IMPACT COMPLIANCE & TESTING

AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM
NATURAL GAS-FIRED RECIPROCATING ENGINES

Breitburn Operating LP – Riverside Energy Michigan

1.0 INTRODUCTION

Breitburn Operating LP (a subsidiary of Maverick Natural Resources) and Riverside Energy Michigan (Riverside) own and operate stationary natural gas fired reciprocating internal combustion engines (RICE) at the Wilderness CO2 – Hayes 29 Central Production Facility. The two facilities (Maverick and Riverside) are operated under Renewable Operating Permit (ROP) No. MI-ROP-N5831-2014b issued by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). This test report is for

- Five (5) RICE operated by Maverick that are identified in Section 1 of the ROP as emission units EUENGINE1, EUENGINE2, EUENGINE3, EUENGINE4, and EUENGINE6. EUENGINE1-4 are collectively identified as flexible emission group FGCATENGINES.
- One RICE operated by Riverside that is identified as EUENGINEH29 in Section 2 of the ROP.

The compliance testing presented in this report was performed by Impact Compliance & Testing, Inc. (ICT). ICT representatives Blake Beddow and Clay Gaffey performed the field sampling and measurements on May 19 - 22, 2020.

The engine emission performance tests consisted of triplicate, one-hour sampling periods for nitrogen oxides (NOx) and carbon monoxide (CO). Exhaust gas velocity, moisture content, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate pollutant mass emission rates.

The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocol that was reviewed and approved by the EGLE-AQD in the March 17, 2020 Test Plan Approval Letters. The originally scheduled test event was delayed due to the nationwide COVID-19 (Coronavirus Disease 2019) outbreak. This was communicated to the regulatory agency using the enforcement discretion reporting procedures specified by EGLE.

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Questions regarding this emission test report should be directed to:

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Riverside Energy Section 2 Emission Unit	Carolann Knapp Compliance Coordinator Riverside Energy Group (231) 995-4130 cknapp@riversideem.com

Report Certification

This test report was prepared by Impact Compliance & Testing, Inc. based on field sampling data collected by ICT. Facility process data were collected and provided by Maverick and Riverside employees or representatives. This test report has been reviewed by Maverick and Riverside representatives and approved for submittal to the EGLE.

I certify that the testing was conducted in accordance with the specified test methods and submitted test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Report Prepared By:

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Reviewed By:

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Services Director
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2.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

2.1 Purpose and Objective of the Tests

The conditions of MI-ROP-N5831-2014b specify that:

> The permittee shall verify NOx and CO emissions from EUENGINEH29 … EUENGINE6 … FGCATENGINES, by testing at owner's expense, within nine months of issuance of this permit, and thereafter within every five years, in accordance with Department requirements.

The test results will be used to develop emission factors for NOx and CO that will be applied to the monthly fuel use to determine compliance with the 12-month rolling average emission limits in SC I.1 and SC I.2.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while the RICE were operated at maximum routine operating conditions. Maverick / Riverside representatives provided fuel flowrate (thousand cubic feet (Mcf)) for each test period. For the engines that were equipped with catalysts Maverick / Riverside representatives also recorded catalyst inlet/outlet temperatures, and catalyst differential pressures for each test period.

Appendix 1 provides operating records provided by Maverick / Riverside representatives for the test periods.

Table 2.1 presents a summary of the average engine operating conditions during the test periods.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the sampled natural gas-fueled RICE (EUENGINE1-4, EUENGINE6, and EUENGINEH29) were each sampled for three (3) one-hour test periods during the compliance testing performed May 19-22, 2020.

Table 2.2 presents the average measured NO_X and CO, emission rates for each engine (average of the three test periods).

Test results for each one-hour sampling period and comparison to the permitted emission rates are presented in Section 6.0 of this report.

