Unit 2 Main Stack
Compliance Test Report
Haverhill North Coke Company
Facility ID 0773000182

Test Date:

July 9, 2009

Prepared for:

Haverhill North Coke Company
2446 Gallia Pike
Franklin Furnace, Ohio 45629

URS

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FACILITY ID 0773000182

Prepared for:

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Prepared by:

URS Corporation
1093 Commerce Park Drive, Suite 100
Oak Ridge, Tennessee 37830

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ACRONYMS

acfm	actual cubic feet per minute
CEM	Continuous Emissions Monitor
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
dscf	dry standard cubic feet
EPA	Environmental Protection Agency
HNCC	Haverhill North Coke Company
NO_x	Nitrogen oxide
O_2	Oxygen
OEPA	Ohio Environmental Protection Agency
ppm	parts per million
scfm	Standard cubic feet per minute
URS	URS Corporation

1.0 INTRODUCTION/OVERVIEW

On July 9, 2009 URS Corporation (URS) performed air emissions compliance testing on the Unit 2 Main Stack at the Haverhill North Coke Company (HNCC). Testing was conducted for nitrogen oxide (NO_x), carbon monoxide (CO) and volatile organic compounds (VOC), along with velocity traverses and moisture determination of the stack gas. The CO and VOC testing was performed as indicators of good combustion. The tests were performed using the methods and procedures listed in the Permit to Install (07-00511) and described in the Intent To Test Notification submitted on June 26, 2009.

The emission limits from the permit are listed in Table 1-1 along with the measured values. A more detailed list of test results is located in Table 2-1.

Personnel on-site during the tests included:

- Chris Sharp, Corporate Environmental Manager, SunCoke;
- Kris Kinder, Environmental Manager, HNCC;
- Cindy Charles, Ohio EPA, Portsmouth (OEPA);
- Todd Gregg, Environmental Scientist, URS;
- Thomas Brado, Field Technician, URS;
- Brad Johnson, Field Technician, URS.

This report summarizes the test results for each emission unit in Section 2.0 and provides information on how the tests were performed in Section 3.0. The quality assurance program used by URS for this test program is described in Section 4.0. The appendices contains the process data, calculations, analytical reports, field data sheets, calibration information, and a copy of the Intent to Test.

Table 1-1

Compliance Demonstration HNNC – Unit 2 Main Stack (July 9, 2009)

Emission Unit		Pollutant	Emission Limit	Measured Value	Comply?
Name	Number				
Unit 2 Main Stack	P902	NO_x	120.0 lb/hour	74.25 lb/hour	Yes
		NO_x	1 lb/ton coal	0.792 lb/ton coal	Yes
		CO	21.81 lb/hour	0.37 lb/hour	Yes
		CO	20 ppm	0.42 ppm	Yes
		VOC [a]	4.67 lb/hour	0.597 lb/hour	Yes
		VOC [a]	10 ppm	0.432 ppm	Yes

[a] Reported as methane.

HNCC utilizes the Jewell-Thompson heat recovery oven to manufacture metallurgical coke. In coke production from both heat recovery and byproduct ovens, the volatile fraction of the coal is driven off in a reducing atmosphere. Coke is essentially the remaining carbon and ash. With byproduct ovens, the volatiles and combustion products are collected downstream of the oven chamber and refined in a chemical plant to produce coke oven gas and other products such as tar, ammonia, and light oils. In heat recovery ovens, all the coal volatiles are oxidized.

Heat recovery steam generators (HRSGs) recover heat from the oven waste gases. The cooled gases pass through a lime spray dryer/baghouse system prior to being exhausted from the main stack. The oven pushing/charging machine travels on rails between ovens during the production cycle. A traveling hood/baghouse system controls emissions from coal charging that escape the ovens. On the opposite side of the ovens from the pushing/charging machine, coke is pushed into a flat push hot car that travels on rails from the oven to the quench tower. A multicyclone captures and controls emissions from pushing the coke into the car and during travel to the quench tower. A baghouse controls particulate emissions from the coke screening and crushing facilities in the coke processing area.

There are currently 200 ovens at HNCC that operate on a 48-hour coking cycle. There are 100 ovens in Unit 1 and 100 ovens in Unit 2. The operating schedule is arranged such that half of

the ovens are charged each day. For example, the 50 even-numbered ovens in Unit 2 are charged one day and the 50 odd-numbered ovens in Unit 2 are charged the next.

Since emissions from the ovens are essentially continuous, testing on the vent stack can be performed anytime. However, Ohio EPA (OEPA) requires that at least one of the compliance test runs on the Main Stack be performed during the oven push/charge production cycle. Each production cycle consists of pushing and charging 25 ovens.

2.0 TEST RESULTS

The tests for NO_x, CO and VOC performed on the Unit 2 Main Stack on July 9, 2009 are summarized below in Table 2-1.

Table 2-1

Unit 2 - Main Stack Compliance Test Results

Parameters	Run 1	Run 2	Run 3	Average
Run Times	1530-1629	1700-1759	1825-1924	
Date	7/9/2009	7/9/2009	7/9/2009	
Vol. Sampled @ STP (ft^3)	33.815	33.625	34.535	33.992
Moisture Content (% Vol.)	17.74%	21.04%	19.42%	19.40%
O_2 (%)	9.9	9.8	10.0	9.9
CO_2 (%)	6.0	6.4	6.2	6.2
Stack Gas Temperature (°F)	253.3	249.4	254.1	252.3
Stack Velocity (ft/min.)	2,562	2,541	2,541	2,548
Stack Velocity (ft/sec.)	42.70	42.35	42.35	42.47
Gas Flow Rate (acfm)	340,023	337,303	337,292	338,206
Gas Flow Rate (scfm)	252,440	251,845	250,150	251,478
Gas Flow Rate (dscfm)	207,668	198,850	201,583	202,701
NOx Concentration (ppm)	51.08	49.64	52.54	51.09
NOx Mass Rate (lb/hour)	76.05	70.77	75.94	74.25
NOx Mass Rate (lb/ton coal)[a]	0.811	0.755	0.810	0.792
CO Concentration (ppm)	0.000	0.299	0.949	0.416
CO Mass Rate (lb/hour)	0.000	0.260	0.835	0.365
VOC Concentration (ppm)[b]	0.151	0.993	0.149	0.432
VOC Mass Rate (lb/hour)[b]	0.217	1.364	0.209	0.597

[a] Based on 50 ovens charged with 45 tons coal/oven for a 24-hr period.
[b] Reported as methane.

In comparison of the test results presented in Tables 2-1 to the permit requirements listed in Table 1-1, the Unit 2 Main Stack is in compliance with the OEPA permit.

Also in comparison of the CO and VOC emissions of these tests to the compliance testing performed on 4/9/09, the CO mass rate decreased by 1.05 lb/hr and the VOC slightly increased by 0.097 lb/hr.

3.0 SAMPLING METHODOLOGY

Each of the test methods used for this compliance test program were based on standard methodology taken from the latest version of Title 40 of the Code of Federal Regulations Part 60 (40 CFR Part 60), Appendix A. These test methods were presented in the Intent to Test and Sampling Protocol submitted to OEPA on June 26, 2009, and updated for Method 25A on July 8, 2009. The sampling methods used during the tests are summarized in Table 3-1. A detailed description of the sampling trains and methods used is provided below.

Table 3-1

Test Method Summary

Emission Unit	Pollutant	Test Method	Comment
Unit 2 Main Stack	Traverse point layout	EPA Method 1	
	Gas flow rate	EPA Method 2	
	Gas molecular weight	EPA Method 3	
	Moisture	EPA Method 4	
	NO_x	EPA Method 7E	
	CO	EPA Method 10	
	VOC	EPA Method 25A	Reported as methane

3.1 Determination of Stack Gas Volumetric Flow Rate

U.S. Environmental Protection Agency (EPA) Methods 1 and 2 were used to determine the sampling traverse layout and stack gas volumetric flow rate at the sampling location. An integrated velocity traverse was conducted at discrete points during each test run for the vent stack at each traverse point. A calibrated S-type pitot tube and an incline manometer was used to measure the velocity pressure. A calibrated type “K” thermocouple was used to measure the stack gas temperature at each traverse point. Utilizing the measured stack gas molecular weight and the moisture content, the standard (Q_{std}) and actual volumetric flow rates were calculated in accordance with the formulas found in EPA Reference Method 2. One complete velocity traverse was performed during each compliance test run.

A cyclonic flow check was performed on the Main Stack during the initial compliance testing performed on April 7, 2009. The results of the cyclonic flow check showed that the Main Stack was well within the limitations of cyclonic flow established in EPA Method 1. Since no modifications had been made to the stack since the compliance tests were performed, the original cyclonic flow evaluation is still valid for this test program.

3.2 Determination of Stack Gas Molecular Weight

In accordance with EPA Reference Method 3A, the stack gas O_2 and CO_2 concentrations were determined for the Main Stack exhaust gas. The O_2 and CO_2 content of the stack gas was determined using a Servomex 1400 O_2 and CO_2 gas analyzer. The resulting O_2 and CO_2 concentrations were used to calculate the molecular weight of the stack gas. The gas sample was collected using the CEM sampling system described in Section 3.5.

3.3 Determination of Stack Gas Moisture Content

The moisture content (%), B_{wo}, was determined for the Main Stack exhaust gas in accordance with EPA Reference Method 4. A moisture test was performed during each compliance test run. The moisture sampling was performed by extracting a sample of the stack exhaust gas stream through a stainless steel sampling probe connected to a Method 4 sampling train with a flexible hose. The Method 4 sampling train consisted of four glass impingers. The first Smith-Greenburg impinger contained 100 ml of distilled water. The second modified Smith-Greenburg impinger also contained 100 ml of distilled water. The third modified Smith-Greenburg impinger was originally empty, and the fourth modified Smith-Greenburg impinger contained approximately 200 grams of indicating silica gel. The impingers were weighed prior to assembling the sampling train to permit gravimetric moisture determination. After exiting the impingers, the exhaust gas sample traveled through an umbilical cord to the control console and was then exhausted to atmosphere. The control console contained the sample pump, dry gas meter, calibrated orifice meter, thermocouple readouts and heat controls for the sampling train.

At the conclusion of each test run, the sample train was recovered by weighing each individual impinger to determine the amount of moisture gain for the sample run. Figure 3-1 is a schematic of the Method 4 sample train.

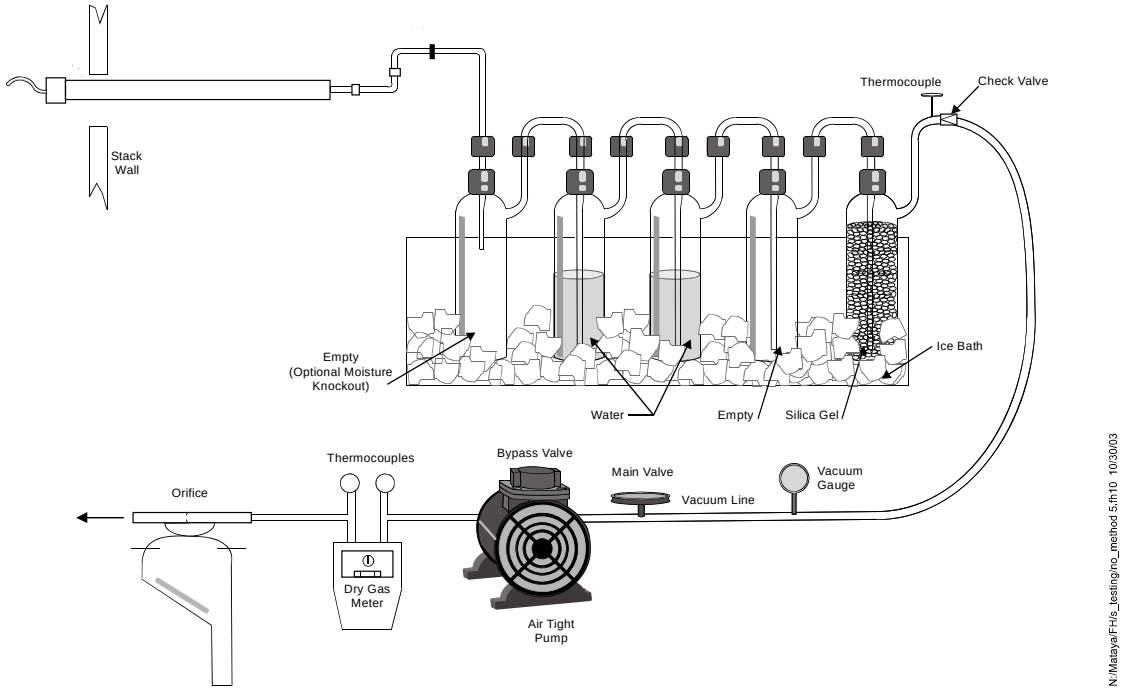


Figure 3-1. Schematic of EPA Method 4 Sample Train

3.4 Continuous Emission Monitoring – NO_x, CO, VOC

The continuous emission monitoring (CEM) for NO_x, CO and VOC was performed using a single CEM sampling system. The sampling system included a stainless steel probe connected to a heated Teflon sample line. The sample line was connected to an electric gas conditioner, which is used to remove moisture from the sample gas stream. An unheated Teflon sample line carried the sample gas from the gas conditioner to the CEM rack which contained the individual CEMs and the control valves used to operate the CEM sample system. Once the sample line reached the CEM rack, the sample was split to the individual CEM monitors for gas analysis.

To accommodate the VOC sampling, a separate heated Teflon sample line was connected

to a tee placed between the first heated sample line and inlet of the gas conditioner. This second heated line allowed a slip stream of sample gas to be extracted and transported directly to the VOC CEM analyzer, which requires the sample gas to remain heated until analyzed.

Each reference method CEM was connected to an ESC datalogger for collection of data. One minute averages of each reference method CEM was recorded throughout the compliance test period. A copy of this raw data is provided in the Appendix of this report. Figure 3-2 is a schematic of a typical CEM sampling system.

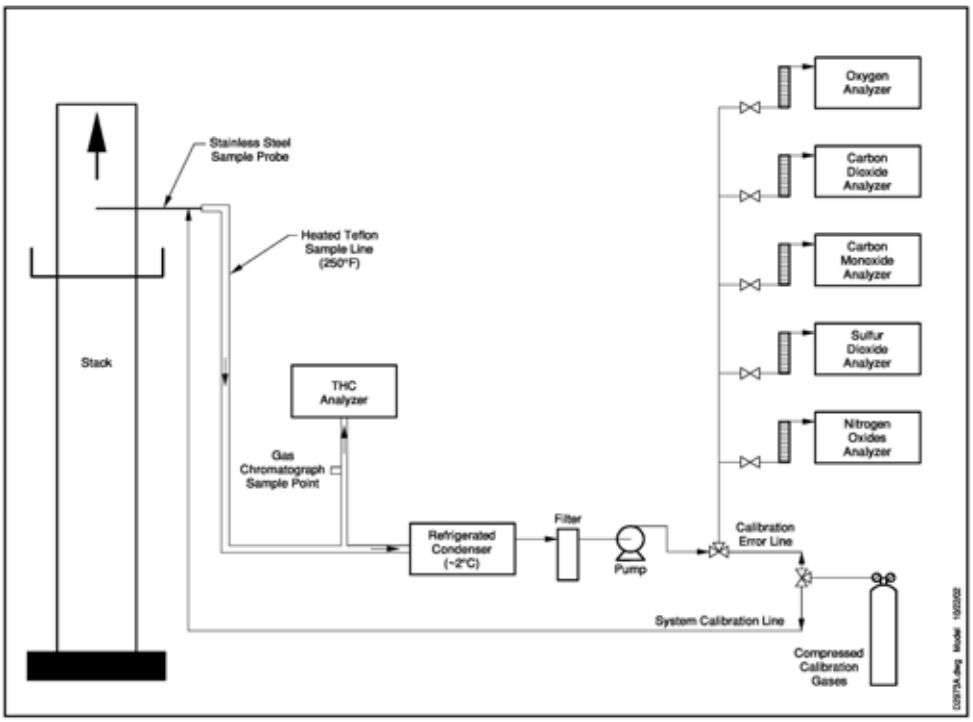


Figure 3-2. Schematic of Typical CEM Sampling System

(CEMs may vary)

Prior to performing the compliance test, the CEM analyzers were calibrated with a zero nitrogen gas along with RATA class calibration gases. Section 4.2 describes the methodology used for CEM calibration.

3.4.1 Nitrogen Oxides (NO_x) Determination

The NO_x concentrations were sampled using a TECO chemiluminescent NO-NO_x gas analyzer. The NO_x sampling conformed to procedures presented in EPA 40 CFR 60, Appendix A, Method 7E. The concentration and mass emissions of NO_x in the gas stream are reported in parts per million by volume (ppmv) on a dry basis, pounds per hour (lb/hr) and pounds per ton of coal charged per oven (lb/ton coal). The emission rate was calculated using the specific run time average concentration in ppm, the dry standard volumetric flow rate, the Ideal Gas Law, and the sampling time.

3.4.2 Carbon Monoxide (CO) Determination

The CO concentrations were sampled and determined using an API Model 300E gas filter correlation analyzer. The CO sampling conformed to procedures presented in 40 CFR 60, Appendix A, Method 10. The concentration and mass emissions of CO in the gas stream were reported in ppmv on a dry basis, and in pounds per hour (lb/hr). The emission rate was calculated using the specific run-time average concentration in ppmv, the dry standard volumetric flow rate, the Ideal Gas Law, and the sampling time.

3.4.3 Volatile Organic Compound (VOC) Determination

The VOC concentrations were sampled using a JUM Flame Ionizing Detector gas analyzer. The VOC sampling conformed to procedures presented in EPA 40 CFR 60, Appendix A, Method 25A. The analyzer was calibrated with propane calibration gas, and all VOC test results are reported as methane. The emission rate was calculated using the specific run-time average concentration in ppmv, the dry standard volumetric flow rate, the Ideal Gas Law, and the sampling time.

4.0 QUALITY ASSURANCE

The objective of URS's QA Program was to ensure the accuracy and precision, as well as reliability, of the data collected and generated for URS's clients and to meet the data quality objectives of regulatory or accrediting bodies. Management, administrative, statistical, investigative, preventative, and corrective techniques were employed to maximize the reliability of data.

During the compliance testing, a strict QA/QC program was adhered to. Before actual sampling on-site, all the sampling equipment was thoroughly checked to ensure that each component was clean and operable. Any damaged or faulty equipment was tagged and removed from service until it could be repaired. If any corrective actions were taken in response to these QC checks or in response to supervisor review of QC procedures, the corrective action taken was documented in a field QA/QC logbook.

Proper equipment calibration is essential in maintaining the desired data quality level. All calibrations of the equipment used in the stack sampling portion of the testing conformed to the guidelines outlined in the EPA quality assurance handbook, *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods* (EPA-600/4-77-027a). The following sections give a synopsis of the calibration procedures for the main components of the stack sampling systems.

4.1 Wet Method Test Equipment

The following sections describe the calibration procedures performed on the equipment used to perform the stack gas velocity and moisture sampling.

4.1.1 Dry Gas Meters/Orifice Meters

The dry gas meter and orifice meter in each control box to be used during the testing were calibrated before the test in order to ensure accurate measurements of the sample gas volumes. The dry gas meter and orifice meter are normally housed as a set inside each control

box and were calibrated as such. These sets of meters were calibrated against a secondary standard dry gas meter that is annually calibrated by Apex Instruments.

The dry gas meter/orifice meter sets were calibrated at predetermined nominal volume flow settings. For each of these flow rates, an accuracy ratio factor to the calibration standard (Y_i) was computed for the individual dry gas meters. A successful calibration for a particular dry gas meter would be achieved if each value of Y_i was within 2 percent of the average value of Y_i ($Y_i = Y \pm 0.02Y$).

In order to establish calibration for the orifice meter, a calibration coefficient ($\Delta H@_I$) was calculated for each flow rate. This coefficient is the orifice pressure differential (in inches H_2O) at a distinct orifice manometer setting that gives a flow of 0.75 ft^3/min of air at standard conditions. The desired tolerance for this coefficient is ±0.2 of the average value of the four values of $\Delta H@_I$ ($\Delta H@ \pm 0.2$). If any of the pre-test calibration coefficients for a particular meter violates the acceptance criteria, the meter in question would be adjusted and recalibrated.

4.1.2 Thermocouples and Thermocouple Readouts

All thermocouples used during the compliance test were calibrated to ensure accurate temperature measurements. All of the sensors utilized were type "K" thermocouples, which have a working range of approximately -300 °F to approximately 2,500 °F. These sensors were used in the measurement of stack gas temperature, impinger train outlet temperature and dry gas meter temperature. The thermocouples were calibrated against an NITS traceable mercury-in-glass thermometer at predetermined temperatures. In order to obtain the calibration data from each sensor, a single, recently calibrated thermocouple readout was used.

The thermocouple readouts used during the testing were calibrated using a thermocouple simulator. This calibration apparatus generates a voltage signal that mimics the signal an ideal "K" type thermocouple would exhibit at a particular temperature. The signal can be changed via a slide switch. The readouts were calibrated at ten different points from 200 °F through 2,000 °F, at increments of 200 °F.

4.1.3 Barometer

The field barometer used during the compliance test was an electronic barometer. This barometer was calibrated by comparing it to a standard mercury column barometer and adjusting it if any deviation existed between it and the standard. This exercise was performed both before and after the testing activities.

4.1.4 Analytical Balance

The field analytical balance was calibrated before the test with certified standard weights. The balance was adjusted for any deviation from the standard weights. In the field, periodic checks were made to insure data validity. This balance was used to measure the impinger weight changes due to moisture gain during the stack sampling (determination of stack moisture content).

4.1.5 Pitot Tubes

The S-type pitot tube used for the gas velocity traverses was calibrated by taking geometric measurements of the tube sizes and alignments. The basis for the calibration is described in 40 CFR, Part 60, Appendix A, Method 2.

4.2 CEMs

The reference method analyzers were calibrated with EPA-approved RATA Class calibration gases prior to the beginning of the test series, and after each compliance test run. The initial calibration error checks were performed at the beginning of the test run series in accordance with the specific reference method applicable to the analyzer. After the successful completion of the initial calibration error check, a system bias check was performed.

Zero, mid and high point calibration bias checks were performed prior to the beginning of the NO_x and CO compliance test runs. The VOC calibration bias checks included zero, low, mid and high point calibrations. The bias check is a comparison of instrument response to gas

introduced into the analyzer with gases routed throughout the entire sampling system. The maximum allowable bias is 5% of the span. After the bias check was performed, the analyzers were not adjusted during the compliance tests, unless an analyzer failed the drift check. No analyzers failed the drift check.

The drift checks were performed on each analyzer by introducing the mid-range calibration gas and the zero nitrogen. The maximum allowable calibration drift is 3% of the span. Calibration drift was determined by comparing the before run and after run values. The test data values were corrected for bias and calibration drift. The following calculation, as cited in the reference method, was used to correct the measured concentrations for bias and instrument calibration drifts:

$$C_{gas} = (C_{anz} - C_o)\frac{C_{ma}}{(C_m - C_o)}$$

where:

C_{gas} = effluent gas concentration, dry basis, ppmv

C_{anz} = average gas concentration indicated by the gas analyzer, dry basis, ppmv

C_o = average of initial and final system calibration bias check responses for the zero gas, ppmv

C_m = average of initial and final system calibration bias check responses for the upscale calibration gas, ppmv

C_{ma} = actual concentration of the upscale calibration gas, ppmv.

Response time tests were performed in conjunction with the bias checks. The response time test was performed by measuring the time it took for each analyzer to reach 95% of the concentration of the high range calibration gas. The zero gas was then introduced into the sample system and the amount of time it took for the analyzer to reach a 95% reduction in scale reading was measured. The greater of these two readings was recorded as the response time for that analyzer.

Copies of the CEM calibrations, stratification test, drift check and bias check are located in the Appendix of this report.

Appendix A

PROCESS DATA

HNCC PUSHING REPORT **MITTAL** **OPERATORS INITIALS** WC/DC/DU

DATE:

OVEN	PREV TIME	PREV WEIGHT	DATE	CHG TIME	AM/PM CIRCLE	DATE	TONS GHG	SPILL >250 LBS	DOOR FIRE - PUSHER SIDE: DOOR OBS.	DOOR FIRE	Fire Out Time	PCM Pressure Readings: Pressure Reading	Fan Amp Reading	Cor Act Required	Operator / Maintenance / Corrective Action Comments
104	258pm	45	7/7	6:38	AM/PM	7/9	45.0	Y // N	Y // N	Y // N		4.4	131	Y // N	
108	307	45	7/7	6:46	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
112	314	45	7/7	6:57	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
116	323	45	7/7	7:06	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
120	331	45	7/7	7:15	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
124	339	45	7/7	7:21	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
128	426	45	7/7	7:33	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
132	434	45	7/7	7:44	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
136	442	45	7/7	7:52	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
140	450	45	7/7	8:02	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
144	457	45	7/7	8:10	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	lost power to the quench car
148	504	45	7/7	8:55	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
152	511	45	7/7	9:04	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
156	518	45	7/7	9:13	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
160	526	45	7/7	9:22	AM/PM	"	"	Y // N	X // N	Y // X				Y // N	
164	940	45	7/7	10:37	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
168	948	45	7/7	10:47	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
172	956	45	7/7	6:59	AM/PM	7/10	"	Y // N	Y // N	Y // N				Y // N	
176	1005	45	7/7	7:07	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
180	1012	45	7/7	7:15	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
184	1020	45	7/7	7:27	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	Quench / Plant Feed
188	1028	45	7/7	7:39	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	Plant Feed / Short Charge
192	1036	45	7/7	8:36	AM/PM	"	"	Y // N	Y // N	Y // N		4.4	129	Y // N	WArt full
196	1044	45	7/7	8:45	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
200	1052	45	7/7	8:56	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	Stationary Ram prox
102		45		6:29	AM/PM	7/9	"	Y // X	X // N	Y // X				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	

PCM Inspection		Comments
Charged Fire Ext.	YES NO	
Hydraulic Oil Spill	YES NO	
Windows Good Condition.	YES NO	
Doors Good Condition.	YES NO	

Door fire correction step list

1) Tighten door
2) Place K-Wool
3) Open uptake
4) Check blocks
5) Verify up take setting
6) Raise draft
7) Close SF 50%
8) Reduce door holes
9) Open EVS

PCM Pressure Readings

Must be in the required range of 3.0 to 12.0
If the reading isn't within the required range. Notify maintenance and the Turn Manager immediately. Write in the corrective actions taken t bring the pressure readings back into the EPA range.
Pressure Readings are to be recorded Once Per 8 Hour Shift / Every turn
Fan Amps are to be recorded Once Per 8 Hour Shift / Every Turn
Skipped Ovens - Record all out of sequence skipped ovens in the blanks provided.

