Carbon Monoxide Emissions Testing of EUDGPEAKER1 and EUDGPEAKER2

Cloverland Electric Cooperative

335 Chippewa Avenue
Manistique, Michigan 49854
SRN: N8304

Cloverland
ELECTRIC COOPERATIVE

Prepared for
Cloverland Electric Cooperative
Sault Ste. Marie, Michigan

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Executive Summary

Cloverland Electric Cooperative (Cloverland Electric) retained Bureau Veritas North America, Inc. (Bureau Veritas) to test air emissions at the Cloverland Electric facility at 335 Chippewa Avenue in Manistique, Michigan. Cloverland Electric operates two reciprocating internal combustion engines installed for peak shaving and power outages. The purpose of the emission test program was to evaluate compliance with National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE) (40 CFR Part 63, Subpart ZZZZ) by measuring the oxygen (O_2) and carbon monoxide (CO) concentrations from the outlet of the two regulated engines.

The relevant emission standards are presented below:

Emission Standards

Pollutant	Limit	Equipment	USEPA Testing Method	Underlying Applicable Requirements
CO	23 ppmvd at 15% O_2 or reduce CO emissions by 70% or more	EUDGPEAKER1 EUDGPEAKER2	3A and 10	40 CFR Part 63, Subpart ZZZZ

O_2 oxygen
CO carbon monoxide
ppmvd part per million by volume, dry basis

The testing was completed in accordance with United States Environmental Protection Agency (USEPA) Reference Methods 3A and 10. The testing was conducted on December 11, 2014 and consisted of three 60-minute test runs at each source to measure O_2 and CO concentrations.

Detailed results are presented in Tables 1 and 2 after the Tables Tab of this report. The results of the testing are summarized in the table on the following page.

O_2 and CO Emissions Results Compared to Permit Emission Limits

Date (2014)	Source ID	Parameter	Units	Average Result	Emission Limit
EUDGPEAKER2 Outlet CO Testing					
Dec 11	EUDGPEAKER2 (Engine No. 2) Outlet	O_2	%	12.0	N/A
		CO	ppmvd	22.3	N/A
		CO	**ppmvd at 15% O_2**	**14.8**	**23**
EUDGPEAKER1 CO Removal Efficiency Testing					
Dec 11	EUDGPEAKER1 (Engine No. 1) Inlet	O_2	%	10.4	N/A
		CO	ppmvd	717	N/A
		CO	ppmvd at 15% O_2	402	N/A
Dec 11	EUDGPEAKER1 (Engine No. 1) Outlet	O_2	%	10.4	N/A
		CO	ppmvd	66.4	N/A
		CO	**ppmvd at 15% O_2**	**37.2**	**23**
Carbon Monoxide Removal Efficiency			**%**	**90.7**	**70**

O_2 oxygen
CO carbon monoxide
N/A not applicable
ppmvd part per million by volume, dry basis

The O_2 and CO measurements demonstrate EUDGPEAKER1 and EUDGPEAKER2 are operating within allowable limits.

1.0 Introduction

Cloverland Electric Cooperative (Cloverland Electric) retained Bureau Veritas North America, Inc. (Bureau Veritas) to test air emissions at the Cloverland Electric facility at 335 Chippewa Avenue in Manistique, Michigan. The purpose of the emission test program was to evaluate compliance with National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE) (40 CFR Part 63, Subpart ZZZZ) by measuring the oxygen (O_2) and carbon monoxide (CO) concentrations from two regulated engines.

1.1 Summary of Test Program

Cloverland Electric operates a peak shaving facility in Manistique, Michigan. The facility operates two diesel fueled power generating engines that are operated for peak shaving, and as required by the Midcontinental Independent System Operator for system emergencies.

The testing was completed in accordance with United States Environmental Protection Agency (USEPA) Reference Methods 3A and 10. Three 60-minute tests were conducted on December 11, 2014 to measure the CO concentrations in part per million by volume, dry basis (ppmvd) corrected to 15% O_2.

1.2 Purpose of Testing

The purpose of the emission test program was to evaluate compliance with National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE) (40 CFR Part 63, Subpart ZZZZ) by measuring the oxygen (O_2) and carbon monoxide (CO) concentrations from two regulated engines. The relevant emission standards are presented in Table 1-1 on the following page.

