COMPLIANCE TEST REPORT

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for

OXIDES OF NITROGEN (NO_X), CARBON MONOXIDE (CO), AND NON-METHANE NON-ETHANE ORGANIC COMPOUNDS (NMEOC) EMISSIONS

COMPRESSOR ENGINE & EMERGENCY GENERATOR

ALPENA COMPRESSOR STATION
Harrison, Michigan

May 16-17, 2016

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

DTE Energy

DEQ
MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

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 (RO) Permit 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 described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Alpena Compressor Station   County: Clare

Source Address: 8512 East Arnold Lake Rd Harrison MI   City: Harrison

AQD Source ID (SRN): N5935   RO Permit No.: MI-ROP-N5935-2014b   RO Permit Section No.: ______

Please check the appropriate box(es):

☐ **Annual Compliance Certification** **(General Condition No. 28 and No. 29 of the RO Permit)**

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 RO Permit, 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 RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, 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 RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification** **(General Condition No. 23 of the RO Permit)**

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

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit 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 RO Permit 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 5/16/2016 To 5/17/16

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

ROP Emissions Test Report, Emergency Generator NOx, CO, NMOC 40 CFR Part 60 Subpart JJJJ

ROP Emissions Test Report,White-Superior Compressor CO 40 CFR Part 63 Subpart ZZZZ

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.

Ms. Karla Shawhan-Bonnee	Manager	(231) 258-3750
Name of Responsible Official (print or type)	Title	Phone Number

Shawhan Bonnee
Signature of Responsible Official

7/25/16
Date

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at Alpena Compressor Station, located in Harrison, Michigan. The fieldwork, performed on May 16-17, 2016 was conducted to satisfy requirements of the Michigan Renewable Operating Permit No. MI-ROP-N5935-2014b, 40 CFR Part 60, Subpart JJJJ, and 40 CFR Part 63 Subpart ZZZZ. Emissions tests were performed on the Emergency Generator for oxides of nitrogen (NO_x), carbon monoxide (CO), and non-methane organic compounds (NMOC) and on the Compressor Engine for CO.

The results of the emissions testing are summarized below:

Emissions Testing Summary – Emergency Generator & Compressor Engine
Alpena Compressor Station
Harrison, MI

May 16, 2017	Oxides of Nitrogen[1] (ppm_{dry})	Carbon Monoxide[1] (ppm_{dry})	Non Methane Organic Compounds[1] (ppm_{dry})
Emergency Generator[2]	3.3	48.5	2.4
Compressor Engine[3]		14.8	
[2]Subpart JJJJ Permit Limit	160	540	86
[3]Subpart ZZZZ Permit Limit		<47	

[1] ppm, corrected to 15% $O_{2,dry}$

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1.0 INTRODUCTION

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group performed emissions testing at Alpena Compressor Station, located in Harrison, Michigan. The fieldwork, performed on May 16-17, 2016 was conducted to satisfy requirements of the Michigan Air Permit No. MI-ROP-N5935-2014b, 40 CFR Part 60, Subpart JJJJ, and 40 CFR Part 63 Subpart ZZZZ. Emissions tests were performed on the Emergency Generator for oxides of nitrogen (NO_x), carbon monoxide (CO), and non-methane organic compounds (NMOC) and on the Compressor Engine for CO.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 1-3A, 25A and ASTM D6348.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test[1], which was approved by the Michigan Department of Environmental Quality (MDEQ)[2]. The following DTE personnel participated in the testing program: Mr. Mark Grigereit, Principal Engineer, Mr. Thomas Snyder and Mr. Fred Meinecke, Sr. Environmental Technicians. Mr. Grigeriet was the project leader.

Mr. Tyler Gage, DTE Gas, provided on-site support and coordination of the testing program. Ms. Karla Shawhan-Bonnee, Manager, DTE Gas, provided on-site coordination and operation of the units. Mr. Rob Dickman, MDEQ, reviewed the Test Plan. Mr. Dickman and Ms. Sharon LeBlanc, MDEQ, observed the testing.