102 7/9 45.0 - 6:29 Pm

HNCC PUSHING REPORT **MITTAL** **OPERATORS INITIALS** DD/DU/DM

DATE:

OVEN	PREV TIME	PREV WEIGHT	DATE	CHG TIME	AM/PM CIRCLE	DATE	TONS GHG	SPILL >250 LBS	DOOR FIRE - PUSHER SIDE: DOOR OBS.	DOOR FIRE	Fire Out Time	PCM Pressure Readings: Pressure Reading	Fan Amp Reading	Cor Act Required	Operator / Maintenance / Corrective Action Comments
102	249pm	45	7/7		AM/PM			Y // N	Y // N	Y // N				Y // N	
106	202am	45	7/7	6:47	AM/PM	7/9	45	Y // N	Y // N	Y // N		4.3	129	Y // N	
110	211	45	7/7	6:56	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
114	219	45	7/7	7:04	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
118	227	45	7/7	7:12	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
122	236	45	7/7	7:21	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
126	244	45	7/7	7:30	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
130	252	45	7/7	7:41	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
134	302	45	7/7	8:22	AM/PM	"	"	Y // N	Y // N	Y // N		4.4	126	Y // N	
138	312	45	7/7	8:32	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	Pcm Latch
142	320	45	7/7	8:41	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
146	327	45	7/7	8:49	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
150	334	45	7/7	8:58	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
154	341	45	7/7	9:18	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	I.D. Fan
158	349	45	7/7	9:26	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
162	505	45	7/7	9:45	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
166	536	45	7/7	11:13	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	I.D. FAN
170	545	45	7/7	11:23	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
174	554	45	7/7	11:36	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
178	602	45	7/7	11:50	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	Quench - Tram
182	610	45	7/7	11:59	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
186	618	45	7/7	12:08	AM/PM	"	"	Y // N	Y // N	Y // N		4.2	125	Y // N	
190	626	45	7/7	12:17	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
194	634	45	7/7	12:25	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	
198	642	45	7/7	12:35	AM/PM	"	"	Y // N	Y // N	Y // N				Y // N	pcm Latch
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	

PCM Inspection		Comments
Charged Fire Ext.	YES-NO	
Hydraulic Oil Spill	YES-NO	
Windows Good Condition.	YES-NO	
Doors Good Condition.	YES-NO	

Door fire correction step list

1) Tighten door
2) Place K-Wool
3) Open uptake
4) Check blocks
5) Verify up take setting
6) Raise draft
7) Close SF 50%
8) Reduce door holes
9) Open EVS

PCM Pressure Readings

Must be in the required range of 3.0 to 12.0
If the reading isn't within the required range. Notify maintenance and the Turn Manager immediately. Write in the corrective actions taken t bring the pressure readings back into the EPA range.
Pressure Readings are to be recorded Once Per 8 Hour Shift / Every turn
Fan Amps are to be recorded Once Per 8 Hour Shift / Every Turn
Skipped Ovens - Record all out of sequence skipped ovens in the blanks provided.

HNCC PUSHING REPORT **SEVERSTAL** **OPERATORS INITIALS** TH/DT/[illegible]

DATE: 7/08/09

OVEN	PREV TIME	PREV WEIGHT	DATE	CHG TIME	AM/PM CIRCLE	DATE	TONS GHG	SPILL >250 LBS	DOOR FIRE - PUSHER SIDE: DOOR OBS.	DOOR FIRE	Fire Out Time	PCM Pressure Readings: Pressure Reading	Fan Amp Reading	Cor Act Required	Operator / Maintenance / Corrective Action Comments
103	616am	45	7/6	7:05	AM/PM	[illegible]	45	Y // N	Y // N	Y // N		4.6	129	Y // N	
107	625	45	7/6	7:13	AM/PM	7/8	45	Y // N	Y // N	Y // N				Y // N	
111	634	45	7/6	7:21	AM/PM			Y // N	Y // N	Y // N				Y // N	
115	643	45	7/6	7:29	AM/PM			Y // N	Y // N	Y // N				Y // N	
119	652	45	7/6	7:40	AM/PM			Y // N	Y // N	Y // N				Y // N	
123	703	45	7/6	7:49	AM/PM			Y // N	Y // N	Y // N				Y // N	
127	714	45	7/6	7:57	AM/PM			Y // N	Y // N	Y // N				Y // N	lunchtime
131	726	45	7/6	9:10	AM/PM			Y // N	Y // N	Y // N				Y // N	
135	739	45	7/6	9:18	AM/PM			Y // N	Y // N	Y // N				Y // N	
139	843	45	7/6	9:26	AM/PM			Y // N	Y // N	Y // N				Y // N	PCM Pushing Ram water hose
143	851	45	7/6	10:31	AM/PM			Y // N	Y // N	Y // N		4.4	128	Y // N	D.M latches
147	859	45	7/6	10:44	AM/PM			Y // N	Y // N	Y // N				Y // N	
151	908	45	7/6	10:52	AM/PM			Y // N	Y // N	Y // N				Y // N	
155	916	45	7/6	10:59	AM/PM			Y // N	Y // N	Y // N				Y // N	
159	924	45	7/6	11:06	AM/PM			Y // N	Y // N	Y // N				Y // N	
163	939	45	7/6	11:21	AM/PM			Y // N	Y // N	Y // N				Y // N	
167	947	45	7/6	11:37	AM/PM			Y // N	Y // N	Y // N				Y // N	
171	955	45	7/6	12:24	AM/PM	7/9		Y // N	Y // N	Y // N		4.5	124	Y // N	
175	1003	45	7/6	12:32	AM/PM			Y // N	Y // N	Y // N				Y // N	
179	1011	45	7/6	12:40	AM/PM			Y // N	Y // N	Y // N				Y // N	
183	1019	45	7/6	12:48	AM/PM			Y // N	Y // N	Y // N				Y // N	
187	1027	45	7/6	12:55	AM/PM			Y // N	Y // N	Y // N				Y // N	
191	1035	45	7/6	1:03	AM/PM			Y // N	Y // N	Y // N				Y // N	
195	1043	45	7/6	1:11	AM/PM			Y // N	Y // N	Y // N				Y // N	
199	1051	45	7/6	1:18	AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	
					AM/PM			Y // N	Y // N	Y // N				Y // N	

12
19
20

PCM Inspection		Comments
Charged Fire Ext.	YES-NO	
Hydraulic Oil Spill	YES-NO	(FALSE DOOR
Windows Good Condition.	YES-NO	COAL SPILLAGE)
Doors Good Condition.	YES-NO	

Door fire correction step list

1) Tighten door
2) Place K-Wool
3) Open uptake
4) Check blocks
5) Verify up take setting
6) Raise draft
7) Close SF 50%
8) Reduce door holes
9) Open EVS

PCM Pressure Readings

Must be in the required range of 3.0 to 12.0
If the reading isn't within the required range. Notify maintenance and the Turn Manager immediately. Write in the corrective actions taken t bring the pressure readings back into the EPA range.
Pressure Readings are to be recorded Once Per 8 Hour Shift / Every turn
Fan Amps are to be recorded Once Per 8 Hour Shift / Every Turn
Skipped Ovens - Record all out of sequence skipped ovens in the blanks provided.

Appendix B

CEM STACK TEST DATA

Field Notes

URS

CALC. NO. _____

CALCULATION SHEET

SIGNATURE _____ DATE _____ CHECKED _____ DATE 7/8/09

PROJECT Haverhill Unit #2 JOB NO. _____

SUBJECT NOx / CO Compliance SHEET 1 OF 3 SHEETS

Direct cals

	Time	O2	CO2	NOx	CO
Zero	12:13	0.0	0.1	0.25	0.06
O2/CO2	12:31	20.8	19.0		
O2/CO2	12:37	12.4	9.9		
NOx	12:17			89.32	
NOx	12:23			48.42	
CO	12:26				89.97
CO	12:29				50.78

Response Times

	NOx	O2/CO2	CO	THC
up	1.26.25	26.87	1.05.99	21.32
down	1.22.43	28.32	1.06.35	20.15
up	1.27.62	26.24	1.05.88	21.47
down	1.25.76	28.41	1.06.44	20.69
up	1.27.15	27.30	1.06.26	20.83
down	1.24.19	27.70	1.06.12	20.23

Stratification test

point #1 @ 09:10 - 09:14
point #2 @ 09:15 - 09:19
point #3 @ 09:20 - 09:24

System Bias

	Time	O2	CO2	NOx	CO	THC
Zero	08:16	0.0	0.1	0.05		0.0
O2/CO2	08:23	12.5	10.0		0.0	
NOx	08:28			47.50		
CO	08:31				50.15	
THC	08:35					85.46
THC	08:39					50.97
THC	08:42					23.65

URS

CALC. NO. _____

CALCULATION SHEET

SIGNATURE _____ DATE _____ CHECKED _____ DATE 7/9/09

PROJECT Haverhill Unit #2 JOB NO. _____

SUBJECT NOx/CO Compliance SHEET 2 OF 3 SHEETS

Bias

	Time	O2	CO2	NOx	CO	THC
Zero	14:11	0.0	0.1	0.27		0.0
O2/CO2	14:14	12.5	10.0		0.58	
NOx	14:18			47.53		
CO	14:21				50.18	
THC	14:24					23.11

Run #1 @ 15:30 - 16:29

Bias

	Time	O2	CO2	NOx	CO	THC
Zero	16:37	0.0	0.1	0.26		0.11
O2/CO2	16:40	12.5	9.9		0.0	
NOx	16:44			47.39		
CO	16:47				50.01	
THC	16:52					23.27

Run # 2 @ 17:00 - 17:59

Bias

	Time	O2	CO2	NOx	CO	THC
Zero	18:04	0.0	0.1	0.24		0.09
O2/CO2	18:07	12.5	9.9		-0.60	
NOx	18:11			47.46		
CO	18:14				50.14	
THC	18:18					23.67

Run # 3 @ 18:25 - 19:24

URS

CALC. NO. _____

CALCULATION SHEET

SIGNATURE _____ DATE _____ CHECKED _____ DATE 7/9/09

PROJECT Haverhill Unit #2 JOB NO. _____

SUBJECT NOx/CO Compliance SHEET 3 OF 3 SHEETS

Bias

	Time	O2	CO2	NOx	CO	THC
Zero	19:30	0.0	0.1	0.29		-0.11
O2/CO2	19:33	12.5	10.0		-0.61	
NOx	19:37			47.41		
CO	19:40				50.02	
THC	19:48					23.37

CEM Raw Data

Date	Hour	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	NOTES
7/9/2009	14:00	6.1	10	55.52	0.58	0.01	
7/9/2009	14:01	5.9	10.1	55.59	0.53	0	
7/9/2009	14:02	5.8	10.2	54.71	0.01	0	
7/9/2009	14:03	5.8	10.2	54.2	0.11	0.03	
7/9/2009	14:04	5.8	10.2	54.57	0.51	0.05	
7/9/2009	14:05	5.8	10.2	54.4	0.58	0.05	
7/9/2009	14:06	5.7	10.3	54.28	0.58	0	
7/9/2009	14:07	5.6	10.3	54.3	0.56	0	
7/9/2009	14:08	4.7	8.3	54.31	0.56	0	
7/9/2009	14:09	0	0.2	48.14	1.16	0	
7/9/2009	14:10	0	0.1	2.38	1.9	0	
7/9/2009	14:11	0	0.1	0.27	2.34	0	
7/9/2009	14:12	8.1	6.5	0.2	2.02	0.05	
7/9/2009	14:13	12.5	9.9	0.16	0.79	1.22	
7/9/2009	14:14	12.5	10	0.11	0.58	0.79	
7/9/2009	14:15	5.7	4.5	0.11	0.58	0.13	Run 1 Pre-test Bias Check
7/9/2009	14:16	0	0.1	20.12	0.48	0.02	
7/9/2009	14:17	0	0.1	46.58	1.3	0.01	
7/9/2009	14:18	0	0.1	47.53	1.74	0.01	
7/9/2009	14:19	0	0.1	47.64	14.25	0.02	
7/9/2009	14:20	0	0.1	28.17	48.09	0	
7/9/2009	14:21	0	0.1	0.51	50.18	0.01	
7/9/2009	14:22	11.8	0.3	0.18	32.3	12.8	
7/9/2009	14:23	20.8	0.1	2.75	2.5	23.41	
7/9/2009	14:24	20.9	0.1	0.13	1.74	23.11	
7/9/2009	14:25	16.2	3.3	0.07	1.55	12.6	
7/9/2009	14:26	5.8	10.1	12.22	0.49	0.14	
7/9/2009	14:27	5.6	10.3	54.64	0	0.06	
7/9/2009	14:28	5.4	10.4	54.6	0	0.07	
7/9/2009	14:29	6.6	9.5	53.78	0	0.15	
7/9/2009	14:30	7.2	9.1	50.55	0	0.32	
7/9/2009	14:31	7	9.3	46.19	0	0.24	
7/9/2009	14:32	5.9	10	45.57	0	0.17	
7/9/2009	14:33	7.9	8.6	51.41	0	0.25	
7/9/2009	14:34	6.1	9.9	47.74	0	0.15	
7/9/2009	14:35	5.8	10.1	49.49	0	0.3	
7/9/2009	14:36	5.8	10.2	53.82	0	0.29	
7/9/2009	14:37	5.5	10.4	54.78	0	0.14	
7/9/2009	14:38	5.4	10.4	53	0	0.11	
7/9/2009	14:39	5.5	10.3	52.51	0	0.11	
7/9/2009	14:40	5.4	10.4	53.31	0	0.21	
7/9/2009	14:41	5.5	10.3	53.06	0	0.29	
7/9/2009	14:42	5.5	10.2	53.41	0	0.13	
7/9/2009	14:43	5.4	10.4	54.15	0	0.11	
7/9/2009	14:44	5.5	10.4	54.08	0	0.13	
7/9/2009	14:45	6	10	51.72	0	0.17	
7/9/2009	14:46	5.9	10.1	53.32	0	0.41	
7/9/2009	14:47	5.6	10.3	54.28	0	0.13	
7/9/2009	14:48	5.3	10.4	54.03	0	0.11	
7/9/2009	14:49	5.4	10.3	52.95	0	0.1	
7/9/2009	14:50	5.7	10.2	53.74	0	0.11	
7/9/2009	14:51	5.8	10.1	54.67	0	0.36	
7/9/2009	14:52	5.9	10.1	54.67	0	0.15	
7/9/2009	14:53	5.8	10.1	54.13	0	0.12	
7/9/2009	14:54	5.7	10.2	53.77	0	0.12	
7/9/2009	14:55	5.7	10.2	53.51	0	0.12	

7/9/2009	14:56	5.6	10.2	53.5	0	0.31	
7/9/2009	14:57	5.6	10.2	53.78	0	0.16	
7/9/2009	14:58	5.7	10.2	53.9	0	0.11	
7/9/2009	14:59	5.7	10.2	54.32	0	0.11	
7/9/2009	15:00	5.8	10.2	54.44	0	0.12	
7/9/2009	15:01	5.8	10.2	54.38	0	0.32	
7/9/2009	15:02	5.8	10.1	54.13	0	0.2	
7/9/2009	15:03	5.8	10.2	54	0	0.13	
7/9/2009	15:04	5.8	10.2	53.63	0	0.12	
7/9/2009	15:05	5.7	10.2	53.47	0	0.11	
7/9/2009	15:06	5.7	10.2	53.46	0	0.3	
7/9/2009	15:07	5.7	10.2	53.05	0	0.28	
7/9/2009	15:08	5.8	10.2	53.07	0	0.11	
7/9/2009	15:09	5.7	10.2	53.3	0	0.1	
7/9/2009	15:10	5.7	10.2	53.43	0	0.1	
7/9/2009	15:11	5.7	10.2	53.11	0	0.21	
7/9/2009	15:12	5.7	10.2	52.94	0	0.27	
7/9/2009	15:13	5.7	10.2	52.74	0	0.1	
7/9/2009	15:14	5.8	10.2	52.75	0	0.09	
7/9/2009	15:15	5.7	10.2	52.83	0	0.09	
7/9/2009	15:16	5.7	10.2	52.57	0	0.15	
7/9/2009	15:17	5.7	10.2	52.16	0	0.31	
7/9/2009	15:18	5.8	10.1	52.12	0	0.1	
7/9/2009	15:19	5.8	10.1	52.21	0	0.1	
7/9/2009	15:20	5.7	10.2	52.1	0	0.09	
7/9/2009	15:21	5.8	10.1	52.16	0	0.11	
7/9/2009	15:22	5.8	10.1	52.45	0	0.33	
7/9/2009	15:23	5.8	10.1	52.55	0	0.1	
7/9/2009	15:24	5.9	10.1	52.37	0	0.07	
7/9/2009	15:25	5.7	10.2	52.59	0	0.07	
7/9/2009	15:26	5.7	10.2	51.79	0	0.08	
7/9/2009	15:27	5.8	10.1	51.36	0	0.32	
7/9/2009	15:28	5.9	10.1	51.98	0	0.11	
7/9/2009	15:29	5.7	10.2	52.24	0	0.06	
7/9/2009	15:30	5.9	10.1	51.73	0	0.06	Start Run 1
7/9/2009	15:31	5.9	10	51.75	0	0.06	
7/9/2009	15:32	5.8	10.2	52.64	0	0.28	
7/9/2009	15:33	5.9	10.1	51.81	0	0.13	
7/9/2009	15:34	6	10	51.82	0	0.07	
7/9/2009	15:35	5.9	10.1	52.75	0	0.06	
7/9/2009	15:36	5.9	10.1	52.3	0	0.05	
7/9/2009	15:37	6	10	52.39	0	0.29	
7/9/2009	15:38	5.9	10.1	53.34	0	0.17	
7/9/2009	15:39	5.9	10.1	53.13	0	0.06	
7/9/2009	15:40	5.9	10.1	52.78	0	0.05	
7/9/2009	15:41	5.9	10.1	52.58	0	0.05	
7/9/2009	15:42	5.9	10.1	52.51	0	0.24	
7/9/2009	15:43	5.9	10.1	52.3	0	0.23	
7/9/2009	15:44	6	10	52.32	0	0.06	
7/9/2009	15:45	5.9	10.1	52.65	0	0.05	
7/9/2009	15:46	5.9	10.1	52.41	0	0.05	
7/9/2009	15:47	5.9	10.1	52.23	0	0.16	
7/9/2009	15:48	5.9	10.1	52.45	0	0.28	
7/9/2009	15:49	5.9	10.1	52.13	0	0.06	
7/9/2009	15:50	6	10	52.3	0	0.04	
7/9/2009	15:51	5.9	10.1	52.22	0	0.04	
7/9/2009	15:52	6	10	52.05	0	0.08	
7/9/2009	15:53	6	10.1	52.09	0	0.23	
7/9/2009	15:54	6	10	51.99	0	0.06	
7/9/2009	15:55	6	10	52.13	0	0.05	
7/9/2009	15:56	6	10	52.06	0	0.04	

7/9/2009	15:57	6	10	51.82	0	0.05	
7/9/2009	15:58	6	10	51.6	0	0.33	
7/9/2009	15:59	6	10	51.61	0	0.07	
7/9/2009	16:00	6	10	51.44	0	0.04	
7/9/2009	16:01	6	10.1	51.22	0	0.04	
7/9/2009	16:02	6	10.1	51.11	0	0.04	
7/9/2009	16:03	6	10	50.89	0	0.25	
7/9/2009	16:04	6	10	50.84	0	0.08	
7/9/2009	16:05	6	10.1	51.02	0	0.03	
7/9/2009	16:06	6	10.1	50.94	0	0.04	
7/9/2009	16:07	6	10.1	50.83	0	0.04	
7/9/2009	16:08	6	10	50.67	0	0.24	
7/9/2009	16:09	6	10	50.6	0	0.11	
7/9/2009	16:10	6	10	50.59	0	0.04	
7/9/2009	16:11	6	10	50.48	0	0.04	
7/9/2009	16:12	6.1	10	50.24	0	0.04	
7/9/2009	16:13	6	10	50.44	0	0.23	
7/9/2009	16:14	6	10.1	50.34	0	0.17	
7/9/2009	16:15	6	10	50.04	0	0.05	
7/9/2009	16:16	6	10.1	49.87	0	0.04	
7/9/2009	16:17	6	10.1	49.8	0	0.04	
7/9/2009	16:18	6	10	49.8	0	0.15	
7/9/2009	16:19	6	10.1	49.89	0	0.18	
7/9/2009	16:20	6	10.1	49.95	0	0.05	
7/9/2009	16:21	6	10	49.93	0	0.04	
7/9/2009	16:22	6.1	10	50.17	0	0.04	
7/9/2009	16:23	6.1	10	50.23	0	0.11	
7/9/2009	16:24	6	10	49.95	0	0.23	
7/9/2009	16:25	6.1	10	49.64	0	0.07	
7/9/2009	16:26	6.1	10	49.85	0	0.05	
7/9/2009	16:27	6.1	10	50.42	0	0.05	
7/9/2009	16:28	6	10	50.67	0	0.08	
7/9/2009	16:29	6.1	10	50.81	0	0.27	End Run 1
7/9/2009	16:30	6.2	9.9	51.13	0	0.07	
7/9/2009	16:31	6.2	9.9	51.59	0	0.04	
7/9/2009	16:32	6.2	10	51.68	0	0.04	
7/9/2009	16:33	6.1	10	51.56	0	0.04	
7/9/2009	16:34	7.4	8.3	51.18	0	1.43	
7/9/2009	16:35	0.1	0.2	44.73	1.68	0.52	
7/9/2009	16:36	0	0.1	2.58	1.79	0.18	
7/9/2009	16:37	0	0.1	0.26	1.74	0.11	
7/9/2009	16:38	1	0.9	0.17	1.74	0.1	
7/9/2009	16:39	12.4	9.9	0.15	0.89	0.13	
7/9/2009	16:40	12.5	9.9	0.11	0	0.12	
7/9/2009	16:41	6.8	5.3	0.11	0	0.09	
7/9/2009	16:42	0.1	0.1	18.49	0.58	0.06	
7/9/2009	16:43	0	0.1	47.1	1.62	0.05	
7/9/2009	16:44	0	0.1	47.39	1.73	0.04	Run 1 Post-test Bias Check
7/9/2009	16:45	0.1	0.1	47.48	14.5	0.03	Run 2 Pre-test Bias Check
7/9/2009	16:46	0	0.1	27.81	48.18	0.02	
7/9/2009	16:47	0	0.1	0.4	50.01	0.02	
7/9/2009	16:48	7.1	0.1	0.18	43.72	9.65	
7/9/2009	16:49	20.8	0.1	0.26	4.66	20.73	
7/9/2009	16:50	20.8	0.1	0.12	1.74	21.54	
7/9/2009	16:51	20.9	0.1	0.07	1.79	22.54	
7/9/2009	16:52	20.9	0.1	0.05	1.74	23.27	
7/9/2009	16:53	15	4.2	0.05	1.57	10.04	
7/9/2009	16:54	6.2	9.9	18.38	0.31	0.2	
7/9/2009	16:55	6.2	10	49.6	0	0.33	
7/9/2009	16:56	6.2	10	49.75	0	0.07	
7/9/2009	16:57	6.2	10	49.96	0	0.06	

