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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
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RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: North American Natural Resources SBL-LLC   County: Berrien

Source Address: 3200 Chamberlain Road   City: Buchanan

AQD Source ID (SRN): N5432   ROP No.: N5432-2021   ROP Section No.: 2

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From ________ To ________

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From ________ To ________

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From ________ To ________

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Test Protocol for compliance testing of emission units EUENGINE1-S2 through EUENGINE3-S2. The testing will be conducted in accordance with the enclosed test protocol and the facility will be operated in compliance with the permit, at or near maximum routine operating conditions for the facility.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Richard Spranger	Director of Operations	(517) 719-1322
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official: [signature]   Date: 4-01-19

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

IMPACT COMPLIANCE & TESTING

NSPS STACK TEST PROTOCOL

Report Title:	STACK TEST PROTOCOL FOR THE VERIFICATION OF AIR POLLUTANT EMISSIONS FROM LANDFILL GAS FIRED ENGINE – GENERATOR SETS
Test Date(s):	May 7-8, 2019

Facility Information	
Name:	North American Natural Resources SBL-LLC
Street Address:	3200 Chamberlain Road,
City, County, State:	Buchanan, Berrien, Michigan
Facility SRN:	N5432
Phone:	(269) 695-2500

Emission Unit and Permit Information	
Operating Permit No.:	MI-ROP-N5432-2021
Emission Unit ID Nos.	EUENGINE1-S2 through EUENGINE3-S2

Testing Contractor	
Company:	Impact Compliance & Testing, Inc
Mailing Address:	4180 Keller Rd. Holt, MI 48842
Phone:	(517) 268-0043
Project No.:	1900146

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NSPS STACK TEST PROTOCOL
FOR
AIR POLLUTANT EMISSIONS
FROM
LANDFILL GAS FIRED ENGINE - GENERATOR SETS

NORTH AMERICAN NATURAL RESOURCES SBL-LLC

Scheduled Test Dates: May 7-8, 2019

North American Natural Resources SBL-LLC (NANR) operates gas-fired reciprocating internal combustion engine (RICE) and electricity generator sets at the Southeast Berrien County Landfill (SEBC Landfill) in Buchanan, Berrien County, Michigan. The RICE are fueled by landfill gas (LFG) that is recovered from the SEBC Landfill. The recovered gas is transferred to NANR where it is treated and used as fuel.

The Michigan Department of Environmental Quality-Air Quality Division (MDEQ-AQD) has issued to SEBC Landfill and NANR a Renewable Operating Permit (MI-ROP-N5432-2021). Section 2 of the permit specifies conditions for operation of the renewable electricity generation facility, which consists of three (3) CAT® Model No. G3520C RICE-generator set identified as emission units EUENGINE1-S2, EUENGINE2-S2, and EUENGINE3-S2 (Flexible Group ID: FGENGINES-S2).

Air emission compliance testing will be performed pursuant to ROP No. MI-ROP-N5432-2021 and the federal Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (the SI-RICE NSPS; 40 CFR Part 60 Subpart JJJJ). The conditions of ROP No. MI-ROP-N5432-2021 state:

> *… The permittee must conduct performance testing every 8,760 hours or 3 years after the initial test, whichever comes first. … to demonstrate compliance with the emission limits in 40 CFR 60.4233(e) … If a performance test is required, the performance test shall be conducted according to 40 CFR 60.4244.*

Emission testing was most recently performed on March 27-28, 2018 and is being repeated for each engine within 8,760 operating hours of the previous test. The engine emission performance tests will consist of triplicate, one-hour sampling periods for nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC, as non-methane hydrocarbons). Exhaust gas velocity, moisture, oxygen (O_2) content, and carbon dioxide (CO_2) content will be determined for each test period to calculate pollutant mass emission rates.

The following listed items provide information required by *Format for Submittal of Source Emission Test Plans and Reports* issued by the MDEQ-AQD in March 2018 for source emission test program procedures.

