Executive Summary

Dow Silicones Corporation, a subsidiary of the Dow Chemical Company, operates a chemical manufacturing facility in Midland, Michigan. The facility uses a thermal oxidizer with a caustic scrubber and two ionizing wet scrubbers to control emissions. The treatment system includes a continuous emission monitoring system (CEMS) that continuously measures stack gas concentration of nitrogen oxides (NOx), carbon dioxide (CO_2) , oxygen (O_2) , total hydrocarbons (THC) and air flow rate.

An annual Performance Specification Test and VOC compliance test was completed on October 19th, 2021 to certify treatment system CEMS. All treatment system CEMS met required performance specifications. The unit met required permit limits.

An annual compliance test measuring emission of PM_{10} and CO was completed on October 20th, 2021. The unit met required permit limits.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (February 2008). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

The results of the test results are summarized in the tables below RECEIVED

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Performance Deculte for Emission Departing Tage

Performance Result	erformance Results for Emission Reporting Tags		
Monitor	Results	Allowable	Pass/Fail
NOx Mass	3 %	20% RA using RM or	AIR OLIAPARS DILLIS
Emissions	1 %	10% ARA using EL	Pass
(Lb/hr)			Pass
	100 %	20% RA using RM or	Use Alternative
TOC Conc.	2.5 %	10 % ARA	Pass
			Pass
(ppmv @ 3% 02)			Pass

Please note that the relative accuracy performance results for NOx and TOC emission reporting tags reflect the relative accuracy based on a comparison with the reference method and emission reporting tags.

Performance Results for Specific System

Monitor	Results	Allowable	Pass/Fail
NOx Conc.	< 1 %	20% RA using RM or 10% ARA using Fl	Pass
Vol Flow Meter	10 %	20% RA using RM or	Pass
(scfm)		10% ARA using EL	Pass
SIC Flow Meter	2 %	20% RA using RM or	Pass
(scfm)		10% ARA using EL	Pass
	2.1 %	No greater than 20.0% of	Pass
CO3	0.1 %	mean value of RM	Pass
(%)		or the absolute difference between RM and CEMS <= 1.0%	Pass
	4.9 %	No greater than 20.0% of	Pass
02 Conc	0.5 %	mean value of RM	Pass
(%)		or the absolute difference between RM and CEMS <= 1.0%	Pass

Operational Rates during RATA

Run	Run Time	Gas Flow Dry Vent (lb/br)	Gas Flow Wet Vent (lb/br)	Gas Flow MeCl (lb/br)	Gas Flow THROX Out Stack (scfm)	Silicon Loading (lb/br)	Heat Input (mmBtu/hr)
Run 1	1110/1130	1421	426	61	10436	0.45	24.8
Run 2	1131/1151	1461	421	66	9416	0.43	24.6
Run 3	1152/1212	1504	418	60	9777	0.45	24.8
Run 4	1237/1257	1505	447	65	10030	0.48	24.8
Run 5	1258/1318	1506	433	58	10472	0.62	24.7
Run 6	1319/1339	1530	441	69	10129	0.69	24.9
Run 7	1353/1413	1544	461	64	10052	0.52	24.8
Run 8	1414/1434	1508	449	64	9938	0.50	24.8
Run 9	1435/1455	1564	425	66	10019	0.59	24.9
Run 10	1519/1539	1491	437	65	10174	0.50	24.7
Run 11	1540/1600	1466	452	65	10332	0.44	24.6
Run 12	1601/1621	1735	401	66	9875	0.49	25.3
Average	N/A	1520	434	64	10054	0.51	24.8

Emission Results THC

Sample Type	Test Method	Sampling Time (Min/Run)	Allowable Emission Rate	Actual Emission Rate*
VOC Emissions (lb/hr)	EPA Method 25A	60	6.6 lb/hr	< 0.1 lb/hr

* Emissions based on average of three one-hour runs.

Testing Run Data VOC

PARAMETER	RUN 1	RUN 2	RUN 3	AVERAGE
Run Date	10/19/21	10/19/21	10/19/21	N/A
Run Times	1110/1210	1237/1337	1335/1435	N/A
Stack Gas Flow Std Cond (scfm)	9258	9193	9160	9204
Conc. TOC as Carbon (ppmv)	< 2.3	< 2.3	< 2.3	< 2,3
TOC as Carbon Emissions (Lb/Hr)	< 0.1	< 0.1	< 0.1	< 0.1

Please note flow used for VOC emissions are the average of the 3 RATA runs during sample time (for example Run 1 = average of Runs 1-3 during RATA)

Emission Results PM/CO

Sample Type	Test Method	Sampling Time (Min/Run)	Allowable Emission Rate	Actual Emission Rate*
PM ₁₀ as Total Particulate Matter	EPA Method 5/202	60	3.5 lb/hr 13.4 ton/yr	0.3 lb/hr 1.3 ton/yr
Carbon Monoxide	EPA Method 10	60	90 ton/yr	< 1 ton/yr

* Emissions based on average of three one-hour runs.

Testing Run Data PM/CO

PARAMETER	RUN 1	RUN 2	RUN 3	AVERAGE
Run Date	10/20/2021	10/20/2021	10/20/2021	N/A
Run Times	0905/0935	1036/1106	1208/1238	
	0938/1008	1111/1141	1244/1314	N/A
Stack Gas Flow Std Cond (dscfm)	8838	8327	8403	8523
PM Conc (g/dscf)	0.00025	0.00025	0.00026	0.00025
PM Emissions (lb/hr)	0.3	0.3	0.3	0.3
PM Emissions (ton/yr)	1.3	1.2	1.3	1.3
CO Conc (ppmvd)	< 0.6	< 0.6	< 0.6	< 0.6
CO Emissions (ton/yr)	< 1	< 1	< 1	< 1

Operational Rates during PM/CO

Run	Run Time	Gas Flow Dry Vent (lb/hr)	Gas Flow Wet Vent (lb/hr)	Gas Flow MeCl (lb/hr)	Gas Flow THROX Out Stack (scfm)	Silicon Loading (lb/hr)	Heat Input (mmBtu/hr)
Run 1	0905/1008	1644	366	149	19125	0.75	25.5
Run 2	1036/1141	1605	370	132	18712	0.99	25.3
Run 3	1208/1314	1516	382	121	18147	0.94	25.2
Average	N/A	1588	373	134	18661	0.89	25.3

1. Summary of Test Program/Introduction

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Dow Silicones Corporation, a subsidiary of the Dow Chemical Company, operates θ 2021 chemical manufacturing facility in Midland, Michigan. The facility uses a thermal oxidizer with a caustic scrubber and two ionizing wet scrubbers to editrolUALITY DIVISION emissions. The treatment system includes a continuous emission monitoring system (CEMS) that continuously measures stack gas concentration of nitrogen oxides (NOx), carbon dioxide (CO₂), oxygen (O₂), total hydrocarbons (THC) and air flow rate.

