Consumers Energy

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Compliance Test Report

EUENGINE 3-1, 3-2, 3-3, 3-4, 3-5 and EUEMERGGEN3

Ray Compressor Station
69333 Omo Road
Armada, Michigan 48005
State Registration Number (SRN) B6636

Test Dates: March 25-28, 2014

Report Submitted:
May 27, 2014

Work Order No. 21777989
Report Revision 0

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Laboratory Services Department

1.0 INTRODUCTION

Identification, location and dates of tests

This report summarizes the results of testing conducted on March 25-28, 2014 at Consumers Energy Company's (CEC) Ray Compressor Station. CEC's Regulatory Compliance Testing Section (RCTS) conducted performance tests on five (5) 4-stroke lean burn (4SLB) natural gas-fired, reciprocating internal combustion engines (RICE) and one (1) 4SLB natural gas-fired emergency RICE, identified as EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4, EUENGINE3-5 (i.e., production engines) and EUEMERGGEN3. The engines are located and operating at the Ray Compressor Station in Armada, Michigan.

Purpose of testing

The purpose of the testing was to evaluate compliance with both (a) the National Emission Standards for Hazardous Air Pollutants (NESHAP) for RICE, 40 CFR Part 63, Subpart ZZZZ, and (b) Standards of Performance for Stationary Spark Ignition (SI) Internal Combustion Engines (ICE), 40 CFR Part 60, Subpart JJJJ and consisted of the following:

Unit	Parameter to be Tested	Underlying Regulation
EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4 & EUENGINE3-5	Carbon Monoxide (CO) & diluent gas (Oxygen (O_2)or Carbon Dioxide (CO_2)) both upstream and downstream from the oxidation catalyst (% reduction)	Subpart ZZZZ
	Nitrogen Oxides (NO_x), CO[1] & Volatile Organic Compound (VOC) emissions at the engine exhaust (outlet)	Subpart JJJJ
EUEMERGGEN3	NO_x, CO & VOC emissions at exhaust outlet	Subpart JJJJ

[1] Please note in 40 CFR Part 60, Subpart JJJJ, Table 1, footnote (b) indicates a new or reconstructed non-emergency lean burn SI ICE greater than or equal to 250 brake horsepower meeting 40 CFR Part 63, Subpart ZZZZ requirements are not required to comply with the CO emission standards in Subpart JJJJ.

Brief description of source

The Ray Compressor Station is a natural gas compressor station. The purpose of the facility is to maintain pressure of natural gas in order to move it in and out of storage reservoirs and along the pipeline system. Each RICE is of a 4SLB design and is exclusively fired with pipeline quality natural gas. EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4 and EUENGINE3-5 are Caterpillar Model G3616 engines. Each of these engines are equipped with oxidation catalysts to reduce CO and VOC emissions. EUEMERGGEN3 is a Caterpillar Model G3516B LE engine and is not equipped with add-on controls.

Names, addresses, and telephone numbers of the contacts for information regarding the test and the test report, and names and affiliation of all personnel involved in conducting the testing

The testing was performed by CEC RCTS employees Joe Mason and Brian Glendening on March 25-28, 2014. MDEQ representatives Mr. Robert Elmouchi and Mr. Mark Dziadosz observed portions of the test. Ray Field Leader, Mr. Dominic Tomasino, coordinated the test and collected operating data. The following table contains the test program participant contact information.

Test Program Participants
Ray Compressor Station

Responsible Party	Address	Contact
Test Facility	Ray Compressor Station 69333 Omo Road Armada, Michigan 48005	Mr. Dominic Tomasino 586-784-2096 dominic.tomasino@cmsenergy.com
Corporate Air Quality Contact	Consumers Energy Company Environmental Services Department 1945 West Parnall Road Jackson, Michigan 49201	Ms. Amy Kapuga 517-788-2201 amy.kapuga@cmsenergy.com
Test Representative	Consumers Energy Company Regulatory Compliance Testing Section 17010 Croswell Street West Olive, Michigan 49460	Mr. Joe Mason, QSTI 231-720-4856 joe.mason@cmsenergy.com
State Representative	Michigan Department of Environmental Quality Technical Programs Unit 525 W. Allegan, Constitution Hall Lansing, Michigan 48909	Mr. Robert Elmouchi 586-753-3736 elmouchir@michigan.gov
		Mr. Mark Dziadosz 586-753-3745 dziadoszm@michigan.gov

2.0 SUMMARY OF RESULTS

Operating Data

EUENGINE3-1 – EUENGINE3-5

Operating data collected during each test run for the production engines included catalyst inlet temperature, pressure drop across catalyst, engine load, ambient temperature, barometric pressure, humidity, fuel flow rate, suction pressure, discharge pressure and horsepower. The purpose of documenting engine horsepower is to verify engine load during the performance test, as Subpart ZZZZ § 63.6620 (b) states *the test must be conducted at any load condition within plus or minus 10 percent of 100 percent load.* Engine percent load was obtained directly from the data acquisition system and was calculated by dividing the recorded horsepower value observed during each test run by the rated engine horse power.

EUEMERGGEN3

Operating data collected during each test run for the emergency engine included torque, rpm, fuel flow rate, engine load, horsepower, ambient temperature, barometric pressure and humidity. The purpose of documenting engine load is to verify that the unit was operating at full load during the performance test, as Subpart JJJJ § 60.4244(a) states *each performance test must be conducted within 10 percent of 100 percent peak (or the highest achievable) load.*

Applicable Permit Number

The Ray Compressor Station is currently operating pursuant to the terms and conditions of Renewable Operating Permit (ROP) No. MI-ROP- B6636-2010 and Permit to Install (PTI) No. 206-09. Performance tests were conducted, as required, on five (5) 4SLB natural gas-fired RICE and one (1) 4SLB natural gas-fired emergency RICE, identified as EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4, EUENGINE3-5 (i.e., production engines) and EUEMERGGEN3.

