US DOE OH	3.70	0.27	3.43
RPD	0.2%	41.3%	2.7%
Overage RPD >	6.2%	39.0%	7.3%

Table 3. Method Intercomparison for Total Hg in Flue Gas – FSMS Versus Ontario Hydro Versus FGS STM

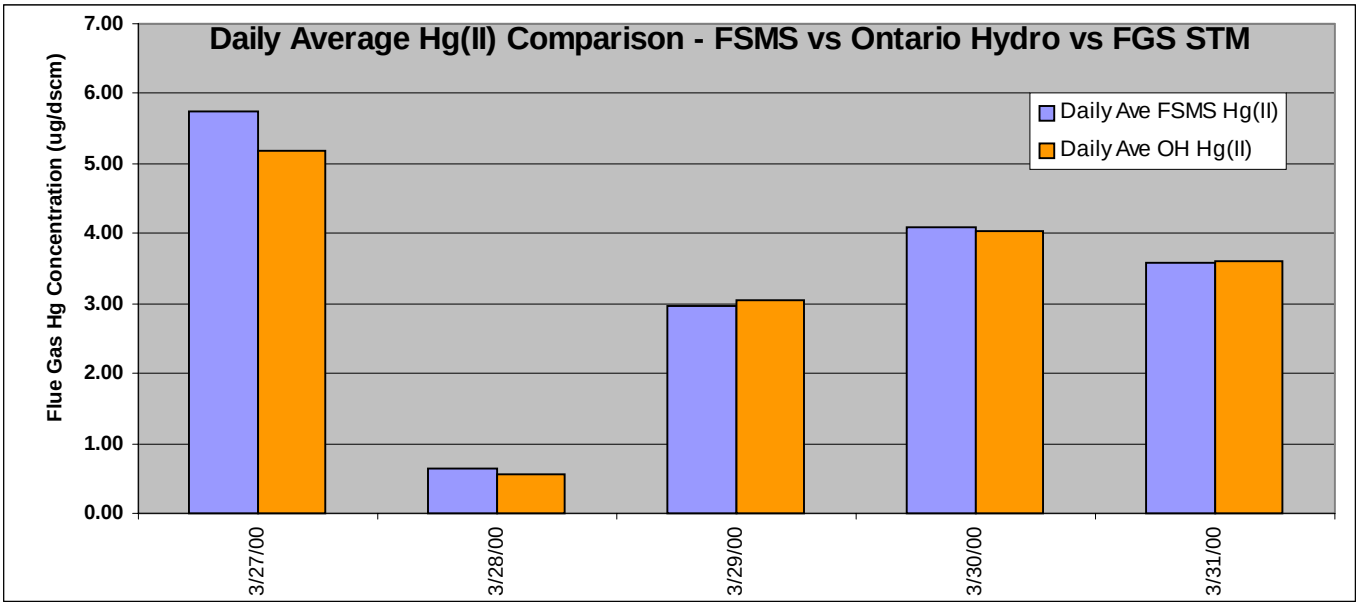
	Total Hg Concentrations (µg Hg/m^2)				Combined Method Intercomparison			Individual Method Intercomparison			
								FSMS#1 vs	Ave FSMS	Ave FSMS	OH vs
	Individual Method Results				FSMS, OH and FGS STM			FSMS#2	vs FGS STM	vs OH	FGS STM
	FSMS#1	FSMS#2	OH	FGS STM	Average	SD	RSD ALL	RPD	RPD	RPD	RPD
0327 #1	5.27	na	5.19	na	5.23	na	1.6%	na	na	1.6%	na
0327 #2	5.65	na	5.05	na	5.35	na	11.1%			na	na
0327 #3	6.22	5.86	5.33	5.22	5.66	0.47	8.3%	6.0%	14.3%	12.2%	2.2%
0328 #1	0.50	0.53	0.48	0.47	0.50	0.03	5.5%	5.2%	9.4%	7.6%	1.9%
0328 #2	0.71	0.71	0.61	0.61	0.66	0.06	9.0%	0.1%	15.4%	15.1%	0.3%
0328 #3	0.62	0.70	0.62	0.64	0.65	0.04	6.1%	12.7%	3.2%	6.4%	3.2%
0329 #1	2.94	2.89	3.09	3.23	3.04	0.15	5.0%	1.7%	10.4%	5.7%	4.5%
0329 #2	3.01	3.28	3.10	3.21	3.15	0.12	3.8%	8.5%	2.2%	1.4%	3.6%
0329 #3	2.77	2.85	2.92	2.75	2.82	0.08	2.8%	3.0%	2.3%	3.8%	6.1%
0330 #1	3.67	3.80	3.87	4.07	3.85	0.17	4.3%	3.4%	8.7%	3.5%	5.1%
0330 #2	4.45	4.19	4.04	4.48	4.29	0.21	4.9%	6.1%	3.7%	6.6%	10.3%
0330 #3	4.25	4.22	4.16	4.45	4.27	0.13	2.9%	0.7%	5.0%	1.8%	6.7%
0331 #1	2.96	3.37	3.38	3.47	3.29	0.23	7.0%	13.2%	9.2%	6.6%	2.6%
0331 #3	3.98	3.84	3.75	3.88	3.86	0.10	2.5%	3.8%	0.8%	4.1%	3.4%
0331 #3	3.62	3.77	3.70	3.85	3.73	0.10	2.6%	4.2%	4.1%	0.2%	3.9%