An annual compliance test measuring emission of PM₁₀, CO and VOC are required. Additionally, each of the CEMS are required to meet the analyte specific performance specification annually.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (February 2008). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

a) Identification, location and dates of tests

An annual Performance Specification Test/VOC Compliance test was completed on October 19th, 2021 at the Dow Silicones thermal heat recovery oxidation (THROX) unit in Midland Michigan.

An annual compliance test measuring emission of PM_{10} and CO was completed on October 20th, 2021 at the Dow Silicones thermal heat recovery oxidation (THROX) unit in Midland Michigan.

b) Purpose of testing

The purpose of this test was to demonstrate compliance with the regulations for the THROX at Dow Silicones Corporation, a wholly owned subsidiary of Dow in Midland, Michigan. The specific objectives were:

- Determine the relative accuracy of the continuous NOx, O₂, CO₂, THC and flow monitor systems on the THROX stack.
- Determine PM₁₀ (filterable and condensable), CO and VOC emissions.

c) Brief Description of source

The THROX and IWS are utilized to treat emissions from various processes at the chemical facility. The typical feed rate to the THROX is approximately 28 MMBtu/hr. The permitted maximum operating rate for the THROX is 95 MMBTU/hr. The proposed production operating rate for this test is >30 MMBTU/hr.

d) Test program contacts

The contact for the source and test report is:

Ms. Amanda Karapas, Air Specialist The Dow Chemical Company 1400 Building Midland, Michigan 48674 989-708-5405

Names and affiliation of personnel including their roles of the test program is summarized below.

Role	Role Description	Name	Affiliation
Process Focal Point	 Coordinate plant operation during the test Ensure the unit is operating at the agreed upon conditions in the test plan Collect any process data required Provide all technical support related to process operation 	Lindsay White	Dow
Environmental Focal Point	 Ensure all regulatory requirements and citations are reviewed and considered for the testing 	Becky Meyerholt	Dow
Test Plan Coordinator	 Leadership of the sampling program Develop the overall testing plan Determine the correct sample methods. 	Chuck Glenn	Dow
Test Plan Coordinator Back-up	 Leadership of the sampling program Develop the overall testing plan Determine the correct sample methods. 	Spencer Hurley	Dow
Technical Reviewer	Completes technical review of the test data	Michael Abel	Dow
Field Team Leader	 Ensures field sampling meets the quality assurance objectives of the plan 	Randy Reinke	AECOM
Sample Project Leader	 Ensures data generated meets the quality assurance objectives of the plan 	James Edmister	AECOM
Analytical Project Manager	 Oversees laboratory analysis Ensures data generated meets the quality assurance objectives of the plan 	Ashley Miller	Enthalpy

2. Summary of Results

a) Operating Data – See Appendix C for Raw Data

Data during RATA/VOC Compliance

Run	Run Time	Gas Flow Dry Vent (lb/hr)	Gas Flow Wet Vent (lb/hr)	Gas Flow MeCl (lb/hr)	Gas Flow THROX Out Stack (scfm)	Silicon Loading (lb/hr)	Heat Input (mmBtu/hr)
Run 1	1110/1130	1421	426	61	10436	0.45	24.8
Run 2	1131/1151	1461	421	66	9416	0.43	24.6
Run 3	1152/1212	1504	418	60	9777	0.45	24.8
Run 4	1237/1257	1505	447	65	10030	0.48	24.8
Run 5	1258/1318	1506	433	58	10472	0.62	24.7
Run 6	1319/1339	1530	441	69	10129	0.69	24.9
Run 7	1353/1413	1544	461	64	10052	0.52	24.8
Run 8	1414/1434	1508	449	64	9938	0.50	24.8
Run 9	1435/1455	1564	425	66	10019	0.59	24.9
Run 10	1519/1539	1491	437	65	10174	0.50	24.7
Run 11	1540/1600	1466	452	65	10332	0.44	24.6
Run 12	1601/1621	1735	401	66	9875	0.49	25.3
Average	N/A	1520	434	64	10054	0.51	24.8

Data during CO/PM Compliance

Run	Run Time	Gas Flow Dry Vent (lb/hr)	Gas Flow Wet Vent (lb/hr)	Gas Flow MeCl (lb/hr)	Gas Flow THROX Out Stack (scfm)	Silicon Loading (lb/hr)	Heat Input (mmBtu/hr)
Run 1	0905/1008	1644	366	149	19125	0.75	25.5
Run 2	1036/1141	1605	370	132	18712	0.99	25.3
Run 3	1208/1314	1516	382	121	18147	0.94	25.2
Average	N/A	1588	373	134	18661	0.89	25.3

b) Applicable permit number, State Registration Number (SRN) and Emission Unit ID or designation for the source.

- MI-ROP- A4043-2019
 - o PTI 91-07E
 - **FGTHROX**
 - o Vent SV2514-006

c) Results expressed in units consistent with the emission limitation applicable to the source and comparison with emission regulations

All monitors met the Performance Specification Test requirements. The results of the Performance Specification Test are summarized in the tables below.