Results

The purpose of the testing was to evaluate compliance with both (a) the National Emission Standards for Hazardous Air Pollutants (NESHAP) for RICE, 40 CFR Part 63, Subpart ZZZZ, and (b) Standards of Performance for Stationary Spark Ignition (SI) Internal Combustion Engines (ICE), 40 CFR Part 60, Subpart JJJJ. A summary of the test results are presented below.

Summary of 40 CFR 63 Subpart ZZZZ RICE Carbon Monoxide Reduction, Catalyst Pressure Drop & Catalyst Inlet Temperature Results

Source	CO Reduction Efficiency (%) [ZZZZ Limit = ≥93%]	Catalyst Pressure Drop (Inches Water Gauge)	Catalyst Inlet Temperature (°F)
EUENGINE3-1	99.6	2.0	839
EUENGINE3-2	99.6	2.3	856
EUENGINE3-3	99.0	2.1	832
EUENGINE3-4	99.2	2.4	855
EUENGINE3-5	99.2	2.1	843

Based on the dry CO concentrations measured at the oxidation catalyst inlet and outlet and corrected to 15% O_2, the above results indicate the oxidation catalysts are operating at a CO reduction efficiency greater than the 93 percentage requirement in Subpart ZZZZ.

In addition, NO_x, CO and VOC emission rates were verified for the natural gas-fired RICE pursuant to PTI 206-09, FGENGINES3, Conditions I.1, I.2, I.4 and IX.2 and EUEMERGGEN33, Conditions I.1, I.2 and IX.1.

Summary of 40 CFR 60 Subpart JJJJ NO_x, CO and VOC Emission Rates

Source	NO_x Emission Rate (g/HP-hr) [PTI Limit = 0.5; JJJJ Limit = 2.0]	CO Emission Rate (g/HP-hr) [PTI Limit = 0.2[1]; JJJJ Limit = 4.0]	VOC Emission Rate, Expressed as NMNEOC (g/HP-hr) [PTI Limit = 0.19; JJJJ Limit = 1.0]	VOC Emission Rate, Expressed as NMNEOC (g/HP-hr) [PTI Limit = 0.81; JJJJ Limit = 1.0]
EUENGINE3-1	0.30	0.007	0.04	
EUENGINE3-2	0.33	0.009	0.04	
EUENGINE3-3	0.30	0.014	0.04	
EUENGINE3-4	0.33	0.013	0.09	
EUENGINE3-5	0.26	0.014	0.04	
EUEMERGGEN3	0.44	2.26		0.095

[1]Please note that the CO emission limit of 0.2 g/HP-hr only applies to EUENGINE3-1 through EUENGINE3-5, not EUEMERGGEN3.

The NOx, CO and VOC engine emission rates shown above all fall within the permit requirements, as well as the applicable emission limits within 40 CFR Part 60, Subpart JJJJ in cases where the permit does not contain an explicit emission limit.

3.0 SOURCE DESCRIPTION

Description of Process

The Ray Compressor Station is a natural gas compressor station. The purpose of the facility is to maintain pressure of natural gas in order to move it in and out of storage reservoirs and along the pipeline system. Five (5) natural gas-fired reciprocating engine driven compressor units, designated at EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4 and EUENGINE3-5 (i.e, production engines), were installed in 2013 to maintain station reliability, working in conjunction with several other RICE located at the facility. In addition, a natural gas-fired emergency engine, identified as EUEMERGGEN3, was also installed in 2013.

The NO_x emissions from each of the engines are minimized through the use of lean-burn combustion technology. Lean-burn combustion refers to a high level of excess air (generally 50% to 100% relative to the stoichiometric amount) in the combustion chamber. The excess air absorbs heat during the combustion process, thereby reducing the combustion temperature and pressure and resulting in lower NO_x emissions.

Each of the production engines is also equipped with oxidation catalysts. The catalysts are designed in a modular manner, and each Caterpillar Model G3616 engine is equipped with four catalyst modules. The catalysts use proprietary materials in order to lower the temperature at which the oxidation process occurs for CO and other organic compounds. As a result, the oxidation process will occur at the exhaust gas temperatures generated by the engines. The catalyst vendor has guaranteed a minimum CO destruction efficiency of 93%. The estimated formaldehyde and non-methane, non-ethane hydrocarbon (NMNEHC) destruction efficiencies are 85% and 75%, respectively.

Process Flow Sheet or Diagram

NA

Type and Quantity of Raw Material Processed During the Tests

NA

Maximum and Normal Rated Capacity of the Process

The Ray Compressor Station operates five (5) natural gas-fired, 4SLB Caterpillar engines equipped with oxidation catalysts for CO and formaldehyde reduction. These Model 3616's are operated to maintain pressure of natural gas in order to move it in and out of storage reservoirs and along the pipeline system. The facility also includes one natural gas-fired, 4SLB Caterpillar engine, without add-on controls, which supplies emergency power. The following table contains pertinent engine specifications.

Summary of Specifications for Ray Compressor Station RICE

Parameter [1]	EUENGINES3-1 thru 3-5	EUEMERGGEN3
Make	Caterpillar	Caterpillar
Model	G3616	G3516B LE
Output (brake-horsepower)	4,735	1,818
Heat Input, LHV (mmBtu/hour)	32.0	12.8
Exhaust Gas Temp. (°F)	856	974

[1] All engine specifications are based upon vendor data for operation at 100% of rated engine capacity.

Description of Process Instrumentation Monitored During the Test

Production engine process data collected included catalyst inlet temperature, pressure drop across the catalyst, engine load, horsepower, ambient temperature, barometric pressure, humidity, fuel flow rate, suction pressure and discharge pressure. Emergency engine process data collected included torque, rpm, engine load, fuel flow rate, horsepower, ambient temperature, barometric pressure and humidity. With the exception of the ambient data (collected once per day of testing), the preceding data was logged at least once every clock minute and then averaged to determine the per-test run values.

