From:	Randy Ammons
To:	Jarrod Hoskinson
Cc:	Ramiro Garcia; OCE
Subject:	RE: Erthwrks - Sequitur Texon Central Gas Lift Facility - JJJJ Sept2020 - Notification Waiver Request
Date:	Wednesday, August 19, 2020 7:43:58 AM

Good afternoon Mr. Hoskinson,

This is in response to your August 17, 2020 request seeking enforcement discretion from a 30-day notification requirement due to your [redacted] as a result of the COVID-19 pandemic. Thank you for the additional information submitted on August 18. The TCEQ is committed to working with you as we respond to this pandemic. This request is approved for the performance testing notification requirements of the source emission testing on the four engines at the Texon Central Gas Lift Facility (TCEQ RN 110816543). If you have any questions or if new information becomes available, please feel free to contact us at any time.

The TCEQ will revisit this issue at the appropriate time and reserves the right to withdraw this approval.

Regards,

Randy J. Ammons, Director
North Central and West Texas
Texas Commission on Environmental Quality

From: Jarrod Hoskinson <[redacted]
Sent: Tuesday, August 18, 2020 12:09 PM
To: Randy Ammons <randy.ammons@tceq.texas.gov>
Subject: Re: Erthwrks - Sequitur Texon Central Gas Lift Facility - JJJJ Sept2020 - Notification Waiver Request

Mr. Ammons,

The information for the Texon Central Gas Lift Facility is as follows:

Sequitur Permian, LLC
Project Description/Unit: Texon Central Gas Lift Facility
City: Big Lake, Reagan County
Regulated Entity Number: RN110816543
Customer Reference Number: CN605190081

Thank You,

Jarrod Hoskinson

Get [Outlook for iOS]

From: Randy Ammons <randy.ammons@tceq.texas.gov>
Sent: Tuesday, August 18, 2020 7:27:35 AM
To: Jarrod Hoskinson <[redacted]
Subject: Re: Erthwrks - Sequitur Texon Central Gas Lift Facility - JJJJ Sept2020 - Notification Waiver Request

Good morning Mr. Hoskinson.

We are in receipt of your request regarding Sequitur Texon Central Gas Lift Facility.

Please include the location, RN number and CN number of the facility on your request.

Thank you.

Randy

From: Jarrod Hoskinson <[redacted]
Sent: Monday, August 17, 2020 12:47 PM
To: OCE <OCE@tceq.texas.gov>; Ramiro Garcia <ramiro.garcia@tceq.texas.gov>
Cc: Trey Chapman <[redacted]
Subject: Erthwrks - Sequitur Texon Central Gas Lift Facility - JJJJ Sept2020 - Notification Waiver Request

All,

I have attached a test protocol and notification document concerning upcoming US EPA JJJJ testing at the Sequitur Permian Texon Central Gas Lift Facility in Reagan County, TX. The proposed test dates are September 9th – September 11th. I am requesting a 30-day notification waiver, as this notification does not meet the 30-day minimum requirement. [redacted], therefore this notification was unfortunately not prepared and submitted in time.

Please let me know if this is an acceptable request, and if we can continue with our original scheduled test program.

Sincerely,

Jarrod Hoskinson
Erthwrks, Inc.
512-994-7487

Air Emission Test Plan

for

Sequitur Permian

at the

Texon Central Gas Lift Facility in Reagan County, Texas

on

Four (4) Caterpillar 3516 Compressor Engines

subject to

EPA Title 40 CFR Part 60, Subpart JJJJ

Prepared for:

Projected Test Date: September 9 - 11, 2020

Erthwrks Project No. 8723

Endorsement Page

This air emission test plan has been prepared and reviewed by the following representatives:

Erthwrks, Inc.

Name: Trey Chapman

Title: Senior Partner Manager.

Signature: Trey Chapman

Sequitur Permian

Name: Russ Perry

Title: Health Safety & Environment

Signature:

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APPENDICES

1.0 INTRODUCTION

1.1 Identification, location and dates of tests

Erthwrks, Inc. is contracted to complete the source emission testing on four engines at the Texon Central Gas Lift Facility. This testing is scheduled to be conducted between the 9th and 11th of September 2020. The following table lists the engines to be tested during this project.

Table 1: Facility Unit Information

Unit	Serial Number	Make	Model	HP Rating
E190416	N6W00830	Caterpillar	3516B	1380
E190424	N6W00826	Caterpillar	3516	1380
811082	JEF01819	Caterpillar	G3516ULB	1380
412705	NE600202	Caterpillar	G3516ULB	1380

1.2 Purpose of Testing

These units at the Sequitur Permian Texon Lift Facility are to be tested according to the procedures in, and to satisfy the requirements of 40 CFR 60, Subpart JJJJ. (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines). Testing will be conducted for the determination of carbon monoxide (CO), oxides of nitrogen (NOx), and volatile organic compounds (VOC). Oxygen (O_2) concentrations will also be measured to normalize the pollutant concentrations to 15% excess O_2.

Table 2: JJJJ Unit Limits

Unit ID	NOx g/hp-hr	CO g/hp-hr	VOC g/hp-hr
See Table 1	1.0	2.0	0.7

1.3 Description of Source

These Caterpillar engines are 4-stroke, lean burn (4SLB), spark ignited, natural gas fired compression engine. These Caterpillar engines are used to compress and transmit natural gas through a local gas pipeline.

1.4 Contact Information

Sequitur Permian
Russ Perry
Health Safety & Environment Manager
2050 West Sam Houston Parkway S. Suite 1850
Houston, TX 77042
713-395-3014 ph
[redacted]

Sequitur Permian – Texon Central Gas Lift Facility
Reagan County, TX

Erthwrks, Inc.
Jarrod Hoskinson
Project Manager
P.O. Box 150549
Austin, TX 78715
512-994-7487 phone
888-573-9994 fax
[redacted]

2.0 SOURCE OPERATION DURING TEST

The engines will be tested while operating at approximately full load capacity or highest achievable load at the time of the test. A complete list of operating parameters, ambient conditions, and engine fuel consumption will be recorded on the Erthwrks summary of results.

3.0 ANALYTICAL PROCEDURES

Erthwrks, Inc. will conduct the engine emission tests following all procedures set forth in 40 CFR 60, Appendix A. As specified in 40 CFR 60 Subpart JJJJ, Erthwrks will utilized the following methods for the determination of O_2, CO_2, NOx, CO, VOCs and moisture content.

