Excelsior

Emission Test and LDAR Assessment of Small Glycol Dehydration Unit

ANR Pipeline Company Excelsior Compressor Station

4963 State Road Northeast
Kalkaska, Michigan

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TransCanada
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Executive Summary

TransCanada retained Bureau Veritas North America, Inc. to evaluate the closed-vent system and test air emissions at the ANR Pipeline Company (ANR) Excelsior Compressor Station in Kalkaska, Michigan. TransCanada stores natural gas in underground reservoirs and transports gas via pipelines to other companies and end-users after the gas is processed through glycol dehydration units. Testing was conducted on the Excelsior glycol dehydration unit. The purpose of the testing was to:

- Evaluate the glycol dehydration unit's closed-vent system for leaks.
- Measure benzene, toluene, ethylbenzene, and xylenes (BTEX) emissions from the Excelsior glycol dehydration unit's thermal oxidizer exhaust stack.
- Evaluate compliance with 40 CFR Part 63, National Emissions Standards for Hazardous Air Pollutants for Source Categories, Subpart HHH, "National Emissions Standards for Hazardous Air pollutants for Natural Gas Transmission and Storage Facilities," incorporated in Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP- B7196-2012a.

The glycol dehydration system is defined as "existing small glycol dehydration unit" in accordance with 40 CFR 63, Subpart HHH, and subject to:

- Leak Detection and Repair (LDAR) standards.
- Control device BTEX, total organic compound (TOC), or total hazardous air pollutants (HAPs) emission standards.

The testing was completed in accordance with United States Environmental Protection Agency (USEPA) Reference Methods 1 through 4, 18, and 21. On February 18, 2015, testing was conducted at Excelsior and consisted of completion of the LDAR assessment and three 60-minute test runs to measure BTEX.

Leak Detection and Repair

Detailed results of the LDAR assessment are presented in Table 3-3. Documentation of the LDAR assessment was recorded on LDAR Recordkeeping and Field Inspection Forms, which are included in Appendix C of this report. The results of the LDAR assessment are summarized in the following table.

LDAR Assessment Results

Date (2015)	Glycol Dehydration Unit	Number of Components Evaluated	Number of Readings Below Leak Criterion of 500 ppmv	Number of Readings Exceeding Leak Criterion of 500 ppmv	Comment
Feb 18	Excelsior	30	30	0	No leaks detected

ppmv; part per million by volume

Based on the results of the LDAR assessment, no volatile organic compound (VOC) readings were measured at a concentration exceeding the criterion of a leak (i.e., 500 part per million by volume [ppmv]).

Performance Testing

The emission testing was conducted to evaluate compliance with the emission limit of the thermal oxidizer, which controls air emissions from the glycol dehydration system. Emission testing was conducted on the Excelsior glycol dehydration unit.

Detailed results of the Excelsior testing are presented in Table 1 after the Tables Tab of this report. The results of the testing are summarized in the following table.

BTEX Emission Results Compared to Permit Emission Limits

Date (2015)	Glycol Dehydration Unit	Emission Unit	Parameter	Units	Average Result[1]	Emission Limit[2]
Excelsior						
Feb 18	Excelsior	EUEXGLYDEH	Benzene†	lb/hr	0.00047	NA
			Toluene†		<0.00073	NA
			Ethylbenzene†		<0.00074	NA
			Total xylenes†		<0.0015	NA
			Mass rate of BTEX	lb/hr	0.0034	NA
				Mg/yr	0.0057	77.01

† Corrected for spike recovery following USEPA Method 18.

1 Based on typical maximum operating hours for the total withdrawal season.

2 Emission limit was calculated based on the annual average daily throughput rates from 2009 through 2013 using Equation 1 of the regulation (40CFR63.1275(b)(1)(iii)).

lb/hr: pound per hour

Mg/yr: megagrams per year

NA: not applicable

BTEX: benzene, toluene, ethylbenzene, total xylenes

The BTEX measurements demonstrate that estimated annual air emissions from the thermal oxidizer controlling the glycol dehydration unit are within the allowable limit.

1.0 Introduction

1.1 Summary of Test Program

TransCanada retained Bureau Veritas North America, Inc. to evaluate the closed-vent system and test air emissions at the ANR Pipeline Company (ANR) Excelsior Compressor Station in Kalkaska, Michigan. TransCanada stores natural gas in underground reservoirs and transports gas via pipelines to other companies and end-users after the gas is processed through glycol dehydration units. Testing was conducted on the Excelsior glycol dehydration unit. The purpose of the testing was to:

- Evaluate the glycol dehydration unit's closed-vent system for leaks.
- Measure benzene, toluene, ethylbenzene, and xylenes (BTEX) emissions from the Excelsior glycol dehydration unit's thermal oxidizer exhaust stack.
- Evaluate compliance with 40 CFR Part 63, National Emissions Standards for Hazardous Air Pollutants for Source Categories, Subpart HHH, "National Emissions Standards for Hazardous Air pollutants for Natural Gas Transmission and Storage Facilities," incorporated in Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP- B7196-2012a.