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4.0 SAMPLING AND ANALYTICAL PROCEDURES

Description of sampling train(s) and field procedures

Triplicate one-hour runs were performed on each production engine to determine CO reduction efficiency by concurrently measuring O_2, CO_2 and CO concentrations at the oxidation catalyst inlet and outlet (engine exhaust). NO_x and VOC concentrations were also measured in conjunction with the CO at the engine exhausts. The U.S. EPA Test Methods were used exclusively, as described within the test protocol. The CO reduction efficiency test methods and calculations were consistent with those specified in 40 CFR Part 63, Subpart ZZZZ §63.6620 Equation 1 and Table 4. The NO_x, CO and VOC emission rates were measured and calculated using Equations 1-3 in 40 CFR Part 60, Subpart JJJJ §60.4244 and Table 2.

Please note that RCTS measured O_2 and CO_2 diluent concentrations, which affords the use of either to satisfy Subpart ZZZZ requirements for correcting CO concentrations to 15% O_2 prior to determining percent CO reduction. The CO_2 correction factor is based on O_2 to CO_2 fuel factor ratios as described in §63.6620 (e)(2)(ii)(Eq.3), which allows the CO concentrations to be corrected to 15% O_2 based on dry basis CO_2 concentrations as described in Equation 4, § 63.6620 (e)(2)(iii). The F_c and F_d fuel factors used to derive the CO_2 correction factors were based on the daily natural gas fuel samples and analyses.

The sampling locations at EUENGINES3-1 thru 3-5 are a-typical (relative to U.S. EPA Method 1 *"Sample and Velocity Traverses for Stationary Sources"* criteria) at the oxidation catalyst inlet, due to the proprietary nature and design of that abatement equipment. Figure 3 of this report illustrates the path of engine effluent as it enters and exits the oxidation catalyst. In an attempt to meet the gas stratification requirements of U.S. EPA Method 7E, measurements at each engine catalyst inlet were performed by selecting and traversing 2 points within each of the two catalyst inlet "ducts". The design and dimension of these ducts precluded the use of more than 2 traverse points. Conversely, the engine exhaust traverse points were typical from a U.S. EPA Method 1 perspective. As illustrated in Figure 3, each engine exhausts via a single duct, so the initial engine exhaust traverses included 12 traverse points, meeting U.S. EPA Method 7E requirements. While performing initial stratification traverses at each location, it was apparent the gas stream concentrations varied significantly at each traverse point, rather than at consecutive traverse points. These findings essentially indicated the engine exhaust varied temporally at each traverse point such that the intent of the stratification test could not be satisfied, thus negating the purpose of the exercise. Subsequently, after establishing similarly varying effluent existed at each of the other engine sample locations, all test runs performed thereafter utilized a single traverse point, located as close to the middle of the duct as practicable.

All components of the CO_2, O_2, NO_x, CO and VOC extractive sample systems in contact with flue gas were constructed of Type 316 stainless steel and/or Teflon. The sampling systems consisted of two separate sample probes securely clamped together and co-located in the duct at the same location and two separate heated sample lines. The CO_2, O_2, NO_x and CO samples were routed to an ice/water bath to remove moisture from the gas prior to injection into the respective analyzer, while the VOC sample was injected directly into the analyzer from the heated sample line as the VOC instrument measures gas on a wet basis. The output signal from each analyzer was connected to a computerized data acquisition system (DAS).

The CO_2, O_2, NO_x, and CO analyzers were calibrated with U.S. EPA Protocol calibration gases at a minimum of three points: low (0-20% of calibration span), mid-level (40-60% of calibration span) and high-level gas (equal to the calibration span) following specifications in U.S. EPA Method 7E. The VOC instrument was calibrated with four propane in nitrogen gases following U.S. EPA Method 25A specifications at the zero level, low (25 to 35 percent of calibration span), mid (45 to 55 percent of calibration span and high (equivalent to instrument span). All instruments were operated thereafter to insure that zero drift, calibration gas drift, bias and calibration error met the specified method requirements. The extractive sample system apparatus diagram is shown in Figure 1.

The data measured from the pollutant and diluent analyzers was averaged for each run and corrected for drift and bias. The inlet and outlet CO concentrations in part per million by volume (ppmv) used for determining CO reduction efficiency were also corrected to 15 percent O_2 using the CO_2 correction factor ratio equation in 40 CFR Part 63, Subpart ZZZZ, § 63.6620 (e)(2)(ii). Both CO_2 and O_2, concentrations were measured as percent by volume, dry basis, while NO_x concentrations were measured as ppmv, dry basis.

CO_2 and O_2 diluent concentrations were monitored using a non-dispersive infrared (NDIR) and paramagnetic analyzer, respectively, following the guidelines of U.S. EPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from a Stationary Source (Instrumental Analyzer Procedure).*

NO_x concentrations were monitored using a chemiluminescence analyzer following the guidelines of U.S. EPA Method 7E, *Determination of Nitrogen Oxides from Stationary Sources (Instrumental Analyzer Procedure).*

The CO concentrations were measured using an NDIR analyzer following the guidelines of U.S. EPA Reference Method 10, *Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure).*