2.0 SOURCE DESCRIPTION

The Alpena Compressor Station, located at 8512 East Arnold Lake Road, Harrison, MI is a natural gas compressor station. The facility operates one White-Superior, 4-cycle, lean burn, natural gas-fired 2,000 Horse Power reciprocating engine. The engine generates line pressure assisting in the transmission of natural gas throughout the pipeline transmission system in Michigan.

The emissions from the engine are exhausted through a catalyst bed and to the atmosphere through an individual exhaust stack. The composition of the emissions from the engine

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[1] MDEQ, Test Plan, Submitted April 21, 2016. (Attached-Appendix A)

[2] MDEQ, Acceptance Letter, May 2, 2016. (Attached-Appendix A)

depend both upon the speed of the engine and the torque delivered to the compressor. Ambient atmospheric conditions, as it affects the density of air, may limit the speed and torque at which the engines can effectively operate on a daily basis.

Additionally, the facility operates one Kohler, 4-cycle, rich burn, natural gas-fired emergency generator. The generator supplies electrical service to the facility in the event of an interruption of service to the facility.

The emissions from the engine are exhausted through a three-way catalyst bed and to the atmosphere through an individual exhaust stack. In order to operate the emergency generator, DTE Gas employed the use of a "Load Bank" to generate a load of >80% on the generator.

Schematic representations of each engine's exhaust and sampling locations are presented in Figures 1 & 2.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below

Sampling Method	Parameter	Analysis
USEPA Methods 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 25A	Volatile Organic Compounds	Flame Ionization Detector
ASTM D6348	NO_x, CO, Methane, Moisture Content	FTIR

3.1 OXYGEN (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental

Analyzer Method)". The analyzer utilizes a paramagnetic sensor. Continuous oxygen sampling was performed simultaneously with gaseous pollutant sampling.

The EPA Method 3A sampling system consisted of the following:

(1) Single-point sampling probe
(2) Flexible heated PTFE sampling line
(3) MAK® gas conditioner
(4) Servomex 1400 O_2/CO_2 gas analyzer
(5) Appropriate USEPA Protocol 1 calibration gases
(6) Daqview® Data Acquisition System

3.1.2 Sampling Train Calibration

The O_2 analyzer was calibrated according to procedures outlined in USEPA Methods 3A and 7E. Zero, span, and mid-range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid-range span gas was then introduced through the entire sampling system to determine sampling system bias at the completion of each test.

3.1.3 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 7E. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid-range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

3.1.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O_2 emissions were recorded in percent (%). The 1-minute readings collected during the testing can be found in Appendix B.

3.2 VOLATILE ORGANIC COMPOUNDS (USEPA Method 25A)

3.2.1 Sampling Method

USEPA Method 25A, "Determination of Total Hydrocarbon Emissions from Stationary Sources (Instrumental Analyzer Method)" was used to measure the Volatile Organic Compounds (VOC) emissions from the emergency generator. The VOC analyzer utilizes a flame ionization detector (FID) to measures total organic hydrocarbon compounds (as propane). Triplicate 15-minute test runs were performed.

The Method 25A sampling system (Figure 4) consisted of the following:

(1) Stainless Steel sampling probe
(2) Heated PTFE sampling line
(3) J.U.M.109A® Total & Non-Methane® gas analyzer
(4) Appropriate certified propane calibration gases
(5) Daqview® Data Acquisition system

Sampling was conducted at a single in the exhaust stack. Concurrent methane, oxygen and moisture sampling was conducted with the VOC sampling in order to calculate the NMOC emission rates.

3.2.2 Quality Control and Assurance

In accordance with USEPA Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the VOC analyzer. The analyzer was calibrated in the 0-500 ppm range using the following Propane (C_3H_8) calibration gases (0, 49.02, 250.2, and 455.1). Calibration drift checks were performed at the completion of each run and emissions data was drift corrected per USEPA Method 7E. Calibration gas certification sheets are located in Appendix E.

