1001 Louisiana Street, Suite 1000, Houston, TX 77002

January 15, 2021

Mr. Jim Semerad
Director of Air Quality
North Dakota Department of Environmental Quality
Division of Air Quality
918 E. Divide Avenue, 2nd Floor
Bismarck, ND 58501-1947

Re: Permit Revision with Updated PTE Site-Wide Emissions
Hiland Partners Holdings LLC
Stony Creek Compressor Station
Permit Number PTO O18015
Williams County, North Dakota
Corrective Action for Item # 28 and # 34 and # 44

Dear Mr. Semerad,

Hiland Partners Holdings LLC (Hiland) owns and operates the Stony Creek Compressor Station authorized under Permit to Operate PTO 18015. Hiland is submitting the attached permit revision which includes revised Potential to Emit (PTE) emission calculations based on findings discovered during an internal audit initiated June 22, 2020 and disclosed to the NDDEQ on December 18, 2020. The emission calculations update calculation methodologies for various sources and include existing sources previously not represented in the permit.

Hiland requests that PTO O18015 be updated to include the emission sources represented and establish federal enforceability.

The attached permit revision proposes to update manufacture date of two engines after a like-kind exchange, correct NSPS JJJJ applicability of one engine, lower the VOC g/hp-hr limit for all engines so the station stays below Title V thresholds, and correct a Reboiler rating.

Please contact me at 520-349-0611 or by email at anu_pundari@kindermorgan.com if you have any questions or need additional information.

Sincerely,

Anu Pundari
Sr. Engineer – EHS Staff

Enclosures

Stony Creek Permit Revision – Revisions to Existing Permit

Page 1:

- EU4 – Submitted a like-kind engine exchange letter dated October 24, 2019. The new unit is a Waukesha L7044GSI (4SRB) manufactured in 2005.
- Revise Source Unit to:
    - EU4 : Waukesha 7044GSI (4SRB) natural gas-fired compressor engine rated at 1,680 hp manufactured November 2005. This unit does not have NSPS JJJJ g/hp-hr and ppmv limits.
- EU5 – Submitted a like-kind exchange letter dated November 25, 2019. The new unit is a Waukesha L7044GSI (4SRB) manufactured in Oct 2013.
- Revise Source Unit to:
    - EU5 : Waukesha 7044GSI (4SRB) natural gas-fired compressor engine rated at 1,680 hp manufactured October 2013 (JJJJ).
- Revise EU7 – Triethylene Glycol (TEG) Reboiler rated at 1.0 X 10^6 Btu/hr

Page 2:

- Four Waukesha engines – EU1, EU2, EU3, and EU6 – Same as current permit for NOx and CO.
    - 2.46 lb/hr VOC and 0.65 g/hp-hr or 60 ppmvd@ 15 % O_2
- One Waukesha engine – EU4 – NOx (3.70 lb/hr), CO (3.70 lb/hr), VOC(2.46 lb/hr)
    - 0.65 g/hp-hr VOC
- One Waukesha engine – EU5 – NOx (3.70 lb/hr), CO (3.70 lb/hr), VOC (2.46 lb/hr)
    - NOx - 2.0 g/hp-hr or 160 ppmvd@ 15 % O_2
    - CO – 4.0 g/hp-hr or 540 ppmvd @ 15 % O_2
    - VOC – 0.65 g/hp-hr or 86 ppmvd @ 15% O_2
- Add note at bottom of Emissions Limits Table
    - VOC emissions limit of 0.65 g/hp-hr is lower than 40 CFR 60, Subpart JJJJ. The ppmvd (15 % O_2) is from 40 CFR 60, Subpart JJJJ. The owner/operator must also meet all applicable emission limits established by 40 CFR 63, Subpart ZZZZ.
- Compared current permit to a more recently issued permit, as needed, add to Emissions Unit Description/EU List ;
    - Truck Loading (produced water)
    - Truck Loading (NGLs)
    - Fugitive Emissions
    - Methanol tanks – There are (3) Methanol tanks
    - NGL Bullet Tanks – There are (2) 60,000 gallon NGL Bullet Tanks
    - Blowdowns

Page 3:

- Emissions Testing Section – Revise as needed according most recent template for Minor Source Permits.

Page 3 to 6

- Section G, H, Q, R, W, X – Revise as needed according most recent template for Minor Source Permits.

PERMIT REVISION AND UPDATED POTENTIAL TO EMIT EMISSION CALCULATIONS TO AIR QUALITY PERMIT TO OPERATE NATURAL GAS COMPRESSOR STATION

Hiland Partners Holdings LLC
Stony Creek Compressor Station
Permit to Operate PTO O18015
Williams County, North Dakota

January 2021

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Introduction

Hiland Partners Holdings LLC (Hiland) owns and operates the Stony Creek Compressor Station located in Williams County, ND. The Stony Creek Compressor Station is authorized under Permit to Operate PTO O18015. Hiland is submitting this permit revision and updated Potential to Emit (PTE) site-wide emissions at Stony Creek Compressor Station based on an internal audit initiated June 22, 2020 and disclosed December 18, 2020. Hiland requests that the permit be updated to include the emission sources represented and establish federal enforceability.

The following updates are being requested:

1. Update manufacture date of two engines after a like-kind exchange.
2. Correct NSPS JJJJ applicability of one engine after the like-kind exchange.
3. Lower to 0.65 VOC g/bhp-hr limit for all engines so that site wide PTE is below Title V thresholds.
4. Correct the TEG Reboiler rating to 1.0 MM BTU/hr.
5. Increased the fuel heating value for combustion sources to reflect current fuel conditions.
6. Updated engine heatrate from LHV of 8347 Btu/hp-hr to 9233 Btu/hp-hr.
7. Updated TEG Still Vent (EU8) emissions based on recent gas analysis and site specific information.
8. Updated Produced Water Tanks (EU9, EU10) emissions using ProMax process simulation and updated throughputs.
9. Addition of existing sources previously not represented in the permit:
    a. Produced Water Truck Loading
    b. Pigging
    c. Compressor Blowdowns
    d. NGL Truck Loading
    e. Methanol Storage Tanks
    f. Fugitives

Detailed information for the emission sources can be found in Section 2.0.

2.0 EMISSION SOURCES

2.1 Criteria Pollutant Emission Inventory

The criteria air pollutants that will be emitted are as follows: nitrogen oxides (NO_x), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and carbon monoxide (CO).

2.2 Glycol Dehydrator Emissions

Emissions from the dehydrator still vent were calculated using GRI-GLYCalc Version 4.0. The flash tank off-gas will be recycled. A condenser system will be used to reduce the VOC emissions in the overhead stream from the reboiler with a control efficiency of 80%. Non-condensable gas from the condenser will be routed to the reboiler firebox with a destruction efficiency of 90%. The GRI-GLYCalc reports are found in Appendix A.

2.3 Produced Water Storage Tank Emissions

The station receives an oil/water mixture which is routed to a slug catcher. The slug catcher separates the oil fraction and water fraction. The oil fraction routes to the pressurized Natural Gas Liquids (NGL) tanks. The water fraction routes to the atmospheric produced water storage tanks. As part of the audit, Hiland obtained pressurized liquid samples from the slug catcher drain that routes to the produced water storage tanks. A liquid sample was obtained from Sacramento CS as representative site.

Using ProMax estimation software, working, breathing, and flashing losses were calculated for a tank with 15,000 bbls/year throughput. ProMax is a chemical process simulator that uses thermodynamic flash algorithms to determine flashing losses and follows AP-42 regulation to calculate working and breathing losses. Although historical throughput has been less than 15,000 bbls/year, a safety factor was applied to the total emissions. To be conservative, 1.0 TPY VOCs was chosen as the PTE per storage tank.

The ProMax simulation reports are found in Appendix B and the analyses are found in Appendix C. The analytical results show that Produced Water tanks contain primarily water (>99 % water).

2.4 Produced Water Truck Loading Emissions

The VOC emissions from tank truck loading were estimated using the equation from EPA's AP-42 Section 2, 5th Edition, June 2008, Equation 1:

$$L = \frac{12.46 * S * P * M}{T}$$

where:

L = Loading Losses, lb/1000 gallons

S = Saturation Factor, see Table 5.2-1 in AP-42, Section 5.2.
P = True vapor pressure, psia
M = Molecular weight of vapors, lb/lb-mol
T = Temperature of bulk liquid loaded, R (F + 460)

The contents being transported from the tanks will be mainly produced water. To be conservative, a 90% water content reduction has been taken on the total emissions.

2.5 Pigging Emissions

Gas lines are pigged to perform various maintenance activities on a pipeline. Emissions associated with pigging result from gaseous releases when the “pig” is loaded into a pig launcher or removed from a pig receiver.

The estimated MCF per event was calculated considering pig receiver/pig launcher volume, pressure, temperature, gas quality parameters, and gas compressibility. The estimated MCF per event was multiplied by lb/scf based on site specific gas analysis to calculate VOC emissions. To be conservative, pigging emissions are assumed to be 1.00 tpy of VOC.

2.6 Compressor Blowdown Emissions

At Hiland stations, compressor blowdowns are controlled manually. During the recycle process a pressure reduction valve is used to route compressor blowdowns directly into the suction header. Technicians manually open the valve during a blowdown event to route compressor discharge back to the suction header to be recycled back into the system. The discharge pressures range from 700 psig to 1250 psig. Technicians monitor a pressure gauge and when pressures reach 100 psig or lower the blowdown is vented to atmosphere. Emission calculations for compressor blowdowns assume the majority of compressor blowdowns occur at approximately 100 psig using this recycle design.

In certain instances the compressor blowdown must be vented directly to atmosphere. In these cases, there is a second compressor blowdown valve that a technician manually opens allowing the blowdown to vent directly to atmosphere.

Technicians monitor and document the number of blowdowns, discharge pressure and temperatures of each blowdown event.

The estimated MCF per event was calculated considering compressor volume, pressure, temperature, gas quality parameters, and gas compressibility. The estimated MCF per event was multiplied by lb/scf based on site specific gas analysis to calculate VOC emissions.

2.7 NGL Truck Loading Emissions

NGL truck loading emissions are conservatively estimated at 60,000 gallons/day. The calculation of depressurized volume assumes that any residual vapors in the loading arm at 1 psig and all vapors from the soft loading hose depressurize to atmospheric pressure.

2.8 Fugitives Emissions

Fugitive emissions are based on emission factors are from EPA's "Protocol for Equipment Leak Emission Estimates" EPA-453/R-95-017, 11/1995, Table 2-4. The total component count is based on estimated number of components for each compressor, tank, and TEG glycol dehydrator unit at the station.

2.9 HAP Emission Inventory

Potential HAP emissions will not exceed the major source thresholds of 10 tpy of any individual HAP or 25 tpy of any combination of HAPs.

3.0 PROPOSED REVISIONS TO EXISTING PERMIT AND NDDEQ FORMS AND EMISSION CALCULATIONS

Proposed Revisions to Existing Permit and NDDEQ Forms and are included in Site specific Potential to Emit (PTE) emission calculations are included in this section.

PROPOSED REVISIONS TO EXISTING PERMIT

Stony Creek Permit Revision – Revisions to Existing Permit

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    - Truck Loading (NGLs)
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Page 3 to 6

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NDDEQ FORMS

PERMIT APPLICATION FOR AIR CONTAMINANT SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8516 (3-2019)

SECTION A - FACILITY INFORMATION

Name of Firm or Organization Hiland Partners Holdings LLC		
Applicant's Name Anu Pundari		
Title Sr. Engineer	Telephone Number 520-349-0611	E-mail Address anu_pundari@kindermorgan.com
Contact Person for Air Pollution Matters Anu Pundari		
Title Sr. Engineer	Telephone Number 520-349-0611	E-mail Address anu_pundari@kindermorgan.com
Mailing Address (Street & No.) 1001 Louisiana Street, Suite 1000		
City Houston	State TX	ZIP Code 77002
Facility Name Stony Creek Compressor Station		
Facility Address (Street & No.) 4330 130 Road NW		
City Alexander	State ND	ZIP Code 58801

County Williams	Latitude (Nearest Second) 48.042622	Longitude (Nearest Second) -103.498356

Legal Description of Facility Site

Quarter NE/4	Quarter SE/4	Section 26	Township 153N	Range 100W

Land Area at Facility Site 8.3 Acres (or) Sq. Ft.	MSL Elevation at Facility 2100

SECTION B – GENERAL NATURE OF BUSINESS

Describe Nature of Business	North American Industry Classification System Number	Standard Industrial Classification Number (SIC)
Natural Gas Compressor Station	211111	1311

SECTION C – GENERAL PERMIT INFORMATION

Type of Permit? ☐ Permit to Construct (PTC) ☒ Permit to Operate (PTO)

If application is for a Permit to Construct, please provide the following data:

Planned Start Construction Date NA	Planned End Construction Date NA

SECTION D – SOURCE IDENTIFICATION AND CATEGORY OF EACH SOURCE INCLUDED ON THIS PERMIT APPLICATION

		Permit to Construct				Minor Source Permit to Operate						
Your Source ID Number	Source or Unit (Equipment, Machines, Devices, Boilers, Processes, Incinerators, Etc.)	New Source	Existing Source Modification	Existing Source Expansion	Existing Source Change of Location	New Source	Existing Source Initial Application	Existing Source After Modification	Existing Source After Expansion	Existing Source After Change of Location	Existing Source After Change of Ownership	Other
EU1	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU2	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU3	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU4	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU5	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU6	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU7	TEG Reboiler	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU8	TEG Dehydration Unit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
EU9 and EU10	Two 400 bbl produced water tanks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑

Add additional pages if necessary

SECTION D2 – APPLICABLE REGULATIONS

Source ID No.	Applicable Regulations (NSPS/MACT/NESHAP/etc.)
Facility-wide	NSPS OOOOa - Fugitive Emissions at a Compressor Station
EU1, EU2, EU3, EU6	NSPS OOOOa - Reciprocating Compressors
EU1, EU2, EU3, EU5, EU6	NSPS JJJJ - Compressor Engines
EU7	MACT HH - TEG Still Vent
EU1 to EU6	MACT ZZZZ - Compressor Engines

SECTION E – TOTAL POTENTIAL EMISSIONS

Pollutant	Amount (Tons Per Year)
NO_x	97.61
CO	97.57
PM	7.95

Pollutant	Amount (Tons Per Year)
PM_{10} (filterable and condensable)	7.95
$PM_{2.5}$ (filterable and condensable)	7.95
SO_2	0.24
VOC	95.57
GHG (as CO_2e)	47715
Largest Single HAP	1.44
Total HAPS	5.30

*If performance test results are available for the unit, submit a copy of test with this application. If manufacturer guarantee is used provide spec sheet.