- EPA Method 3A for O_2 concentration
- ASTM D-6348-03 (Extractive Direct Interface FTIR) for NOx, CO, VOC, and moisture content.
- EPA Method 19 for mass emission rate calculations

Table 3: Analytical Instrumentation

Effluent Tested	Analyzer Make/Model	Expected Range to be utilized	Detection Principle
NOx*	California Analytical 700 FTIR	Dynamic Range Internal Reference Spectra	FTIR
CO*	California Analytical 700 FTIR	Dynamic Range Internal Reference Spectra	FTIR
VOC* (NMNEHC)	California Analytical 700 FTIR	Dynamic Range Internal Reference Spectra	FTIR
O_2	Teledyne Model 200EH	25 %	Paramagnetic Cell

*Common FTIR analyzer

3.1 Description of sampling and field procedures

Erthwrks will utilize a mobile laboratory on site to conduct the emission testing. A stainless-steel sample probe of sufficient length to reach all traverse points, if greater than 6 inches, and a heated sample line will be used to direct the sample to the FTIR analyzer. The sample will maintain 191oC temperature throughout the sample system until exiting the FTIR exhaust port. Upon exit of the FTIR exhaust port, the sample will be directed to a moisture removal condenser and a dry, cool sample stream will then be sent to the O_2 analyzer.

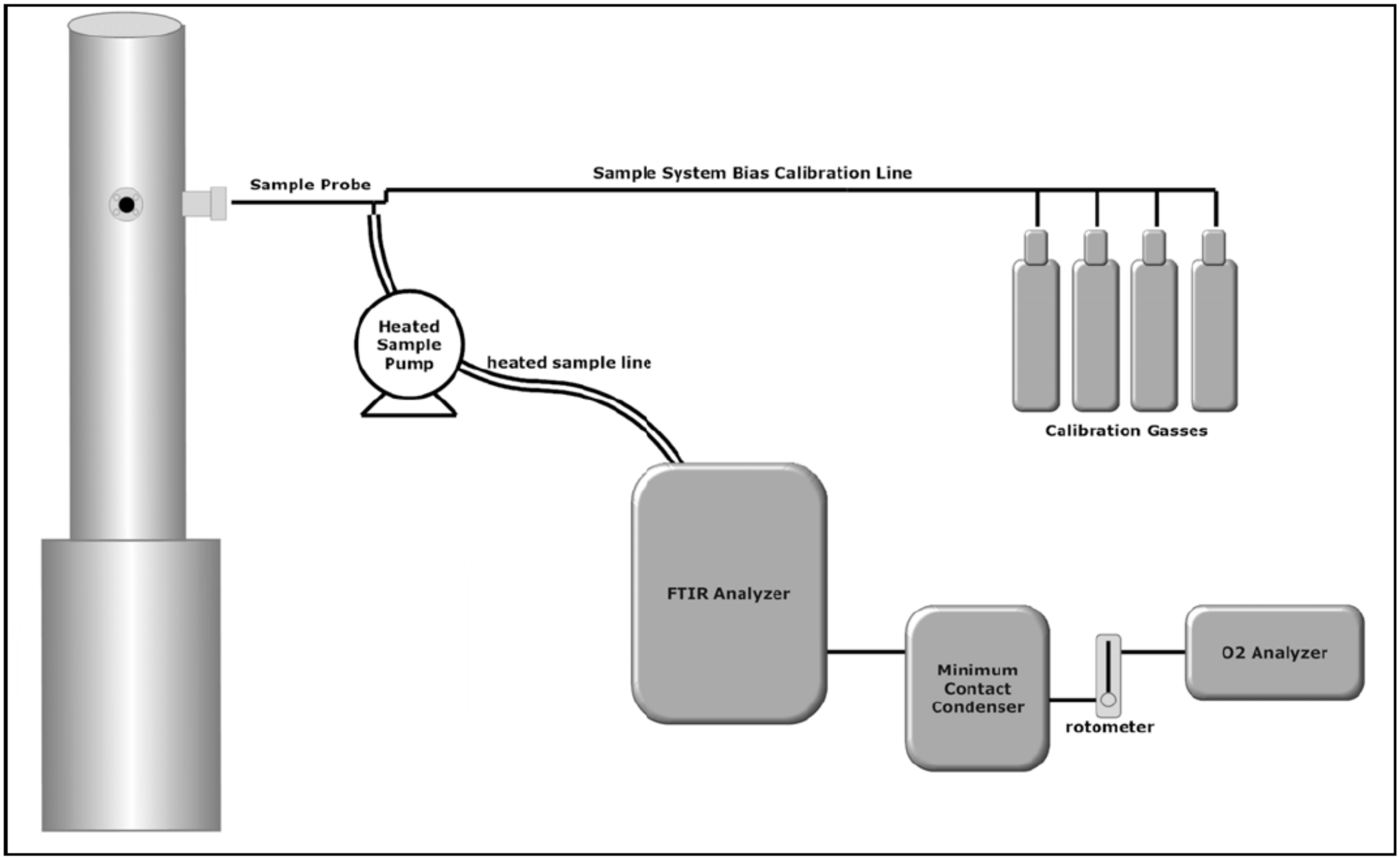


Figure 1: Sample System Diagram

3.2 Description of Analytical Procedures (QAQC)

3.2.1 O_2 Determination QAQC Procedures

Erthwrks will follow all quality assurance and quality control procedures as defined in US EPA 40 CFR 60 Appendix A, Method 3A for the determination of the concentrations of O_2.

The *Calibration Error (CE) Test* will be conducted as specified in **EPA Method 7E §8.2.3**. In accordance with this requirement, a three-point analyzer calibration error test will be conducted prior to sampling. The CE test will be conducted by introducing the low, mid, and high-level calibration gasses (as defined in **EPA Method 7E §3.3.1-3**) sequentially and the response will be recorded. The results of the CE test are acceptable if the calculated calibration error is within ±2.0% of calibration span (or ≤ 0.5 ppmv).

The *Initial System Bias and System Calibration Error Check* will be conducted in accordance with **EPA Method 7E §8.2.5**. The upscale calibration gas will be introduced at the probe upstream of all sample system components and the response will be recorded. The procedure will be repeated with the low-level gas and the response will be recorded. The sample system response time will also be recorded. This specification is acceptable if the calculated values of the system calibration error check are within ±5.0% of the calibration span value (or ≤0.5 ppmv).

After each compliance test run, the sample system bias check will be conducted to validate the run data. The low-level and upscale drift will be calculated using *Equation 7E-4*. The run data is valid if the calculated drift is within ±3.0% of the calibration span value (or ≤0.5 ppmv).