The glycol dehydration system is defined as "existing small glycol dehydration unit" in 40 CFR 63, Subpart HHH, and subject to:

- Leak Detection and Repair (LDAR) standards.
- Control device BTEX, total organic compound (TOC), or total hazardous air pollutants (HAPs) emission standards.

Leak Detection and Repair

The LDAR assessment was conducted following the LDAR plan that Bureau Veritas prepared which outlined procedures to detect volatile organic compound (VOC) leaks from equipment components of the closed-vent system and identify necessary repairs as required by 40 CFR 60, Subpart HHH and MDEQ MI-ROP-B7196-2012a.

When compliance with the emission standard is achieved using a control device or combination of control devices, the closed-vent system shall have no detectable emissions. A potential leak interface is evaluated to operate with no detectable organic emissions if the organic concentration is less than 500 parts per million by volume (ppmv).

Bureau Veritas conducted the following LDAR activities:

- Identified, tagged, and listed the components to be monitored and those that are difficult to inspect.
- Established procedures if the leak criterion is exceeded.
- Monitored components through initial visual inspection and LDAR monitoring following United States Environmental Protection Agency (USEPA) Method 21 guidelines.
- Communicated findings to TransCanada for leak repair (if applicable) and reporting by TransCanada.
- Reported the initial inspection findings.

Documentation of the LDAR assessment was recorded on LDAR Recordkeeping and Field Inspection Forms, which are included in Appendix C of this report.

Performance Testing

The emission testing was conducted to evaluate compliance with the emission limit of the thermal oxidizer, which controls air emissions from the glycol dehydration system. Emission testing was conducted on the Excelsior glycol dehydration unit.

The thermal oxidizer is subject to the following emission limit:

Unit-specific BTEX emission limit in megagrams (Mg) per year, calculated using Equation 1 of the regulation (40CFR63.1275(b)(1)(iii)):

$$EL_{BTEX} = 3.10x10^{-4} \times \text{Throughput} \times C_{i,BTEX} \times 365 \frac{\text{day}}{\text{yr}} \times \frac{1\ \text{Mg}}{1x10^{6}\ \text{gram}}$$

Where:

EL_{BTEX} = Unit-specific BTEX emission limit, megagrams per year

$3.10x10^{-4}$ = BTEX emission limit, grams BTEX/standard cubic meter-ppmv

Throughput = Annual average daily natural gas throughput, standard cubic meters

$C_{i,BTEX}$ = Annual average BTEX concentration of the natural gas at the inlet to the glycol dehydration unit, ppmv

The throughput values were measured at the custody transfer meter and based on annual average daily throughput rates from 2009 through 2013.

The testing was completed in accordance with USEPA Reference Methods 1 through 4, 18, and 21 identified in §63.1282 of Subpart HHH of 40 CFR Part 63—Test Methods, Compliance Procedures, and Compliance Demonstrations. Measurement of BTEX concentrations following USEPA Method 18 incorporates the analytical procedures of Occupational Health and Safety Administration (OSHA) 7 and USEPA SW-846 Method 8260.

On February 18, 2015, Bureau Veritas conducted the following for the Excelsior unit:

- The LDAR assessment.
- Three 60-minute test runs at the exhaust of the unit to measure BTEX concentrations.

The sampling conducted is summarized below in Table 1-1.

Table 1-1
Sources Tested, Parameters, and Test Date

Source	Test Parameter	Test Date
Excelsior		
Excelsior thermal oxidizer exhaust	BTEX	February 18, 2015
Closed vent system joints	VOC leaks	

BTEX: benzene, toluene, ethylbenzene, total xylenes
VOC: volatile organic compound

1.2 Key Personnel

Key personnel involved in this test program are listed in Table 1-2. Mr. Thomas Schmelter, Senior Project Manager with Bureau Veritas, led the emission testing program under the direction of Dr. Derek Wong, Director and Vice President with Bureau Veritas.

Mr. Jeff Punjak, Controls Specialist, Plant Reliability with TransCanada; Mr. Pedro Amieva, US Plant Reliability with TransCanada; Ms. Melinda Holdsworth, Environmental Air Emissions and GHG Advisor with TransCanada; and others coordinated with Bureau Veritas and arranged for process data to be recorded.

Portions of the testing were witnessed by Mr. William Rogers, Environmental Quality Analyst, with MDEQ.

Table 1-2
Key Personnel

TransCanada	
Jeff Punjak Controls Specialist, Plant Reliability TransCanada P.O. Box 336, Forest Road 241 Iron River, Wisconsin 54847 Phone: 248.205.7554 jeffrey_punjak@transcanada.com	Melinda Holdsworth Environmental Air Emissions & GHG Advisor TransCanada 700 Louisiana St., Suite 700 Houston, Texas 77002-2700 Phone: 832.320.5665 Melinda_Holdsworth@TransCanada.com Pedro Amieva US Plant Reliability TransCanada 717 Texas Street Houston, Texas 77002 Phone: 832.320.5839 pedro_amieva@transcanada.com
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Derek Wong, Ph.D., P.E. Director and Vice President Bureau Veritas North America, Inc. 22345 Roethel Drive Novi, Michigan 48375 Tel. 248.344.2669 Fax. 248.344.2656 derek.wong@us.bureauveritas.com	Thomas Schmelter Senior Project Manager Bureau Veritas North America, Inc. 22345 Roethel Drive Novi, Michigan 48375 Tel: 248.344.3003 Fax: 248.344.2656 thomas.schmelter@us.bureauveritas.com

2.0 Source and Sampling Locations

2.1 Process Description

ANR, a wholly owned subsidiary of TransCanada, operates natural gas pipeline systems that connect supply basins and markets throughout the Midwest and south to the Gulf of México. ANR owns and operates several facilities in Michigan that are used in both natural gas transmission and storage. The location evaluated as part of this test program is a natural gas transmission and compression station that operates a natural gas storage field.