SECTION F1 – ADDITIONAL FORMS

Indicate which of the following forms are attached and made part of the application	
■ Air Pollution Control Equipment (SFN 8532)	■ Fuel Burning Equipment Used for Indirect Heating (SFN 8518)
☐ Construct/Operate Incinerators (SFN 8522)	☐ Hazardous Air Pollutant (HAP) Sources (SFN 8329)
☐ Natural Gas Processing Plants (SFN 11408)	☐ Manufacturing or Processing Equipment (SFN 8520)
☐ Glycol Dehydration Units (SFN 58923)	☐ Volatile Organic Compounds Storage Tank (SFN 8535)
☐ Flares (SFN 59652)	■ Internal Combustion Engines and Turbines (SFN 8891)
☐ Grain, Feed, and Fertilizer Operations (SFN 8524)	☐ Oil/Gas Production Facility Registration (SFN 14334)

SECTION F2 – OTHER ATTACHMENTS INCLUDED AS PART OF THIS APPLICATION

1.	Emissions Calculations	4.	GRI-GLY Calc Reports
2.	Engine Specifications	5.	
3.	Gas Analysis	6.	

I, the undersigned applicant, am fully aware that statements made in this application and the attached exhibits and statements constitute the application for Permit(s) to Construct and/or Operate Air Contaminant sources from the North Dakota Department of Environmental Quality and certify that the information in this application is true, correct and complete to the best of my knowledge and belief. Further, I agree to comply with the provisions of Chapter 23.1-06 of the North Dakota Century Code and all rules and regulations of the Department, or revisions thereof. I also understand the permit is nontransferable and, if granted a permit, I will promptly notify the Department upon sale or legal transfer of this permitted establishment.

Signature	Date
Ann Purdue	1/4/20

PERMIT APPLICATION FOR INTERNAL COMBUSTION ENGINES AND TURBINES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8891 (3-2019)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must include SFN 8516 or SFN 52858

SECTION A – GENERAL INFORMATION

Name of Firm or Organization	Facility Name
Hiland Partners Holdings LLC	Stony Creek Compressor Station

SECTION B – FACILITY AND UNIT INFORMATION

Source ID Number (From form SFN 8516)		
EU1, EU2, EU3, EU5, EU6		
Type of Unit (check all that apply)	■ Stationary Natural Gas-Fired Engine ☐ Stationary Diesel and Dual Fuel Engine ☐ Stationary Gasoline Engine ☐ Stationary Natural Gas-Fired Turbine	☐ Emergency Use Only ■ Non-Emergency Use ☐ Peaking ☐ Demand Response
	☐ Other – Specify:	

SECTION C – MANUFACTURER DATA

Make	Model	Date of Manufacture
Waukesha	L7044 GSI	Post July 2010

Reciprocating Internal Combustion Engine

■ Spark Ignition ☐ Compression Ignition

■ 4 Stroke ☐ 2 Stroke ■ Rich Burn ☐ Lean Burn

Maximum Rating (BHP @ rpm)	Operating Capacity (BHP @ rpm)
1680 @ 1200 rpm	1564 @ 1200 rpm

Engine Subject to:
☐ 40 CFR 60, Subpart IIII ■ 40 CFR 60, Subpart JJJJ ■ 40 CFR 63, Subpart ZZZZ
☐ 40 CFR 60, Subpart OOOO ☐ 40 CFR 60, Subpart OOOOa

Turbine Dry Low Emissions? ☐ Yes ☐ No

Heat Input (MMBtu/hr)	Maximum Rating (HP)	75% Rating (HP)	Efficiency

Turbine Subject to: ☐ 40 CFR 60, Subpart GG ☐ 40 CFR 60, Subpart KKKK

SECTION D – FUELS USED

Natural Gas (10^6 cu ft/year)	Percent Sulfur	Percent H_2S
90587 MMscf/yr	Negligible	Negligible
Oil (gal/year)	Percent Sulfur	Grade No.
LP Gas (gal/year)	Other – Specify:	

SECTION E – NORMAL OPERATING SCHEDULE

Hours Per Day	Days Per Week	Weeks Per Year	Hours Per Year	Peak Production Season (if any)
24	7	52	8760	

SECTION F – STACK PARAMETERS

Emission Point ID Number		Stack Height Above Ground Level (feet)	
Engines 1,2,3,5,6		1.5 x Building Height (approximately 35 ft)	
Stack Diameter (feet at top)	Gas Discharged (SCFM)	Exit Temp (°F)	Gas Velocity (FPS)
14 inches	2391	1,216	9.32

SECTION G – EMISSION CONTROL EQUIPMENT

Is any emission control equipment installed on this unit?

☐ No ■ Yes – Complete and attach form SFN 8532

SECTION H – MAXIMUM AIR CONTAMINANTS EMITTED

Pollutant	Maximum Pounds Per Hour	Amount (Tons Per Year)	Basis of Estimate*
NO_x	3.70	16.22	NSPS JJJJ Standard
CO	3.70	16.22	Vendor Guarantee
PM	0.30	1.32	AP-42 Table 3.2-3
PM_{10} (filterable and condensable)	0.30	1.32	AP-42 Table 3.2-3
$PM_{2.5}$ (filterable and condensable)	0.30	1.32	AP-42 Table 3.2-3
SO_2	0.01	0.04	AP-42 Table 3.2-3
VOC	2.46	10.79	Permit Limit
GHG (as CO_2e)	1,802	7894	AP-42 Table 3.2-3
Largest Single HAP	0.056	0.24	Vendor Data
Total HAPS	0.15	0.65	Vendor Data/AP-42

* If performance test results are available for the unit, submit a copy of test with this application, if manufacture data used, submit manufacturers specification sheets.

IS THIS UNIT IN COMPLIANCE WITH ALL APPLICABLE AIR POLLUTION RULES AND REGULATIONS?

■ YES ☐ NO

If "NO" a Compliance Schedule (SFN 61008) must be completed and attached.

Attach and label separate sheet(s) if you need more space to explain any system or answers or to provide complete listings of Emissions, Contaminants, or other items.

SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
918 E Divide Avenue, 2nd Floor
Bismarck, ND 58501-1947
(701) 328-5188

PERMIT APPLICATION FOR INTERNAL COMBUSTION ENGINES AND TURBINES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8891 (3-2019)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must include SFN 8516 or SFN 52858

SECTION A – GENERAL INFORMATION

Name of Firm or Organization	Facility Name
Hiland Partners Holdings LLC	Stony Creek Compressor Station

SECTION B – FACILITY AND UNIT INFORMATION

Source ID Number (From form SFN 8516): EU4

Type of Unit (check all that apply)

- ☒ Stationary Natural Gas-Fired Engine
- ☐ Stationary Diesel and Dual Fuel Engine
- ☐ Stationary Gasoline Engine
- ☐ Stationary Natural Gas-Fired Turbine
- ☐ Other – Specify:
- ☐ Emergency Use Only
- ☒ Non-Emergency Use
- ☐ Peaking
- ☐ Demand Response

SECTION C – MANUFACTURER DATA

Make	Model	Date of Manufacture
Waukesha	L7044 GSI	Post July 2010

Reciprocating Internal Combustion Engine

☒ Spark Ignition ☐ Compression Ignition

☒ 4 Stroke ☐ 2 Stroke ☒ Rich Burn ☐ Lean Burn

Maximum Rating (BHP @ rpm)	Operating Capacity (BHP @ rpm)
1680 @ 1200 rpm	1564 @ 1200 rpm

Engine Subject to:
☐ 40 CFR 60, Subpart IIII ☐ 40 CFR 60, Subpart JJJJ ☒ 40 CFR 63, Subpart ZZZZ
☐ 40 CFR 60, Subpart OOOO ☐ 40 CFR 60, Subpart OOOOa

Turbine — Dry Low Emissions? ☐ Yes ☐ No

Heat Input (MMBtu/hr)	Maximum Rating (HP)	75% Rating (HP)	Efficiency

Turbine Subject to: ☐ 40 CFR 60, Subpart GG ☐ 40 CFR 60, Subpart KKKK

SECTION D – FUELS USED

Natural Gas (10^6 cu ft/year)	Percent Sulfur	Percent H_2S
90587 MMscf/yr	Negligible	Negligible
Oil (gal/year)	Percent Sulfur	Grade No.
LP Gas (gal/year)	Other – Specify:	

SECTION E – NORMAL OPERATING SCHEDULE

Hours Per Day	Days Per Week	Weeks Per Year	Hours Per Year	Peak Production Season (if any)
24	7	52	8760	

SECTION F – STACK PARAMETERS

Emission Point ID Number		Stack Height Above Ground Level (feet)	
Engines 1,2,3,5,6		1.5 x Building Height (approximately 35 ft)	
Stack Diameter (feet at top)	Gas Discharged (SCFM)	Exit Temp (°F)	Gas Velocity (FPS)
14 inches	2391	1,216	9.32

SECTION G – EMISSION CONTROL EQUIPMENT

Is any emission control equipment installed on this unit?

☐ No ■ Yes – Complete and attach form SFN 8532

SECTION H – MAXIMUM AIR CONTAMINANTS EMITTED

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NO_x	3.70	16.22	NSPS JJJJ Standard
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PM	0.30	1.32	AP-42 Table 3.2-3
PM_{10} (filterable and condensable)	0.30	1.32	AP-42 Table 3.2-3
$PM_{2.5}$ (filterable and condensable)	0.30	1.32	AP-42 Table 3.2-3
SO_2	0.01	0.04	AP-42 Table 3.2-3
VOC	2.46	10.79	Permit Limit
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PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8532 (3-2019)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must also include forms SFN 8516 or SFN 52858

SECTION A – GENERAL INFORMATION

Name of Firm or Organization	Facility Name
Hiland Partners Holdings LLC	Stony Creek Compressor Station

Source ID No. of Equipment being Controlled
EU1 to EU6

SECTION B – EQUIPMENT

Type: ☐ Cyclone ☐ Multiclone ☐ Baghouse ☐ Electrostatic Precipitator
☐ Wet Scrubber ☐ Spray Dryer ☐ Flare/Combustor
☒ Other – Specify: NSCR

Name of Manufacturer	Model Number	Date to Be Installed
Waukesha INNIO	emPACT	upon startup

Application:
☐ Boiler ☐ Kiln ☒ Engine ☐ Other – Specify:

Pollutants Removed	NOx	CO	NMHC/VOC	HCHO
Design Efficiency (%)	93.0 %	92.5 %	50 %	70 %
Operating Efficiency (%)	TBD	TBD	TBD	TBD

Describe method used to determine operating efficiency:

SECTION CD – GAS CONDITIONS

Gas Conditions			Inlet	Outlet
Gas Volume (SCFM; 68°F; 14.7 psia)				2391
Gas Temperature (°F)				1216
Gas Pressure (in. H_2O)				
Gas Velocity (ft/sec)				9.32
Pollutant Concentration (Specify Pollutant and Unit of Concentration)	Pollutant	Unit of Concentration		
	NOx	g/bhp-hr	14.2	1.0
	CO	g/bhp-hr	12.6	1.0
	VOC	g/bhp-hr	0.65	0.65 as permit limit

Pressure Drop Through Gas Cleaning Device (in. H_2O)
TBD

PERMIT APPLICATION FOR FUEL BURNING EQUIPMENT FOR INDIRECT HEATING

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8518 (3-2019)

NOTE: READ INSTRUCTIONS BEFORE COMPLETING THIS FORM.
- Must include SFN 8516 or SFN 52858

SECTION A - GENERAL INFORMATION

Name of Firm or Organization	Facility Name
Hiland Partners Holdings LLC	Stony Creek Compressor Station

SECTION B – EQUIPMENT

Source ID No. (From form SFN 8516)	Name of Manufacturer
7	Unknown
Rated Capacity/Maximum Input	Model Number
1.0 MMBTU/hr	Unknown

Purpose
Space Heat _____ %
Process Heat 100 %
Power Generation _____ %
Other (Specify % if Multi-Purpose) _____ %

SECTION C – TYPE OF COMBUSTION UNIT AND FUEL FEEDING METHOD

Coal (If other solid fuel, specify here)

- ☐ Pulverized
- ☐ General
- ☐ Dry Bottom
- ☐ Wet Bottom with Fly Ash Reinjection
- ☐ Wet Bottom without Fly Ash Reinjection
- ☐ Other – Specify:
- ☐ Spreader Stoker with Fly Ash Reinjection
- ☐ Spreader Stoker without Fly Ash Reinjection
- ☐ Fluidized Bed
- ☐ Cyclone
- ☐ Hand-Fired

Fuel Oil

- ☐ Horizontally Fired
- ☐ Tangentially Fired
- ☐ Other – Specify:

Gas

- ☐ Horizontally Fired
- ☐ Tangentially Fired
- ☒ Other – Specify: Unknown

SECTION D – NORMAL SCHEDULE OF OPERATION

Hours Per Day	Days Per Week	Weeks Per Year	Hours Per Year Total	Peak Season (Specify Months)
24	7	52	8760	

SECTION E – FUEL USE EXPECTED IN A CALENDAR YEAR

Year 20 20

Primary Fuels		Standby Fuels	
Type: Natural Gas		Type:	
Quantity Per Year: 5.84	Units of Measure: MMSCF/YR	Quantity Per Year:	Units of Measure:

Percent Ash (Solid Fuels Only)					
Minimum	Maximum	Average	Minimum	Maximum	Average

Percent Sulfur					
Minimum	Maximum	Average	Minimum	Maximum	Average

Btu Per Unit of Measure (e.g. lb, gal, etc. - Specify)					
Minimum	Maximum	Average	Minimum	Maximum	Average

Describe Fuel Transport and Storage Methods:

Natural gas processed at the compressor station.