3.2.3 Data Reduction

Data was recorded at 10-second intervals and averaged in 1-minute increments. The average VOC concentration, as Propane (C_3H_8) emissions were reported in parts per million, dry @ 15% O_2 (ppm_{vd} @ 15%O_2). The 1-minute readings are presented in Appendix B.

3.3 MOISTURE (ASTM D6348)

3.3.1 Sampling Method

Moisture content in the exhaust was evaluated using ASTM D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)".

3.4 OXIDES of NITROGEN, CARBON MONOXIDE, METHANE (ASTM D6348)

3.4.1 Sampling Method

Oxides of nitrogen, carbon monoxide, and methane emissions were evaluated using ASTM D6348, "Measurement of Vapor Phase Organic Emissions by Extractive Fourier Transform Infrared (FTIR)". Single point sampling was performed. Triplicate 15-minute test runs were performed.

The ASTM D6348 sampling system (Figure 2) consisted of the following:

(1) Single-point sampling probe (located in the centroid of the exhaust stack)
(2) Flexible heated PTFE sampling line
(3) Air Dimensions Heated Head Diaphram Pump
(4) MKS MultiGas 2030 FTIR spectrometer
(5) Appropriate calibration gases
(6) Data Acquisition System

The FTIR was equipped with a temperature controlled, 5.11 meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotometer and pressure transducer. All data was collected at 0.5 cm^{-1} resolution.

3.4.2 Sampling Train Calibration

The FTIR was calibrated according to procedures outlined in ASTM D6348. Direct measurements of nitrogen, oxides of nitrogen (NO_x), carbon monoxide (CO), propane (C_3H_8), and ethylene (C_2H_4) gas standards were made at the test location to confirm concentrations.

A calibration transfer standard (CTS) was analyzed before and after testing at each location. The concentration determined for all CTS runs were within ±5% of the certified value of the standard. Ethylene was passed through the entire system to determine the sampling system response time and to ensure that the entire sampling system was leak-free.

Nitrogen was purged through the sampling system at each test location to confirm the system was free of contaminants.

Protocol gas standards were passed through the sampling system at each test location to determine the response time and confirm recovery.

NO_x and CO spiking was performed to verify the ability of the sampling system to quantitatively deliver a sample containing NO_x and CO from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR to quantify NO_x and CO in the presence of effluent gas.

As part of the spiking procedure, samples from each engine were measured to determine NO_x and CO concentrations to be used in the spike recovery calculations. The determined sulfur hexafluoride (SF_6) concentration in the spiked and unspiked samples was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked NO_x and CO. The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF_{6(spike)}}{SF_{6(direct)}}$$ (Sec. 9.2.3 (3) ASTM D6348)

$$CS = DF * Spike_{dir} + Unspike\ (1 - DF)$$ (Sec. 9.2.3 (4) ASTM D6348)

DF = Dilution factor of the spike gas
$SF_{6(direct)}$ = SF6 concentration measured directly in undiluted spike gas
$SF_{6(spike)}$ = Diluted SF_6 concentration measured in a spiked sample
$Spike_{dir}$ = Concentration of the analyte in the spike standard measured by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

All analyte spikes were introduced using an instrument grade stainless steel rotometer. The spike target dilution ratio was 1:10 or less. All NO_x and CO spike recoveries were within the ASTM D6348 allowance of ±30%.

3.4.3 Quality Control and Assurance

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 5% agreement. If there is a difference greater than ± 5%, the spectra are reviewed for possible spectral interferences or any other possible causes that might lead to inaccurately quantified data. PRISM Analytical Technologies, Inc. validated the FTIR data. The data validation reports are located in Appendix D.

3.4.4 Data Reduction

Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. The NO_x, CO, and VOC emissions were recorded in parts per million (ppm) dry volume basis. The CO_2 emissions were recorded in percent (%) dry volume basis. The moisture content was recorded in percent (%).

4.0 OPERATING PARAMETERS

The test program included the collection of generator load (kW) on the emergency generator. The compressor data collected included engine speed (RPM) and torque (Hp), fuel flow, inlet & exhaust manifold air pressure (psi) and temperature (F), and differential pressure across the catalyst (in. H_2O).