Monitor	Results	Allowable	Pass/Fail
NOx Mass	3 %	20% RA using RM or	Pass
Emissions	1 %	10% ARA using EL	Pass
(Lb/hr)			Pass
TOO O	100 %	20% RA using RM or	Use ARA
TOC Conc.	2.5 %	10 % ARA	Pass
Emissions (ppmv @ 3% O2)			Pass
			Pass

Performance Results for Emission Reporting Tags

Performance Results for Specific System

Monitor	Results	Allowable	Pass/Fail
NOx Conc.	< 1 %	20% RA using RM or	Pass
(ppmv)		10% ARA using EL	Pass
Vol Flow Meter	10 %	20% RA using RM or	Pass
(scfm)		10% ARA using EL	Pass
SIC Flow Meter	2 %	20% RA using RM or	Pass
(scfm)		10% ARA using EL	Pass
CO2 (%)	2.1 %	No greater than 20.0% of	Pass
	0.1 %	mean value of RM	Pass
		or	
		CEMS <= 1.0%	Pass
	4.9 %	No greater than 20.0% of	Pass
02 Conc. (%)	0.5 %	mean value of RM	Pass
		or	
		the absolute difference between RM and	Pass
		CEMS <= 1.0%	

Testing Run Data TOC

PARAMETER	RUN 1	RUN 2	RUN 3	JN 3 AVERAGE	
Run Date	10/19/21	10/19/21	10/19/21	N/A	
Run Times	1110/1210	1237/1337	1335/1435	N/A	
Stack Gas Wet Flow Std Cond (scfm)	9258	9193	9160	9204	
Conc. TOC as Carbon (ppmv)	< 2,3	< 2,3	< 2,3	< 2,3	
THC as Propane Emissions (Lb/Hr)	< 0.1	< 0.1	< 0.1	< 0.1	

Please note flow used for VOC emissions are the average of the 3 RATA runs during sample time (for example Run 1 = average of Runs 1-3 during RATA)

Testing Run Data PM/CO

PARAMETER	RUN 1	RUN 2	RUN 3	AVERAGE
Run Date	10/20/2021	10/20/2021	10/20/2021	N/A
Run Times	0905/0935	1036/1106	1208/1238	
	0938/1008	1111/1141	1244/1314	<u>N/A</u>
Sampling Time (minutes)	60	60	60	60
Lab Barometric Pressure ("Hg)	29.36	29.36	29.36	29.36
Average Meter Δ H ("H2O)	1.10	0.93	1.03	1.02
Meter Pressure ("Hg)	29.44	29.43	29.44	29.43
Total Gas Volume collected (ft ³)	33,864	32.574	33.586	33.341
Dry Gas Meter Cal Factor	1.026	1.026	1.026	1.026
Average Meter Temperature (deg R)	523	538	538	533
Dry Gas Meter Sample Volume @ STP (ft ³)	34.515	32.260	33.272	33.349
Impinger Weight Gain (g)	83.4	75,0	82,9	80.43
Volume of Water Vapor Collected @ STP (ft ³)	3.932	3.536	3.909	3.792
Moisture Content (mole fraction)	0.102	0.099	0.105	0.102
Moisture Content (%)	10.2%	9.9%	10.5%	10.2%
Dry Gas Fraction	89.8%	90.1%	89.5%	89.8%
Concentration O2, dry basis (%)	10.1	10.1	10.1	10.1
Concentration CO2, dry basis (%)	5.1	5.1	5,1	5.1
Concentration N2, dry basis (%)	84.8	84.8	84.8	84.8
Stack Gas Molecular Weight (wet lb/lb mole)	29.2	29.2	29.2	29.2
Stack Gas Molecular Weight (dry lb/lb mole)	28.1	28.1	28.0	28.1
Measured Static Pressure ("H2O)	-0.03	-0.03	-0.03	-0.03
Absolute Stack Pressure ("Hg)	29.36	29.36	29.36	29.36
AVG (dp)^1/2	0.037	0.033	0.033	0.034
AVG (dp)^1/2	0.191	0.180	0.182	0.184
Average Stack Temperature (deg F)	576	579	576	577
Stack Gas Velocity (ft/s)	11.47	10.82	10.94	11.08
Stack Area (sq ft)	15.90	15.90	15.90	15.90
Stack Gas Wet Flow (acfm)	10946	10326	10440	10571
Stack Gas Wet Flow Std Cond (scfm)	9845	9240	9390	9492
Stack Gas Dry Flow (dscfm)	8838	8327	8403	8523
Nozzle Volume @ Stack Cond (cf/hr)	41.700	38.956	40.325	40.33
% Isokinetic	96.8%	95.9%	98.1%	96.9%
PM Conc (g/dscf)	0.00025	0.00025	0.00026	0.00025
PM Emissions (lb/hr)	0.3	0.3	0.3	0.3
PM Emissions (ton/yr)	1.3	1.2	1.3	1.3
CO Conc (ppmvd)	< 0.6	< 0.6	< 0.6	< 0.6
CO Emissions (ton/yr)	< 1	< 1	< 1	< 1

3. Source Description

a) Description of process, including operation of emission control equipment

The unit is designed to thermally treat vent streams from across the Michigan Operations Site. As necessary, natural gas is used as a supplemental fuel. Destruction of organic compounds takes place in the combustion chamber, which operates at a minimum of 1800°F. The permitted maximum operating rate for the THROX is 95 MMBTU/hr. The typical operating rate is approximately 28 MMBTU/hr.

After the combustion gases exit the oxidizer chamber, they enter the boiler section where heat is recovered to generate steam. Next, the gases enter the quench section, then a packed bed absorber. The absorber uses caustic water to neutralize hydrogen chloride in the vapor. Finally, the gases pass through two (2) ionizing wet scrubbers in series. The ionizing wet scrubbers remove particulate by passing the stream through a charged field. The particles become charged and are attracted to the charged plates, then they are removed by a continuous flow of water down the plates and through the packed beds.



Process flow sheet or diagram

b) Type and quantity of raw and finished materials processed during the tests

THROX and its associated air pollution control equipment are utilized to treat emissions from various processes at the chemical facility

c) Maximum and normal rated capacity of the process

During the performance tests, the unit will be operated at greater than 50% of normal operating rates. The operating rate for this unit will be determined based on mmBtu/Hr rate.