VOC concentrations were monitored using a Thermo Model 55i Direct Methane and Non-methane Analyzer following the guidelines of U.S. EPA Method 25A, *Determination of Total Gaseous Organic Concentration Using a Flame ionization Analyzer (FIA)* using the drift and bias corrections specified in U.S. EPA Method 7E, *Determination of Nitrogen Oxides from Stationary Sources (Instrumental Analyzer Procedure).* This instrument is similar to a Method 25A analyzer with methane cutter in that it employs a flame ionization detector (FID) analytical principal and is capable of providing a total hydrocarbon concentration, minus methane. However, with the Thermo 55i analyzer, the method of determining the methane and non-methane organic concentrations is slightly different. Specifically, while the Thermo 55i does rely upon a FID to determine the concentration of organic compounds, it also contains a gas chromatographic column which is used to separate methane from the other organic compounds. It works by first injecting the sample gas into the column, after which the methane fraction of the sample gas moves through the column more quickly than the other organic compounds (due to its low molecular weight and high volatility). The methane then exits the column and is analyzed in the FID. After the methane has been analyzed, the column is flushed with inert carrier gas and the remaining non-methane organic compounds are then analyzed in the FID. The preceding analytical technique results in separate measurements for methane and non-methane organic compounds via the use of a single FID, and these measurements are recorded by a data acquisition system. Compared to more conventional Method 25A analyzers with methane cutters, the Thermo 55i is expected to yield more accurate low-level non-methane hydrocarbon measurements, even in the presence of high levels of methane. It should be noted that, for purposes of this test program, RCTS did not quality assure the methane channel on the Thermo Model 55i analyzer.

Quality Assurance Procedures

Each U.S. EPA reference method performed during this test contains specific language stating that to obtain reliable results, persons using these methods should have a thorough knowledge of the techniques associated with each method. To that end, CEC RCTS attempts to minimize any factors which could cause sampling errors by implementing a quality assurance (QA) program into every component of field testing, including the following information.

U.S. EPA Protocol gas standards certified according to the U.S. EPA Traceability Protocol for Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997 or May, 2012 version and certified to have a total relative uncertainty of ±1 percent were used to calibrate the analyzers during the test program. Although not required in the context of this Parts 60 and 63 test program, the vendors providing the calibration gases also participate in the Protocol Gas Verification Program (PGVP), an EPA audited program recently developed for 40 CFR Part 75.

The extractive sample system instruments were calibrated and operated following the appropriate method guidelines, based on specifications contained in Method 7E (as referenced in Methods 3A and 10). Before daily testing began, an analyzer calibration error (ACE) test was conducted by introducing the calibration gases directly into each analyzer. If the measured response didn't meet the ±2 percent of instrument span specification, or within 0.5 ppmv absolute difference to pass the ACE check, appropriate action was taken and the ACE was repeated. Prior to beginning the first run, an initial system bias check was conducted by introducing the low and upscale calibration gases into the sampling system at the probe outlet and drawing them through the sample conditioning system in the same manner as the exhaust gas sample, while measuring the instrument response. Each instrument response must meet a specification of $\leq$ 5.0 percent of instrument span.

Low and upscale bias calibrations were performed after each run thereafter to quantify system calibration drift and bias. During the initial system bias tests, system response time was measured and the sample flow rate throughout the remainder of the test was monitored to maintain the sample flow rate within 10 percent of the average flow rate observed during the response time test. Sampling for each run was started after twice the system response time had elapsed.

Description of recovery and analytical procedures
NA

Dimensioned sketch showing all sampling ports in relation to breeching and to upstream and downstream disturbances or obstructions of gas flow and a sketch of cross-sectional view of stack indicating traverse point locations and exact stack dimensions
The exhaust stack configuration for the Caterpillar Model G3616 engines (i.e., EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4 and EUENGINE3-5) is shown in Figure 2, including hand markups which are intended to provide an illustration of the flue gas path through the stack. The exhaust stack configuration for the emergency engine (EUEMERGGEN3) is shown in Figure 3.

5.0 TEST RESULTS AND DISCUSSION

Detailed tabulation of results, including process operating conditions and flue gas conditions

Except as noted, Tables 1-6 contain a summary of the CO percent reductions and emission rates observed for each of the units during testing conducted March 25-28, 2014. RICE operating data, calculation spreadsheets, field data sheets, calibration information, fuel analyses and analytical data are contained in Attachments 1 - 6.

Discussion of significance of results relative to operating parameters and emission regulations

40 CFR 63 Subpart ZZZZ

The average percent reduction of CO, for each of the five production units, was greater than the minimum required destruction efficiency. Thus, Units EUENGINE3-1, EUENGINE3-2, EUENGINE3-3, EUENGINE3-4 and EUENGINE3-5 are in compliance with the CO percent reduction across the catalyst. In addition, the catalyst inlet temperatures and pressure drop across the catalyst were monitored continuously throughout testing and were shown to be within the required ranges.

40 CFR 60 Subpart JJJJ

The NO_x, CO and VOC emission rates are within the MDEQ PTI 206-09 and 40 CFR 60 Subpart JJJJ emission limits for each of the five production engines, as well as the emergency engine.

While the Thermo Model 55i Direct Methane and Non-methane Analyzer described above was operated throughout the various engine tests, this data was not ultimately used for purposes of demonstrating compliance. Although calibrations were generally passing, the NMOC values indicated by the Thermo 55i analyzer were higher than the values observed at these same engines during 2013 testing, as well as the same model engines at Consumers Energy's White Pigeon Compressor Station, which were tested earlier in March 2014. After consultation with the MDEQ-AQD, RCTS extracted VOC samples into Tedlar bags at each source in conjunction with other ongoing tests.

Subsequently, the grab samples were collected and analyzed by an outside laboratory in order to determine the VOC concentrations for EUENGINES3-1 thru 3-5 and EUEMERGGEN3; the results of these analyses provided methane, ethane and total non-methane, non-ethane organic concentration (TNMNEOC). As the Method 25A VOC measurements were not ultimately used to determine compliance, none of the associated data has been included within the test report. However, the data can be provided upon request.

