Hiland Partners Holdings LLC
a Kinder Morgan company

5151 E. Broadway, Suite 1680, Tucson, Arizona 85711

August 10, 2023 Electronic Submittal

Mr. Craig Thorstenson
Director of Air Quality
North Dakota Department of Environmental Quality
Division of Air Quality
918 E. Divide Ave, 2nd floor
Bismarck, ND 58501

Re: Air Permit Revision Application
Hiland Partners Holdings LLC
Rivers Edge Compressor Station
Permit to Operate AOP 28062 v1.0 and ACP 18124 v1.0
McKenzie County, North Dakota

Dear Mr. Thorstenson:

Hiland Partners Holdings LLC (Hiland) owns and operates the Rivers Edge Compressor Station. The attached air permit revision to add one Waukesha L5794GSI (4SRB) natural gas fired compressor engine rated at 1380 bhp at Rivers Edge compressor station and increase dehydrator throughput from 20 MMSCFD to 25 MMSCFD. The new engine will be installed with a new recycle process for compressor blowdowns similar to other compressor stations.

A letter with a $325 check will be sent via a separate letter. The Waukesha L5794GSI compressor engine will be placed upon permit issuance. If possible, Hiland hopes to receive a revised permit by early October 2023.

If you need additional information or have any questions, please contact me at (520) 663-4249 or by email at Anu_Pundari@KinderMorgan.com.

Sincerely,

Anu Pundari

Anu Pundari
Engineer – EHS Staff

RIVERS EDGE COMPRESSOR STATION
AIR PERMIT REVISION
PERMIT TO OPERATE AOP 28062 v1.0 (PTO O19025)
and PERMIT TO CONSTRUCT ACP 018124 v1.0

Hiland Partners Holdings LLC

McKenzie County, North Dakota

August 2023

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APPENDICES

1.0 INTRODUCTION

1.1 Introduction

Hiland Partners Holdings LLC (Hiland) owns and operates the Rivers Edge Compressor Station (Rivers Edge CS) located in McKenzie County, North Dakota. The Rivers Edge CS is authorized under Permit to Operate AOP 28062 v1.0 (Previous permit O19025) and PTC ACP 018124 v1.0. The location has (3) existing engines.

The permit revision application for PTC ACP 018124 v1.0. included addition of Produced Water Truck Loading, Compressor Blowdowns, NGL Truck Loading, and Fugitives to the EU list. This application carries forward the EU list from the July 2021 permit revision.

Hiland is submitting this permit revision to add one Waukesha L5794GSI (4SRB) natural gas-fired compressor engine rated at 1380 bhp manufactured in April 2012 (NSP JJJJ) and increase dehydrator throughput from 20 MMSCFD to 25 MMSCFD.

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

1.2 Application

In accordance with North Dakota Division of Air Quality requirements, permit application forms have been completed and are included in Appendix A.

1.3 Public Notice

Per North Dakota Administrative Code (NDAC) §33-15-14-02.6 - Public participation - Final action on application, this facility does qualify as a source category not subject to public participation procedures. The following discussion substantiates this claim:

§33-15-14-02-6.a.(1)	The facility is not an affected facility per 40 CFR 61 - National Emission Standards For Hazardous Air Pollutants as incorporated by NDAC Chapter 33-15-13.
§33-15-14-02-6.a.(2)	The facility does not have the potential to emit more than 100 tons per year of any criteria pollutant; therefore, is not subject to the Title V operating permit program.
§33-15-14-02-6.a.(3)	The proposed modifications will not increase the potential to emit from the facility above the listed limits.
§33-15-14-02-6.a.(4)	Potential emissions as reported in Section 3 are not expected to have a “major impact on air quality.”
§33-15-14-02-6.a.(5) & (6)	As of the application date, no request for a public comment period has been received.
§33-15-14-02-6.a.(7)	Hiland is not requesting a federally enforceable permit which limits their potential to emit.

1.4 Site Location

The Rivers Edge Compressor Station is located approximately 10 miles southwest of Williston, North Dakota, in the NW¼ NW ¼ Township 152 North, Range 102 West in McKenzie County, North Dakota. The geographic coordinates are Latitude: 47.992749 North and Longitude: 103.711397 West. The site elevation is approximately 2,200 feet above sea level.

1.5 Site Description

The terrain surrounding the facility is characterized as flat to rolling hills. The surrounding area is mainly used for agriculture and livestock grazing. The air quality classification for the area is “Better than National Standards” or unclassifiable/ attainment for the National Ambient Air Quality Standards for criteria pollutants (40 CFR 81.335). There are no non-attainment areas within a reasonable distance of the site.

2.0 PROJECT SUMMARY

2.1 Process Description

The Rivers Edge Compressor Station compresses natural gas from nearby wells for pipeline transmission to a local gas plant.

The field gas is dehydrated and compressed into the pipeline. The gas compression is achieved by three compressor driven by Waukesha L5794 GSI (C1 and C2 and C3) engines equipped with Non-Selective Catalytic Reduction (NSCR) catalysts for control of emissions.

The permit revision is to add one Waukesha L5794 GSI (C4) with NSCR catalyst for control of emissions and increase dehydrator throughput from 20 MMSCFD to 25 MMSCFD.

The gas is dehydrated using an TEG dehydration absorber, BTEX condenser, and associated TEG reboiler. Emissions from the dehydrator still vent are routed to a flash tank. Emissions from flash tank are recompressed or recycled back into the process. Emissions from the regenerator are routed to a BTEX condenser system. The condensed vapors are recycled back into the system. Uncondensed vapors are routed to the TEG reboiler firebox for destruction. The reboiler also uses natural gas as fuel in addition to the uncondensed vapors.

The two atmospheric tanks are used to store produced water for eventual shipment offsite via tank truck loading. All combustion equipment at the site is fired with a portion of natural gas after it has been processed at the station.

Emission sources with insignificant emissions include two chemical tanks, natural gas liquid (NGL) pressurized bullet tanks, pig launchers and receivers, compressor and maintenance venting.

2.2 Proposed Construction

To increase operational flexibility, Hiland is proposing to add one Waukesha L5794GSI compressor engine and increase dehydrator throughput from 20 MMSCFD to 25 MMSCFD. The field work will begin in October 2023-; the new unit will be placed upon air permit issuance and therefore Hiland hopes to receive the permit by early October 2023. Activities such as site work including grading, piping, and equipment that is not an emissions unit may be performed prior to air permit issuance as allowed by NDDEQ regulations.

3.0 EMISSIONS SOURCES

3.1 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).

Fuel heating value was assumed to be 1500 Btu/scf for all emission sources.

3.2 Compressor Engine Emissions

The (1) new and (3) existing Waukesha L5794 GSI engines are four stroke rich-burn engines for compression of natural gas. These engines will be rated at equal to or less than 1,380 bhp at 1200 rpm and will be equipped with Non-Selective Catalytic Reduction (NSCR). The compressor engines' NO_x and VOC emissions were based on 40 CFR 60 Subpart JJJJ standards of 1.0 and 0.7 grams per brake horsepower-hour (g/bhp-hr), respectively. CO emissions were based on data from the catalyst vendor indicating a post-catalyst emission rate of 1.0 g/hp-hr. Formaldehyde emissions are based on data from the vendor. PM/PM_{10} and SO_2 emissions were based on AP-42 Table 3.2-3 emission factors. Per AP-42, all particulate emissions from natural gas combustion are considered to be less than 1.0 micrometer in diameter.

Emission calculations are provided in Section 5. The engine specifications including information of controlled and uncontrolled emission rates are provided in Appendix E.

3.3 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 is 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 B.

3.4 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. Hiland obtained pressurized liquid samples from the slug catcher drain that routes to the produced water storage tanks. A liquid sample was obtained from Cedar Butte CS as a 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).

3.5 Produced Water Truck Loading Emissions

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

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

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.

3.6 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 1.0 tpy of VOC.

3.7 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.

3.8 NGL Truck Loading Emissions

NGL truck loading emissions are conservatively estimated at 40,000 gallons/day. Any vapors from the NGL tank are routed to the inlet slug catcher. Any vapors from the inlet slug catcher are routed to the suction of the compressors. There are no emissions from the NGL tanks during the tank truck loading process. During loading, there is a liquid line and vapor line that connects from the tanker truck to the tank. When the two lines are disconnected from the tank, there will be a small amount of emissions.

3.9 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.

3.10 HAP Emission Inventory

HAP emissions from natural gas combustion in the compressor engines (except

formaldehyde) were estimated using data from AP-42 Tables. Formaldehyde emissions from compressor engines were estimated using emission factors from the manufacturer. HAP emissions from the TEG dehydrator still vent were calculated using GRI GlyCalc Version 4.0.

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.

4.0 REGULATORY ANALYSIS

4.1 Permit Requirements

Hiland is required to obtain an air quality preconstruction permit for the proposed construction at the Rivers Edge Compressor Station per NDAC 33-15-14-02: Permit to Construct**.**

4.2 Regulatory Requirements

The Table below lists the rules potentially applicable to the Rivers Edge Compressor Station. The rules are addressed individually in the following sections as they pertain to the facility.

Potentially Applicable Rules

Rule Citation	Subject of the Rule
NDAC 33-15-01	General Provisions
NDAC 33-15-02	Ambient Air Quality Standards
NDAC 33-15-03	Restriction of Emission of Visible Air Contaminants
NDAC 33-15-04	Open Burning Restrictions
NDAC 33-15-05	Emissions of Particulate Matter Restricted
NDAC 33-15-06	Emissions of Sulfur Compounds Restricted
NDAC 33-15-07	Control of Organic Compounds Emissions
NDAC 33-15-08	Control of Air Pollution From Vehicles and Other Internal Combustion Engines
NDAC 33-15-10	Control of Pesticides
NDAC 33-15-11	Prevention of Air Pollution Emergency Episodes
NDAC 33-15-12	Standards of Performance for New Stationary Sources
NDAC 33-15-13	Emission Standards for Hazardous Air Pollutants
NDAC 33-15-14	Designated Air Contaminant Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate
NDAC 33-15-15	Prevention of Significant Deterioration of Air Quality
NDAC 33-15-16	Restriction of Odorous Air Contaminants
NDAC 33-15-17	Restriction of Fugitive Emissions
NDAC 33-15-18	Stack Heights
NDAC 33-15-19	Visibility Protection

NDAC 33-15-20	Control of Emissions From Oil and Gas Well Production Facilities
NDAC 33-15-21	Acid Rain Program
NDAC 33-15-22	Emissions Standards for Hazardous Air Pollutants for Source Categories
NDAC 33-15-23	Fees
NDAC 33-15-24	Standards for Lead-Based Paint Activities
NDAC 33-15-25	Regional Haze Requirements
	Policy for the Control of Hazardous Air Pollutant Emissions In North Dakota (Air Toxics Policy)

4.3 General Provisions (NDAC 33-15-01)

This facility is subject to all general requirements of this section (i.e., inspection, circumvention, shutdown/malfunction, compliance, enforcement, confidentiality of records, etc.).

4.4 Ambient Air Quality Standards (NDAC 33-15-02)

The air quality of the area is classified as "Better than National Standards" or unclassifiable/attainment of the National Ambient Air Quality Standards (NAAQS) for criteria pollutants (40 CFR 81.335). There are no nonattainment areas within a reasonable distance of the site.

The emissions at Rivers Edge Compressor Station will vent from stacks with a height greater than or equal to 1.5 times the height of any nearby building. Because the facility's potential emissions will be lower than the modeling thresholds, modeling for criteria pollutants is not required for this application.

Hiland will abide by all standards set forth in these regulations.

4.5 Restriction of Emission of Visible Air Contaminants (NDAC 33-15-03)

NDAD 33-15-03 contains regulations governing particulate matter and opacity limits form new and existing sources. Hiland will comply with all applicable standards.

There are no new applicable regulations as a result of the new engine.

4.6 Open Burning Restrictions (NDAC 33-15-04)

Hiland will comply with all open burning regulations at the Rivers Edge Compressor Station.

4.7 Emissions of Particulate Matter Restricted (NDAC 33-15-05)

This facility will operate four natural gas-fired stationary combustion engine and one TEG reboiler. Hiland will comply with the provisions of Sections 33-15-05-01 and 33-15-05-04. Fuel is also consumed for the purposes of indirect heating; therefore, Section 33-15-05-02 and 33-15-03 does apply.

4.8 Emissions of Sulfur Compounds Restricted (NDAC 33-15-06)

This facility combusts pipeline quality natural gas and, per Section 33-15-06-01.1.e, is not subject to the regulations of this Chapter.