Operational data is located in Appendix F.

5.0 DISCUSSION OF RESULTS

Table No. 1 presents the emission testing results from Compressor Engine & Emergency Generator while operating at greater than 80% of full load conditions. The NO_x, CO and NMOC emissions are presented in parts per million (ppm) at fifteen percent oxygen (ppm @ 15% O_2). Additional test data presented for each test includes the collected operating data.

The emissions testing protocol and Subpart JJJJ require that emissions testing consists of triplicate 60-minute emissions tests. When the emergency generator was tested it was discovered that the engine was a rich-burn 4-cycle engine equipped with a three-way catalyst. The oxygen reading was less than 0.1% in the exhaust (Permit conditions require results to be submitted as a concentration, corrected to 15% O_2). The unusual conditions were discussed with Mr. Dickman (MDEQ) and it was agreed that the emissions testing would continue with a modification to test duration. Triplicate 15-minute tests were performed.

The results from the testing demonstrate that the Compressor Engine and Emergency Generator are each in compliance with Michigan Renewable Operating Permit No. MI-ROP-N5935-2014b and their applicable Subpart, 40 CFR Part 60, Subpart JJJJ or 40 CFR Part 63 Subpart ZZZZ.

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6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

Thomas Snyder, QSTI

This report prepared by: ______________________

Mr. Thomas Snyder, QSTI
Senior Engineering Technician, Environmental Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC

This report reviewed by: ______________________

Mr. Mark Grigereit, QSTI
Principal Engineer, Environmental Field Services
Environmental Management and Resources
DTE Energy Corporate Services, LLC

Gaseous Emissions Testing Results
Compressor Engine
DTE Energy Gas, Alpena Compressor Station
Harrison, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	05/17/16	05/17/16	05/17/16	
Sampling Start Time	9:30-9:45	9:56-10:11	10:20-10:35	
Load (%)	84.5	85.5	90.0	
Speed (RPM)	893.0	900.5	998.0	
Brake-HP	1,679	1,711	1,794	
Average Outlet O_2 Concentration (%, dry)	8.4	8.4	8.5	8.4
Average Outlet O_2 Concentration (%, dry, corrected)[1]	8.5	8.5	8.6	8.5
Average Outlet CO Concentration (ppmv, dry)	14.5	12.2	17.8	14.8
Average Outlet CO Concentration (ppmv, dry, corrected)[1]	14.4	12.1	17.9	14.8

[1]corrected for analyzer drift as per USEPA Method 7E

O_2 : oxygen

CO : carbon monoxide

Gaseous Emissions Testing Results
Emergency Generator
DTE Energy Gas, Alpena Compressor Station
Harrison, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	05/16/16	05/16/16	05/16/16	
Sampling Start Time	13:10-13:25	13:39-13:54	14:05-14:20	
Power Output (kW)	121.7-122.2	121.7-122.6	121.4-122.6	
Moisture (%)	0.198	0.198	0.198	0.198
Average Outlet O_2 Content (%, dry)	0.1	0.2	0.2	0.2
Average Outlet O_2 Content (%, dry, corrected)[1]	0.1	-0.03	-0.02	0.01
Average Outlet CO Concentration (ppmv, wet)	140.2	154.6	118.0	137.6
Average Outlet CO Concentration (ppmv, dry @ 15% O2)	**49.5**	**54.3**	**41.5**	**48.5**
Average Outlet NO_x Concentration (ppmv, wet)	10.9	11.1	6.5	9.5
Average Outlet NO_x Concentration (ppmv, dry @ 15% O2)	**3.8**	**3.9**	**2.3**	**3.3**
Average Outlet VOC Concentration (ppmv as propane, wet)	23.4	18.1	18.9	20.1
Average Outlet VOC Concentration (ppmv, corrected)[1]	23.6	18.2	19.1	20.3
Average Outlet VOC Concentration (ppmvd, corrected)[2]	29.4	22.7	23.8	25.3
Average Outlet CH_4 Concentration (ppmv as methane)	56	47	49	51
Average Outlet CH_4 Concentration (ppmv as propane)	18.6	15.7	16.5	16.9
Average Outlet NMOC Concentration (ppmv as propane)	10.8	7.0	7.3	
Average Outlet VOC Concentration (ppmv as propane, dry @ 15% O2)	**3.1**	**2.0**	**2.1**	**2.4**