Parameter	Maximum	Normal	Actual
Heat Input (mmBtu/hr) During RATA/VOC	~ 95 mmBtu/hr	~ 28 mmBtu/hr	~ 25 mmBtu/hr
Heat Input (mmBtu/hr) During CO/PM	~ 95 mmBtu/hr	~ 28 mmBtu/hr	~ 25 mmBtu/hr

d) A description of process instrumentation monitored during the test

Process Variable	Process Tag Unit
NOx (ppm)	ppm
THC (ppm)	ppm
CO2 (%)	%
02 (%)	%
Flow (scfm) – monitoring solutions	scfm
Flow (scfm) – SIC	scfm
Total Feed (mmbtu/hr)	mmbtu/hr
Gas Dry Flow Vent	lb/hr
Gas Wet Flow Vent	lb/hr
Gas Flow MeCl	lb/hr
Silicon Loading	lb/hr

4. Sampling and Analytical Procedures

a) Description of sampling train(s), field procedures, recovery and analytical procedures

Relative Accuracy Test Methods

The relative accuracies of the CEMS will be determined by comparison to EPA methods for measurement of each component gas. The performance specifications (PS) require the use of the following methods:

- PS 2 Method 7E for NO_x;
- PS 3 Method 3A for O₂;
- PS 3 Method 3A for CO₂;
- PS 6 Methods 1, 2, 3 and 4 for flow; and
- PS 8 Method 25A for THC

Procedures

Relative Accuracy

The above methods were performed using mobile continuous emission monitors provided by The Dow Chemical Company internal testing team. Gas was withdrawn from the stack and transported to monitors located at ground level. A stainless-steel probe was inserted into the stack and used to collect sample gas. A Teflon sample line heated to 250°F transported sample gas from the probe to the analyzers. The analyzers were kept at a constant temperature inside the mobile laboratory.

Sample gas was collected continuously from the stack for a period of 21 minutes. Although the data supports no stratification, sampling was completed at three traverse points with probe movement completed every 7 minutes. At the mobile laboratory, the stack gas is routed to a condenser and then transported to the analyzers for analysis.

The Relative Accuracy Tests was conducted by comparison of the CEMS response to a value measured by a Performance Test Method (PTM) which, in this case, was Method 7E for NOx, EPA Method 25A for THC, EPA Methods 1-4 for Flowrate and 3A for O_2 .

EPA Method 1 (Sample Point Determination)

The number and location of traverse points in the stack was determined according to the procedures outlined in EPA Method 1.

EPA Method 2 (Flue Gas Velocity and Volumetric Flow Rate)

The flue gas velocity and volumetric flow rate was determined according to the procedures outline in 40 CFR 60, Appendix A, EPA Method 2. Velocity measurements were made using S-type pitot tubes conforming to the geometric specifications outlined in EPA Method 2. Differential pressures were measured with a low-flow manometer. Flue gas temperature, velocity, and volumetric flow rate data was recorded.

EPA Method 3A (Flue Gas Composition and Molecular Weight)

EPA Method 3A (Instrumental Method) was utilized to determine the diluent during each run on the outlet.

An analyzer measured O_2 content on the basis of the strong paramagnetic properties of O_2 relative to other compounds present in combustion gases. In the presence of a magnetic field, O_2 molecules become temporary magnets. The analyzer determines the sample gas O_2 concentration by detecting the displacement torque of the sample test body in the presence of a magnetic field.

An analyzer measured CO_2 based on its absorption of infrared radiation. The infrared unit uses a single beam, single wavelength technique, with wavelength selection being achieved by a carefully specified narrow band optical filter making it highly selective for CO_2 measurement in the presence of other infrared-absorbing gases.

EPA Method 4 (Moisture)

A calibrated Method 5 console pulled stack gas samples through a Method 5 probe equipped with a glass liner to determine percent moisture of the stack gas. Stack gas was bubbled through two impingers containing water, one empty impinger, and one impinger containing silica gel. All of the impingers were weighed prior to sampling. The impinger train was kept iced in order to knock out all moisture in the stack gas. After the final leak check following each run, the exterior of the impingers were dried off and the impingers were weighed to determine percent moisture.

EPA Method 7E (NO_X Sampling and Analysis)

EPA Method 7E was utilized to determine nitrogen oxide concentrations during each run on the outlet.

An analyzer measured NOx using chemiluminescence technology. Ozone is combined with nitric oxide to form nitrogen dioxide in an activated state. The activated NO_2 luminesces broadband visible to infrared light as it reverts to a lower energy state. A photomultiplier and associated electronics counts the photons that are proportional to the amount of NO present. Since the stream contains both NO and NO₂, the amount of nitrogen oxide (NO₂) must first be converted to nitric oxide, NO, by passing the sample through a converter before the above ozone activation reaction is applied. The above reaction yields the amount of NO and NO₂ combined in the air sample.

Please note Dow Silicones Corporation has elected to complete a post-run bias and drift assessment after each set of three 21-minute runs for all analytes as allowed in EPA Method 7E 8.5 for all gas phase analyzer methods. EPA Method 7E section 8.5 reads as follows:

Post-Run System Bias Check and Drift Assessment. How do I confirm that each sample I collect is valid? After each run, repeat the system bias check or 2-point system calibration error check (for dilution systems) to validate the run. Do not make adjustments to the measurement system (other than to maintain the target sampling rate or dilution ratio) between the end of the run and the completion of the post-run system bias or system calibration error check. Note that for all post-run system bias or 2-point system calibration error checks, you may inject the low-level gas first and the upscale gas last, or vice-versa. You may risk sampling for multiple runs before performing the post-run bias or system calibration error check provided you pass this test at the conclusion of the group of runs. A failed final test in this case will invalidate all runs subsequent to the last passed test.

EPA Method 25A (Total VOC Sampling and Analysis)

EPA Method 25A was utilized to determine total THC as propane concentrations during each run on the outlet.

A gas sample is extracted from the source through a heated line to a flame ionization analyzer (FIA). Results were reported as volume concentration to carbon equivalent as found in EPA M25A.

	Process	CEMS	Instr	uments
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Toccas dellas institumenta				
Monitor System	EQUIPMENT	ID #		
Oxygen FGTHROX	Brad Gaus Model 4705	S/N: 10687		
Carbon Dioxide FGTHROX	California Analytical Instruments Model ZRE	S/N: N4K1905		
Total Hydrocarbon FGTHROX	California Analytical Instruments Model 700 HFID	S/N: 2008015		
Nitrogen Oxides FGTRHOX	Thermo Scientific Model 42I	S/N: 0733125534		
Air Flow FGTHROX	Monitoring Solutions Model CEM Flow	S/N: 012808-000-1017		
Air Flow FGTHROX	SIC Model FLSE100- PK17835HSHS	S/N: 13488341		

Performance Test

The PM₁₀ and CO emissions were determined using the following methods:

- Methods 1-4 for volumetric flow rate;
- Methods 5 and 202 for PM₁₀ (filterable and condensable);
- Method 10 for CO; and
- Method 25A for THC as Propane

EPA Method 1 (Sample Point Determination) EPA Method 2 (Flue Gas Velocity and Volumetric Flow Rate) EPA Method 3A (Flue Gas Composition and Molecular Weight) EPA Method 4 (Moisture) EPA Method 25A (Total VOC Sampling and Analysis)

Same description as mentioned above. However, all readings were completed over a one-hour period for three test runs.