After each test run, the effluent gas concentration will be calculated as specified in **EPA Method 7E §12.6.** The arithmetic average of all valid concentration values will be adjusted for bias using equation 7E-5B.

3.2.2 Direct Interface FTIR NOx, CO, VOC, and Moisture

Erthwrks will follow all quality assurance and sampling procedures as outlined in ASTM D6348-12. Three 1-hour sampling runs will be used to quantify average concentrations of the desired pollutants.

A series of pre-test preparations and evaluations will be conducted on site prior to sampling as outlined in ASTM D6348-12 sections 11.2.1 – 11.3.6.1. These procedures include determining a minimum detection limit (*MDL*), determining the sample system response time, developing a spectral background, and the introduction of a calibration transfer standard (*CTS*).

The calibration transfer standard will be introduced directly to the FTIR sampling cell and the results will be recorded. The measured response of the FTIR will be within 5% of the certificate value. Erthwrks will use an EPA Protocol 1 gas cylinder containing ethylene at approximately 100 ppm as the CTS.

Upon completion of all required pre-test measures, Erthwrks will perform a dynamic spike. A pollutant of known concentration will be introduced to the sample system at the tip of the probe, and will be mixed with the effluent gas at a ratio no greater than 10:1. A flowmeter and tracer gas (SF_6) will be used to measure the spiking rate. Equations A5.1 – A5.4 from Annex 5 in ASTM D6348-12 will be used to calculate the spiking rate and percent recovery. A recovery percentage between 70% -130% will be achieved before sampling commences.

During sampling Erthwrks will utilize a scanning rate of 16 scans/minute and an averaging rate of 60 seconds. A spectrum will then be generated once every 60 seconds, and the resulting concentrations will be added to the cumulative data file. All spectra and raw interferograms will be appropriately named and saved.

Table 5. FTIR Data Quality Objectives

Pollutant	Infrared Analysis Region (cm^{-1})	Expected Concentration Range (ppm)	Minimum Detection Limit* (ppm)	System Accuracy / Precision
NOx	1975 – 2000	0 - 100	>0.5 ppm	<±10% / <±5%
CO	2100 – 2250	0 - 50	>1.0 ppm	<±10% / <±5%
VOC	2900 – 3200	0-50	>.10 ppm	<±10% / <±5%
Moisture	1300 – 1700	11% - 15%	N/A	<±10% / <±5%

3.3 Discussion of methodology variations or operational variances

This emission testing program is expected to be conducted with no sampling or operational variances.

Appendix A
Example Detailed Results of Emission Test

Erthwrks Tabular Results of Emission Test

Client ____________________
Facility Name ____________________
Location ____________________
Unit Identification ____________________
Unit Serial Number

Run Information				
Run Number		**Run 1**	**Run 2**	**Run 3**
Date		7/25/2017	7/25/2017	7/25/2017
Run Start Time		9:38	10:56	11:49
Run End Time		10:38	11:56	12:55
Operating Conditions				
Intake Manifold Pressure (" Hg)		50.9	51.4	52.9
Intake Manifold Temperature (°F)		148.3	150.3	152.6
% Load		100%	100%	100%
Suction Pressure (psi)		22.0	23.0	23.0
1st Discharge Pressure (psi)		135.0	135.0	135.0
2nd Discharge Pressure (psi)		390.0	390.0	390.0
Discharge Pressure (psi)		930	930	930
Actual Speed (RPM)		1385	1383	1385
Ignition Timing (^{o}BTDC)		29.7	29.7	29.7
Engine Hours		9554		
Engine Horsepower		1380	1380	1380
Ambient Conditions				
Temperature (°F)		82	78	85
Pressure ("Hg)		27.10	27.11	27.12
Fuel Analysis				
Fuel Heating Value (Btu/scf)		1264	1264	1264
Fuel F Factor (F_d) (scf/MMBtu)		8810	8810	8810
Unit Fuel Data via Table 29				
Fuel Flow (scf/hr)		8964	8964	8964
Fuel Consumption (Btu/hp-hr)		8211	8211	8211
Fuel Heat Rate (F_H) (MMBtu/hr)		11.33	11.33	11.33
Method 19 Exhaust Flow (scf/hr)		1.80E+05	1.80E+05	1.81E+05
Emission Concentrations				
NOx (ppmvd)		51.49	51.72	51.30
CO (ppmvd)		73.34	73.60	75.18
O_2 (%)		9.30	9.32	9.37
NMEHC [VOC] (ppmvd)		27.13	26.50	26.60
Stack Moisture %		12.41	12.17	12.09

Emission Concentrations (Corrected to 15% O2)					**Average**
NOx (ppmv @ 15% O2)	Limit 82	26.18	26.35	26.26	**26.3 ppmv**
CO (ppmv @ 15% O2)	Limit 270	37.29	37.49	38.48	**37.8 ppmv**
NME VOC (ppmvd @ 15%	Limit 60	13.80	13.50	13.61	**13.6 ppmv**
Emission Rates (lb/scf)					
NOx (lb/scf)		6.15E-06	6.17E-06	6.13E-06	
CO (lb/scf)		5.33E-06	5.35E-06	5.46E-06	
NME VOC (lb/scf)**		3.10E-06	3.03E-06	3.04E-06	
Emission Rates (lb/MMBtu)					**Average**
NOx (lb/MMBtu)		0.098	0.098	0.098	**0.098 lb/MMBtu**
CO (lb/MMBtu)		0.085	0.085	0.087	**0.086 lb/MMBtu**
NME VOC (lb/MMBtu)**		0.049	0.048	0.049	**0.049 lb/MMBtu**
Emission Rates (lb/hr)					**Average**
NOx (lb/hr)		1.11	1.11	1.11	**1.11 lb/hr**
CO (lb/hr)		0.96	0.96	0.99	**0.97 lb/hr**
NME VOC (lb/hr)**		0.56	0.55	0.55	**0.55 lb/hr**
Emission Rates (g/Hp-hr) via M19 Table 29 Fuel Consumption					**Average**
NOx (g/Hp-hr)	Limit 1.0[T]	0.36	0.37	0.36	**0.36 g/hp-hr**
CO (g/Hp-hr)	Limit 1.42[T]	0.32	0.32	0.33	**0.32 g/hp-hr**
NME VOC (g/Hp-hr)**	Limit 0.41†	0.18	0.18	0.18	**0.18 g/hp-hr**