7/9/2009	16:58	6.2	10	50.15	0	0.05	
7/9/2009	16:59	6.2	9.9	50.1	0	0.11	
7/9/2009	17:00	6.2	10	50.2	0	0.25	Start Run 2
7/9/2009	17:01	6.2	10	50.09	0	0.07	
7/9/2009	17:02	6.2	10	49.97	0	0.07	
7/9/2009	17:03	6.2	10	50.04	0	0.07	
7/9/2009	17:04	6.2	10	49.95	0	0.09	
7/9/2009	17:05	6.2	10	49.86	0	0.3	
7/9/2009	17:06	6.3	9.9	50.11	0	0.1	
7/9/2009	17:07	6.2	10	51.14	0	0.07	
7/9/2009	17:08	6.3	9.9	50.48	0	0.06	
7/9/2009	17:09	6.4	9.9	50.2	0	0.07	
7/9/2009	17:10	6.2	10	50.66	0	0.31	
7/9/2009	17:11	6.3	9.9	50.21	0	0.11	
7/9/2009	17:12	6.4	9.8	50.25	0	0.07	
7/9/2009	17:13	6.3	9.9	51.04	0	0.08	
7/9/2009	17:14	6.3	9.9	50.58	0	0.07	
7/9/2009	17:15	6.5	9.8	49.89	0	0.3	
7/9/2009	17:16	6.3	9.9	50.36	0	0.16	
7/9/2009	17:17	6.3	10	50.36	0	0.07	
7/9/2009	17:18	6.4	9.9	49.86	0	0.07	
7/9/2009	17:19	6.4	9.9	50.28	0	0.06	
7/9/2009	17:20	6.3	9.9	50.39	0	0.29	
7/9/2009	17:21	6.3	10	49.97	0	0.21	
7/9/2009	17:22	6.3	10	49.88	0	0.08	
7/9/2009	17:23	6.4	9.9	50.06	0	0.07	
7/9/2009	17:24	6.4	9.9	50.43	0	0.07	
7/9/2009	17:25	6.4	9.9	50.55	0	0.22	
7/9/2009	17:26	6.4	9.9	50.42	0	0.21	
7/9/2009	17:27	6.4	9.9	50.19	0	0.07	
7/9/2009	17:28	6.4	9.9	50.21	0	0.06	
7/9/2009	17:29	6.4	9.9	50.19	0	0.07	
7/9/2009	17:30	6.3	10	49.98	0	0.18	
7/9/2009	17:31	6.3	9.9	49.96	0	0.3	
7/9/2009	17:32	6.4	9.9	49.68	0	0.09	
7/9/2009	17:33	6.4	9.9	49.91	0	0.08	
7/9/2009	17:34	6.4	9.9	49.88	0	0.08	
7/9/2009	17:35	6.4	9.9	49.65	0	0.12	
7/9/2009	17:36	6.4	9.9	49.8	0	0.29	
7/9/2009	17:37	6.4	9.9	49.61	0	0.1	
7/9/2009	17:38	6.4	9.9	49.21	0	0.07	
7/9/2009	17:39	6.4	9.9	49.22	0	0.07	
7/9/2009	17:40	6.4	9.9	49.17	0	0.08	
7/9/2009	17:41	6.5	9.9	49.42	0	0.32	
7/9/2009	17:42	6.5	9.9	49.58	0	12.76	
7/9/2009	17:43	6.5	9.9	49.66	0	1.86	
7/9/2009	17:44	6.5	9.9	49.54	0	1.33	
7/9/2009	17:45	6.4	9.9	49.15	0	0.73	
7/9/2009	17:46	6.5	9.9	49.17	0	0.66	
7/9/2009	17:47	6.5	9.9	49.35	0	0.36	
7/9/2009	17:48	6.5	9.9	49.46	0	0.23	
7/9/2009	17:49	6.5	9.8	49.55	0	0.22	
7/9/2009	17:50	6.5	9.8	49.58	0	0.32	
7/9/2009	17:51	6.5	9.9	49.56	0	0.54	
7/9/2009	17:52	6.5	9.9	49.26	0	0.4	
7/9/2009	17:53	6.5	9.9	49.07	0	0.26	
7/9/2009	17:54	6.5	9.9	49.54	0	0.24	
7/9/2009	17:55	6.4	9.9	49.4	0	0.21	
7/9/2009	17:56	6.4	9.9	49.07	0	0.39	
7/9/2009	17:57	6.6	9.8	49.05	0	0.33	
7/9/2009	17:58	6.6	9.8	49.77	0	0.27	

7/9/2009	17:59	6.5	9.9	50.32	0	0.22	End Run 2
7/9/2009	18:00	6.6	9.8	49.77	0	0.21	
7/9/2009	18:01	5.7	7.4	49.58	0	1.01	
7/9/2009	18:02	0.1	0.2	42.35	0.43	0.28	
7/9/2009	18:03	0	0.1	1.65	1.31	0.26	
7/9/2009	18:04	0	0.1	0.24	1.74	0.09	
7/9/2009	18:05	5.7	4.6	0.17	1.54	0.03	
7/9/2009	18:06	12.5	9.9	0.11	0.12	0.04	
7/9/2009	18:07	12.5	9.9	0.1	0	0.03	
7/9/2009	18:08	1.2	0.9	0.96	0	0	
7/9/2009	18:09	0.1	0.1	37.14	0.89	0	
7/9/2009	18:10	0	0.1	47.29	1.18	0	Run 2 Post-test Bias Check
7/9/2009	18:11	0.1	0.1	47.46	1.26	0	Run 3 Pre-test Bias Check
7/9/2009	18:12	0	0.1	45.75	32.9	0	
7/9/2009	18:13	0	0.1	8.99	49.67	0	
7/9/2009	18:14	0	0.1	0.24	50.14	0	
7/9/2009	18:15	6	0.1	0.14	45.25	9.26	
7/9/2009	18:16	20.8	0.1	0.19	5.16	22.14	
7/9/2009	18:17	20.9	0.1	0.1	1.74	22.63	
7/9/2009	18:18	20.9	0.1	0.05	1.74	23.67	
7/9/2009	18:19	15.2	4.1	0.05	1.52	10.39	
7/9/2009	18:20	6.7	9.7	17.37	0.03	0	
7/9/2009	18:21	6.7	9.8	48.68	0	0	
7/9/2009	18:22	6.6	9.8	48.5	0	0.22	
7/9/2009	18:23	6.6	9.8	48.91	0	0.02	
7/9/2009	18:24	6.7	9.8	49.24	0	0	
7/9/2009	18:25	6.7	9.8	49.65	0	0	Start Run 3
7/9/2009	18:26	6.6	9.8	49.4	0	0	
7/9/2009	18:27	6.6	9.8	49.01	0	0.18	
7/9/2009	18:28	6.6	9.8	48.77	0	0.07	
7/9/2009	18:29	6.7	9.8	48.61	0	0	
7/9/2009	18:30	6.8	9.7	48.06	0	0	
7/9/2009	18:31	6.6	9.9	48.08	0	0	
7/9/2009	18:32	6.5	9.9	48.82	0	0.17	
7/9/2009	18:33	6.4	10	48.96	0	0.13	
7/9/2009	18:34	6.4	10	49.12	0	0	
7/9/2009	18:35	6.3	10.1	49.54	0	0	
7/9/2009	18:36	6.3	10.1	50.07	0	0	
7/9/2009	18:37	6.4	10	49.76	0	0.1	
7/9/2009	18:38	6.4	10	48.54	0	0.16	
7/9/2009	18:39	6.4	10	48.3	0	0	
7/9/2009	18:40	6.4	10	48.76	0	0	
7/9/2009	18:41	6.4	10	48.97	0	0	
7/9/2009	18:42	6.2	10.1	48.88	0	0.02	
7/9/2009	18:43	6.1	10.1	49.18	0	0.18	
7/9/2009	18:44	6.2	10.1	49.89	0	0	
7/9/2009	18:45	6.2	10.1	50.95	0	0	
7/9/2009	18:46	6.2	10.1	50.65	0	0	
7/9/2009	18:47	6.3	10	49.35	0	0	
7/9/2009	18:48	6.3	10.1	49.19	0	0.16	
7/9/2009	18:49	6.2	10.1	49.5	0	0	
7/9/2009	18:50	6.1	10.2	49.52	0	0.01	
7/9/2009	18:51	6.1	10.1	49.76	0	0	
7/9/2009	18:52	6	10.2	50.27	0	0	
7/9/2009	18:53	6	10.2	51.71	0	0.24	
7/9/2009	18:54	6.1	10.1	52.57	0	0.01	
7/9/2009	18:55	6.1	10.1	52.61	0	0	
7/9/2009	18:56	6.2	10.1	52.37	0	0	
7/9/2009	18:57	6.2	10.1	51.19	0	0	
7/9/2009	18:58	6.3	10	51.13	0	0.2	
7/9/2009	18:59	6.2	10	51.49	0	0.04	

7/9/2009	19:00	6.2	10.1	52.83	0	0	
7/9/2009	19:01	6.1	10.1	53.18	0	0	
7/9/2009	19:02	6	10.1	54.05	0	0	
7/9/2009	19:03	5.9	10.2	55.23	0	0.16	
7/9/2009	19:04	5.9	10.2	57.53	0	0.05	
7/9/2009	19:05	6	10.1	58.03	0	0	
7/9/2009	19:06	6.1	10.1	56.77	0	0	
7/9/2009	19:07	6.2	10	54.77	0	0	
7/9/2009	19:08	6.1	10.1	54.9	0	0.11	
7/9/2009	19:09	6.1	10.1	55.65	0	0.08	
7/9/2009	19:10	6	10.1	55.67	0	0	
7/9/2009	19:11	6.3	9.9	56.11	0	0	
7/9/2009	19:12	6.3	9.9	55.72	0.94	0	
7/9/2009	19:13	5.8	10.3	55.46	16	0.04	
7/9/2009	19:14	6	10.1	57.61	3.21	0.14	
7/9/2009	19:15	6	10.1	58.36	0.86	0	
7/9/2009	19:16	6	10.1	58.18	0	0	
7/9/2009	19:17	5.9	10.2	58	0	0	
7/9/2009	19:18	5.8	10.3	58.7	0	0	
7/9/2009	19:19	5.7	10.3	58.87	0	0.26	
7/9/2009	19:20	5.6	10.4	59.38	0	0	
7/9/2009	19:21	5.6	10.4	59.8	0	0	
7/9/2009	19:22	5.6	10.3	60.89	0	0	
7/9/2009	19:23	5.7	10.3	60.66	0	0	
7/9/2009	19:24	5.8	10.2	59.57	0	0.17	End Run 3
7/9/2009	19:25	6.7	9.6	59.19	0	0	
7/9/2009	19:26	6	10.1	56.42	0	0	
7/9/2009	19:27	5.4	8.4	57.53	0	0.61	
7/9/2009	19:28	0.1	0.2	52.94	0.36	0	
7/9/2009	19:29	0	0.1	3.06	1.13	0	
7/9/2009	19:30	0	0.1	0.29	1.6	0	
7/9/2009	19:31	4	3.2	0.18	1.17	0	
7/9/2009	19:32	12.5	9.9	0.12	0.06	0	
7/9/2009	19:33	12.5	10	0.11	0	0	
7/9/2009	19:34	7.8	6.1	0.05	0	0	
7/9/2009	19:35	0	0.1	15.03	0	0	
7/9/2009	19:36	0	0.1	46.89	0.98	0	
7/9/2009	19:37	0	0.1	47.41	1.17	0	
7/9/2009	19:38	0	0.1	47.48	9.95	0	Run 3 Post-test Bias Check
7/9/2009	19:39	0	0.1	30.05	47.25	0	
7/9/2009	19:40	0	0.1	0.51	50.02	0	
7/9/2009	19:41	7.3	0.6	0.16	42.23	9.9	
7/9/2009	19:42	21	0.1	2.86	3.98	22.08	
7/9/2009	19:43	21	0.1	0.28	1.6	21.79	
7/9/2009	19:44	21	0.1	0.05	1.74	21.85	
7/9/2009	19:45	21	0.1	0.05	1.68	21.72	
7/9/2009	19:46	21	0.1	0.05	1.54	22.03	
7/9/2009	19:47	21	0.1	0.05	1.33	22.69	
7/9/2009	19:48	21	0.1	0.05	1.18	23.37	
7/9/2009	19:49	15.5	3.8	0.05	49.76	12.07	
7/9/2009	19:50	5.7	10.2	17.34	180.44	0.48	

CEM Test Data

Run 1

Haverhill Unit # 2 Main Stack
Run # 1 Data

		Raw Data					Corrected Data						Mass Rate		
Date	Hour	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	Flow (dscfm)	NOX (lb/hr)	CO (lb/hr)	THC (lb/hr)
7/9/2009	15:30	5.9	10.1	51.73	0	0.06	5.90	10.00	51.46	0.00	0.01	207,668	76.622	0.000	0.008
7/9/2009	15:31	5.9	10	51.75	0	0.06	5.90	9.90	51.48	0.00	0.01	207,668	76.652	0.000	0.008
7/9/2009	15:32	5.8	10.2	52.64	0	0.28	5.80	10.10	52.37	0.00	0.23	207,668	77.977	0.000	0.324
7/9/2009	15:33	5.9	10.1	51.81	0	0.13	5.90	10.00	51.54	0.00	0.08	207,668	76.741	0.000	0.108
7/9/2009	15:34	6	10	51.82	0	0.07	6.00	9.90	51.55	0.00	0.02	207,668	76.756	0.000	0.022
7/9/2009	15:35	5.9	10.1	52.75	0	0.06	5.90	10.00	52.48	0.00	0.01	207,668	78.141	0.000	0.008
7/9/2009	15:36	5.9	10.1	52.3	0	0.05	5.90	10.00	52.03	0.00	0.00	207,668	77.471	0.000	-0.007
7/9/2009	15:37	6	10	52.39	0	0.29	6.00	9.90	52.12	0.00	0.24	207,668	77.605	0.000	0.338
7/9/2009	15:38	5.9	10.1	53.34	0	0.17	5.90	10.00	53.07	0.00	0.12	207,668	79.019	0.000	0.166
7/9/2009	15:39	5.9	10.1	53.13	0	0.06	5.90	10.00	52.86	0.00	0.01	207,668	78.707	0.000	0.008
7/9/2009	15:40	5.9	10.1	52.78	0	0.05	5.90	10.00	52.51	0.00	0.00	207,668	78.186	0.000	-0.007
7/9/2009	15:41	5.9	10.1	52.58	0	0.05	5.90	10.00	52.31	0.00	0.00	207,668	77.888	0.000	-0.007
7/9/2009	15:42	5.9	10.1	52.51	0	0.24	5.90	10.00	52.24	0.00	0.19	207,668	77.784	0.000	0.266
7/9/2009	15:43	5.9	10.1	52.3	0	0.23	5.90	10.00	52.03	0.00	0.18	207,668	77.471	0.000	0.252
7/9/2009	15:44	6	10	52.32	0	0.06	6.00	9.90	52.05	0.00	0.01	207,668	77.501	0.000	0.008
7/9/2009	15:45	5.9	10.1	52.65	0	0.05	5.90	10.00	52.38	0.00	0.00	207,668	77.992	0.000	-0.007
7/9/2009	15:46	5.9	10.1	52.41	0	0.05	5.90	10.00	52.14	0.00	0.00	207,668	77.635	0.000	-0.007
7/9/2009	15:47	5.9	10.1	52.23	0	0.16	5.90	10.00	51.96	0.00	0.11	207,668	77.367	0.000	0.151
7/9/2009	15:48	5.9	10.1	52.45	0	0.28	5.90	10.00	52.18	0.00	0.23	207,668	77.694	0.000	0.324
7/9/2009	15:49	5.9	10.1	52.13	0	0.06	5.90	10.00	51.86	0.00	0.01	207,668	77.218	0.000	0.008
7/9/2009	15:50	6	10	52.3	0	0.04	6.00	9.90	52.03	0.00	0.00	207,668	77.471	0.000	0.000
7/9/2009	15:51	5.9	10.1	52.22	0	0.04	5.90	10.00	51.95	0.00	0.00	207,668	77.352	0.000	0.000
7/9/2009	15:52	6	10	52.05	0	0.08	6.00	9.90	51.78	0.00	0.03	207,668	77.099	0.000	0.036
7/9/2009	15:53	6	10.1	52.09	0	0.23	6.00	10.00	51.82	0.00	0.18	207,668	77.158	0.000	0.252
7/9/2009	15:54	6	10	51.99	0	0.06	6.00	9.90	51.72	0.00	0.01	207,668	77.009	0.000	0.008
7/9/2009	15:55	6	10	52.13	0	0.05	6.00	9.90	51.86	0.00	0.00	207,668	77.218	0.000	-0.007
7/9/2009	15:56	6	10	52.06	0	0.04	6.00	9.90	51.79	0.00	0.00	207,668	77.114	0.000	0.000
7/9/2009	15:57	6	10	51.82	0	0.05	6.00	9.90	51.55	0.00	0.00	207,668	76.756	0.000	-0.007
7/9/2009	15:58	6	10	51.6	0	0.33	6.00	9.90	51.33	0.00	0.28	207,668	76.429	0.000	0.395
7/9/2009	15:59	6	10	51.61	0	0.07	6.00	9.90	51.34	0.00	0.02	207,668	76.444	0.000	0.022
7/9/2009	16:00	6	10	51.44	0	0.04	6.00	9.90	51.17	0.00	0.00	207,668	76.191	0.000	0.000
7/9/2009	16:01	6	10.1	51.22	0	0.04	6.00	10.00	50.95	0.00	0.00	207,668	75.863	0.000	0.000
7/9/2009	16:02	6	10.1	51.11	0	0.04	6.00	10.00	50.84	0.00	0.00	207,668	75.699	0.000	0.000
7/9/2009	16:03	6	10	50.89	0	0.25	6.00	9.90	50.62	0.00	0.20	207,668	75.372	0.000	0.280
7/9/2009	16:04	6	10	50.84	0	0.08	6.00	9.90	50.57	0.00	0.03	207,668	75.297	0.000	0.036
7/9/2009	16:05	6	10.1	51.02	0	0.03	6.00	10.00	50.75	0.00	0.00	207,668	75.565	0.000	0.000
7/9/2009	16:06	6	10.1	50.94	0	0.04	6.00	10.00	50.67	0.00	0.00	207,668	75.446	0.000	0.000
7/9/2009	16:07	6	10.1	50.83	0	0.04	6.00	10.00	50.56	0.00	0.00	207,668	75.282	0.000	0.000
7/9/2009	16:08	6	10	50.67	0	0.24	6.00	9.90	50.40	0.00	0.19	207,668	75.044	0.000	0.266
7/9/2009	16:09	6	10	50.6	0	0.11	6.00	9.90	50.33	0.00	0.06	207,668	74.940	0.000	0.079
7/9/2009	16:10	6	10	50.59	0	0.04	6.00	9.90	50.32	0.00	0.00	207,668	74.925	0.000	0.000
7/9/2009	16:11	6	10	50.48	0	0.04	6.00	9.90	50.21	0.00	0.00	207,668	74.761	0.000	0.000
7/9/2009	16:12	6.1	10	50.24	0	0.04	6.10	9.90	49.97	0.00	0.00	207,668	74.404	0.000	0.000
7/9/2009	16:13	6	10	50.44	0	0.23	6.00	9.90	50.17	0.00	0.18	207,668	74.702	0.000	0.252
7/9/2009	16:14	6	10.1	50.34	0	0.17	6.00	10.00	50.07	0.00	0.12	207,668	74.553	0.000	0.166
7/9/2009	16:15	6	10	50.04	0	0.05	6.00	9.90	49.77	0.00	0.00	207,668	74.106	0.000	-0.007
7/9/2009	16:16	6	10.1	49.87	0	0.04	6.00	10.00	49.60	0.00	0.00	207,668	73.853	0.000	0.000
7/9/2009	16:17	6	10.1	49.8	0	0.04	6.00	10.00	49.53	0.00	0.00	207,668	73.749	0.000	0.000
7/9/2009	16:18	6	10	49.8	0	0.15	6.00	9.90	49.53	0.00	0.10	207,668	73.749	0.000	0.137
7/9/2009	16:19	6	10.1	49.89	0	0.18	6.00	10.00	49.62	0.00	0.13	207,668	73.883	0.000	0.180
7/9/2009	16:20	6	10.1	49.95	0	0.05	6.00	10.00	49.68	0.00	0.00	207,668	73.972	0.000	-0.007
7/9/2009	16:21	6	10	49.93	0	0.04	6.00	9.90	49.66	0.00	0.00	207,668	73.942	0.000	0.000
7/9/2009	16:22	6.1	10	50.17	0	0.04	6.10	9.90	49.90	0.00	0.00	207,668	74.300	0.000	0.000
7/9/2009	16:23	6.1	10	50.23	0	0.11	6.10	9.90	49.96	0.00	0.06	207,668	74.389	0.000	0.079
7/9/2009	16:24	6	10	49.95	0	0.23	6.00	9.90	49.68	0.00	0.18	207,668	73.972	0.000	0.252
7/9/2009	16:25	6.1	10	49.64	0	0.07	6.10	9.90	49.37	0.00	0.02	207,668	73.511	0.000	0.022
7/9/2009	16:26	6.1	10	49.85	0	0.05	6.10	9.90	49.58	0.00	0.00	207,668	73.823	0.000	-0.007
7/9/2009	16:27	6.1	10	50.42	0	0.05	6.10	9.90	50.15	0.00	0.00	207,668	74.672	0.000	-0.007
7/9/2009	16:28	6	10	50.67	0	0.08	6.00	9.90	50.40	0.00	0.03	207,668	75.044	0.000	0.036
7/9/2009	16:29	6.1	10	50.81	0	0.27	6.10	9.90	50.54	0.00	0.22	207,668	75.253	0.000	0.309
Averages		**5.98**	**10.05**	**51.34**	**0.00**	**0.11**	**5.98**	**9.95**	**51.08**	**0.00**	**0.05**	**207,668**	**76.05**	**0.00**	**0.08**

Note: All negative values were converted to 0's for reporting purposes.

CEM CALIBRATIONS

PROJECT NAME	Haverhill Unit # 2 Retest
PROJECT NUMBER	
DATE	July 9, 2009
RUN NUMBER	R1
START TIME	3:30 PM
STOP TIME	4:29 PM

ANALYZER SPAN	
CO	89
CO_2	19
O_2	21
NO_x	89
SO_2	
THC	85

		CALIBRATION ERROR			SYSTEM BIAS CHECK								
					PRETEST		POST TEST						
	GAS CYLINDER NUMBER	CAL. GAS VALUE (% or PPM)	ANALYZER RESPONSE (% or PPM)	CAL ERROR (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	DRIFT (% SPAN)	IS CAL ERROR CHECK OK? (YES/NO)	IS PRETEST BIAS OK? (YES/NO)	IS POSTEST BIAS OK? (YES/NO)	IS SYSTEM DRIFT OK? (YES/NO)
CO zero	n/a	0.00	0.06	-0.07	0.58	-0.58	0.00	0.07	0.65	YES	YES	YES	YES
CO mid	XC0218478	50.21	50.78	-0.64	50.18	0.67	50.01	0.86	0.19	YES	YES	YES	YES
CO hi	CC177164	89.09	89.97	-0.99									
CO_2 zero	n/a	0.00	0.10	-0.53	0.10	0.00	0.10	0.00	0.00	YES	YES	YES	YES
CO_2 mid	CC175259	10.00	9.90	0.53	10.00	-0.53	9.90	0.00	0.53	YES	YES	YES	YES
CO_2 hi	CC144573	18.97	19.00	-0.16									
O_2 zero	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	YES	YES	YES	YES
O_2 mid	CC175259	12.50	12.40	0.48	12.50	-0.48	12.50	-0.48	0.00	YES	YES	YES	YES
O_2 hi	CC144573	20.95	20.80	0.72									
NO_x zero	n/a	0.00	0.25	-0.28	0.27	-0.02	0.26	-0.01	0.01	YES	YES	YES	YES
NO_x mid	CC232136	47.40	48.42	-1.15	47.53	1.00	47.39	1.16	0.16	YES	YES	YES	YES
NO_x hi	CC7488	89.00	89.32	-0.36									
THC zero	n/a	0.00	0.00	0.00	0.00	0.00	0.11	-0.13	-0.13	YES	YES	YES	YES
THC mid	XC001145	49.19	50.97	-2.09									
THC low	CC206929	23.04	23.65	-0.72	23.11	0.63	23.27	0.45	-0.19	YES	YES	YES	YES
THC hi	CC213565	85.13	85.46	-0.39									

Correction factors

CO	Avg. Conc -	0.29	*	1.0081116
CO_2	Avg. Conc -	0.1	*	1.0152284
O_2	Avg. Conc -	0	*	1
NO_x	Avg. Conc -	0.265	*	1.0043437
THC	Avg. Conc -	0.055	*	0.9958937

Calibration error = ((cal. gas value - analyzer resp) / analyzer span) * 100: allowable error ± 2 %, ± 5 % for THC

System Bias = ((analyzer resp - system resp) / analyzer span) * 100: allowable error ± 5 %

Drift = ((pretest sys resp - post test sys resp) / analyzer span) * 100: allowable error ± 3 %

Sys Bias (pre and post) must be performed on each run: To determine Drift.
Use zero gas and either mid or hi cal gas, choose cal gas closest to measured stack concentration.

Drift must be performed every hour on THC

Calibration Error is performed only at start, unless allowable error parameters are exceeded.