EPA Method 10 (CO Sampling and Analysis)

EPA Method 10 was utilized to determine carbon monoxide concentrations during each run on the outlet.

An analyzer measured CO based on its absorption of infrared radiation. The infrared unit uses a single beam, single wavelength technique, with wavelength selection being achieved by a carefully specified narrow band optical filter making it highly selective for CO measurement in the presence of other infrared-absorbing gases.

EPA M202 in Conjunction with EPA M5 (Filterable and Condensable Particulate Matter Sampling and Analysis)

EPA Method 202 was utilized in conjunction with EPA Method 17 to determine both filterable (FPM) and condensable particulate matter (CPM) concentrations during each run on the outlet.

Using EPA Method 5 methodology, filterable particulate matter (FPM) is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at stack temperature. The FPM mass is determined gravimetrically after the removal of uncombined water.

EPA Method 202 methodology is used to collect condensable particulate matter (CPM) in dry impingers after filterable PM has been collected on a filter maintained as specified in Method 5 of appendix A-6 to part 60. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter are then taken to dryness and weighed. The total of the impinger fractions and the CPM filter represents the CPM. Analysis for FPM and CPM will be completed by Enthalpy Analytical.

b) Dimensioned sketch showing all sampling ports in relation to breeching and to upstream and downstream disturbances or obstruction of gas flow



c) Sketch of cross-sectional view of stack indicating traverse point locations and exact stack dimensions

Isokinetic 12 Point Circular Traverse Layout for Outlet

Division: MIOP Facility/Block: DSC 2514 THROX

Stack ID: 54 inches Port Ext: 6 inches

Duct Downstream Length: 50 Feet Duct Upstream Length: 25 Feet Duct Downstream Diameters: 11 Diameters Duct Upstream Diameters: 5.5 Diameters

Traverse Point	Stack ID	Port Ext	Traverse Pt Distance	Traverse Pt Distance ६	Final Probe Mark
1	54	6	2 6/16	2 6/16	8 6/16
2	54	6	7 14/16	7 14/16	13 14/16
3	54	6	16	16	22
4	54	6	38	38	44
5	54	6	46 2/16	46 2/16	52 2/16
6	54	6	51 10/16	51 10/16	57 10/16

5. Test Results and Discussion

a) Detailed tabulation of results including process operating conditions and flue gas conditions

Detailed results can be found in section 2(c).

b) Discussion of significance of results relative to operating parameter and emission regulations

All CEM systems were within in allowed ranges. All air permit limits were achieved during sampling.

c) Discussion of variations from normal sampling procedures or operating condition which could have affected the results.

d) Discussion of any process or control equipment upset condition which occurred during test

N/A

e) Description of any major maintenance performed on the air pollution devices during the three-month period prior to testing

The unit was shut down for maintenance during the month of September which included safety system testing and regulatory inspections. No major equipment was modified during the three months period prior to testing.

f) In the event of a re-test, a description of any changes made to the process or air pollution devices since the last test.

N/A

g) Results of any quality assurance audit sample analysis required by the reference method

N/A

h) Calibration sheets for the dry gas meter, orifice meter, pitot tube and any other equipment or analytical procedure that require calibration

All calibration verification information is located in Appendix B.

i) Sample calculations of all formulas used to calculate the results

Absolute Meter Pressure

$$P_M = P_B + \left(\frac{P_O}{13.6}\right)$$

Where: P_M = Absolute Dry Gas Meter Pressure (in. Hg) P_B = Barometric Pressure (in Hg) P_O = Average Meter Differential Pressure (in H2O)

Run #1 Example 10/19/21

$$P_M = 29.38 "Hg + \left(\frac{1.00 "H_2O}{1}\right) \left(\frac{1 "Hg}{13.6 "H_2O}\right) = \frac{29.45 "Hg}{29.45 "Hg}$$

Dry Gas Meter Sample Volume @ STP

$$V_{M_{STD}} = \frac{(V_M)(DGMC)(P_M)(T_{STD})}{(P_{STD})(T_M)}$$

Where: $V_{M_{STD}}$ = Dry Gas Meter Sample Volume @ STP (scf) V_M = Dry Gas Meter Sample Volume (cf) DGMC = Dry Gas Meter Correction Factor (dimensionless) P_M = Absolute Dry Gas Meter Pressure (in H2O) T_{STD} = Absolute Standard Temperature, 528 (°R) P_{STD} = Absolute Standard Pressure, 29.92 (in Hg) T_M = Average Dry Gas Meter Temperature (°R)

Run #1 Example 10/19/21

$$V_{M_{STD}} = \frac{(32.73 \, ft^3)(1.026)(29.45 \, "Hg)(528 \, °R)}{(29.92 \, "Hg)(543 \, °R)} = \frac{32.14 \, scf}{2000 \, schology}$$

Volume of Water Vapor Collected (Volume @ STP)

$$V_{W_{STD}} = (K_2)(Vic_G)$$

Where: $V_{W_{STD}}$ = Volume of Water Vapor Collected @ STP (scf) K_2 = Standard Volume H2O Vapor/Unit Weight Liquid, 0.04715 (cf/g) Vic_G = Total Condensate Collected (g)

$$V_{W_{STD}} = \left(\frac{0.04715 \, cf}{g}\right) \left(\frac{77.6 \, g}{1}\right) = \frac{3.659 \, scf}{1}$$

Moisture Content (Mole Fraction)

$$B_{WS} = \left(\frac{V_{W_{STD}}}{V_{W_{STD}} + V_{M_{STD}}}\right)$$

Where: B_{WS} = Moisture Content (mole fraction) $V_{M_{STD}}$ = Dry Gas Meter Sample Volume @ STP (scf)

 $V_{W_{STD}}$ = Volume of Water Vapor Collected @ STP (scf)

Run #1 Example 10/19/21

 $B_{WS} = \left(\frac{3.659\,scf}{3.659\,scf + 32.14\,scf}\right) = \underline{0.1022\,mole\,fraction}$