1. IDENTIFICATION AND DESCRIPTION OF THE SOURCE TO BE TESTED

1.1 Contact Person(s) for Source and Test Plan Information

The compliance testing will be performed by Impact Compliance & Testing (ICT). Questions concerning the source and test plan should be addressed to:

Test Procedures

Tyler J. Wilson
Senior Project Manager
Impact Compliance & Testing, Inc.
39395 Schoolcraft Road
Livonia, MI 48150
(734) 464-3880
Tyler.Wilson@ImpactCandT.com

Site Operations / Responsible Official

Mr. Richard Spranger
Director of Operations
North American Natural Resources, Inc.
300 North 5th Street, Suite 100
Ann Arbor, MI 48104
(517) 719-1322

1.2 Identification and Description of Source to be Tested

NANR operates three (3) CAT® Model No. 3520C RICE-generator sets at its Southeast Berrien County Generating station. The units are fired exclusively with LFG that is recovered from the SEBC Landfill solid waste disposal facility and is treated prior to use.

1.3 Type and Typical Quantity of Raw and Finished Materials Used in each Process

The RICE-generator sets are typically operated at base load conditions (i.e., at, or near, 100% output). A certain heat input rate is required to maintain base load conditions. Therefore, the actual volumetric flowrate of treated fuel is dependent on the fuel heating value, or methane content.

1.4 Description of Cyclical or Batch Operations

The RICE operating conditions are continuous and relatively constant for the entire time period that base load electricity generation occurs.

1.5 Basic Operating Parameters Used to Regulate the Process

Following startup of an engine (once the engine is at a steady-state condition) the process operates automatically. Each engine is equipped with an electronic air-to-fuel ratio (AFR) controller that blends the appropriate ratio of combustion air and treated LFG fuel. The AFR controllers monitor engine performance parameters and automatically adjust the AFR and ignition timing to maintain efficient fuel combustion

1.6 Rated Capacity of the Processes

The CAT® G3520C engine generator sets will be tested while operations occur at, or near (± 10%), maximum design capacity:

- Engine Power; 2,250 bhp
- Electricity Generation; 1,600 kW

2. DESCRIPTION OF THE CONTROL EQUIPMENT

The RICE are not equipped with add-on emission control equipment. The recovered LFG is treated prior to use to result in a viable renewable fuel. The electronic AFR controller maintains efficient fuel combustion, which minimizes air pollutant emissions. Exhaust gas is exhausted directly to atmosphere through a noise muffler and vertical exhaust stack.

3. PERMIT NO. AND EMISSION LIMITS

Renewable Operating Permit No. MI-ROP-N5432-2021 specifies the following air pollutant emission limits for each RICE generator set.

- 2.8 grams per brake horsepower-hour (g/bhp-hr) for CO;
- 0.62 g/bhp-hr for NOx; and
- 1.0 g/bhp-hr for VOC.

The specified emission limits are equal to, or more stringent than, the emission standards specified in the SI-RICE NSPS.

4. POLLUTANTS TO BE MEASURED

The RICE generator sets will be tested to verify the concentrations of CO, NO_X and VOC in the exhaust stack. Volumetric flowrate will be measured to calculate the CO, NO_X and VOC mass emission rate (pounds per hour). Electricity output will be recorded during the emissions testing to calculate the grams per brake horsepower-hour (g/bhp-hr) emission rates for NO_X, CO, and VOC.

The following table presents test methods that will be used to measure the specified engine pollutant emissions and exhaust parameters.

USEPA Method 1	Sample and velocity traverse locations will be selected based on physical stack measurements.
USEPA Method 2	Exhaust gas velocity pressure will be determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature measurements using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas oxygen (O_2) and carbon dioxide (CO_2) content will be determined using zirconia ion/paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture measurements will be based on the water weight gain in chilled impingers.
USEPA Method 7E	Exhaust gas NOx concentration will be determined using a chemiluminescence instrumental analyzer.
USEPA Method 10	Exhaust gas CO concentration will be determined using a NDIR instrumental analyzer.
USEPA Method 25A and Alt 096	VOC emissions will be determined using an FID instrument with internal methane separation column.

In addition to the sampling and analytical methods presented in the preceding text, USEPA Method 205, "Verification of Dilution Systems for Field Instrument Calibrations", will be used to verify dilution system linearity.