Appendix A: Graphs

Graph 1: Method Intercomparison for Total Hg—FGS FSMS, OH, FGS STM



Graph 2: Daily HG (II) Intercomparison—FSMS Versus OH



Appendix B: Comparison of Sampling Methods to Determine Total and Speciated Mercury in Flue Gas

Results of Ontario-Hydro samples obtained during the week of March 27, 2000, are contained in data sheets numbered Outlet-15 through Outlet-29, including summary data and calculated flow rates.

Table 1 contains the pertinent mercury concentration data used in the comparison.

Table 1. Hg Concentrations Based on Ontario-Hydro Samples (μg/dscm)

Date	Start	Duration (minutes)	Mercury Concentration @ Stack 02		
			Hg Total	Elem. Hg	Oxid. Hg
03/27/00	9:27 AM	120	5.19	0.52	4.67
03/27/00	12:47 PM	120	5.05	0.80	4.25
03/27/00	3:40 PM	120	5.33	1.00	4.33
		average	5.19	0.77	4.42
03/28/00	9:29 AM	120	0.48	0.04	0.44
03/28/00	12:42 PM	120	0.61	0.05	0.56
03/28/00	3:21 PM	120	0.62	0.02	0.60
		average	0.57	0.04	0.53
03/29/00	9:15 AM	120	3.09	0.25	2.83
03/29/00	12:35 PM	120	3.10	0.16	2.94
03/29/00	3:15 PM	77	2.92	0.19	2.73
		average	3.03	0.20	2.83
03/30/00	9:25 AM	120	3.87	0.32	3.54
03/30/00	12:25 PM	120	4.04	0.44	3.60
03/30/00	3:10 PM	120	4.16	0.45	3.71
		average	4.02	0.40	3.62
03/31/00	8:59 AM	120	3.38	0.27	3.10
03/31/00	11:52 AM	120	3.75	0.26	3.49
03/31/00	2:32 PM	120	3.70	0.27	3.43
		average	3.61	0.27	3.34

Note that numbering of outlet runs starts with Outlet-15 since test period 00-02 started on March 20, 2000, but CRADA testing did not start until March 27, 2000.

Appendix B: Outlet-15

TEST 0002	RUN #	DATE	TIME
	outlet-15	27-Mar	9:27 AM
INPUT PARAMETERS			
Pbar	28.48	in. Hg	
Pstack	1.72	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.313	in.	
Delta P, pitot		in. H_20	
Delta H	1.336783	in. H_20	
Tstack, avg	218.375	°F	
Tmeter, avg	69.11538	°F	
DRY GAS COMP			
CO_2	10.55652		
O_2	8.575678		
N_2	80.8678		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	86.7	grams	
VOLdgm	70.382	cu. ft.	
CALCULATED PARAMETERS			
Pstack	28.61	in. Hg	
Pmeter	28.58	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	678.38	R	
Tmeter, avg	529.12	R	
Vol, sample	71.51	dscf	
Vol, H_2O	4.09	scf	
% H_2O, impingers	5.41	%	
% H_2O, stocal	?		
MWdry, flue gas	30.03	lb/lb-mole	
MWwet, flue gas	29.38	lb/lb-mole	
Velocity, flue gas	24.90	fps	
Qstack	1957.30	acfm	
Qstack	1456.54	scfm	
Qstack	1377.78	dscfm	
Qstack	39.02	dscm/min @ actual O_2	
Qstack	26.86	dscm/min @ 3% O_2	
MASS OF Hg	10.52	µg	
CONC'N	5.19	µg/dscm @ actual O_2	
CONC'N, 3% O_2	7.54	µg/dscm @ 3% O_2	
Hg FLOW RATE	202.6324	µg/min	
MASS OF ELEMENTAL Hg	1.05	µg	
CONC'N	0.52	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.75	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	20.25	µg/min	

MASS OF OXIDIZED Hg	9.46	µg	
CONC'N	4.67	µg/dscm @ actual O_2	
CONC'N, 3% O_2	6.79	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	182.31	µg/min	
% OXIDIZED	90.00%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.59	mg/dscm actual O_2	
GRAIN LDNG.	0.86	mg/dscm @ 3% O_2	
PART. RATE	0.023	g/min	
PART. RATE	0.003	lb/hr	