Run 2

Haverhill Unit # 2 Main Stack
Run # 2 Data

		Raw Data					Corrected Data						Mass Rate		
Date	Hour	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	Flow (dscfm)	NOX (lb/hr)	CO (lb/hr)	THC (lb/hr)
7/9/2009	17:00	6.2	10	50.2	0	0.25	6.20	9.90	49.95	0.30	0.15	198,850	71.209	0.260	0.208
7/9/2009	17:01	6.2	10	50.09	0	0.07	6.20	9.90	49.84	0.30	0.00	198,850	71.052	0.260	0.000
7/9/2009	17:02	6.2	10	49.97	0	0.07	6.20	9.90	49.72	0.30	0.00	198,850	70.881	0.260	0.000
7/9/2009	17:03	6.2	10	50.04	0	0.07	6.20	9.90	49.79	0.30	0.00	198,850	70.981	0.260	0.000
7/9/2009	17:04	6.2	10	49.95	0	0.09	6.20	9.90	49.70	0.30	0.00	198,850	70.852	0.260	0.000
7/9/2009	17:05	6.2	10	49.86	0	0.3	6.20	9.90	49.61	0.30	0.20	198,850	70.724	0.260	0.277
7/9/2009	17:06	6.3	9.9	50.11	0	0.1	6.30	9.80	49.86	0.30	0.00	198,850	71.081	0.260	0.002
7/9/2009	17:07	6.2	10	51.14	0	0.07	6.20	9.90	50.89	0.30	0.00	198,850	72.549	0.260	0.000
7/9/2009	17:08	6.3	9.9	50.48	0	0.06	6.30	9.80	50.23	0.30	0.00	198,850	71.608	0.260	0.000
7/9/2009	17:09	6.4	9.9	50.2	0	0.07	6.40	9.80	49.95	0.30	0.00	198,850	71.209	0.260	0.000
7/9/2009	17:10	6.2	10	50.66	0	0.31	6.20	9.90	50.41	0.30	0.21	198,850	71.865	0.260	0.291
7/9/2009	17:11	6.3	9.9	50.21	0	0.11	6.30	9.80	49.96	0.30	0.01	198,850	71.223	0.260	0.016
7/9/2009	17:12	6.4	9.8	50.25	0	0.07	6.40	9.70	50.00	0.30	0.00	198,850	71.280	0.260	0.000
7/9/2009	17:13	6.3	9.9	51.04	0	0.08	6.30	9.80	50.79	0.30	0.00	198,850	72.406	0.260	0.000
7/9/2009	17:14	6.3	9.9	50.58	0	0.07	6.30	9.80	50.33	0.30	0.00	198,850	71.751	0.260	0.000
7/9/2009	17:15	6.5	9.8	49.89	0	0.3	6.50	9.70	49.64	0.30	0.20	198,850	70.767	0.260	0.277
7/9/2009	17:16	6.3	9.9	50.36	0	0.16	6.30	9.80	50.11	0.30	0.06	198,850	71.437	0.260	0.084
7/9/2009	17:17	6.3	10	50.36	0	0.07	6.30	9.90	50.11	0.30	0.00	198,850	71.437	0.260	0.000
7/9/2009	17:18	6.4	9.9	49.86	0	0.07	6.40	9.80	49.61	0.30	0.00	198,850	70.724	0.260	0.000
7/9/2009	17:19	6.4	9.9	50.28	0	0.06	6.40	9.80	50.03	0.30	0.00	198,850	71.323	0.260	0.000
7/9/2009	17:20	6.3	9.9	50.39	0	0.29	6.30	9.80	50.14	0.30	0.19	198,850	71.480	0.260	0.263
7/9/2009	17:21	6.3	10	49.97	0	0.21	6.30	9.90	49.72	0.30	0.11	198,850	70.881	0.260	0.153
7/9/2009	17:22	6.3	10	49.88	0	0.08	6.30	9.90	49.63	0.30	0.00	198,850	70.753	0.260	0.000
7/9/2009	17:23	6.4	9.9	50.06	0	0.07	6.40	9.80	49.81	0.30	0.00	198,850	71.009	0.260	0.000
7/9/2009	17:24	6.4	9.9	50.43	0	0.07	6.40	9.80	50.18	0.30	0.00	198,850	71.537	0.260	0.000
7/9/2009	17:25	6.4	9.9	50.55	0	0.22	6.40	9.80	50.30	0.30	0.12	198,850	71.708	0.260	0.167
7/9/2009	17:26	6.4	9.9	50.42	0	0.21	6.40	9.80	50.17	0.30	0.11	198,850	71.522	0.260	0.153
7/9/2009	17:27	6.4	9.9	50.19	0	0.07	6.40	9.80	49.94	0.30	0.00	198,850	71.195	0.260	0.000
7/9/2009	17:28	6.4	9.9	50.21	0	0.06	6.40	9.80	49.96	0.30	0.00	198,850	71.223	0.260	0.000
7/9/2009	17:29	6.4	9.9	50.19	0	0.07	6.40	9.80	49.94	0.30	0.00	198,850	71.195	0.260	0.000
7/9/2009	17:30	6.3	10	49.98	0	0.18	6.30	9.90	49.73	0.30	0.08	198,850	70.895	0.260	0.112
7/9/2009	17:31	6.3	9.9	49.96	0	0.3	6.30	9.80	49.71	0.30	0.20	198,850	70.867	0.260	0.277
7/9/2009	17:32	6.4	9.9	49.68	0	0.09	6.40	9.80	49.43	0.30	0.00	198,850	70.468	0.260	0.000
7/9/2009	17:33	6.4	9.9	49.91	0	0.08	6.40	9.80	49.66	0.30	0.00	198,850	70.795	0.260	0.000
7/9/2009	17:34	6.4	9.9	49.88	0	0.08	6.40	9.80	49.63	0.30	0.00	198,850	70.753	0.260	0.000
7/9/2009	17:35	6.4	9.9	49.65	0	0.12	6.40	9.80	49.40	0.30	0.02	198,850	70.425	0.260	0.029
7/9/2009	17:36	6.4	9.9	49.8	0	0.29	6.40	9.80	49.55	0.30	0.19	198,850	70.639	0.260	0.263
7/9/2009	17:37	6.4	9.9	49.61	0	0.1	6.40	9.80	49.36	0.30	0.00	198,850	70.368	0.260	0.002
7/9/2009	17:38	6.4	9.9	49.21	0	0.07	6.40	9.80	48.96	0.30	0.00	198,850	69.797	0.260	0.000
7/9/2009	17:39	6.4	9.9	49.22	0	0.07	6.40	9.80	48.97	0.30	0.00	198,850	69.812	0.260	0.000
7/9/2009	17:40	6.4	9.9	49.17	0	0.08	6.40	9.80	48.92	0.30	0.00	198,850	69.740	0.260	0.000
7/9/2009	17:41	6.5	9.9	49.42	0	0.32	6.50	9.80	49.17	0.30	0.22	198,850	70.097	0.260	0.305
7/9/2009	17:42	6.5	9.9	49.58	0	12.76	6.50	9.80	49.33	0.30	12.66	198,850	70.325	0.260	17.418
7/9/2009	17:43	6.5	9.9	49.66	0	1.86	6.50	9.80	49.41	0.30	1.76	198,850	70.439	0.260	2.423
7/9/2009	17:44	6.5	9.9	49.54	0	1.33	6.50	9.80	49.29	0.30	1.23	198,850	70.268	0.260	1.694
7/9/2009	17:45	6.4	9.9	49.15	0	0.73	6.40	9.80	48.90	0.30	0.63	198,850	69.712	0.260	0.869
7/9/2009	17:46	6.5	9.9	49.17	0	0.66	6.50	9.80	48.92	0.30	0.56	198,850	69.740	0.260	0.772
7/9/2009	17:47	6.5	9.9	49.35	0	0.36	6.50	9.80	49.10	0.30	0.26	198,850	69.997	0.260	0.360
7/9/2009	17:48	6.5	9.9	49.46	0	0.23	6.50	9.80	49.21	0.30	0.13	198,850	70.154	0.260	0.181
7/9/2009	17:49	6.5	9.8	49.55	0	0.22	6.50	9.70	49.30	0.30	0.12	198,850	70.282	0.260	0.167
7/9/2009	17:50	6.5	9.8	49.58	0	0.32	6.50	9.70	49.33	0.30	0.22	198,850	70.325	0.260	0.305
7/9/2009	17:51	6.5	9.9	49.56	0	0.54	6.50	9.80	49.31	0.30	0.44	198,850	70.296	0.260	0.607
7/9/2009	17:52	6.5	9.9	49.26	0	0.4	6.50	9.80	49.01	0.30	0.30	198,850	69.869	0.260	0.415
7/9/2009	17:53	6.5	9.9	49.07	0	0.26	6.50	9.80	48.82	0.30	0.16	198,850	69.598	0.260	0.222
7/9/2009	17:54	6.5	9.9	49.54	0	0.24	6.50	9.80	49.29	0.30	0.14	198,850	70.268	0.260	0.195
7/9/2009	17:55	6.4	9.9	49.4	0	0.21	6.40	9.80	49.15	0.30	0.11	198,850	70.068	0.260	0.153
7/9/2009	17:56	6.4	9.9	49.07	0	0.39	6.40	9.80	48.82	0.30	0.29	198,850	69.598	0.260	0.401
7/9/2009	17:57	6.6	9.8	49.05	0	0.33	6.60	9.70	48.80	0.30	0.23	198,850	69.569	0.260	0.318
7/9/2009	17:58	6.6	9.8	49.77	0	0.27	6.60	9.70	49.52	0.30	0.17	198,850	70.596	0.260	0.236
7/9/2009	17:59	6.5	9.9	50.32	0	0.22	6.50	9.80	50.07	0.30	0.12	198,850	71.380	0.260	0.167
Averages		**6.39**	**9.91**	**49.89**	**0.00**	**0.45**	**6.39**	**9.81**	**49.64**	**0.30**	**0.36**	**198,850**	**70.77**	**0.26**	**0.50**

Note: All negative values were converted to 0's for reporting purposes.

CEM CALIBRATIONS

PROJECT NAME	Haverhill Unit # 2 Retest
PROJECT NUMBER	0
DATE	July 9, 2009
RUN NUMBER	R2
START TIME	5:00 PM
STOP TIME	5:59 PM

ANALYZER SPAN	
CO	89
CO_2	19
O_2	21
NO_x	89
SO_2	0
THC	85

		CALIBRATION ERROR			SYSTEM BIAS CHECK								
					PRETEST		POST TEST						
	GAS CYLINDER NUMBER	CAL. GAS VALUE (% or PPM)	ANALYZER RESPONSE (% or PPM)	CAL ERROR (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	DRIFT (% SPAN)	IS CAL ERROR CHECK OK? (YES/NO)	IS PRETEST BIAS OK? (YES/NO)	IS POSTEST BIAS OK? (YES/NO)	IS SYSTEM DRIFT OK? (YES/NO)
CO zero	n/a	0.00	0.06	-0.07	0.00	0.07	-0.60	0.74	0.67	YES	YES	YES	YES
CO mid	XC0218478	50.21	50.78	-0.64	50.01	0.86	50.14	0.72	-0.15	YES	YES	YES	YES
CO hi	CC177164	89.09	89.97	-0.99									
CO_2 zero	n/a	0.00	0.10	-0.53	0.10	0.00	0.10	0.00	0.00	YES	YES	YES	YES
CO_2 mid	CC175259	10.00	9.90	0.53	9.90	0.00	9.90	0.00	0.00	YES	YES	YES	YES
CO_2 hi	CC144573	18.97	19.00	-0.16									
O_2 zero	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	YES	YES	YES	YES
O_2 mid	CC175259	12.50	12.40	0.48	12.50	-0.48	12.50	-0.48	0.00	YES	YES	YES	YES
O_2 hi	CC144573	20.95	20.80	0.72									
NO_x zero	n/a	0.00	0.25	-0.28	0.26	-0.01	0.24	0.01	0.02	YES	YES	YES	YES
NO_x mid	CC232136	47.40	48.42	-1.15	47.39	1.16	47.46	1.08	-0.08	YES	YES	YES	YES
NO_x hi	CC7488	89.00	89.32	-0.36									
THC zero	n/a	0.00	0.00	0.00	0.11	-0.13	0.09	-0.11	0.02	YES	YES	YES	YES
THC mid	XC001145	49.19	50.97	-2.09									
THC low	CC206929	23.04	23.65	-0.72	23.27	0.45	23.67	-0.02	-0.47	YES	YES	YES	YES
THC hi	CC213565	85.13	85.46	-0.39									

Correction factors

CO	Avg. Conc -	-0.3	*	0.9967047
CO_2	Avg. Conc -	0.1	*	1.0204082
O_2	Avg. Conc -	0	*	1
NO_x	Avg. Conc -	0.25	*	1.0047695
THC	Avg. Conc -	0.1	*	0.9858793

Calibration error = ((cal. gas value - analyzer resp) / analyzer span) * 100: allowable error ± 2 %, ± 5 % for THC

System Bias = ((analyzer resp - system resp) / analyzer span) * 100: allowable error ± 5 %

Drift = ((pretest sys resp - post test sys resp) / analyzer span) * 100: allowable error ± 3 %

Sys Bias (pre and post) must be performed on each run: To determine Drift.
Use zero gas and either mid or hi cal gas, choose cal gas closest to measured stack concentration.

Drift must be performed every hour on THC

Calibration Error is performed only at start, unless allowable error parameters are exceeded.

Run 3

Haverhill Unit # 2 Main Stack
Run # 3 Data

		Raw Data					Corrected Data						Mass Rate		
Date	Hour	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	O2 (%)	CO2 (%)	NOX (ppm)	CO (ppm)	THC (ppm)	Flow (dscfm)	NOX (lb/hr)	CO (lb/hr)	THC (lb/hr)
7/9/2009	18:25	6.7	9.8	49.65	0	0	6.70	9.70	49.38	0.60	0.01	201,583	71.371	0.527	0.014
7/9/2009	18:26	6.6	9.8	49.4	0	0	6.60	9.70	49.13	0.60	0.01	201,583	71.009	0.527	0.014
7/9/2009	18:27	6.6	9.8	49.01	0	0.18	6.60	9.70	48.74	0.60	0.19	201,583	70.446	0.527	0.265
7/9/2009	18:28	6.6	9.8	48.77	0	0.07	6.60	9.70	48.50	0.60	0.08	201,583	70.099	0.527	0.111
7/9/2009	18:29	6.7	9.8	48.61	0	0	6.70	9.70	48.34	0.60	0.01	201,583	69.868	0.527	0.014
7/9/2009	18:30	6.8	9.7	48.06	0	0	6.80	9.60	47.79	0.60	0.01	201,583	69.073	0.527	0.014
7/9/2009	18:31	6.6	9.9	48.08	0	0	6.60	9.80	47.81	0.60	0.01	201,583	69.102	0.527	0.014
7/9/2009	18:32	6.5	9.9	48.82	0	0.17	6.50	9.80	48.55	0.60	0.18	201,583	70.171	0.527	0.251
7/9/2009	18:33	6.4	10	48.96	0	0.13	6.40	9.90	48.69	0.60	0.14	201,583	70.374	0.527	0.195
7/9/2009	18:34	6.4	10	49.12	0	0	6.40	9.90	48.85	0.60	0.01	201,583	70.605	0.527	0.014
7/9/2009	18:35	6.3	10.1	49.54	0	0	6.30	10.00	49.27	0.60	0.01	201,583	71.212	0.527	0.014
7/9/2009	18:36	6.3	10.1	50.07	0	0	6.30	10.00	49.80	0.60	0.01	201,583	71.978	0.527	0.014
7/9/2009	18:37	6.4	10	49.76	0	0.1	6.40	9.90	49.49	0.60	0.11	201,583	71.530	0.527	0.153
7/9/2009	18:38	6.4	10	48.54	0	0.16	6.40	9.90	48.27	0.60	0.17	201,583	69.767	0.527	0.237
7/9/2009	18:39	6.4	10	48.3	0	0	6.40	9.90	48.03	0.60	0.01	201,583	69.420	0.527	0.014
7/9/2009	18:40	6.4	10	48.76	0	0	6.40	9.90	48.49	0.60	0.01	201,583	70.084	0.527	0.014
7/9/2009	18:41	6.4	10	48.97	0	0	6.40	9.90	48.70	0.60	0.01	201,583	70.388	0.527	0.014
7/9/2009	18:42	6.2	10.1	48.88	0	0.02	6.20	10.00	48.61	0.60	0.03	201,583	70.258	0.527	0.042
7/9/2009	18:43	6.1	10.1	49.18	0	0.18	6.10	10.00	48.91	0.60	0.19	201,583	70.691	0.527	0.265
7/9/2009	18:44	6.2	10.1	49.89	0	0	6.20	10.00	49.62	0.60	0.01	201,583	71.718	0.527	0.014
7/9/2009	18:45	6.2	10.1	50.95	0	0	6.20	10.00	50.68	0.60	0.01	201,583	73.250	0.527	0.014
7/9/2009	18:46	6.2	10.1	50.65	0	0	6.20	10.00	50.38	0.60	0.01	201,583	72.816	0.527	0.014
7/9/2009	18:47	6.3	10	49.35	0	0	6.30	9.90	49.08	0.60	0.01	201,583	70.937	0.527	0.014
7/9/2009	18:48	6.3	10.1	49.19	0	0.16	6.30	10.00	48.92	0.60	0.17	201,583	70.706	0.527	0.237
7/9/2009	18:49	6.2	10.1	49.5	0	0	6.20	10.00	49.23	0.60	0.01	201,583	71.154	0.527	0.014
7/9/2009	18:50	6.1	10.2	49.52	0	0.01	6.10	10.10	49.25	0.60	0.02	201,583	71.183	0.527	0.028
7/9/2009	18:51	6.1	10.1	49.76	0	0	6.10	10.00	49.49	0.60	0.01	201,583	71.530	0.527	0.014
7/9/2009	18:52	6	10.2	50.27	0	0	6.00	10.10	50.00	0.60	0.01	201,583	72.267	0.527	0.014
7/9/2009	18:53	6	10.2	51.71	0	0.24	6.00	10.10	51.44	0.60	0.25	201,583	74.348	0.527	0.348
7/9/2009	18:54	6.1	10.1	52.57	0	0.01	6.10	10.00	52.30	0.60	0.02	201,583	75.591	0.527	0.028
7/9/2009	18:55	6.1	10.1	52.61	0	0	6.10	10.00	52.34	0.60	0.01	201,583	75.649	0.527	0.014
7/9/2009	18:56	6.2	10.1	52.37	0	0	6.20	10.00	52.10	0.60	0.01	201,583	75.302	0.527	0.014
7/9/2009	18:57	6.2	10.1	51.19	0	0	6.20	10.00	50.92	0.60	0.01	201,583	73.596	0.527	0.014
7/9/2009	18:58	6.3	10	51.13	0	0.2	6.30	9.90	50.86	0.60	0.21	201,583	73.510	0.527	0.293
7/9/2009	18:59	6.2	10	51.49	0	0.04	6.20	9.90	51.22	0.60	0.05	201,583	74.030	0.527	0.069
7/9/2009	19:00	6.2	10.1	52.83	0	0	6.20	10.00	52.56	0.60	0.01	201,583	75.967	0.527	0.014
7/9/2009	19:01	6.1	10.1	53.18	0	0	6.10	10.00	52.91	0.60	0.01	201,583	76.472	0.527	0.014
7/9/2009	19:02	6	10.1	54.05	0	0	6.00	10.00	53.78	0.60	0.01	201,583	77.730	0.527	0.014
7/9/2009	19:03	5.9	10.2	55.23	0	0.16	5.90	10.10	54.96	0.60	0.17	201,583	79.435	0.527	0.237
7/9/2009	19:04	5.9	10.2	57.53	0	0.05	5.90	10.10	57.26	0.60	0.06	201,583	82.759	0.527	0.083
7/9/2009	19:05	6	10.1	58.03	0	0	6.00	10.00	57.76	0.60	0.01	201,583	83.482	0.527	0.014
7/9/2009	19:06	6.1	10.1	56.77	0	0	6.10	10.00	56.50	0.60	0.01	201,583	81.661	0.527	0.014
7/9/2009	19:07	6.2	10	54.77	0	0	6.20	9.90	54.50	0.60	0.01	201,583	78.770	0.527	0.014
7/9/2009	19:08	6.1	10.1	54.9	0	0.11	6.10	10.00	54.63	0.60	0.12	201,583	78.958	0.527	0.167
7/9/2009	19:09	6.1	10.1	55.65	0	0.08	6.10	10.00	55.38	0.60	0.09	201,583	80.042	0.527	0.125
7/9/2009	19:10	6	10.1	55.67	0	0	6.00	10.00	55.40	0.60	0.01	201,583	80.071	0.527	0.014
7/9/2009	19:11	6.3	9.9	56.11	0	0	6.30	9.80	55.84	0.60	0.01	201,583	80.707	0.527	0.014
7/9/2009	19:12	6.3	9.9	55.72	0.94	0	6.30	9.80	55.45	1.54	0.01	201,583	80.143	1.355	0.014
7/9/2009	19:13	5.8	10.3	55.46	16	0.04	5.80	10.20	55.19	16.60	0.05	201,583	79.768	14.606	0.069
7/9/2009	19:14	6	10.1	57.61	3.21	0.14	6.00	10.00	57.34	3.81	0.15	201,583	82.875	3.352	0.209
7/9/2009	19:15	6	10.1	58.36	0.86	0	6.00	10.00	58.09	1.46	0.01	201,583	83.959	1.284	0.014
7/9/2009	19:16	6	10.1	58.18	0	0	6.00	10.00	57.91	0.60	0.01	201,583	83.699	0.527	0.014
7/9/2009	19:17	5.9	10.2	58	0	0	5.90	10.10	57.73	0.60	0.01	201,583	83.438	0.527	0.014
7/9/2009	19:18	5.8	10.3	58.7	0	0	5.80	10.20	58.43	0.60	0.01	201,583	84.450	0.527	0.014
7/9/2009	19:19	5.7	10.3	58.87	0	0.26	5.70	10.20	58.60	0.60	0.27	201,583	84.696	0.527	0.376
7/9/2009	19:20	5.6	10.4	59.38	0	0	5.60	10.30	59.11	0.60	0.01	201,583	85.433	0.527	0.014
7/9/2009	19:21	5.6	10.4	59.8	0	0	5.60	10.30	59.53	0.60	0.01	201,583	86.040	0.527	0.014
7/9/2009	19:22	5.6	10.3	60.89	0	0	5.60	10.20	60.62	0.60	0.01	201,583	87.615	0.527	0.014
7/9/2009	19:23	5.7	10.3	60.66	0	0	5.70	10.20	60.39	0.60	0.01	201,583	87.283	0.527	0.014
7/9/2009	19:24	5.8	10.2	59.57	0	0.17	5.80	10.10	59.30	0.60	0.18	201,583	85.707	0.527	0.251
Averages		**6.17**	**10.08**	**52.81**	**1.75**	**0.09**	**6.17**	**9.97**	**52.54**	**0.95**	**0.05**	**201,583**	**75.94**	**0.84**	**0.08**

Note: All negative values were converted to 0's for reporting purposes.

CEM CALIBRATIONS

PROJECT NAME	Haverhill Unit # 2 Retest
PROJECT NUMBER	0
DATE	July 9, 2009
RUN NUMBER	R3
START TIME	6:25 PM
STOP TIME	7:24 PM

ANALYZER SPAN	
CO	89
CO_2	19
O_2	21
NO_x	89
SO_2	0
THC	85

		CALIBRATION ERROR			SYSTEM BIAS CHECK								
					PRETEST		POST TEST						
	GAS CYLINDER NUMBER	CAL. GAS VALUE (% or PPM)	ANALYZER RESPONSE (% or PPM)	CAL ERROR (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	SYSTEM RESP.	SYS. BIAS (% SPAN)	DRIFT (% SPAN)	IS CAL ERROR CHECK OK? (YES/NO)	IS PRETEST BIAS OK? (YES/NO)	IS POSTEST BIAS OK? (YES/NO)	IS SYSTEM DRIFT OK? (YES/NO)
CO zero	n/a	0.00	0.06	-0.07	-0.60	0.74	-0.61	0.75	0.01	YES	YES	YES	YES
CO mid	XC0218478	50.21	50.78	-0.64	50.14	0.72	50.02	0.85	0.13	YES	YES	YES	YES
CO hi	CC177164	89.09	89.97	-0.99									
CO_2 zero	n/a	0.00	0.10	-0.53	0.10	0.00	0.10	0.00	0.00	YES	YES	YES	YES
CO_2 mid	CC175259	10.00	9.90	0.53	9.90	0.00	10.00	-0.53	-0.53	YES	YES	YES	YES
CO_2 hi	CC144573	18.97	19.00	-0.16									
O_2 zero	n/a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	YES	YES	YES	YES
O_2 mid	CC175259	12.50	12.40	0.48	12.50	-0.48	12.50	-0.48	0.00	YES	YES	YES	YES
O_2 hi	CC144573	20.95	20.80	0.72									
NO_x zero	n/a	0.00	0.25	-0.28	0.24	0.01	0.29	-0.04	-0.06	YES	YES	YES	YES
NO_x mid	CC232136	47.40	48.42	-1.15	47.46	1.08	47.41	1.13	0.06	YES	YES	YES	YES
NO_x hi	CC7488	89.00	89.32	-0.36									
THC zero	n/a	0.00	0.00	0.00	0.09	-0.11	-0.11	0.13	0.23	YES	YES	YES	YES
THC mid	XC001145	49.19	50.97	-2.09									
THC low	CC206929	23.04	23.65	-0.72	23.67	-0.02	23.37	0.33	0.35	YES	YES	YES	YES
THC hi	CC213565	85.13	85.46	-0.39									

Correction factors

CO	Avg. Conc -	-0.605	*	0.9906087
CO_2	Avg. Conc -	0.1	*	1.0152284
O_2	Avg. Conc -	0	*	1
NO_x	Avg. Conc -	0.265	*	1.004876
THC	Avg. Conc -	-0.01	*	0.9791755

Calibration error = ((cal. gas value - analyzer resp) / analyzer span) * 100: allowable error ± 2 % , ± 5 % for THC

System Bias = ((analyzer resp - system resp) / analyzer span) * 100: allowable error ± 5 %

Drift = ((pretest sys resp - post test sys resp) / analyzer span) * 100: allowable error ± 3 %

Sys Bias (pre and post) must be performed on each run: To determine Drift.
Use zero gas and either mid or hi cal gas, choose cal gas closest to measured stack concentration.

Drift must be performed every hour on THC

Calibration Error is performed only at start, unless allowable error parameters are exceeded.