4.9 Control of Organic Compounds Emissions (NDAC 33-15-07)

There is no water-oil separator or flare at this facility. The produced water tanks will be equipped with submerged fill pipes and the NGL truck loading will use a vapor return system. Hiland will comply with the provisions of Section 33-15-07-02.

4.10 Control of Air Pollution From Vehicles And Other Internal Combustion Engines (NDAC 33-15-08)

This facility will operate three natural gas-fired stationary combustion engines, and Hiland will comply with the restricted emissions regulation of Section 33-15-08-01. Hiland will also comply with Section 33-15-08-02.

4.11 Control of Pesticides (NDAC 33-15-10)

Hiland will comply with the provisions of NDAC 33-15-10 should pesticides be used at this facility.

4.12 Prevention of Air Pollution Emergency Episodes (NDAC 33-15-11)

Hiland will comply with any applicable source curtailment regulations when notified by the Department of an Air Pollution Emergency Episode.

4.11 Standards of Performance for New Stationary Sources (NDAC 33-15-12)

The Rivers Edge Compressor Station does qualify as a designated source for NSPS per certain subparts of 40 CFR 60, as incorporated by Section 33-15-12-01.1.

New Source Performance Standards (NSPS) apply to certain source categories. Four subparts were reviewed for applicability in regards to the proposed construction.

NSPS Subpart Dc

The TEG reboiler has a maximum design heat input capacity of less than 10 MMBtu/hr; therefore, the reboiler will not be subject to Subpart Dc.

NSPS Subpart JJJJ

The new engine was manufactured after July 1, 2007; therefore, Subpart JJJJ is applicable. Hiland will comply with the requirements of Subpart JJJJ.

NSPS Subpart OOOO/OOOOa

Owners and operators are subject to Subpart OOOO if they commence construction, modification or reconstruction after August 23, 2011 and on or before September 18, 2015 on one or more affected facilities.

Owner and operators are subject to Subpart OOOOa if they commence construction, modification or reconstruction after September 18, 2015 on one or more affected facilities.

An affected facility could include the following:

- Centrifugal compressors;
- Reciprocating compressors;
- Storage vessels;
- Pneumatic controllers;
- Sweeting units; and,
- Equipment leaks at an onshore natural gas processing plant.
-

There will be no centrifugal compressors at the Rivers Edge Compressor Station.

There are reciprocating compressors at Rivers Edge Compressor Station. Based on the applicability dates, NSPS OOOOa and NSPS OOOO are applicable. The facility will be subject to the recordkeeping and reporting requirements associated with this regulations.

The produced water storage vessels emit less than six tons per year of VOC; therefore, the vessels are not subject to the requirements.

The facility will utilize only air driven pneumatic controllers. The facility will not be designed with continuous bleed natural gas driven pneumatic controllers.

Rivers Edge Compressor Station does not have a sweetening unit or a sweetening unit followed by a sulfur recovery unit and is not considered an onshore natural gas processing plant.

4.12 Emission Standards for Hazardous Air Pollutants (NDAC 33-15-13)

The process fluids at this facility (field gas) will not contain 10% or greater of Volatile Hazardous Air Pollutant (VHAP) as defined by §61.241 of 40 CFR 61; therefore, this facility is not subject to Subpart V, as incorporated by Section 33-15-13-01.1.

4.13 Designated Air Contaminant Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate (NDAC 33-15-14)

Rivers Edge Compressor Station is not a listed source, with a PTE for all criteria pollutants and HAPS below the major source thresholds, the facility is subject to the requirements of Section 33-15-14-03 - Minor Source Permit to Operate.

Since Rivers Edge Compressor Station will not have the potential to emit more than 100 tons per year of any criteria pollutant and will not be a major source of HAPs, the facility will not be subject to the Title V operating permit program described in NDAC 33-15-14-06.

Per the Criteria Pollutant Modeling Requirements for a Permit to Construct modeling policy memo dated October 6, 2014, modeling is required when:

- The emissions vent from a stack with a height greater than or equal to 1.5 times the height of any nearby building, and potential emissions exceed 100 tons per year of NOx or SO_2 or 40 tons per year of PM_{10} or 25 tons per year of $PM_{2.5}$.
- The emissions vent from a stack with a height less than 1.5 times the height of any nearby building, and potential emissions exceed 40 tons per year of NOx or SO_2 or 15 tons per year of PM_{10} or 10 tons per year of $PM_{2.5}$.

The emissions from previously permitted and a new engine will vent from stacks with a height greater than or equal to 1.5 times the height of any nearby building. Because the facility's potential emissions will be lower than the modeling thresholds, modeling for criteria pollutants is not required for this application.

In North Dakota, Best Available Control Technology (BACT) is not required for any source unless it is a PSD major source for criteria pollutants or HAPs, regardless if a construction permit is required.

4.14 Prevention of Significant Deterioration of Air Quality (NDAC 33-15-15)

Rivers Edge Compressor Station is not a listed facility and does not have the potential to emit greater than 250 tons per year of any regulated pollutant ; therefore, PSD is not applicable.

4.15 Restriction of Odorous Air Contaminants (NDAC 33-15-16)

Hiland will comply with all requirements concerning odorous air contaminants at the Rivers Edge Compressor Station as applicable to sources outside a city or outside the area over which a city has exercised extraterritorial zoning as defined in North Dakota Century Code Section 40-47-01.1.

4.16 Restriction of Fugitive Emissions (NDAC 33-15-17) and Stack Heights (NDAC 33-15-18)

This facility is subject to the requirements of these chapters. Based on NDDEQ guidance the site does not emit more than 20 tpy combined uncontrolled VOCs from the facility; therefore, additional controls are not required.

4.17 Visibility Protection (NDAC 33-15-19)

The Rivers Edge Compressor Station is not a major PSD stationary source as defined by Section 33-15-15-01; therefore, these regulations do not apply per Section 33-15-19-01.

4.18 Control of Emissions from Oil and Gas Well Production Facilities (NDAC 33-15-20)

This facility does not meet the definition of an oil and gas production facility. Therefore, the requirements of this chapter do not apply to the compressor station.

4.19 Acid Rain Program (NDAC 33-15-21)

This facility is not a listed source per 40 CFR 72 and 73, as incorporated by Section 33-15-21-08.1; therefore, these rules do not apply.

4.20 Air Pollutants for Source Categories (NDAC 33-15-22)

Title 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Source Categories, is incorporated into the North Dakota rules at NDAC 33-15-22-01.

Two NESHAP subparts were reviewed for applicability in regard to the facility: Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines) and Subpart HH (National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities).

NESHAP Subpart HH

This facility is an area source of HAPs; therefore, is subject to certain

requirements applicable to TEG dehydrators. The TEG dehydrator at Rivers Edge Compressor Station will process up to 25 MMcfd of gas (greater than the exemption threshold of 85 Mcfd). However, the proposed TEG dehydration unit will include emission controls to limit annual potential benzene emissions to less than 0.9 megagrams/yr (1.0 tpy). Therefore, the facility is exempt from the standards listed in Subpart HH.

NESHAP Subpart ZZZZ

The Rivers Edge Compressor Station is an area source of HAPs. Engine #1, Engine #2, Engine #3, and Engine # 4 are considered to be new stationary RICE because construction commenced after June 12, 2006. Therefore, Subpart ZZZZ is applicable to the proposed compressor engines.

Since the engines were manufactured after July 1, 2007, they must meet the requirements in Subpart ZZZZ by meeting the requirements in NSPS Subpart JJJJ. There are no further requirements for any of the engines under Subpart ZZZZ.

4.21 Fees (NDAC 33-15-23)

NDAC 33-15-23 sets out applicable fees that will apply to the Rivers Edge Compressor Station. Hiland is submitting $325 for the associated permit application fee. Hiland will pay the required annual operating fees based on the specifications in Section 33-15-23-03.

4.22 Standards for Lead-Based Paint Activities (NDAC 33-15-24)

This facility is not involved in lead-based paint activities as defined in 40 CFR 745 Subpart 745.223 as incorporated in NDAC 33-15-24-01; therefore, the requirements of this chapter do not apply.

4.23 Regional Haze Requirements (NDAC 33-15-25)

This facility is not located in a Class I Federal Area per 40 CFR Part 81 as incorporated in NDAC 33-15-25-02; therefore, the requirements of this chapter do not apply.

4.24 Policy for the Control of Hazardous Air Pollutant Emissions in North Dakota (Air Toxics Policy)

The compressor engines at Rivers Edge Compressor Station are listed sources in NDAC 33-15-14-01. Therefore, per the applicability section of the North Dakota Air Toxics Policy, this facility is subject to these regulations. However, per the *Dispersion*

Modeling Requirements, Compressor Engines and Glycol Dehydration Memorandum, dispersion modeling for air toxics is not required to be submitted with a permit application if all of the conditions in the memorandum are met.

1. *Emissions from all compressor engines at the facility are controlled with catalytic emissions control systems (or an equivalent control technology) which is designed to reduce non-methane hydrocarbons by at least 50%.*

   As described in Section 3.0, all of the compressor engines are controlled by NSCRs that reduce non-methane hydrocarbons emissions by at least 50 %.

2. *Emissions from all compressor engines at the facility are vented from a stack height which is greater than or equal to 1.5 times the nearest building height.*

   The emissions from the compressor engines at the facility are vented from a stack height greater than or equal to 1.5 times the nearest building height.

3. *For glycol dehydration unit(s):*

   a. *Emissions from all glycol dehydration units(s) at the facility are controlled by combustion in the flare, process heater, boiler or other combustion device; or*

   b. *Emissions from all glycol dehydration unit(s) at the facility are controlled by a control technology with a VOC destruction and removal efficiency of at least 90%; or*

   c. *Combined air toxics emissions from all glycol dehydration units at the facility are less than 5.0 tons/year.*

   As specified in Section 3.0, the emissions from the glycol dehydration units are controlled by a condenser and the non-condensable gas from the condenser will be routed to the reboiler firebox.

4. *If the facility is less than ¼ mile from a residence: combined air toxics emissions from the entire facility are less than 10.0 tons/year, benzene emissions are less than 2.0 tons/year, and formaldehyde emissions are less than 2.0 tons/year.*

   A residence is located approximately 0.5 miles south of the station ; therefore, this section is not applicable.

5. *If the facility is at least ¼ mile from a residence: combined air toxics emissions from the entire facility are less than 10.0 tons/year, benzene emissions are less than 3.0 tons/year, and formaldehyde emissions are less than 3.0 tons/year.*

The combined air toxics emissions from the entire facility are less than 10.0 tons/year, benzene emissions are less than 3.0 tons/year, and formaldehyde emissions are less than 3.0 tons/year.

Since the facility meets conditions all the conditions in the memorandum, dispersion modeling for air toxics is not required for this station. A dispersion modeling for air toxics will be submitted if requested by the Department.

5.0 EMISSION CALCULATIONS

Site specific Potential to Emit (PTE) emission calculations are included in this section.

Rivers Edge Compressor Station
Site Emissions Summary

Emission Unit #	Emission Unit Description	PM_{10} (tpy)	NO_x (tpy)	CO (tpy)	SO_x (tpy)	VOC (tpy)	HAPS (tpy)	Formaldehyde (tpy)	CO2e (tpy)	GHG (tpy)
C1	Waukesha L5794GSI	0.88	13.33	13.33	0.03	9.46	0.40	0.13	5,274	5,004
C2	Waukesha L5794GSI	0.88	13.33	13.33	0.03	9.46	0.40	0.13	5,274	5,004
C3	Waukesha L5794GSI	0.88	13.33	13.33	0.03	9.46	0.40	0.13	5,274	5,004
C4	Waukesha L5794GSI	0.88	13.33	13.33	0.03	9.46	0.40	0.13	5,274	5,004
EU5	TEG Reboiler (0.50 mmbtu/hr)	0.02	0.15	0.12	0.00	0.01	0.00	0.00	254	241
EU6	TEG Still Vent - 25 MMSCFD	--	--	--	--	0.49	0.16	--	--	--
EU7	Produced Water Tank - 400 bbl	--	--	--	--	1.00	--	--	--	--
EU8	Produced Water Tank - 400 bbl	--	--	--	--	1.00	--	--	--	--
NA	Produced Water Truck Loading	--	--	--	--	0.44	--	--	--	--
NA	Pigging	--	--	--	--	1.00	--	--	--	--
NA	Compressor Blowdowns	--	--	--	--	12.45	0.06	--	--	--
NA	Fugitive Emissions	--	--	--	--	9.34	0.01	--	--	--
NA	NGL Truck Loading	--	--	--	--	0.37	--	--	--	--
NA	Methanol Chemical Storage Tank	--	--	--	--	0.01	--	--	--	--
NA	Discharge Methanol Storage Tank	--	--	--	--	0.01	--	--	--	--
	Total Sitewide Emissions:	**3.54**	**53.45**	**53.43**	**0.11**	**63.97**	**1.86**	**0.53**	**21351**	**20257**
	Emissions <100 tpy?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**				
	Minor Sources					**16.38**				

Notes:
1. Pigging emissions emissions are conservatively assumed to be 1.00 tpy of VOC.
2. Methanol storage tank emissions are conservatively assumed to be 0.01 tpy of VOC.
3. Minor sources are considered TEG Still Vent, Produced Water Tanks, Produced Water Truck Loading, Pigging, Compressor Blowdowns, and NGL Truck Loading.