*** JJJJ NME VOC represent non methane / non-ethane*

Appendix B
Example QA/QC Documentation and Calculations

Erthwrks Gaseous Sample Collection and Quality Assurance Worksheet

Date: 7/25/2017
Client:
Facility Name:
Location:
Unit Identification: ENG-3
Unit Serial Number: JEF03285

Calibration Gas Concentration

Pollutant	Low-Level Target Gas Conc. (C_V)	Mid-Level Target Gas Conc. (C_V)	High-Level Target Gas Conc. (C_V/CS)
O2	NA	10.09	20.95

Certified Bottles Serial Number

Low-Level Cylinder Cert	Mid-Level Cylinder Cert	High-Level Cylinder Cert	Dilutor Root Gas
NA	CC194254	CC470375	NA

Calibration Error Test

Pollutant	Zero Gas Response (C_{Dir})	Calibration Error (ACE)*	Low-Level Response (C_{Dir})	Calibration Error (ACE)*	Mid-Level Response (C_{Dir})	Calibration Error (ACE)*	High-Level Response (C_{Dir})	Calibration Error (ACE)*
O2	0.00	0.01%	NA	NA	10.11	0.08%	20 96	0 03%

** ACE must either be within ± 2.0% or ≤ 0.5 ppmv absolute difference/VOC must be ± 5.0% of certified gas*

Initial Sample System Bias and Response Time

Pollutant	Upscale Gas Cert. Conc. (C_{MA})	Upscale Gas Direct (C_{Dir})	Upscale Response (C_S)	Sample System Bias (SB)*	Response Time (sec)	Downscale Response (C_S)	Sample System Bias (SB)*	Response Time (sec)
O2	10.09	10.11	10.09	-0.07%	15	0.02	-0.09%	15

** SB must either be within ± 5.0% or ≤ 0.5 ppmv absolute difference/ VOC not applicable*

Sample Collection Raw Data--Pre and Post Sample System Calibration (SSC) and Raw Run Results

Run #:	**Run 1**	Run #:	**Run 2**	Run #:	**Run 3**
Start Time:	9 26 AM	Start Time:	10:37 AM	Start Time:	11:49 AM
End Time:	10:32 AM	End Time:	11:43 AM	End Time:	12:55 PM

Pollutant	Zero SSC (C_S)	Upscale SSC (C_S)	Raw Results (C_{Avg})	Zero SSC (C_S)	Upscale SSC (C_S)	Raw Results (C_{Avg})	Zero SSC (C_S)	Upscale SSC (C_S)	Raw Results (C_{Avg})	Zero SSC (C_S)	Upscale SSC (C_S)
O2	0.02	10.09	9.31	0 06	10.11	9.34	0.06	10.10	9.38	0.05	10.09

Run 1 Sample Collection Calculations--Pre- and Post-Run Sample System Bias Check, Drift Assessment, Corrected Results

Pollutant	Initial Zero Sys. Bias (SB)*	Initial Upscale Sys. Bias (SB)*	Final Zero Sys. Bias (SB)*	Final Upscale Sys. Bias (SB)*	Avg. Zero Sys. Bias (C_O)	Avg. Upscale Sys. Bias (C_M)	Zero Drift Assessment (D)	Upscale Drift Assessment (D)	Corrected Results (C_{gas})
O2	0.09%	-0.07%	0.26%	0.02%	0.04	10.10	0.17%	0.09%	**9.30**

SB must either be within ± 5.0% or ≤ 0.5 ppmv absolute difference/ VOC not applicable
† D must either be within ± 3.0% or the pre- and post-run bias responses are ≤ 0.5 ppmv absolute difference

Run 2 Sample Collection Calculations--Pre- and Post-Run Sample System Bias Check, Drift Assessment, Corrected Results

Pollutant	Initial Zero Sys. Bias (SB)*	Initial Upscale Sys. Bias (SB)*	Final Zero Sys. Bias (SB)*	Final Upscale Sys. Bias (SB)*	Avg. Zero Sys. Bias (C_O)	Avg. Upscale Sys. Bias (C_M)	Zero Drift Assessment (D)	Upscale Drift Assessment (D)	Corrected Results (C_{gas})
O2	0.26%	0.02%	0.28%	-0.02%	0.06	10.11	0 02%	0.05%	**9.32**

** SB must either be within ± 5.0% or ≤ 0.5 ppmv absolute difference/ VOC not applicable*
† D must either be within ± 3.0% or the pre- and post-run bias responses are ≤ 0.5 ppmv absolute difference

Run 3 Sample Collection Calculations--Pre- and Post-Run Sample System Bias Check, Drift Assessment, Corrected Results

Pollutant	Initial Zero Sys. Bias (SB)*	Initial Upscale Sys. Bias (SB)*	Final Zero Sys. Bias (SB)*	Final Upscale Sys. Bias (SB)*	Avg. Zero Sys. Bias (C_O)	Avg. Upscale Sys. Bias (C_M)	Zero Drift Assessment (D)	Upscale Drift Assessment (D)	Corrected Results (C_{gas})
O2	0.28%	-0.02%	0.20%	-0.08%	0.05	10.10	0 08%	0.05%	**9.37**

SB must either be within ± 5.0% or ≤ 0.5 ppmv absolute difference/ VOC not applicable
† D must either be within ± 3.0% or the pre- and post-run bias responses are ≤ 0.5 ppmv absolute difference

Source Validation Summary

Erthwrks
Tuesday, July 25, 2017

Instrument Performance	(Unit 1412002)	Completed		
Amplitude:		8:39 AM		-2106
Apodized Resolution (cm-1):		8:41 AM		1.58
Peak Position (cm-1):		8:41 AM	Expected: 1481.29	1481.30
Temperature (°C):		8:39 AM		192.3
Pressure (torr):		8:39 AM		685
Pathlength (m):		8:48 AM		10.20

Limits of Detection	4 Measurements	Mean	Standard Deviation	Limit of Detection
C2H2	ppm	1.111	1.061	3.184
C2H4	ppm	-2.815	1.089	3.266
C2H4O	ppm	0.043	0.601	1.804
C2H6	ppm	-1.245	1.715	5.145
C2H4O	ppm	0.000	0.000	0.000
C3H4O	ppm	0.095	0.318	0.953
C3H6	ppm	-1.020	1.251	3.754
C3H8	ppm	1.790	0.345	1.034
C6H6	ppm	-0.535	1.588	4.763
CH3OH	ppm	-0.064	0.128	0.385
CH4	ppm	-0.925	0.501	1.504
CO	ppm	0.378	0.199	0.598
CO2	%	0.000	0.000	0.000
H2O	%	-0.006	0.003	0.010
HCHO	ppm	0.024	0.378	1.135
HCl	ppm	0.037	0.177	0.531
N2O	ppm	-0.136	0.059	0.176
NH3	ppm	-0.056	0.136	0.408
NO	ppm	0.713	0.671	2.012
NO2	ppm	-0.256	0.122	0.365
SF6	ppm	0.003	0.007	0.022
SO2	ppm	0.192	0.175	0.526