5. DETAILED SAMPLING AND ANALYTICAL PROCEDURES

The compliance test will consist of three (3) one-hour test periods, in which CO, NO_X, VOC, O_2 and CO_2 concentration, and moisture content will be determined for each RICE exhaust gas stream. The concentration and exhaust gas flowrate measurements will be performed on each RICE horizontal duct prior to the muffler and vertical exhaust stack.

5.1 Measurement of Stack Gas Velocity (USEPA Method 1 and 2)

Prior to commencing the engine emission performance test field measurements, stack gas sampling locations (i.e., pollutant concentration and velocity pressure measurement locations) will be determined in accordance with USEPA Method 1.

To determine hourly pollutant emission rates, the stack gas velocity and volumetric flowrate will be measured using USEPA Method 2 once for each test period. Gas velocity (pressure) measurements will be conducted at each traverse point of the stack with an S-type Pitot tube and red-oil manometer. Temperature measurements will be conducted at each traverse point using a K-type thermocouple and a calibrated digital thermometer. Once the molecular weight and moisture content of the engine exhaust gas is obtained, the stack exhaust volumetric flowrate will be determined.

Attachment 1 provides diagrams of the proposed sampling locations.

5.2 <u>Measurement of Carbon Dioxide and Oxygen Content (USEPA Method 3A)</u>

RICE exhaust CO_2 and O_2 concentration and pollutant emission measurements will be performed concurrently during each test run sample period using an instrumental analyzer in accordance with Method 3A. An infrared gas analyzer will be used to measure the CO_2 concentrations of the RICE exhaust gas. A gas analyzer that uses a paramagnetic sensor will be used to measure the O_2 concentrations of the RICE exhaust gas.

Attachment 2 provides information of the extractive gas sampling and conditioning system that will be used to deliver RICE exhaust gas samples to the Method 3A instruments.

5.3 <u>Determination of Moisture Content (USEPA Method 4 Non-Isokinetic Sampling)</u>

The engine exhaust gas moisture content will be determined in accordance with the USEPA Method 4 chilled impinger method for each test period. A sample of the engine exhaust gas will be extracted at a constant rate from the source and moisture in the sample will be collected in a chilled impinger train. The moisture content of the collected sample will be determined gravimetrically (or volumetrically) based on the water gain measured in the impinger train. A non-heated probe will be used to collect the moisture sample since the engine exhaust temperature will be greater than 800°F. During sampling, a single representative sample location will be used in lieu of collecting the sample across the velocity traverse profile. At 5-minute intervals, sampling train data will be recorded. Sampling will continue until the minimum sample volume, specified in USEPA Method 4 (21 scf), is achieved.

Attachment 3 provides a sample train diagram and description of the USEPA Method 4 sampling procedures.

5.4 <u>Measurement of Nitrogen Oxides, Instrumental Analyzers (USEPA Method 7E)</u>

RICE exhaust NO_x concentrations will be determined during each sample period using a Thermo Environmental Instruments Inc. Model 42C NO-NO_2-NO_X Analyzer that uses chemiluminescence technology for the measurement of NO_x concentrations in accordance with USEPA Method 7E.

A continuous sample of the RICE exhaust gas will be delivered to the instrument analyzer using an extractive gas sampling system that prevents condensation or contamination of the sample. The exhaust gas samples will be conditioned (i.e., dried) prior to being introduced to the instrument analyzer. Therefore, NO_x measurements correspond to standard conditions with moisture correction (dry basis).

The specified instrumental analyzer will be calibrated using certified NO_x concentrations in nitrogen. The calibration gases will be diluted (using a certified gas divider) with nitrogen to obtain intermediate NO_x concentrations and to demonstrate linearity of the instrument analyzer.

Attachment 2 provides specifications for the instrumental analyzers and a description of the extractive gas sampling system.

5.5 Measurement of Carbon Monoxide, Instrumental Analyzers (USEPA Method 10)

RICE exhaust CO concentrations will be determined during each test period using a TEI Model 48i infrared CO (or equivalent) analyzer in accordance with USEPA Method 10.