Moisture Content (% Fraction)

$$B_{WD} = (B_{WS})(K_3)$$

Where: B_{WD} = Moisture Content (% Vol) B_{WS} = Moisture Content (mole fraction) K_3 = Conversion Factor (100 %)

Run #1 Example 10/19/21

 $B_{WD} = (0.1022 \text{ mole})(100 \%) = 10.2 \%$

Sample Molecular Weight (lb/lb mole dry)

 $M_D = (0.44)(\% CO_2) + (0.32)(\% O_2) + (0.28)(\% N_2 + \% CO)$

Where: M_D = Sample Gas Molecular Weight, Dry Basis (lb/lb mole)
 $\% CO_2$ = Carbon Dioxide Concentration (%)0.44= Molecular Weight of Carbon Dioxide, divided by 100% (lb/lb mole)
 $\% O_2$ = Oxygen Concentration (%)0.32= Molecular Weight of Oxygen, divided by 100% (lb/lb mole)
 $\% N_2$ = Nitrogen Concentration (%)0.28= Molecular Weight of Nitrogen, divided by 100% (lb/lb mole)
% CO= Carbon monoxide Concentration (%)0.28= Molecular Weight of Carbon Monoxide, divided by 100% (lb/lb mole)
% CO0.28= Molecular Weight of Carbon Monoxide, divided by 100% (lb/lb mole)

Run #1 Example 10/19/21

 $M_D = (0.44)(5.2\%) + (0.32)(10.0\%) + (0.28)(84.8\%) = 29.2 \ lb/lb \ mole \ dry$

Sample Molecular Weight (lb/lb mole wet)

$$M_S = (M_D)(1 - B_{WS}) + (18.0)(B_{WS})$$

Where: M_S = Sample Gas Molecular Weight, Wet Basis (*lb/lb mole*)

 M_D = Sample Gas Molecular Weight, Dry Basis (*lb/lb mole*)

 B_{WS} = Moisture Content (mole fraction)

Run #1 Example 10/19/21

$$M_{S} = \left(\frac{29.2 \ lb}{lb \ mole}\right)(0.898 \ mole) + \left(\frac{18.0 \ lb}{lb \ mole}\right)(0.1022 \ mole) = \frac{28.1 \ lb/lb \ mole}{28.1 \ lb/lb \ mole}$$

Absolute Stack Pressure

$$P_S = (P_B) + \left(\frac{S_P}{K_1}\right)$$

Where: P_S = Absolute Stack Gas Pressure (in Hg)

 P_B = Barometric Pressure (in Hg)

 S_P = Static Pressure of Gas Stream (in H2O)

 K_1 = Conversion Factor, 13.6 (*in H20/in Hg*)

Run #1 Example 10/19/21

$$P_{S} = 29.38 "Hg + \left(\frac{-0.070 "H_{2}O}{1}\right) \left(\frac{1 "Hg}{13.6 "H_{2}O}\right) = \frac{29.37 "Hg}{29.37 "Hg}$$

Stack Gas Velocity

$$V_S = (K_P)(C_P)(D_P)\left(\sqrt{\frac{T_S}{(M_S)(P_S)}}\right)$$

Where: V_S = Stack Gas Velocity (ft/sec)

$$K_P = \text{Pitot Tube Constant, 85.49} \frac{ft}{sec} \sqrt{\frac{(lb/lb \ mol)("\ Hg)}{(^{\circ}R)("\ H_2O)}}$$

$$C_P$$
 = Pitot Tube Coefficient, 0.84 (dimensionless)

 D_P = Avg. Sq. Root of Velocity Head (in H2O)

 T_S = Stack Temperature (°R)

 M_s = Sample Gas Molecular Weight, Wet Basis (*lb/lb mole*)

 P_S = Absolute Stack Gas Pressure (in Hg)

$$V_{S} = (85.49)(0.84)(0.180 "H_{2}O)\left(\sqrt{\frac{577 \ ^{\circ}R}{(28.1 \ lb/lb \ mole)(29.37 "Hg)}}\right) = \frac{10.8 \ ft/sec}{10.8 \ ft/sec}$$

Stack Cross-Sectional Area

$$CSA = \left(\frac{\pi}{1}\right) \left(\frac{D}{2}\right)^2 \left(\frac{1 f t^2}{144 i n^2}\right)$$

Where: CSA = Stack Cross-Sectional Area (sq ft)

 π = Constant, 3.1416 (dimensionless)

D = Stack Diameter (in)

 K_4 = Conversion Factor, 144 (in^2/ft^2)

Run #1 Example 10/19/21

$$CSA = \left(\frac{\pi}{1}\right) \left(\frac{54 \text{ in}}{2}\right)^2 \left(\frac{1 \text{ ft}^2}{144 \text{ in}^2}\right) = \frac{15.90 \text{ ft}^2}{144 \text{ in}^2}$$

Volumetric Flow Rate (cfm - wet basis)

$$Q_{ACT} = (V_S)(CSA)(K_5)$$

Where: Q_{ACT} = Volumetric Flow Rate, Wet Basis (cfm)

CSA = Stack Cross-Sectional Area (sq ft)

 V_s = Stack Gas Velocity (ft/sec)

 K_5 = Conversion Factor, 60 (*sec/min*)

$$Q_{ACT} = \left(\frac{10.8 \, ft}{sec}\right) \left(\frac{15.9 \, ft^2}{1}\right) \left(\frac{60 \, sec}{1 \, min}\right) = \frac{1.03 \times 10^4 \, cfm}{1000 \, cfm}$$

Volumetric Flow Rate (scfm - wet basis)

$$Q_{WC} = \frac{(Q_{ACT})(P_S)(T_{STD})}{(P_{STD})(T_S)}$$

Where: Q_{WC} = Volumetric Flow Rate, Wet Basis (scfm) Q_{ACT} = Volumetric Flow Rate, Wet Basis (cfm) P_S = Absolute Stack Gas Pressure (in Hg) T_S = Stack Temperature (°R)

$$Q_{WC} = \frac{(1.03 \times 10^4 \ cfm)(29.37 \ "Hg)(528 \ ^\circ R)}{(29.92 \ "Hg)(577 \ ^\circ R)} = \frac{9.26 \times 10^3 \ scfm}{2000}$$

$$Q_{SM} = \left(\frac{9.26 \times 10^3 \, scf}{1 \, min}\right)(0.898) = \frac{8.31 \times 10^3 \, dscfm}{1 \, min}$$