Method 25A Calibration

	Cal. Gas Value	Analyzer Response
High check	85.13	85.46
Zero check	0	0

Slope	1.003876
y-Intercept	0
Predicted	23.129
	49.381
Analyzer Response	23.65
	50.97
difference	0.5207
	1.5893
Cal ok?	**Yes**
	Yes

	Cal Gas Value	5%
TRUE	23.04	1.152
	49.19	2.4595

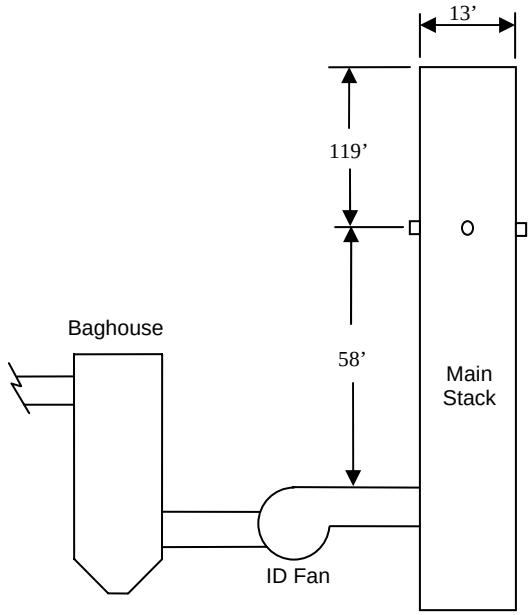
Appendix C

VELOCITY TRAVERSE STACK TEST DATA

16 Sample Points Required
4 ports with 4 points each

Traverse Layout

Point	Distance (from wall)
1	4.99
2	16.38
3	30.26
4	50.39



Schematic of Main Stack

Run 1

URS

VELOCITY TRAVERSE DATA SHEET

Project Name: Haverhill Unit # 2
Project No.:
Date: 7/9/2009

Test No.: 1
Location: Main Stack
Personnel: TG, BJ

Stack Dimensions: 156"
Barometric Pressure: 30.05 in. Hg
Static Pressure: -0.78 in. H_2O

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE	STACK TEMP.
1	0.46	262
2	0.43	262
3	0.46	262
4	0.34	260
5		
6	0.42	258
7	0.47	257
8	0.44	255
9	0.35	255
10		
11	0.40	242
12	0.44	243
13	0.43	250
14	0.34	249
15		
16	0.42	248
17	0.45	249
18	0.44	251
19	0.33	253
20		
21		
22		
23		
24		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	716.9	843.4	126.5
2	720.9	731.3	10.4
3	605.0	607.3	2.3
4	920.3	929.0	8.7
Total	2963.1	3111.0	147.9

MOISTURE TRAIN

SAMPLING TIME Clock	SAMPLING TIME Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM
~~15:50~~	~~0~~	~~677.905~~			
15:40	0	678.550	75	63	2.0
	10	685.00	76	53	2.0
	20	692.90	79	56	2.0
	30	698.40	80	58	2.0
	40	—	—	—	—
	50	712.365			
pitot					
pre good	good	pre = 0.00@7"Hg			
post good	good	post = 0.00@5"Hg			

Control Console I.D.: URS001 ΔH@: 1.7667 Y: 0.9634
Pitot Tube Type: S type I.D. No.: P001 Coefficient: 0.84
Manometer Type: oil I.D. No.: URS001
Thermometer Type: elect I.D. No.: URS001

NOTES:

URS

VELOCITY TRAVERSE CALCULATION SHEET

Client: Haverhill Nox Compliance
Project Number:
Source: Unit # 2 Main
Date: 7/9/2009
Velocity Test #: R1

INPUT PARAMETERS

Barometric Pressure (Pb), in.Hg.	30.05 in. Hg
Avg. Percent CO2	9.9 %
Avg. Percent O2	6.0 %
Avg. Percent CO	0.0 %
Avg. Percent N2	84.1 %
Average Square Root of Delta P	0.6422 in. H_2O
Average Stack Temperature, (T_s)	253 (^oF)
Static Pressure	-0.78 in. H_2O
Stack Diameter	156.00 inches
Pressure in the stack, (P_s)	29.99 in Hg
Stack area, (A_s)	132.73 ft^2
Pitot Tube Coeffiecent , (C_p)	0.84
Average Percent Moisture, (B_{wo})	17.74%

Point No.	Delta P	Sq. Root Delta P	Stack Temp (F)
1	0.46	0.6782	262
2	0.43	0.6557	262
3	0.46	0.6782	262
4	0.34	0.5831	260
5	0.42	0.6481	258
6	0.47	0.6856	257
7	0.44	0.6633	255
8	0.35	0.5916	255
9	0.4	0.6325	242
10	0.44	0.6633	243
11	0.43	0.6557	250
12	0.34	0.5831	249
13	0.42	0.6481	245
14	0.45	0.6708	249
15	0.44	0.6633	251
16	0.33	0.5745	253
17		n/a	
16		n/a	
19		n/a	
20		n/a	
21		n/a	
22		n/a	
23		n/a	
24		n/a	
Average	**0.4138**	**0.6422**	**253**

VELOCITY CALCULATIONS

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.95) + (0.32)*(5.98) + (0.28)*(84.07)
Md = 29.83 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.83) * (1-0.177) + (18) * (0.177)
Ms = 27.73 lb/lbmol

Velocity of Stack Gas
Vs = 85.49*60*Cp*(ΦP)$^{0.5}$ [(Ts+460)/Ps/Ms]$^{0.5}$
Vs = 85.49 * 60 *(0.84) * (0.6422) * sqrt {[(712.91)/(29.99)/(27.73)]}
Vs = 2,561.7 ft/min

Total Flow of Stack Gas
Qa = As X Vs
Qa = (132.7322) * (2,561.7)
Qa = 340,022.7 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = (340,022.7) * (528/712.9) * (29.99/29.92)
Qs = 252,440.4 SCFM

Qstd = Qs(1 - Bwo)
Qstd = (252,440.4) * (1-0.177)
Qstd = 207,668.5 DSCFM

Vsstd = Qstd/As
Vsstd = (207,668.5)/(132.7322)
Vsstd = 1,564.6 ft/min

Velocity Test #: R1
VELOCITY TRAVERSE RESULTS

Stack Gas Temperature (F)	253	Stack Velocity (ft/min)	2,562
Moisture Content (% Vol)	17.74%	Gas Flow Rate (ACFM)	340,023
CO2 Percent	9.9	Gas Flow Rate (@ wet STP)	252,440
O2 Percent	6.0	Gas Flow Rate (DSCFM)	207,668

URS

GAS COMPOSITION TEST
Test Location Haverhill Unit # 2
Test Date: 7/9/2009
Project Number
Test Number R1

Note: Manual input only data marked in RED

INPUT PARAMETERS

Volume of water Collected, Vl_o (ml)	147.9	ml
Volume measured by dry gas meter (Vm), ft^3	33.82	ft^3
Delta H, in. H_2O	1.767	in. H_2O
Gamma	0.963	
Barometric Pressure (Pb), in. Hg.	30.05	in. Hg
Temperature of the meter box (Tm), °F	77.50	°F
Percent CO_2	9.9	%
Percent O_2	6.0	%
Percent CO	0.0	%
Percent N_2	84.1	%
Average Stack Temperature (T_s), °F	253.0	°F

Impinger Weights

	Initial	Final	Net Gain
	716.9	843.4	126.5
	720.9	731.3	10.4
	605.0	607.3	2.3
	920.3	929.0	8.7
Total	2963.1	3111	147.9

SAMPLING CALCULATIONS

Volume of Water Collected
Vwstd = (Vl0)(0.04707)
Vwstd = (147.9) * (0.04707)
Vwstd = 6.96 ft^3

Volume of Gas Metered, Standard Conditions
Vmstd = ((17.65) (V_m)(P_b + ①H/13.6)(☎)/Tm
Vmstd = ((17.65) * (33.82) * (30.05 + (1.7667/13.6)) * (0.9634) / (537.10)
Vmstd = 32.31 ft^3

Moisture Content
Bwo = Vwstd/(Vmstd + Vwstd)
Bwo = 6.96 / (32.29 + 6.96)
Bwo = 0.177

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.95) + (0.32)*(5.98) + (0.28)*(84.07)
Md = 29.83 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.83) * (1-0.177) + (18) * (0.177)
Ms = 27.73 lb/lbmol

GAS COMPOSITION TEST RESULTS

Vol. Sampled at STP (ft^3)	32.29
Stack Gas Temperature (°F)	253
Moisture Content (% Vol)	17.74%
CO_2 Percent	9.9
O_2 Percent	6.0
CO Percent	0.0

Run 2

URS

VELOCITY TRAVERSE DATA SHEET

Project Name: Haverhill Unit # 2
Project No.:
Date: 7/9/2009

Test No.: 2
Location: Main Stack
Personnel: TG, BJ

Stack Dimensions: 156"
Barometric Pressure: 30.05 in. Hg
Static Pressure: -0.69 in. H_2O

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE	STACK TEMP.
1	0.39	254
2	0.41	260
3	0.40	261
4	0.33	259
5		
6	0.40	240
7	0.47	247
8	0.43	249
9	0.37	250
10		
11	0.42	245
12	0.42	245
13	0.44	250
14	0.38	248
15		
16	0.44	240
17	0.42	241
18	0.39	252
19	0.34	250
20		
21		
22		
23		
24		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	721.0	883.1	162.1
2	720.7	731.1	10.4
3	608.5	610.2	1.7
4	941.7	949.3	7.6
Total	2991.9	3173.7	181.8

MOISTURE TRAIN

SAMPLING TIME Clock	Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM
17:00	0	712.500	81	55	2.0
	10	720.80	81	49	2.0
	20	726.60	82	50	2.0
	30	732.70	84	51	2.0
	40	740.00	85	51	2.0
17:50	50	746.125			
pitot		train			
pre good	good	pre 0.0 @ 7" Hg			
post good	good	post 0.0 @ 5" Hg			

Control Console I.D.: URS001
Pitot Tube Type: Stype
Manometer Type: oil
Thermometer Type: elect

ΔH@: 1.7667
I.D. No.: P001
I.D. No.: URS 001
I.D. No.: URS 001

Y: 0.9634
Coefficient: 0.84

NOTES:

URS

VELOCITY TRAVERSE CALCULATION SHEET

Client: Haverhill Nox Compliance
Project Number:
Source: Unit # 2 Main
Date: 7/9/2009
Velocity Test #: R2

INPUT PARAMETERS

Barometric Pressure (Pb), in.Hg.	30.05 in. Hg
Avg. Percent CO2	9.8 %
Avg. Percent O2	6.4 %
Avg. Percent CO	0.0 %
Avg. Percent N2	83.8 %
Average Square Root of Delta P	0.6343 in. H_2O
Average Stack Temperature, (T_s)	249 (^{0}F)
Static Pressure	-0.69 in. H_2O
Stack Diameter	156.00 inches
Pressure in the stack, (P_s)	30.00 in Hg
Stack area, (A_s)	132.73 ft^2
Pitot Tube Coeffiecent , (C_p)	0.84
Average Percent Moisture, (B_{wo})	21.04%

Point No.	Delta P	Sq. Root Delta P	Stack Temp (F)
1	0.39	0.6245	254
2	0.41	0.6403	260
3	0.4	0.6325	261
4	0.33	0.5745	259
5	0.4	0.6325	240
6	0.47	0.6856	247
7	0.43	0.6557	249
8	0.37	0.6083	250
9	0.42	0.6481	245
10	0.42	0.6481	245
11	0.44	0.6633	250
12	0.38	0.6164	248
13	0.44	0.6633	240
14	0.42	0.6481	241
15	0.39	0.6245	252
16	0.34	0.5831	250
17		n/a	
16		n/a	
19		n/a	
20		n/a	
21		n/a	
22		n/a	
23		n/a	
24		n/a	
Average	**0.4031**	**0.6343**	**249**

VELOCITY CALCULATIONS

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.81) + (0.32)*(6.39) + (0.28)*(83.81)
Md = 29.82 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.82) * (1-0.210) + (18) * (0.210)
Ms = 27.34 lb/lbmol

Velocity of Stack Gas
$Vs = 85.49*60*Cp*(\Delta P)^{0.5}\ [(Ts+460)/Ps/Ms]^{0.5}$
Vs = 85.49 * 60 *(0.84) * (0.6343) * sqrt {[(709.04)/(30.00)/(27.34)]}
Vs = 2,541.2 ft/min

Total Flow of Stack Gas
Qa = As X Vs
Qa = (132.7322) * (2,541.2)
Qa = 337,302.6 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = (337,302.6) * (528/709.0) * (30.00/29.92)
Qs = 251,845.0 SCFM

Qstd = Qs(1 - Bwo)
Qstd = (251,845.0) * (1-0.210)
Qstd = 198,850.2 DSCFM

Vsstd = Qstd/As
Vsstd = (198,850.2)/(132.7322)
Vsstd = 1,498.1 ft/min

Velocity Test #: R2
VELOCITY TRAVERSE RESULTS

Stack Gas Temperature (F)	249	Stack Velocity (ft/min)	2,541
Moisture Content (% Vol)	21.04%	Gas Flow Rate (ACFM)	337,303
CO2 Percent	9.8	Gas Flow Rate (@ wet STP)	251,845
O2 Percent	6.4	Gas Flow Rate (DSCFM)	198,850

URS

GAS COMPOSITION TEST
Test Location Haverhill Unit # 2
Test Date: 7/9/2009
Project Number
Test Number R2

Note: Manual input only data marked in RED

INPUT PARAMETERS

Volume of water Collected, Vl_o (ml)	181.8	ml
Volume measured by dry gas meter (Vm), ft^3	33.63	ft^3
Delta H, in. H_2O	1.767	in. H_2O
Gamma	0.963	
Barometric Pressure (Pb), in. Hg.	30.05	in. Hg
Temperature of the meter box (Tm), °F	77.50	°F
Percent CO_2	9.8	%
Percent O_2	6.4	%
Percent CO	0.0	%
Percent N_2	83.8	%
Average Stack Temperature (T_s), °F	249.4	°F

Impinger Weights

	Initial	Final	Net Gain
	721.0	883.1	162.1
	720.7	731.1	10.4
	608.5	610.2	1.7
	941.7	949.3	7.6
Total	2991.9	3173.7	181.8

SAMPLING CALCULATIONS

Volume of Water Collected
Vwstd = (Vl0)(0.04707)
Vwstd = (181.8) * (0.04707)
Vwstd = 8.56 ft^3

Volume of Gas Metered, Standard Conditions
Vmstd = ((17.65) (V_m)(P_b + ①H/13.6)(☎)/Tm
Vmstd = ((17.65) * (33.63) * (30.05 + (1.7667/13.6)) * (0.9634) / (537.10)
Vmstd = 32.13 ft^3

Moisture Content
Bwo = Vwstd/(Vmstd + Vwstd)
Bwo = 8.56 / (32.11 + 8.56)
Bwo = 0.210

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.81) + (0.32)*(6.39) + (0.28)*(83.81)
Md = 29.82 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.82) * (1-0.210) + (18) * (0.210)
Ms = 27.34 lb/lbmol

GAS COMPOSITION TEST RESULTS

Vol. Sampled at STP (ft^3)	32.11
Stack Gas Temperature (°F)	249
Moisture Content (% Vol)	21.04%
CO_2 Percent	9.8
O_2 Percent	6.4
CO Percent	0.0

Run 3

URS

VELOCITY TRAVERSE DATA SHEET

Project Name: Haverhill Unit # 2
Project No.:
Date: 7/9/2009

Test No.: 3
Location: Main Stack
Personnel: TG, BJ

Stack Dimensions: 156"
Barometric Pressure: 30.05 in. Hg
Static Pressure: -0.78 in. H_2O

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE	STACK TEMP.
1	0.45	266
2	0.46	266
3	0.42	267
4	0.36	265
5		
6	0.42	248
7	0.42	249
8	0.41	252
9	0.33	253
10		
11	0.46	250
12	0.41	252
13	0.45	252
14	0.36	250
15		
16	0.40	247
17	0.39	250
18	0.40	250
19	0.32	248
20		
21		
22		
23		
24		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	731.4	883.2	151.8
2	725.6	733.1	7.5
3	604.6	606.1	1.5
4	954.0	962.0	8.0
Total	3015.6	3184.4	168.8

MOISTURE TRAIN

SAMPLING TIME Clock	SAMPLING TIME Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM
18:25	0	746.300	82	53	2.0
	10	754.00	82	45	2.0
	20	760.10	84	46	2.0
	30	766.80	85	46	2.0
	40	773.70	86	47	2.0
	50	780.835			
pitot +	–	train			
pre good	good	pre 0.0 @ 8" Hg			
post good	good	post 0.01 @ 4" Hg			

Control Console I.D.: URSC01
Pitot Tube Type: stype
Manometer Type: oil
Thermometer Type: elect

ΔH@: 1.7667
I.D. No.: P001
I.D. No.: URSC01
I.D. No.: URSC01

Y: 0.9634
Coefficient: 0.84

NOTES:

URS

VELOCITY TRAVERSE CALCULATION SHEET

Client: Haverhill Nox Compliance
Project Number:
Source: Unit # 2 Main
Date: 7/9/2009
Velocity Test #: R3

INPUT PARAMETERS

Barometric Pressure (Pb), in.Hg.	30.05 in, Hg
Avg. Percent CO2	10.0 %
Avg. Percent O2	6.2 %
Avg. Percent CO	0.0 %
Avg. Percent N2	83.9 %
Average Square Root of Delta P	0.6345 in. H_2O
Average Stack Temperature, (T_s)	254 (°F)
Static Pressure	-0.78 in. H_2O
Stack Diameter	156.00 inches
Pressure in the stack, (P_s)	29.99 in Hg
Stack area, (A_s)	132.73 ft^2
Pitot Tube Coeffiecent , (C_p)	0.84
Average Percent Moisture, (B_{wo})	19.42%

Point No.	Delta P	Sq. Root Delta P	Stack Temp (F)
1	0.45	0.6708	266
2	0.46	0.6782	266
3	0.42	0.6481	267
4	0.36	0.6000	265
5	0.42	0.6481	248
6	0.42	0.6481	249
7	0.41	0.6403	252
8	0.33	0.5745	253
9	0.46	0.6782	250
10	0.41	0.6403	252
11	0.45	0.6708	252
12	0.36	0.6000	250
13	0.4	0.6325	247
14	0.39	0.6245	250
15	0.4	0.6325	250
16	0.32	0.5657	248
17		n/a	
16		n/a	
19		n/a	
20		n/a	
21		n/a	
22		n/a	
23		n/a	
24		n/a	
Average	**0.4038**	**0.6345**	**254**

VELOCITY CALCULATIONS

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.97) + (0.32)*(6.17) + (0.28)*(83.86)
Md = 29.84 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.84) * (1-0.194) + (18) * (0.194)
Ms = 27.54 lb/lbmol

Velocity of Stack Gas
$Vs = 85.49*60*Cp*(\Delta P)^{0.5}\ [(Ts+460)/Ps/Ms]^{0.5}$
Vs = 85.49 * 60 *(0.84) * (0.6345) * sqrt {[(713.66)/(29.99)/(27.54)]}
Vs = 2,541.1 ft/min

Total Flow of Stack Gas
Qa = As X Vs
Qa = (132.7322) * (2,541.1)
Qa = 337,292.3 CFM

Qs = Qa X 528/Ts X Ps/29.92
Qs = (337,292.3) * (528/713.7) * (29.99/29.92)
Qs = 250,150.1 SCFM

Qstd = Qs(1 - Bwo)
Qstd = (250,150.1) * (1-0.194)
Qstd = 201,582.9 DSCFM

Vsstd = Qstd/As
Vsstd = (201,582.9)/(132.7322)
Vsstd = 1,518.7 ft/min

Velocity Test #: R3
VELOCITY TRAVERSE RESULTS

Stack Gas Temperature (F)	254	Stack Velocity (ft/min)	2,541
Moisture Content (% Vol)	19.42%	Gas Flow Rate (ACFM)	337,292
CO2 Percent	10.0	Gas Flow Rate (@ wet STP)	250,150
O2 Percent	6.2	Gas Flow Rate (DSCFM)	201,583

URS

GAS COMPOSITION TEST

Test Location Haverhill Unit # 2
Test Date: 7/9/2009
Project Number
Test Number R3

Note: Manual input only data marked in RED

INPUT PARAMETERS

Volume of water Collected, Vl_o (ml)	168.8	ml
Volume measured by dry gas meter (Vm), ft^3	34.54	ft^3
Delta H, in. H_2O	1.767	in. H_2O
Gamma	0.963	
Barometric Pressure (Pb), in. Hg.	30.05	in. Hg
Temperature of the meter box (Tm), °F	77.50	°F
Percent CO_2	10.0	%
Percent O_2	6.2	%
Percent CO	0.0	%
Percent N_2	83.9	%
Average Stack Temperature (T_s), °F	254.1	°F

Impinger Weights

	Initial	Final	Net Gain
	731.4	883.2	151.8
	725.6	733.1	7.5
	604.6	606.1	1.5
	954.0	962.0	8
Total	3015.6	3184.4	168.8

SAMPLING CALCULATIONS

Volume of Water Collected
Vwstd = (Vl0)(0.04707)
Vwstd = (168.8) * (0.04707)
Vwstd = 7.95 ft^3

Volume of Gas Metered, Standard Conditions
Vmstd = ((17.65) (V_m)(P_b + ①H/13.6)(☎)/Tm
Vmstd = ((17.65) * (34.54) * (30.05 + (1.7667/13.6)) * (0.9634) / (537.10)
Vmstd = 33.00 ft^3

Moisture Content
Bwo = Vwstd/(Vmstd + Vwstd)
Bwo = 7.95 / (32.98 + 7.95)
Bwo = 0.194

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(9.97) + (0.32)*(6.17) + (0.28)*(83.86)
Md = 29.84 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (29.84) * (1-0.194) + (18) * (0.194)
Ms = 27.54 lb/lbmol

GAS COMPOSITION TEST RESULTS

Vol. Sampled at STP (ft^3)	32.98
Stack Gas Temperature (°F)	254
Moisture Content (% Vol)	19.42%
CO_2 Percent	10.0
O_2 Percent	6.2
CO Percent	0.0

Appendix D

CALIBRATION DATA

CEM Calibration Data

NO_2-NO Converter Efficiency Test (NO_2 Cylinder Method)

Date:	7/8/2009	Location:	URS Trailer
Project:	Haverhill Unit # 2	Operator:	Todd Gregg
Analyzer:	TECO	Operating Range:	0-100
Model:	42C		
S/N:	708921176		

Cylinder Number	Cal Gas Concentration	NO_x Analyzer Response in Direct Cal Mode
CC260561	50.85	49.23

$$\text{Converter Efficiency} = \frac{C_{Dir}}{C_v} \times 100$$

Converter Efficiency = **96.8** % (Must be greater than or equal to 90 percent)

Procedures

1. Calibrate analyzer
2. Introduce a 40 to 60 ppmv NO_2 calibration gas cylinder to the analyzer in direct cal mode and record the NO_x response.
3. Calculate efficiency.

Current Date : 07/08/09
Current Time : 12:38

NOx Converter Check

Daily Parameter Report - Minute Averages
Haverhill Unit # 2 Compliance

Logger Name : LOGGER
Logger Id : 01
Parameter : NOX
Units : PPM

Date	Time 001M	00	01	02	03	04	Minute 05	06	07	08	09
07/08/09	12:20	47.16	48.98	49.12	49.72	49.86	49.54	49.40	49.47	49.39	49.70

Max	49.86
Min	47.16
Mean	49.23
Records	10

Status : '<' - Less than ##% Data, 'P' - Power Fail, 'D' - Disabled, 'T' - Out-of-Control, 'F' - Boiler Off-Line,
Flags : 'B' - Bad Status, 'C' - Calibration, 'M' - Maintenance, 'O' - Analog Overrange, 'U' - Analog Underrange,
'A' - Arithmetic Error, '+' - Maximum, '-' - Minimum, 'R' - Rate of Change, 'H' - High-High Alarm,
'L' - Low-Low Alarm, 'h' - High Alarm, 'l' - Low Alarm, 'J' - High Rate of Change, 'j' - Low Rate of Change,
'V' - DIS #1 Obs, 'W' - DIS #2 Obs, 'X' - DIS #3 Obs, 'Y' - DIS #4 Obs, 'Z' - DIS #5 Obs.