SECTION F – COMBUSTION AIR

☒ Natural Draft ☐ Induced ☐ Forced ☐ Other – Specify:

SECTION G – STACK DATA

Inside Diameter (ft) Unknown	Height Above Grade (ft) Unknown
Gas Temperature at Exit (Avg. °F) Unknown	Gas Velocity at Exit (Avg. ft/sec) Unknown
Are Emission Control Devices in Place? If YES – Complete SFN 8532 ☐ Yes ☒ No	
Stack Exit Gas Flow Rate	
Average (ACFM) Unknown	Average (DSCFM) Unknown
Maximum (ACFM) Unknown	Maximum (DSCFM) Unknown
Are sampling ports available? ☒ No ☐ Yes – Describe:	

SECTION H – NEARBY BUILDINGS

Attach drawings which show the plan and elevation views of any nearby buildings including the building that houses the fuel-fired equipment.

SECTION I – AIR CONTAMINANTS EMITTED

Pollutant	Maximum Pounds Per Hour	Amount (Tons Per Year)	Basis of Estimate*
NO_x	0.07	0.29	AP-42 Table 1.4-1 and Table 1.4-2
CO	0.06	0.25	AP-42 Table 1.4-1 and Table 1.4-2
PM	0.007	0.03	AP-42 Table 1.4-1 and Table 1.4-2
PM_{10} (filterable and condensable)	0.007	0.03	AP-42 Table 1.4-1 and Table 1.4-2
$PM_{2.5}$ (filterable and condensable)	0.007	0.03	AP-42 Table 1.4-1 and Table 1.4-2
SO_2	0.0006	0.003	AP-42 Table 1.4-1 and Table 1.4-2

Pollutant	Maximum Pounds Per Hour	Amount (Tons Per Year)	Basis of Estimate*
VOC	0.005	0.02	AP-42 Table 1.4-1 and Table 1.4-2
GHG (as CO_2e)	80.48	352.48	AP-42 Table 1.4-1 and Table 1.4-2
Largest Single HAP	0.00176	0.00773	AP-42 Table 1.4-1 and Table 1.4-2
Total HAPS	0.002	0.008	AP-42 Table 1.4-1 and Table 1.4-2

*If performance test results are available for the unit, submit a copy of test with this application. If manufacturer guarantees are used provide spec sheet.

EMISSIONS CALCULATIONS

Stony Creek Compressor Station
Site Emissions Summary

Emissions Summary

Emission Unit #	Emission Unit Description	PM-10 (tpy)	NOx (tpy)	CO (tpy)	SOx (tpy)	VOC (tpy)	HAPS (tpy)	Formaldehyde (tpy)	CO2e (tpy)	GHG (tpy)	Revisions from Previous Permit Application
EU1	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Updated Fuel Heating Value; Updated heatrate from LHV of 8347 Btu/hp-hr to HHV 9233 Btu/hp-hr. Revised from 0.7 g/hp-hr VOCs to 0.65 g/hp-hr VOCs.
EU2	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Same as EU1
EU3	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Same as EU1
EU4	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Same as EU1
EU5	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Same as EU1
EU6	Waukesha L7044 GSI - 1,680 bhp w/NSCR	1.32	16.22	16.22	0.04	10.79	0.65	0.24	7,893.76	7,489.14	Same as EU1
EU7	TEG Reboiler (1.0 MMBtu/hr)	0.03	0.29	0.25	0.00	0.02	0.01	--	352.48	350.41	Current permit lists 0.75 MMBtu/hr unit. The onsite unit is 1.0 MMBtu/hr rated unit.
EU8	TEG Still Vent (TEG Dehy Unit rated at 45 MMscfd)	--	--	--	--	2.02	0.83	--	--	--	Updated Calculations.
EU9	Produced Water Tank - 400 bbl - 15,000 bbl/year	--	--	--	--	1.00	--	--	--	--	Assume 1.0 TPY per tank
EU10	Produced Water Tank - 400 bbl - 15,000 bbl/year	--	--	--	--	1.00	--	--	--	--	Assume 1.0 TPY per tank
NA	Produced Water Truck Loading	--	--	--	--	0.44	--	--	--	--	Updated Calculations.
NA	Pigging	--	--	--	--	1.04	--	--	--	--	Updated Calculations.
NA	Compressor Blowdowns w/recycle	--	--	--	--	18.53	0.37	--	--	--	Updated Calculations.
NA	NGL Truck Loading	--	--	--	--	0.82	--	--	--	--	Updated Calculations.
NA	Three Methanol Chemical Storage Tanks	--	--	--	--	0.03	--	--	--	--	Updated Calculations.
NA	Fugitives	--	--	--	--	5.52	0.19	--	--	--	Updated Calculations.
	Total Sitewide Emissions	**7.95**	**97.61**	**97.57**	**0.24**	**95.16**	**5.30**	**1.44**	**47715.04**	**45285.25**	
	Emissions <100 tpy ?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**				

Notes:

1. Methanol storage tank emissions are conservatively assumed to be 0.01 tpy of VOC for each tank.
2. Minor sources are considered TEG Still Vent, Produced Water Tanks, Produced Water Truck Loading, Pigging, Compressor Blowdowns, and NGL Truck Loading.

Stony Creek Compressor Station
Engine Emissions

Equipment Data:

Emission Unit (EU):	EU1-EU6
Emission Unit Name:	Waukesha L7044GSI
Engine Type:	4SRB

Fuel Usage =	90.587	MMscf/yr	(Calculated value based on max fuel combustion rate.)
Horsepower =	1,680	bhp	
Speed =	1,200	rpm	
Hours of Operation =	8,760	hr/yr	
Max. Fuel Combustion Rate (HHV) =	9,233	Btu/bhp-hr	(Based on Manufacturer Specs)
Fuel Heating Value (HHV) =	1,500	MMBtu/MMscf	estimated
Max. Heat Rate (HHV) =	15.51	MMBtu/hr	
Unit Conversion:	2000	lb/ton	
Unit Conversion:	453.59	g/lb	
Unit Conversion:	2.2	lb/kg	
Unit Conversion:	0.907185	tonne/ton	
CO_2 GWP (100 year) =	1		
CH_4 GWP (100 year) =	25		
N_2O GWP (100 year) =	298		

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM-10 (Front and Back Half)	0.01941	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	0.30	1.32
NOx	1.0	g/BHP-hr	40 CFR 60 Subpart JJJJ	3.70	16.22
CO	1.0	g/BHP-hr	Catalyst Vendor	3.70	16.22
SOx	5.88E-04	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	0.01	0.04
VOC	0.65	g/BHP-hr	40 CFR 60 Subpart JJJJ	2.46	10.79
Total HAPs			Engine Vendor/AP-42 Table 3.2-3	0.15	0.65
Formaldehyde	0.015	g/BHP-hr	Catalyst Vendor	0.056	0.24
Pollutant	**Emission Factor**	**Units**	**Emission Factor Reference**	**Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO_2e	--	--	--	1,802	7,894
GHG	--	--	--	1,710	7,489
CO_2	110	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	1,706	7,473
CH_4	0.23	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	3.57	15.63
N_2O	2.2	lb/MMscf	AP-42 Table 1.4-2 (07/00)	0.02	0.10

Notes:
1. NO_x and VOC emissions based on 40 CFR 60 Subpart JJJJ standards. Formaldehyde emissions are based on manufacturer data. PM/PM_{10} and SO_2 emissions based on AP-42 Table 3.2-3.
2. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.
3. VOC emissions include formaldehyde.

Sample Calculation:

PM-10 Emissions (ton/yr) = (Emission Factor, lb/MMBtu) x (Max Heat Input Rate (HHV), MMBtu/hr) x (Hours of Operation, hr/yr) / (2,000 lb/ton)
PM-10 Emissions (ton/yr) = (0.01941 lb/MMBtu) x (15.51 MMBtu/hr) x (8,760 hr/yr) / (2,000 lb/ton) = 1.32 ton/yr

VOC Emissions (ton/yr) = (Emission Factor, g/bhp-hr) x (Horsepower, bhp) x (Hours of Operation, hr/yr) / (2,000 lb/ton) / (453.59 grams/1 lb)
VOC Emissions (ton/yr) = (0.65 g/bhp-hr) x (1680 bhp) x (8,760 hr/yr) / (2,000 lb/ton) / (453.59 g/lb) = 10.79 ton/yr

CO_2e Emissions (ton/yr) = (CO_2 emissions x 1) + (CH_4 emissions x 25) + (N_2O emissions x 298)
CO_2e Emissions (ton/yr) = ((7473.41 ton/yr x 1) + (15.63 ton/yr x 25) + (0.10 ton/yr x 298)) = 7893.76 ton/yr

GHG Emissions (ton/yr) = (CO_2 emissions) + (CH_4 emissions) + (N_2O emissions)
GHG Emissions (ton/yr) = (7473.41 ton/yr) + (15.63 ton/yr) + (0.10 ton/yr) = 7489.14 ton/yr

Stony Creek Compressor Station
Site Emissions Summary

HAP Emissions per engine

HAP Emissions from Rich-Burn Compressor Engines

Engines	Horsepower (hp)	Hours per Year	Heat Input (MMBtu/yr)	Fuel Input (MMscf/yr)
Emission Units 1-6 Compressor Engines #1 - 6	1,680	8,760	135,880	90.59

HAP	Emission Factor (lb/MMBtu)	Emission Factor (g/bhp-hr)	Control Efficiency (%)	Emissions (tpy) (Controlled)	Notes
1,1,2,2-Tetrachloroethane	2.53E-05	--	50%	8.59E-04	1,4
1,1,2-Trichloroethane	1.53E-05	--	50%	5.20E-04	1,4
1,1-Dichloroethane	1.13E-05		50%	3.84E-04	1,4
1,2-Dichloroethane	1.13E-05		50%	3.84E-04	1,4
1,2-Dichloropropane	1.30E-05		50%	4.42E-04	1,4
1,3-Butadiene	6.63E-04	--	50%	2.25E-02	1,4
1,3-Dichloropropene	1.27E-05	--	50%	4.31E-04	1,4
Acetaldehyde	2.79E-03	--	50%	9.48E-02	1,4
Acrolein	2.63E-03	--	50%	8.93E-02	1,4
Benzene	1.58E-03	--	50%	5.37E-02	1,4
Carbon Tetrachloride	1.77E-05	--	50%	6.01E-04	1,4
Chlorobenzene	1.29E-05	--	50%	4.38E-04	1,4
Chloroform	1.37E-05	--	50%	4.65E-04	1,4
Ethylbenzene	2.48E-05	--	50%	8.42E-04	1,4
Ethylene Dibromide	2.13E-05	--	50%	7.24E-04	1,4
Formaldehyde	--	1.50E-02	NA	0.24	2
Methanol	3.06E-03	--	50%	1.04E-01	1,4
Methylene Chloride	4.12E-05	--	50%	1.40E-03	1,4
Naphthalene	9.71E-05	--	50%	3.30E-03	1,4
PAH	1.41E-04	--	50%	4.79E-03	1,4
Styrene	1.19E-05	--	50%	4.04E-04	1,4
Toluene	5.58E-04	--	50%	1.90E-02	1,4
Vinyl Chloride	7.18E-06	--	50%	2.44E-04	1,4
Xylene	1.95E-04	--	50%	6.62E-03	1,4
HAP	**Emission Factor (lb/MMscf)**		**Control Efficiency (%)**	**Emissions (tpy) (Uncontrolled)**	**Notes**
Arsenic	2.04E-04	--	0%	9.24E-06	3
Beryllium	1.20E-05	--	0%	5.44E-07	3
Cadmium	1.10E-03	--	0%	4.98E-05	3
Chromium	1.40E-03	--	0%	6.34E-05	3
Cobalt	8.40E-05	--	0%	3.80E-06	3
Manganese	3.80E-04	--	0%	1.72E-05	3
Mercury	2.60E-04	--	0%	1.18E-05	3
Nickel	2.10E-03	--	0%	9.51E-05	3
Selenium	2.40E-05	--	0%	1.09E-06	3
Total HAP Emissions				**0.65**	

1. Emission factor from AP-42 Table 3.2-3, Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines (July 2000)
2. Vendor Information.
3. Emission factor from AP-42 Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion (July 1998)
4. Control efficiency from the dual catalytic converter unit was conservatively assumed to be 50% per verbal guidance by NDDH on 4/29/10.

Stony Creek Compressor Station
Glycol Reboiler Emissions

Equipment Data:

Emission Unit (EU):	**EU7**
Emission Unit Name:	TEG Reboiler
Rating:	1.0 MMBtu/hr

Maximum Fuel Usage =	5.84	MMscf/yr	(Calculated value based on max fuel combustion rate)
Maximum Fuel Usage =	0.0007	MMscf/hr	
Hours of Operation =	8,760	hr/yr	
design Heat Input Rate =	1.00	MMBtu/hr	
Fuel Heating Value (HHV) =	1,500	MMBtu/MMscf	
CO_2 GWP (100 year) =	1		
CH_4 GWP (100 year) =	25		
N_2O GWP (100 year) =	298		

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM-10 (Front and Back Half)	7.6	lb/MMscf	AP-42 Table 1.4-2 (07/98)	0.007	0.03
NOx	100	lb/MMscf	AP-42 Table 1.4-1 (07/98)	0.07	0.29
CO	84	lb/MMscf	AP-42 Table 1.4-1 (07/98)	0.06	0.25
SOx	0.6	lb/MMscf	AP-42 Table 1.4-2 (07/98)	0.0006	0.003
VOC	5.5	lb/MMscf	AP-42 Table 1.4-2 (07/98)	0.005	0.02
Pollutant	**Emission Factor**	**Units**	**Emission Factor Reference**	**Hourly Emissions (lb/hr)**	**Annual Emissions (tons/yr)**
CO_2e	--	--	--	80.48	352.48
GHG	--	--	--	80.00	350.41
CO_2	120,000	lb/MMscf	AP-42 Table 3.2-2 (07/00)	80.00	350.40
CH_4	2.3	lb/MMscf	AP-42 Table 3.2-2 (07/00)	0.002	0.007
N_2O	2.2	lb/MMscf	AP-42 Table 3.2-2 (07/00)	0.001	0.006

Notes:
1. Emission factors based on AP-42 Table 1.4-1 and Table 1.4-2. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.