Table 2.1 Average engine-operating conditions during the test periods

Engine Parameter	Fuel Use Rate (Mcf)	Catalyst Differential Pressure ("WC)	Catalyst Inlet Temperature (°F)	Catalyst Outlet Temperature (°F)
EUENGINE1	7.41	--	--	--
EUENGINE2	8.00	6.5	977	945
EUENGINE3	7.33	4.0	866	841
EUENGINE4	7.75	7.0	890	866
EUENGINE6	9.3	2.5	1,007	1,062
EUENGINEH29	7.3	4.5	786	779

Table 2.2 Average measured emission rates for each engine (three-test average)

Emission Unit	CO Emission Rates		NOx Emission Rates	
	(lb/hr)	(TPY)	(lb/hr)	(TPY)
EUENGINE1	2.47	10.8	2.53	11.1
Permit Limit (No. 1)	--	*20.8*	--	*23.1*
EUENGINE2	0.19	0.81	1.16	5.09
Permit Limit (No. 2)	--	*4.5*	--	*23.1*
EUENGINE3	0.05	0.20	4.19	18.3
Permit Limit (No. 3)	--	*4.5*	--	*23.1*
EUENGINE4	0.05	0.21	4.25	18.6
Permit Limit (No. 4)	--	*4.2*	--	*24.4*
EUENGINE6	4.24	18.6	0.46	2.00
Permit Limit (No. 6)	--	*41.1*	--	*24.6*
EUENGINEH29	0.08	0.36	3.27	14.3
Permit Limit (No. 6-H29)	--	*41.1*	--	*24.6*

Note for Table 2: The calculated ton per year (TPY) values are based on continuous operation at the tested emission rate. Actual emissions will be reported by the source based on actual operating data.

3.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

3.1 Emission Unit Description

Information and specifications for the engines included in this test event are summarized below.

Engine ID and Specifications – Section 1, Breitburn Operating L.P.			
Emission Unit ID	**Model**	**Power Rating**	**Add-On Controls**
EUENGINE1	CAT®3516 LE Lean Burn	1,085 hp	None
EUENGINE2	CAT®3516 LE Lean Burn	1,085 hp	Oxidation Catalyst
EUENGINE3			
EUENGINE4	CAT®3516 LE Lean Burn	1,150 hp	Oxidation Catalyst
EUENGINE6	Waukesha L-7042 Rich Burn	1,478 hp	3-way Catalytic Convertor, AFRC

Engine ID and Specifications – Section 2, Riverside Energy Michigan			
Emission Unit ID	**Model**	**Power Rating**	**Add-On Controls**
EUENGINE29	CAT®3516TALE Lean Burn	1,085 hp	Oxidation Catalyst

3.2 Sampling Locations

The RICE exhaust gas is directed through a muffler and is released to the atmosphere through a dedicated vertical exhaust stack with a vertical release point.

The exhaust stack sampling ports for the CAT® Model G3516 LE Lean Burn engines (EUENGINE1, EUENGINE2, EUENGINE3, and EUENGINE4) are located downstream of the catalyst (if equipped) in a horizontal exhaust duct with an inner diameter of 12.25 inches. The exhaust duct is equipped with two (2) sample ports, opposed 90°, that provide a sampling location at least 9.0 feet (8.8 duct diameters) upstream and at least 9.0 feet (8.8 duct diameters) downstream from any flow disturbance.

The exhaust stack sampling ports for EUENGINE6 are located after the muffler in a vertical exhaust stack with an inner diameter of 12.5 inches. The stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 18 feet (17.3 duct diameters) upstream and 36 inches (2.9 duct diameters) downstream from any flow disturbance.

The exhaust stack sampling ports for EUENGINEH29 are located after the muffler in a vertical exhaust stack with an inner diameter of 12.25 inches. The stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 20 feet (19.6 duct diameters) upstream and 36 inches (2.9 duct diameters) downstream from any flow disturbance.

All sample port locations satisfy the USEPA Method 1 criteria for a representative sample location. Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 2 provides diagrams of the exhaust stacks and emission test sampling locations.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol for the air emission testing was reviewed and approved by the EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 7E	Exhaust gas NO_X concentration was determined using chemiluminescence instrumental analyzers.
USEPA Method 10	Exhaust gas CO concentration was measured using an infrared instrumental analyzer.

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The RICE exhaust stack gas velocities and volumetric flow rates were determined using USEPA Method 2 once for each test period. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube.