Rivers Edge Compressor Station
Glycol Still Vent Emissions

Equipment Data:

Emission Unit (EU):	**EU5**
Emission Unit Name:	TEG Dehydrator Still Vent

Emissions Data:

Wet Gas Pressure (psig)	1200
Wet Gas Temperature (°F)	100
Gas Throughput (mmscf/day)	25
Dry Gas Water Content (lb/H2O/mmscf)	4.0
Glycol Type =	TEG
Lean Glycol Water Content (wt% H20)	1.5
Lean Glycol Flow Rate (gpm)	4.0
Glycol Pump Type	Electric/Pneumatic
Gas Injection Pump Ratio (acfm gas/gpm glycol)	NA
Flash Tank Pressure (psig)	55
Flash Tank Temperature (°F)	180
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	1.4896	6.5243	80%	90%	0.0298	0.1305
-Isobutane	0.2589	1.1341	80%	90%	0.0052	0.0227
-n-Butane	1.2030	5.2693	80%	90%	0.0241	0.1054
-Isopentane	0.1710	0.7490	80%	90%	0.0034	0.0150
-n-Pentane	0.2935	1.2853	80%	90%	0.0059	0.0257
-Cyclopentane	0.0180	0.0788	80%	90%	0.0004	0.0016
-n-Hexane	0.0322	0.1410	80%	90%	0.0006	0.0028
-Cyclohexane	0.0978	0.4284	80%	90%	0.0020	0.0086
-Other Hexanes	0.0361	0.1583	80%	90%	0.0007	0.0032
-Heptanes	0.1020	0.4468	80%	90%	0.0020	0.0089
-Methylcyclohexane	0.0171	0.0748	80%	90%	0.0003	0.0015
-2,2,4-Trimethylpentane	0.0070	0.0032	80%	90%	0.0001	0.0001
-Benzene	0.7396	3.2392	80%	90%	0.0148	0.0648
-Toluene	0.7143	3.1287	80%	90%	0.0143	0.0626
-Ethylbenzene	0.0000	0.0000	80%	90%	0.0000	0.0000
-Xylenes	0.3842	1.6829	80%	90%	0.0077	0.0337
-C8+ Heavies	0.0406	0.1777	80%	90%	0.0008	0.0036
Total VOC	**5.5986**	**24.5218**			**0.1121**	**0.4904**
Total HAPs	**1.8710**	**8.1950**			**0.0375**	**0.1639**
Total BTEX	**1.8381**	**8.0508**			**0.0368**	**0.1610**

Notes:

1. The flash tank off-gas will be recycled.
2. There is a JATCO 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%.

Rivers Edge Compressor Station
Produced Water Storage Tank Emissions

Equipment Data:

Emission Unit (EU):	EU7	EU8
Emission Unit Name:	Produced Water Storage Tank	Produced Water Storage Tank

Emissions Data:

Tank Contents	Produced Water	
Tank Type	VFR	
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 + 70% (lb/hr)	Standing Losses (ton/yr)	Working Losses (ton/yr)	Total Losses + 70% (ton/yr)
Produced Water Storage Tank	0.04	0.09	0.23	0.19	0.40	1.00
Produced Water Storage Tank	0.04	0.09	0.23	0.19	0.40	1.00

Notes:
1. Emissions calculated using ProMax model.
2. The liquid stored is essentially water. To be conservative, an additional 70% safety factor was added to the emissions calculated via ProMax.

Rivers Edge Compressor Station
Pigging Blowdown Emissions

Pig Launcher/Pig Receiver	# of Pig Launchers/Receivers	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)
HP Launcher	1	5	1200	12	33.49	24.98	60	0.70	700	8400	0.022	185	0.09
LP Receivers	2	15	250	104	33.49	24.98	60	0.30	300	31200	0.022	688	0.34
												Total Losses	**0.44**

Notes:
1. Assume 12 events per 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 2022 Inlet Gas Analysis.
Molecular Weight of Gas = 24.98 approx
VOC Weight Percent = 0.335 approx
Universal Gas Content = 379.5 ft^3/lb-mol @ 60 F and 14.696 psia

Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

lbs NM/E VOC/scf = 0.022

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)

Rivers Edge Compressor Station
Compressor Blowdowns

Emission Unit	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)
(4) Engines [2]	Compressor	197.00	100	284	33.5	24.98	60	1.58	1580	448720	0.022	9893	4.95
(4) Engines [3]	Compressor	197.00	1,200	24	33.5	24.98	60	28.35	28350	680400	0.022	15001	7.50
												Total Losses	**12.447**

Notes:
1. To be conservative, a buffer is added to the total number of controlled blowdown events.
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.

Notes:
VOC weight percentage is from Inlet Gas Analysis
Molecular Weight of Gas = 24.983 approx
VOC Weight Percent = 0.335 approx
Universal Gas Content = 379.5 ft^3/lb-mol @ 60 F and 14.696 psia
Specific Gravity = 0.86259
Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

Molecular Weight of Gas = 24.983
HAPs Weight Percent = 0.169%

lbs NM/E VOC/scf = 0.022
lbs/scf= 0.066

lb HAPs/scf = 0.00011

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)

Component	MW (g/mol)	Mol%	Gas Weight (lb/lbmol)	Wt %	Emissions (tpy)
Carbon Dioxide	44.010	0.903	0.3974	1.591	0.591
Hydrogen Sulfide	34.082	0.000	0.0000	0.000	0.000
Nitrogen	28.013	2.312	0.6477	2.593	0.964
Methane (C1)	16.042	60.577	9.7180	38.899	14.457
Ethane (C2)	30.069	19.463	5.8523	23.426	8.706
Propane (C3)	44.096	11.155	4.9189	19.689	7.318
iso-Butane (C4)	58.122	1.062	0.6173	2.471	0.918
nor-Butane (C4)	58.122	3.338	1.9401	7.766	2.886
iso-Pentane (C5)	72.149	0.460	0.3319	1.328	0.494
nor-Pentane	72.149	0.559	0.4033	1.614	0.600
Cyclopentane	72.149	0.004	0.0029	0.012	0.004
n-Hexane	86.180	0.032	0.0276	0.110	0.041
Cyclohexane	86.180	0.012	0.0103	0.041	0.015
Other Hexanes	86.180	0.051	0.0440	0.176	0.065
Heptanes (C7+)	100.200	0.046	0.0461	0.184	0.069
Methylcyclohexane	86.180	0.002	0.0017	0.007	0.003
2,2,4 Trimethyl pentane	72.149	0.001	0.0007	0.003	0.001
Benzene	78.110	0.008	0.0062	0.025	0.009
Toluene	92.140	0.006	0.0055	0.022	0.008
Ethylbenzene	106.170	0.000	0.0000	0.000	0.000
Xylenes (M, P, O)	106.170	0.002	0.0021	0.008	0.003
Octanes (C8+)	114.230	0.005	0.0057	0.023	0.008
Nonanes (C9+)	128.260	0.001	0.0013	0.005	0.002
Decanes (C10+)	142.290	0.001	0.0014	0.006	0.002
Total		100.000	24.9825	100.000	**Total** 37.165
Vapor MW (lb/lb-mol)		**24.983**	-	-	**VOC Total** 12.447
VOC (%)		**16.745**	**-**	**33.492**	**HAPs Total** 0.063

Rivers Edge Compressor Station
Engine Emissions

Equipment Data:

Emission Unit (EU):	**C1, C2, C3, C4**
Emission Unit Name:	Waukesha L5794
Engine Type:	4SRB

Emissions Data:

Fuel Usage =	60.525	MMscf/yr (Calculated value based on max fuel combustion rate)
Horsepower =	1,380	bhp
Speed =	1,200	rpm
Hours of Operation =	8,760	hr/yr
Max. Fuel Combustion Rate (HHV) =	7,510	Btu/bhp-hr
Fuel Heating Value (HHV) =	1,500	MMBtu/MMscf
Max. Heat Rate (HHV) =	10.36	MMBtu/hr

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM_{10}	0.01941	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	0.20	0.88
NOx	1.0	g/bhp-hr	NSPS Subpart JJJJ	3.04	13.33
CO	1.0	g/bhp-hr	Vendor Data	3.04	13.33
SOx	5.88E-04	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	0.01	0.03
VOC	0.7	g/bhp-hr	NSPS Subpart JJJJ	2.16	9.46
Total HAPs			Engine Vendor/AP-42	0.09	0.40
Formaldehyde	0.010	g/bhp-hr	Vendor Data	0.03	0.13
Pollutant	**Emission Factor**	**Units**	**Emission Factor Reference**	**Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO_2e	--	--	--	1,204	5,274
GHG	--	--	--	1,142	5,004
CO_2	110	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	1,140	4,993
CH_4	0.23	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	2.38	10.44
N_2O	2.2	lb/MMscf	AP-42 Table 1.4-2 (07/00)	0.02	0.07

Notes:
1. NO_x and VOC emissions based on 40 CFR 60 Subpart JJJJ standards. CO emissions based on data from the catalyst vendor indicating a post-catalyst emission rate of 1.0 g/hp-hr. Formaldehyde emissions are based on manufacturer data. PM/PM_{10} and SO_2 emissions based on AP-42 Table 3.2-3.
1. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.
2. 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 (10.36 MMBtu/hr) x (8,760 hr/yr) / (2,000 lb/ton) = 0.88 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) = (0.7 g/bhp-hr) x (1380 bhp) x (8,760 hr/yr) / (2,000 lb/ton) / (453.59 g/lb) = 9.46 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) = ((4993.28 ton/yr x 1) + (10.44 ton/yr x 25) + (0.07 ton/yr x 298)) = 5274.13 ton/yr

GHG Emissions (ton/yr) = (CO_2 emissions) + (CH_4 emissions) + (N_2O emissions)

GHG Emissions (ton/yr) = (4993.28 ton/yr) + (10.44 ton/yr) + (0.07 ton/yr) = 5003.79 ton/yr

Rivers Edge Compressor Station
Compressor Engine HAP Emissions

Engines	Horsepower (hp)	Operating Hours	Heat Input (MMBtu/yr)	Fuel Input (MMscf/yr)
C1, C2, C3, C4	1,380	8,760	90,787	60.525

HAP	Emission Factor (lb/MMBtu)	Emission Factor (g/bhp-hr)	Control Efficiency (%)	Total Emissions (tpy)
1,3-Butadiene	6.63E-04	--	50	0.0150
Acetaldehyde	2.79E-03	--	50	0.0633
Acrolein	2.63E-03	--	50	0.06
Benzene	1.58E-03	--	50	0.0359
Formaldehyde	--	0.01	0	0.13
Methanol	3.06E-03	--	50	0.0695
Toluene	5.58E-04	--	50	0.0127
Total HAP Emissions				**0.40**

1. Emission factors from AP-42 Table 3.2-3, Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines (July 2000) and AP-42 Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion (July 1998).