While neither methane nor ethane is classified as a VOC, RCTS also used this data to calculate the non-methane organic concentration (NMOC), as 40 CFR Part 60, Subpart JJJJ only explicitly states that formaldehyde and methane can be excluded from the total organic concentrations when assessing compliance with the VOC emission limits. For EUENGINES3-1 thru 3-5 and EUEMERGGEN3, the test summary tables provide VOC g/HP-hr emission rates as both NMOC and NMNEOC; in all cases, the VOC emission rates are well below the Subpart JJJJ emission limit of 1.0 g/HP-hr.

Discussion of any variations from normal sampling procedures or operating conditions, which could have affected the results

<u>VOC Test Procedures (All Engines)</u>
As noted above, the Thermo 55i analyzer NMOC values appeared suspicious based upon recent testing for the same model engines and onsite MDEQ personnel allowed Tedlar bag grab samples to be taken at each engine exhaust during each test run for purposes of determining VOC concentration. The samples were sent to an off-site laboratory to be analyzed for methane, ethene, ethane and total non-methane, non-ethane organic carbon (TNMNEOC) according to CTM-035, *Determination of Low Concentration Non-Methane Non-Ethane Organic Compound Emissions From Clean Fueled Combustion Sources*. The laboratory conducting the analyses was Atmospheric Analysis & Consulting, Inc. (AAC), located in Ventura, California. Attachment 6 contains the analytical reports from AAC, including the Quality Control/Quality Assurance (QA/QC) reports associated with the CTM-035 analyses.

Per the discussion of the 40 CFR Part 60, Subpart JJJJ test results, the ethane and TNMNEOC concentrations provided by AAC were also used determine the NMOC concentrations associated with each test run. The TNMNEOC values provided by AAC were expressed as propane, and AAC stated that the NMOC concentration as propane could be calculated by multiplying the ethane concentration by 2 (for two carbon atoms per ethane molecule) and then dividing by 3 (for three carbon atoms per propane molecule), and then adding the resulting concentration to the provided TNMNEOC values (already expressed as propane). This process is illustrated below for EUENGINE3-1, Run 1.

- Ethane Concentration = 20.4 ppmvw; TNMNEOC = 4.4 ppmvw tested units), the revisions require that sampling be conducted at three traverse points located at 16.7%, 50.0% and 83.3% of the measurement line or that stratification testing be conducted, after which the number of sampling points would be selected consistent with Section 8.1.2 of Method 7E. If the stratification test is failed, Method 7E then requires sampling from 12 traverse points.

During previous 40 CFR Part 63, Subpart ZZZZ testing events at the Ray Compressor Station, stratification testing had also been conducted and the same temporal variation was observed and discussed with the MDEQ-AQD, after which the MDEQ-AQD approved sampling from a single traverse point. Based upon the previous stratification testing, there is no evidence that exhaust gas concentrations are stratified across the measurement plane in a consistent manner, so sampling at a single traverse point is expected to yield results similar to what would be obtained by traversing the measurement plane. Thus, the use of a single sampling point in lieu of a 3 point traverse should not affect the test results.

EUENGINE3-1 Discussion

The data sheets in Attachment 3 include the 1-minute reference method concentrations collected during each test run. When conducting a detailed review of this 1-minute data following the test event, a shift in outlet Run 1 concentrations was observed for the time period 12:24-12:40, with CO_2 and NO_x concentrations falling, O_2 concentrations increasing and CO concentrations generally staying steady. While the cause of this shift is not known, the observed shift is generally indicative of ambient air being pulled into the sampling system. To gauge the impact of this shift in concentrations on the calculated test results, the Run 1 outlet average values were recalculated based on the time period 11:41-12:23. The results associated with this truncated data set (43 minutes for the outlet averages) are as follows:

- Outlet CO Concentration at 15% O_2 = 1.07 ppmvd;
- CO Reduction Efficiency = 99.61%;
- Outlet CO Emission Rate = 0.008 g/HP-hr;
- Outlet NO_x Emission Rate = 0.296 g/HP-hr

The preceding results are nearly identical to those presented in the official summary tables based on the entire data set, as they are well below the applicable emission limits in PTI 206-09 and 40 CFR Part 60, Subpart JJJJ. Thus, this observed shift in concentrations towards the end of Run 1 does not appear to have a material effect on the test results.

If should also be noted that for Run 2, the outlet 1-minute data for 12:59 appears to be suspect and not representative of the exhaust gas concentrations. Thus, minute 12:59 was excluded when calculating the outlet averages for Run 2, leaving 59 minutes of valid data. Due to little minute-to-minute variation observed in the outlet concentrations, the use of 59 minutes of data as opposed to 60 minutes of data is not expected to affect the run average result.

EUENGINE3-2 Discussion

For this test event, the first run was conducted on 03/26/14, while the second and third runs were conducted on 03/27/14. Although not technically required by Method 7E, analyzer calibration error tests were conducted prior to the start of testing on each calendar day of the testing event.

While in the field, RCTS closely observes the instantaneous analyzer DAS responses to calibration gas injections to ensure that they are within tolerance for calibration error, drift and bias. However, during each test event, RCTS did not consistently calculate analyzer calibration error, drift and bias test results using official logged 1-minute data. Note that the RCTS DAS software displays only current values, updated every three seconds, rather than a running one-minute average, and under normal test circumstances, RCTS easily recognizes and utilizes this function. Various extenuating field circumstances however, can truncate the observation timing, and occasionally, an instantaneous DAS value is observed and inadvertently accepted in lieu of a one-minute average. In this particular case, even though the instantaneous analyzer responses observed in the field were within tolerance, the logged 1-minute analyzer readings for 03/27/14 suggest the analyzer calibration error is outside of tolerance for CO at the catalyst inlet and outlet, thereby effecting the CO inlet drift checks for Runs 2 and 3 and the NO_x Run 3 drift, accordingly. Please note there were no instances of failed bias tests.