Appendix B: Outlet-16

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-16	**27-Mar**	**12:47 PM**
INPUT PARAMETERS			
Pbar	28.48	in. Hg	
Pstack	1.575	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.313	in.	
Delta P, pitot		in. H_20	
Delta H	1.129473	in. H_20	
Tstack, avg	217.375	°F	
Tmeter, avg	72.92308	°F	
DRY GAS COMP			
CO_2	10.58283		
O_2	8.287289		
N_2	81.12988		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	75.3	grams	
VOLdgm	67.291	cu. ft.	
CALCULATED PARAMETERS			
Pstack	28.60	in. Hg	
Pmeter	28.56	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	677.38	R	
Tmeter, avg	532.92	R	
Vol, sample	67.85	dscf	

Vol, H_2O	3.55	scf	
% H_2O, impingers	4.97	%	
% H_2O, stocal	?		
MWdry, flue gas	30.03	lb/lb-mole	
MWwet, flue gas	29.43	lb/lb-mole	
Velocity, flue gas	23.21	fps	
Qstack	1824.89	acfm	
Qstack	1359.51	scfm	
Qstack	1291.90	dscfm	
Qstack	36.59	dscm/min @ actual O_2	
Qstack	25.78	dscm/min @ 3% O_2	
MASS OF Hg	9.71	µg	
CONC'N	5.05	µg/dscm @ actual O_2	
CONC'N, 3% O_2	7.17	µg/dscm @ 3% O_2	
Hg FLOW RATE	184.8337	µg/min	
MASS OF ELEMENTAL Hg	1.54	µg	
CONC'N	0.80	µg/dscm @ actual O_2	
CONC'N, 3% O_2	1.14	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	29.35	µg/min	
MASS OF OXIDIZED Hg	8.16	µg	
CONC'N	4.25	µg/dscm @ actual O_2	
CONC'N, 3% O_2	6.03	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	155.42	µg/min	
% OXIDIZED	84.12%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.002	grams	
GRAIN LDNG.	0.83	mg/dscm actual O_2	
GRAIN LDNG.	1.18	mg/dscm @ 3% O_2	
PART. RATE	0.030	g/min	
PART. RATE	0.004	lb/hr	

Appendix B: Outlet-17

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-17	**27-Mar**	**3:40 PM**
INPUT PARAMETERS			
Pbar	28.48	in. Hg	
Pstack	1.575	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.315	in.	
Delta P, pitot		in. H_20	
Delta H	1.17102	in. H_20	

Tstack, avg	217.375	°F	
Tmeter, avg	76	°F	
DRY GAS COMP			
CO_2	10.61569		
O_2	8.395413		
N_2	80.98889		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	84.5	grams	
VOLdgm	67.906	cu. ft.	
CALCULATED PARAMETERS			
Pstack	28.60	in. Hg	
Pmeter	28.57	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00054	sq. ft.	
Tstack, avg	677.38	R	
Tmeter, avg	536.00	R	
Vol, sample	68.08	dscf	
Vol, H_2O	3.98	scf	
% H_2O, impingers	5.53	%	
% H_2O, stocal	?		
MWdry, flue gas	30.03	lb/lb-mole	
MWwet, flue gas	29.37	lb/lb-mole	
Velocity, flue gas	23.21	fps	
Qstack	1824.61	acfm	
Qstack	1359.30	scfm	
Qstack	1284.15	dscfm	
Qstack	36.37	dscm/min @ actual O_2	
Qstack	25.41	dscm/min @ 3% O_2	
MASS OF Hg	10.28	µg	
CONC'N	5.33	µg/dscm @ actual O_2	
CONC'N, 3% O_2	7.63	µg/dscm @ 3% O2	
Hg FLOW RATE	193.8808	µg/min	
MASS OF ELEMENTAL Hg	1.92	µg	
CONC'N	1.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	1.42	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	36.20	µg/min	
MASS OF OXIDIZED Hg	8.36	µg	
CONC'N	4.33	µg/dscm @ actual O_2	
CONC'N, 3% O_2	6.20	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	157.62	µg/min	
% OXIDIZED	81.32%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.26	mg/dscm actual O_2	

GRAIN LDNG.	0.37	mg/dscm @ 3% O_2	
PART. RATE	0.009	g/min	
PART. RATE	0.001	Lb/hr	