2. Formaldehyde emission factor is from manufacturer's information.

3. Control efficiency is based on catalyst vendor specifications.

Rivers Edge Compressor Station
Glycol Reboiler Emissions

Equipment Data:

Emission Unit (EU):	**EU5**
Emission Unit Name:	TEG Reboiler
Rating:	0.5 MMBtu/hr

Emissions Data:

Maximum Fuel Usage =	2.92	MMscf/yr	(Calculated value based on max fuel combustion rate)
Maximum Fuel Usage =	0.0003	MMscf/hr	
Hours of Operation =	8,760	hr/yr	
design Heat Input Rate =	0.50	MMBtu/hr	
Fuel Heating Value (HHV) =	1,500	MMBtu/MMscf	
Unit Conversion:	2000	lb/ton	
Unit Conversion:	2.2	lb/kg	

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM_{10}	7.6	lb/MMscf	AP-42	0.004	0.02
NOx	100	lb/MMscf	AP-42	0.03	0.15
CO	84	lb/MMscf	AP-42	0.03	0.12
SOx	0.6	lb/MMscf	AP-42	0.0003	0.001
VOC	5.5	lb/MMscf	AP-42	0.003	0.01
Pollutant	**Emission Factor**	**Units**	**Emission Factor Reference**	**Hourly Emissions (lb/hr)**	**Annual Emissions (tons/yr)**
CO_2e	--	--	--	58.09	254.45
GHG	--	--	--	55.12	241.41
CO_2	110	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	55.00	240.90
CH_4	0.23	lb/MMBtu	AP-42 Table 3.2-3 (07/00)	0.12	0.504
N_2O	2.2	lb/MMscf	AP-42 Table 1.4-2 (07/00)	0.001	0.003

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) = (0.5 MMBtu/hr) / (1500 MMBtu/MMscf) x (8,760 hr/yr) = 2.92 MMscf/yr

PM_{10} 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_{10} Emissions (lb/hr) = (7.6 lb/MMscf) x (1500 MMBtu/scf) / (1,020 MMBtu/MMscf) x (7.6 MMscf/yr) / (8760 hr/yr) = 0.004 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) = (0.004 lb/hr) x (8760 hr/yr) / (2000 lb/ton) = 0.02 ton/yr

Rivers Edge Compressor Station
Glycol Reboiler HAPs Emissions

TEG Reboiler - 0.5 MMBtu/hr

HAP Emissions

Equipment	Heat Input Rate (MMBtu/hr)	Fuel Consumption (MMscf/yr)
Rating:	0.50	2.92

HAP	Emission Factor[1] (lb/MMscf)	Control Efficiency (%)	Emissions (tpy) (Uncontrolled)
2-Methylanpthalene	2.40E-05	0%	3.50E-08
3-Methylchloranthrene	1.80E-06	0%	2.63E-09
7,12-Dimethylben(a)anthracene	1.60E-05	0%	2.34E-08
Acenapthene	1.80E-06	0%	2.63E-09
Acenapthylene	1.80E-06	0%	2.63E-09
Anthracene	2.40E-06	0%	3.50E-09
Benz(a)anthracene	1.80E-06	0%	2.63E-09
Benzene	2.10E-03	0%	3.07E-06
Benzo(a)pyrene	1.20E-06	0%	1.75E-09
Benzo(b)fluorathene	1.80E-06	0%	2.63E-09
Benzo(g,h,i)perylene	1.20E-06	0%	1.75E-09
Benzo(k)fluorathene	1.80E-06	0%	2.63E-09
Chrysene	1.80E-06	0%	2.63E-09
Dibenzo(a,h)anthracene	1.20E-06	0%	1.75E-09
Dichlorobenzene	1.20E-03	0%	1.75E-06
Fluoranthene	3.00E-06	0%	4.38E-09
Fluorene	2.80E-06	0%	4.09E-09
Formaldehyde	7.50E-02	0%	1.10E-04
Hexane	1.80E+00	0%	2.63E-03
Indeno(1,2,3-cd)pyrene	1.80E-05	0%	2.63E-08
Napthalene	6.10E-04	0%	8.91E-07
Phenanathrene	1.70E-05	0%	2.48E-08
Pyrene	5.00E-06	0%	7.30E-09
Toluene	3.40E-03	0%	4.96E-06
HAP	**Emission Factor[2] (lb/MMscf)**	**Control Efficiency (%)**	**Emissions (tpy) (Uncontrolled)**
Arsenic	2.04E-04	0%	2.98E-07
Beryllium	1.20E-05	0%	1.75E-08
Cadmium	1.10E-03	0%	1.61E-06
Chromium	1.40E-03	0%	2.04E-06
Cobalt	8.40E-05	0%	1.23E-07
Manganese	3.80E-04	0%	5.55E-07
Mercury	2.60E-04	0%	3.80E-07
Nickel	2.10E-03	0%	3.07E-06
Selenium	2.40E-05	0%	3.50E-08
Total HAP Emissions			**0.003**

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).

Hiland Partners Holdings LLC
Rivers Edge Compressor Station
Fugitive Emissions

Component Type	Service	Emission Factor [1] (lb/hr/comp)	Component Count	Total Loss (lb/hr)	Total Loss (tpy)
Valves	Gas/Vapor	0.00992	73	0.724	3.172
	Light Liquid	0.0055	29	0.160	0.699
Pumps	Gas Vapor	0.00529	0	0.000	0.000
	Light Liquid	0.02866	1	0.029	0.126
Flanges [2]	Gas/Vapor	0.00086	1311	1.127	4.938
	Light Liquid	0.000243	60	0.015	0.064
Connectors	Gas/Vapor	0.00044	0	0.000	0.000
	Light Liquid	0.000463	0	0.000	0.000
Open Ended Lines	Gas/Vapor	0.00441	0	0.000	0.000
	Light Liquid	0.00309	0	0.000	0.000
Other [3]	Gas/Vapor	0.0194	0	0.000	0.000
	Light Liquid	0.0165	0	0.000	0.000
Compressors	Gas/Vapor	0.0194	4	0.078	0.340
	Light Liquid	0.0165	0	0.000	0.000
Component Emission Total Losses				2.132	9.338
Gas/Vapor Emissions				1.929	8.450
Light Liquid Emissions				0.203	0.888

Component	Gas (wt%)	Gas/Vapor Emissions		Total Emissions [4]	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)
Carbon Dioxide	1.591	0.031	0.134	0.031	0.134
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000
Nitrogen	2.593	0.050	0.219	0.050	0.219
Methane (C1)	38.899	0.750	3.287	0.750	3.287
Ethane (C2)	23.426	0.452	1.979	0.452	1.979
Propane (C3)	19.689	0.380	1.664	0.380	1.664
iso-Butane (C4)	2.471	0.048	0.209	0.048	0.209
nor-Butane (C4)	7.766	0.150	0.656	0.150	0.656
iso-Pentane (C5)	1.328	0.026	0.112	0.026	0.112
nor-Pentane	1.614	0.031	0.136	0.031	0.136
Cyclopentane	0.012	0.000	0.001	0.000	0.001
n-Hexane	0.110	0.002	0.009	0.002	0.009
Cyclohexane	0.041	0.001	0.003	0.001	0.003
Other Hexanes	0.176	0.003	0.015	0.003	0.015
Heptanes (C7+)	0.184	0.004	0.016	0.004	0.016
Methylcyclohexane	0.007	0.000	0.001	0.000	0.001
2,2,4 Trimethyl pentane	0.003	0.000	0.000	0.000	0.000
Benzene	0.025	0.000	0.002	0.000	0.002
Toluene	0.022	0.000	0.002	0.000	0.002
Ethylbenzene	0.000	0.000	0.000	0.000	0.000
Xylenes (M, P, O)	0.008	0.000	0.001	0.000	0.001
Octanes (C8+)	0.023	0.000	0.002	0.000	0.002
Nonanes (C9+)	0.005	0.000	0.000	0.000	0.000
Decanes (C10+)	0.006	0.000	0.000	0.000	0.000
Total	**100.000**	**1.929**	**8.450**	**2.132**	**9.338**
Total VOC	**33.492**	**0.646**	**2.830**	**0.849**	**3.718**
Total HAPs	**0.169**	**0.003**	**0.014**	**0.003**	**0.014**

Notes:
1. Emission factors are from EPA's "Protocol for Equipment Leak Emission Estimates" EPA-453/R-95-017, 11/1995, Table 2-4.
2. Maintenance Plugs & Blind Flanges are treated as screwed connectors. Per TCEQ's "Air Permit Technical Guidance for Chemical
3. For Oil and Gas Production Operations, "Other" includes compressors, diaphrams, drains, dump arms, hatches, instruments,
4. The total emissions include the light liquid emissions assuming 100% VOC of light liquid.
5. Water/Oil emissions are assumed to be 100% VOC.

Rivers Edge Compressor Station
Gas Analysis

Sample name	Gas Taken Before Dehydrator			
Sample location	Rivers Edge Compressor Station			
Sample temperature and pressure	130 °F, 1050 psig			
Date of sample	11/3/2022			
Specific Gravity	0.86259			
Component	**MW (g/mol)**	**Mole %**	**Gas Weight (lb/lbmol)**	**Weight %**
Carbon Dioxide	44.010	0.903	0.397	1.591
Hydrogen Sulfide	34.082	0.000	0.000	0.000
Nitrogen	28.013	2.312	0.648	2.593
Methane (C1)	16.042	60.577	9.718	38.899
Ethane (C2)	30.069	19.463	5.852	23.426
Propane (C3)	44.096	11.155	4.919	19.689
iso-Butane (C4)	58.122	1.062	0.617	2.471
nor-Butane (C4)	58.122	3.338	1.940	7.766
iso-Pentane (C5)	72.149	0.460	0.332	1.328
nor-Pentane	72.149	0.559	0.403	1.614
Cyclopentane	72.149	0.004	0.003	0.012
n-Hexane	86.180	0.032	0.028	0.110
Cyclohexane	86.180	0.012	0.010	0.041
Other Hexanes	86.180	0.051	0.044	0.176
Heptanes (C7+)	100.200	0.046	0.046	0.184
Methylcyclohexane	86.180	0.002	0.002	0.007
2,2,4 Trimethyl pentane	72.149	0.001	0.001	0.003
Benzene	78.110	0.008	0.006	0.025
Toluene	92.140	0.006	0.006	0.022
Ethylbenzene	106.170	0.000	0.000	0.000
Xylenes (M, P, O)	106.170	0.002	0.002	0.008
Octanes (C8+)	114.230	0.005	0.006	0.023
Nonanes (C9+)	128.260	0.001	0.001	0.005
Decanes (C10+)	142.290	0.001	0.001	0.006
Total		100.000	24.9825	100.0000
Vapor MW (lb/lb-mol)		**24.983**		
VOC Weight (%)		**33.4916**		
HAPs Weight (%)		**0.1689**		

NGL Truck Loading Emissions

Description	Designation	Volume	Pressure	Number of Events	Gas VOC Weight %	Gas MW	Average Gas Temperature	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Estimated VOC Emissions		
		(ft^3)	(psig)	(#/ per Year)	(%)	(lb/lb-mol)	(°F)				lb/scf	lb/year	tons per year
NGL Truck Loading Line	NGL Disconnect and Vapor Disconnect	0.090	250	1,622	100.0	97	60	0.0018	1.8	2920	0.26	746	0.37
												Total Gas VOC	**0.37**

Notes:
1. Approximately 10 inches of 2 inch diameter pipe for liquid connection from tanker truck to NGL tank. Assume 24 inches of pipe when calculating volume.
2. Approximately 10 inches of 2 inch diameter pipe for vapor connection from tanker truck to NGL tank. Assume 24 inches of pipe when calculating volume.
3. Average pressure in tank is approximately 30 psig to 50 psig. As a conservative measure, assume 250 psig.
4. Assume Gas/Vapor Weight percent equals 100 %.
5. As a conservative measure, assume Vapor Molecular Weight is 97 lb/lb-mol by assuming all Hexanes+ as Decanes.

Liquid DisConnect - 24 inches of 2 inch pipe =	0.044	cubic feet of pipe	
Vapor DisConnect - 24 inches of 2 inch pipe =	0.044	cubic feet of pipe	
Total (Liquids + Vapor) =	0.09		
Expected Max NGL Daily Volume =	40,000	gal/day	Maximum with 20 % safety factor
Expected Max NGL Annual Volume =	14,600,000	gal/yr	
Average Tank Truck Capacity =	9,000	gal	
Number of Annual Truck Loads =	1622	truckloads per year	

Molecular Weight of Gas = 97
VOC Weight Percent = 100%
Universal Gas Content = 379.5 ft^3/lb-mol @ 60 F and 14.696 psia

Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf
Emissions (tpy) = (Estimated scf/event * number of events per year * lb/scf)/2000 (lb/ton)

Gas lbs /scf = 0.26

NGL Gasoline Tank	MW (g/mol)	Mol%	Gas Weight (lb/lbmol)
Nitrogen	28.013	0	0.000
Methane	16.042	0	0.000
Carbon Dioxide	44.01	0	0.000
Ethane	30.069	0	0.000
Propane	44.096	0	0.000
i-Butane	58.122	0	0.000
n-Butane	58.122	3.221	1.872
i-Pentane	72.149	24.4	17.604
n-Pentane	72.149	36.565	26.381
Hexanes+*	142.29	35.814	50.960
		MW =	**96.817**

** To be conservative, assume MW Decanes rather than MW Hexanes in calculation of NGL Molecular Weight.*

Rivers Edge Compressor Station
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.

