BTEC Inc.

NOx and CO Emissions Test Report

Prepared for:

DCP Antrim Gas, LLC

Johannesburg, Michigan

South Chester Antrim CO_2 Removal Facility
6250 Old State Road
Johannesburg, Michigan

Project No. 14-4553.00
August 20, 2014

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by DCP Antrim Gas, LLC (DCP) to evaluate emission rates from twelve emission units located at the South Chester Antrim CO_2 Removal Facility (SCA) at 6250 Old State Road in Johannesburg, Michigan. The emissions test program was conducted during May and June 2014. Test results for ten of the emission units were included in a test report dated July 23, 2014. Emission test results for Plant 6 Engines 1 and 2 are summarized by Table I.

Table I
Overall Emission Test Results Summary
DCP Antrim Gas, LLC
Johannesburg, Michigan

#	Test Date	Unit	Average NOx Emission Rate (pph)	NOx Emission Limit (pph)	Average CO Emission Rate (pph)	CO Emission Limit (pph)
1	6/26/2014	Plant 6 Engine 1 (EUENGINE1)	0.08	-	25.63	N/A
2	6/27/2014	Plant 6 Engine 2 (EUENGINE2)	4.59	-	33.72	N/A

*Plant 6 Engines 1 and 2 have a combined NOx emission limit of 18 tons per year. The engines do not have CO emission Limitations.

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by DCP Antrim Gas, LLC (DCP) to evaluate emission rates from twelve emission units located at the South Chester Antrim CO_2 Removal Facility (SCA) at 6250 Old State Road in Johannesburg, Michigan. The emissions test program was conducted during May and June 2014. The facility operates under Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MIROP-N2940-2009a. Test results for ten of the emission units were included in a test report dated July 23, 2014. The purpose of this report is to document the results of the test program for DCP Plant 6, Engines 1 and 2.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013, see Appendix A). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

The DCP SCA facility is located at 6250 Old State Road in Johannesburg, Michigan. The emission units tested and the corresponding test dates are summarized by Table 1.

1.b Purpose of Testing

As summarized by Table 1, the ROP for the SCA site required testing of oxides or nitrogen (NOx) and carbon monoxide (CO) emission rates from a total of thirteen emission units[1]. Because Plant Generator 7 (EUGEN7) will not operate again until 2015, the emissions test program did not include EUGEN7. The remainder of the emission units listed in Table 1 were included in the emissions test program.

1.c Source Description

The emissions test program included five plant media heaters, five reciprocating internal combustion engines, and two gas turbines. Each unit is fired exclusively by natural gas. This test report is for Plant 6, Engines 1 and 2 only.

[1] It should be noted that although CO testing was conducted on the emission units designated EUPLANT101, EUENGINE1, and EUENGINE2, these units do not have corresponding CO emission limitations and CO testing was not required.

1.d Test Program Contacts

The contacts for the source and test report are:

Ms. Lori Myott
Project Manager
NTH Consultants, Ltd
608 S. Washington Avenue
Lansing, Michigan 48933
(517) 702-2957
lmyott@nthconsultants.com

Mr. David Bennett
Operations Supervisor
DCP Antrim Gas, LLC
6250 Old State Road
Johannesburg, Michigan 49751
(989) 939-8360
dbennett@dcpmidstream.com

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Process operating data collected during the emissions test program is included in Appendix B.

2.b Applicable Permit

The applicable permit for this emissions test program is MDEQ ROP No. MI-ROP-N2940-2009a.

2.c Results

The overall results of the emission test program are summarized by Table 1 (see Section 5.a).

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

The emissions test program included five plant media heaters, five reciprocating internal combustion engines, and two gas turbines. Each unit is fired exclusively by natural gas. This test report is for Plant 6, Engines 1 and 2 only.

3.b Process Flow Diagram

Due to the simplicity of the engine, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The raw material used by the processes is natural gas.

3.d Process Capacity

The rated capacity of each emission unit is summarized by Table 3.

3.e Process Instrumentation

Process operating data collected during the emissions test program is included in Appendix B.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

Sampling and analysis procedures followed the methodologies of the following emissions test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Sample and Velocity Traverses for Stationary Sources"* was used to determine sampling and traverse point locations
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"* was used to measure exhaust gas flowrates.
- Method 3A - *"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources"* was used to evaluate the O_2 content of the exhaust gas
- Method 320 - *"Measurement of vapor phase organic and inorganic emissions by extractive Fourier Transform Infrared Spectroscopy"* was used to measure CO, NOx, CO_2, and moisture concentrations in the exhaust gas from EUENGINE1 and EUENGINE2

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with

Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing.

Cyclonic flow checks were performed at each sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists.