The pipeline transports natural gas to and from the storage reservoir field. Natural gas is injected into underground field in spring and summer and withdrawn in fall and winter for residential and commercial heating purposes. During injection, natural gas flows into the reservoir until the field pressure approaches pipeline pressure. When the pressures near equilibrium, one or more engines are used to compress the natural gas into the reservoir. Compression injection usually continues until the field reaches its maximum rated pressure.

During the storage period, natural gas absorbs hydrocarbons and water while in the underground geologic formation. Gas withdrawn from the storage field is conditioned through a glycol dehydration system to remove water. Dehydration is necessary in order to (1) meet contract sales specifications, (2) remove water vapor that may form hydrates, ice-like structures that can cause corrosion or plug equipment lines, and (3) to improve fuel heating values. Glycol dehydration is an absorption process in which a liquid glycol absorbent directly contacts the natural gas stream, which is circulated counter-current to the glycol flow, and absorbs water vapor in a contact tower or absorption column.

At the existing small glycol dehydration unit, natural gas is pumped into a tower, where the gas passes over a series of glycol trays. The glycol in these trays absorbs water and hydrocarbons in the natural gas. The conditioned natural gas can be fed into a separator to remove liquids that remain before being compressed and/or transported into the pipeline for distribution.

The rich, or "dirty," glycol that contains water and hydrocarbons accumulates in the bottom of the tower and is transported to a three-phase separator that separates heavy hydrocarbons from the glycol. The glycol is filtered before being transported into a re-boiler unit. The re-boiler evaporates water from the glycol. The resulting lean, or "clean," glycol is recirculated into the glycol tower.

Water from the re-boiler is condensed and transported to condensate and brine tanks, when necessary. The re-boiler vapors, which may contain volatile organic compounds (VOCs)—including HAPs such as BTEX—are directed to a condenser and/or thermal oxidizer for control prior to exhausting to atmosphere.

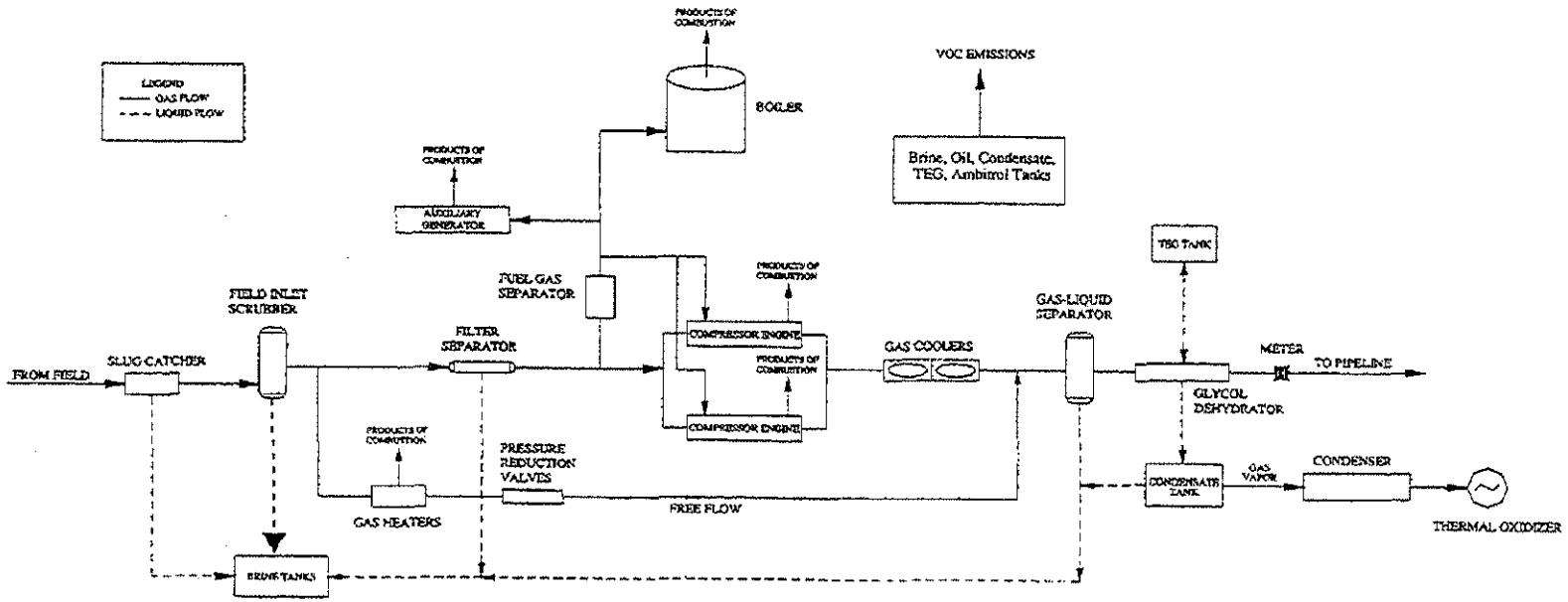
Figures 2-1 and 2-2 depict the general natural gas withdrawal and small glycol dehydration unit processes for Excelsior.