Appendix B: Outlet-18

TEST 0002	RUN #	DATE	TIME
	outlet-18	28-Mar	9:29 AM
INPUT PARAMETERS			
Pbar	28.43	in. Hg	
Pstack	1.605	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.316	in.	
Delta P, pitot		in. H_20	
Delta H	1.229449	in. H_20	
Tstack, avg	212.875	°F	
Tmeter, avg	69.73077	°F	
DRY GAS COMP			
CO_2	10.59679		
O2	8.491843		
N_2	80.91137		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	78.3	grams	
VOLdgm	69.657	cu. ft.	
CALCULATED PARAMETERS			
Pstack	28.55	in. Hg	
Pmeter	28.52	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00054	sq. ft.	
Tstack, avg	672.88	R	
Tmeter, avg	529.73	R	
Vol, sample	70.55	dscf	
Vol, H_2O	3.69	scf	
% H_2O, impingers	4.97	%	
% H_2O, stocal	?		
MWdry, flue gas	30.04	lb/lb-mole	
MWwet, flue gas	29.44	lb/lb-mole	
Velocity, flue gas	22.80	fps	
Qstack	1792.49	acfm	
Qstack	1342.05	scfm	
Qstack	1275.31	dscfm	
Qstack	36.12	dscm/min @ actual O_2	
Qstack	25.04	dscm/min @ 3% O_2	
MASS OF Hg	0.96	µg	
CONC'N	0.48	µg/dscm @ actual O_2	

CONC'N, 3% O_2	0.69	µg/dscm @ 3% O_2	
Hg FLOW RATE	17.38174	µg/min	
MASS OF ELEMENTAL Hg	0.09	µg	
CONC'N	0.04	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.06	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	1.59	µg/min	
MASS OF OXIDIZED Hg	0.87	µg	
CONC'N	0.44	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.63	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	15.79	µg/min	
% OXIDIZED	90.83%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.35	mg/dscm actual O_2	
GRAIN LDNG.	0.51	mg/dscm @ 3% O_2	
PART. RATE	0.013	g/min	
PART. RATE	0.002	lb/hr	

Appendix B: Outlet-19

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-19	**28-Mar**	**12:42 PM**
INPUT PARAMETERS			
Pbar	28.43	in. Hg	
Pstack	1.8	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.318	in.	
Delta P, pitot		in. H_20	
Delta H	1.309868	in. H_20	
Tstack, avg	212.375	°F	
Tmeter, avg	71.53846	°F	
DRY GAS COMP			
CO_2	10.46414		
O_2	8.588512		
N_2	80.94735		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	84	grams	
VOLdgm	72.169	cu. ft.	

CALCULATED PARAMETERS			
Pstack	28.56	in. Hg	
Pmeter	28.53	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00055	sq. ft.	
Tstack, avg	672.38	R	
Tmeter, avg	531.54	R	
Vol, sample	72.86	dscf	
Vol, H_2O	3.96	scf	
% H_2O, impingers	5.16	%	
% H_2O, stocal	?		
MWdry, flue gas	30.02	lb/lb-mole	
MWwet, flue gas	29.40	lb/lb-mole	
Velocity, flue gas	23.71	fps	
Qstack	1864.47	acfm	
Qstack	1397.69	scfm	
Qstack	1325.62	dscfm	
Qstack	37.54	dscm/min @ actual O_2	
Qstack	25.82	dscm/min @ 3% O_2	
MASS OF Hg	1.25	µg	
CONC'N	0.61	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.88	µg/dscm @ 3% O_2	
Hg FLOW RATE	22.8035	µg/min	
MASS OF ELEMENTAL Hg	0.10	µg	
CONC'N	0.05	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.07	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	1.73	µg/min	
MASS OF OXIDIZED Hg	1.15	µg	
CONC'N	0.56	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.81	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	20.93	µg/min	
% OXIDIZED	92.36%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.24	mg/dscm actual O_2	
GRAIN LDNG.	0.35	mg/dscm @ 3% O_2	
PART. RATE	0.009	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-20

TEST 0002	RUN #	DATE	TIME
	outlet-20	28-Mar	3:21 PM
INPUT PARAMETERS			
Pbar	28.43	in. Hg	
Pstack	1.8	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.318	in.	
Delta P, pitot		in. H_20	
Delta H	1.305155	in. H_20	
Tstack, avg	212.375	°F	
Tmeter, avg	70.76923	°F	
DRY GAS COMP			
CO_2	10.56951		
O_2	8.36214		
N_2	81.06835		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	84.1	grams	
VOLdgm	71.849	cu. ft.	
CALCULATED PARAMETERS			
Pstack	28.56	in. Hg	
Pmeter	28.53	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00055	sq. ft.	
Tstack, avg	672.38	R	
Tmeter, avg	530.77	R	
Vol, sample	72.64	dscf	
Vol, H_2O	3.97	scf	
% H_2O, impingers	5.18	%	
% H_2O, stocal	?		
MWdry, flue gas	30.03	lb/lb-mole	
MWwet, flue gas	29.40	lb/lb-mole	
Velocity, flue gas	23.71	fps	
Qstack	1864.24	acfm	
Qstack	1397.51	scfm	
Qstack	1325.17	dscfm	
Qstack	37.53	dscm/min @ actual O_2	
Qstack	26.29	dscm/min @ 3% O_2	
MASS OF Hg	1.28	µg	
CONC'N	0.62	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.89	µg/dscm @ 3% O_2	
Hg FLOW RATE	23.41345	µg/min	
MASS OF ELEMENTAL Hg	0.05	µg	
CONC'N	0.02	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.03	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	0.86	µg/min	