Completion Time: 8:39 AM

Dynamic Response	Mechanical Response	System Response	Time to Zero
CTS:			
C2H4	0:52	1:32	1:15

Spike Recovery Results		Bottle	Direct	Bias	Native	Spiked	Recovery
Bottle 1	Dilution Factor: 0.036						
CO	ppm	95.680	100.873	104.710	69.845	65.365	0.920
NO	ppm	95.520	99.640	96.050	48.428	51.540	1.028
SF6	ppm	97.950	104.889	105.574	0.025	3.755	0.994

Completion Time: 9:22 AM

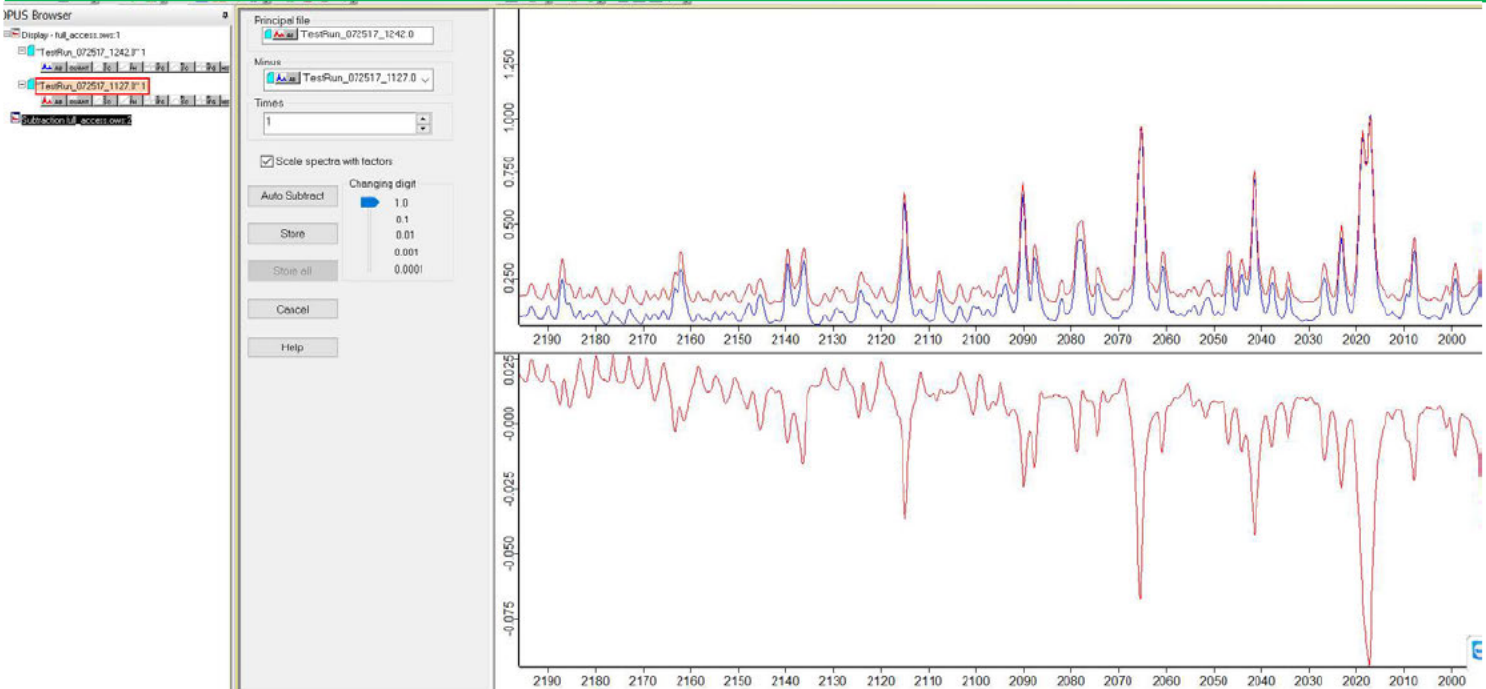
CTS:	1:03 PM
C2H4	102%

Operator: Max Kammer

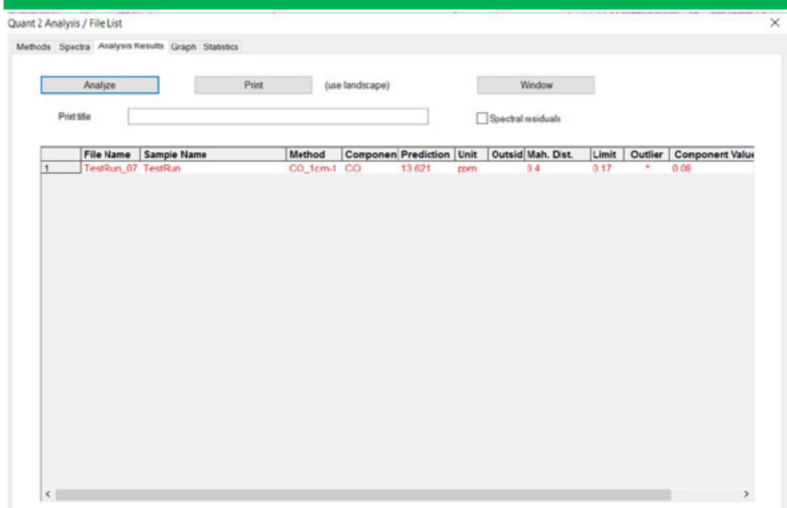
Signature: Max Kammer

ASTM D6348-12 Annex 8.4.3.1 Procedures - CO Spectral Validation

ASTM D6348-12 A8.4.3 Sample Spectra Subtraction



ASTM D6348-12 A8.4.3 CO Concentration of Difference Spectrum (Analytical Algorithm)