The small glycol dehydration unit was tested when natural gas was being processed at the maximum routine operating conditions. The natural gas throughput rate was measured at the custody transfer meter. Process and control equipment data recorded during testing are included in Appendix F. Table 2-1 summarizes the process and control equipment data.

Table 2-1
Summary of Process Operating Parameters

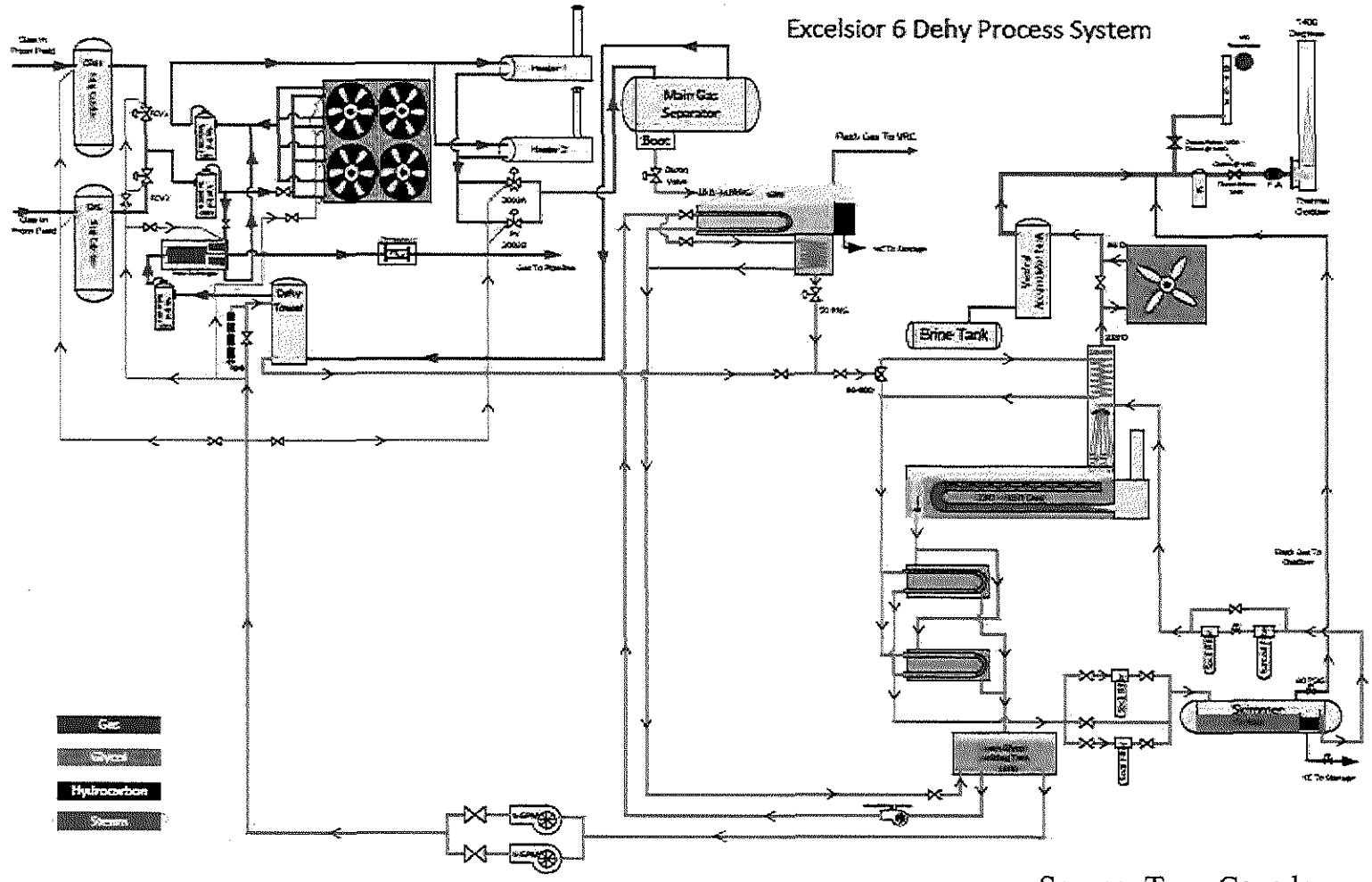
Parameter	Units	Run 1	Run 2	Run 3	Average
Excelsior (EUEXGLYDEH)					
Natural gas throughput rate during testing	MMCFH	6.5	6.3	6.2	6.3
Thermal oxidizer combustion temperature	°F	1,511	1,508	1,511	1,510
Glycol recirculation Rate	GPM	5	5	5	5

MMCFH: million cubic feet per hour
GPM: gallon per minute
Notes
1. The throughput values were measured at the custody transfer meter.
2. As provided by TransCanada, the maximum facility withdrawal rate for Excelsior is 8.3 MMCFH.