Appendix 3 provides exhaust gas flowrate calculations and field data sheets.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the RICE exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 1440D single beam single wavelength (SBSW) infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 1440D gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the RICE exhaust gas stream was extracted from the stack using a stainless steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the RICE exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. The moisture sampling was performed concurrently with the instrumental analyzer sampling. During each sampling-period, a gas sample was extracted at a constant rate from the source where moisture was removed from the sampled gas stream using impingers that were submersed in an ice bath. At the conclusion of each sampling period, the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.5 NO_X and CO Concentration Measurements (USEPA Methods 7E and 10)

NO_X and CO pollutant concentrations in the RICE exhaust gas streams were determined using a Thermo Environmental Instruments, Inc. (TEI) Model 42c High Level chemiluminescence NO_X analyzer and a TEI Model 48i infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix 4 provides CO and NO_X calculation sheets. Raw instrument response data are provided in Appendix 5.

5.0 QA/QC ACTIVITIES

5.1 Flow Measurement Equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, and Pitot tube) were calibrated to specifications in the sampling methods.

The Pitot tube and connective tubing were leak-checked onsite prior to the test event to verify the integrity of the measurement system.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 NO_X Converter Efficiency Test

The NO_2 – NO conversion efficiency of the Model 42c analyzer was verified prior to the testing program. A USEPA Protocol 1 certified concentration of NO_2 was injected directly into the analyzer, following the initial three-point calibration, to verify the analyzer's conversion efficiency. The analyzer's NO_2 – NO converter uses a catalyst at high temperatures to convert the NO_2 to NO for measurement. The conversion efficiency of the analyzer is deemed acceptable if the measured NO_2 concentration is greater than or equal to 90% of the expected value.

The NO_2 – NO conversion efficiency test satisfied the USEPA Method 7E criteria (measured NO_2 concentration was greater than 90% of the expected value as required by Method 7E).

5.3 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.4 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure NO_X, CO, O_2, and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.5 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the NO_X, CO, CO_2, and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, NO_X, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.6 Determination of Exhaust Gas Stratification

A stratification test was performed for each RICE exhaust stack. The stainless steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid) and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the RICE exhaust stacks indicated that the measured O_2 and CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the RICE exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within each RICE exhaust stack.

5.7 Meter Box Calibrations

The dry gas meter and sampling console, which was used for exhaust gas moisture content sampling, was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the Nutech metering consoles were calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

Appendix 6 presents test equipment quality assurance data (NO_2 – NO conversion efficiency test data, instrument calibration and system bias check records, calibration gas and gas divider certifications, interference test results, meter box calibration records, Pitot tube calibration records, and stratification checks).

6.0 RESULTS

6.1 Test Results and Allowable Emission Limits

Engine operating data and air pollutant emission measurement results for each one-hour test period are presented in Tables 6.1 through 6.6.

Annual emissions (tons per year, TPY) were calculated based on continuous operation at the one-hour average emission rate and are presented in Tables 6.1 through 6.6 along with the annual limits specified in MI-ROP-N7463-2019. Actual annual (12-month rolling total) emissions will be calculated by the source based on actual operations. The calculated annual emission rates based on the measured emission rates for EUENGINE1, EUENGINE2, EUENGINE3, EUENGINE4, EUENGINE6, and EUENGINEH29 are less than the allowable NO_X and CO limits specified in MI-ROP-N7463-2019.

The ROP also specifies allowable Source Wide Emissions of:

- 224 tpy (12-month rolling time period) for NO_X; and
- 224 tpy (12-month rolling time period) for CO.

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the approved Stack Test Protocol. The RICE were operated at maximum routine conditions and no variations from normal operating conditions occurred during the engine test periods.

Table 6.1 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 1 (EUENGINE1)

Test No. Test date Test period (24-hr clock)	1 5/21/20 1306-1406	2 5/21/20 1423-1523	3 5/21/20 1540-1640	Three Test Average
Natural Gas Usage (Mcf)	7.41	7.41	7.41	7.41
Exhaust Gas Composition				
CO_2 content (% vol)	8.96	8.89	8.85	8.90
O_2 content (% vol)	7.81	7.90	8.07	7.93
Moisture (% vol)	12.8	13.5	13.0	13.1
Exhaust gas temperature (°F)	770	773	777	773
Exhaust gas flowrate (dscfm)	1,555	1,566	1,577	1,566
Exhaust gas flowrate (scfm)	1,784	1,810	1,814	1,803
Nitrogen Oxides				
NO_X conc. (ppmvd)	235	228	214	225
NO_X emissions (lb/hr)	2.62	2.56	2.42	2.53
NO_X emissions (TPY)	11.5	11.2	10.6	11.1
Permitted emissions (TPY)	-	-	-	*23.1*
Carbon Monoxide				
CO conc. (ppmvd)	360	360	365	362
CO emissions (lb/hr)	2.44	2.46	2.51	2.47
CO emissions (TPY)	10.7	10.8	11.0	10.8
Permitted emissions (TPY)	-	-	-	*20.8*