Sample Calculation:

Fuel Usage (MMscf/yr) = (Design Heat Input Rate, MMBtu/hr) / (Fuel heating Value, MMBtu/MMscf) * (Hours of Operation, hr/yr)
Fuel Usage (MMscf/yr) = (1.0 MMBtu/hr) / (1500 MMBtu/MMscf) x (8,760 hr/yr) = 5.84 MMscf/yr

PM Total Emissions (lb/hr) = (Emission Factor, lb/MMscf) x (Fuel Heating Value, MMBtu/MMscf) / (1,020 MMBtu/MMscf) x (Fuel Usage, MMscf/yr) / (Hours of Operation, hr/yr)
PM Total Emissions (lb/hr) = (7.6 lb/MMscf) x (1500 MMBtu/scf) / (1,020 MMBtu/MMscf) x (7.6 MMscf/yr) / (8760 hr/yr) = 0.007 lb/hr

PM-10 Emissions (ton/yr) = (Hourly Emissions, lb/hr) x (8,760 hrs/yr) / (2,000 lb/ton)
PM-10 Emissions (ton/yr) = (0.007 lb/hr) x (8760 hr/yr) / (2000 lb/ton) = 0.03 ton/yr

Stony Creek Compressor Station
Glycol Reboiler HAPs Emissions

Emission Unit 7 - TEG Reboiler - 1.0 MMBtu/hr

HAP Emissions

Equipment	Heat Input Rate (MMBtu/hr)	Fuel Consumption (MMscf/yr)
Rating:	1.00	5.84

HAP	Emission Factor[1] (lb/MMscf)	Control Efficiency (%)	Emissions (tpy) (Uncontrolled)
2-Methylanpthalene	2.40E-05	0%	1.03E-07
3-Methylchloranthrene	1.80E-06	0%	7.73E-09
7,12-Dimethylben(a)anthracene	1.60E-05	0%	6.87E-08
Acenapthene	1.80E-06	0%	7.73E-09
Acenapthylene	1.80E-06	0%	7.73E-09
Anthracene	2.40E-06	0%	1.03E-08
Benz(a)anthracene	1.80E-06	0%	7.73E-09
Benzene	2.10E-03	0%	9.02E-06
Benzo(a)pyrene	1.20E-06	0%	5.15E-09
Benzo(b)fluorathene	1.80E-06	0%	7.73E-09
Benzo(g,h,i)perylene	1.20E-06	0%	5.15E-09
Benzo(k)fluorathene	1.80E-06	0%	7.73E-09
Chrysene	1.80E-06	0%	7.73E-09
Dibenzo(a,h)anthracene	1.20E-06	0%	5.15E-09
Dichlorobenzene	1.20E-03	0%	5.15E-06
Fluoranthene	3.00E-06	0%	1.29E-08
Fluorene	2.80E-06	0%	1.20E-08
Formaldehyde	7.50E-02	0%	3.22E-04
Hexane	1.80E+00	0%	7.73E-03
Indeno(1,2,3-cd)pyrene	1.80E-05	0%	7.73E-08
Napthalene	6.10E-04	0%	2.62E-06
Phenanathrene	1.70E-05	0%	7.30E-08
Pyrene	5.00E-06	0%	2.15E-08
Toluene	3.40E-03	0%	1.46E-05
HAP	**Emission Factor[2] (lb/MMscf)**	**Control Efficiency (%)**	**Emissions (tpy) (Uncontrolled)**
Arsenic	2.04E-04	0%	5.96E-07
Beryllium	1.20E-05	0%	3.50E-08
Cadmium	1.10E-03	0%	3.21E-06
Chromium	1.40E-03	0%	4.09E-06
Cobalt	8.40E-05	0%	2.45E-07
Manganese	3.80E-04	0%	1.11E-06
Mercury	2.60E-04	0%	7.59E-07
Nickel	2.10E-03	0%	6.13E-06
Selenium	2.40E-05	0%	7.01E-08
Total HAP Emissions			**0.008**

1. Emission factor from AP-42 Table 1.4-3, Emission Factors for Speciated Organic Compounds from Natural Gas Combustion (July 1998).
2. Emission factor from AP-42 Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion (July 1998).

Stony Creek Compressor Station
Glycol Still Vent Emissions

Equipment Data:

Emission Unit (EU):	**EU8**
Emission Unit Name:	TEG Dehydrator Still Vent

Emissions Data:

Wet Gas Pressure (psig)	1000
Wet Gas Temperature (°F)	100
Gas Throughput (mmscf/day)	45
Dry Gas Water Content (lb/H2O/mmscf)	7
Glycol Type =	TEG
Lean Glycol Water Content (wt% H20)	1.5
Lean Glycol Flow Rate (gpm)	7.5
Glycol Pump Type	Pneumatic
Gas Injection Pump Ratio (acfm gas/gpm glycol)	NA
Flash Tank Pressure (psig)	55
Flash Tank Temperature (°F)	150
Flash Tank Control	Recycle/Recomp.
Regen Controls	90% firebox

Pollutant	Uncontrolled		Control Efficiency		Controlled	
	Hourly Emissions	Annual Emissions	BTEX Condenser	Reboiler Firebox	Hourly Emissions	Annual Emissions
	lb/hr	tpy	%	%	lb/hr	tpy
-Propane	3.3406	14.6318	80%	90%	0.0668	0.2926
-Isobutane	0.7689	3.3678	80%	90%	0.0154	0.0674
-n-Butane	3.6734	16.0894	80%	90%	0.0735	0.3218
-Isopentane	0.7624	3.3391	80%	90%	0.0152	0.0668
-n-Pentane	1.5117	6.6212	80%	90%	0.0302	0.1324
-Cyclopentane	0.1425	0.6241	80%	90%	0.0029	0.0125
-n-Hexane	0.5104	2.2356	80%	90%	0.0102	0.0447
-Cyclohexane	0.8761	3.8375	80%	90%	0.0175	0.0768
-Other Hexanes	0.4113	1.8014	80%	90%	0.0082	0.0360
-Heptanes	0.9122	3.9954	80%	90%	0.0182	0.0799
-Methylcyclohexane	0.3860	1.6906	80%	90%	0.0077	0.0338
-2,2,4-Trimethylpentane	0.0127	0.0555	80%	90%	0.0003	0.0011
-Benzene	3.6513	15.9928	80%	90%	0.0730	0.3199
-Toluene	2.7836	12.1920	80%	90%	0.0557	0.2438
-Ethylbenzene	0.3159	1.3836	80%	90%	0.0063	0.0277
-Xylenes	2.1802	9.5493	80%	90%	0.0436	0.1910
-C8+ Heavies	0.8135	3.5632	80%	90%	0.0163	0.0713
Total VOC	**23.0527**	**100.9703**			**0.4611**	**2.0194**
Total HAPs	**9.4541**	**41.4088**			**0.1891**	**0.8282**
Total BTEX	**8.9310**	**39.1177**			**0.1786**	**0.7824**

Notes:

1. The flash tank off-gas will be recycled.
2. There is a condenser controlling the BTEX emissions with an 80% control efficiency.
3. The non-condensable gas from the condenser will be routed to the reboiler firebox. The efficiency of the firebox was assumed at 90%.

Produced Water Storage Tank Emissions

Equipment Data:

Emission Unit (EU):	EU9	EU10
Emission Unit Name:	Produced Water Storage Tank	Produced Water Storage Tank

Emissions Data:

Tank Contents = Produced Water
Tank Type = Vertical Fixed Roof
Tank Capacity = 16,800 gallons
Annual Throughput = 15,000 bbl/year per tank
Annual Throughput = 630,000 gallons/year per tank

Emission Unit	Standing Losses (lb/hr)	Working Losses (lb/hr)	Total Losses + 20 % (lb/hr)	Standing Losses (ton/yr)	Working Losses (ton/yr)	Total Losses + 20 % (ton/yr)
Produced Water Storage Tank EU5	0.06	0.13	0.23	0.2787	0.55	1.00
Produced Water Storage Tank EU6	0.06	0.13	0.23	0.2787	0.55	1.00

Notes:

1. Emissions calculated using ProMax model.
2. The liquid stored is essentially water. To be conservative, an additional 20 % safety factor was added to the emissions calculated via ProMax.

Stony Creek Compressor Station
Compressor Blowdowns Emissions

Emission Units	Designation	Compressor Volume	Compressor Pressure	Number of Events	Gas VOC Weight %	Gas MW	Average Gas Temperature	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Potential VOC Emissions		
		(ft^3)	(psig)	(#/ per Year)	(%)	(lb/lb-mol)	(°F)				lb/scf	lb/year	(tpy)
6	Compressor	197	100	57	38.68	26.49	62	1.58	1580	540360	0.027	14588	7.29
1	Compressor	197	1,250	24	38.68	26.49	62	34.68	34680	832320	0.027	22470	11.23
												Total VOC Controlled Emissions	**18.53**

Emission Units	Designation	Compressor Volume	Compressor Pressure	Number of Events	Gas HAPs Weight %	Gas MW	Average Gas Temperature	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Potential HAPs Emissions		
		(ft^3)	(psig)	(#/ per Year)	(%)	(lb/lb-mol)	(°F)				lb/scf	lb/year	(tpy)
6	Compressor	197	100	57	0.763	26.49	62	1.58	1580	540360	0.001	288	0.14
1	Compressor	197	1,250	24	0.763	26.49	62	34.68	34680	832320	0.001	443	0.22
												Total HAPs Controlled Emissions	**0.37**

Notes:
1. To be conservative, a 20% buffer is added to the total number of controlled blowdown events at 100 psig.
2. Assumes the majority of blowdowns are using the recycle process of reducing the pressure to 100 psig.
3. Assumes 24 blowdowns/year released to atmosphere at 1250 psig.

VOC weight percentage is from Inlet Gas Analysis 11/21/2019.
Molecular Weight of Gas = 26.49 approx
VOC Weight Percent = 38.68% approx
Molecular Weight of Gas = 26.49
HAPs Weight Percent = 0.7626%
Universal Gas Content = 379.5 ft^3/lb-mol @ 60 F and 14.696 psia
Specific Gravity = 0.91473
Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

lbs NM/E VOC/scf = 0.027
lb HAPs/scf = 0.00053

Estimated MCF per event from using Blowdown Volumes Compressibility Spreadsheet
Emissions (tpy) = (Estimated scf/event * number of events per year * lb/scf)/2000 (lb/ton)

Stony Creek Compressor Station
Produced Water Tank Truck Loading Emissions

Parameter		
Product	Produced Water	
Saturation Factor, S [1]	0.6	
Vapor MW [2]	62.00	lb/lb-mol
Maximum Vapor Pressure	10.06	psia
Average Vapor Pressure	7.93	psia
Max Temperature	78.28	°F
Average Temperature	64.9	°F
Short-Term Loading Loss Factor [4, 5]	8.67	lb/1000 gal
Annual Loading Loss Factor [4, 5]	7.01	lb/1000 gal
Hourly Throughput	7,560	gal/hr
Annual Throughput	1,260,000	gal/yr
Water Content Reduction (%) [7]	90%	

Fugitive Losses		
Hourly Losses	65.52	lb/hr
Annual Losses	4.41	tpy
Hourly Losses (minus water)	6.55	lb/hr
Annual Losses (minus water)	0.44	tpy

Notes:
1. Saturation factor is from EPA's AP-42, 5th Edition, Section 5.2, Table 5.2-1; for submerged loading; dedicated normal service.
2. Molecular weight of vapors was taken from Tanks 4.09d.
3. Vapor pressure was determined using AP-42, Figure 7.1-13b.
4. Losses are based on the loading losses equation from EPA's AP-42, Section 2, 5th Edition, June, 2008, Equation 1:

$$L = \frac{12.46 * S * P * M}{T}$$

where:

L = Loading Losses, lb/1000 gallons
S = Saturation Factor, see Table 5.2-1 in AP-42, Section 5.2.
P = True vapor pressure, psia
M = Molecular weight of vapors, lb/lb-mol
T = Temperature of bulk liquid loaded, R (F + 460)

5. Short-term loading loss factor is calculated based on the worst-case (highest) temperature and vapor pressure.
6. Annual loading loss factor is calculated based on the average temperature and vapor pressure.
7. The volume of liquids loaded are estimated to be 90% water; therefore, overall fugitive losses from loading are assumed to be 10% of the total emissions.