Source: TransCanada.

Figure 2-1. General Gas Withdrawal Process Flow



Source: TransCanada.

Figure 2-2. Excelsior Dehydration Unit Process Flow

2.2 Control Equipment

From the gas conditioning process, the glycol dehydration re-boiler vent is the primary source of emissions. These emissions can be controlled by vapor recovery (condensation), combustion, and pollution prevention.

A condenser controls emissions from the small glycol dehydration unit. The condenser converts components in the vapor phase to the liquid phase by reducing the temperature of the process vent stream. The condenser not only reduce emissions, but also recovers condensable hydrocarbon vapors that can be used or sold for hydrocarbon liquid production or disposed.

Residual VOCs and HAPs in the exhaust gas of the condenser is combusted in the thermal oxidizer. Process gas enters the combustion chamber, where the burner heats the gas to 1,400°F to oxidize VOCs, producing primarily water vapor and carbon dioxide. The treated gas exiting the combustion chamber is discharged to the atmosphere through the exhaust stack. The incinerators are designed to obtain a minimum VOC destruction efficiency greater than 95%.

Pollution prevention refers to system optimization of the small glycol dehydration units by adjustment of process variables to reduce air emissions. For example, small glycol dehydration units may circulate more glycol than necessary to meet contract specifications. High glycol circulation rates increase the amount of BTEX absorbed from the natural gas stream; therefore, more BTEX and VOCs are released from the small glycol dehydration unit re-boiler vent during regeneration of the glycol. Optimizing the glycol circulation rate and other process variables may reduce associated air emissions.

Process and control equipment data recorded during testing are included in Appendix F. Table 2-1 summarizes the process and control equipment data.

2.3 Flue Gas Sampling Location

The sampling port location meets the upstream and downstream siting requirements of USEPA Method 1; however, only one sample port is available at the Excelsior sampling location. Because two sampling ports were not present, a single sampling port was used for volumetric flowrate measurements. This sampling approach was approved by MDEQ prior to testing.

A description of the flue gas sampling location is presented in Section 2.3.1.

2.3.1 Excelsior Thermal Oxidizer Exhaust

The Excelsior thermal oxidizer exhaust stack is 21 inches in diameter and has one 2-inch-diameter sampling port. Six traverse points were used to measure stack gas velocity. The port is located:

- 55 inches (2.6 duct diameters) from the nearest downstream disturbance.
- 228 inches (10.9 duct diameters) from the nearest upstream disturbance.

The port was accessible via an articulating boom lift.

Figure 2-3 is a photograph of the Excelsior thermal oxidizer sampling location. Figure 1 in the Appendix depicts the sampling ports and traverse point locations.

2.4 LDAR Sampling Locations

The process equipment at the Excelsior location that was evaluated for LDAR included valves, flanges, pressure relief devices, and other connections.

Bureau Veritas conducted the initial LDAR monitoring by inspecting closed-vent system joints, seams, or other connections that are permanently or semi-permanently sealed (e.g., a welded joint between two sections of hard piping or a bolted or gasketed ducting flange).

The inspection consisted of a (1) visual examination and (2) no-detectable-emission evaluation. The visual examination evaluated defects that could result in air emissions, such as visible cracks, holes, gaps in piping, loose connections, or broken or missing caps or other closure devices. The no-detectable-emissions evaluation was performed following USEPA Method 21 procedures discussed in Section 4.0.

Where metal wrap pipe insulation was present around a pipe joint, seam, or other connection and a visual inspection could not be performed without damage, the Method 21 monitoring was performed at the seams in the metal pipe wrap insulation near the inaccessible joint, seam, or other connection.

TransCanada identified the LDAR locations evaluated at the Excelsior small glycol dehydration unit. The LDAR test locations are presented in Figure 2-4.