MASS OF OXIDIZED Hg	1.23	µg	
CONC'N	0.60	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.85	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	22.39	µg/min	
% OXIDIZED	96.30%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.26	mg/dscm actual O_2	
GRAIN LDNG.	0.37	mg/dscm @ 3% O_2	
PART. RATE	0.009	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-21

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-21	**29-Mar**	**9:15 AM**
INPUT PARAMETERS			
Pbar	28.85	in. Hg	
Pstack	2.055	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.309	in.	
Delta P, pitot		in. H_20	
Delta H	1.39431	in. H_20	
Tstack, avg	230.5	°F	
Tmeter, avg	71.73077	°F	
DRY GAS COMP			
CO_2	10.61299		
O_2	8.461926		
N_2	80.92508		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	83.3	grams	
VOLdgm	73.74	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.00	in. Hg	
Pmeter	28.95	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00052	sq. ft.	
Tstack, avg	690.50	R	
Tmeter, avg	531.73	R	
Vol, sample	75.53	dscf	
Vol, H_2O	3.93	scf	
% H_2O, impingers	4.94	%	

% H_2O, stocal	?		
MWdry, flue gas	30.04	lb/lb-mole	
MWwet, flue gas	29.44	lb/lb-mole	
Velocity, flue gas	26.56	fps	
Qstack	2087.91	acfm	
Qstack	1547.51	scfm	
Qstack	1471.02	dscfm	
Qstack	41.66	dscm/min @ actual O_2	
Qstack	28.95	dscm/min @ 3% O_2	
MASS OF Hg	6.60	µg	
CONC'N	3.09	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.44	µg/dscm @ 3% O_2	
Hg FLOW RATE	128.5884	µg/min	
MASS OF ELEMENTAL Hg	0.54	µg	
CONC'N	0.25	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.36	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	10.56	µg/min	
MASS OF OXIDIZED Hg	6.06	µg	
CONC'N	2.83	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.08	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	118.03	µg/min	
% OXIDIZED	91.79%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.28	mg/dscm actual O_2	
GRAIN LDNG.	0.40	mg/dscm @ 3% O_2	
PART. RATE	0.012	g/min	
PART. RATE	0.002	lb/hr	

Appendix B: Outlet-22

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-22	**29-Mar**	**12:35 PM**
INPUT PARAMETERS			
Pbar	28.85	in. Hg	
Pstack	2.055	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.309	in.	
Delta P, pitot		in. H_20	
Delta H	1.226662	in. H_20	
Tstack, avg	234.75	°F	
Tmeter, avg	78.53846	°F	
DRY GAS COMP			

CO_2	10.5114		
O_2	8.552248		
N_2	80.93636		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	78	grams	
VOLdgm	69.767	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.00	in. Hg	
Pmeter	28.94	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00052	sq. ft.	
Tstack, avg	694.75	R	
Tmeter, avg	538.54	R	
Vol, sample	70.53	dscf	
Vol, H_2O	3.68	scf	
% H_2O, impingers	4.96	%	
% H_2O, stocal	?		
MWdry, flue gas	30.02	lb/lb-mole	
MWwet, flue gas	29.43	lb/lb-mole	
Velocity, flue gas	25.51	fps	
Qstack	2005.69	acfm	
Qstack	1477.48	scfm	
Qstack	1404.25	dscfm	
Qstack	39.77	dscm/min @ actual O_2	
Qstack	27.43	dscm/min @ 3% O_2	
MASS OF Hg	6.18	µg	
CONC'N	3.10	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.49	µg/dscm @ 3% O_2	
Hg FLOW RATE	123.0992	µg/min	
MASS OF ELEMENTAL Hg	0.31	µg	
CONC'N	0.16	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.23	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	6.22	µg/min	
MASS OF OXIDIZED Hg	5.86	µg	
CONC'N	2.94	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.26	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	116.76	µg/min	
% OXIDIZED	94.95%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.30	mg/dscm actual O_2	
GRAIN LDNG.	0.44	mg/dscm @ 3% O_2	
PART. RATE	0.012	g/min	
PART. RATE	0.002	lb/hr	