Stony Creek Compressor Station
NGL Truck Loading Emissions

Emissions Data:

Emission Unit (EU):		
Expected Max NGL Daily Volume =	40,000	gal/day
Expected Max NGL Annual Volume =	14,600,000	gal/yr
Average Tank Truck Capacity =	9,000	gal

Loading Arm Diameter	Soft Hose Length	Loading Arm Pipe Length	Loading Arm Overpressure	Depressurized Volume
(in)	(ft)	(ft)	(psig)	(ft^3/truck)
4	6	10	1	0.62

Product Transferred	Vapor Molecular Weight	Vapor Pressure at 60ºF	Unloading Emissions	VOC Content	Loading VOC Emissions	Loading VOC Emissions
	(lb/lb-mole)	(psia)	(lb/truck)	wt. %	(lb/truck)	(tpy)
Y-Grade	56	164	1.01	100%	1.01	0.82

Notes:

1. The calculation of depressurized volume assumes that any residual vapors in the loading arm at 1 psig and all vapors from the soft

Number of Trucks (#/yr) = Expected Max NGL Volume (gal/yr) /Avg Tank Truck capacity (gal)
Number of Trucks (#/yr) = 1,623 per year

Emissions (lb/truck) = Depr. Vol (ft^3/truck)/St. Pressure (psia) * TVP (psia) / Gas Constant (scf/lb-mole) * MW (lb/lbmole)
Emissions (lb/truck) = 1.01 lb/truck
Emissions (tpy) = Number of Trucks x Emissions (lb/truck) / 2000 lb/ton
Emissions (tpy) = 0.82 tpy

Stony Creek Compressor Station
Pigging Blowdowns Emissions

Pig Receiver/Pig Launcher	Designation	Pigging Volume	Pig Receiver or Launcher Pressure	Number of Events	Gas VOC Weight %	Gas MW	Average Gas Temperature	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Potential VOC Emissions		
		(ft^3)	(psig)	(#/ per Year)	(%)	(lb/lb-mol)	(°F)				lb/scf	lb/year	(tpy)
High Pressure	Pigging	7	1,250	12	38.68	26.49	60	1.25	1250	15000	0.027	405	0.20
Low Pressure	Pigging	11	250	52	38.68	26.49	60	0.2	200	10400	0.027	281	0.14
Low Pressure	Pigging	11	250	52	38.68	26.49	60	0.2	200	10400	0.027	281	0.14
Low Pressure	Pigging	19	250	52	38.68	26.49	60	0.4	400	20800	0.027	562	0.28
Low Pressure	Pigging	19	250	52	38.68	26.49	60	0.4	400	20800	0.027	562	0.28
												Total Losses	**1.04**

Notes:
1. Assume 12 events per year for each year for each high pressure (HP) launcher/receiver and 52 events per year for each low pressure (LP) launcher/receiver.

VOC weight percentage is from Inlet Gas Analysis 11/21/2019.
Molecular Weight of Gas = 26.49 approx
VOC Weight Percent = 38.68% approx
Universal Gas Content = 379.5 ft^3/lb-mol @ 60 F and 14.696 psia
Specific Gravity = 0.91473
Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

lbs NM/E VOC/scf = 0.027

Estimated MCF per event from using Blowdown Volumes Compressibility Spreadsheet
Emissions (tpy) = (Estimated scf/event * number of events per year * lb/scf)/2000 (lb/ton)

APPENDIX A: GRI-GLYCalc REPORTS

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Stony Creek ND Audit PTE
File Name: \\houdata2v\EHS\AIR\States\ND\General\2020 Audit\Glycol Dehydrators\North System\Stoney Creek CS\Stony Creek ND Audit PTE.ddf
Date: November 30, 2020

DESCRIPTION:

Description: Stony Creek ND Audit PTE

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 100.00 deg. F
Pressure: 1000.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.8560
Nitrogen	2.2420
Methane	57.3810
Ethane	20.0680
Propane	11.2350
Isobutane	1.3290
n-Butane	4.2320
Isopentane	0.7930
n-Pentane	1.1210
Cyclopentane	0.0140
n-Hexane	0.1930
Cyclohexane	0.0470
Other Hexanes	0.2190
Heptanes	0.1570
Methylcyclohexane	0.0190
2,2,4-Trimethylpentane	0.0060
Benzene	0.0190
Toluene	0.0110
Ethylbenzene	0.0010
Xylenes	0.0050
C8+ Heavies	0.0520

DRY GAS:

Flow Rate: 45.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Flow Rate: 7.5 gpm

PUMP:

Glycol Pump Type: Electric/Pneumatic

FLASH TANK:

Flash Control: Recycle/recompression
Temperature: 150.0 deg. F
Pressure: 55.0 psig

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Stony Creek ND Audit PTE
File Name: \\houdata2v\EHS\AIR\States\ND\General\2020 Audit\Glycol Dehydrators\North System\Stoney Creek CS\Stony Creek ND Audit PTE.ddf
Date: November 30, 2020

DESCRIPTION:

Description: Stony Creek ND Audit PTE

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.3851	9.242	1.6867
Ethane	1.7596	42.230	7.7071
Propane	3.3406	80.174	14.6318
Isobutane	0.7689	18.454	3.3678
n-Butane	3.6734	88.161	16.0894
Isopentane	0.7624	18.297	3.3391
n-Pentane	1.5117	36.281	6.6212
Cyclopentane	0.1425	3.420	0.6241
n-Hexane	0.5104	12.250	2.2356
Cyclohexane	0.8761	21.027	3.8375
Other Hexanes	0.4113	9.870	1.8014
Heptanes	0.9122	21.893	3.9954
Methylcyclohexane	0.3860	9.264	1.6906
2,2,4-Trimethylpentane	0.0127	0.304	0.0555
Benzene	3.6513	87.632	15.9928
Toluene	2.7836	66.805	12.1920
Ethylbenzene	0.3159	7.581	1.3836
Xylenes	2.1802	52.325	9.5493
C8+ Heavies	0.8135	19.524	3.5632
Total Emissions	25.1972	604.733	110.3638
Total Hydrocarbon Emissions	25.1972	604.733	110.3638
Total VOC Emissions	23.0525	553.261	100.9701
Total HAP Emissions	9.4540	226.897	41.4087
Total BTEX Emissions	8.9310	214.343	39.1176

FLASH GAS EMISSIONS

Note: Flash Gas Emissions are zero with the Recycle/recompression control option.

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	9.1165	218.795	39.9301
Ethane	12.8910	309.383	56.4624

Propane	11.7125	281.100	51.3007
Isobutane	1.8896	45.349	8.2763
n-Butane	7.0491	169.178	30.8750
Isopentane	1.3344	32.024	5.8445
n-Pentane	2.1581	51.795	9.4526
Cyclopentane	0.0525	1.261	0.2301
n-Hexane	0.4295	10.309	1.8814
Cyclohexane	0.1888	4.531	0.8269
Other Hexanes	0.4491	10.778	1.9669
Heptanes	0.3992	9.581	1.7486
Methylcyclohexane	0.0677	1.624	0.2964
2,2,4-Trimethylpentane	0.0108	0.258	0.0471
Benzene	0.1205	2.892	0.5278
Toluene	0.0628	1.508	0.2752
Ethylbenzene	0.0043	0.104	0.0190
Xylenes	0.0211	0.505	0.0922
C8+ Heavies	0.0555	1.331	0.2429
Total Emissions	48.0128	1152.308	210.2961
Total Hydrocarbon Emissions	48.0128	1152.308	210.2961
Total VOC Emissions	26.0054	624.130	113.9037
Total HAP Emissions	0.6490	15.576	2.8427
Total BTEX Emissions	0.2087	5.009	0.9142

EQUIPMENT REPORTS:

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages:	1.25	
Calculated Dry Gas Dew Point:	3.39	lbs. H2O/MMSCF
Temperature:	100.0	deg. F
Pressure:	1000.0	psig
Dry Gas Flow Rate:	45.0000	MMSCF/day
Glycol Losses with Dry Gas:	4.2650	lb/hr
Wet Gas Water Content:	Saturated	
Calculated Wet Gas Water Content:	58.05	lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	4.39	gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	5.83%	94.17%
Carbon Dioxide	99.76%	0.24%
Nitrogen	99.97%	0.03%
Methane	99.98%	0.02%
Ethane	99.95%	0.05%
Propane	99.94%	0.06%
Isobutane	99.93%	0.07%
n-Butane	99.91%	0.09%
Isopentane	99.93%	0.07%
n-Pentane	99.91%	0.09%

Cyclopentane	99.60%	0.40%
n-Hexane	99.89%	0.11%
Cyclohexane	99.46%	0.54%
Other Hexanes	99.91%	0.09%
Heptanes	99.83%	0.17%
Methylcyclohexane	99.51%	0.49%
2,2,4-Trimethylpentane	99.93%	0.07%
Benzene	94.86%	5.14%
Toluene	94.32%	5.68%
Ethylbenzene	93.90%	6.10%
Xylenes	91.61%	8.39%
C8+ Heavies	99.80%	0.20%

FLASH TANK

Flash Control: Recycle/recompression
Flash Temperature: 150.0 deg. F
Flash Pressure: 55.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.91%	0.09%
Carbon Dioxide	29.94%	70.06%
Nitrogen	3.92%	96.08%
Methane	4.05%	95.95%
Ethane	12.01%	87.99%
Propane	22.19%	77.81%
Isobutane	28.92%	71.08%
n-Butane	34.26%	65.74%
Isopentane	36.68%	63.32%
n-Pentane	41.48%	58.52%
Cyclopentane	73.20%	26.80%
n-Hexane	54.53%	45.47%
Cyclohexane	82.84%	17.16%
Other Hexanes	48.32%	51.68%
Heptanes	69.71%	30.29%
Methylcyclohexane	85.68%	14.32%
2,2,4-Trimethylpentane	54.78%	45.22%
Benzene	96.96%	3.04%
Toluene	97.97%	2.03%
Ethylbenzene	98.78%	1.22%
Xylenes	99.17%	0.83%
C8+ Heavies	94.39%	5.61%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	38.18%	61.82%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%

Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	1.36%	98.64%
n-Pentane	1.21%	98.79%
Cyclopentane	0.68%	99.32%
n-Hexane	0.92%	99.08%
Cyclohexane	3.86%	96.14%
Other Hexanes	2.07%	97.93%
Heptanes	0.72%	99.28%
Methylcyclohexane	4.67%	95.33%
2,2,4-Trimethylpentane	2.74%	97.26%
Benzene	5.16%	94.84%
Toluene	8.07%	91.93%
Ethylbenzene	10.55%	89.45%
Xylenes	13.06%	86.94%
C8+ Heavies	12.75%	87.25%

STREAM REPORTS:

WET GAS STREAM

Temperature: 100.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.88e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.22e-001	1.09e+002
Carbon Dioxide	8.55e-001	1.86e+003
Nitrogen	2.24e+000	3.10e+003
Methane	5.73e+001	4.55e+004
Ethane	2.00e+001	2.98e+004
Propane	1.12e+001	2.45e+004
Isobutane	1.33e+000	3.82e+003
n-Butane	4.23e+000	1.22e+004
Isopentane	7.92e-001	2.83e+003
n-Pentane	1.12e+000	4.00e+003
Cyclopentane	1.40e-002	4.85e+001
n-Hexane	1.93e-001	8.22e+002
Cyclohexane	4.69e-002	1.96e+002
Other Hexanes	2.19e-001	9.33e+002
Heptanes	1.57e-001	7.78e+002
Methylcyclohexane	1.90e-002	9.22e+001
2,2,4-Trimethylpentane	5.99e-003	3.39e+001
Benzene	1.90e-002	7.34e+001
Toluene	1.10e-002	5.01e+001
Ethylbenzene	9.99e-004	5.25e+000
Xylenes	4.99e-003	2.62e+001
C8+ Heavies	5.19e-002	4.38e+002
Total Components	100.00	1.31e+005

DRY GAS STREAM

Temperature: 100.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.88e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.15e-003	6.36e+000
Carbon Dioxide	8.54e-001	1.86e+003
Nitrogen	2.24e+000	3.10e+003
Methane	5.74e+001	4.55e+004
Ethane	2.01e+001	2.98e+004
Propane	1.12e+001	2.45e+004
Isobutane	1.33e+000	3.82e+003
n-Butane	4.23e+000	1.21e+004
Isopentane	7.93e-001	2.83e+003
n-Pentane	1.12e+000	3.99e+003
Cyclopentane	1.39e-002	4.83e+001
n-Hexane	1.93e-001	8.21e+002
Cyclohexane	4.68e-002	1.94e+002
Other Hexanes	2.19e-001	9.32e+002
Heptanes	1.57e-001	7.76e+002
Methylcyclohexane	1.89e-002	9.18e+001
2,2,4-Trimethylpentane	6.00e-003	3.39e+001
Benzene	1.80e-002	6.96e+001
Toluene	1.04e-002	4.73e+001
Ethylbenzene	9.39e-004	4.93e+000
Xylenes	4.58e-003	2.40e+001
C8+ Heavies	5.19e-002	4.37e+002
Total Components	100.00	1.31e+005

LEAN GLYCOL STREAM

Temperature: 100.00 deg. F
Flow Rate: 7.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	4.16e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	1.06e-011	4.48e-010
Nitrogen	1.98e-012	8.36e-011
Methane	7.56e-018	3.19e-016
Ethane	1.64e-007	6.92e-006
Propane	1.45e-008	6.13e-007
Isobutane	1.89e-009	7.98e-008
n-Butane	6.30e-009	2.66e-007
Isopentane	2.50e-004	1.05e-002
n-Pentane	4.37e-004	1.84e-002
Cyclopentane	2.32e-005	9.80e-004
n-Hexane	1.12e-004	4.72e-003
Cyclohexane	8.34e-004	3.52e-002
Other Hexanes	2.06e-004	8.69e-003
Heptanes	1.56e-004	6.59e-003
Methylcyclohexane	4.48e-004	1.89e-002
2,2,4-Trimethylpentane	8.46e-006	3.57e-004
Benzene	4.70e-003	1.99e-001
Toluene	5.79e-003	2.44e-001

Component	Conc. (wt%)	Loading (lb/hr)
Ethylbenzene	8.82e-004	3.72e-002
Xylenes	7.76e-003	3.28e-001
C8+ Heavies	2.82e-003	1.19e-001
Total Components	100.00	4.22e+003