While these official calibration records for 03/27/14 show failing analyzer calibration error and drift tests, RCTS purports the associated CO and NO_x analyzers were performing well within tolerance during the test event, and these failed tests were ultimately a result of not allowing the DAS 1-minute average to stabilize between the calibration gas injections. Specifically, RCTS believes the 1-minute averages recorded within the data logger during the calibration gas injections weren't stable responses to a given calibration level, but rather the combined stable response and transition to another calibration gas level.

Lastly, in relation to NO_x, RCTS notes the only failed quality assurance test consisted of the drift test for Run 3. Pursuant to Method 7E, Section 8.5, a failed drift test does not invalidate the associated test run. Rather, subsequent test runs cannot be conducted until an analyzer calibration error and bias test are conducted and passed for each effected instrument. As Run 3 was the last run in the daily test series, no additional analyzer calibration error tests or bias tests were required.

Documentation of any process or control equipment upset condition which occurred during the testing

NA

Description of any major maintenance performed on the air pollution control device(s) during the three month period prior to testing

NA

In the event of a re-test, a description of any changes made to the process or air pollution control device(s)
NA

Results of any quality assurance audit sample analyses required by the reference method
NA

Calibration sheets for the dry gas meter, orifice meter, pitot tube, and any other equipment or analytical procedures which require calibration
Attachment 4 contains the analyzer calibration data, response time test results, NO_2 to NO converter efficiency check and calibration gas Certificates of Analysis. The results of stratification testing are not included as they ultimately were not used to determine the appropriate number of traverse points. The stratification test requirements in Method 7E do not lend themselves well to the small-diameter stacks of stationary combustion engines, which are noted for well-mixed yet temporally varying effluent. These exhaust gas attributes rarely result in a meaningful stratification test because any measured stratification using Method 7E techniques is indistinguishable from the natural temporal "stratification" created by the process. Therefore, RCTS performed initial stratification tests at each source in an attempt to corroborate any stratification beyond existing temporal variations.

Sample calculations of all the formulas used to calculate the results
Sample calculations for all formulas used in the test report are contained in Attachment 7.

Copies of all field data sheets, including any pre-testing, aborted tests, and/or repeat attempts
Please refer to Attachment 1 for process data collected during the test runs; Attachment 2 for calculation spreadsheets for each of the test runs; and Attachment 3 for data sheets with the measured concentrations for each test run.

Copies of all laboratory data including QA/QC
For this testing event, laboratory data includes the results of the natural gas fuel analyses which are presented in Attachment 5, and the VOC grab samples analyses which are presented in Attachment 6. The information in Attachment 5 also includes a calculation spreadsheet for each natural gas fuel analysis for purposes of calculating the F_d, F_c and F_w fuel factors. The analytical test reports for VOC analysis in Attachment 6 include Quality Control/Quality Assurance Reports which document the acceptability of the test results.

TABLE 1
SUMMARY OF RICE EFFICIENCY AND EMISSIONS
RAY COMPRESSOR STATION
EUENGINE 3-1
March 27, 2014

Time Period	Run 1	Run 2	Run 3	Averages
	1141-1240	1252-1351	1404-1503	
Process Conditions				
Engine Speed, Revolutions Per Minute:	1,000	999	999	**999**
Brake Horsepower:	4,587	4,595	4,560	**4,581**
Load, Percent:	96.9	97.2	96.4	**96.8**
Fuel Flow, SCFM	549.1	549.9	545.8	**548.2**
Suction Pressure, PSIG	462.9	462.3	461.8	**462.4**
Catalyst Delta P, Inches of Water:	2.00	2.00	2.00	**2.0**
Catalyst Inlet Temperature, degrees F:	839	838	839	**839**
Inlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	4.69	4.81	4.82	**4.77**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	388.23	397.14	403.16	**396.17**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	274.58	273.98	277.22	**275.26**
Outlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (percent):	4.68	5.07	5.08	**4.94**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	1.67	1.46	1.26	**1.46**
Drift Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	1.17	0.95	0.82	**0.98**
CO Percent Reduction Efficiency (≥93% per 40 CFR Part 63, Subpart ZZZZ):	99.6	99.7	99.7	**99.6**
Emission Rate, Grams Per Brake Horsepower:	0.008	0.007	0.006	**0.007**
ROP Emission Limit, Grams Per Brake Horsepower[1]:	0.2	0.2	0.2	**0.2**
Drift Corrected Nitrogen Oxides Concentration (ppmdv):	35.4	37.8	37.7	**37.0**
Emission Rate, Grams Per Brake Horsepower:	0.29	0.29	0.32	**0.30**
PTI Emission Limit, Grams Per Brake Horsepower:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv), Expressed as Propane:	5.03	5.18	5.30	**5.17**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.04	0.04	0.04	**0.04**
Volatile Organic Compounds (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	20.59	21.54	22.35	**21.49**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.16	0.16	0.18	**0.17**
PTI Emission Limit, Grams Per Brake Horsepower Hour[1]:	0.19	0.19	0.19	**0.19**

The PTI CO, NO_x and VOC emission limits are more stringent than the applicable limits in 40 CFR Part 60, Subpart JJJJ, which are as follows: CO = 4.0 grams/HP-hr; NO_x = 2.0 grams/HP-hr; VOC = 1.0 grams/HP-hr