Appendix B: Outlet-23

TEST 0002	RUN #	DATE	TIME
	outlet-23	29-Mar	3:15 PM
INPUT PARAMETERS			
Pbar	28.85	in. Hg	
Pstack	2.055	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.309	in.	
Delta P, pitot		in. H_20	
Delta H	1.121381	in. H_20	
Tstack, avg	234.75	°F	
Tmeter, avg	76.77778	°F	
DRY GAS COMP			
CO_2	10.57292		
O_2	8.463182		
N_2	80.9639		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	77	min.	
TOTAL H_2O	50.7	grams	
VOLdgm	45.454	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.00	in. Hg	
Pmeter	28.93	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00052	sq. ft.	
Tstack, avg	694.75	R	
Tmeter, avg	536.78	R	
Vol, sample	46.09	dscf	
Vol, H_2O	2.39	scf	
% H_2O, impingers	4.93	%	
% H_2O, stocal	?		
MWdry, flue gas	30.03	lb/lb-mole	
MWwet, flue gas	29.44	lb/lb-mole	
Velocity, flue gas	25.51	fps	
Qstack	2005.49	acfm	
Qstack	1477.33	scfm	
Qstack	1404.48	dscfm	
Qstack	39.77	dscm/min @ actual O_2	
Qstack	27.64	dscm/min @ 3% O_2	
MASS OF Hg	3.81	µg	
CONC'N	2.92	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.20	µg/dscm @ 3% O_2	
Hg FLOW RATE	116.0905	µg/min	
MASS OF ELEMENTAL Hg	0.25	µg	
CONC'N	0.19	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.28	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	7.69	µg/min	

MASS OF OXIDIZED Hg	3.56	µg	
CONC'N	2.73	µg/dscm @ actual O_2	
CONC'N, 3% O_2	3.92	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	108.41	µg/min	
% OXIDIZED	93.38%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.46	mg/dscm actual O_2	
GRAIN LDNG.	0.66	mg/dscm @ 3% O_2	
PART. RATE	0.018	g/min	
PART. RATE	0.002	lb/hr	

Appendix B: Outlet-24

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-24	**30-Mar**	**9:25 AM**
INPUT PARAMETERS			
Pbar	29.06	in. Hg	
Pstack	2.07	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.311	in.	
Delta P, pitot		in. H_20	
Delta H	1.432397	in. H_20	
Tstack, avg	228.875	°F	
Tmeter, avg	76.19231	°F	
DRY GAS COMP			
CO_2	10.8846		
O_2	8.24738		
N_2	80.86802		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	70.6	grams	
VOLdgm	75.053	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.21	in. Hg	
Pmeter	29.17	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	688.88	R	
Tmeter, avg	536.19	R	
Vol, sample	76.80	dscf	
Vol, H_2O	3.33	scf	
% H_2O, impingers	4.15	%	

% H_2O, stocal	?		
MWdry, flue gas	30.07	lb/lb-mole	
MWwet, flue gas	29.57	lb/lb-mole	
Velocity, flue gas	26.89	fps	
Qstack	2114.53	acfm	
Qstack	1582.37	scfm	
Qstack	1516.63	dscfm	
Qstack	42.95	dscm/min @ actual O_2	
Qstack	30.36	dscm/min @ 3% O_2	
MASS OF Hg	8.41	µg	
CONC'N	3.87	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.47	µg/dscm @ 3% O_2	
Hg FLOW RATE	166.0569	µg/min	
MASS OF ELEMENTAL Hg	0.70	µg	
CONC'N	0.32	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.46	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	13.87	µg/min	
MASS OF OXIDIZED Hg	7.71	µg	
CONC'N	3.54	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.01	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	152.19	µg/min	
% OXIDIZED	91.65%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.000	grams	
GRAIN LDNG.	0.09	mg/dscm actual O_2	
GRAIN LDNG.	0.13	mg/dscm @ 3% O_2	
PART. RATE	0.004	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-25

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-25	**30-Mar**	**12:25 PM**
INPUT PARAMETERS			
Pbar	29.06	in. Hg	
Pstack	2.115	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.311	in.	
Delta P, pitot		in. H_20	
Delta H	1.459072	in. H_20	
Tstack, avg	236.875	°F	
Tmeter, avg	73.34615	°F	
DRY GAS COMP			