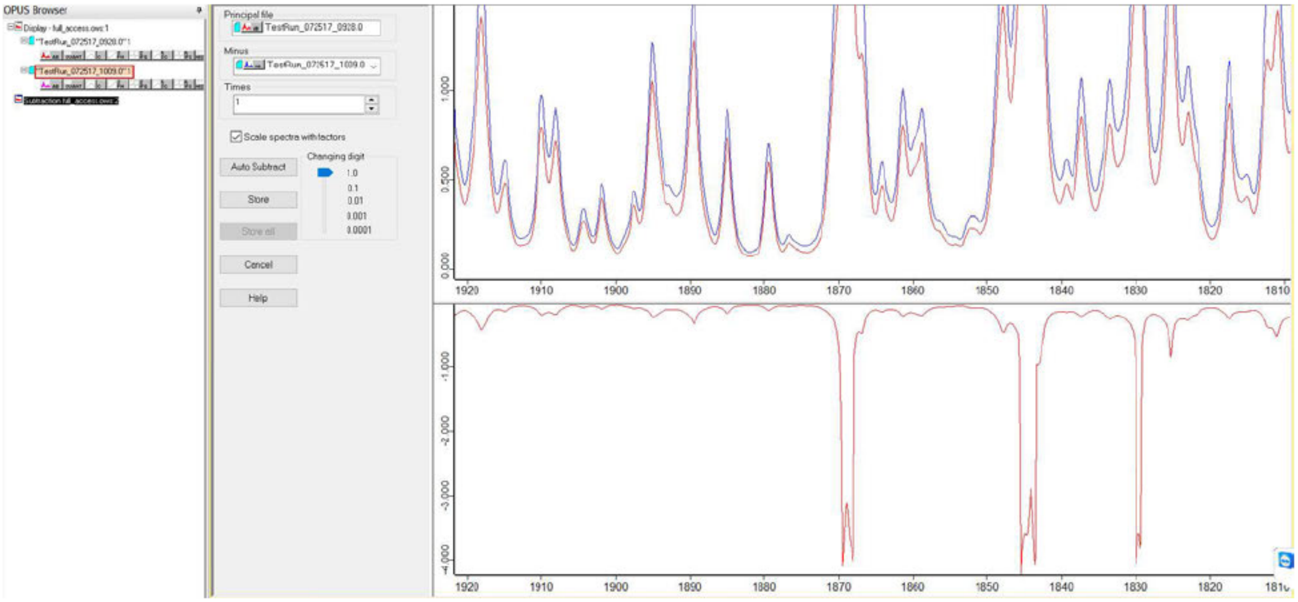


ASTM D6348-12 A8.4.4 Difference Spectrum Comparison

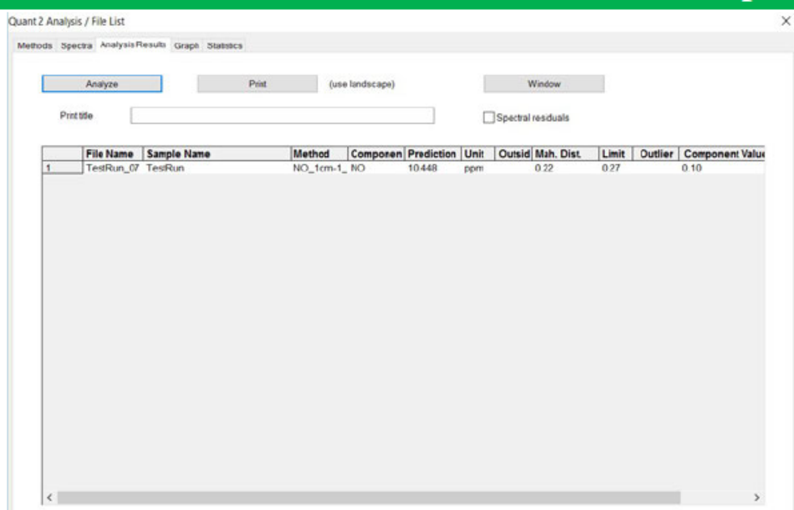
Spectra Identification	**C:\gaslog\SV_250717_0827\TestRun_072517_1127.0**	**C:\gaslog\SV_250717_0827\TestRun_072517_1242.0**
Analyte Concentrations (ppmv)	**64.960**	**83.236**
Manually Calculated Conc. Of Difference Spectrum (ppmv)	**18.276**	
Analytical Algorithm Calculated Conc. Of Difference Spectrum (ppmv) *(Corrected to 760mmHg)	**15.097**	
Percent Difference ***ASTM D6348.12 A8.4.4 ≥ ± 20%***	**17.40%**	

ASTM D6348-12 Annex 8.4.3.1 Procedures - NO Spectral Validation

ASTM D6348-12 A8.4.3 Sample Spectra Subtraction



ASTM D6348-12 A8.4.3 NO Concentration of Difference Spectrum (Analytical Algorithm)



ASTM D6348-12 A8.4.4 Difference Spectrum Comparison

Spectra Identification	**C:\gaslog\SV_250717_0827\TestRun_072517_1009.0**	**C:\gaslog\SV_250717_0827\TestRun_072517_0928.0**
NO Concentrations (ppmv)	**35.758**	**48.160**
Manually Calculated Conc. Of Difference Spectrum (ppmv)	**12.402**	
Analytical Algorithm Calculated Conc. Of Difference Spectrum (ppmv) *(pressure corrected to 760mmHg)	**10.607**	
Percent Difference *ASTM D6348.12 A8.4.4 ≥ ± 20%*	**14.47%**	

Appendix C
Example Calculations

Erthwrks Example Calculations

Example Calcls : Run 1 ENG-3

Example Calcs for Pollutant : O2

C_V	=	10.09	= Target concentration of calibration gas, ppmv.
C_{Dir}	=	10.11	= Measured concentration of the cal gas when introduced in direct mode, ppmv.
CS	=	20.95	= Calibration span, ppmv.
C_S	=	10.09	= Measured concentration of the cal gas when introduced in the system cal mode, ppmv.
SB_i		-0.07%	= Pre-run system bias, percent of calibration span.
SB_f		0.02%	= Post-run system bias, percent of calibration span.
C_{Avg}	=	9.31	= Average unadjusted gas concentration for test run, ppmv.
C_0		0.04	= Average of the pre- and post-run system cal bias responses from zero gas, ppmv.
C_M	=	10.10	= Average of the pre- and post-run system cal bias responses from the upscale gas, ppmv.
C_{MA}	=	10.09	= Actual concentration of the upscale calibration gas, ppmv.