3-Point Stratification Check
Test Location

Stack Diameter	(in)	156
Port Length	(in)	6
3 pts.		
Pts.	(in)	(%)
1	32.1	16.7
2	84.0	50.0
3	135.9	83.3

Pts.	NO_x Conc.	SO_2 Conc.	CO Conc.	CO_2 Conc.	O_2 Conc.
1	53.8	#DIV/0!	0.7	9.6	7.3
2	55.0	#DIV/0!	0.6	9.6	7.3
3	57.4	#DIV/0!	0.7	9.6	7.3
avg.	55.4207	#DIV/0!	0.67867	9.59333	7.28

	NO_x		SO_2		CO		CO_2		O_2	
Pts.	% Diff	Abs Diff	% Diff	Abs Diff	% Diff	Abs Diff	% Diff	Abs Diff	% Diff	Abs Diff
1	-2.9423	1.63067	#DIV/0!	#DIV/0!	7.26916	-0.0493	0.06949	0.0	-0.2747	0.0
2	-0.6869	0.38067	#DIV/0!	#DIV/0!	-8.3497	0.05667	-0.139	0.0	0.54945	0.0
3	3.62921	-2.0113	#DIV/0!	#DIV/0!	1.08055	-0.0073	0.06949	0.0	-0.2747	0.0

7/8/2009	9:10	52.57		1.17	9.5	7.4
7/8/2009	9:11	53.13		0.73	9.5	7.4
7/8/2009	9:12	53.65		0.58	9.6	7.3
7/8/2009	9:13	54.07		0.58	9.7	7.1
7/8/2009	9:14	55.53		0.58	9.7	7.1
		53.79	***#DIV/0!***	***0.73***	***9.60***	***7.26***
7/8/2009	9:15	56.9		0.79	9.7	7.2
7/8/2009	9:16	55.35		0.58	9.6	7.3
7/8/2009	9:17	53.69		0.58	9.5	7.4
7/8/2009	9:18	54.12		0.59	9.5	7.4
7/8/2009	9:19	55.14		0.57	9.6	7.3
		55.04	***#DIV/0!***	***0.62***	***9.58***	***7.32***
7/8/2009	9:20	55.11		1.06	9.6	7.3
7/8/2009	9:21	56.11		0.65	9.6	7.2
7/8/2009	9:22	58.06		0.58	9.7	7.1
7/8/2009	9:23	59.5		0.57	9.6	7.3
7/8/2009	9:24	58.38		0.57	9.5	7.4
		57.43	***#DIV/0!***	***0.69***	***9.60***	***7.26***

URS

RESPONSE TIME TEST

Date of Test: July 8, 2009

Facility / Location Haverhill Unit # 2

Analyzer Type: O_2

Span Gas Concentration: 21

Analyzer Span Setting: 25

UPSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	20.0	26.87
2	0.0	20.0	26.24
3	0.0	20.0	27.3
Average Upscale Response			26.80

DOWNSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	20.0	1.1	28.32
2	20.0	1.1	28.41
3	20.0	1.1	27.7
Average Downscale Response			28.14

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas.

RESPONSE TIME = The longer of the two mean times.

URS

RESPONSE TIME TEST

Date of Test: July 8, 2009

Facility / Location Haverhill Unit # 2

Analyzer Type: CO_2

Span Gas Concentration:

Analyzer Span Setting: 25

UPSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	26.87
2	0.0	0.0	26.24
3	0.0	0.0	27.3
Average Upscale Response			26.80

DOWNSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	28.32
2	0.0	0.0	28.41
3	0.0	0.0	27.7
Average Downscale Response			28.14

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas.

RESPONSE TIME = The longer of the two mean times.

URS

RESPONSE TIME TEST

Date of Test: July 8, 2009

Facility / Location Haverhill Unit # 2

Analyzer Type: CO

Span Gas Concentration:

Analyzer Span Setting: 100

UPSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	65.99
2	0.0	0.0	65.88
3	0.0	0.0	66.26
Average Upscale Response			66.04

DOWNSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	66.35
2	0.0	0.0	66.44
3	0.0	0.0	66.12
Average Downscale Response			66.30

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas.

RESPONSE TIME = The longer of the two mean times.

URS

RESPONSE TIME TEST

Date of Test: July 8, 2009

Facility / Location Haverhill Unit # 2

Analyzer Type: NO_x

Span Gas Concentration:

Analyzer Span Setting: 100

UPSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	86.25
2	0.0	0.0	87.62
3	0.0	0.0	87.15
Average Upscale Response			87.01

DOWNSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	0.0	82.43
2	0.0	0.0	85.76
3	0.0	0.0	84.19
Average Downscale Response			84.13

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas.

RESPONSE TIME = The longer of the two mean times.

URS

RESPONSE TIME TEST

Date of Test:	July 8, 2009
Facility / Location	Haverhill Unit # 2
Analyzer Type:	THC
Span Gas Concentration:	85.13
Analyzer Span Setting:	100

UPSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	0.0	80.9	21.32
2	0.0	80.9	21.47
3	0.0	80.9	20.83
Average Upscale Response			21.21

DOWNSCALE RESPONSE			
	Start	95% Response	Time (sec)
1	80.9	4.3	20.15
2	80.9	4.3	20.69
3	80.9	4.3	20.23
Average Downscale Response			20.36

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas.

RESPONSE TIME = The longer of the two mean times.

ThermoFisher
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The world leader
in serving science

To Whom It May Concern:

In an effort to assist our customers with the requirements of the Instrumental methods for testing, 3A, 6C, 7E, 10, and 20, we are providing a summary of interferences for certain Thermo Scientific analyzers.

The requirement for conducting analyzer interference checks for potential interfering gases is the responsibility of the testing organizations. The Methods do, however, allow the manufacturer of instruments to provide this data. Test are required to be conducted on the same "make and model" as those being used for method testing.

The information contained in the accompanying tables pertains to the "make" of analyzers under the names of; Thermo Electron Corporation, Thermo Environmental Instruments and Thermo Scientific. The "model" are models; Model 42 for NO, NO_2, NO_x, Model 43 for SO_2, and Model 410i for CO_2. The specific pollutant detection and analytical technology for each of the above listed specific models have remained the same for the various series of analyzers manufactured over the past years. Therefore, the interference test results shown for iSeries analyzers, would produce essentially the same results for C Series and earlier Series of these models.

The potential interference gases test results shown in the tables to follow indicate that none of Thermo Scientific analyzers tested have a collective analytical detection interference that would sum more than 0.06% of analyzer span value. The acceptance criterion is; the sum of the interference responses must not be greater than 2.5% of analyzer span value.

If you have any questions regarding the information contained herein please do no hesitate to contact us.

Thermo Fisher Scientific

Frank Duckett
Product Manager, Continuous Gas Analyzers
Air Quality Instruments

Air Quality Instruments
Environmental Instruments
27 Forge Parkway
Franklin, MA
02038
(508) 520-0430
(508) 520-1460 fax
www.thermofisher.com

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Thermo Scientific Model 42 NO-NO_2-NO_x Analyzer Potential Interference Gas Responses

Potential Interferent		Model 42iLS			Model 42iHL		
Test Gas	Concentration	NO	NO_2	NO_x	NO	NO_2	NO_x
CO_2	5.20%	0.001	0.004	0.004	0.001	0.003	0.004
CO_2	15.60%	0	0.003	0.003	0.001	0.004	0.005
H_2O	1.00%	0	0	0	0.003	0.001	0.004
NO	15 ppm	14.9	0.1	15	15	-0.06	14.99
NO_2	15 ppm	1.1	14	15	0.4	14.6	15
N_2O	10 ppm	0	0	0	0	0	0
CO	50 ppm	0	0	0	0	0	0
SO_2	21 ppm	-0.01	0	-0.01	0.007	0	0.007
CH_4	50 ppm	0	0	0	0	0	0
HCl	10 ppm	0	0.006	0.006	0	0.004	0.004
NH_3[1]	10 ppm	0	0	0	0.17	8.9	9.1
Sum of Responses		**0.011**	**0.01**	**0.02**	**0.011**	**0.009**	**0.02**
Span Value		**160**	**152**	**160**	**160**	**152**	**160**
% of Calibration Span		**0.01%**	**0.01%**	**0.01%**	**0.01%**	**0.01%**	**0.01%**

Acceptance Criteria found in Section 13.4 of Method 7E is the sum of responses must not be greater than 2.5% of the analyzer calibration span value.

[1]NH_3 interferent results shown for the Model 42iHL was not used in calculation of interference response check because it is a known interferent with an approximate 1 ppm to 1 ppm positive bias in analyzers using stainless steel NO_2 to NO converters. Thermo recommends that NO_x analyzers with stainless steel NO_2 to NO converters must use a NH_3 scrubber when testing sources with potential HN_3 in the flue gas.

This document is subject to change without notice.

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Thermo Scientific Model 43 SO_2 and Model 410i CO_2 Analyzer Potential Interference Gas Responses

Potential Interferent		*Model 43iLH*	*Model 410iHL*
Test Gas	*Concentration*	*SO_2*	*CO_2*
CO_2	5.20%	0.03	5.2
CO_2	15.60%	0.14	15.6
H_2O	1.00%	-0.05	0
NO	15 ppm	0.2	0
NO_2	15 ppm	0.06	0
N_2O	10 ppm	0	0
CO	50 ppm	0	0
SO_2	21 ppm	21	0
CH_4	50 ppm	0	0
HCl	10 ppm	0	0
NH_3	10 ppm	0	0
Sum of Responses		**0.45**	**0**
Span Value		**800**	**16**
% of Calibration Span		**0.06%**	**0%**

Acceptance Criteria found in Section 13.4 of Method 7E is the sum of responses must not be greater than 2.5% of the analyzer calibration span value.

This document is subject to change without notice.

To: <todd_gregg@urscorp.com>
From: "Melanie Danner" <mdanner@teledyne.com>
Date: 07/31/2009 07:29PM
cc: "API-InsideSales" <API-InsideSales@teledyne.com>, "Bill Taylor" <billtayl@ix.netcom.com>
Subject: RE: Inquiry - URS Coporation (TN)

Dear Todd,

I have listed the requested information below as well as a link to our manual. Please feel free to contact me with any questions.
http://www.teledyne-api.com/manuals/man_300e-em.pdf

3.6.1. INTERFERENTS FOR CO2 MEASUREMENTS
It should be noted that the gas filter correlation method for detecting CO is subject to interference from a number
of other gases that absorb IR in a similar fashion to CO. Most notable of these are water vapor, CO2, N2O
(nitrous oxide) and CH4 (methane). The M300E/EM has been successfully tested for its ability to reject
interference from of these sources, however high concentrations of these gases can interfere with the
instrument's ability to make low-level CO measurements.
For a more detailed discussion of this topic, see Section 11.2.1.3.

11.2.1.3. Summary Interference Rejection
The basic design of the M300E/EM rejects most of this interference at a 300:1 ratio. The two primary methods
used to accomplish this are:
· The 4.7µm band pass filter just before the IR sensor which allows the instrument to only react to IR
absorption in the wavelength affected by CO.
· Comparison of the measure and reference signals and extraction of the ratio between them.

Best Regards,

Melanie L. Danner
Inside Sales Engineer
Teledyne - Advanced Pollution Instrumentation, Inc.
(858) 657-9800 Ext 7723
(858) 642-7723 Direct
(858) 657-9816 Fax
mdanner@teledyne.com

11.2.1.2. The Measure Reference Ratio

The M300E/EM determines the amount of CO in the sample chamber by computing the ratio between the peak of the measurement pulse (**CO MEAS**) and the peak of the reference pulse (**CO REF**).

If no gases exist in the sample chamber that absorb light at 4.7µm, the high concentration of CO in the gas mixture of the reference cell will attenuate the intensity of the IR beam by 60% giving a M/R ratio of approximately 2.4:1.

Adding CO to the sample chamber causes the peaks corresponding to both cells to be attenuated by a further percentage. Since the intensity of the light passing through the measurement cell is greater, the effect of this additional attenuation is greater. This causes **CO MEAS** to be more sensitive to the presence of CO in the sample chamber than **CO REF** and the ratio between them (M/R) to move closer to 1:1 as the concentration of CO in the sample chamber increases.

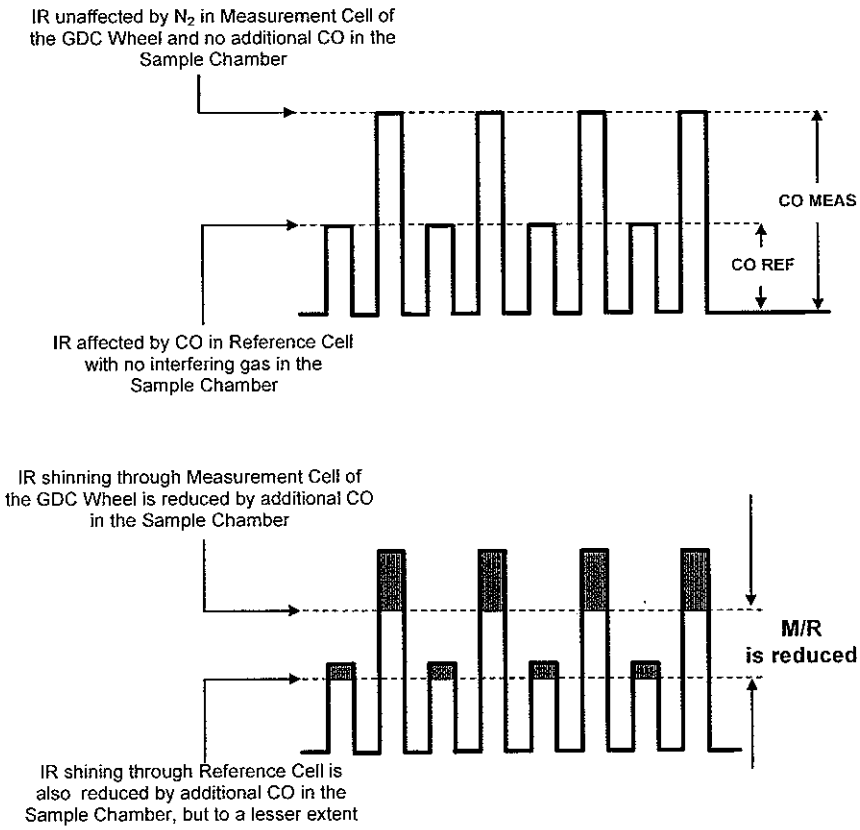


Figure 11-4: Affect of CO in the Sample on CO MEAS & CO REF

Once the M300E/EM has computed this ratio, a look-up table is used, with interpolation, to linearize the response of the instrument. This linearized concentration value is combined with calibration SLOPE and OFFSET values to produce the CO concentration which is then normalized for changes in sample pressure.

Interference and Signal to Noise Rejection:

If an interfering gas, such as H_2O vapor is introduced into the sample chamber, the spectrum of the IR beam is changed in a way that is identical for both the reference and the measurement cells, but without changing the ratio between the peak heights of **CO MEAS** and **CO REF**. In effect, the difference between the peak heights remains the same.

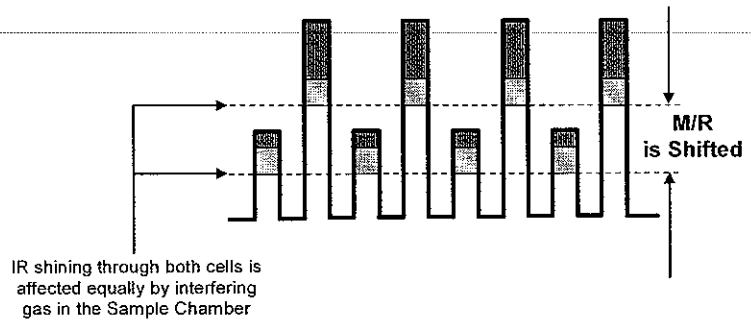


Figure 11-5: Effects of Interfering Gas on CO MEAS & CO REF

Thus, the difference in the peak heights and the resulting M/R ratio is only due to CO and not to interfering gases. In this case, GFC rejects the effects of interfering gases and so that the analyzer responds only to the presence of CO.

To improve the signal-to-noise performance of the IR photo-detector, the GFC Wheel also incorporates an optical mask that chops the IR beam into alternating pulses of light and dark at six times the frequency of the measure/reference signal. This limits the detection bandwidth helping to reject interfering signals from outside this bandwidth improving the signal to noise ratio.

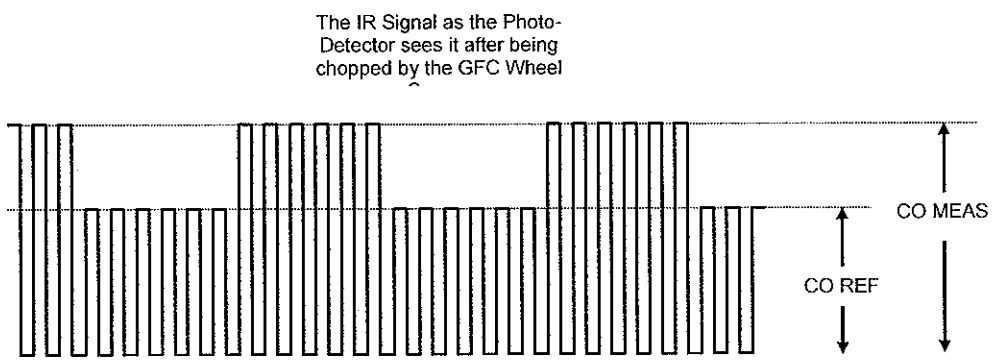


Figure 11-6: Chopped IR Signal

11.2.1.3. Summary Interference Rejection

The basic design of the M300E/EM rejects most of this interference at a 300:1 ratio. The two primary methods used to accomplish this are:

- The 4.7µm band pass filter just before the IR sensor which allows the instrument to only react to IR absorption in the wavelength affected by CO.
- Comparison of the measure and reference signals and extraction of the ratio between them.

Calibration Gas Certificates

PRAXAIR

Praxair Distribution Mid-Atlantic LLC

145 Shimersville Road • Bethlehem, PA 18015 • Phone: 610.317.1608 • Fax: 610.758.8384

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:
PDI WHSE KNOXVILLE HUB
3020 E INDUSTRIAL PKWY
KNOXVILLE TN 37921

Doc Number: 00000003577
Order Number: 130496800 6
Customer P. O. Number:
Customer Reference Number: LB216

Fill Date: 10/27/2008
Part Number: NI NO47.5ME-AS
Lot Number: N/A
Cylinder Style & Outlet: AS 660
Cylinder Pressure & Volume: 2000 psi 140 cu ft

Certified Concentration:

Expiration Date: 11/14/2010
Cylinder Number: CC232136

			Analytical Uncertainty:
47.4	ppm	NITRIC OXIDE	±1 %
	Balance	NITROGEN	

NOx ppm = 47.4 (NOX Values for Reference Only)

Certification Information: Certification Date: 11/14/2008 Term: 24 Months Expiration Date: 11/14/2010

1. This cylinder was certified according to the 1997 EPA Traceability Protocol, document #EPA-600/R-97/121, using procedure G1
2. Do not use this standard if pressure is less than 150 PSIG.

Analytical Data: (R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: NITRIC OXIDE

Requested Concentration: 47.5 ppm
Certified Concentration: 47.4 ppm
Instrument Used: ECOPHYSICS CLD 822 S S/N 82250350
Analytical Method: CHEMILUMINESCENCE
Last Multipoint Calibration: 11/10/2008

Reference Standard Type: GMIS
Ref. Std. Cylinder # : SA16186
Ref. Std. Conc. 49.6 PPM
Ref. Std. Traceable to SRM # : 1684b

First Analysis Data: Date: 10/31/2008

Z:	0	R:	49.62	C:	47.41	Conc:	47.4
R:	49.6	Z:	0	C:	47.4	Conc:	47.5
Z:	0	C:	47.45	R:	49.5	Conc:	47.5

UOM: PPM Mean Test Assay: 47.5 PPM

Second Analysis Data: Date: 11/14/2008

Z:	0	R:	49.66	C:	47.7	Conc:	47.5
R:	49.65	Z:	0	C:	47.65	Conc:	47.4
Z:	0	C:	47.68	R:	49.77	Conc:	47.5

UOM: PPM Mean Test Assay: 47.4 PPM

Analyzed by: Melissa Santana

Certified by: 11-19-08

Information contained herein has been prepared at your request by qualified experts within GTS-Welco, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of GTS-Welco, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.

Airgas

Airgas Speciality Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A3576	Reference Number:	54-124144094-1
Cylinder Number:	CC7488	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Jul 09, 2008	Valve Outlet:	660

Expiration Date: Jul 09, 2010

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Relative % Uncertainty
NITRIC OXIDE	90.00 PPM	89.00 PPM	[illegible]	± 1% NIST traceable
NITROGEN	Balance			

Total oxides of nitrogen	89.00 PPM	For Reference Only

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	2786	CC220043	95.98PPM NITRIC OXIDE/NITROGEN	Sep 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
HORIBA 510	NDIR	Jun 19, 2008

Triad Data Available Upon Request

Notes:

QA Approval

Airgas

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Airgas Speciality Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
http://www.airgas.com

Part Number:	E02NI99E15AC017	Reference Number:	54-124085328-4
Cylinder Number:	XC0218478	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Jan 23, 2007	Valve Outlet:	350

Expiration Date: Jan 23, 2010

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainity
CARBON MONOXIDE	50.000 PPM	50.209 PPM	G1	+/- 2% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	980503	SG9174863BAL	50.46PPM CARBON MONOXIDE/NITROGEN	Oct 02, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet Nexus	FTIR	Jan 08, 2007

Triad Data Available Upon Request

Notes:

QA Approval

Airgas

Airgas Specialty Gases
12722 South Wentworth Avenue
Chicago, IL 60628
773-785-3000
FAX: 773-785-1928
http://www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0406	Reference Number:	54-124118248-4
Cylinder Number:	CC177164	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Dec 19, 2007	Valve Outlet:	350

Expiration Date: Dec 19, 2010

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON MONOXIDE	90.00 PPM	89.09 PPM	G1	+/- 1% NIST traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	5120408	CC180103	89.49PPM CARBON MONOXIDE/	Feb 02, 2009

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
HORIBA 510	NDIR	Dec 03, 2007

Triad Data Available Upon Request

Notes:

QA Approval

Airgas

Airgas Specialty Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI60E15A1968	Reference Number:	54-124119942-2
Cylinder Number:	CC144573	Cylinder Volume:	159 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Dec 28, 2007	Valve Outlet:	590

Expiration Date: Dec 28, 2010

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	18.00 %	18.07 %	G1	+/- 1% NIST Traceable
OXYGEN	21.00 %	20.95 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	60608	CC206134	22.51% OXYGEN/NITROGEN	May 01, 2010
NTRM	101705	SG9169340BAL	17.89% CARBON DIOXIDE/	May 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
HORIBA 510	NDIR	Dec 03, 2007
CAI-110	Paramagnetic	Dec 03, 2007

Triad Data Available Upon Request

Notes:

QA Approval

Linde Gas

Certificate of Analysis

EPA Protocol

HiQ® Certificate

Performed according to EPA-600/R97/121, Procedure G1

Notice: This Cylinder is not to be used when pressure is under 150 psig.

Manufactured and certified at:

Linde Gas USA LLC
Maumee Specialty Gas Plant
6421 Monclova Road
MAUMEE OH 43537
419-893-7226

Produced for customer:

LINDE DECATUR INTERBRANCH
3150 N WOODFORD ST
DECATUR IL 62526-2834
USA
217-875-2000

Material:	2179		**Blend Tolerance:**	5 % Relative
MISC 3 COMPONENT	EPA	A31	**Blend Type:**	EPA Protocol
Production #:	100134529		**Cyl. Pressure:**	2000 psig
Lot #:	02499D7040ZC		**Balance Gas:**	Nitrogen
Cylinder #:	CC175259		**CGA:**	590
Expiration Date:	4/11/2010		**Analytical Accuracy:**	1.00 % Relative
Shelf Life:	36 months		**Confidence:**	95 %

CAS #	Certified Component	Requested Concentration	Concentration and Uncertainty	Date of Certification
7782-44-7	Oxygen	12.5	12.5 +/- 0.1 %	04/11/2007
124-38-9	Carbon Dioxide	10.0	9.90 +/- 0.10 %	04/11/2007
7727-37-9	Nitrogen		Balance	04/11/2007

CAS #	Reference Standard	Cylinder/Standard #	Concentration	Expire Date
124-38-9	Carbon Dioxide	CC59133 , NTRM 81675	13.78 %	10/02/2008
7782-44-7	Oxygen	CC195913 , NTRM	20.90 %	01/01/2010

Instrument	Serial #	Analytical Principle	Calibration Date
Horiba VIA-510	568849043	Non-Dispersive Infrared	04/02/2007
Rosemount 755R	1000559	Paramagnetic	04/06/2007

All analyses are performed under controlled environmental conditions.This product is manufactured using equipment which has been calibrated with NIST traceable, or equivalent, standards, weights, or equipment.

Analytical report approved by Roy Yoder

Roy Yoder

HiQ Certificate

Airgas

R 9252

Airgas Speciality Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
Fax: 1-773-785-1928
http://www.airgas.com

Certificate of Analysis: EPA Protocol Gas Mixture

Cylinder Number:	CC213565	Reference Number:	54-124074609-9
Cylinder Pressure:	2000.6 PSIG	Expiration Date:	9/13/2009
Certification Date:	9/13/2006	Laboratory:	ASG - Chicago - IL

Certified Concentrations

Component	Concentration	Accuracy	Analytical Principle	Procedure
PROPANE	85.13 PPM	+/- 1%	FID	G1
Air	Balance			

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences.

Notes:

Do not use cylinder below 150 psig.