The O_2 content was measured using a M&C Products PMA 100-L O_2 gas analyzer (or equivalent). A sample of the gas stream was drawn through an insulated stainless-steel probe with an in-line glass fiber filter to remove any particulate, a heated Teflon® sample line, and through an electronic sample conditioner to remove the moisture from the sample before it enters the analyzers. Data was recorded at 4-second intervals on a PC equipped with data acquisition software.

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United State's National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11 point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity.

The O_2 analyzer was calibrated in accordance with the procedures of Methods 3A. An exhaust gas stratification test utilizing Method 1 sampling points was conducted during the first test run on each stack and using the procedures of Method 7E or, for the reciprocating engines, followed the procedures of 40 CFR 60, Subparts IIII and JJJJ.

Exhaust gas CO, NO, NO_2, CO_2, and moisture concentrations for EUENGINE1 and EUENGINE2 were measured by Fourier Transform Infrared (FTIR) spectroscopy. Emissions from the engine were continually purged through the sampling system and FTIR. The sample gas was extracted from the engine exhaust using a heated stainless steel probe, maintained at 191°C. A heated filter box (191°C) connected the probe to the filter assembly to a heated transfer line. A 0.1µ glass filter will used for particulate matter removal. A heated diaphragm pump was used to pull the sample from the engine. The sampling rate was 8 to 10 liters per minute.

The heated transfer line, held at 191°C, connected the probe/filter assembly to the FTIR. The FTIR was be equipped with a temperature-controlled, 5.11 meter multipass gas cell maintained at 191°C.

FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer. All data was collected at 0.5cm_{-1} resolution. Each sample spectrum was derived from the co-addition of 60 scans, with a new data point generated every one minute.

FTIR sampling and analysis was conducted by Prism Analytical Technologies, Inc. (PATI)

of Mount Pleasant, Michigan. A copy of PATI's test summary report is included as Appendix C.

4.b Recovery and Analytical Procedures

This test program did not include laboratory samples, consequently, sample recovery and analysis is not applicable to this test program.

4.c Sampling Ports

Sampling ports were installed on each stack that met the minimum requirements of Method 1.

4.d Traverse Points

Each exhaust stack was traversed at the minimum Method 1 sampling points.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 1. Detailed results for the emissions test program are summarized by Tables 4 and 5.

5.b Discussion of Results

The NOx emission limitation for EUENGINE1 and EUENGINE2 is 18 tons per year.

5.c Sampling Procedure Variations

Sampling procedure variations for this emissions test program were as follows:

- Testing of EUENGINE1 was initiated on May 30, 2014, however, the NOx analyzer was producing erroneous data and could not pass calibration after the test run. Consequently, the testing was aborted and EUENGINE1 and EUENGINE2 testing was completed on June 26 and 27, 2014 using Method 320 instead of Methods 7E and 10.

Test data collected for the aborted testing of EUENGINE1 is provided in Appendix D.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix E.

5.i Sample Calculations

Sample calculations are provided in Appendix F.

5.j Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix G.

5.k Laboratory Data

Raw CEM data is provided electronically in Appendix H.

TABLES

Table 1
Overall Emission Test Results Summary
DCP Antrim Gas, LLC
Johannesburg, Michigan

#	Test Date	Unit	Average NOx Emission Rate (pph)	NOx Emission Limit (pph)	Average CO Emission Rate (pph)	CO Emission Limit (pph)
1	6/26/2014	Plant 6 Engine 1 (EUENGINE1)	0.08	-	25.63	N/A
2	6/27/2014	Plant 6 Engine 2 (EUENGINE2)	4.59	-	33.72	N/A

*Plant 6 Engines 1 and 2 have a combined NOx emission limit of 18 tons per year. The engines do not have CO emission Limitations.

Table 2
Test Personnel

Name and Title	Affiliation	Telephone
Mr. David Bennett Operations Supervisor	DCP Antrim Gas, LLC 6250 Old State Road Johannesburg, Michigan 49751	(989) 939-8360
Mr. Peter Hilty Senior Project Manager	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Draper Environmental Technician	BTEC 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Tom Gasloli Environmental Quality Analyst	MDEQ Air Quality Division	(517) 284-6778
Mr. Shane Nixon Environmental Engineer	MDEQ Air Quality Division	(231) 876-4413