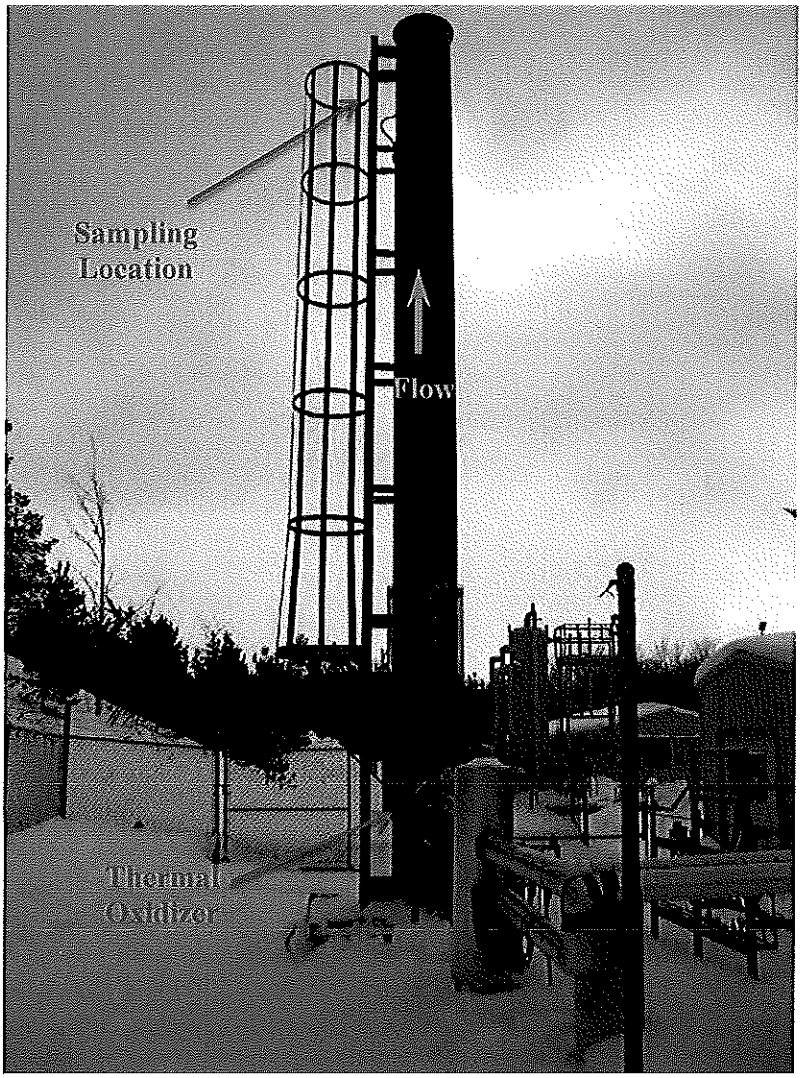


Figure 2-3. Excelsior Thermal Oxidizer Exhaust Stack

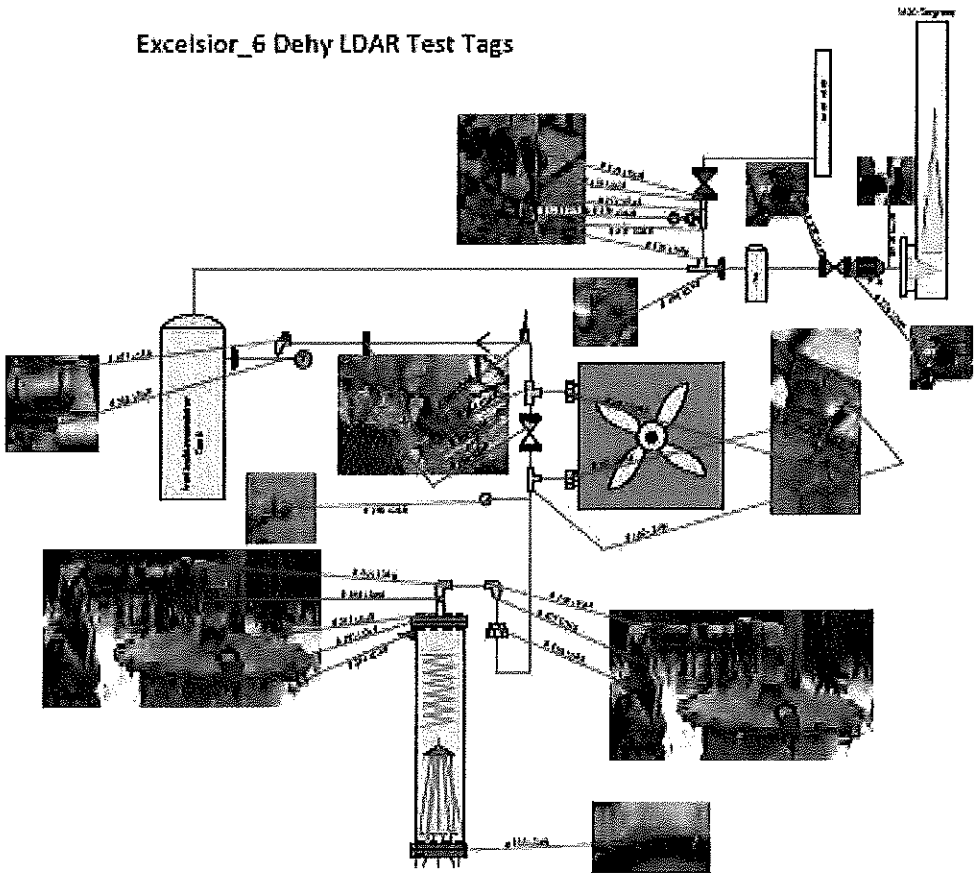


Figure 2-4. Excelsior LDAR Sampling Locations

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3.0 Results

3.1 Objective

The objective of the testing was to evaluate the closed-vent system and test air emissions of the small glycol dehydration unit for:

- Leaks of VOCs.
- BTEX emissions from the Excelsior glycol dehydration unit's thermal oxidizer exhaust stack.
- Compliance with 40 CFR Part 63, National Emissions Standards for Hazardous Air Pollutants for Source Categories, Subpart HHH, "National Emissions Standards for Hazardous Air pollutants for Natural Gas Transmission and Storage Facilities" incorporated in MDEQ ROP MI-ROP- B7196-2012a.