A continuous sample of the RICE exhaust gas will be delivered to the instrument analyzer using an extractive gas sampling system that prevents condensation and contamination of the sample. The RICE exhaust gas samples will be conditioned (i.e., dried) prior to being introduced to the instrument analyzer. Therefore, CO measurements correspond to standard conditions with moisture correction (dry basis).

The specified instrumental analyzer will be calibrated using certified CO concentrations in nitrogen. The calibration gases will be diluted (using a certified gas divider) with nitrogen to obtain intermediate CO concentrations and to demonstrate linearity of the specified instrument analyzer.

Attachment 2 provides specifications for the instrumental analyzers and a description of the extractive gas sampling system.

5.6 Measurement of VOC Concentration (USEPA Method 25A / ALT-096)

VOC as non-methane hydrocarbon (NMHC or NMOC) concentrations in the RICE exhaust will be determined using a Thermo Environmental Instruments, Inc. (TEI), Model 55i Methane-NMHC analyzer in accordance with USEPA Alternate Method (ALT) 096 for direct measurement of NMHC concentrations in exhaust gases for RICEs.

The TEI 55i is an automated batch analyzer that repeatedly collects and analyzes samples of the exhaust gas stream that are drawn into the instrument by the internal sampling pump. The sampled gas is separated by an internal gas chromatography (GC) column into methane and non- methane fractions and each fraction is analyzed separately using a flame ionization detector (FID), in accordance with USEPA Method 25A. The NMHC concentration will be reported relative to a propane calibration standard (parts per million as propane, C_3) and the molecular weight of propane will be used to calculate NMOC mass emissions.

Samples of the exhaust gas will be delivered to the instrument analyzer using an extractive gas sampling system that prevents condensation or contamination of the sample. The exhaust gas samples will be delivered directly to the instrument analyzer. Therefore, VOC measurements correspond to standard conditions with no moisture correction (wet basis).

The specified instrument analyzer will be calibrated using certified propane concentrations in hydrocarbon-free air. The calibration gases will be diluted (using a certified gas divider) with hydrocarbon-free air to obtain intermediate concentrations and to demonstrate linearity of the instrument analyzer.

Attachment 2 provides information of a typical extractive gas sampling and conditioning system that will be used to deliver IC engine exhaust gas samples to the TEI Model 55i analyzer.

The USEPA Office of Air Quality Planning and Standards (OAQPS) has issued several alternate test methods approving the use of the TEI 55-series analyzer as an effective instrument for measuring VOC from gas-fueled IC engines in that it uses USEPA Method 25A and 18 (ALT-066, ALT-078 and ALT-096).

Attachment 4 provides the approval letter from the USEPA for the use of Test Method ALT-096 for IC engines.

5.7 Verification of Gas Dilution Calibration Equipment (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider will be 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 delivers calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 will be followed prior to use of gas divider.

6. NUMBER AND LENGTH OF SAMPLING RUNS

The emission performance tests will consist of three (3), one-hour sampling periods for CO, NOx, and VOC concentrations measurements for each engine. Exhaust gas flowrate measurements will be performed once for each test period. The average of the three (3) one-hour test periods will be used for determining compliance with the permit emission limits.

7. DIMENSIONS OF SAMPLING LOCATIONS

The following table presents information on the engine exhaust stack sampling locations. Actual measurements for the specified stack parameters will be verified prior to conducting the engine performance tests and reported with the results.

Stack Diameter (ID): 13.0 inches
Discharge Orientation: horizontal, prior to muffler
Raincap: N/A

Distance to nearest
Downstream Disturbance (A): 28 inches
Upstream Disturbance (B): 144 inches

8. ESTIMATED FLUE GAS CONDITIONS

Sampling Location	Temp. (°F)	O_2 Content (%)	CO_2 Content (%)	Moisture (%)	Expected Flowrate (dscfm)
Engine Exhaust	950	8.05	11.5	12.0	4,000

9. PROJECTED PROCESS OPERATING CONDITIONS

For the compliance demonstration, each RICE will be operated within +/- 10% of rated design capacity; 2,250 hp for the engine and 1,600 kW of electricity production in the generator.