CO_2	10.62417		
O_2	8.573744		
N_2	80.80208		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	84.9	grams	
VOLdgm	76.006	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.22	in. Hg	
Pmeter	29.17	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	696.88	R	
Tmeter, avg	533.35	R	
Vol, sample	78.19	dscf	
Vol, H_2O	4.00	scf	
% H_2O, impingers	4.87	%	
% H_2O, stocal	?		
Mwdry, flue gas	30.04	lb/lb-mole	
Mwwet, flue gas	29.46	lb/lb-mole	
Velocity, flue gas	27.62	fps	
Qstack	2171.40	acfm	
Qstack	1606.46	scfm	
Qstack	1528.22	dscfm	
Qstack	43.28	dscm/min @ actual O_2	
Qstack	29.80	dscm/min @ 3% O_2	
MASS OF Hg	8.96	µg	
CONC'N	4.04	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.87	µg/dscm @ 3% O_2	
Hg FLOW RATE	175.0499	µg/min	
MASS OF ELEMENTAL Hg	0.98	µg	
CONC'N	0.44	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.64	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	19.10	µg/min	
MASS OF OXIDIZED Hg	7.98	µg	
CONC'N	3.60	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.23	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	155.95	µg/min	
% OXIDIZED	89.09%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.000	grams	
GRAIN LDNG.	0.18	mg/dscm actual O_2	
GRAIN LDNG.	0.26	mg/dscm @ 3% O_2	
PART. RATE	0.008	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-26

TEST 0002	RUN #	DATE	TIME
	outlet-26	30-Mar	3:10 PM
INPUT PARAMETERS			
Pbar	29.06	in. Hg	
Pstack	2.115	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.311	in.	
Delta P, pitot		in. H_20	
Delta H	1.488897	in. H_20	
Tstack, avg	236.875	°F	
Tmeter, avg	80	°F	
DRY GAS COMP			
CO_2	10.63725		
O_2	8.502744		
N_2	80.86001		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	91.9	grams	
VOLdgm	77.49	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.22	in. Hg	
Pmeter	29.17	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	696.88	R	
Tmeter, avg	540.00	R	
Vol, sample	78.74	dscf	
Vol, H_2O	4.33	scf	
% H_2O, impingers	5.22	%	
% H_2O, stocal	?		
MWdry, flue gas	30.04	lb/lb-mole	
MWwet, flue gas	29.41	lb/lb-mole	
Velocity, flue gas	27.62	fps	
Qstack	2171.42	acfm	
Qstack	1606.48	scfm	
Qstack	1522.68	dscfm	
Qstack	43.12	dscm/min @ actual O_2	
Qstack	29.87	dscm/min @ 3% O_2	
MASS OF Hg	9.27	µg	
CONC'N	4.16	µg/dscm @ actual O_2	
CONC'N, 3% O_2	6.00	µg/dscm @ 3% O_2	
Hg FLOW RATE	179.2882	µg/min	
MASS OF ELEMENTAL Hg	0.99	µg	
CONC'N	0.45	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.64	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	19.21	µg/min	

MASS OF OXIDIZED Hg	8.28	µg	
CONC'N	3.71	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.36	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	160.08	µg/min	
% OXIDIZED	89.29%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.001	grams	
GRAIN LDNG.	0.22	mg/dscm actual O_2	
GRAIN LDNG.	0.32	mg/dscm @ 3% O_2	
PART. RATE	0.010	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-27

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-27	**31-Mar**	**8:59 AM**
INPUT PARAMETERS			
Pbar	29.27	in. Hg	
Pstack	2.0875	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.312	in.	
Delta P, pitot		in. H_20	
Delta H	1.480183	in. H_20	
Tstack, avg	228.75	°F	
Tmeter, avg	78.30769	°F	
DRY GAS COMP			
CO_2	10.28794		
O_2	9.179116		
N_2	80.53294		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	83.1	grams	
VOLdgm	76.289	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.42	in. Hg	
Pmeter	29.38	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	688.75	R	
Tmeter, avg	538.31	R	
Vol, sample	78.32	dscf	
Vol, H_2O	3.92	scf	
% H_2O, impingers	4.76	%	

% H_2O, stocal	?		
MWdry, flue gas	30.01	lb/lb-mole	
MWwet, flue gas	29.44	lb/lb-mole	
Velocity, flue gas	27.11	fps	
Qstack	2131.35	acfm	
Qstack	1606.80	scfm	
Qstack	1530.24	dscfm	
Qstack	43.34	dscm/min @ actual O_2	
Qstack	28.38	dscm/min @ 3% O_2	
MASS OF Hg	7.49	µg	
CONC'N	3.38	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.16	µg/dscm @ 3% O_2	
Hg FLOW RATE	146.3918	µg/min	
MASS OF ELEMENTAL Hg	0.61	µg	
CONC'N	0.27	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.42	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	11.84	µg/min	
MASS OF OXIDIZED Hg	6.88	µg	
CONC'N	3.10	µg/dscm @ actual O_2	
CONC'N, 3% O_2	4.74	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	134.40	µg/min	
% OXIDIZED	91.90%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.000	grams	
GRAIN LDNG.	0.09	mg/dscm actual O_2	
GRAIN LDNG.	0.14	mg/dscm @ 3% O_2	
PART. RATE	0.004	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-28