Analyzer Calibration Error Calculations

The calibration error test consisted of challenging each reference monitor at three measurement points against known calibration gas values. Calibration error is calculated using the following equation:

$$CE_{RM} = \frac{|Analyzer \, Response - Calibration \, Gas \, Value|}{Span \, of \, Analzyer} \times 100$$

Reference NOx Calibration Error Example 10/19/21

 $CE_{RM} = \frac{|0.07 \ ppmv - 0.0 \ ppmv|}{122.50 \ ppmv} \times 100 = \underline{0.1 \ \%}$ $CE_{RM} = \frac{|60.80 \ ppmv - 60.66 \ ppmv|}{122.50 \ ppmv} \times 100 = \underline{0.1 \ \%}$ $CE_{RM} = \frac{|123.00 \ ppmv - 122.50 \ ppmv|}{122.50 \ ppmv} \times 100 = \underline{0.4 \ \%}$

System Calibration Bias Calculations

The system bias calibration test consisted of challenging the reference sample system at two measurement points against the local calibration values. Calibration bias calculations for the reference sample system are calculated using the following equation:

 $CB_{RM} = \frac{|System \ Calibration \ Response - Analzyer \ Calibration \ Response|}{Span \ of \ Analzyer} \times 100$

Reference NOx System Bias Run #1 Example 10/19/21

$$CB_{RM} = \frac{|0.78 \ ppmv - 0.07 \ ppmv|}{122.50 \ ppmv} \times 100 = \frac{0.6 \ \%}{122.50 \ ppmv}$$
$$CB_{RM} = \frac{|60.05 \ ppmv - 60.80 \ ppmv|}{122.50 \ ppmv} \times 100 = \frac{0.6 \ \%}{122.50 \ ppmv}$$

Calibration Drift Calculations

The calibration drift tests were conducted at the beginning and end of each run. Analyzer maintenance, repair or adjustment could not be completed until the system calibration response was recorded. Calibration drifts for the reference is calculated using the following equation:

$$CD_{RM} = rac{|Final System Cal Response - Initial System Cal Response|}{Span of Analzyer} imes 100$$

Reference NOx Calibration Drift Run #1 Example 10/19/21

 $CD_{RM} = \frac{|0.56 \, ppmv - 0.78 \, ppmv|}{122.50 \, ppmv} \times 100 = \ \underline{0.2 \ \%}$

$$CD_{RM} = \frac{|61.74 \ ppmv - 60.05 \ ppmv|}{122.50 \ ppmv} \times 100 = \ \underline{1.4 \ \%}$$

System Calibration Drift Correction

The gas concentrations are corrected for the system calibration bias. The concentrations are calculated using the following equations:

$$C_{Gas} = \left(\overline{C} - C_0\right) \left(\frac{C_{MA}}{C_M - C_0}\right)$$

where: C_{Gas} = Effluent Concentration, dry ppm or %

 \overline{C} = Average Analyzer Concentration, ppm or %

- C_o = Average Initial and Final System Calibration Responses for Zero Gas, ppm or %
- C_M = Average Initial and Final System Calibration Responses for Upscale Calibration Gas, ppm or %

 C_{MA} = Actual Concentration of Upscale Calibration Gas, ppm or %

NOx System Calibration Drift Correction for Run #1 Example 10/19/21

$$C_{Gas} = (49.19 \, ppmv - \, 0.67 \, ppmv) \left(\frac{60.66 \, ppmv}{60.90 \, ppmv - \, 0.67 \, pmv}\right) = \frac{48.9 \, ppmv}{48.9 \, ppmv}$$

NOx, CO and VOC Outlet Emission Rate

$$E_{Gas} = \frac{(C_{Gas})(Q_{SD})(Gas_{MW})(28.32 \ L/ft^3)}{(10^6 \ ppmv)(24.056 \ L/mol)(453.6 \ g/lb)}$$
$$E_{THC} = \frac{(THC_{Gas})(Q_{SW})(Gas_{MW})(28.32 \ L/ft^3)}{(10^6 \ ppmv)(24.056 \ L/mol)(453.6 \ g/lb)}$$

where: E_{Gas} = Emission of Gas, (lb/hr) E_{TOC} = Emission of TOC, (lb/hr) C_{Gas} = Concentration of Gas, (dry ppmv) TOC_{Gas} = Concentration of TOC Gas, (wet ppmv) Q_{SD} = Stack Gas Flow @ Std. Conditions, dry basis (dscf/hr) Q_{SW} = Stack Gas Flow @ Std. Conditions, wet basis (scf/hr) Gas_{MW} = Molecular Weight of Gas (g/g mol) Where: CO_{MW} = Molecular Weight of CO (28.01 g/g mol) NOx_{MW} = Molecular Weight of NOx (46.01 g/g mol) VOC_{MW} = Molecular Weight of VOC as Carbon (16.04 g/g mol)

NOx Emissions Calculation RATA Run #1 10/19/21

$$E_{NOx} = \frac{(48.9 \, ppmvd)(8315 \, dscf/m)(60 \, min)(46.01 \, g/g \, mol)(28.32 \, L/ft^3)}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{2.9 \, lb/hr}{2.9 \, lb/hr}$$

VOC Mass Emissions Calculation Run #1 10/19/21

$$E_{TOC} = \frac{(<2.3 \, ppmvw)(9258 \, scf/m)(60 \, min)(44.01 \, g/g \, mol)(28.32 \, L/ft^3)}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(24.056 \, L/mol)(1 \, hr)(453.6 \, g/lb)} = \frac{<0.1 \, lb/hr}{(10^6 \, ppmv)(1 \, hr)(1 \, hr$$

CO Mass Emissions Calculation Run #1 10/20/21

$$E_{co} = \frac{(<0.6 \ ppmvd)(8838 \ dscf/m)(60 \ min)(28.01 \ g/g \ mol)(28.32 \ L/ft^3)}{(10^6 \ ppmv)(24.056 \ L/mol)(1 \ hr)(453.6 \ g/lb)} = \frac{<0.1 \ lb/hr}{E_{coT}}$$
$$E_{coT} = \left(\frac{<0.1 \ lb}{hr}\right) \left(\frac{ton}{2000 \ lb}\right) \left(\frac{24 \ hr}{1 \ day}\right) \left(\frac{365 \ day}{yr}\right) = \frac{<1 \ ton/yr}{1 \ ton/yr}$$