Approval Signature

Reference Standard Information

Type	Balance Gas	Component	Cyl.Number	Concentration
NTRM 51715		PROPANE	SG9101987ALB	103.6 PPM

Analytical Results

1st Component **PROPANE**

1st Analysis Date: 09/13/2006

R 161741	S 56689	Z 0	Conc 85.17 PPM
S 56588	Z 0	R 161897	Conc 85.02 PPM
Z 0	R 161965	S 56710	Conc 85.20 PPM
			AVG: 85.13 PPM

Airgas R7903

Airgas Speciality Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02AI99E15A0456	Reference Number:	54-124178474-6
Cylinder Number:	XC001145B	Cylinder Volume:	130 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	1800 PSIG
Analysis Date:	May 18, 2009	Valve Outlet:	590

Expiration Date: May 18, 2012

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	50.00 PPM	49.910 PPM	G1	+/- 1% NIST Traceable
Air	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	520	SG902252ALB	50.5PPM PROPANE/NITROGEN	Apr 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet Nexus	FTIR	May 06, 2009

Triad Data Available Upon Request

Notes:

QA Approval

Airgas

R19050

Airgas Speciality Gases
12722 S. Wentworth Avenue
Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02AI99E15A2976	Reference Number:	54-124162322-2
Cylinder Number:	CC206929	Cylinder Volume:	146 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Dec 24, 2008	Valve Outlet:	590

Expiration Date: Dec 24, 2011

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	23.00 PPM	23.04 PPM	G1	+/- 1% NIST Traceable
Air	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	520	SG880914ALB	50.5PPM PROPANE/NITROGEN	Apr 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet Nexus	FTIR	Dec 07, 2008

Triad Data Available Upon Request

Notes:

Cindy Stewart

QA Approval

URS Equipment Calibration Data

URS

Stack Temperature Sensor Calibration Spreadsheet
Primary Standard: NIST Traceable Thermometer
Enclosures Denote Input Data

Thermocouple ID:	AQS 6ICL 1001	Calibrated By:	R. Raymond
Calibration Standard:	PRIMARY	Thermocouple Readout Number	SR 2/0201004
Calibration Standard ID:	15059408	Thermocouple Readout Correlation:	1:00000
Date Calibrated:	3/19/2009	Ambient Temperature (F):	68

Reference Point Number	Source (Specify) See Note 1	Reference Thermometer Temperature F	Reference Thermometer Temperature C
1	Ice Bath	37.0	2.8
2	Ambient	66.0	18.9
3	Hot Sand	441.0	227.2

Thermocouple Potentiometer Temperature F	Corrected Potentiometer Temperature F	Corrected Potentiometer Temperature C	Temperature % Difference See Note 2
38.0	38.0	3.3	0.2
66.0	66.0	18.9	0.0
435.0	435.0	223.9	0.7

Does thermocouple Meet Specifications?

YES at 38 F
YES at 66 F
YES at 435 F

Calibrator Signature:

Note 1 - Type of calibration system used
Note 2 - $\frac{[(\text{ref temp, C} + 273) - (\text{test thermometer temp, C} + 273)]100}{\text{ref temp, C} + 273} < 1.5\%$

URS TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? x yes ____ no

Pitot tube openings damaged? ____ yes (explain below) x no

a_1 = 1 ° (<10°), a_2 = 2 ° (<10°) z = A sin γ = 0.000 (in.); (<0.125 in.)

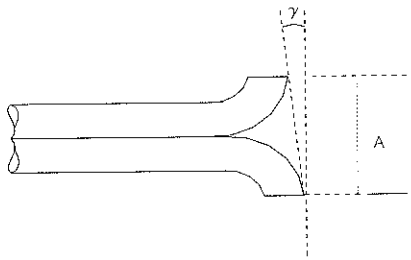
b_1 = 1 ° (<5°), b_2 = 4 ° (<5°) w = A sin θ = 0.017 (in.); (<0.03125 in.)

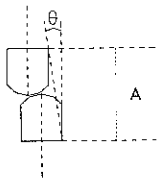
γ = 0 °, θ = 1 °, A = 0.979 (in.) P_A = 0.36 (in.), P_B = 0.39 (in.), D_t = 0.864

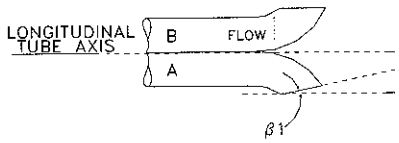
Comments: _____

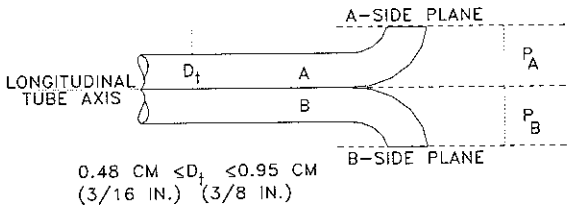
Does the calibration meet Method 2 construction requirements for use at 0.84 coefficient? **Yes**

Pitot Tube No.: AQS 6 ICL p001 Date: 6/15/2009 Name: R. Raymond

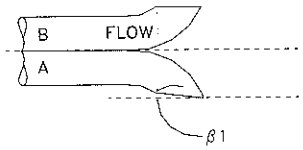


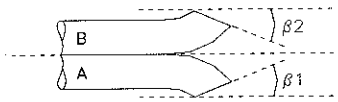


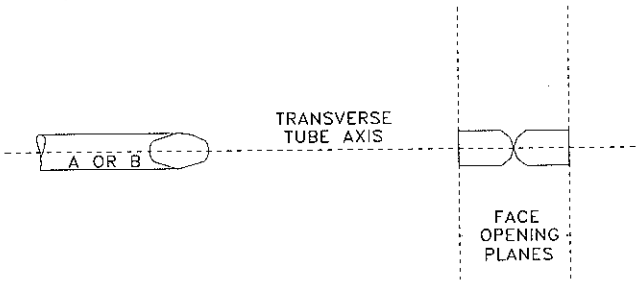


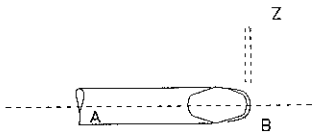


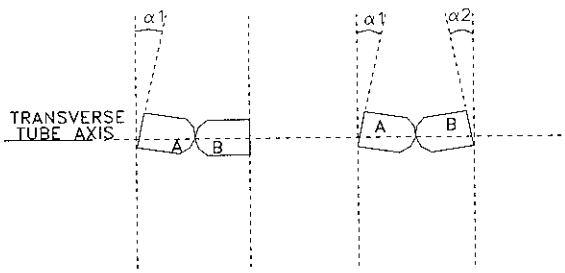
NOTE:
1.05 D_t<P_t <1.50 D
P_A = P_B

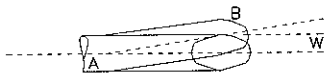












THERMOCOUPLE READOUT CALIBRATION DATA FORM
(FOR K-TYPE THERMOCOUPLES)

Control Box / Thermocouple Readout Number: URS 001 Calibrated By: R. Raymond

Ambient Temperature: 72 °F Date: 6/15/2009

Omega Engineering Calibrator Model No. 22 TC Serial #'s 174470

Primary Standards Directly Traceable t National Institute of Standards and Technology (NIST)

Reference[a] Source Temperature, (°F)	Test Thermometer Temperature, (°F)	Temperature Difference, %
0	0	0.00
200	201	0.15
400	397	0.35
600	600	0.00
1000	1001	0.07
1200	1199	0.06

Are all the Thermocouple Readout calibration points within calibration standard of <= to 1.5 %? Yes

$$\frac{(\text{Ref. Temp., oF} + 460) - (\text{Test Therm. Temp., oF} + 460)}{\text{Ref. Temp., oF} + 460} * 100 <= 1.5\ \%$$

Calibrator Signature: Date: 6/15/2009

Approval Signature: Date: 6/17/09

URS

DRY GAS METER CALIBRATION SPREADSHEET

CONTROL BOX ID:	URS-001	CALIBRATED BY:	R. Raymond
CALIBRATION STANDARD:	Secondary	AMBIENT TEMPERATURE (F):	68
CALIBRATION STANDARD ID:	361815	AMBIENT PRESSURE (In Hg):	30.09
DATE CALIBRATED:	5/13/2009	Secondary Standard Correction Factor	0.9941

GAS VOLUME

Setting (delta H)	Gas Volume Metered (ft3)	Gas Volume Corrected (ft3) Vw	Gas Volume DGM (ft3) Vd
0.5	5	4.971	5.102
1.0	5	4.971	5.146
2.0	10	9.941	10.431
3.0	10	9.941	10.498
4.0	10	9.941	10.557

TEMPERATURE

Calibrator Temperature (F) Tw	Average DGM (F) Td
64.0	65.0
64.0	67.0
64.0	71.0
64.0	74.0
64.0	76.0

CALCULATIONS

Time (min)	Gamma (Y)	Delta H@
12.52	0.9749	1.7479
9.05	0.9691	1.8196
12.55	0.9611	1.7365
10.30	0.9580	1.7446
9.04	0.9539	1.7851
	Avg Y	Avg Delta H@
	0.9634	1.7667
	0.9434	1.5667
Tolerances	0.9834	1.9667

Y - Ratio of Accuracy of Wet Test Meter Tolerance = +/- 0.02

Delta H@ - Orifice Pressure Differential that Yields 0.75 CFM

Is Unit Within Calibration Tolerances? YES

Calibrator: R D Raymond Date: 5-13-09

Approved by: Michael Mowery Date: 5-15-09

URS

DRY GAS METER CALIBRATION SPREADSHEET

CONTROL BOX ID:	URS 001	CALIBRATED BY:	R. Raymond
CALIBRATION STANDARD:	Secondary	AMBIENT TEMPERATURE (F):	73
CALIBRATION STANDARD ID:	361815	AMBIENT PRESSURE (in Hg):	30.09
DATE CALIBRATED:	7/15/2009	Secondary Standard Correction Factor	0.9941

GAS VOLUME

Setting (delta H)	Gas Volume Metered (ft3)	Gas Volume Corrected (ft3) Vw	Gas Volume DGM (ft3) Vd
0.5	5	4.971	5.118
1.0	5	4.971	5.171
2.0	10	9.941	10.439
3.0	10	9.941	10.495
4.0	10	9.941	10.538

TEMPERATURE

Calibrator Temperature (F) Tw		Average DGM (F) Td
75.0		79.0
75.0		80.0
75.0		83.0
75.0		85.0
75.0		86.0

CALCULATIONS

Time (min)	Gamma (Y)	Delta H@
13.08	0.9772	1.9371
9.07	0.9678	1.8594
12.39	0.9618	1.7253
16.20	0.9579	1.7475
9.01	0.9534	1.8147
	Avg Y	Avg Delta H@
	0.9636	1.8168
Tolerances	0.9436 0.9836	1.6168 2.0168

Y - Ratio of Accuracy of Wet Test Meter Tolerance = +/- 0.02

Delta H@ - Orifice Pressure Differential that Yields 0.75 CFM

Is Unit Within Calibration Tolerances? YES

Calibrator: _____ Date: 7-15-09

Approved by: _____ Date: 7/16/09

Appendix E

TEST PROTOCOL

June 26, 2009

Ms. Cindy Charles, Director
Ohio Environmental Protection Agency
Portsmouth Local Air Agency
605 Washington Street, Third Floor
Portsmouth, Ohio 45662

Haverhill North Coke Company
Intent to Test Notification – Emission Unit P902
Facility ID: 077300018

Dear Ms. Charles:

In accordance with the Permit to Install No 07-00511, Emission Unit P902 Testing Requirements, Haverhill North Coke Company (HNCC) wishes to submit the attached "Intent to Test" notification. This request is for retesting of NOx emissions on the P902 main stack. Results from the initial April 9, 2009 compliance test demonstrated compliance with PTI short term limit. However, during the test unrepresentative conditions may have occurred which resulted in a higher measured emission factor. HNCC feels that an evaluation of operating conditions and a recharacterization of the emission factor is warranted to ensure future compliance with the long term permit limits. Per your request, we will also retest for carbon monoxide (CO) to assure that we remain in compliance with related PTI limits.

The proposed test date is Thursday, July 9th with Friday, July 10th held as a contingency day. As you are aware, this test notification is inside the typical 30 day notice. Due to current economic conditions, HNCC stakeholders have requested immediate reductions in coke production. In order to honor this request HNCC must reduce production below 90 percent capacity required during the compliance testing. HNCC is requesting that Ohio EPA waive the 30 day notice to facilitate the retest without significant delay in the planned production reductions.

HNCC appreciates your prompt attention to this matter and looks forward to your approval of the retest. If you have any questions, please don't hesitate to contact me at 740-355-9823

Best regards,

Kris Kinder
Environmental Manager
Haverhill North Coke Company

Intent to Test Notification
Haverhill North Coke Company

June 25, 2009

Prepared for:

Haverhill North Coke Company
2446 Gallia Pike
Franklin Furnace, Ohio 45629

INTENT TO TEST NOTIFICATION
HAVERHILL NORTH COKE COMPANY

Prepared for:

Haverhill North Coke Company
2446 Gallia Pike
Franklin Furnace, Ohio 45629

Prepared by:

URS Corporation
1093 Commerce Park Drive, Suite 100
Oak Ridge, Tennessee 37830

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APPENDIX

A Schematic of Stack

B Schematics of Proposed Test Trains

C Example Data Sheets

D Example Calculations

ACRONYMS

CO	Carbon Monoxide
CEMS	Continuous Emissions Monitoring System
EPA	Environmental Protection Agency
HAP	Hazardous Air Pollutant
HNCC	Haverhill North Coke Company
HRSG	Heat Recovery Steam Generator
MACT	Maximum Achievable Control Technology
OEPA	Ohio Environmental Protection Agency
NO_x	Nitrogen Oxides

1.0 INTRODUCTION

Haverhill North Coke Company (HNCC) utilizes Sun Coke's Thompson heat recovery type of oven to manufacture metallurgical coke. In coke production from both heat recovery and byproduct ovens, the volatile fraction of the coal is driven off in a reducing atmosphere. Coke is essentially the remaining carbon and ash. With byproduct ovens, the volatiles and combustion products are collected downstream of the oven chamber and refined in a chemical plant to produce coke oven gas and other products such as tar, ammonia, and light oils. In heat recovery ovens, all the coal volatiles are oxidized.

Heat recovery steam generators (HRSGs) recover heat from the oven waste gases. The cooled gases pass through a lime spray dryer/baghouse system prior to being exhausted from the main stack. The oven pushing/charging machine travels on rails between ovens during the production cycle. A traveling hood/baghouse system controls emissions from coal charging that escape the ovens. On the opposite side of the ovens from the pushing/charging machine, coke is pushed into a flat push hot car that travels on rails from the oven to the quench tower. A multicyclone captures and controls emissions from pushing the coke into the car and during travel to the quench tower. A baghouse controls particulate emissions from the coke screening and crushing facilities in the coke processing area.

There are currently 200 ovens at HNCC that operate on a 48-hour coking cycle. The operating schedule is arranged such that that half the ovens are charged each day. For example, the 100 even-numbered ovens are charged one day and the 100 odd-numbered ovens are charged the next.

The second 100 ovens at HNCC (P902) were started-up in 2008. Initial compliance tests for P902 are required by the January 2008 final permit to install modification. The sources listed in the permit that require compliance testing include the main waste gas stack, charging machine baghouse stack, pushing hot car multiclone stack, fugitive charging emissions, and fugitive pushing emissions.

The initial compliance tests on the main waste gas stack, charging/pushing machine baghouse stack and pushing hot car were performed on April 6-17, 2009. Unrepresentative conditions may have existed during the test that caused higher than expected NO_x emissions. HNCC believes that a recharacterization of the NOx emissions is warranted.

The purpose of this notification is to provide the notice to Ohio EPA for retesting the main stack for NO_x and CO only. Although less than 30 days, HNCC requests a proposed test date of July 9, 2009, with July 10, 2009 held as a contingency day.

2.0 TESTING

Since emissions from the ovens are essentially continuous, testing on the main stack can be performed anytime. However, if emissions testing is required during the oven pushing and charging, the test can only be performed during production. Each production cycle, on a battery of ovens, consists of pushing and charging 25 ovens. The cycle, repeated at 12-hour intervals, is approximately 3 ½ hours long. The approach presented here for the NO_x and CO testing is to perform 2 of the 3 test runs during the non-production cycle, and the third test run during a production cycle.

2.1 Main Stack

The test requirements are summarized in Table 2-1. The test methods for the main stack are essentially those listed in the permit as described here.

- The following pollutants will be measured simultaneously during each test run: nitrogen oxides (NO_x), carbon monoxide (CO), oxygen (O_2), carbon dioxide (CO_2). The test runs will be a minimum of 1 hour. The continuous emissions monitoring systems (CEMS) will be calibrated prior to the start, and at the conclusion, of each test run.

- The stack exhaust gas flow and moisture content will be measured during each of the three test runs.

Table 2-1

Test Requirements

Emission Unit	Pollutant	Test Method	Comment
Main Stack P902	NO_x	EPA Method 7E	
	CO	EPA Method 10	
	Traverse point layout	EPA Method 1	
	Gas flowrate	EPA Method 2	
	Gas molecular weight	EPA Method 3A	Includes O_2 & CO_2
	Moisture	EPA Method 4	

3.0 TEST SCHEDULE

The test schedule should allow for all three test runs to be performed in one day. The main impact to the test schedule will be to perform one of the three test runs during a production cycle. Once the production schedule is provided to URS, the test team will coordinate with HNCC personnel to perform the first two test runs prior to the production cycle, and one test at the beginning of a production cycle. It is expected that total time to complete all three test runs will be five hours, once the first test run is started.

4.0 TEST REPORT

At the completion of the test project a final engineering report will be issued to HNNC for subsequent submittal to OEPA. The test report will be submitted within 30 days of conducting the test. Provided below is a general description of what will be contained in the report.

- A summary of the test results,
- A description of the technical approach used including EPA reference methods,
- QA/QC procedures,
- All permit-required plant process data,
- All raw data sheets,
- Production data for the process during the compliance tests,
- All calibration data, and
- Formulas used to calculate mass emission rates

5.0 INTENT TO TEST FORMS

The Ohio EPA Intent to Test Forms are attached.

GENERAL TESTING AND REPORTING REQUIREMENTS

Ohio EPA requires that an Ohio Intent to Test ("ITT") form be filed with the appropriate Ohio EPA representative at least 30 days (or more if required by regulation) prior to the testing event. If a test witness is required by Ohio EPA, witnesses are scheduled on a first-come-first-served basis, so test date flexibility may be necessary. Ohio EPA expects to see the required testing and sample recovery/analysis performed per the applicable methods, without any modifications. If ANY modification to the specified test methods, as published, is planned, the modification is required to be detailed in the ITT with justification as to why the modification is necessary. Alternate procedures spelled out within a given method are considered modifications, and must also be noted on the ITT. All proposed modifications are subject to the approval of Ohio EPA, and depending on the nature of the modification, Ohio EPA may require the testing company or facility to obtain written approval of the modification from USEPA. Do not expect Ohio EPA to approve any modifications on-site, or without adequate advance notice.

Incomplete ITTs may be returned for more information.

Below are commonly overlooked testing and reporting requirements. Please review test methods being proposed in the ITT for a complete listing of the requirements that are expected to be met.

TEST EVENT REQUIREMENTS:

All testing

- All field data sheets are to be filled out in pen, not pencil.
- Correction fluid is not permissible on any data sheet. Changes or mistakes are to be corrected with a single line strikeout, and initialed by the person making the change.
- All applicable pre-survey work should be available for review on-site.
- Testing must be scheduled so it can be completed within a normal workday (8:00 am - 4:30 pm). At the discretion of Ohio EPA, other test times may be available, but must be pre-approved. In addition, Ohio EPA expects that testing must begin no later than 12:00 p.m. on the scheduled date, unless an alternative testing time has been pre-approved by Ohio EPA. It is the responsibility of the facility and the stack-testing consultant to ensure that this happens. If testing has not begun by noon, Ohio EPA staff may leave the facility unless, in their professional opinion, the start of testing is imminent. At the point when Ohio EPA staff leave the facility because testing has not begun, the testing shall be rescheduled to a mutually agreed upon date and time.
- Tests must be completed such that each applicable "units of the standard(s)" can be determined.
- All method required leak checks are expected to be completed pursuant to the method(s) being used.
- All Reference Method data being recorded electronically on site must be available in hard-copy form, or on media supplied by personnel completing the testing in a .PDF format.
- For testing that occurs with no Ohio EPA witness present, Ohio EPA reserves the right to require that a copy of all field data collected during a testing event be sent via email in a .PDF format within 24 hours of the end of the testing event.
- Test runs must be made consecutively (back to back), and completed within 24-hour of the start of the test, unless Ohio EPA has pre-approved an alternate test schedule.
- For emissions units that have multiple stacks or outlets, all stacks or outlets must be tested simultaneously for emissions rate determinations. Destruction efficiency determinations require all inlet and outlet points be tested simultaneously.
- It is understandable that a test may need to be postponed due to circumstances that would not allow representative conditions to be established, such as recent maintenance or modification, equipment failure, or the absence of key personnel. However, concern that a test will result in a determination of non-compliance is not a valid reason for postponement, and a facility decision to postpone without a valid reason may result in enforcement action against the facility.

Methods 1-4

- Stack diameter and sample point measurements must be available for review and verification on-site.
- Documentation of compliance with the specifications displayed in Figures 2-2, 2-3, 2-4, 2-7, and 2-8 of EPA Method 2 must be available for review on-site.
- The time of dry molecular weight analysis must be recorded per EPA Method 3, Section 8.2.4
- For emission rate corrections, O2/CO2 measurements are made utilizing an instrumental analyzer or an Orsat analyzer in which the time of analysis is recorded as per EPA Method 3B, Section 8.2.4.

- A meter box check must be performed prior to testing per Section 9.2 of Method 5, and a copy of the meter box calibration made available on-site.
- On-site determination of Method 4 moisture content is required.
- Good condition, indicating-type silica gel must be used for Method 4 moisture determinations. Water in the bottom of the silica gel impinger, or indications of breakthrough in the silica gel, will invalidate the associated test run.

Methods 5, 6, 8 and 29/Isokinetic

- Nozzles used during testing must be made available for on-site verification that Method 5, Section 6.1.1.1 specifications are being met.
- Paperwork indicating that thermocouple and barometric pressure readings are within Method 5 specifications must be available on-site and included in the test report.
- Filter temperature must be monitored by a thermocouple that is in contact with the sample gas stream per EPA Method 5, Section 6.1.1.7. This temperature must also be recorded at a frequency in keeping with other sample train temperatures.
- Equipment must be available to allow for the on-site recovery of the sample probe, impingers and the nozzle.
- All samples recovered for off-site analysis must be sealed and labeled, and a "record of custody" must be completed prior to leaving the site.
- Solutions must be labeled with preparation date and time to confirm compliance with EPA Method 6, Section 7.1.3 / Method 8 Section 7.1.4 / Method 29, Section 7.3.2 requirements.
- Probe temperatures must be recorded.

Method 7E

- On-site NOx converter check pursuant to Section 8.2.4 (or an Ohio EPA prior approved alternative NOx converter check) must be completed prior to each emissions unit-testing event.

Method 9

- Visible emission readers must have photo identification and a copy of their current Method 9 certification paperwork, available for review on-site.

Method 18

- Method 18 spike recoveries must be performed per the specification of the applicable section.
- Spike and recovery analysis must be performed for compliance methane analysis for subtraction from a total VOC number.

Method 25/25A

- The methodology selected for the measurement of VOC must be in accordance with USEPA Emission Measurement Center Guidance Document 033 (GD-033).

Method 26

- The filter temperature must be maintained at 248 degrees Fahrenheit or above.

All instrumental test methods

- Copies of all reference method calibration gas certifications must be available for review on-site. Ambient air, scrubbed or otherwise, will not be allowed for use as a calibration standard (zero air generators will be allowed, however.)
- If a calibration gas dilution system is utilized, Emission Measurement Technical information Center Test Method 205 (EMTIC TM-205) must be performed, on site, to validate system performance prior to testing. Calibration gas dilution systems shall not be used for 40 CFR Part 75 testing events.

Compliance testing using instrumental test methods 6C, 7E, 10 and 20 (and test method 3A when data is being used for anything other than molecular weight determinations)

- With the sample train in the testing configuration, response time tests completed in accordance with test method 7E, Section 8.2.6, must be completed prior to stratification testing, and data must be available for review on site.
- Stratification testing in accordance with test method 7E, Section 8.1.2, must be completed prior to each testing event, and data must be available for review on site.
- All sampling points as dictated by the results of the stratification test are required to be sampled. The sampling time at each point is required to be two times the response time. (Please note that this may cause compliance test runs to last for more than 60 minutes, depending on the response times and the number of points that must be sampled.)

Relative accuracy test audits ("RATA")

- Relative accuracy determinations are required for each unit of the standard.
- Flow and molecular weight determinations, where required to convert data to units of the standard, are required for each RATA run.
- Moisture determinations are required for each RATA run. Ohio EPA may approve the use of one moisture determination for two RATA runs, depending on the type of source/process, but prior approval is required.
- The use of multi-hole sample probes will not be allowed.

REPORTING REQUIREMENTS:

In addition to the above-mentioned conditions, please note that Ohio EPA must receive test results in a report format consistent with the USEPA Emission Measurement Center Guidance Documents 042 and 043 (GD-042 and GD-043) within 30 days of the test event unless additional time is allowed pursuant to permit conditions or rule requirements that have not been incorporated into the permit. Acceptable test reports must contain the following:

All test reports

- Testing data reported in units of the applicable standard(s).
- Names and contact information for all members of the test team.
- Facility representative name and contact information.
- Emission unit identification(s), including Ohio EPA assigned emissions unit I.D.
- Copies of all field data sheets and measurements.
- Copies of the completed "record of custody" for all samples removed from the testing site - if applicable.
- Full outside laboratory reports with supporting documentation (please call if greater than 25 pages long) - if applicable.
- Copies of all relevant emissions unit process/operational data.
- All formulas used in calculating emission rates if different than specified in the applicable reference methods.
- An explanation of all disruptions encountered during the test period, (i.e., Meter box changes, process shutdowns, broken glassware, etc.)
- All applicable pre-survey work should be included in the final test report.
- Production records and parametric monitoring data recorded during testing must be included in the final report.

Methods 1-4

- Copies of the calibrations performed on all Pitots, meter boxes, thermocouples, barometers, balances, and nozzles used during testing and analysis.
- Copies of the certificates verifying the accuracy of the equipment utilized to calibrate the meter boxes and thermocouples utilized during testing.