10. PROCESS OR CONTROL EQUIPMENT DATA TO BE COLLECTED

For each one-hour test period, NANR personnel will monitor fuel use, LFG methane content, and kW output of the generator connected to the RICE that is being tested. Data will be recorded continuously or at least every 15 minutes.

Engine horsepower output cannot be directly measured. However, it can be calculated based on a linear relationship with recorded generator output using the generator set efficiency:

Engine bhp = generator output (kW) / (0.7457 kW/hp) / generator efficiency (95.36%)

Using this equation, a generator output of 1,600 kW corresponds to an engine output of approximately 2,250 hp.

11. MONITORING DATA TO BE COLLECTED

Not applicable.

12. FIELD QA/QC PROCEDURES

12.1 Exhaust Gas Flowrate

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

Prior to performing the initial engine exhaust stack velocity traverse, the S-type Pitot tube and manometer lines will be leak-checked at the test site. This check will be made by blowing into the impact opening of the Pitot tube until 3 or more inches of water are recorded on the manometer, then capping the impact opening and holding it closed for 15 seconds to ensure that it is leak free. The static pressure side of the Pitot tube will be leak-checked using the same procedure.

12.2 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations will be 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 will be 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 verifying the instrument response against the initial instrument calibration readings.

At the beginning of each test day, appropriate high-range, mid-range, and low-range span gases followed by a zero gas will be introduced to the NMHC analyzer, in series at a tee connection, which is installed between the sample probe and the particulate filter, through a poppet check valve. After each one hour test period, low-range and zero gases will be re-introduced in series at the tee connection in the sampling system to check against the method's performance specifications for calibration drift and zero drift error.

The instruments will be calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, NO_x, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. The NMHC (VOC) instrument will be calibrated with USEPA Protocol 1 certified concentrations of propane in air and zeroed using hydrocarbon-free air. A STEC Model SGD-710C 10-step gas divider will be used to obtain intermediate calibration gas concentrations as needed.

12.3 Verification of Gas Dilution Calibration Equipment

A STEC Model SGD-710C 10-step gas divider will be 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 delivers calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 will be followed prior to use of gas divider.

12.4 NO_2 – NO Converter Test

The NO_2 – NO conversion efficiency of the TEI Model 42c instrumental analyzer will be verified prior to the commencement of the performance tests. A USEPA Protocol 1 certified NO_2 calibration gas will be used to verify the efficiency of the NO_2 – NO converter. The instrument analyzer NO_2 – NO converter uses a catalyst at high temperatures to convert the NO_2 to NO for measurement. The conversion efficiency of the instrument analyzer will be deemed acceptable if the calculated NO_2 – NO conversion efficiency is greater than or equal to 90%.

12.5 Sampling System Response Time Determination

The response time of the sampling system will be determined prior to the commencement of the engine performance tests by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration will be determined using a stopwatch. Test periods will commence once the sampling probe has been in place for at least twice the system response time.

12.6 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 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.

12.7 Dry Gas Meter Calibrations

The dry gas metering console, which will be used to extract a measured amount of exhaust gas from the stack for moisture content determinations, will be calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5.