Standard Deviation

The standard deviation between the nine runs chosen should be calculated. The following equation was used to calculate standard deviation:

$$S_D = \sqrt{\left[\frac{(Sum \ of \ d^2) - \frac{(Sum \ of \ d)^2}{n}}{n-1}\right]}$$

Where: Sd

d

 Γ

r

r----

= Standard deviation of nine selected runs

- Arithmetic difference between CO2 corrected Reference Method NOx values and CEMS NOx values
- *n* = Number of sample runs used for standard deviation calculation

NOx Mass Emissions Standard Deviation

$$Sd = \sqrt{\frac{(0.05 \ lb/hr) - \frac{(0.5 \ lb/hr)^2}{9}}{(9-1)}} = \frac{0.053 \ lb/hr}{0.053 \ lb/hr}$$

TOC Standard Deviation

$$Sd = \sqrt{\frac{(2.250 \ ppmv) - \frac{(4.50 \ ppmv)^2}{9}}{(9-1)}} = \frac{0.00 \ ppmv}{100}$$

Vol Flow Standard Deviation

$$Sd = \sqrt{\frac{(5714064\,scfm) - \frac{(7026\,scfm)^2}{9}}{(9-1)}} = \frac{169.1\,scfm}{10}$$

SIC Flow Standard Deviation

$$Sd = \sqrt{\frac{(169785.4 \, scfm) - \frac{(1057.8 \, scfm)^2}{9}}{(9-1)}} = \frac{75.4 \, scfm}{75.4 \, scfm}$$

CO2 Standard Deviation

$$Sd = \sqrt{\frac{(0.06\%) - \frac{(0.6\%)^2}{9}}{(9-1)}} = 0.050\%$$

O2 Standard Deviation

$$Sd = \sqrt{\frac{(1.89\%) - \frac{(4.1\%)^2}{9}}{(9-1)}} = 0.05\%$$

Confidence Coefficient

The 95% confidence coefficient of the runs chosen should be calculated. The factors of 2.201 and 2.306 come from Table 2.1 (t-value table) of the 40 CFR Part 266, Appendix IX. The following equation was used to calculate the confidence coefficient:

$$CC = 2.306 \text{ or } 2.201 \times \left(\frac{S_D}{\sqrt{n}}\right)$$

Where: *CC* = Confidence Coefficient

Sd = Standard deviation of nine selected runs

= Number of sample runs used for standard deviation calculation n

NOx Mass Emissions Confidence Coefficient

$$CC = (2.306) \left(\frac{0.053 \ lb/hr}{\sqrt{9}} \right) = \frac{0.041 \ lb/hr}{1000}$$

TOC Confidence Coefficient

 $CC = (2.306) \left(\frac{0.00 \, ppmv}{\sqrt{9}} \right) = \underline{0.00 \, ppmv}$

Vol Flow Confidence Coefficient

$$CC = (2.306) \left(\frac{169.11 \, scfm}{\sqrt{9}} \right) = \frac{129.99 \, scfm}{129.99 \, scfm}$$

SIC Flow Confidence Coefficient

$$CC = (2.306) \left(\frac{75.38 \ scfm}{\sqrt{9}} \right) = \frac{57.94 \ scfm}{\sqrt{9}}$$

CO2 Confidence Coefficient

$$CC = (2.306) \left(\frac{0.050 \%}{\sqrt{9}} \right) = 0.038 \%$$

O2 Confidence Coefficient

$$CC = (2.306) \left(\frac{0.05\%}{\sqrt{9}} \right) = 0.04\%$$

Relative Accuracy

The relative accuracy of the CEMS was calculated to prove all analyzers were within the allowances as per 40 CFR Part 60, Appendix B, Performance Specification.

- PS-2 Specifications and Test Procedures for SO₂ and NOx Continuous Emission Monitoring Systems in Stationary Sources
 - The RA of the CEMS must be no greater than 20 percent when reference method (RM) is used in the denominator of equation below (average emissions during test are greater than 50 percent of the emission standard).
- PS-3 Specifications and Test Procedures for O2 and CO2 Continuous Emission Monitoring Systems in Stationary Sources
 - The RA of the CEMS must be no greater than 20 percent of the mean value of the reference method (RM) data.
- PS-6 Specifications and Test Procedures For Continuous Emission Rate Monitoring Systems in Stationary Sources
 - The RA of the CERMS shall be no greater than 20 percent of the mean value of the RM's test data in terms of the units of the emission standard.
- PS-8 Performance Specifications For Volatile Organic Compound Continuous Emission Monitoring Systems in Stationary Sources
 - Unless stated otherwise in the regulation or permit, the RA of the CEMS must not be greater than 20 percent of the mean value of the RM test data in terms of the units of the emission standard.

$$RA = \frac{(|Average "d"|) + (|CC|)}{(RM)} \times 100$$

Where: *CC* = Confidence Coefficient

Sd = Standard deviation of nine selected runs

n = Number of sample runs used for standard deviation calculation

NOx Mass Emissions Relative Accuracy

$$RA = \frac{(|0.06 \ lb/hr|) + (|0.041 \ lb/hr|)}{(2.856 \ lb/hr)} \ge 100 = \frac{3\%}{3\%}$$

TOC Relative Accuracy

 $RA = \frac{(|0.500 \, ppmv|) + (|0.00 \, ppmv|)}{(0.50 \, ppmv)} \ge 100 = \frac{100 \,\%}{100 \,\%}$

Vol Flow Relative Accuracy

 $RA = \frac{(|781 \, scfm|) + \, (|130 \, scfm|)}{(9230 \, scfm)} \ge 100 = \frac{10 \,\%}{100}$

SIC Flow Relative Accuracy

 $RA = \frac{(|117.5 \, scfm|) + (|57.94 \, scfm|)}{(9230 \, scfm)} \ge 100 = \frac{2\%}{2\%}$

CO2 Relative Accuracy

$$RA = \frac{(|0.07\%|) + (|0.038\%|)}{(5.12\%)} \times 100 = \frac{2.1\%}{2.1\%}$$

O2 Relative Accuracy

 $RA = \frac{(|0.46\%|) + (|0.04\%|)}{(10.03\%)} \ge 100 = \frac{4.9\%}{4.9\%}$