Analyzer Calibration Error (Eq. 7E-1)

$$ACE = \frac{C_{Dir} - C_V}{CS} \times 100$$

$$ACE = \frac{10.11 - 10.09}{20.95} \times 100$$

ACE = 0.08%

Sample System Bias (Eq. 7E-2)

$$SB = \frac{C_S - C_{Dir}}{CS} \times 100$$

$$SB = \frac{10.09 - 10.11}{20.95} \times 100$$

SB = -0.07%

Drift Assessment (Eq. 7E-4)

$$D = ABS\ (SB_f - SB_i)$$

$$D = ABS\ (0.000 \quad -- \quad 0.0007)$$

D = 0.09%

Effluent Gas Concentration (Eq. 7E-5)

$$C_{Gas} = (C_{Avg} - C_O)\ \frac{C_{MA}}{C_M - C_O}$$

$$C_{Gas} = (9.31 - 0.04)\ \frac{10.09}{10.10 - 0.04}$$

C_{Gas} = 9.30

Erthwrks Example Calculations

Nomenclature

MGV	Molar gas volume, volume of gas at standard conditions, scf/lbmol
V	Volume, ft3
n	Moles, lbmol
F_d	Fuel F Factor, scf/MMBtu
%O2d	Oxygen concentration measured on a dry basis, %
F_H	Fuel Heating Value (MMBtu/hr)
Hp	Engine horse power during test, hp

Constants

R	10.7316	Universal gas constant, ft^3 psi / R lbmol
T_s	527.67	Standard Temperature, R
p_s	14.696	Standard Pressure, psi
MW_{NOx}	46.0055	Molecular Weight of NOx, lb/lbmol
MW_{CO}	28.0104	Molecular Weight of CO, lb/lbmol
MW_{SO2}	64.0588	Molecular Weight of SO_2, lb/lbmol
MW_{VOC}	44.0962	Molecular Weight of VOC as propane, lb/lbmol
F_d	8810	Fuel F Factor for Natural Gas, scf/MMBtu
$Conv_{lb-g}$	453.6	Number of grams in one pound

Molar gas volume (MGV) calculation at standard conditions (Ideal Gas Law)

$$MGV = \frac{V}{n} = \frac{R * T_s}{p_s}$$

$$MGV = \frac{V}{n} = \frac{10.7316 * 527.67}{14.696}$$

$$\mathbf{MGV = 385.325 \frac{scf}{lbmol}}$$

Emission Concentration, C_{NOx}, lb/scf (For NOx, Run 1)

$$C_{NOx} = \frac{PPM_{NOx} * MW_{NOx}}{MGV} * 10^{-6}$$

$$C_{NOx} = \frac{51.49 * 46.0055}{385.325} * 10^{-6}$$

$$\mathbf{C_{NOx} = 6.15E\text{-}06 \frac{lb}{scf}}$$

Erthwrks Example Calculations

Emission Rate Calculation, $E_{(lb/MMBtu)}$, (For NOx, Run 1)

$$E_{(lb/MMBtu)} = C_{NOx} * F_d * \frac{20.9}{20.9 - \%O2d}$$

$$E_{(lb/MMBtu)} = 6.15E\text{-}06 * 8810 * \frac{20.9}{20.9 - 9.30}$$

$$\mathbf{E_{(lb/MMBtu)} = 0.098 \frac{lb}{MMBtu}}$$

Emission Rate Calculation, $E_{(lb/hr)}$, (For NOx, Run 1)

$$E_{(lb/hr)} = E_{(lb/MMBtu)} * F_H$$

$$E_{(lb/hr)} = 0.098 * 0.000$$

$$\mathbf{E_{(lb/hr)} = 0.00 \frac{lb}{hr}}$$

Emission Rate Calculation, $E_{(g/hp\text{-}hr)}$, (For NOx, Run 1)

$$E_{(g/hp\text{-}hr)} = \frac{E_{(lb/hr)} \quad Conv_{lb\text{-}g}}{Hp}$$

$$E_{(g/hp\text{-}hr)} = \frac{0.000 * 453.60}{1380}$$

$$\mathbf{E_{(g/hp\text{-}hr)} = 0.00 \frac{g}{hp\text{-}hr}}$$

Erthwrks Example Calculations

Nomenclature

C_{CO} Carbon Monoxide concentration measured on a dry basis, ppmv

C_{Nox} NOx concentration measured on a dry basis, ppmv

C_{VOC} VOC concentration measured on a dry basis, ppmv

%O2d Oxygen concentration measured on a dry basis, %

Emission Concentrations Corrected to 15% O2 **(For CO, Run 1)**

$$CO = C_{CO} * \frac{20.9 - 15\%O2}{20.9 - \%O2d}$$

$$CO = 73.34 \frac{20.9 - 15.00}{20.9 - 9.30}$$

CO = 37.29 ppmvd @ 15% O2

Emission Concentrations Corrected to 15% O2 **(For NOx, Run 1)**

$$Nox = C_{NOx} * \frac{20.9 - 15\%O2}{20.9 - \%O2d}$$

$$Nox = 51.49 \frac{20.9 - 15.00}{20.9 - 9.30}$$

Nox = 26.18 ppmvd @ 15% O2

Emission Concentrations Corrected to 15% O2 **(For VOC, Run 1)**

$$VOC = C_{VOC} * \frac{20.9 - 15\%O2}{20.9 - \%O2d}$$

$$VOC = 27.13 \frac{20.9 - 15.00}{20.9 - 9.30}$$

VOC = 13.80 ppmvd @ 15% O2

Appendix G
Erthwrks Personnel Resumes

Jarrod Hoskinson
Curricula Vitae

EDUCATION
B.S. Chemisty – Texas State University, 2003
Graduate Studies in Polymer Chemistry – Texas State University, (All coursework completed, no degree obtained)

REPRESENTATIVE EXPERIENCE
Mr. Hoskinson has more than eight (8) years of experience in air measurements. His qualifications include active participation in a variety of air measurements projects, with primary responsibilities in preparation, field sampling, sample recovery, data analysis, and reporting. Mr. Hoskinson has functioned as a field technician, field test leader and project manager on multiple emissions testing programs covering a wide variety of sampling techniques and methods. Mr. Hoskinson has extensive experience in the source testing methodology and regulations associated with the power and utilities industries, gas transmission pipeline industry, and the oil and petrochemical refining industries. The below project descriptions provide a snapshot of some large projects Jarrod Hoskinson was involved in.

Mesaieed Power Company, Ltd (MPower) USEPA Part 75 RATA and CEMS Audit (Project Manager: September 2015)
Mr. Hoskinson served as the Project Manager and on-site Qualified Stack Testing Individual (QSTI) during the CEMS certification program at MPower. Hoskinson and the Glotech team conducted RATA tests on six (6) combined cycle power turbines and two (2) gas turbine generators. Hoskinson and the Glotech team also conducted calibration error tests and linearity tests on all associated CEMS at the MPower facility.