Table 1-1
Emission Standards

Pollutant	Limit	Equipment	USEPA Testing Method	Underlying Applicable Requirements
CO	23 ppmvd at 15% O_2 or reduce CO emissions by 70% or more	EUDGPEAKER1 EUDGPEAKER2	3A and 10	40 CFR Part 63, Subpart ZZZZ

ppmvd part per million by volume, dry basis
CO carbon monoxide
O_2 oxygen

1.3 Contact Information

Contact information is listed in Table 1-2 on the following page. Mr. Dillon King, Consultant with Bureau Veritas led the emission testing program. Mr. Phil Schmitigal, Director of Generation with Cloverland Electric, provided process coordination and arranged for facility operating parameters to be recorded. The testing was witnessed by Mr. Edward Lancaster, Environmental Quality Analyst with the Michigan Department of Environmental Quality.

Table 1-2
Key Personnel

Cloverland Electric	Bureau Veritas
Phil Schmitigal Director of Generation **Cloverland Electric Cooperative** 725 East Portage Avenue Sault Ste. Marie, Michigan 49783 Telephone: 906.632.5185 Facsimile: 906.635.6815 pschmitiga@cloverland.com	Dillon King, QSTI Consultant **Bureau Veritas North America, Inc.** 22345 Roethel Drive Novi, Michigan 48375 Telephone: 248.344.3002 Facsimile: 248.344.2656 dillon.king@us.bureauveritas.com
Michigan Department of Environmental Quality	
Edward Lancaster Environmental Quality Analyst Air Quality Division – Upper Peninsula District Office 1504 West Washington Street Marquette, Michigan 49855 Telephone: 906.250.5124 Facsimile: 906.228.4940 Email: lancastere1@michigan.gov	

2.0 Source and Sampling Locations

2.1 Process Description

Cloverland Electric operates a peak shaving facility in Manistique, Michigan. The facility operates two diesel fueled power generating engines that are operated for peak shaving, and as required by the Midcontinental Independent System Operator for system emergencies. EUDGPEAKER1 and EUDGPEAKER2 were tested as they are subject to 40 CFR Part 63, Subpart ZZZZ.

EUDGPEAKER1 is an EMD model 16-567ED4 engine that drives a 2,000 kW generator. The two-stroke reciprocating compressor engine was installed in 1970 and operates using 16 cylinders with a displacement of 149 liters.

EUDGPEAKER2 is an EMD model 20-645-E4 engine that drives a 3,575 kW generator. The two-stroke reciprocating compressor engine was installed in 1972 and operates using 20 cylinders with a displacement of 211 liters. Specifications of the engines are presented in Table 2-1.

Table 2-1
Non-Emergency Area Source RICE Engines Tested

ID	Installation Date	Make	Model	Serial Number	Rating (brake hp)	Fuel
EUDGPEAKER1	1970	EMD	16-567ED4	70-F3-1034	2,855	Diesel
EUDGPEAKER2	1972	EMD	20-645-E4	72-G1-1036	3,600	Diesel

Operating parameters recorded during testing are included in Appendix E.

2.2 Control Equipment

The exhausts of the engines pass through oxidation catalysts prior to discharge to the atmosphere. The expected life expectancy of the catalysts is 10,000 hours. The emission-control equipment for the diesel generation units was installed in 2013 to meet regulatory requirements.

The installed diesel oxidation catalysts (DOC) promote oxidation of the exhaust gas components by oxygen. Active catalytic sites on the surface of the DOC absorb oxygen. The bonded oxygen reacts with the effluent engine flue causing a reaction. The oxidation of carbon monoxide forms carbon dioxide, thus reducing carbon monoxide emissions.

2.3 Flue Gas Sampling Locations

Figure 1 behind the Figures Tab of this report, depicts the EUDGPEAKER1 and EUDGPEAKER2 sampling ports and traverse point locations. Descriptions of the source sampling locations are presented in sections 2.3.1 and 2.3.2

2.3.1 EUDGPEAKER1

The EUDGPEAKER1 exhaust was sampled from one of two sampling ports oriented at 90° to one another. The sampling ports are located in a straight section of a 20-inch-internal-diameter duct. The ports are located:

- 1.5 feet (0.9 duct diameters) from the nearest downstream disturbance.
- 6 feet (3.6 duct diameters) from the nearest upstream disturbance.

The ports were accessible via a ladder.