Table 6.2 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 2 (EUENGINE2)

Test No. Test date Test period (24-hr clock)	1 5/21/20 0755-0855	2 5/21/20 0912-1012	3 5/21/20 1027-1127	Three Test Average
Natural Gas Usage (Mcf)	8.00	8.00	8.00	8.00
Cat. Diff. Pressure	6.5	6.5	6.5	6.5
Catalyst Inlet Temp. (°F)	977	977	979	977
Catalyst Outlet Temp. (°F)	944	944	946	945
Exhaust Gas Composition				
CO_2 content (% vol)	8.68	8.62	8.61	8.64
O_2 content (% vol)	8.41	8.39	8.40	8.40
Moisture (% vol)	11.7	10.4	13.4	11.8
Exhaust gas temperature (°F)	855	851	869	858
Exhaust gas flowrate (dscfm)	1,791	1,894	1,831	1,839
Exhaust gas flowrate (scfm)	2,029	2,114	2,114	2,086
Nitrogen Oxides				
NO_X conc. (ppmvd)	85.5	93.7	84.9	88.0
NO_X emissions (lb/hr)	1.10	1.27	1.12	1.16
NO_X emissions (TPY)	4.81	5.57	4.88	5.09
Permitted emissions (TPY)	-	-	-	*23.1*
Carbon Monoxide				
CO conc. (ppmvd)	22.9	23.3	23.3	23.2
CO emissions (lb/hr)	0.18	0.19	0.19	0.19
CO emissions (TPY)	0.78	0.84	0.82	0.81
Permitted emissions (TPY)	-	-	-	*4.5*

Table 6.3 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 3 (EUENGINE3)

Test No. Test date Test period (24-hr clock)	1 5/20/20 1207-1307	2 5/20/20 1533-1633	3 5/20/20 1655-1755	Three Test Average
Natural Gas Usage (Mcf)	7.33	7.33	7.33	7.33
Cat. Diff. Pressure	4.0	4.0	4.0	4.0
Catalyst Inlet Temp. (°F)	867	867	866	866
Catalyst Outlet Temp. (°F)	841	841	840	841
Exhaust Gas Composition				
CO_2 content (% vol)	8.82	8.80	8.90	8.84
O_2 content (% vol)	8.26	8.22	8.39	8.29
Moisture (% vol)	10.8	11.1	12.6	11.5
Exhaust gas temperature (°F)	769	787	782	779
Exhaust gas flowrate (dscfm)	1,505	1,478	1,468	1,484
Exhaust gas flowrate (scfm)	1,687	1,662	1,679	1,676
Nitrogen Oxides				
NO_X conc. (ppmvd)	376	398	407	394
NO_X emissions (lb/hr)	4.06	4.22	4.28	4.19
NO_X emissions (TPY)	17.8	18.5	18.8	18.3
Permitted emissions (TPY)	-	-	-	*23.1*
Carbon Monoxide				
CO conc. (ppmvd)	7.10	7.12	7.33	7.18
CO emissions (lb/hr)	0.05	0.05	0.05	0.05
CO emissions (TPY)	0.20	0.20	0.21	0.20
Permitted emissions (TPY)	-	-	-	*4.5*

Table 6.4 Measured exhaust gas conditions and NOX and CO air pollutant emission rates for Engine No. 4 (EUENGINE4)