APPENDIX A: 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 520-663-4249	E-mail Address anu_pundari@kindermorgan.com
Contact Person for Air Pollution Matters Anu Pundari		
Title Sr. Engineer	Telephone Number 520-663-4249	E-mail Address anu_pundari@kindermorgan.com
Mailing Address (Street & No.) 5151 E. Broadway, Suite 1680		
City Tucson	State AZ	ZIP Code 85711
Facility Name Rivers Edge Compressor Station		
Facility Address (Street & No.) Approximately 10 miles southwest of Williston, ND		
City Williston	State ND	ZIP Code 58801

County McKenzie	Latitude (Nearest Second) 47.992749	Longitude (Nearest Second) -103.711397

Legal Description of Facility Site

Quarter NW	Quarter NW	Section 14	Township 152N	Range 102W

Land Area at Facility Site 6 Acres (or) Sq. Ft.	MSL Elevation at Facility 2200

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	213112	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 October 2023	Planned End Construction Date November 2023

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
C1	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
C2	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
C3	Compressor Engine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
C4	New Compressor Engine	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
5	TEG Reboiler	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
6	TEG Dehydrator	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
7	Produced Water Tank	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
8	Produced Water Tank	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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
	NSPS OOOOa - Reciprocating Compressors
1,2,3,4	NSPS JJJJ - Compressor Engines
6	MACT HH - TEG Still Vent
1,2,3,4	MACT ZZZZ - Compressor Engines

SECTION E – TOTAL POTENTIAL EMISSIONS

Pollutant	Amount (Tons Per Year)
NO_x	53.45
CO	53.43
PM	3.54

Pollutant	Amount (Tons Per Year)
PM_{10} (filterable and condensable)	3.54
$PM_{2.5}$ (filterable and condensable)	3.54
SO_2	0.11
VOC	63.97
GHG (as CO_2e)	20257
Largest Single HAP	0.53
Total HAPS	1.86

*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.	Application	4.	Gas Analysis
2.	Emission Calculations	5.	GRI-GLY Calc Reports
3.	Engine Specifications	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 Pundari	8/10/2023

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	Rivers Edge Compressor Station

SECTION B – FACILITY AND UNIT INFORMATION

Source ID Number (From form SFN 8516)		
C1 and C2 and C3 and C4		
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	L5794GSI	Post July 2007

Reciprocating Internal Combustion Engine

■ Spark Ignition ☐ Compression Ignition

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

Maximum Rating (BHP @ rpm)	Operating Capacity (BHP @ rpm)
1380 @ 1200 rpm	1380 @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
10.36	1380		

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
60.525 MMscf/year	Neglible	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)	
EU1 and EU2 and EU3		1.5 X Building Height (approximately 40.50 feet)	
Stack Diameter (feet at top)	Gas Discharged (SCFM)	Exit Temp (°F)	Gas Velocity (FPS)
1.125 approx	6179	1149	

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	3.04	13.33	NSPS JJJJ Standard
CO	3.04	13.33	Vendor Guarantee
PM	0.20	0.88	AP-42 Table 3.2-3
PM_{10} (filterable and condensable)	0.20	0.88	AP-42 Table 3.2-3
$PM_{2.5}$ (filterable and condensable)	0.20	0.88	AP-42 Table 3.2-3
SO_2	0.01	0.03	AP-42 Table 3.2-3
VOC	2.16	9.46	NSPS JJJJ Standard
GHG (as CO_2e)	1204	5274	AP-42 Table 3.2-3
Largest Single HAP	0.03	0.13	Vendor Data
Total HAPS	0.09	0.40	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 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	Rivers Edge Compressor Station

Source ID No. of Equipment being Controlled
C4

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
MAXIM		upon startup

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

Pollutants Removed	NOx	CO		
Design Efficiency (%)	92.8%	88.6%		
Operating Efficiency (%)	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)				6179
Gas Temperature (°F)				1,149
Gas Pressure (in. H_2O)				
Gas Velocity (ft/sec)				
Pollutant Concentration (Specify Pollutant and Unit of Concentration)	Pollutant	Unit of Concentration		
	NOx	g/bhp-hr	13.9	1.0
	CO	g/bhp-hr	8.8	1.0

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

PERMIT APPLICATION FOR HAZARDOUS AIR POLLUTANT (HAP) SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8329 (3-2019)

SECTION A1 - APPLICANT INFORMATION

Name of Firm or Organization Hiland Partners Holdings LLC		
Applicant's Name Anu Pundari		
Title Engineer	Telephone Number 713-420-6225	E-mail Address anu_pundari@kindermorgan.com
Mailing Address (Street & No.) 1001 Louisiana St, Suite 1000		
City Houston	State TX	ZIP Code 77002

SECTION A2 - FACILITY INFORMATION

Contact Person for Air Pollution Matters Anu Pundari		
Title Engineer	Telephone Number 713-420-6225	E-mail Address anu_pundari@kindermorgan.com
Facility Address (Street & No. or Lat/Long to Nearest Second) 47.992749 Lat and -103.711397 Long		
City Williston	State ND	ZIP Code 58801
County McKenzie	Number of Employees at Location 0	
Land Area at Plant Site 6 Acres (or) _____ Sq. Ft.	MSL Elevation at Plant 2200	

Describe Nature of Business/Process Natural gas compressor station

SECTION B – STACK DATA

Inside Diameter (ft) 1.125 approx	Height Above Grade (ft) approximately 40.50	
Gas Temperature at Exit (°F) 1149	Gas Velocity at Exit (ft/sec)	Gas Volume (scfm) 6179
Basis of any Estimates (attach separate sheet if necessary)		
Are Emission Control Devices in Place? If YES – Complete SFN 8532	(•) Yes	( ) No
Nearest Residences or Building Residence	Distance (ft) ~2640	Direction South of station
Nearest Property Line	Distance (ft)	Direction

SECTION C – EMISSION STREAM DATA

Source ID No. From SFN 8516 C4	Mean Particle Diameter (um)
Flow Rate (scfm) 6179	Drift Velocity (ft/sec)
Stream Temperature (°F) 1149	Particulate Concentration (gr/dscf)
Moisture Content (%)	Halogens or Metals Present?
Pressure (in. Hg)	Organic Content (ppmv)
Heat Content (Btu/scfm) 1500	O_2 Content (%)

SECTION D – POLLUTANT SPECIFIC DATA
(Complete One Box for Each Pollutant in Emission Stream)

Pollutant Emitted Formaldehyde	Chemical Abstract Services (CAS) Number 50-00-0
Proposed Emission Rate (lb/hr) 0.03	Emission Source (describe) 1380 hp Compressor Engine
Source Classification (process point, process fugitive, area fugitive) Process point	Pollutant Class and Form (organic/inorganic - particulate/vapor) Organic-vapor
Concentration in Emission Stream (ppmv)	Vapor Pressure (in. Hg @ °F) 3890 mm Hg at 25 degrees C
Solubility >100 g/100 ml (20 degrees C)	Molecular Weight (lb/lb-mole) 30
Absorptive Properties	

Pollutant Emitted	Chemical Abstract Services (CAS) Number
Proposed Emission Rate (lb/hr)	Emission Source (describe)
Source Classification (process point, process fugitive, area fugitive)	Pollutant Class and Form (organic/inorganic - particulate/vapor)
Concentration in Emission Stream (ppmv)	Vapor Pressure (in. Hg @ °F)
Solubility	Molecular Weight (lb/lb-mole)
Absorptive Properties	

(Add additional pages if necessary)

Signature of Applicant 	Date 8/8/2023

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 GLYCOL DEHYDRATION UNITS

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 58923 (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	Rivers Edge Compressor Station

SECTION B - 40 CFR 63, SUBPART HH APPLICABILITY DETERMINATION

The facility is a (check one): ☐ major, or ■ area source of hazardous air pollutants (HAP) as defined in §63.761. Attach calculations showing expected HAP emissions in accordance with §63.760(a)(1).

The facility (check all that apply):

■ Processes, upgrades or stores hydrocarbon liquids prior to the point of custody transfer.

■ Processes, upgrades or stores natural gas prior to the point at which natural gas enters the transmission and storage source category or is delivered to a final end user.

Identify the 40 CFR 63 Subpart HH (MACT HH) affected source:

☐ Glycol (ethylene, diethylene, or triethylene) dehydration unit & associated equipment (located at a major source), or

■ Tryiethylene glycol (TEG) dehydration unit (located at an area source)

The facility is exempt from MACT HH because it:

☐ Is a qualifying black oil facility, or

☐ Is a major source facility, prior to the point of custody transfer, with a facility-wide actual annual average natural gas throughout less than 18.4 thousand standard cubic meters per day and a facility-wide actual annual average hydrocarbon liquid throughput less than 39,700 liters per day.

■ The facility is not exempt from MACT HH.

SECTION C – EMISSION UNIT INFORMATION

Emission Unit Description	Emission Unit Identifier (EU)	Emission Point Number (EP)	Pollutant*	Emission Rate lb/hr	Emission Rate ton/yr	Air Pollution Control Equipment
TEG Still Vent	6	6	VOC	0.11	0.49	Condenser and reboiler firebox.
TEG Still Vent	6	6	HAPs	0.04	0.16	Condenser and reboiler firebox.
TEG Still Vent	6	6	BTEX	0.04	0.16	Condenser and reboiler firebox.

* *Includes an estimate of greenhouse gas emissions (CO2e).*

Complete the following for each glycol and triethylene glycol dehydration unit.								
EU	Design Capacity (MMSCFD)	Actual Throughput (MMSCFD)	Gas Pressure (psig)	Gas Temp (°F)	Water Content (lb/MMSCF)		Glycol Recirc. Rate (gal/min)	VOC Emissions (ton/yr)
					Wet Gas	Dry Gas		
6	25	25	1200	100	Saturated	4.0	4.0	0.49

SECTION D – STACK DATA

Inside Diameter (ft) NA	Height Above Grade (ft) NA	Gas Volume (scfm) Unknown
Gas Temperature at Exit (°F) Unknown	Gas Velocity at Exit (ft/sec) Unknown	
Are Emission Control Devices in Place? If YES – Complete SFN 8532	☒ Yes	☐ No
Nearest Residence or Building Residence	Distance (ft) 4224	Direction West
Nearest Property Line	Distance (ft)	Direction

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 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 Holding LLC	Rivers Edge Compressor Station
Source ID No. of Equipment being Controlled 6	

SECTION B – EQUIPMENT

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

Name of Manufacturer	Model Number	Date to Be Installed
Unknown	Unknown	Currently installed at site

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

Pollutants Removed	VOC	HAPs		
Design Efficiency (%)	98 %	98 %		
Operating Efficiency (%)	98 %	98 %		

Describe method used to determine operating efficiency:
GRI-GLY Calc simulation

SECTION CD – GAS CONDITIONS

Gas Conditions			Inlet	Outlet
Gas Volume (SCFM; 68°F; 14.7 psia)				
Gas Temperature (°F)				
Gas Pressure (in. H_2O)				
Gas Velocity (ft/sec)				
Pollutant Concentration (Specify Pollutant and Unit of Concentration)	Pollutant	Unit of Concentration		
	VOC	lb/hr	24.52 uncontrolled	0.49 controlled
	HAPs	lb/hr	8.2 uncontrolled	0.16 controlled
Pressure Drop Through Gas Cleaning Device (in. H_2O)				

PERMIT APPLICATION FOR HAZARDOUS AIR POLLUTANT (HAP) SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8329 (3-2019)

SECTION A1 - APPLICANT INFORMATION

Name of Firm or Organization Hiland Partners Holdings LLC- Rivers Edge Compressor Station		
Applicant's Name Anu Pundari		
Title Senior Engineer	Telephone Number 520-663-4249	E-mail Address anu_pundari@kindermorgan.com
Mailing Address (Street & No.) 5151 E. Broadway, Suite 1680		
City Tucson	State AZ	ZIP Code 85711