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

12.8 Determination of Exhaust Gas Stratification

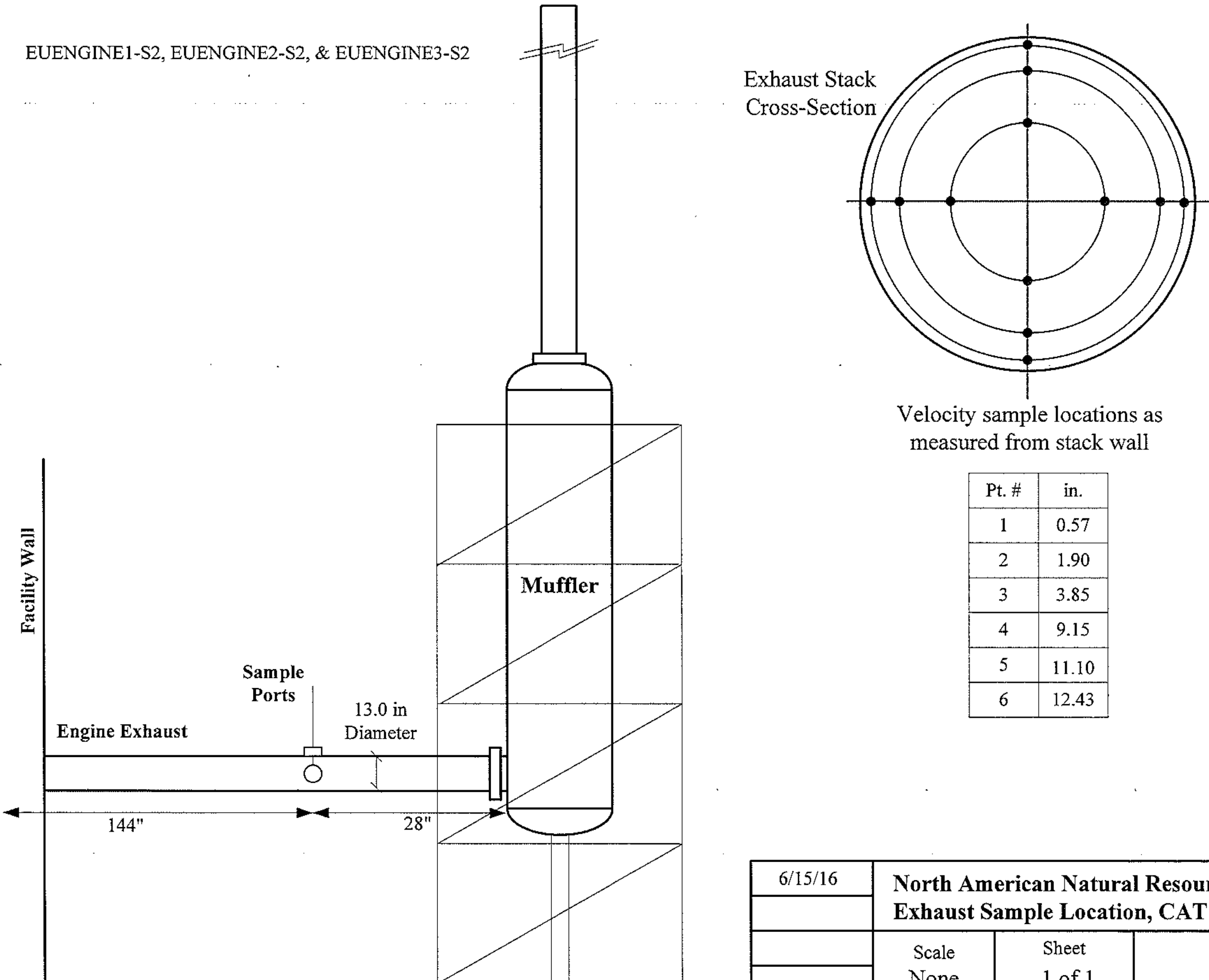
USEPA Method 7E requires a stratification test for each IC engine exhaust stack. Exhaust gas stratification measurements will be performed on the engine exhaust stack prior to the commencement of the performance tests. A stainless steel sample probe will be positioned at measurement points that correlate to 16.7%, 50.0% (centroid) and 83.3% of the stack diameter. Pollutant concentration data will be recorded at each sample point for a minimum of twice the maximum system response time. Stratification determinations and the appropriate number of required sampling points will be calculated prior to the performance testing.

13. LABORATORY QA/QC PROCEDURES

Laboratory QA/QC procedures are not applicable to this compliance demonstration.

ATTACHMENT 1

CAT® Model G3520C IC Engine Exhaust Sampling Locations



Velocity sample locations as measured from stack wall

Pt. #	in.
1	0.57
2	1.90
3	3.85
4	9.15
5	11.10
6	12.43

6/15/16	**North American Natural Resources (NANR) Exhaust Sample Location, CAT G3520 ICE**		
	Scale None	Sheet 1 of 1	ICT

ATTACHMENT 2

USEPA Methods 3A, 7E, 10, ALT 096 Sampling Train Diagram
USEPA Methods 3A, 7E, 10, ALT 096 Extractive Gas Sampling Procedures

Extractive Gas Sampling System

The extractive gas sampling system that serves the instrumental analyzers used for Methods 3A, 7E, 10, 25A and ALT 096 is configured as described below.