Technip Chiyoda Joint Venture (TCJV) Qatargas QG1 Plateau Maintenance Project (PMP) Ras Laffan Industrial City (Associate Project Manager: February 2015)
Mr. Hoskinson served as the onsite Qualified Stack Testing Individual (QSTI) during the CEMS certification programs on Qatargas GG1 assets.. Hoskinson performed US EPA 40 CFR Part 60 RATA and calibration tests on all units and their associated CEMS. Hoskinson generated all reference method data, compiled all corresponding CEMS data, and participated in the generation of the final report for submittal to Qatargas personnel.

RasGas, LNG facility, Ras Laffan Industrial City (Associate Project Manager: October-December 2014)
Mr. Hoskinson served as the onsite Qualified Stack Testing Individual (QSTI) during the CEMS certification programs on several RasGas assets (Train 6, Train 7, AKG-2 and all associated utilities). Hoskinson performed US EPA 40 CFR Part 75 RATA and calibration tests on all units and their associated CEMS. Hoskinson generated all

reference method data, compiled all corresponding CEMS data, and participated in the generation of the final report for submittal to RasGas personnel.

Qatargas, LNG facility, Ras Laffan Industrial City (Associate Project Manager: October-December 2013)
Mr. Hoskinson served as the onsite Qualified Stack Testing Individual (QSTI) during the CEMS certification programs on all Qatargas assets (Train 4-7, all utilities, Laffan Refinery, CVOC). Hoskinson performed US EPA 40 CFR Part 75 RATA and calibration tests on all units and their associated CEMS. Hoskinson generated all reference method data, compiled all corresponding CEMS data, and participated in the generation of the final report for submittal to Qatargas personnel.

WTG Gas Processing, LP 2012 - Current
Mr. Hoskinson currently serves as the Erthwrks project manager and coordinator for West Texas Gas (WTG) pipeline and gas transmission. Mr. Hoskinson develops test plans, conducts emissions tests and prepares compliance reports for numerous stationary compressors throughout West Texas. Mr. Hoskinson utilizes Fourier Transform Infra-Red (FTIR) technology and standard instrumentation for WTG Gas Processing, LP.

Targa Pipeline WesTex 2014 – Current
Mr. Hoskinson currently serves as the Erthwrks project manager and coordinator for Targa pipeline and gas transmission. Mr. Hoskinson develops test plans, conducts emissions tests and prepares compliance reports for numerous stationary compressors throughout Targa's asset region in West Texas.

Calpine Corporation, Freestone Energy Center – Fairfield, Texas Associate Project Manager: June, 2012)
Mr. Hoskinson served as the onsite Qualified Individual (QI) during the CEMS certification programs. Hoskinson performed US EPA 40 CFR Part 60 & 75 RATA tests on four GE Frame 7 power turbines and their associated CEMS. Hoskinson generated all reference method data, compiled all corresponding CEMS data, and generated the final report for submittal to Calpine personnel.

Entegra Power Partners LP, Union Power Station, El Dorado Arkansas (Associate Project Manager 2011 & FTIR operator and sample recovery specialist 2012)
In 2011 Mr. Hoskinson certified the CEMS of eight power turbines at the Union Power facility. Hoskinson worked closely with Union Power staff to verify the accuracy of each CEMS. Hoskinson generated onsite, daily Relative Accuracy (RA) calculations and Bias Adjustment Factors (BAF) for facility staff review.

In 2012 Mr. Hoskinson performed Fourier Transform Infrared Spectroscopy (FTIR) measurements on one of the eight units for the determination of ammonia slip.

Hoskinson was able to provide real time ammonia concentrations to plant personnel, in order to ensure their catalytic injection system was functioning properly.

Suez Energy, Poolville, Texas (Associate Project Manager: August, 2011)
Mr. Hoskinson served as the onsite Qualified Individual (QI) during the CEMS certification programs. Hoskinson performed US EPA 40 CFR Part 75 RATA tests on two GE Frame 7 power turbines and their associated CEMS. Hoskinson generated all reference method data, compiled all corresponding CEMS data, and generated the final report for submittal to Suez Energy personnel. Hoskinson also compiled the results of ammonia field sampling for comparison with facility's ammonia CEMS, and prepared an ammonia RATA report.

Chevron Texaco, Pascagoula, MS (Field Test Technician: April 2010-2012)
Mr. Hoskinson has performed a multitude of source tests on numerous sources at the Chevron Refinery. Hoskinson has functioned as a test technician, manual sampling operator, instrumental operator, and field chemist responsible for sample recovery, reagent preparation, and sample shipment.

Luminant, Big Brown Power Generation, Fairfield TX (Associate Project Manager/Field Test Team Leader July 2011)
Mr. Hoskinson served as the on-site field supervisor during a complex test program at the facility. Hoskinson was responsible for three test teams sampling for mercury, halogen, and particulate emissions. Hoskinson also measured sulfur dioxide emissions from the three locations via instrumental analysis (M 6C). Hoskinson coordinated with plant staff, and pollution control contractors to ensure each test was performed simultaneously and accurately at each of the three locations.

Oglethorpe Power Partners, Dalton Georgia (Associate Project Manager: June 2011)
Mr. Hoskinson served as the onsite Qualified Individual (QI) during the CEMS certification programs. Hoskinson performed US EPA 40 CFR Part 60 & 75 RATA tests on four GE Frame 7 power turbines and their associated CEMS. Hoskinson generated all reference method data, compiled all corresponding CEMS data, and generated the final report for submittal to plant personnel.

Cemex, Odessa, Texas (Associate Project Manager: October, June 2011)
Mr. Hoskinson served as the on-site field supervisor and FTIR operator. Hoskinson lead a team of three technicians for the determination of metals, particulate matter, organic HAPs, VOCs, and HCl emissions. Hoskinson also served as the instrument and FTIR operator and supplied plant engineers with real time formaldehyde, acetaldehyde, and HCl emissions data. Hoskinson also collected all field data, samples, and generated a final report for submission to Cemex staff. The report was used as an informational tool in the development of new compliance procedures as dictated by recent Federal Regulations concerning the pollutants measured.

SPECIALIZED TRAINING

- Qualified Source Testing Individual (QSTI) Groups I, II, III, and IV
- Basic Plus Safety Training, current
- Hydrogen Sulfide Safety Training, current