SECTION A2 - FACILITY INFORMATION

Contact Person for Air Pollution Matters Anu Pundari		
Title Senior Engineer	Telephone Number 520-663-4249	E-mail Address anu_pundari@kindermorgan.com
Facility Address (Street & No. or Lat/Long to Nearest Second) Located approximately 10 miles southwest of Williston, North Dakota		
City Williston	State ND	ZIP Code 58801
County McKenzie	Number of Employees at Location 0	
Land Area at Plant Site 6 Acres (or) _____ Sq. Ft.	MSL Elevation at Plant 2200	

Describe Nature of Business/Process

Natural gas compressor station

SECTION B – STACK DATA

Inside Diameter (ft) Unknown	Height Above Grade (ft) Unknown	
Gas Temperature at Exit (°F) Unknown	Gas Velocity at Exit (ft/sec) Unknown	Gas Volume (scfm) Unknown
Basis of any Estimates (attach separate sheet if necessary)		
Are Emission Control Devices in Place? If YES – Complete SFN 8532	(•) Yes	( ) No
Nearest Residences or Building Residence	Distance (ft) 2640 (0.5 mile)	Direction South of station
Nearest Property Line	Distance (ft)	Direction

SECTION C – EMISSION STREAM DATA

Source ID No. From SFN 8516 6 and 7	Mean Particle Diameter (um) Unknown
Flow Rate (scfm) Unknown	Drift Velocity (ft/sec) Unknown
Stream Temperature (°F) Unknown	Particulate Concentration (gr/dscf) Unknown
Moisture Content (%) Unknown	Halogens or Metals Present? Unknown
Pressure (in. Hg) Unknown	Organic Content (ppmv) Unknown
Heat Content (Btu/scfm) Unknown	O_2 Content (%) Unknown

SECTION D – POLLUTANT SPECIFIC DATA
(Complete One Box for Each Pollutant in Emission Stream)

Pollutant Emitted Benzene	Chemical Abstract Services (CAS) Number 71-43-2
Proposed Emission Rate (lb/hr) 0.015	Emission Source (describe) Dehydrator Still Vent
Source Classification (process point, process fugitive, area fugitive) Process point	Pollutant Class and Form (organic/inorganic - particulate/vapor) Organic
Concentration in Emission Stream (ppmv) Unknown	Vapor Pressure (in. Hg @ °F) 166 mm Hg
Solubility 0.18 g/100mL	Molecular Weight (lb/lb-mole) 78.11
Absorptive Properties Unknown	

Pollutant Emitted	Chemical Abstract Services (CAS) Number
Proposed Emission Rate (lb/hr)	Emission Source (describe)
Source Classification (process point, process fugitive, area fugitive)	Pollutant Class and Form (organic/inorganic - particulate/vapor)
Concentration in Emission Stream (ppmv)	Vapor Pressure (in. Hg @ °F)
Solubility	Molecular Weight (lb/lb-mole)
Absorptive Properties	

(Add additional pages if necessary)

Signature of Applicant 	Date 8/8/23

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

APPENDIX B: GRI-GLYCalc REPORTS

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Rivers Edge CS August 2023 Permit Revision
File Name: Z:\Rivers Edge\Permits\2023 August Permit Revision\Dehydrator\Rivers Edge August 2023.ddf
Date: August 08, 2023

DESCRIPTION:

Description: Update from 20 MMSCFD to 25 MMSCFD

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 100.00 deg. F
Pressure: 1200.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.9030
Nitrogen	2.3120
Methane	60.5770
Ethane	19.4630
Propane	11.1550
Isobutane	1.0620
n-Butane	3.3380
Isopentane	0.4600
n-Pentane	0.5590
Cyclopentane	0.0040
n-Hexane	0.0320
Cyclohexane	0.0120
Other Hexanes	0.0510
Heptanes	0.0460
Methylcyclohexane	0.0020
2,2,4-Trimethylpentane	0.0010
Benzene	0.0080
Toluene	0.0060
Xylenes	0.0020
C8+ Heavies	0.0100

DRY GAS:

Flow Rate: 25.0 MMSCF/day
Water Content: 4.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Flow Rate: 4.0 gpm

PUMP:

Glycol Pump Type: Electric/Pneumatic

FLASH TANK:

Flash Control: Recycle/recompression
Temperature: 180.0 deg. F
Pressure: 55.0 psig

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Rivers Edge CS August 2023 Permit Revision
File Name: Z:\Rivers Edge\Permits\2023 August Permit Revision\Dehydrator\Rivers Edge August 2023.ddf
Date: August 08, 2023

DESCRIPTION:

Description: Update from 20 MMSCFD to 25 MMSCFD

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.2237	5.368	0.9797
Ethane	0.8408	20.180	3.6829
Propane	1.4896	35.749	6.5243
Isobutane	0.2589	6.214	1.1341
n-Butane	1.2030	28.873	5.2693
Isopentane	0.1710	4.104	0.7490
n-Pentane	0.2935	7.043	1.2853
Cyclopentane	0.0180	0.432	0.0788
n-Hexane	0.0322	0.773	0.1410
Cyclohexane	0.0978	2.347	0.4284
Other Hexanes	0.0361	0.867	0.1583
Heptanes	0.1020	2.448	0.4468
Methylcyclohexane	0.0171	0.410	0.0748
2,2,4-Trimethylpentane	0.0007	0.018	0.0032
Benzene	0.7396	17.749	3.2392
Toluene	0.7143	17.143	3.1287
Xylenes	0.3842	9.221	1.6829
C8+ Heavies	0.0406	0.974	0.1777
Total Emissions	6.6631	159.914	29.1844
Total Hydrocarbon Emissions	6.6631	159.914	29.1844
Total VOC Emissions	5.5986	134.366	24.5218
Total HAP Emissions	1.8710	44.904	8.1950
Total BTEX Emissions	1.8381	44.114	8.0508

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	5.8321	139.971	25.5447
Ethane	7.3687	176.848	32.2748
Propane	6.5293	156.702	28.5982

Isobutane	0.8438	20.252	3.6959
n-Butane	3.1554	75.728	13.8204
Isopentane	0.4295	10.308	1.8813
n-Pentane	0.6136	14.726	2.6875
Cyclopentane	0.0098	0.235	0.0428
n-Hexane	0.0422	1.013	0.1849
Cyclohexane	0.0333	0.800	0.1460
Other Hexanes	0.0603	1.448	0.2643
Heptanes	0.0743	1.782	0.3253
Methylcyclohexane	0.0050	0.119	0.0217
2,2,4-Trimethylpentane	0.0010	0.024	0.0044
Benzene	0.0441	1.058	0.1930
Toluene	0.0311	0.745	0.1360
Xylenes	0.0078	0.187	0.0341
C8+ Heavies	0.0216	0.520	0.0948
Total Emissions	25.1028	602.468	109.9504
Total Hydrocarbon Emissions	25.1028	602.468	109.9504
Total VOC Emissions	11.9020	285.648	52.1308
Total HAP Emissions	0.1262	3.028	0.5526
Total BTEX Emissions	0.0829	1.990	0.3632

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:	2.95	lbs. H2O/MMSCF
Temperature:	100.0	deg. F
Pressure:	1200.0	psig
Dry Gas Flow Rate:	25.0000	MMSCF/day
Glycol Losses with Dry Gas:	3.3411	lb/hr
Wet Gas Water Content:	Saturated	
Calculated Wet Gas Water Content:	52.31	lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	4.67	gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	5.64%	94.36%
Carbon Dioxide	99.74%	0.26%
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	99.92%	0.08%
Isopentane	99.93%	0.07%
n-Pentane	99.92%	0.08%
Cyclopentane	99.64%	0.36%
n-Hexane	99.90%	0.10%

Cyclohexane	99.53%	0.47%
Other Hexanes	99.92%	0.08%
Heptanes	99.86%	0.14%
Methylcyclohexane	99.59%	0.41%
2,2,4-Trimethylpentane	99.94%	0.06%
Benzene	95.43%	4.57%
Toluene	95.09%	4.91%
Xylenes	93.27%	6.73%
C8+ Heavies	99.87%	0.13%

FLASH TANK

Flash Control: Recycle/recompression
Flash Temperature: 180.0 deg. F
Flash Pressure: 55.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.80%	0.20%
Carbon Dioxide	24.30%	75.70%
Nitrogen	3.59%	96.41%
Methane	3.69%	96.31%
Ethane	10.24%	89.76%
Propane	18.58%	81.42%
Isobutane	23.48%	76.52%
n-Butane	27.60%	72.40%
Isopentane	28.83%	71.17%
n-Pentane	32.69%	67.31%
Cyclopentane	64.96%	35.04%
n-Hexane	43.55%	56.45%
Cyclohexane	75.39%	24.61%
Other Hexanes	38.08%	61.92%
Heptanes	58.08%	41.92%
Methylcyclohexane	78.41%	21.59%
2,2,4-Trimethylpentane	43.08%	56.92%
Benzene	94.66%	5.34%
Toluene	96.16%	3.84%
Xylenes	98.27%	1.73%
C8+ Heavies	69.39%	30.61%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	39.69%	60.31%
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	1.73%	98.27%

n-Pentane	1.53%	98.47%
Cyclopentane	0.77%	99.23%
n-Hexane	1.15%	98.85%
Cyclohexane	4.24%	95.76%
Other Hexanes	2.63%	97.37%
Heptanes	0.86%	99.14%
Methylcyclohexane	5.10%	94.90%
2,2,4-Trimethylpentane	3.48%	96.52%
Benzene	5.28%	94.72%
Toluene	8.22%	91.78%
Xylenes	13.18%	86.82%
C8+ Heavies	17.32%	82.68%

STREAM REPORTS:

WET GAS STREAM

Temperature: 100.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 1.04e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.10e-001	5.46e+001
Carbon Dioxide	9.02e-001	1.09e+003
Nitrogen	2.31e+000	1.78e+003
Methane	6.05e+001	2.67e+004
Ethane	1.94e+001	1.61e+004
Propane	1.11e+001	1.35e+004
Isobutane	1.06e+000	1.70e+003
n-Butane	3.33e+000	5.33e+003
Isopentane	4.59e-001	9.11e+002
n-Pentane	5.58e-001	1.11e+003
Cyclopentane	4.00e-003	7.70e+000
n-Hexane	3.20e-002	7.57e+001
Cyclohexane	1.20e-002	2.77e+001
Other Hexanes	5.09e-002	1.21e+002
Heptanes	4.59e-002	1.27e+002
Methylcyclohexane	2.00e-003	5.39e+000
2,2,4-Trimethylpentane	9.99e-004	3.14e+000
Benzene	7.99e-003	1.72e+001
Toluene	5.99e-003	1.52e+001
Xylenes	2.00e-003	5.83e+000
C8+ Heavies	9.99e-003	4.68e+001
Total Components	100.00	6.87e+004

DRY GAS STREAM

Temperature: 100.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 1.04e+006 scfh

Component	Conc.	Loading

	(vol%)	(lb/hr)
Water	6.23e-003	3.08e+000
Carbon Dioxide	9.01e-001	1.09e+003
Nitrogen	2.31e+000	1.78e+003
Methane	6.06e+001	2.67e+004
Ethane	1.95e+001	1.61e+004
Propane	1.12e+001	1.35e+004
Isobutane	1.06e+000	1.69e+003
n-Butane	3.34e+000	5.32e+003
Isopentane	4.60e-001	9.11e+002
n-Pentane	5.59e-001	1.11e+003
Cyclopentane	3.99e-003	7.68e+000
n-Hexane	3.20e-002	7.57e+001
Cyclohexane	1.19e-002	2.76e+001
Other Hexanes	5.10e-002	1.21e+002
Heptanes	4.59e-002	1.26e+002
Methylcyclohexane	1.99e-003	5.37e+000
2,2,4-Trimethylpentane	1.00e-003	3.14e+000
Benzene	7.64e-003	1.64e+001
Toluene	5.71e-003	1.44e+001
Xylenes	1.87e-003	5.44e+000
C8+ Heavies	9.99e-003	4.67e+001
Total Components	100.00	6.86e+004