Method 5

- Copies of the gravimetric analysis performed on the particulate matter samples complete with laboratory conditions (ambient temperature, barometric pressure, humidity, and time of measurement).

Method 7E

- Copies of the on-site converter check performed per EPA Method 7E, Section 8.2.4.

Method 25/25A

- Test results must be reported in terms of actual VOC, and not VOC as carbon or propane, unless specified by the permit.

All continuous emission monitoring system ("CEMS") Methods

- Copies of all gas certification sheets for every calibration gas utilized.
- Response times for every analyzer in the configuration utilized in the field (EPA Method 7E, Section 8.2.6).

All RATA reports must also include:

- The make, model and serial number of each analyzer that is part of the facility CEMS being tested.
- 7-day drift check data for all CEMS that are undergoing initial certification.
- Linearity data, where required, for all CEMS that are undergoing initial certification.
- Relative accuracy determinations must be reported in each required units of the standard(s) for which the CEMS are being used to demonstrate compliance.
- Facility process data indicating that the facility operated at 50 percent or more of the normal load (EPA Performance Specification 2, Section 8.4.1).

Failure to follow the above guidance may result in Ohio EPA rejecting all or part of the associated test or testing results.

INTENT TO TEST NOTIFICATION (One Emissions Unit Per Sheet)

Agency use only	
Date Received	
Assigned	

Facility Premise No. 0773000182

Emissions Unit PTI No. P902

SCC Number NA

Proposed Test Date July 2-3, 2009

Proposed Start Time 08:00, or as process requires

A. Facility Contact Information:

Name Haverhill North Coke Company

Address 2446 Gallia Pike, Franklin Furnace, OH 45692

Contact Person Kris Kinder

Telephone (O) (740) 355-9823 (Cell)

E-mail kkkinder@sunocoinc.com

Testing Firm Information:

Name URS Corporation

Address 1093 Commerce Park Dr., Ste. 100, Oak Ridge, TN 37830

Contact Person Michael Mowery

Telephone (O) (865) 220-8109 (Cell) (865) 310-0439

E-mail michael_mowery@urscorp.com

B. Test Location Information:

Name Unit 2

Contact Person Kris Kinder

Address 2446 Gallia Pike, Franklin Furnace, OH 45692

Telephone (O) (740) 355-9808 (Cell)

C. Test Plan and Emissions Unit Information Table: List the applicable information under each respective column heading.

Emission Unit # / Description	Control Equipment	Monitoring Equipment	Pollutant(s) to be Tested	EPA Test Method(s)	Number of Sampling Points	Total Time for Sample Run	Number of Sampling Runs
P902 Main Stack	Spray Dryer / Baghouse	SO2 CEM, Hg CEM	Gas Flow, Moisture	EPA Methods 1, 2, 4	16 point velocity traverse for flow only	20 min	3
	Spray Dryer / Baghouse	SO2 CEM, Hg CEM	NOx, CO, O2, CO2	EPA Methods 7E, 10, 3A	1	60 min	3

Are *any* modifications, or alternatives as spelled out within the test methods, being proposed? Yes ☐ No ☒ If "no", then no modifications or alternatives, however minor, will be accepted. If yes, list each test method and section being modified, and attach a detailed modification description and justification:

Source is testing to comply with (check all that apply): State PTI ☒ State PTO ☐ Title V ☐ NSPS ☐ MACT ☐ BIF ☐ Title IV ☐ Other (explain)

D. What is the maximum rated capacity or throughput of the emissions unit given in its permit-to-install or permit-to-operate? 48 tons of coal per oven

Has the facility scheduled production or throughput so that the emissions unit can be operated at the maximum capacity given in its permit-to-install or permit-to-operate during the test? Yes ☒ No ☐ If no, attach explanation.

Specify how the operating rate will be demonstrated during testing: The coal is weighed before each oven is charged.

Sampling Location(s): Inlet ☐ Outlet ☒ Simultaneous ☐ Will Cyclonic flow check(s) be conducted? Yes ☒ No ☐

Fuel Sampling: Coal - Proximate ☐ Ultimate ☐ Other ☐ If other, specify: NA

Emission rate to be calculated using: F-Factor ☐ Ultimate Coal Analysis ☐ Other ☐ If other, specify: NA

Has any maintenance or parts replacement been performed on the emissions unit or the control equipment within the last year? Yes ☐ No ☒

If yes, briefly describe:

(Note: Some maintenance, such as installing new filter bags in a baghouse, or replacing the activated carbon in an adsorber, may disqualify the emissions unit from a performance test until a sufficient amount of time has elapsed to ensure a test which will be representative of normal operations.)

E. Sample Train Calibration: All affected measuring and monitoring equipment should be calibrated within 60 days of the scheduled testing.

THE FOLLOWING ADDITIONAL INFORMATION SHALL BE SUBMITTED AS ATTACHMENTS:

F. Sample Train Information:

- A schematic diagram of each sampling train.
- The type or types of capture media to be used to collect each gas stream pollutant. (Include filter specification sheets)
- Sample probe type, (e.g., glass, teflon, stainless steel, etc.)
- Probe cleaning method and solvent to be used, if applicable.

G. Laboratory Analysis:

- A description of the laboratory analysis methods to be used to determine the concentration of each pollutant.

H. Description of Operations:

- A description of any operation, process, or activity that could vent exhaust gases to the stack being tested. This shall include the description and feed rate of all materials capable of producing pollutant emissions used in each separate operation. Maximum process weight rate, or coating rate, and parameters such as line speed, VOC content etc. should be specifically documented with calculations to confirm worst case scenario emissions.

Note 1: All compliance demonstration testing shall be performed at maximum rated capacity as specified by the equipment manufacturer, or at the maximum rate actually used in the emissions unit operation, whichever is greater, or at any other rate as agreed upon with Ohio EPA.

Note 2: If the emissions unit is not operated at maximum capacity, or as close as possible thereto, the emissions unit might be derated to the production capacity achieved during testing.

I. Stack and Vent Description:

- A dimensional sketch or sketches showing the plan and elevation view of the entire ducting and stack arrangement. The sketch should include the relative position of all processed or operations venting to the stack or vent to be tested. It should also include the position of the ports relative to the nearest upstream and downstream gas flow disturbance or duct dimensional change. The sketches should include the relative position, type, and manufacturer's claimed efficiency of all gas cleaning equipment.

- A cross sectional dimensional sketch of the stack or duct at the sampling ports, showing the position of sampling points. In case of a rectangular duct, show division of duct into equal areas.

- For fugitive emissions testing, a sketch illustrating the specific emissions points to be observed must be included.

J. Safety:

- Describe all possible safety hazards including such items as the presence of toxic fumes, high noise levels, areas where eye protection is required, etc. Note: Conditions considered unsafe at the time of the test will cause postponement.

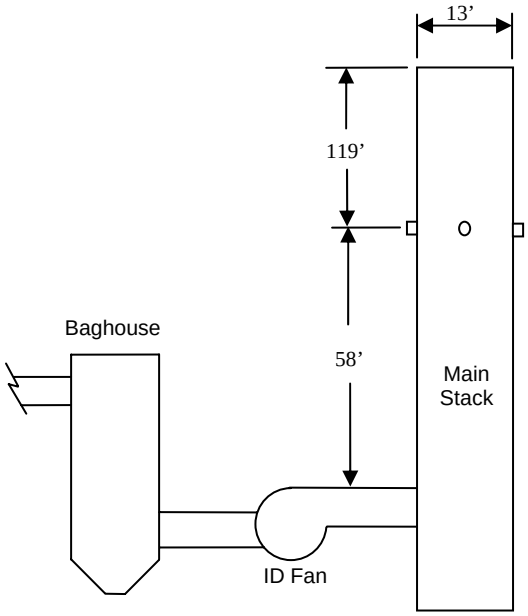
Appendix A

Schematic of Stacks

24 Sample Points Required
4 ports with 6 points each

Traverse Layout

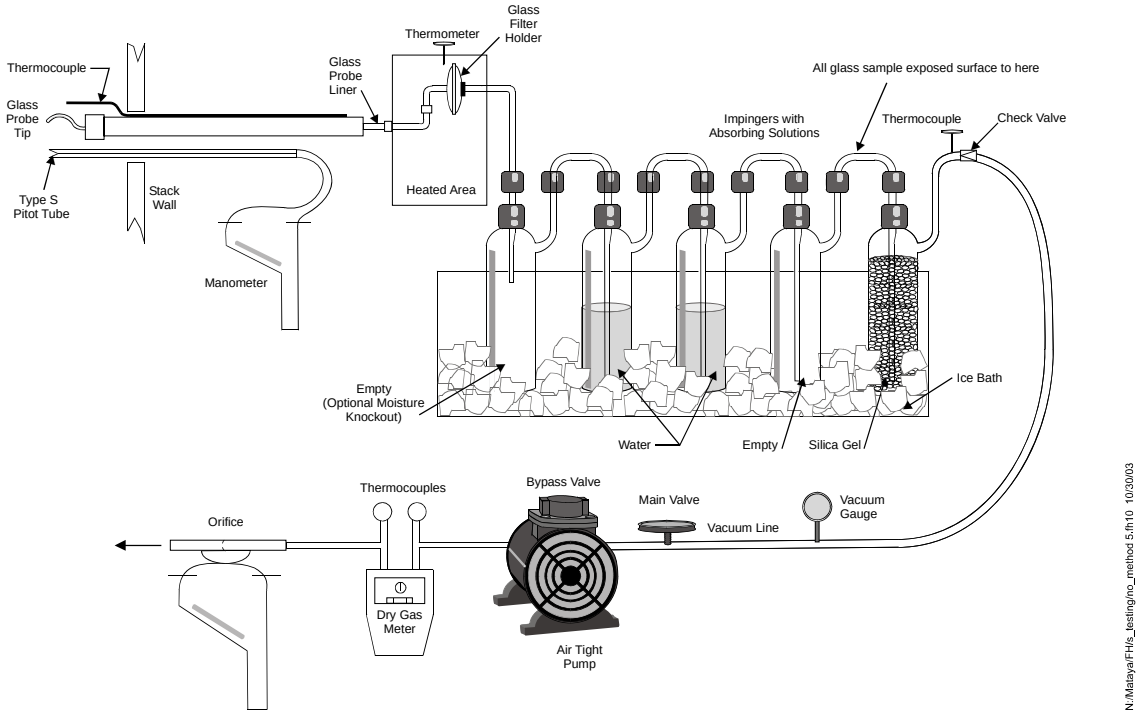
Point	Distance (from wall)
1	3.28
2	10.45
3	18.41
4	27.61
5	39.00
6	55.54



Schematic of Main Stack

APPENDIX B

Schematic of Sample Trains



EPA Method 5 Test Train

Appendix C
Example Data Sheets

URS

STACK TEST DATA SHEET

Method used: __________________

Project: ____________________ Barom. Psr.: ____________________ Stack Dia.: ____________________

Project No: ____________________ Static Psr.: ____________________ Stack Area: ____________________

Source: ____________________ Meter Box I.D.: ____________________ Port Length: ____________________

Run No.: ____________________ Delta H @: ____________________ Port Dia.: ____________________

Date: ____________________ Gamma: ____________________ Probe Liner: ____________________

Operator: ____________________ Pitot Coef.: ____________________ Filter No.: ____________________

TRAVERSE POINT NUMBER	SAMPLING TIME Clock	Sample	VELOCITY DELTA P	SAMPLE DELTA H	GAS SAMPLE VOLUME	DGM TEMP.	STACK TEMP.	PROBE TEMP.	FILTER BOX TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM
AVERAGE											

LEAK CHECKS
Pitot impact:
Pitot static:
Train initial:
Train Final:

NOZZLE MEASUREMENT	
I.D. No.:	
1	
2	
3	
Avg.	

STACK GAS ANALYSIS			
	CO2	O2	
1			
2			
3			
Avg.			

NOTES:

URS

TEST LAB DATA SHEET

PROJECT: _____ JOB NO.: _____

SOURCE: _____ DATE: _____

TRAIN I.D.: _____ TEST NO.: RUN - 1

COLLECTED BY: _____ CHKD. BY: _____

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1			
2			
3			
4			
5			
6			
7			
TOTAL			

NO-NO_x Converter Efficiency Checkout

Date: _____ Location: _____
Project: _____ Technician: _____
Analyzer: _____ Converter Type: _____
Model: _____ Operating Range: _____
S/N: _____

		SPAN	A (90% * SPAN)	NO B (20% * SPAN)	NO_x C	Total NO_x $NO + O_2$ D
Cylinder Number	Cal Gas Concentration	Span Value	Analyzer Response	O_3 Generator Output as "NO"	NO_x Mode Output	O_3 Generator Output Off

EFFICIENCY = (1 + (C-D)/(A-B)) x 100

Converter Efficiency = **#DIV/0!** (Must be greater than 90% conversion)

Procedures

1. Zero Analyzer
2. Connect outlet of the NO_x Generator to the sample inlet of the analyzer with correct operating range.
3. Span gas = 80% NO of range selected, analyzer in NO mode, introduce span gas to NO_x generator inlet and adjust flow on the NO_x generator, record response (SPAN).
4. Start NO_x generator Air Supply, adjust flow so that NO indicated = 90% SPAN, record "A".
5. Power the NO_x generator, adjust Variac so that response is 20% of SPAN and record "B".
6. Switch analyzer to NO_x mode and record "C".
7. Turn AC power off to NO_x generator, maintain gas flow, this is total NO_x "D".
8. Calculate efficiency.

CEM RESPONSE TIME TEST

Date of Test:

Analyzer Type:

S/N:

Span Gas Concentration:

Analyzer Span Setting:

UPSCALE RESPONSE			
	Start	**95% Response**	**Time**
1			
2			
3			
Average Upscale Response			

DOWNSCALE RESPONSE			
	Start	**95% Response**	**Time**
1			
2			
3			
Average Downscale Response			

UPSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable zero to stack gas.

DOWNSCALE RESPONSE = Time required to reach 95% of stable reading shifting from stable high-level cal to stack gas or stable gas to zero.

RESPONSE TIME = The longer of the two mean times.

CEM CALIBRATIONS

PROJECT NAME	
PROJECT NUMBER	
DATE	
RUN NUMBER	
START TIME	
STOP TIME	

ANALYZER SPAN	
CO	500
CO_2	25%
O_2	25%
NO_x	500
SO_2	100
THC	

		CALIBRATION ERROR			SYSTEM BIAS CHECK								
	GAS CYLINDER NUMBER	CAL. GAS VALUE (% or PPM)	ANALYZER RESPONSE (% or PPM)	CAL ERROR (% SPAN)	PRETEST SYSTEM RESP.	PRETEST SYS. BIAS (% SPAN)	POST TEST SYSTEM RESP.	POST TEST SYS. BIAS (% SPAN)	POST TEST DRIFT (% SPAN)	IS CAL ERROR CHECK OK? (YES/NO)	IS PRETEST BIAS OK? (YES/NO)	IS POSTEST BIAS OK? (YES/NO)	IS SYSTEM DRIFT OK? (YES/NO)
CO zero				0.00		0.00		0.00	0.00	YES	YES	YES	YES
CO low				0.00									
CO mid				0.00		0.00		0.00	0.00	YES	YES	YES	YES
CO hi				0.00									
CO_2 zero				0.00		0.00		0.00	0.00	YES	YES	YES	YES
CO_2 low				0.00									
CO_2 mid				0.00		0.00		0.00	0.00	YES	YES	YES	YES
CO_2 hi				0.00									
O_2 zero				0.00		0.00		0.00	0.00	YES	YES	YES	YES
O_2 low				0.00									
O_2 mid				0.00		0.00		0.00	0.00	YES	YES	YES	YES
O_2 hi				0.00									
NO_x zero				0.00		0.00		0.00	0.00	YES	YES	YES	YES
NO_x low				0.00									
NO_x mid				0.00		0.00		0.00	0.00	YES	YES	YES	YES
NO_x hi				0.00									
SO_2 zero				0.00		0.00		0.00	0.00	YES	YES	YES	YES
SO_2 low				0.00									
SO_2 mid				0.00		0.00		0.00	0.00	YES	YES	YES	YES
SO_2 hi				0.00									

Correction factors

CO	Avg. Conc	-	0	*	#DIV/0!
CO_2	Avg. Conc	-	0	*	#DIV/0!
O_2	Avg. Conc	-	0	*	#DIV/0!
NO_x	Avg. Conc	-	0.00	*	#DIV/0!
SO_2	Avg. Conc	-	0.00	*	#DIV/0!

Calibration error = ((cal. gas value - analyzer resp) / analyzer span) * 100: allowable error ± 2 % , ± 5 % for THC

System Bias = ((analyzer resp - system resp) / analyzer span) * 100: allowable error ± 5 %

Drift = ((pretest sys resp - post test sys resp) / analyzer span) * 100: allowable error ± 3 %

Sys Bias (pre and post) must be performed on each run: To determine Drift.
Use zero gas and either mid or hi cal gas, choose cal gas closest to measured stack concentration.

Drift must be performed every hour on THC

Calibration Error is performed only at start, unless allowable error parameters are exceeded.

VELOCITY TRAVERSE DATA SHEET

URS

Project Name: ______________________ Test No.: ______________________

Project No.: ______________________ Location: ______________________

Date: ______________________ Personnel: ______________________

Traverse Point	Velocity Pressure	Stack Temperature
Average		

Stack Dimensions: ______________

Stack Area, As: ______________ FT^2

Barometric Pressure, Pbar: ______________ in. Hg

Static Pressure, Pst: ______________ in. H_2O

Stack Pressure, Ps: (Pst / 13.6) + Pb = ______________ in. Hg

Stack Temperature, Ts: ______________ ^oF

Molecular Weight of Stack Gas, Ms: ______________ Note: (21% O_2 = 28.1 Ms)

Pitot Tube Coefficient, Cp: ______________

Stack Velocity, Vs: 174 * Cp * Sq. Rt. of Delta p * Sq. Rt. of ((29.92 / Ps) * (28.96 / Ms) * (Ts + 460))= __________ ft/min.

Gas Volume Flow (ACFM), V: Vs * As = ______________ ft^3/min.

Gas Volume Flow (SCFM), Vstd: V * (528/(Ts + 460) * (Ps / 29.92) = ______________ SCFM

Pitot Tube Type: ______________ I.D. No.: ______________

Manometer Type: ______________ I.D. No.: ______________

Thermometer Type: ______________ I.D. No.: ______________

Appendix D

Example Calculations

URS

STACK TEST CALCULATIONS

Project:	Client	Barom. Psr.:	27.88		Calculated
Project No:	1	Static Psr.:	-0.2	Ps:	27.865
Source:	Kiln #2	Delta H @:	1.67	As:	77.887
Run No.:	1	Gamma:	1.004	An:	0.000398
Date:	5/4/2006	Pitot Coef.:	0.84		
Sample Volume:	39.35	Stack Dia.:	119.5	,in.	
Sample Time:	60	Nozzle Dia.:	0.27	,in.	
O2 Conc.:	13	H2O Gain:	22.4	,ml	
CO2 Conc.:	8	Part. Weight:	0.0041	,g	

TRAVERSE POINT NUMBER	VELOCITY DELTA P Actual	Sq. Root	DELTA H	DRY GAS METER TEMPERATURE Inlet	Outlet	STACK TEMP.
1	0.42	0.648074	1.5	91		321
2	0.35	0.591608	1.2	91		319
3	0.4	0.632456	1.4	93		322
4	0.4	0.632456	1.4	93		313
5	0.35	0.591608	1.2	95		313
6	0.3	0.547723	1.1	96		317
7	0.35	0.591608	1.2	97		330
8	0.28	0.52915	1	97		344
9	0.28	0.52915	1	97		350
10	0.3	0.547723	1.1	97		363
11	0.28	0.52915	1	99		356
12	0.32	0.565685	1.15	99		355
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
AVERAGE	0.3358333	0.578033	1.1875	95.41667		333.5833

Project: Client
Project No: 1
Source: Kiln #2
Run No.: 1

Stack Sampling Calculations

Volume of Water Collected

Vwstd = (VI0)(0.04707)

Vwstd = 1.05 cubic feet

Volume of Gas Metered, Standard Conditions

Vmstd = ((17.64) (Vm)(Pb + DeltaH/13.6)(gamma))/Tm

Vmstd = 35.092 cubic feet

Moisture Content

Bwo = Vwstd/(Vmstd + Vwstd)

Bwo = 0.03

Molecular Weight of the Dry Gas Stream

Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)

Md = 29.8

Molecular Weight of Stack Gas

Ms = (Md(1-Bwo) + 18(bwo)

Ms = 29.5

Velocity of Stack Gas

Vs = 174 Cp (DeltaP sq.rt.)((Ts+459.6) X 29.92 X 28.96/Ps/Ms)^.5

Vs = 2,444.7 ft/min

Total Flow of Stack Gas

Qa = As X Vs

Qa = 190,411.54 ACFM

Qs = Qa X 528/Ts X Ps/29.92

Qs = 117,987.69 SCFM

Qstd = Qs(1 - Bwo)

Qstd = 114,546.07 DSCFM

Vsstd = Qstd/As

Vsstd = 1470.68 ft/min

Percent Isokinetic

Is = Vmstd/(An X Time X Vsstd)

Is = 1.00

Particulate Concentration

Cs = (15.43)(Mn)/Vmstd

Cs = 0.0018

Particulate Mass Rate

Pmr = (Mn)(Qstd)(60)/(Vmstd)(453.6)

Pmr = 1.77

VELOCITY TRAVERSE CALCULATION SHEET

Note: Manual input only data marked in RED
Client:
Project Number:
Source:
Date:
Velocity Test #:

INPUT PARAMETERS

Barometric Pressure (Pb), in.Hg.	0.00	in, Hg
Avg. Percent CO2	0.0	%
Avg. Percent O2	0.0	%
Avg. Percent CO	0.0	%
Avg. Percent N2	100.0	%
Average Square Root of Delta P	0.0000	in. H_2O
Average Stack Temperature, (T_s)	#DIV/0!	(^oF)
Static Pressure	0.00	in. H_2O
Stack Diameter	0.00	inches
Pressure in the stack, (P_s)	0.00	in Hg
Stack area, (A_s)	0.00	ft^2
Pitot Tube Coeffiecent , (C_p)	0.00	
Average Percent Moisture, (B_{wo})	0.00%	

Point No.	Delta P	Sq. Root Delta P	Stack Temp (F)
1		0.0000	
2		0.0000	
3		0.0000	
4		0.0000	
5		0.0000	
6		0.0000	
7		0.0000	
8		0.0000	
9		0.0000	
10		0.0000	
11		0.0000	
12		0.0000	
13		0.0000	
14		0.0000	
15		0.0000	
16		0.0000	
17			
16			
19			
20			
21			
22			
23			
24			
Average	**#DIV/0!**	**0.0000**	**#DIV/0!**

VELOCITY CALCULATIONS

Molecular Weight of the Dry Gas Stream
Md = (.44)(%CO2) + (.32)(%O2) + (.28)(%CO +%N2)
Md = (0.44)*(0.00) + (0.32)*(0.00) + (0.28)*(100.00)
Md = 28.00 lb/lbmol

Molecular Weight of Stack Gas
Ms = (Md)(1-Bwo) + 18(Bwo)
Ms = (28.00) * (1-0.000) + (18) * (0.000)
Ms = 28.00 lb/lbmol

Velocity of Stack Gas
Vs = 85.49*60*Cp*(①P)$^{0.5}$ [(Ts+460)/Ps/Ms]$^{0.5}$
#VALUE!
#VALUE! ft/min

Total Flow of Stack Gas
Qa = As X Vs
#VALUE!
#VALUE! CFM

Qs = Qa X 528/Ts X Ps/29.92
#VALUE!
#VALUE! SCFM

Qstd = Qs(1 - Bwo)
#VALUE!
#VALUE! DSCFM

Vsstd = Qstd/As
#VALUE!
#VALUE! ft/min

Velocity Test #: 0
VELOCITY TRAVERSE RESULTS

Stack Gas Temperature (F)	#DIV/0!	Stack Velocity (ft/min)	#DIV/0!
Moisture Content (% Vol)	0.00%	Gas Flow Rate (ACFM)	#DIV/0!
CO2 Percent	0.0	Gas Flow Rate (@ wet STP)	#DIV/0!
O2 Percent	0.0	Gas Flow Rate (DSCFM)	#DIV/0!

Gaseous Mass Emission Calculations

Project Name:
Project No.:
Test Date:

INPUT PARAMETERS

Test I.D.	NOx Conc. (ppm)	CO Conc. (ppm)	SO_2 Conc. (ppm)	O_2 Conc. (%)	CO_2 Conc. (%)	THC (ppm)	Flow Rate (dscfm)	NOx Mass Rate (lb/hr)	CO Mass Rate (lb/hr)	SO_2 Mass Rate (lb/hr)	O_2 Mass Rate (lb/hr)	CO_2 Mass Rate (lb/hr)	THC Mass Rate (lb/hr)
1	0.00	0.00	0.00	0.00	0.00	0.00	0	0.000	0.000	0.000	0.000	0.000	0.000

Mass Rate (lb/hr)

MR= (ppm)(mw constant)(Qstd(60)

Mn= grams/sample
Qstd= stack gas flow rate (dscfm)
mw constant for NOx - 1.1949×10^{-7}
mw constant for CO - 7.2753×10^{-8}
mw constant for SO2 - 1.6639×10^{-7}
mw constant for O2 - 8.3114×10^{-8}
mw constant for CO2 - 1.1431×10^{-7}
mw constant for THC (as propane) - 1.1453×10^{-7}