Table 3-1 summarizes the sampling and analytical matrix.

Table 3-1
Test Matrix

Sampling Location	Sample/Type of Pollutant	Sampling Method	No. of Test Runs and Duration	Analytical Method	Analytical Laboratory
Excelsior (EUEXGLYDEH)	BTEX	1, 2, 3, 4, and 18	Three 60-minute runs	Field measurement Gas chromatography	Bureau Veritas and Maxxam Analytics†
	VOC leaks	21	NA	Flame ionization detector	NA

† Maxxam Analytics is a Bureau Veritas company

3.2 Field Test Changes and Issues

Communication between TransCanada, Bureau Veritas, and MDEQ allowed the testing to be completed without field test changes. Section 3.2.1 describes an analytical issue encountered.

3.2.1 Complications from Extreme Weather Conditions

Due to extreme weather conditions (i.e., temperatures below 0°F), three impinger samples likely froze and broke during transport to the laboratory. Figure 3-1 shows the broken sample containers. Based on the similar manner in which the sample containers broke, they did not appear to have shattered as a result of transport; it is more probable that the sample containers froze during transport causing the bottom of the sample containers to break open. The low temperatures in Kalkaska, Michigan during testing and sample transport ranged from -13°F to 16°F and are shown in Table 3-2.

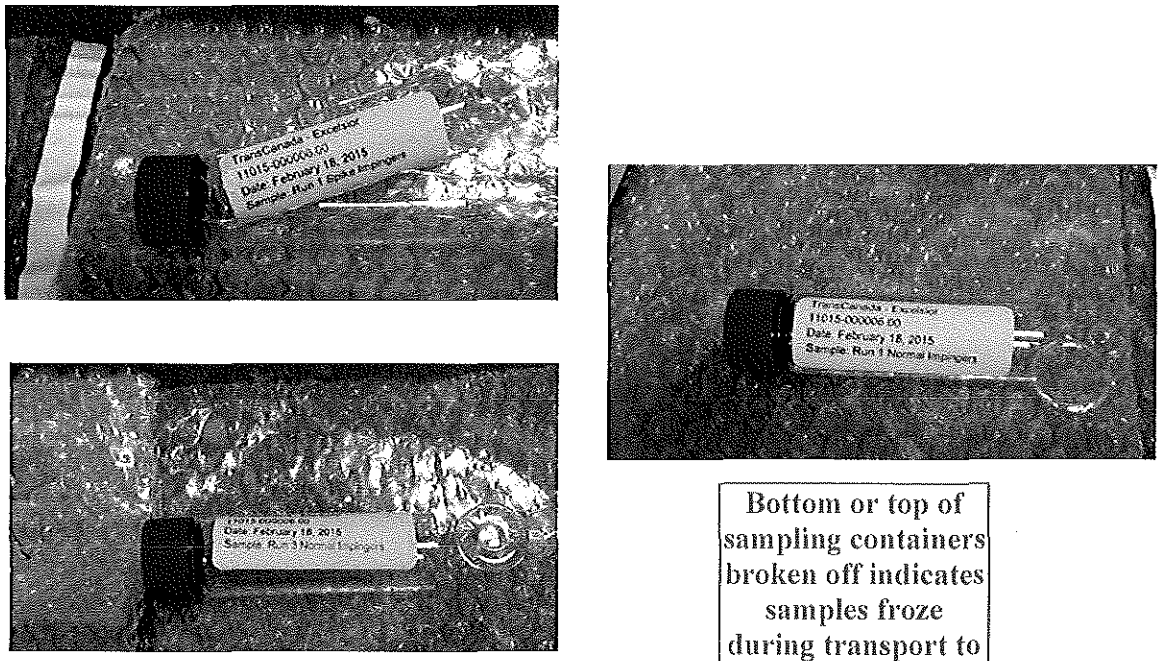

Figure 3-1. Broken Sample Containers

Table 3-2
Temperatures during Emissions Testing and Sample Transport
Kalkaska, Michigan

Date	Temperature (°F)	
	High	Low
February 18, 2015	30	16
February 19, 2015	16	6
February 20, 2015	21	-3
February 21, 2015	18	-3
February 22, 2015	1	-13
February 23, 2015	19	-10
February 24, 2015	15	6

Note that temperatures shown in this table represent actual temperatures and do not take into account adjustment for wind chill

As a result of the broken sample containers the following impinger samples could not be analyzed:

- Excelsior - Run 1 Normal, Run 1 Spike, and Run 3 Normal.

In order to complete the emissions results calculations, the results of these impinger samples were assumed to be non-detect based on the following:

- The concentrations of benzene, toluene, ethylbenzene, and xylenes in the other three impinger samples were below the laboratory analytical detection limit of 1 microgram per liter.