LEAN GLYCOL STREAM

Temperature: 100.00 deg. F
Flow Rate: 4.00e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	2.22e+003
Water	1.50e+000	3.38e+001
Carbon Dioxide	1.25e-011	2.82e-010
Nitrogen	2.39e-012	5.38e-011
Methane	9.04e-018	2.03e-016
Ethane	1.72e-007	3.87e-006
Propane	1.45e-008	3.26e-007
Isobutane	1.47e-009	3.31e-008
n-Butane	4.80e-009	1.08e-007
Isopentane	1.34e-004	3.02e-003
n-Pentane	2.02e-004	4.56e-003
Cyclopentane	6.20e-006	1.40e-004
n-Hexane	1.66e-005	3.74e-004
Cyclohexane	1.93e-004	4.34e-003
Other Hexanes	4.33e-005	9.75e-004
Heptanes	3.93e-005	8.86e-004
Methylcyclohexane	4.08e-005	9.18e-004
2,2,4-Trimethylpentane	1.18e-006	2.66e-005
Benzene	1.83e-003	4.12e-002
Toluene	2.84e-003	6.40e-002
Xylenes	2.59e-003	5.83e-002
C8+ Heavies	3.77e-004	8.50e-003
Total Components	100.00	2.25e+003

RICH GLYCOL STREAM

Temperature: 100.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 4.18e+000 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.48e+001	2.22e+003
Water	3.65e+000	8.53e+001
Carbon Dioxide	1.21e-001	2.82e+000
Nitrogen	2.30e-002	5.37e-001
Methane	2.59e-001	6.06e+000
Ethane	3.51e-001	8.21e+000
Propane	3.43e-001	8.02e+000
Isobutane	4.72e-002	1.10e+000
n-Butane	1.86e-001	4.36e+000
Isopentane	2.58e-002	6.04e-001
n-Pentane	3.90e-002	9.12e-001
Cyclopentane	1.19e-003	2.79e-002
n-Hexane	3.20e-003	7.48e-002
Cyclohexane	5.79e-003	1.35e-001
Other Hexanes	4.17e-003	9.75e-002
Heptanes	7.58e-003	1.77e-001
Methylcyclohexane	9.81e-004	2.29e-002
2,2,4-Trimethylpentane	7.58e-005	1.77e-003
Benzene	3.53e-002	8.25e-001
Toluene	3.46e-002	8.09e-001
Xylenes	1.93e-002	4.50e-001
C8+ Heavies	3.03e-003	7.07e-002
Total Components	100.00	2.34e+003

FLASH TANK OFF GAS STREAM

Temperature: 180.00 deg. F
Pressure: 69.70 psia
Flow Rate: 3.49e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.03e+000	1.70e-001
Carbon Dioxide	5.27e+000	2.13e+000
Nitrogen	2.01e+000	5.18e-001
Methane	3.95e+001	5.83e+000
Ethane	2.66e+001	7.37e+000
Propane	1.61e+001	6.53e+000
Isobutane	1.58e+000	8.44e-001
n-Butane	5.90e+000	3.16e+000
Isopentane	6.47e-001	4.30e-001
n-Pentane	9.24e-001	6.14e-001
Cyclopentane	1.52e-002	9.78e-003
n-Hexane	5.32e-002	4.22e-002
Cyclohexane	4.31e-002	3.33e-002
Other Hexanes	7.61e-002	6.03e-002
Heptanes	8.06e-002	7.43e-002
Methylcyclohexane	5.48e-003	4.95e-003

2,2,4-Trimethylpentane	9.59e-004	1.01e-003
Benzene	6.13e-002	4.41e-002
Toluene	3.66e-002	3.11e-002
Xylenes	7.98e-003	7.79e-003
C8+ Heavies	1.38e-002	2.16e-002
Total Components	100.00	2.79e+001

FLASH TANK GLYCOL STREAM

Temperature: 180.00 deg. F
Flow Rate: 4.12e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.60e+001	2.22e+003
Water	3.68e+000	8.51e+001
Carbon Dioxide	2.96e-002	6.85e-001
Nitrogen	8.36e-004	1.93e-002
Methane	9.68e-003	2.24e-001
Ethane	3.64e-002	8.41e-001
Propane	6.45e-002	1.49e+000
Isobutane	1.12e-002	2.59e-001
n-Butane	5.21e-002	1.20e+000
Isopentane	7.53e-003	1.74e-001
n-Pentane	1.29e-002	2.98e-001
Cyclopentane	7.85e-004	1.81e-002
n-Hexane	1.41e-003	3.26e-002
Cyclohexane	4.42e-003	1.02e-001
Other Hexanes	1.61e-003	3.71e-002
Heptanes	4.45e-003	1.03e-001
Methylcyclohexane	7.79e-004	1.80e-002
2,2,4-Trimethylpentane	3.30e-005	7.63e-004
Benzene	3.38e-002	7.81e-001
Toluene	3.37e-002	7.78e-001
Xylenes	1.92e-002	4.43e-001
C8+ Heavies	2.12e-003	4.91e-002
Total Components	100.00	2.31e+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

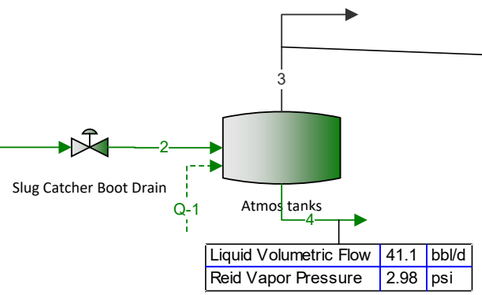
Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 1.14e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.51e+001	5.13e+001

Carbon Dioxide	5.19e-001	6.85e-001
Nitrogen	2.30e-002	1.93e-002
Methane	4.65e-001	2.24e-001
Ethane	9.33e-001	8.41e-001
Propane	1.13e+000	1.49e+000
Isobutane	1.49e-001	2.59e-001
n-Butane	6.91e-001	1.20e+000
Isopentane	7.91e-002	1.71e-001
n-Pentane	1.36e-001	2.93e-001
Cyclopentane	8.56e-003	1.80e-002
n-Hexane	1.25e-002	3.22e-002
Cyclohexane	3.88e-002	9.78e-002
Other Hexanes	1.40e-002	3.61e-002
Heptanes	3.40e-002	1.02e-001
Methylcyclohexane	5.80e-003	1.71e-002
2,2,4-Trimethylpentane	2.15e-004	7.36e-004
Benzene	3.16e-001	7.40e-001
Toluene	2.59e-001	7.14e-001
Xylenes	1.21e-001	3.84e-001
C8+ Heavies	7.95e-003	4.06e-002
Total Components	100.00	5.87e+001

APPENDIX C: PROMAX SIMULATION REPORTS

Cedar Butte Compressor Station
Produced Water Tank Analysis



Liquid Volumetric Flow	41.1	bbl/d
Reid Vapor Pressure	2.98	psi

Cedar Butte Produced Water Tank

Annual tank loss calculations for "To API".
Total working and breathing losses from the Vertical Cylinder are 0.585 ton/yr.
Flashing losses are 0 ton/yr.
.
* Only Non-Exempt VOCs are reported.
Vapor adjusted to ensure mass balance

Names	Units	To API
Water(Mole Fraction)	%	99.5*
Hydrogen Sulfide(Mole Fraction)	%	0*
CO2(Mole Fraction)	%	0.001*
Nitrogen(Mole Fraction)	%	0*
Methane(Mole Fraction)	%	0*
Ethane(Mole Fraction)	%	0*
Propane(Mole Fraction)	%	0*
Isobutane(Mole Fraction)	%	0.001*
n-Butane(Mole Fraction)	%	0.003*
Methanol(Mole Fraction)	%	0.293*
Isopentane(Mole Fraction)	%	0.002*
n-Pentane(Mole Fraction)	%	0.003*
Heptane(Mole Fraction)	%	0.008*
Octane(Mole Fraction)	%	0.013*
Nonane(Mole Fraction)	%	0.005*
Decane(Mole Fraction)	%	0.061*
2-Methylpentane(Mole Fraction)	%	0.002*
3-Methylpentane(Mole Fraction)	%	0.001*
Hexane(Mole Fraction)	%	0.002*
2,2,4-Trimethylpentane(Mole Fraction)	%	0.001*
Benzene(Mole Fraction)	%	0.009*
Toluene(Mole Fraction)	%	0.018*
Ethylbenzene(Mole Fraction)	%	0.001*
m-Xylene(Mole Fraction)	%	0.004*
p-Xylene(Mole Fraction)	%	0.016*
o-Xylene(Mole Fraction)	%	0.007*
TEG(Mole Fraction)	%	0.003*

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)		%

Process Stream	To API	
Tank Geometry	Vertical Cylinder	
Shell Length	12	ft
Shell Diameter	20	ft
Number of Storage Tanks Employed	1	
Location	Villiston, 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	1.32	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	0.58	ton/yr
Working Losses per Tank	0.39	ton/yr
Standing Losses per Tank	0.1938	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	0.3911	0.1938	0.5850
Propane	0.0000	0.0000	0.0000
Isobutane	0.0396	0.0196	0.0592
n-Butane	0.1186	0.0588	0.1774
Methanol	0.0009	0.0004	0.0013
Isopentane	0.0505	0.0250	0.0755
n-Pentane	0.0570	0.0282	0.0852
Heptane	0.0152	0.0075	0.0228
Octane	0.0070	0.0035	0.0105
Nonane	0.0009	0.0004	0.0013
Decane	0.0033	0.0016	0.0049
2-Methylpentane	0.0173	0.0086	0.0259
3-Methylpentane	0.0076	0.0038	0.0114
Hexane	0.0113	0.0056	0.0169
2,2,4-Trimethylpentane	0.0024	0.0012	0.0035
Benzene	0.0282	0.0140	0.0422
Toluene	0.0219	0.0109	0.0328
Ethylbenzene	0.0004	0.0002	0.0006
m-Xylene	0.0014	0.0007	0.0020
p-Xylene	0.0057	0.0028	0.0085
o-Xylene	0.002054	0.001018	0.003071
TEG	5.26E-12	2.61E-12	7.87E-12

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 D: GAS AND LIQUID ANALYSES

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-22987
Date Sampled 10-18-2022
Time Sampled ..... 9:05 AM
Method of Analysis ..... Dual TCD-FID Chromatography

Study Number CR-21
Date Tested 11-3-2022
Time Tested ..... 4:07 PM
Ambient Temp at Sampling ..... 36 F

Sample Identification ..... **GAS TAKEN BEFORE DEHYDRATOR**
RIVERS EDGE COMPRESSOR STATION

Sample Location ..... NORTH DAKOTA
Type Sample ..... SPOT
Effective Date ..... N/A
Sample Pressure ..... 1,050 PSIG
Cylinder ID ..... AMR 562
Instrument Used ..... Shimadzu GC-2014
Sample Method ..... Trap & Purge
Test Method GPA-2286

County ..... McKENZIE
Composite From ..... N/A
Sample Temperature ..... 110 F
Cylinder Heated To ..... 130 F
Calibration Date 11-3-2022
Un-Normalized Total ..... 97.524 %
Sampled By ..... KMI - K. Knutson

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide	0.903	1.591	0.741
Hydrogen Sulfide	0.000	0.000	0.000
Nitrogen	2.312	2.592	1.223
Methane	60.577	38.899	49.379
Ethane	19.463	23.425	25.027
Propane	11.155	19.689	14.777
iso-Butane	1.062	2.471	1.671
n-Butane	3.338	7.766	5.060
iso-Pentane	0.460	1.328	0.809
n-Pentane	0.559	1.614	0.974
Cyclopentane	0.004	0.011	0.006
n-Hexane	0.032	0.110	0.063
Cyclohexane	0.012	0.040	0.020
Other Hexanes	0.051	0.176	0.100
Heptanes	0.046	0.184	0.102
Methylcyclohexane	0.002	0.008	0.004
2,2,4-Trimethylpentane	0.001	0.005	0.002
Benzene	0.008	0.025	0.011
Toluene	0.006	0.022	0.010
Ethylbenzene	0.000	0.000	0.000
Xylenes	0.002	0.008	0.004
Octanes	0.005	0.023	0.012
Nonanes	0.001	0.005	0.003
Decanes +	0.001	0.006	0.003
Totals	**100.000**	**100.000**	**100.000**

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.004	0.011	0.006
Cyclohexane	0.012	0.040	0.020
2-Methylpentane	0.036	0.126	0.072
3-Methylpentane	0.015	0.050	0.029
n-Hexane	0.032	0.110	0.063
Methylcyclohexane	0.002	0.008	0.004
2,2,4-Trimethylpentane	0.001	0.005	0.002
Benzene	0.008	0.025	0.011
Toluene	0.006	0.022	0.010
Ethylbenzene	0.000	0.000	0.000
m-Xylene	0.000	0.001	0.001
p-Xylene	0.001	0.005	0.002
o-Xylene	0.001	0.002	0.001
Hexanes, Total	0.099	0.338	0.189
Heptanes, Total	0.057	0.222	0.119
Octanes, Total	0.013	0.053	0.026
Nonanes, Total	0.001	0.005	0.003
Decanes+, Total	0.001	0.006	0.003

SPECIFIC GRAVITY AT 60/60 F, calculated	0.86259
TOTAL GPM (ETHANE INCLUSIVE)	10.094
CALCULATED BTU / REAL CF AT 14.73 PSIA, dry basis	1440.259
CALCULATED BTU / REAL CF AT 14.73 PSIA, wet basis	1415.454
AVERAGE MOLECULAR WEIGHT	24.983
MOLAR MASS RATIO	0.86259
RELATIVE DENSITY (G x Z (Air) / Z), calculated	0.86700
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF AT 14.696 PSIA, calculated	1429.640
COMPRESSIBILITY FACTOR (Z)	0.99491

ETHANE GPM	5.1918
PROPANE GPM	3.0653
iso-BUTANE GPM	0.3466
n-BUTANE GPM	1.0497
iso-PENTANE GPM	0.1678
n-PENTANE GPM	0.2021
GASOLINE RANGE (HEXANES+) GPM	0.0704

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.