RICH GLYCOL STREAM

Temperature: 100.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 7.87e+000 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.44e+001	4.16e+003
Water	3.77e+000	1.66e+002
Carbon Dioxide	1.02e-001	4.48e+000
Nitrogen	1.89e-002	8.34e-001
Methane	2.16e-001	9.50e+000
Ethane	3.33e-001	1.47e+001
Propane	3.42e-001	1.51e+001
Isobutane	6.04e-002	2.66e+000
n-Butane	2.44e-001	1.07e+001
Isopentane	4.79e-002	2.11e+000
n-Pentane	8.38e-002	3.69e+000
Cyclopentane	4.45e-003	1.96e-001
n-Hexane	2.15e-002	9.45e-001
Cyclohexane	2.50e-002	1.10e+000
Other Hexanes	1.97e-002	8.69e-001
Heptanes	2.99e-002	1.32e+000
Methylcyclohexane	1.07e-002	4.73e-001
2,2,4-Trimethylpentane	5.41e-004	2.38e-002
Benzene	9.02e-002	3.97e+000
Toluene	7.02e-002	3.09e+000
Ethylbenzene	8.12e-003	3.57e-001
Xylenes	5.75e-002	2.53e+000
C8+ Heavies	2.24e-002	9.88e-001
Total Components	100.00	4.40e+003

FLASH TANK OFF GAS STREAM

Temperature: 150.00 deg. F
Pressure: 69.70 psia
Flow Rate: 6.05e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.10e-001	1.46e-001
Carbon Dioxide	4.48e+000	3.14e+000
Nitrogen	1.79e+000	8.01e-001
Methane	3.57e+001	9.12e+000
Ethane	2.69e+001	1.29e+001
Propane	1.67e+001	1.17e+001
Isobutane	2.04e+000	1.89e+000
n-Butane	7.61e+000	7.05e+000
Isopentane	1.16e+000	1.33e+000

n-Pentane	1.88e+000	2.16e+000
Cyclopentane	4.70e-002	5.25e-002
n-Hexane	3.13e-001	4.30e-001
Cyclohexane	1.41e-001	1.89e-001
Other Hexanes	3.27e-001	4.49e-001
Heptanes	2.50e-001	3.99e-001
Methylcyclohexane	4.33e-002	6.77e-002
2,2,4-Trimethylpentane	5.91e-003	1.08e-002
Benzene	9.68e-002	1.20e-001
Toluene	4.28e-002	6.28e-002
Ethylbenzene	2.57e-003	4.35e-003
Xylenes	1.24e-002	2.11e-002
C8+ Heavies	2.04e-002	5.55e-002
Total Components	100.00	5.21e+001

FLASH TANK GLYCOL STREAM

Temperature: 150.00 deg. F
Flow Rate: 7.76e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.56e+001	4.16e+003
Water	3.81e+000	1.66e+002
Carbon Dioxide	3.09e-002	1.34e+000
Nitrogen	7.52e-004	3.27e-002
Methane	8.85e-003	3.85e-001
Ethane	4.05e-002	1.76e+000
Propane	7.68e-002	3.34e+000
Isobutane	1.77e-002	7.69e-001
n-Butane	8.45e-002	3.67e+000
Isopentane	1.78e-002	7.73e-001
n-Pentane	3.52e-002	1.53e+000
Cyclopentane	3.30e-003	1.43e-001
n-Hexane	1.18e-002	5.15e-001
Cyclohexane	2.10e-002	9.11e-001
Other Hexanes	9.66e-003	4.20e-001
Heptanes	2.11e-002	9.19e-001
Methylcyclohexane	9.31e-003	4.05e-001
2,2,4-Trimethylpentane	3.00e-004	1.30e-002
Benzene	8.85e-002	3.85e+000
Toluene	6.96e-002	3.03e+000
Ethylbenzene	8.12e-003	3.53e-001
Xylenes	5.77e-002	2.51e+000
C8+ Heavies	2.14e-002	9.32e-001
Total Components	100.00	4.35e+003

FLASH GAS EMISSIONS

Control Method: Recycle/recompression
Control Efficiency: 100.00

Note: Flash Gas Emissions are zero with the Recycle/recompression control option.

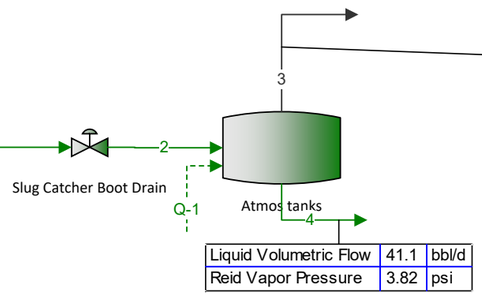
REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 2.33e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.28e+001	1.03e+002
Carbon Dioxide	4.97e-001	1.34e+000
Nitrogen	1.90e-002	3.27e-002
Methane	3.92e-001	3.85e-001
Ethane	9.54e-001	1.76e+000
Propane	1.24e+000	3.34e+000
Isobutane	2.16e-001	7.69e-001
n-Butane	1.03e+000	3.67e+000
Isopentane	1.72e-001	7.62e-001
n-Pentane	3.42e-001	1.51e+000
Cyclopentane	3.31e-002	1.42e-001
n-Hexane	9.66e-002	5.10e-001
Cyclohexane	1.70e-001	8.76e-001
Other Hexanes	7.78e-002	4.11e-001
Heptanes	1.48e-001	9.12e-001
Methylcyclohexane	6.41e-002	3.86e-001
2,2,4-Trimethylpentane	1.81e-003	1.27e-002
Benzene	7.62e-001	3.65e+000
Toluene	4.93e-001	2.78e+000
Ethylbenzene	4.85e-002	3.16e-001
Xylenes	3.35e-001	2.18e+000
C8+ Heavies	7.79e-002	8.14e-001
Total Components	100.00	1.29e+002

APPENDIX B: PROMAX SIMULATION REPORTS

Sacramento Compressor Station
Produced Water Tank Analysis



Liquid Volumetric Flow	41.1	bbl/d
Reid Vapor Pressure	3.82	psi

Names	Units	To API
Water(Mole Fraction)	%	99.6*
Hydrogen Sulfide(Mole Fraction)	%	0*
CO2(Mole Fraction)	%	0*
Nitrogen(Mole Fraction)	%	0*
Methane(Mole Fraction)	%	0*
Ethane(Mole Fraction)	%	0*
Propane(Mole Fraction)	%	0.001*
Isobutane(Mole Fraction)	%	0.001*
n-Butane(Mole Fraction)	%	0.004*
Methanol(Mole Fraction)	%	0.002*
Isopentane(Mole Fraction)	%	0.009*
n-Pentane(Mole Fraction)	%	0.004*
Heptane(Mole Fraction)	%	0.01*
Octane(Mole Fraction)	%	0.023*
Nonane(Mole Fraction)	%	0.006*
Decane(Mole Fraction)	%	0.083*
2-Methylpentane(Mole Fraction)	%	0.003*
3-Methylpentane(Mole Fraction)	%	0.001*
Hexane(Mole Fraction)	%	0.002*
2,2,4-Trimethylpentane(Mole Fraction)	%	0.001*
Benzene(Mole Fraction)	%	0.006*
Toluene(Mole Fraction)	%	0.02*
Ethylbenzene(Mole Fraction)	%	0.002*
m-Xylene(Mole Fraction)	%	0.005*
p-Xylene(Mole Fraction)	%	0.02*
o-Xylene(Mole Fraction)	%	0.009*
TEG(Mole Fraction)	%	0.162*

Water(Mole Fraction)		%
Hydrogen Sulfide(Mole Fraction)		%
CO2(Mole Fraction)		%
Nitrogen(Mole Fraction)		%
Methane(Mole Fraction)		%
Ethane(Mole Fraction)		%
Propane(Mole Fraction)		%
Isobutane(Mole Fraction)		%
n-Butane(Mole Fraction)		%
Methanol(Mole Fraction)		%
Isopentane(Mole Fraction)		%
n-Pentane(Mole Fraction)		%
Heptane(Mole Fraction)		%
Octane(Mole Fraction)		%
Nonane(Mole Fraction)		%
Decane(Mole Fraction)		%
2-Methylpentane(Mole Fraction)		%
3-Methylpentane(Mole Fraction)		%
Hexane(Mole Fraction)		%
2,2,4-Trimethylpentane(Mole Fraction)		%
Benzene(Mole Fraction)		%
Toluene(Mole Fraction)		%
Ethylbenzene(Mole Fraction)		%
m-Xylene(Mole Fraction)		%
p-Xylene(Mole Fraction)		%
o-Xylene(Mole Fraction)		%
TEG(Mole Fraction)		%

Sacramentol Produced Water Tank

Annual tank loss calculations for "To API".
Total working and breathing losses from the Vertical Cylinder are 0.8303 ton/yr.
Flashing losses are 0 ton/yr.

* Only Non-Exempt VOCs are reported.
Vapor adjusted to ensure mass balance

Process Stream	To API	
Tank Geometry	Vertical Cylinder	
Shell Length	12	ft
Shell Diameter	20	ft
Number of Storage Tanks Employed	1	
Location	Williston, North Dakota	
Time Frame	Year	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	FALSE	
Use AP42 Raoult's Vapor Pressure?	FALSE	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Material Category	Light Organics	
Tank Color	Tan	
Shell Paint Condition	Good	
Operating Pressure	0.25	psig
Breather Vent Pressure	0.25	psig
Breather Vacuum Pressure	-2.50E-02	psig
Roof Type	Cone	
Slope of Coned Roof	0.0625	
Roof Color	Tan	
Roof Paint Condition	Good	
Flashing Temperature	54.57398917	°F
Maximum Average Temperature	53.81666667	°F
Minimum Average Temperature	29.04166667	°F
Average Absolute Pressure	13.8185	psia
Daily Solar Insolation	1217.5	Btu/ft^2/day
Average Wind Speed	9.991666667	mi/h
Underground Tank?	TRUE	
Calculate Loading Losses?	TRUE	
Output Loading Losses?	FALSE	
Output Flashing Losses?	TRUE	
Output Working/Breathing Losses?	TRUE	

Atmospheric Pressure	13.82	psia
True Vapor Pressure at Average Temperature	1.65	psia
Average Liquid Surface Temperature	46.45	°F
Maximum Liquid Surface Temperature	54.57	°F
Bulk Liquid Temperature	43.01	°F
Annual Tank Turnover Rate	24.83	
Flashing Losses	0.00	ton/yr
Total W/B Losses	0.83	ton/yr
Working Losses per Tank	0.55	ton/yr
Standing Losses per Tank	0.2787	ton/yr
Rim Seal Losses per Tank	0	ton/yr
Withdrawal Loss per Tank	0	ton/yr
Deck Fitting Losses per Tank	0	ton/yr
Deck Seam Losses per Tank	0	ton/yr

ProMax AP-42 Emissions Report
Annual Emissions
Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	0.5516	0.2787	0.8303
Propane	0.0296	0.0149	0.0445
Isobutane	0.0390	0.0197	0.0587
n-Butane	0.1559	0.0787	0.2346
Methanol	0.0000	0.0000	0.0000
Isopentane	0.1666	0.0842	0.2507
n-Pentane	0.0557	0.0282	0.0839
Heptane	0.0140	0.0071	0.0211
Octane	0.0092	0.0046	0.0138
Nonane	0.0008	0.0004	0.0012
Decane	0.0033	0.0016	0.0049
2-Methylpentane	0.0191	0.0097	0.0288
3-Methylpentane	0.0056	0.0028	0.0084
Hexane	0.0083	0.0042	0.0125
2,2,4-Trimethylpentane	0.0017	0.0009	0.0026
Benzene	0.0151	0.0076	0.0228
Toluene	0.0186	0.0094	0.0280
Ethylbenzene	0.0006	0.0003	0.0009
m-Xylene	0.0013	0.0006	0.0019
p-Xylene	0.0054	0.0027	0.0081
o-Xylene	0.001988	0.001004	0.002992
TEG	2.91E-10	1.47E-10	4.38E-10

Flashing Emissions Report
Annual Emissions
Tank flashed at the daily maximum surface temperature (54.57 °F) and the average atmospheric pressure of Williston, North Dakota (13.82 psia)

There are no flashing losses at the given temperature and pressure.

Source

Shell Length	12	ft
Shell Diameter	20	ft
Breather Vent Pressure	0.25	psig
Breather Vacuum Pressure	-0.025	psig
Operating Pressure	0.25	psig
Average Fraction Fill of Tank	50	%
Maximum Fraction Fill of Tank	90	%
Net Throughput	41.12	bbl/day
Overall Reduction Efficiency	0	
Maximum Hourly Loading Rate	140	gpm
Flashing Temperature	54.57398917	°F
Land Based Mode of Operation	Submerged Loading: Dedicated Normal Service	
Cargo Carrier	Tank Truck or Rail Tank Car	

APPENDIX C: GAS AND LIQUID ANALYSES

Stony Creek Compressor Station
Gas Analysis

Sample name	Gas Taken Before Dehydrator			
Sample location	Stony Creek Compressor Station			
Sample temperature and pressure	130 °F, 1250 psig			
Date of sample	11/21/2019			
Component	**MW (g/mol)**	**Mole %**	**Gas Weight (lb/lbmol)**	**Weight %**
CO2	44.010	0.8560	0.377	1.4222
Nitrogen	28.013	2.2420	0.628	2.3710
methane (C1)	16.042	57.3810	9.205	34.7508
ethane (C2)	30.069	20.0680	6.034	22.7798
propane (C3)	44.096	11.2350	4.954	18.7023
iso-butane (C4)	58.122	1.3290	0.772	2.9160
nor-butane (C4)	58.122	4.2320	2.460	9.2857
iso-pentane (C5)	72.149	0.7930	0.572	2.1599
nor pentane	72.149	1.1210	0.809	3.0532
Cyclopentane	72.149	0.0140	0.010	0.0381
2,2,4 Trimethyl pentane	72.149	0.0060	0.004	0.0163
n-Hexane	86.180	0.1930	0.166	0.6279
Cyclohexane	86.180	0.0470	0.041	0.1529
Other hexanes	86.180	0.2190	0.189	0.7125
Methylcyclohexane	86.180	0.0190	0.016	0.0618
heptane (C7+)	100.200	0.1570	0.157	0.5939
octane (C8+)	114.230	0.0380	0.043	0.1639
nonane (C9+)	128.260	0.0030	0.004	0.0145
decane (C10+)	142.290	0.0110	0.016	0.0591
benzene	78.110	0.0190	0.015	0.0560
toluene	92.140	0.0110	0.010	0.0383
Ethylbenzene	106.170	0.0010	0.001	0.0040
xylenes (M, P, O)	106.170	0.0050	0.005	0.0200
H2S	34.082	0.0000	0.000	0.0000
Total		100.0000	26.4895	100.0000
Vapor MW (lb/lb-mol)		**26.490**		
VOC Weight (%)		**38.6763**		
HAPs Weight (%)		**0.7626**		

AMERICAN MOBILE RESEARCH, INC.