Sample probe - Stainless steel or equivalent single opening probe will be located in the centroid of the stack or moved across the diameter as required by the stratification test.

Tee and check valve - A stainless steel "Tee" will be installed between the sample probe and a stainless steel particulate filter to allow the introduction of calibration gases through a stainless steel spring-loaded check valve into the sampling system. When sampling, the spring-loaded check valve is normally closed, though upon the introduction of pressurized calibration gas from a remote Teflon® line, the check valve opens and allows the calibration gases to be introduced near the base of the sample probe. During this sampling system bias check procedure, excess calibration gas exits the sampling probe tip to avoid the introduction of process gas or ambient air during calibration.

Heated sample line – A heated Teflon® line will be used to transport the sample gas from the stack to the instrument trailer. The heated Teflon® line is equipped with a temperature controller which maintains the temperature of the sample line at approximately 250°F to prevent moisture condensation.

Sample pump and flow control valve – A single head 100% oil-free vacuum pump fitted with a stainless steel flow control valve will be used to transfer sampled gases from the heated sample line to the instrumental analyzer. The vacuum pump is leak-free and non-reactive to the gases being sampled. Subsequent sample transport lines and fittings are either stainless steel or Teflon®.

Sample gas manifold – From the vacuum pump, a sample gas manifold constructed of Teflon® transport lines and stainless steel "Tee" fittings are used to continuously deliver the sampled gas to the instrumental analyzer. Since certain instrumental analyzers are equipped with an internal sampling pump, the end of the sample gas manifold has an atmospheric dump (or bypass discharge vent) to avoid over-pressurization of the instrumental analyzer.

Gas Conditioner - A thermoelectric condenser (Universal Analyzer Model 3080-SS) utilizing the "Peltier Effect" equipped with a peristaltic pump will be used to remove moisture from the sampled gas stream that is directed to the instrumental analyzers (except the VOC analyzer which receives filtered but unconditioned sample gas), which require a conditioned (or dry) gas samples. From the moisture removal system, a sample gas manifold constructed of Teflon® transport lines and stainless steel Tee fittings will be used to continuously deliver the sampled gas to the instrumental analyzers. Since the instrumental analyzers are equipped with internal sampling pumps, the end of the sample gas manifold is equipped with an atmospheric dump (or bypass discharge vent) to avoid over pressurization of the instrumental analyzers.

Data Logger – An ESC Model 8816 data logging system will be used to continuously monitor the analog output of each instrumental analyzer and record that data as 1-minute averages.