TABLE 2
SUMMARY OF RICE EFFICIENCY AND EMISSIONS
RAY COMPRESSOR STATION
EUENGINE3-2
March 26 and 27, 2014

Time Period	Run 1 1612-1611 3/26/2014	Run 2 0854-0954 3/27/2014	Run 3 1011-1111 3/27/2014	Averages
Process Conditions				
Engine Speed, Revolutions Per Minute:	1,000	1,000	1,000	**1,000**
Brake Horsepower:	4,526	4,483	4,503	**4,504**
Load, Percent:	95.6	94.7	95.1	**95.1**
Fuel Flow, SCFM	551.3	546.2	549.8	**549.1**
Suction Pressure, PSIG	460.9	456.2	452.4	**456.5**
Catalyst Delta P, Inches of Water:	2.5	2.1	2.1	**2.3**
Catalyst Inlet Temperature, degrees F:	854	858	857	**856**
Inlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	4.53	4.67	4.75	**4.65**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	353.75	398.19	401.81	**384.58**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	258.93	282.91	280.86	**274.23**
.tlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (percent):	5.0	5.0	5.1	**5.0**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	1.4	1.8	2.3	**1.8**
Drift Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	0.9	1.2	1.5	**1.2**
CO Percent Reduction Efficiency (≥93% per 40 CFR Part 63, Subpart ZZZZ):	99.6	99.6	99.5	**99.6**
Emission Rate, Grams Per Brake Horsepower:	0.007	0.008	0.011	**0.009**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.2	0.2	0.2	**0.2**
Drift Corrected Nitrogen Oxides Concentration (ppmdv):	40.9	41.6	42.2	**41.6**
Emission Rate, Grams Per Brake Horsepower:	0.32	0.33	0.33	**0.33**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv) Expressed as Propane:	5.26	5.76	5.41	**5.48**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.04	0.04	0.04	**0.04**
Volatile Organic Compounds (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	22.32	24.04	22.24	**22.87**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.17	0.18	0.17	**0.17**
PTI Emission Limit, Grams Per Brake Horsepower Hour[1]:	0.19	0.19	0.19	**0.19**

[1] The PTI CO, NO_x and VOC emission limits are more stringent than the applicable limits in 40 CFR Part 60, Subpart JJJJ, which are as follows:) = 4.0 grams/HP-hr; NO_x = 2.0 grams/HP-hr; VOC = 1.0 grams/HP-hr

TABLE 3
SUMMARY OF RICE EFFICIENCY AND EMISSIONS
RAY COMPRESSOR STATION
EUENGINE3-3
March 26, 2014

Time Period	Run 1	Run 2	Run 3	Averages
	1114-1214	**1238-1338**	**1358-1458**	
Process Conditions				
Engine Speed, Revolutions Per Minute:	990	993	992	**992**
Brake Horsepower:	4,449	4,451	4,450	**4,450**
Load, Percent:	94.9	94.7	94.8	**94.8**
Fuel Flow, SCFM	534.9	534.7	535.0	**534.9**
Suction Pressure, PSIG	432.4	433.5	434.0	**433.3**
Catalyst Delta P, Inches of Water:	2.1	2.1	2.1	**2.1**
Catalyst Inlet Temperature, degrees F:	833	834	831	**832**
Inlet Gas Conditions				
Carbon Dioxide Concentration, percent:	4.97	4.97	5.03	**4.99**
Drift Corrected Carbon Monoxide Concentration (ppmdv):	263.56	356.28	359.50	**326.45**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	176.09	237.82	237.23	**217.04**
Outlet Gas Conditions				
Carbon Dioxide Concentration, percent:	5.10	5.06	5.06	**5.1**
Drift Corrected Carbon Monoxide Concentration (ppmdv):	4.61	2.76	2.02	**3.1**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	3.00	1.81	1.33	**2.0**
Percent Reduction Efficiency	98.3	99.2	99.4	**99.0**
Emission Rate, Grams Per Brake Horsepower:	0.021	0.013	0.009	**0.014**
Emission Limit, Grams Per Brake Horsepower:	0.2	0.2	0.2	**0.2**
Drift Corrected Nitrogen Oxides Concentration (ppmdv):	39.7	39.5	38.5	**39.2**
Emission Rate, Grams Per Brake Horsepower:	0.30	0.30	0.30	**0.30**
Emission Limit, Grams Per Brake Horsepower:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv) Expressed as propane):	5.72	5.08	5.77	**5.52**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.04	0.04	0.04	**0.04**
Volatile Organic Compounds (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	22.44	21.55	23.91	**22.63**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.16	0.16	0.18	**0.16**
Emission Limit, Grams Per Brake Horsepower Hour:	0.19	0.19	0.19	**0.19**

[1] The PTI CO, NO_x and VOC emission limits are more stringent than the applicable limits in 40 CFR Part 60, Subpart JJJJ, which are as follows: CO = 4.0 grams/HP-hr; NO_x = 2.0 grams/HP-hr; VOC = 1.0 grams/HP-hr

TABLE 4
SUMMARY OF RICE EFFICIENCY AND EMISSIONS
RAY COMPRESSOR STATION
EUENGINE3-4
March 25 and 26, 2014

Time Period	Run 1 3/25/2014 1513-1613	Run 2 3/25/2014 1637-1737	Run 3 3/26/2014 0934-1034	Averages
Process Conditions				
Engine Speed, Revolutions Per Minute:	989	987	999	**992**
Brake Horsepower:	4,381	4,378	4,532	**4,431**
Load, Percent:	93.6	93.6	95.8	**94.3**
Fuel flow, SCFM	526.5	526.3	542.6	**531.8**
Suction Pressure, PSIG:	447.3	447.2	428.4	**441.0**
Catalyst Delta P, Inches of Water:	2.3	2.3	2.6	**2.4**
Catalyst Inlet Temperature, degrees F:	855	855	856	**855**
Inlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	4.60	4.53	4.51	**4.55**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	200.12	358.45	263.72	**274.10**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	144.29	262.67	193.85	**200.27**
Outlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	4.96	4.96	5.03	**5.0**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	0.21	5.39	2.87	**2.8**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	0.14	3.60	1.90	**1.9**
CO Percent Reduction Efficiency (≥ 93% Per 40 CFR Part 63, Subpart ZZZZ):	99.9	98.6	99.0	**99.2**
Emission Rate, Grams Per Brake Horsepower:	0.001	0.026	0.014	**0.013**
ROP Emission Limit, Grams Per Brake Horsepower[1]:	0.2	0.2	0.2	**0.2**
Drift Corrected Nitrogen Oxides Concentration, Dry (ppmdv):	43.3	43.1	41.2	**42.5**
Emission Rate, Grams Per Brake Horsepower:	0.34	0.34	0.32	**0.33**
ROP Emission Limit, Grams Per Brake Horsepower[1]:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv) Expressed as Propane:	11.6	11.4	11.1	**11.4**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.09	0.09	0.08	**0.09**
VOC (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	28.14	27.70	26.87	**27.57**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.21	0.21	0.20	**0.21**
Emission Limit, Grams Per Brake Horsepower Hour[1]:	0.19	0.19	0.19	**0.19**