Test No. Test date Test period (24-hr clock)	1 5/20/20 0752-0852	2 5/20/20 0906-1006	3 5/20/20 1025-1125	Three Test Average
Natural Gas Usage (Mcf)	7.75	7.75	7.75	7.75
Cat. Diff. Pressure	7.0	7.0	7.0	7.0
Catalyst Inlet Temp. (°F)	889	890	892	890
Catalyst Outlet Temp. (°F)	866	867	867	866
Exhaust Gas Composition				
CO_2 content (% vol)	9.47	9.26	9.31	9.34
O_2 content (% vol)	8.23	8.38	8.35	8.32
Moisture (% vol)	11.3	12.3	13.1	12.2
Exhaust gas temperature (°F)	788	797	790	792
Exhaust gas flowrate (dscfm)	1,611	1,565	1,632	1,603
Exhaust gas flowrate (scfm)	1,817	1,784	1,878	1,826
Nitrogen Oxides				
NO_X conc. (ppmvd)	351	358	399	369
NO_X emissions (lb/hr)	4.06	4.02	4.67	4.25
NO_X emissions (TPY)	17.8	17.6	20.4	18.6
Permitted emissions (TPY)	-	-	-	*24.4*
Carbon Monoxide				
CO conc. (ppmvd)	6.82	6.76	6.61	6.73
CO emissions (lb/hr)	0.05	0.05	0.05	0.05
CO emissions (TPY)	0.21	0.20	0.21	0.21
Permitted emissions (TPY)	-	-	-	*4.2*

Table 6.5 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. 6 (EUENGINE6)

Test No. Test date Test period (24-hr clock)	1 5/22/20 0655-0755	2 5/22/20 0810-0910	3 5/22/20 0924-1024	 Three Test Average
Natural Gas Usage (Mcf)	9.3	9.3	9.3	9.3
Cat. Diff. Pressure	2.5	2.5	2.5	2.5
Catalyst Inlet Temp. (°F)	1,006	1,007	1,009	1,007
Catalyst Outlet Temp. (°F)	1,061	1,061	1,065	1,062
<u>Exhaust Gas Composition</u>				
CO_2 content (% vol)	13.7	13.5	13.5	13.5
O_2 content (% vol)	1.10	1.14	1.11	1.11
Moisture (% vol)	17.3	18.6	13.3	16.4
Exhaust gas temperature (°F)	894	893	893	893
Exhaust gas flowrate (dscfm)	1,421	1,427	1,483	1,444
Exhaust gas flowrate (scfm)	1,719	1,753	1,710	1,727
<u>Nitrogen Oxides</u>				
NO_X conc. (ppmvd)	41.5	44.5	46.4	44.1
NO_X emissions (lb/hr)	0.42	0.45	0.49	0.46
NO_X emissions (TPY)	1.85	1.99	2.16	2.00
Permitted emissions (TPY)	-	-	-	*24.6*
<u>Carbon Monoxide</u>				
CO conc. (ppmvd)	761	806	460	676
CO emissions (lb/hr)	4.72	5.02	2.98	4.24
CO emissions (TPY)	20.7	22.0	13.0	18.6
Permitted emissions (TPY)	-	-	-	*41.1*

Table 6.6 Measured exhaust gas conditions and NO_X and CO air pollutant emission rates for Engine No. H29 (EUENGINEH29)

Test No. Test date Test period (24-hr clock)	1 5/19/20 0935-1035	2 5/19/20 1052-1152	3 5/19/20 1208-1308	Three Test Average
Natural Gas Usage (Mcf)	7.5	7.2	7.3	7.3
Cat. Diff. Pressure	4.7	4.5	4.4	4.5
Catalyst Inlet Temp. (°F)	785	786	788	786
Catalyst Outlet Temp. (°F)	777	780	780	779
Exhaust Gas Composition				
CO_2 content (% vol)	8.55	8.55	8.57	8.56
O_2 content (% vol)	8.99	9.00	9.02	9.00
Moisture (% vol)	11.0	13.0	13.4	12.5
Exhaust gas temperature (°F)	656	662	655	658
Exhaust gas flowrate (dscfm)	1,804	1,725	1,587	1,705
Exhaust gas flowrate (scfm)	2,028	1,984	1,832	1,948
Nitrogen Oxides				
NO_X conc. (ppmvd)	294	259	247	267
NO_X emissions (lb/hr)	3.80	3.21	2.81	3.27
NO_X emissions (lb/MMscf)	507	446	384	446
NO_X emissions (TPY)	16.7	14.1	12.3	14.3
Permitted emissions (TPY)	-	-	-	*24.6*
Carbon Monoxide				
CO conc. (ppmvd)	11.5	11.0	10.8	11.1
CO emissions (lb/hr)	0.09	0.08	0.08	0.08
CO emissions (lb/MMscf)	12.0	11.5	10.3	11.3
CO emissions (TPY)	0.40	0.36	0.33	0.36
Permitted emissions (TPY)	-	-	-	*41.1*