[1]corrected for analyzer drift as per USEPA Method 6C

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Figure 1 – Sampling Location
Emergency Generator
Alpena Compressor Station
May 16-17, 2016

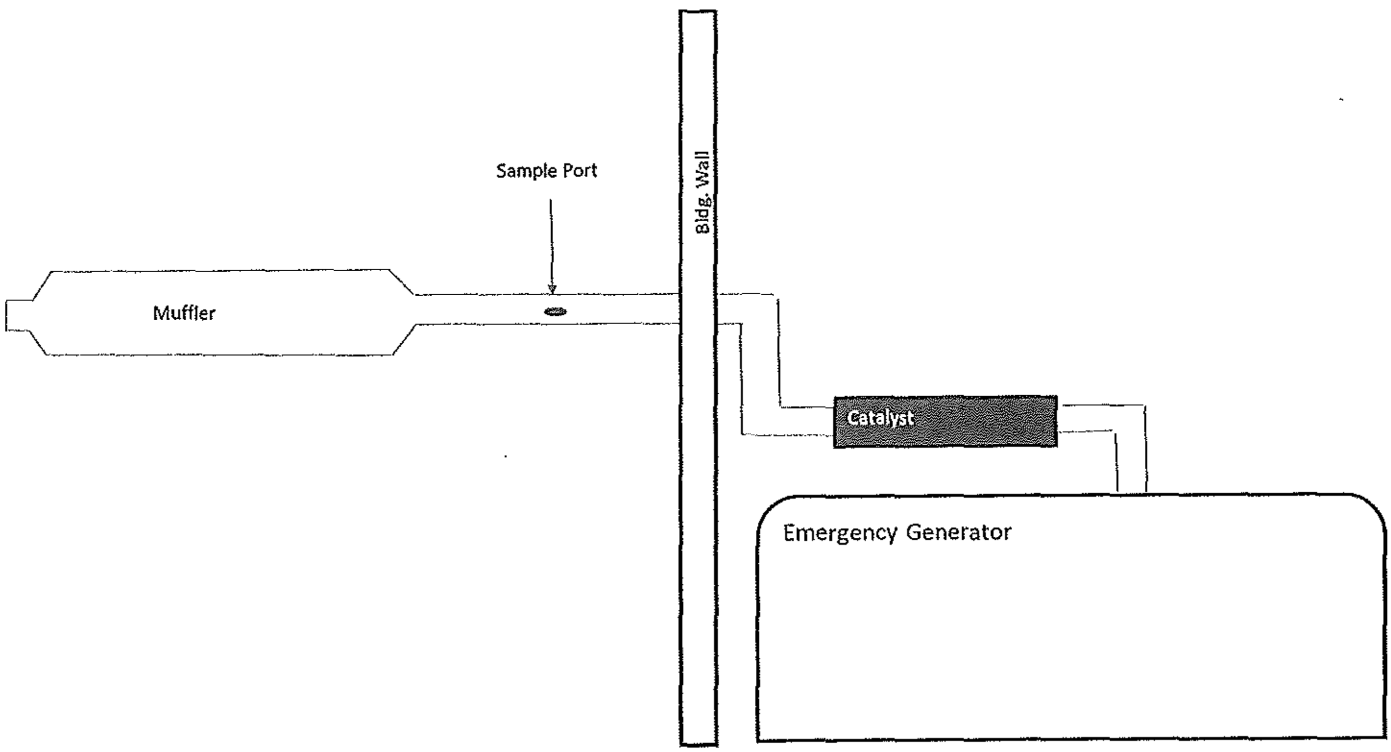

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Figure 2 – Sampling Location
Compressor Engine
Alpena Compressor Station
May 16-17, 2016