[1] The PTI CO and NO_x emision limits are more stringent than the applicable limits in 40 CFR Part 60, Subpart JJJJ, which are as ›ows: CO = 4.0 grams/HP-hour; NOx = 2.0 grams/HP-hour.

TABLE 5
SUMMARY OF RICE EFFICIENCY AND EMISSIONS
RAY COMPRESSOR STATION
EUENGINE3-5
March 25, 2014

Time Period	Run 1	Run 2	Run 3	Averages
	0929-1029	1050-1150	1204-1304	
Process Conditions				
Engine Speed, Revolutions Per Minute:	995	995	993	**994**
Brake Horsepower:	4,378	4,379	4,379	**4,379**
Load, Percent:	93.0	93.0	93.1	**93.0**
Fuel flow, SCFM	517.7	517.5	518.7	**518.0**
Suction Pressure, PSIG:	434.7	434.6	434.5	**434.6**
Catalyst Delta P, Inches of Water:	2.1	2.1	2.1	**2.1**
Catalyst Inlet Temperature, degrees F:	843	842	842	**843**
Inlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	4.88	4.80	4.81	**4.83**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	333.22	313.87	399.47	**348.85**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	230.17	220.20	279.99	**243.45**
Outlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	5.17	4.97	5.02	**5.1**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	3.54	0.75	4.69	**3.0**
Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	2.31	0.51	3.15	**2.0**
CO Percent Reduction Efficiency (≥ 93% Per 40 CFR Part 63, Subpart ZZZZ):	99.0	99.8	98.9	**99.2**
Emission Rate, Grams Per Brake Horsepower:	0.017	0.004	0.022	**0.014**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.2	0.2	0.2	**0.2**
Drift Corrected Nitrogen Oxides Concentration, Dry (ppmdv):	34.1	34.0	3.1	**23.7**
Emission Rate, Grams Per Brake Horsepower:	0.27	0.27	0.26	**0.26**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv) Expressed as Propane:	5.29	5.17	4.72	**5.06**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.04	0.04	0.04	**0.04**
Volatile Organic Compounds (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	21.17	21.43	19.84	**20.81**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.16	0.16	0.15	**0.16**
PTI Emission Limit, Grams Per Brake Horsepower Hour[1]:	0.19	0.19	0.19	**0.19**

The PTI CO, NO_x and VOC emission limits are more stringent than the applicable limits in 40 CFR Part 60, Subpart JJJJ, which are as follows: CO = 4.0 grams/HP-hr; NO_x = 2.0 grams/HP-hr; VOC = 1.0 grams/HP-hr

TABLE 6
SUMMARY OF RICE EMISSIONS
RAY COMPRESSOR STATION
EUEMERGGEN3
March 28, 2014

Time Period	Run 1 3/28/2014 1230-1329	Run 2 3/28/2014 1344-1443	Run 3 3/28/2014 1459-1558	Averages
Process Conditions				
Engine Speed, Revolutions Per Minute:	1,798	1,798	1,798	**1,798**
Brake Horsepower:	1,702	1,703	1,704	**1,703**
Load, Percent:	99.8	100.1	100.1	**100.0**
Fuel Flow, SCFM:	231.27	232.24	234.40	**232.6**
Outlet Gas Conditions				
Drift Corrected Carbon Dioxide Concentration, Dry (Percent):	6.41	6.47	6.47	**6.45**
Drift Corrected Carbon Monoxide Concentration, Dry (ppmdv):	529.53	512.62	534.09	**525.41**
Drift Corrected Carbon Monoxide Concentration (ppmdv @ 15% O2):	277.36	268.50	279.75	**275.20**
Emission Rate, Grams Per Brake Horsepower:	2.28	2.21	2.28	**2.26**
40 CFR Part 60, Subpart JJJJ Emission Limit, Grams Per Brake Horsepower:	4.0	4.0	4.0	**4.0**
Drift Corrected Nitrogen Oxides Concentration (ppmdv):	62.0	62.4	63.5	**62.7**
Emission Rate, Grams Per Brake Horsepower:	0.44	0.44	0.45	**0.44**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.5	0.5	0.5	**0.5**
Volatile Organic Compounds (as NMNEOC) Concentration, Dry (ppmdv), Expressed as Propane:	14.38	13.80	13.95	**14.04**
VOC (as NMNEOC) Emission Rate, Grams Per Brake Horsepower:	0.098	0.094	0.094	**0.095**
Volatile Organic Compounds (as NMOC) Concentration, Dry (ppmdv), Expressed as Propane:	25.91	24.63	24.73	**25.09**
VOC (as NMOC) Emission Rate, Grams Per Brake Horsepower:	0.18	0.17	0.17	**0.17**
PTI Emission Limit, Grams Per Brake Horsepower[1]:	0.81	0.81	0.81	**0.81**

[1] The PTI NO_x and VOC emission limits are more stringent than the applicable NO_x and VOC limits in 40 CFR Part 60, Subpart JJJJ, which are 2.0 grams/HP-hour and 1.0 grams/HP-hour, respectively