TEST 0002	**RUN #**	**DATE**	**TIME**
	outlet-28	**31-Mar**	**11:52 AM**
INPUT PARAMETERS			
Pbar	29.27	in. Hg	
Pstack	2.0575	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.312	in.	
Delta P, pitot		in. H_20	
Delta H	1.390661	in. H_20	
Tstack, avg	228.375	°F	
Tmeter, avg	80.19231	°F	
DRY GAS COMP			

CO_2	10.41487		
O_2	8.932116		
N_2	80.65302		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	79.8	grams	
VOLdgm	73.859	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.42	in. Hg	
Pmeter	29.37	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	688.38	R	
Tmeter, avg	540.19	R	
Vol, sample	75.55	dscf	
Vol, H_2O	3.76	scf	
% H_2O, impingers	4.74	%	
% H_2O, stocal	?		
Mwdry, flue gas	30.02	lb/lb-mole	
Mwwet, flue gas	29.45	lb/lb-mole	
Velocity, flue gas	25.93	fps	
Qstack	2038.53	acfm	
Qstack	1537.54	scfm	
Qstack	1464.59	dscfm	
Qstack	41.48	dscm/min @ actual O_2	
Qstack	27.73	dscm/min @ 3% O_2	
MASS OF Hg	8.02	µg	
CONC'N	3.75	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.61	µg/dscm @ 3% O_2	
Hg FLOW RATE	155.469	µg/min	
MASS OF ELEMENTAL Hg	0.55	µg	
CONC'N	0.26	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.38	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	10.61	µg/min	
MASS OF OXIDIZED Hg	7.47	µg	
CONC'N	3.49	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.22	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	144.86	µg/min	
% OXIDIZED	93.18%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.000	grams	
GRAIN LDNG.	0.09	mg/dscm actual O_2	
GRAIN LDNG.	0.14	mg/dscm @ 3% O_2	
PART. RATE	0.004	g/min	
PART. RATE	0.001	lb/hr	

Appendix B: Outlet-29

TEST 0002	RUN #	DATE	TIME
	outlet-29	31-Mar	2:32 PM
INPUT PARAMETERS			
Pbar	29.27	in. Hg	
Pstack	2.0575	in. H_20	
Cpitot	0.84		
DGMcal	1.066		
Dstack	15.5	in.	
Dnozzle	0.312	in.	
Delta P, pitot		in. H_20	
Delta H	1.3093744	in. H_20	
Tstack, avg	228.375	°F	
Tmeter, avg	80.038462	°F	
DRY GAS COMP			
CO_2	10.366208		
O_2	8.9932605		
N_2	80.640532		
CO	0		
SO_2	500	PPM	
SAMPLE TIME	120	min.	
TOTAL H_2O	82.8	grams	
VOLdgm	73.162	cu. ft.	
CALCULATED PARAMETERS			
Pstack	29.42	in. Hg	
Pmeter	29.37	in. Hg	
Area, stack	1.31	sq. ft.	
Area, nozzle	0.00053	sq. ft.	
Tstack, avg	688.38	R	
Tmeter, avg	540.04	R	
Vol, sample	74.84	dscf	
Vol, H_2O	3.90	scf	
% H_2O, impingers	4.96	%	
% H_2O, stocal	?		
MWdry, flue gas	30.02	lb/lb-mole	
MWwet, flue gas	29.42	lb/lb-mole	
Velocity, flue gas	25.93	fps	
Qstack	2038.70	acfm	
Qstack	1537.67	scfm	
Qstack	1461.43	dscfm	
Qstack	41.39	dscm/min @ actual O_2	
Qstack	27.53	dscm/min @ 3% O_2	
MASS OF Hg	7.85	µg	
CONC'N	3.70	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.57	µg/dscm @ 3% O_2	
Hg FLOW RATE	153.27912	µg/min	
MASS OF ELEMENTAL Hg	0.57	µg	
CONC'N	0.27	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.41	µg/dscm @ 3% O_2	
Hg(0) FLOW RATE	11.19	µg/min	

MASS OF OXIDIZED Hg	7.27	µg	
CONC'N	3.43	µg/dscm @ actual O_2	
CONC'N, 3% O_2	5.16	µg/dscm @ 3% O_2	
Hg(+2) FLOW RATE	141.97	µg /min	
% OXIDIZED	92.69%		
MASS OF PART. Hg	0.00	µg	
CONC'N	0.00	µg/dscm @ actual O_2	
CONC'N, 3% O_2	0.00	µg/dscm @ 3% O_2	
PART. Hg FLOW RATE	0.00	µg/min	
MASS OF PART.	0.000	grams	
GRAIN LDNG.	0.09	mg/dscm actual O_2	
GRAIN LDNG.	0.14	mg/dscm @ 3% O_2	
PART. RATE	0.004	g/min	
PART. RATE	0.001	lb/hr	