- The total condensate collected in the impingers from the Excelsior source averaged 2.3 milliliters. The average volume of air sampled exceeded 12,000 milliliters. The mass of benzene, toluene, ethylbenzene, and xylenes in the air samples were below the laboratory analytical detection limits of 2 to 8 micrograms, with the exception of Run 1 where 4.5 micrograms of Benzene was detected.

- The USEPA Method 18 spike recovery data indicates acceptable QA/QC of the paired sample trains including those where the impinger samples could not be analyzed.

It is Bureau Veritas opinion, the broken sample containers did not significantly affect the calculation of emissions results.

3.3 Summary of Results

Detailed results of the LDAR assessment are presented in Table 3-3. Documentation of the LDAR assessment was recorded on LDAR Recordkeeping and Field Inspection Forms, which are included in Appendix C of this report.

The results of the BTEX testing are summarized in Table 3-4. Detailed results of the BTEX testing are presented in Table 1 after the Table Tab of this report. A graph of the BTEX emission rates is provided after the Graphs Tab in the Appendix. Sample calculations are presented in Appendix B.

Table 3-3
Excelsior LDAR Results - February 18, 2015

Tag	Description of Location	Device Type	Time Inspected	Yellow Tag† VOC Leak Inspection Readings (ppmv)	Red Tag‡ VOC Leak Inspection Readings (ppmv)	Leak Detected
250	Base of the still column	Flange	10:37	-	52	No
251	Tubing to reflux valve	Flange	13:00	-	2	No
252	Top of the still column	Flange	13:00	-	3	No
253	Piping at the top of still column	Flange	13:00	-	3	No
254	Coupling at top of still column	Coupling	13:01	-	2	No
255	Piping at the top of still column	Elbow pipe	13:01	-	1.9	No
256	Piping at the top of still column	Elbow pipe	13:02	-	3	No
257	Piping at the top of still column	Elbow pipe	13:02	-	3	No
258	Union	Union	13:02	-	2	No
259	Temperature probe	Piping Tee	10:38	-	5	No
260	Tee for bypass line and input to condenser	Piping Tee	10:38	-	5	No
261	Inlet to condenser union	Union	10:45	-	14	No
262	Outlet from condenser coupling to Tee	Coupling	10:46	-	20	No
263	Condenser outlet temperature	Thermo well	10:48	-	8	No
264	Outlet of bypass valve to Tee	Flange	10:49	-	12	No
265	Bypass valve flange	Flange	10:49	-	9	No
266	Isolation valve from outlet of condenser	Flange	10:50	-	7	No
267	Bull Inlet to elbow to accumulator tank	Plug	10:50	-	7.5	No
268	Thermowell at accumulator tank	Thermo well	10:51	13	-	No
269	Tee to thermo oxidizer	Flange	10:54	-	6.6	No
270	Tee for piping to Betx valve	Tee	10:55	-	10	No
271	Coupling to the tee to Btex valve	Piping	10:55	-	8.6	No
272	Outlet of the tee to the betx valve	Piping	10:55	-	7.9	No
273	Inlet to the for the betx valve	Piping	10:55	-	10	No
274	betx valve split flange	Piping	10:57	-	8.4	No
275	Outlet from tee to reducer	Piping	10:58	-	8.6	No
276	Reducer to themowell	Thermo well	10:58	-	7	No
277	Inlet to thermo oxidizer iso valve	Flange	10:59	2.7	-	No
278	Outlet from thermo oxidizer iso valve	Flange	11:00	3	-	No
279	Outlet of flame arrester to thermo oxidizer	Flange	11:00	3	-	No

ppmv: part per million by volume
VOC: volatile organic compound
BTEX: benzene, toluene, ethylbenzene, total xylenes
-: not applicable
†: Yellow Tag refers to a component that is accessible and monitored initially and annually.
‡: Red Tag refers to a component that is difficult to access and is monitored initially and every 5 years.
Notes
1. Background VOC reading = between 4 and 9 ppmv
2. No detections exceeding leak criterion of 500 ppmv

Based on the results of the LDAR assessment, results no VOC readings were measured at a concentration exceeding the criterion of a leak (i.e., 500 ppmv).

Table 3-4
Summary of Air Emission Test Results

Date (2015)	Glycol Dehydration Unit	Emission Unit	Parameter	Units	Average Result[1]	Emission Limit[2]
Excelsior						
Feb 18	Excelsior	EUEXGLYDEH	Benzene†	lb/hr	0.00047	NA
			Toluene†		<0.00073	NA
			Ethylbenzene†		<0.00074	NA
			Total xylenes†		<0.0015	NA
			Mass rate of BTEX	lb/hr	0.0034	NA
				Mg/yr	0.0057	77.01

† Corrected for spike recovery following USEPA Method 18.
[1] Based on typical maximum operating hours for the total withdrawal season.
[2] Emission limit was calculated based on the annual average daily throughput rates from 2009 through 2013 using Equation 1 of the regulation (40CFR63.1275(b)(1)(iii)).
lb/hr: pound per hour
Mg/yr: megagrams per year
NA: not applicable
BTEX: benzene, toluene, ethylbenzene, total xylenes

The BTEX measurements demonstrate that estimated annual air emissions from the thermal oxidizer controlling the glycol dehydration unit are within the allowable limit.