P.O. BOX 2909
CASPER, WYOMING 82602

(307) 235-4590 PHONE
(307) 265-4489 FAX

EXTENDED HYDROCARBON GAS (GLYCALC) STUDY

CERTIFICATE OF ANALYSIS

Company ..... **KINDER MORGAN, INC.**
Lab Number CR-20004
Date Sampled 11-21-2019
Time Sampled..... N/A
Method of Analysis..... Dual TCD-FID Chromatography

Study Number..... CR-25
Date Tested..... 12-6-2019
Time Tested..... 11:22 AM
Ambient Temp at Sampling..... N/A

Sample Identification ..... **GAS TAKEN BEFORE DEHYDRATOR**
STONEY CREEK COMPRESSOR STATION

Sample Location ..... NORTH DAKOTA
Type Sample..... Spot
Effective Date..... N/A
Sample Pressure ..... 1,250 PSIG
Cylinder ID ..... AMR 076
Instrument Used..... Shimadzu GC-2014
Sample Method..... Trap & Purge
Test Method GPA-2286

County ..... N/A
Composite From..... N/A
Sample Temperature ..... 100 F
Cylinder Heated To..... 130 F
Calibration Date..... 12-6-2019
Un-Normalized Total..... 97.77 %
Sampled By..... KMI - K. Knutson

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide.....	0.856	1.422	0.684
Hydrogen Sulfide.....	0.000	0.000	0.000
Nitrogen.....	2.242	2.371	1.155
Methane.....	57.381	34.746	45.542
Ethane.....	20.068	22.777	25.126
Propane.....	11.235	18.700	14.491
iso-Butane.....	1.329	2.916	2.036
n-Butane.....	4.232	9.284	6.246
iso-Pentane.....	0.793	2.160	1.358
n-Pentane.....	1.121	3.053	1.902
Cyclopentane.....	0.014	0.037	0.019
n-Hexane.....	0.193	0.628	0.372
Cyclohexane.....	0.047	0.149	0.075
Other Hexanes	0.219	0.712	0.422
Heptanes.....	0.157	0.594	0.339
Methylcyclohexane.....	0.019	0.070	0.036
2,2,4-Trimethylpentane..	0.006	0.026	0.015
Benzene.....	0.019	0.056	0.025
Toluene.....	0.011	0.038	0.017
Ethylbenzene.....	0.001	0.004	0.002
Xylenes.....	0.005	0.020	0.009
Octanes	0.038	0.164	0.091
Nonanes	0.003	0.015	0.008
Decanes + ...	0.011	0.059	0.032
Totals	**100.000**	**100.000**	**100.000**

AMERICAN MOBILE RESEARCH, INC.

P.O. BOX 2909
CASPER, WYOMING 82602

(307) 235-4590 PHONE
(307) 265-4489 FAX

EXTENDED WATER GLYCALC STUDY

CERTIFICATE OF ANALYSIS

Company ..... **KINDER MORGAN, INC.**

Lab Number CR-20730
Date Sampled 8-24-2020

Study Number CR-3
Date Tested 9-3-2020

Sample Identification ..... **PRODUCED WATER**
SACRAMENTO STATION
Sample Location ..... NORTH DAKOTA
Sample Pressure ..... 20 PSIG
Type Sample ..... SPOT
Test Method ..... GPA 2186M

Sample Temperature ..... 50 F
County ..... N/A
Cylinder ID ..... KMI 2573

Components	Mole %	Weight %	Liq. Vol. %
Water	99.626	97.295	96.998
Hydrogen Sulfide	0.000	0.000	0.000
Carbon Dioxide	0.000	0.000	0.000
Nitrogen	0.000	0.000	0.000
Methane	0.000	0.000	0.000
Ethane	0.000	0.000	0.000
Propane	0.001	0.002	0.005
iso-Butane	0.001	0.003	0.006
n-Butane	0.004	0.013	0.022
Methanol	0.002	0.003	0.004
iso-Pentane	0.009	0.035	0.056
n-Pentane	0.004	0.016	0.025
Hexanes	0.004	0.019	0.028
Heptanes	0.010	0.054	0.079
Octanes	0.023	0.142	0.201
Nonanes	0.006	0.042	0.058
Decanes+	0.083	0.709	0.949
Benzene	0.006	0.025	0.029
Toluene	0.020	0.100	0.114
Ethylbenzene	0.002	0.012	0.013
Xylenes	0.034	0.196	0.225
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Glycol	0.162	1.319	1.166
Totals	**100.000**	**100.000**	**100.000**

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
2-Methylpentane	0.003	0.012	0.018
3-Methylpentane	0.001	0.006	0.010
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Benzene	0.006	0.025	0.029
Toluene	0.020	0.100	0.114
Ethylbenzene	0.002	0.012	0.013
m-Xylene	0.005	0.029	0.034
p-Xylene	0.020	0.117	0.135
o-Xylene	0.009	0.049	0.056

API GRAVITY AT 60/60 F, calculated	**10.43**
SPECIFIC GRAVITY AT 60/60 F, calculated	**0.99695**
RELATIVE SPECIFIC GRAVITY OF DECANES+ (C10+) FRACTION, calculated	**0.74442**
AVERAGE MOLECULAR WEIGHT	**18.447**
AVERAGE MOLECULAR WEIGHT OF DECANES+ (C10+) FRACTION, calculated	**157.573**
TRUE VAPOR PRESSURE AT 100 F, PSIA, calculated	**0.955**
AVERAGE BOILING POINT, F, calculated	**214.777**
CUBIC FEET OF GAS / GALLON OF LIQUID, as Ideal Gas, calculated	**170.724**
BTU / GALLON OF LIQUID AT 14.73 PSIA, calculated	**10,899.34**
LBS / GALLON OF LIQUID, calculated	**8.312**

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-16, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

James A. Kane, President
American Mobile Research, Inc.

AMERICAN MOBILE RESEARCH, INC.

1955 CBS COURT
CASPER, WYOMING 82604

(307) 235-4590 OFFICE PHONE
(307) 265-4489 OFFICE FAX

CERTIFICATE OF ANALYSIS

OXYGENATES IN HYDROCARBON GASES

Company ….. KINDER MORGAN, INC.

Lab Number ….. CR-20730
Date Sampled ….. 8-24-2020
Sample Identification ….. **SACRAMENTO STATION PRODUCED WATER**

Study Number ….. CR-3B
Date Tested ….. 9-9-2020

Sample Location ….. SACRAMENTO STATION, WATFORD CITY, NORTH DAKOTA.
Sample Pressure ….. 20 PSIG
Sample Type….. SPOT
Test Method ….. ASTM D-7423

Sample Temperature ….. 50 F
County ….. N/A
Sample Container ….. KMI 1967

Component	Concentration, ppm by Volume
Dimethyl Ether (DME)	< 1.0 PPMV
Acetone	8.98 PPMV
sec-Butyl Methyl Ether	< 1.0 PPMV
Methyl tert-Butyl Ether (MTBE)	< 1.0 PPMV
Methyl Ethyl Ketone (MEK)	< 1.0 PPMV
Methyl Alcohol (MeOH)	31.84 PPMV
Ethyl tert-Butyl Ether (EtBE)	< 1.0 PPMV
Ethyl Alcohol (EtOH)	< 1.0 PPMV
tert-Amyl Methyl Ether (TAME)	< 1.0 PPMV
iso-Propanol (IPA)	23.61 PPMV
tert-Butyl Alcohol (tBA)	< 1.0 PPMV
n-Propanol (nPA)	5.50 PPMV
sec-Butyl Alcohol	< 1.0 PPMV
2-Methyl-1-Propanol	< 1.0 PPMV
Butyl Alcohol	< 1.0 PPMV
Total Glycols (EG, DEG, TEG)…	13,177.30 PPMV
Total Oxygenates	13,247.23 PPMV

Analysis performed according to methodology outlined in ASTM D-7423, Determination of Oxygenates in C2, C3, C4, and C5 Hydrocarbon Matrices.

James A. Kane, President
American Mobile Research, Inc.

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.014	0.037	0.019
Cyclohexane	0.047	0.149	0.075
2-Methylpentane	0.157	0.509	0.301
3-Methylpentane	0.062	0.203	0.120
n-Hexane	0.193	0.628	0.372
Methylcyclohexane	0.019	0.070	0.036
2,2,4-Trimethylpentane	0.006	0.026	0.015
Benzene	0.019	0.056	0.025
Toluene	0.011	0.038	0.017
Ethylbenzene	0.001	0.004	0.002
m-Xylene	0.001	0.003	0.001
p-Xylene	0.003	0.012	0.005
o-Xylene	0.001	0.005	0.002
Hexanes, Total	0.473	1.526	0.887
Heptanes, Total	0.201	0.746	0.414
Octanes, Total	0.055	0.226	0.119
Nonanes, Total	0.003	0.015	0.008
Decanes+, Total	0.011	0.059	0.032

SPECIFIC GRAVITY AT 60/60 F, calculated	0.91473
TOTAL GPM (ETHANE INCLUSIVE)	11.210
CALCULATED BTU / REAL CF AT 14.73 PSIA, dry basis	1526.555
CALCULATED BTU / REAL CF AT 14.73 PSIA, wet basis	1500.249
AVERAGE MOLECULAR WEIGHT	26.493
MOLAR MASS RATIO	0.91473
RELATIVE DENSITY (G x Z (Air) / Z), calculated	0.92013
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF AT 14.696 PSIA, calculated	1514.119
COMPRESSIBILITY FACTOR (Z)	0.99413
ETHANE GPM	5.3532
PROPANE GPM	3.0873
iso-BUTANE GPM	0.4338
n-BUTANE GPM	1.3308
iso-PENTANE GPM	0.2893
n-PENTANE GPM	0.4053
GASOLINE RANGE (HEXANES+) GPM	0.3104
FIELD H2S AT TIME OF SAMPLING, PPM	**N/A PPM**

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

James A. Kane, President

American Mobile Research, Inc.

APPEDIX D: ENGINE MANUFACTURER INFORMATION

GE Power

Kinder Morgan - Stoney Creek Comp Station - North Dakota

GE Power Chris Jacobs

VHP - L7044GSI

Gas Compression

ENGINE SPEED (rpm):	1200	NOx SELECTION (g/bhp-hr):	Customer Catalyst
DISPLACEMENT (in3):	7040	COOLING SYSTEM:	JW, IC + OC
COMPRESSION RATIO:	8:1	INTERCOOLER WATER INLET (°F):	130
IGNITION SYSTEM:	ESM	JACKET WATER OUTLET (°F):	180
EXHAUST MANIFOLD:	Water Cooled	JACKET WATER CAPACITY (gal):	100
COMBUSTION:	Rich Burn, Turbocharged	AUXILIARY WATER CAPACITY (gal):	11
ENGINE DRY WEIGHT (lbs):	24250	LUBE OIL CAPACITY (gal):	190
AIR/FUEL RATIO SETTING:	0.38% CO	MAX. EXHAUST BACKPRESSURE (in. H2O):	18
ENGINE SOUND LEVEL (dBA)	104	MAX. AIR INLET RESTRICTION (in. H2O):	15
		EXHAUST SOUND LEVEL (dBA)	111

SITE CONDITIONS:

FUEL:	Natural Gas	ALTITUDE (ft):	2100
FUEL PRESSURE RANGE (psig):	30 - 60	MAXIMUM INLET AIR TEMPERATURE (°F):	100
FUEL HHV (BTU/ft3):	1,368.5	FUEL WKI:	55.2
FUEL LHV (BTU/ft3):	1,237.1		

SITE SPECIFIC TECHNICAL DATA

POWER RATING	UNITS		MAX RATING AT 100 °F AIR TEMP	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 100 °F		
				100%	75%	54%
CONTINUOUS ENGINE POWER	BHP		1564	1564	1176	843
OVERLOAD	% 2/24 hr		0	0	-	-
MECHANICAL EFFICIENCY (LHV)	%		30.5	30.5	29.1	28.5
CONTINUOUS POWER AT FLYWHEEL	BHP		1564	1564	1176	843
based on no auxiliary engine driven equipment						
FUEL CONSUMPTION						
FUEL CONSUMPTION (LHV)	BTU/BHP-hr		8347	8347	8751	8939
FUEL CONSUMPTION (HHV)	BTU/BHP-hr		9233	9233	9680	9889
FUEL FLOW *based on fuel analysis LHV*	SCFM		176	176	139	102
HEAT REJECTION						
JACKET WATER (JW)	BTU/hr x 1000		3920	3920	3248	2502
LUBE OIL (OC)	BTU/hr x 1000		556	556	505	427
INTERCOOLER (IC)	BTU/hr x 1000		251	251	171	92
EXHAUST	BTU/hr x 1000		3904	3904	2933	1960
RADIATION	BTU/hr x 1000		696	696	641	553
EMISSIONS (ENGINE OUT):						
NOx (NO + NO2)	g/bhp-hr		14.2	14.2	15.2	16.3
CO	g/bhp-hr		12.6	12.6	12.5	11.5
THC	g/bhp-hr		2.2	2.2	2.2	2.2
NMHC	g/bhp-hr		1.21	1.21	1.16	0.99
NM,NEHC (VOC)	g/bhp-hr		0.60	0.60	0.58	0.49
CO2	g/bhp-hr		545	545	571	584
CO2e	g/bhp-hr		570	570	596	604
CH2O	g/bhp-hr		0.05	0.05	0.05	0.05
CH4	g/bhp-hr		1.01	1.01	0.97	0.83
AIR INTAKE / EXHAUST GAS						
INDUCTION AIR FLOW	SCFM		2391	2391	1885	1380
EXHAUST GAS MASS FLOW	lb/hr		11117	11117	8764	6415
EXHAUST GAS FLOW *at exhaust temp, 14.5 psia*	ACFM		8281	8281	6345	4411
EXHAUST TEMPERATURE	°F		1216	1216	1169	1087

HEAT EXCHANGER SIZING[12]			
TOTAL JACKET WATER CIRCUIT (JW)	BTU/hr x 1000		4445
TOTAL AUXILIARY WATER CIRCUIT (IC + OC)	BTU/hr x 1000		916

COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS		
JACKET WATER PUMP MIN. DESIGN FLOW	GPM	450
JACKET WATER PUMP MAX. EXTERNAL RESTRICTION	psig	16
AUX WATER PUMP MIN. DESIGN FLOW	GPM	79
AUX WATER PUMP MAX. EXTERNAL RESTRICTION	psig	44

All data provided per the condtions listed in the notes section on page three.