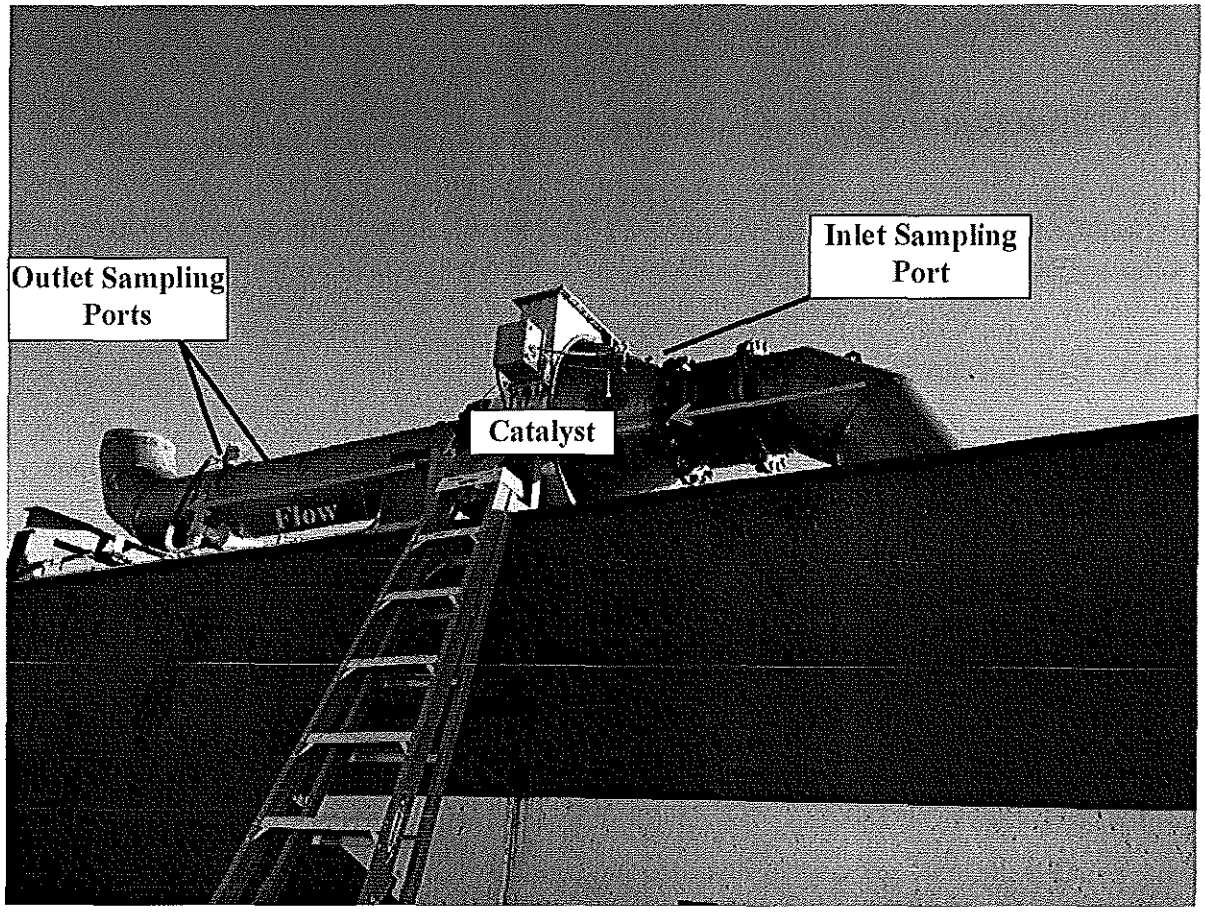
2.3.2 EUDGPEAKER2

The EUDGPEAKER2 exhaust was sampled from one of two sampling ports oriented at 90° to one another. The sampling ports are located in a straight section of a 25-inch-internal-diameter duct. The ports are located:

- 1.5 feet (0.9 duct diameters) from the nearest downstream disturbance.
- 6 feet (3.6 duct diameters) from the nearest upstream disturbance.

The ports were accessible via a ladder. A photograph of the EUDGPEAKER2, representative of both engine sampling locations, is presented in Figure 2-1.

Figure 2-1. EUDGPEAKER2 Sampling Location



2.4 Process Sampling Locations

Process sampling was not required during this test program. A process sample is a sample that is analyzed for operational parameters, such as calorific value of a fuel (e.g., diesel, natural gas, coal), organic compound content (e.g., paint coatings), or composition (e.g., polymers).