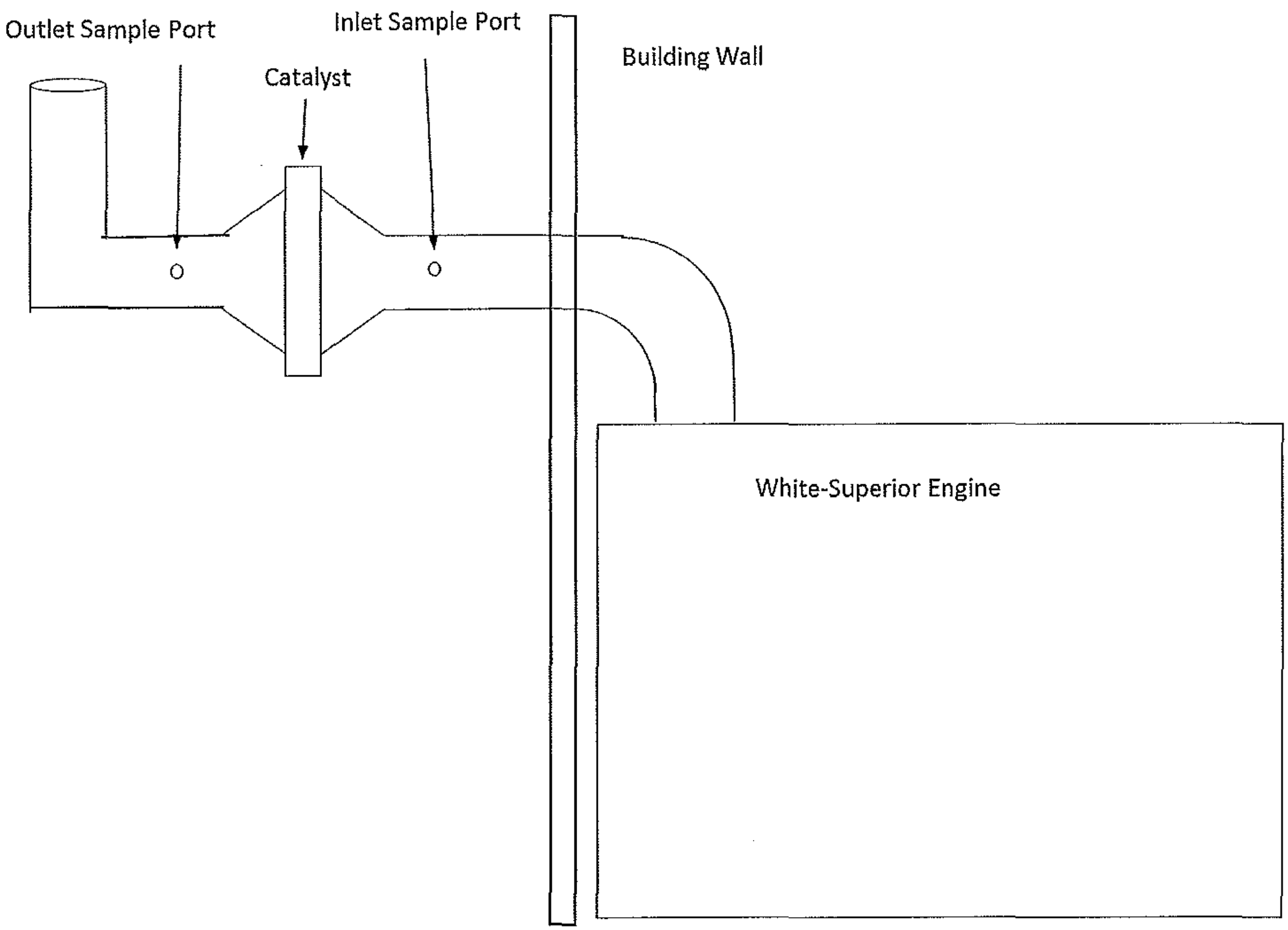

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Figure 3 – ASTM D6348
Alpena Compressor Station
May 16-17, 2016