Table 3
DCP Antrim Gas
Equipment Rated Capacities Summary

#	Unit	Process Rating	Process Rating Units
1	Plant 1 Heat Media Heater (EUPLANT101)	40	MMBtu/hr
2	Plant 2 Heat Media Heater (EUPLANT201)	51.23	MMBtu/hr
3	Plant 3 Heat Media Heater (EUPLANT301)	51.23	MMBtu/hr
4	Plant 4 Heat Media Heater (EUPLANT401)	51.23	MMBtu/hr
5	Plant 5 Heat Media Heater (EUPLANT501)	51.23	MMBtu/hr
6	Plant Generator 6 (EUGEN06)	1,150	hp
7	Plant Generator 7 (EUGEN07), will not run until 2015	1,150	hp
8	Plant Generator 8 (EUGEN08)	1,150	hp
9	Plant Generator 9 (EUGEN09)	1,150	hp
10	Plant 6 Engine 1 (EUENGINE1)	930	hp
11	Plant 6 Engine 2 (EUENGINE2)	930	hp
12	Turbine 1 (EUP5TUR01)	3,505	kW
13	Turbine 2 (EUP5TUR02)	3,505	kW

Table 4
Plantg 6 - Engine 1 NOx, CO Emission Rates
DCP Antrim Gas
Johannesburg, MI
BTEC Project No. 14-4553.00
Sampling Date: 6/26/14

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	6/26/2014	6/26/2014	6/26/2014	
Test Run Time	12:30 - 13:30	14:00 - 15:00	15:25 - 16:25	
Outlet Flowrate (dscfm)	583	587	592	**587**
Oxygen Concentration (%)	1.69	0.06	0.06	**0.60**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	1.66	-0.04	-0.04	**0.53**
Outlet Oxides of Nitrogen Concentration (ppmv)	20.60	20.30	18.30	**19.73**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**0.09**	**0.09**	**0.08**	**0.08**
Outlet Carbon Monoxide Concentration (ppmv)	9967.00	10039.00	10036.00	**10014.00**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**25.33**	**25.69**	**25.89**	**25.63**

O_2 Correction			
Co	0.06	0.10	0.10
Cma	10	10	10
Cm	9.90	9.90	9.87

MW = molecular weight (CO = 28.01, NOx = 46.01, SO_2 = 64.05, C_3H_8 = 44.10, carbon = 12.01)
24.14 = molar volume of air at standard conditions (70 °F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases
$C_c = KC_{meas}$
where Cc = Concentration as Carbon (ppmv), K= Carbon equivalent correction factor (3 for Propane)
and C_{meas} = concentration as measured (as propane)
[1]emission rate calculated on dry basis
[2]emission rate calculated on wet basis

Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *scfm* * 60 *for* VOC
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *dcfm* * 60
$Conc_{@15\%O2}$ = Conc * (20.9 -15)/(20.9 - $\%O_2$)

Table 5
Plantg 6 - Engine 2 NOx, CO Emission Rates
DCP Antrim Gas
Johannesburg, MI
BTEC Project No. 14-4553.00
Sampling Date: 6/27/14

Parameter	Run 1	Run 2	Run 3	Average
Test Run Date	6/27/2014	6/27/2014	6/27/2014	
Test Run Time	8:03 - 9:03	9:10 - 10:10	10:32 - 11:32	
Outlet Flowrate (dscfm)	600	677	556	**611**
Oxygen Concentration (%)	0.16	0.15	0.15	**0.15**
Oxygen Concentration (%, drift corrected as per USEPA 7E)	0.06	0.05	0.07	**0.06**
Outlet Oxides of Nitrogen Concentration (ppmv)	1029.70	1052.60	1062.30	**1048.20**
NOx Emission Rate (lb/hr) (corrected as per USEPA 7E)	**4.42**	**5.11**	**4.23**	**4.59**
Outlet Carbon Monoxide Concentration (ppmv)	12762.00	12560.00	12668.00	**12663.33**
CO Emission Rate (lb/hr) (corrected as per USEPA 7E)	**33.37**	**37.10**	**30.70**	**33.72**

O_2 Correction			
Co	0.10	0.10	0.09
Cma	10	10	10
Cm	9.90	9.94	9.96

MW = molecular weight (CO = 28.01, NOx = 46.01, SO_2 = 64.05, C_3H_8 = 44.10, carbon = 12.01)
24.14 = molar volume of air at standard conditions (70 °F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb

Co= Average of initial and final zero gases
Cma=Actual concentration of the calibration gas
Cm= Average of initial and final calibration gases
$C_c = KC_{meas}$
where Cc = Concentration as Carbon (ppmv), K= Carbon equivalent correction factor (3 for Propane)
and C_{meas} = concentration as measured (as propane)
[1]emission rate calculated on dry basis
[2]emission rate calculated on wet basis

Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *scfm* * 60 *for* VOC
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *dcfm* * 60
$Conc_{@15\%O2}$ = Conc * (20.9 -15)/(20.9 - $\%O_2$)