Quality Assurance / Calibration Procedures

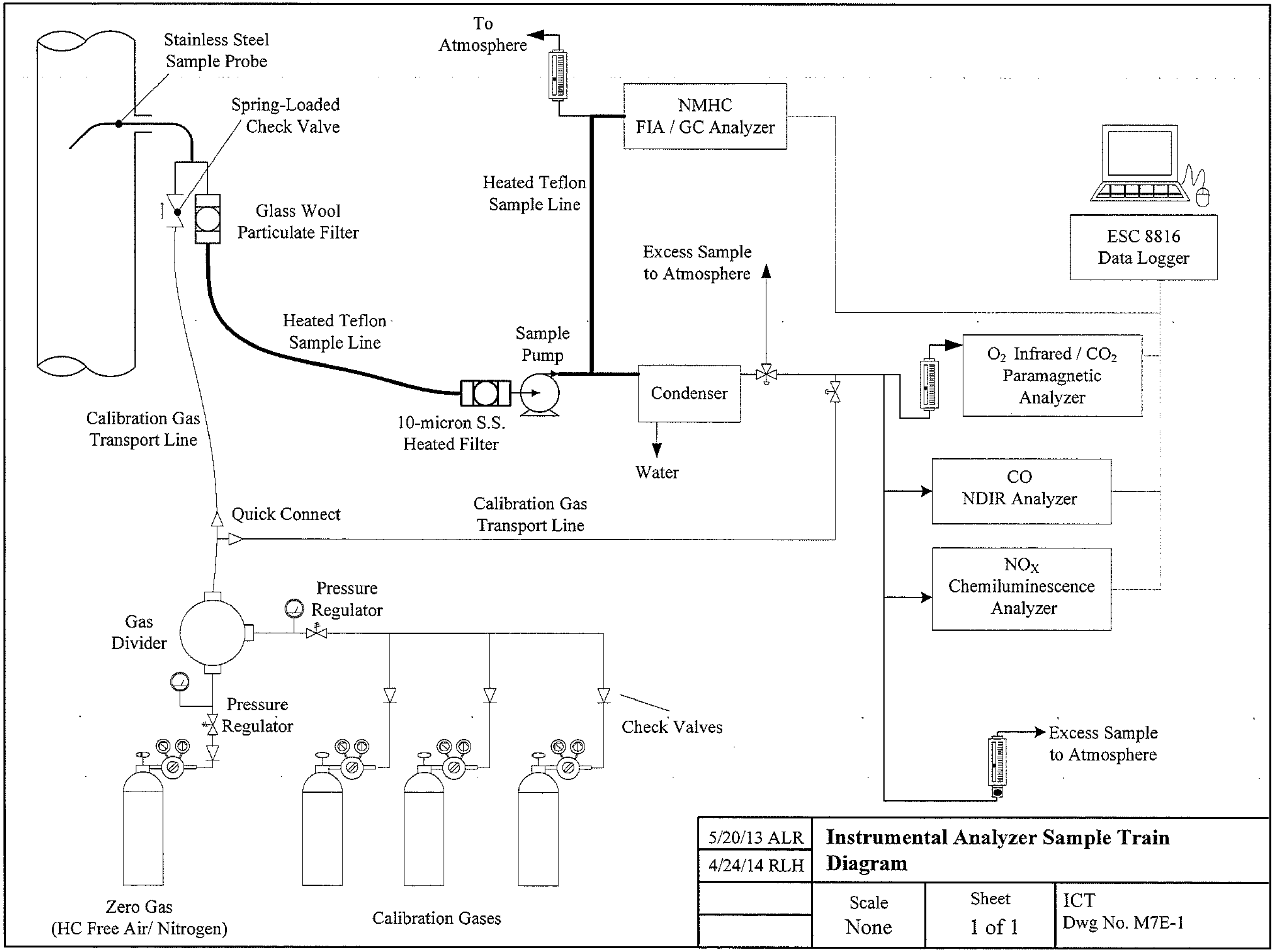
Upon site arrival, the instrumental analyzers will be set-up in accordance with the manufacturer's written recommended procedures. Upon setting the appropriate range for the instrument, zero and appropriate span gases are introduced sequential order to set the instrument's zero and span pots.

In the field prior to the first test run, appropriate high-range, mid-range, and low-range span gases are introduced directly to the instruments through an instrument calibration line in order to determine the analyzer calibration error. Following the analyzer calibration error determination an appropriate up-scale gas (which most closely matches the expected concentration) and zero gas will be introduced in series at the "Tee" in the sampling system through the spring-loaded check valve. This dynamic calibration procedure serves to document the required sampling system bias check, and the analyzer's response time to achieve a stable reading.

The start of the test run occurs when the data acquisition system records a consistent instrumental analyzer response (at least twice the system response time). After one hour of data is obtained, an appropriate up-scale and downscale (zero gas) will be re-introduced in series at the "Tee" in the sampling system. The post-run system bias check will be used to check against the method's performance specifications for calibration drift and zero drift error. The FID will be calibrated similarly using mid-level and zero gases as directed in USEPA Method 25A.

Calibration gas dilution equipment

A STEC Model SGD-710C 10-step gas divider will be 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 delivers calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 will be followed prior to use of gas divider.



5/20/13 ALR 4/24/14 RLH	**Instrumental Analyzer Sample Train Diagram**		
	Scale None	Sheet 1 of 1	ICT Dwg No. M7E-1