Data Generated by EngCalc Program Version 3.6.Dresser Inc.

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FUEL COMPOSITION

HYDROCARBONS:		Mole or Volume %
Methane	CH4	63.836
Ethane	C2H6	20.46
Propane	C3H8	9.1381
Iso-Butane	I-C4H10	0.8216
Normal Butane	N-C4H10	2.1273
Iso-Pentane	I-C5H12	0.2151
Normal Pentane	N-C5H12	0.2386
Hexane	C6H14	0.064
Heptane	C7H16	0
Ethene	C2H4	0
Propene	C3H6	0
	SUM HYDROCARBONS	96.9
NON-HYDROCARBONS:		
Nitrogen	N2	2.2399
Oxygen	O2	0
Helium	He	0
Carbon Dioxide	CO2	0.8597
Carbon Monoxide	CO	0
Hydrogen	H2	0
Water Vapor	H2O	0
	TOTAL FUEL	100

FUEL:	Natural Gas
FUEL PRESSURE RANGE (psig):	30 - 60
FUEL WKI:	55.2
FUEL SLHV (BTU/ft3):	1215.55
FUEL SLHV (MJ/Nm3):	47.80
FUEL LHV (BTU/ft3):	1237.08
FUEL LHV (MJ/Nm3):	48.65
FUEL HHV (BTU/ft3):	1368.45
FUEL HHV (MJ/Nm3):	53.81
FUEL DENSITY (SG):	0.81

Standard Conditions per ASTM D3588-91 [60°F and 14.696psia] and ISO 6976:1996-02-01[25, V(0;101.325)].
Based on the fuel composition, supply pressure and temperature, liquid hydrocarbons may be present in the fuel. No liquid hydrocarbons are allowed in the fuel. The fuel must not contain any liquid water. Waukesha recommends both of the following:
1) Dew point of the fuel gas to be at least 20°F (11°C) below the measured temperature of the gas at the inlet of the engine fuel regulator.
2) A fuel filter separator to be used on all fuels except commercial quality natural gas.
Refer to the 'Fuel and Lubrication' section of 'Technical Data' or contact the Waukesha Application Engineering Department for additional information on fuels, or LHV and WKI* calculations.
* Trademark of General Electric Company

FUEL CONTAMINANTS

Total Sulfur Compounds	0	% volume
Total Halogen as Cloride	0	% volume
Total Ammonia	0	% volume
Siloxanes		
Tetramethyl silane	0	% volume
Trimethyl silanol	0	% volume
Hexamethyldisiloxane (L2)	0	% volume
Hexamethylcyclotrisiloxane (D3)	0	% volume
Octamethyltrisiloxane (L3)	0	% volume
Octamethylcyclotetrasiloxane (D4)	0	% volume
Decamethyltetrasiloxane (L4)	0	% volume
Decamethylcyclopentasiloxane (D5)	0	% volume
Dodecamethylpentasiloxane (L5)	0	% volume
Dodecamethylcyclohexasiloxane (D6)	0	% volume
Others	0	% volume

Total Sulfur Compounds	0 µg/BTU
Total Halogen as Cloride	0 µg/BTU
Total Ammonia	0 µg/BTU
Total Siloxanes (as Si)	0 µg/BTU

Calculated fuel contaminant analysis will depend on the entered fuel composition and selected engine model.

No water or hydrocarbon condensates are allowed in the engine. Requires liquids removal.

NOTES

1. All data is based on engines with standard configurations unless noted otherwise.
2. Power rating is adjusted for fuel, site altitude, and site air inlet temperature, in accordance with ISO 3046/1 with tolerance of ± 3%.
3. Fuel consumption is presented in accordance with ISO 3046/1 with a tolerance of -0 / +5% at maximum rating. Fuel flow calculation based on fuel LHV and fuel consumption with a tolerance of -0/+5 %. For sizing piping and fuel equipment, it is recommended to include the 5% tolerance.
4. Heat rejection tolerances are ± 30% for radiation, and ± 8% for jacket water, lube oil, intercooler, and exhaust energy.
5. Emission levels for engines with GE supplied 3-way catalyst are given at catalyst outlet flange. For all other engine models, emission levels are given at engine exhaust outlet flange prior to any after treatment. Values are based on a new engine operating at indicated site conditions, and adjusted to the specified timing and air/fuel ratio at rated load. Catalyst out emission levels represent emission levels the catalyst is sized to achieve. Manual adjustment may be necessary to achieve compliance as catalyst/engine age. Catalyst-out emission levels are valid for the duration of the engine warranty. Emissions are at an absolute humidity of 75 grains H2O/lb (10.71 g H2O/kg) of dry air. Emission levels may vary subject to instrumentation, measurement, ambient conditions, fuel quality, and engine variation. Engine may require adjustment on-site to meet emission values, which may affect engine performance and heat output. NOx, CO, THC, and NMHC emission levels are listed as a not to exceed limit, all other emission levels are estimated. CO2 emissions based on EPA Federal Register/Vol. 74, No. 209/Friday, October 30, 2009 Rules and Regulations 56398, 56399 (3) Tier 3 Calculation Methodology, Equation C-5.
6. Air flow is based on undried air with a tolerance of ± 7%.
7. Exhaust temperature given at engine exhaust outlet flange with a tolerance of ± 50°F (28°C).
8. Exhaust gas mass flow value is based on a "wet basis" with a tolerance of ± 7%.
9. Inlet air restrictions based on full rated engine load. Exhaust backpressure based on 158 PSI BMEP and 1200 RPM. Refer to the engine specification section of Waukesha's standard technical data for more information.
10. Cooling circuit capacity, lube oil capacity, and engine dry weight values are typical.
11. Fuel must conform to Waukesha's "Gaseous Fuel Specification" S7884-7 or most current version. Fuel may require treatment to meet current fuel specification.
12. Heat exchanger sizing values given as the maximum heat rejection of the circuit, with applied tolerances and an additional 5% reserve factor.
13. Fuel volume flow calculation in english units is based on 100% relative humidity of the fuel gas at standard conditions of 60°F and 14.696 psia (29.92 inches of mercury; 101.325 kPa).
14. Fuel volume flow calculation in metric units is based on 100% relative humidity of the fuel gas at a combustion temperature of 25°C and metering conditions of 0°C and 101.325 kPa (14.696 psia; 29.92 inches of mercury). This is expressed as [25, V(0;101.325)].
15. Engine sound data taken with the microphone at 1 m (3.3 ft) from the side of the engine at the approximate front-to-back centerline. Microphone height was at intake manifold level. Engine sound pressure data may be different at front, back and opposite side locations. Exhaust sound data taken with microphone 1 meter (3.3 ft) away and 1 meter (3.3 ft) to the side of the exhaust outlet.
16. Due to variation between test conditions and final site conditions, such as exhaust configuration and background sound level, sound pressure levels under site conditions may be different than those tabulated above.
17. Cooling system design flow is based on minimum allowable cooling system flow. Cooling system maximum external restriction is defined as the allowable restriction at the minimum cooling system flow.
18. Continuous Power Rating: The highest load and speed that can be applied 24 hours per day, seven days per week, 365 days per year except for normal maintenance at indicated ambient reference conditions and fuel. No engine overload power rating is available.
19. emPact emission compliance available for entire range of operable fuels; however, fuel system and/or O2 set point may need to be adjusted in order to maintain compliance.
20. In cold ambient temperatures, heating of the engine jacket water, lube oil and combustion air may be required. See Waukesha Technical Data.

SPECIAL REQUIREMENTS

September 26, 2016

Emission Control Application Data Sheet

Maxim Silencers
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0980
Fax: 832 554-0990

Customer: **AG EQUIPMENT** Project: **KINDER MORGAN-7044GSI-N.DAKOTA** Date: **7/20/2017**

Customer Contact Powertherm Contact: Order/Quote #: **0**

Engine Data:

Engine Model:	**WAUK 7044GSI, 9% PROPANE APPLICATION**		Speed:	**1200**	RPM
Fuel & Operating Type:	**Natural Gas Rich Burn**		Engine Power:	**1564**	Hp
				1253	KW
Exhaust Flow Rate:	**8281**	**acfm**	Exhaust Temperature:	**1216**	°F
	14070	**m^3/hr**		**658**	°C
	11740	**lbs/hr**			

Catalyst Data:

Number of Core layers:	**1**				
Model:	**QAC4-57-16**		Inlet Size:	**16**	in
Grade:	**Super Critical**		Outlet Size:	**16**	in
Body Diameter:	**45**	in	Body Length:	**130**	in
Estimated weight:	**1567**	lbs	Estimated Back Pressure of the unit:	**6.90**	in of WC
	711	Kg		**17.2**	mbar
Core Part Number:	**PE2-670-400, (33.5" ROUND)**	Qty **1**	Speed through inlet:	**6159**	ft/min
Cell Density	400	cpsi	Back Pressure across Element(s) only	3.32	in of WC
				8.3	mbar

Emission:

Min. Temp. at Core Face:	**1202**	°F	**650**	°C	
Max. Temp. at Core Face:	**1271**	°F	**688**	°C	

Catalyst Type: **3-Way**

O_2 in Exhaust vol %

H_2O in Exhaust vol %

	Pollutant						
	NOx	CO	NMHC/VOC	CH_2O/CHCO	ORGANIC PM10		
Engine Out / Pre Emission:	**14.2**	**12.6**	**0.6**	**0.05**	**0**	g/bhp-hr	
	5775.93	**5125.12**	**244.05**	**20.34**	**0.00**	mg/Nm3	
Post Emission:	**0.994**	**0.945**	**0.300**	**0.015**	**0.000**	g/bhp-hr	
	404.31	**384.38**	**122.03**	**6.10**	**0.00**	mg/Nm3	
	93.0	***92.5***	***50.0***	***70.0***	***50.0***	% Reduction	
	3.68	3.50	1.11	0.06		lb/hr	
	16.13	15.33	4.87	0.24		tons/year operation	**8760** hr/year
	194.1	184.6	58.6	2.9		ppmv	
						ppmvd @ 15% O2	

Acoustics:

Frequency Band (Hz):	31.5	63	125	250	500	1000	2000	4000	8000	
Raw Noise SPL (dB) at 3.28 ft.:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	7 dBA
Estimated Attenuation (dB):	**12**	**25**	**39**	**35**	**23**	**21**	**21**	**20**	**20**	No Element
Plus:	**12**	**26**	**41**	**37**	**27**	**26**	**27**	**26**	**25**	One Element Layer
Silenced SPL (dB) at 3.28 ft.:										

Warranty & Notes:

- **If Pre-Emission levels are not as noted above, contact Maxim Silencers for a re-quote.**
- To achieve Post Emissions levels detailed above, exhaust temperature and Pre-Emission data must be as specified.
- Maximum allowable exhaust temperature at core face is 1350°F.
- If applicable, the engine will require an air/fuel ratio controller to meet above emission levels. For Rich Burn engines λ must be 0.96 - 0.99.
- Catalyst cleaning/regeneration required, if initial backpressure increases by 2" of WC.
- Engine operation to be stable and reproducible.
- QAC is not designed to withstand a backfire, therefore measures should be taken prior to QAC unit to alleviate backfire pressure.
- Maximum lubrication oil consumption rate to be less than 0.0015 lb/bhp/hr.
- Lube oil sulfate ash contents should not exceed 0.5%.
- Phosphorus and/or Zinc should not exceed 5 ppmv in the exhaust stream.
- A high temperature alarm/shutdown to be maintained at downstream of catalyst at 1300°F.
- Fuel not to contain heavy or transition metals such as Pb, Ar, Zn, Cu, Sn, Fe, Ba, Ni, Cr etc.
- Chlorinated or Silicone containing compounds in the exhaust not to exceed 1 ppmv.
- Sulfur compounds in the exhaust gas stream not to exceed 25 ppmv.
- Performance guarantee is voided should the catalyst become masked or de-activated by any contaminant in the exhaust stream.
- Engine to be maintained and operated in accordance within manufacturer's recommended practice.
- Under no condition will Maxim Silencers assume any contingent liabilities.
- Operating manual is available online at www.maximsilencers.com or contact a Maxim sales representative.
- Nomenclature: QAC4-292-8, 4 is grade (Super Critical), 29 is catalyst block size, 2 is no. of catalyst(s) and 8 is flange diameter.
- Organic PM10 are estimate only and not a guarantee because of the variability in fuels and additives which change PM10.
- Maxim Silencers standard one year warranty applies.

Rev level: 86