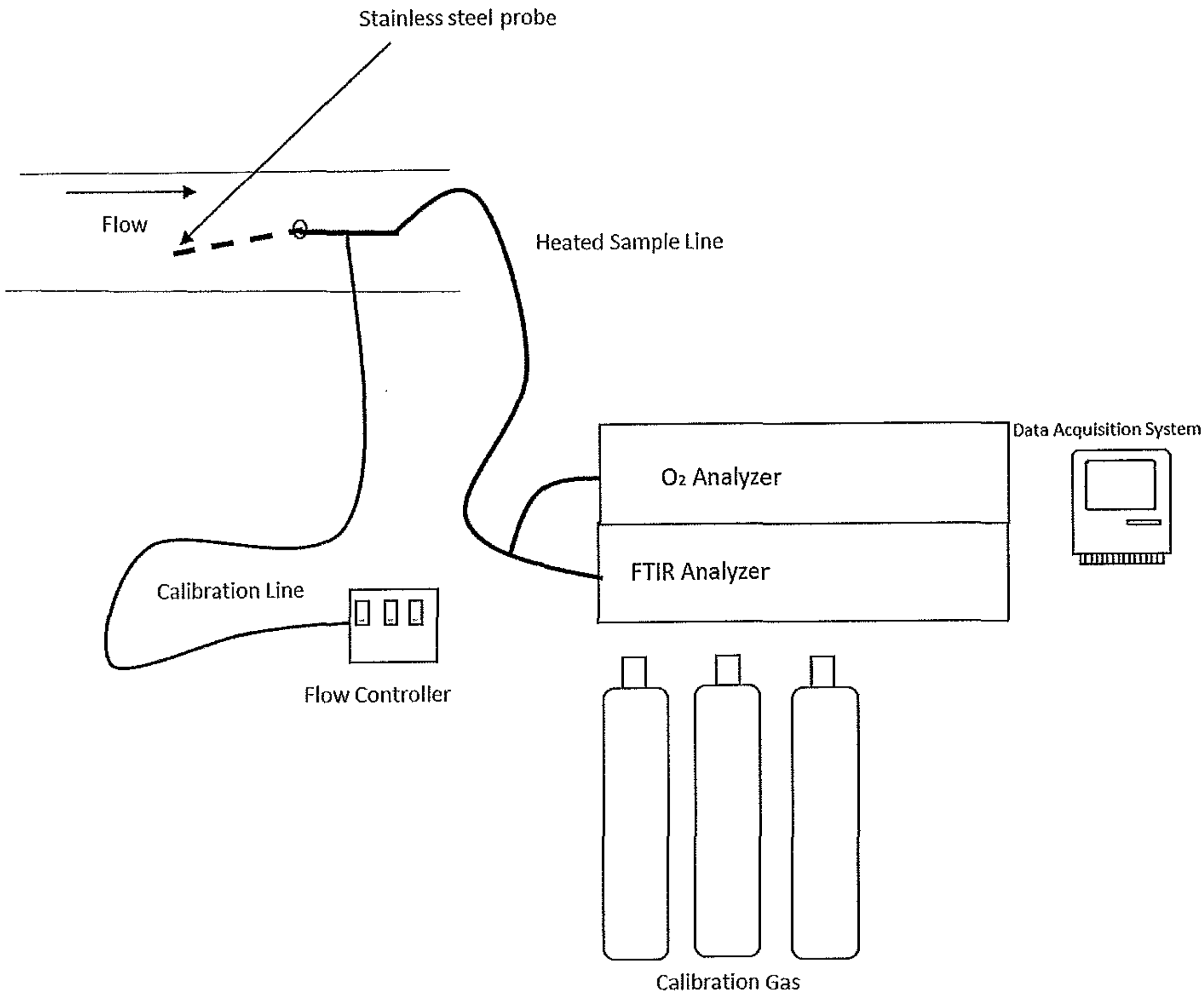

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Figure 4 – EPA Methods 3A/10
Alpena Compressor Station
May 16-17, 2016