P.O. BOX 2909 (307) 235-4590 PHONE
CASPER, WYOMING 82602 (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-2
Date Tested 9-3-2020

Sample Identification ..... **PRODUCED WATER**
CEDAR BUTTE STATION
Sample Location ..... NORTH DAKOTA
Sample Pressure ..... 120 PSIG
Sample Temperature ..... 45 F
Type Sample ..... SPOT
County ..... N/A
Test Method ..... GPA 2186M
Cylinder ID ..... AMR 066

Components	Mole %	Weight %	Liq. Vol. %
Water	99.546	98.388	97.936
Hydrogen Sulfide	0.000	0.000	0.000
Carbon Dioxide	0.001	0.002	0.003
Nitrogen	0.000	0.000	0.000
Methane	0.000	0.000	0.000
Ethane	0.000	0.000	0.000
Propane	0.000	0.000	0.000
iso-Butane	0.001	0.003	0.006
n-Butane	0.003	0.010	0.016
Methanol	0.293	0.515	0.644
iso-Pentane	0.002	0.008	0.013
n-Pentane	0.003	0.012	0.019
Hexanes	0.003	0.014	0.021
Heptanes	0.008	0.044	0.064
Octanes	0.013	0.081	0.115
Nonanes	0.005	0.035	0.048
Decanes+	0.061	0.554	0.736
Benzene	0.009	0.039	0.043
Toluene	0.018	0.091	0.104
Ethylbenzene	0.001	0.006	0.007
Xylenes	0.027	0.157	0.181
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Glycol	0.003	0.025	0.022
Totals	**100.000**	**100.000**	**100.000**

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
2-Methylpentane	0.002	0.009	0.014
3-Methylpentane	0.001	0.005	0.007
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Benzene	0.009	0.039	0.043
Toluene	0.018	0.091	0.104
Ethylbenzene	0.001	0.006	0.007
m-Xylene	0.004	0.024	0.027
p-Xylene	0.016	0.094	0.108
o-Xylene	0.007	0.039	0.045

API GRAVITY AT 60/60 F, calculated	**10.65**
SPECIFIC GRAVITY AT 60/60 F, calculated	**0.99540**
RELATIVE SPECIFIC GRAVITY OF DECANES+ (C10+) FRACTION, calculated	**0.74899**
AVERAGE MOLECULAR WEIGHT	**18.227**
AVERAGE MOLECULAR WEIGHT OF DECANES+ (C10+) FRACTION, calculated	**165.428**
TRUE VAPOR PRESSURE AT 100 F, PSIA, calculated	**0.964**
AVERAGE BOILING POINT, F, calculated	**214.021**
CUBIC FEET OF GAS / GALLON OF LIQUID, as Ideal Gas, calculated	**172.790**
BTU / GALLON OF LIQUID AT 14.73 PSIA, calculated	**10,876.54**
LBS / GALLON OF LIQUID, calculated	**8.299**

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.

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CERTIFICATE OF ANALYSIS

OXYGENATES IN HYDROCARBON GASES

Company ….. KINDER MORGAN, INC.

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

Study Number ….. CR-2B
Date Tested ….. 9-9-2020

Sample Location ….. CEDAR BUTTE STATION, WATFORD CITY, NORTH DAKOTA.
Sample Pressure ….. 120 PSIG
Sample Type….. SPOT
Test Method ….. ASTM D-7423

Sample Temperature ….. 45 F
County ….. N/A
Sample Container ….. KMI 1087

Component	Concentration, ppm by Volume
Dimethyl Ether (DME)	< 1.0 PPMV
Acetone	45.14 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)	5,148.45 PPMV
Ethyl tert-Butyl Ether (EtBE)	< 1.0 PPMV
Ethyl Alcohol (EtOH)	3.05 PPMV
tert-Amyl Methyl Ether (TAME)	< 1.0 PPMV
iso-Propanol (IPA)	112.58 PPMV
tert-Butyl Alcohol (tBA)	< 1.0 PPMV
n-Propanol (nPA)	8.66 PPMV
sec-Butyl Alcohol	1.93 PPMV
2-Methyl-1-Propanol	< 1.0 PPMV
Butyl Alcohol	4.78 PPMV
Total Glycols (EG, DEG, TEG)	246.31 PPMV
Total Oxygenates	**5,570.90 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.

KINDER MORGAN

Sample Name:	GASOLINE TANK 17 18		
Bill of Lading:	5011715	County	
Bottle #:	18	State	
Analysis By:	DL		
Sample Temp:			
Ambient Temp:			
File Name:	C:\LabSolutions\Data\Frank Gasoline\GASOLINE TANK 17 18 _EXPORT_725202		
Analysis Date:	7/25/2021		
Analysis Time:	2:14:37 AM		
Method:	C:\LabSolutions\Data\Frank Gasoline\Frank Gasoline.gcm		

LP ANALYSIS RESULTS BY GPA 2177-03

COMPONENT	Normalized Mole Percent	Gross Heating Value (BTU/ft3)	Gallons per 1000 cuft	Comp. Vapor Pressure	Relative density (Water)	Specific Gravity	Liq. Vol %
NITROGEN	0.000	0.0	0.00	0.0000	0.80687	0.0000	0.0000
METHANE	0.000	0.0	0.00	0.0000	0.3	0.0000	0.0000
CARBON DIOXIDE	0.000	0.0	0.00	0.0000	0.81716	0.0000	0.0000
ETHANE	0.000	0.0	0.00	0.0000	0.35628	0.0000	0.0000
PROPANE	0.000	0.0	0.00	0.0000	0.50719	0.0000	0.0000
I-BUTANE	0.000	0.0	0.00	0.0000	0.56283	0.0000	0.0000
N-BUTANE	3.221	105.1	1.01	1.6610	0.5842	0.0188	2.6784
I-PENTANE	24.400	976.2	8.91	4.9957	0.62514	0.1525	23.5528
N-PENTANE	36.565	1465.8	13.21	5.6954	0.63071	0.2306	34.9304
HEXANES+	35.814	1703.3	14.69	1.7767	0.66406	0.2378	38.8384
TOTAL	100.00	4250.4	38	14.129	3.5741	0.6398	100.0000

(Z) Factor =	0.9330		
Compressibility (1/Z)=	1.0718		
		BTU per Cu.Ft. @ 14.696 & 60F=	4250.4
Absolute Density lb/gal=	5.3450	(As Ideal Gas)	
CU.FT Vapor per Gal =	26.4381	API Gravity=	89.21239
BTU per GAL Liquid =	112371		
		Specific gravity as vapor=	2.6490
BTU per pound liquid=	21024		
		Vapor Pressure @ 100F=	-0.571
Real Specific Gravity (Air)=	0.6852		

NOTES: REAL VALUES CORRECTED FOR COMPRESSIBILITY
STD CONDITIONS: 14.696 PSIA & SP. GR. @ AIR = 0.9995
GAS CONSTANTS FOR C6+ (C6,C7,C8) ARE FOR N-HEXANE, N-HEPTANE, N-OCTANE
ACCURACY IS TO 1 PART IN 1000 (EXTRA DIGITS FOR ROUNDING)
CALCULATIONS ARE BASED UPON DRY ANALYSIS

APPENDIX E: ENGINE SPECIFICATIONS

Maxim Silencers, Inc.
10635 Brighton Lane
Stafford, Texas 77477
Phone: 832 554-0960
Fax: 832 554-0990

Emission Control Application Data Sheet

Customer: [redacted] Project: [redacted] Date: 8/17/2010

Sales Person: [redacted] Site Elevation: [redacted] ft Contact: [redacted] Order/Quote #: [redacted]

Engine Data:

Engine Model:	Waukesha L5794GSI		Speed:	1200	RPM
Fuel & Operating Type:	Natural Gas Rich Burn		Engine Power:	1380 1029	Hp KW
Exhaust Flow Rate:	6179 10498 9124	acfm m^3/hr lbs/hr	Exhaust Temperature:	1149 621	°F °C

QAC (Quick Access Catalyst) Data:

Number of Cores:	2				
QAC Model:	QAC4-57-12		Inlet Size:	12	in
Grade:	Super Critical		Outlet Size:	12	in
QAC Body Diameter:	38	in	QAC Body Length:	116	in
Estimated weight:	917 416	lbs Kg	Estimated Back Pressure:	9.57 23.8	in of WC mbar
			Speed through inlet:	8231	ft/min

Emission:

Min. Temp. at Core Face: 1112 °F 600 °C
Max. Temp. at Core Face: 1239 °F 671 °C

Catalyst Type: 3-Way

	Pollutant					
	NOx	CO	NMHC/VOC	H_2CO		
Engine Out / Pre Emission:	14	6.9	0.27	0.04	g/bhp-hr	W/2
Post Emission:	0.28	0.18	0.02	0.00	g/bhp-hr	—
	99	99	94	99	% Reduction	
	0.85	0.54	0.05	0.00	lb/hr	
	3.73	2.37	0.22	0.01	tons/year operation	8760 hr/year
	58	37	3	0	ppmv	

Acoustics:

Frequency Band (Hz):	63	125	250	500	1000	2000	4000	8000	
Estimated Attenuation (dB):	24	38	35	27	21	21	20	20	No Element
Plus:	25	40	37	31	26	27	26	25	One Element/Layer
Plus:	25	41	38	34	30	31	30	29	Two Elements/Layers

Warranty & Notes:

- If Pre-Emission levels are not as noted above, contact Maxim 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 content 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, Co, 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 Inc. 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.
- Maxim's standard one year warranty applies.

DRESSER Waukesha L5794GSI

STANDARD EQUIPMENT

AIR CLEANER – Two, 3" dry type filter with hinged rain shield and service indicator.

AIR FUEL RATIO CONTROL (AFR) – Integrated ESM® - AFR catalyst rich-burn control, main fuel gas regulator actuators, exhaust O_2 sensor(s), and post turbocharger exhaust thermocouple. Factory mounted and tested. AFR maintains emissions through load and speed changes. The ESM AFR meets Canadian Standards Association Class 1, Division 2, Group D hazardous location requirements. Note: For dual fuel applications, ESM AFR system will control the primary fuel source only.

BARRING DEVICE – Manual.

BATTERY BOX – Ship loose battery box designed to accommodate two Series 31 12 VDC batteries. Includes power disconnect switch and 20 foot (6.1 m) cable for connection to ESM® Power Distribution Box.

BEARINGS – Heavy duty, replaceable, precision type.

BREATHER – Self regulating, closed system.

CONNECTING RODS – Drop forged steel, rifle drilled.

CONTROL SYSTEM – Waukesha Engine System Manager (ESM®) integrates spark timing control, speed governing, detonation detection, start-stop control, diagnostic tools, fault logging and engine safeties. Engine Control Unit (ECU) is central brain of the control system and main customer interface. Interface with ESM is through 25 foot (7.6 m) harness to local panel, through MODBUS RTU slave connection RS-485 multidrop hardware, and through the Electronic Service Program (ESP). Customer connections are only required to the local panel, fuel valve, and 24V DC power supply. Compatible with Woodward load sharing module. ESM meets Canadian Standards Association Class I, Division 2, Group D, hazardous location requirements.

CRANKCASE – Integral crankcase and cylinder frame. Main bearing caps drilled and tapped for temperature sensors. Does not include sensors.

CRANKSHAFT – Forged steel, seven main bearings, counterweighted and dynamically balanced.

CYLINDERS – Removable wet type cylinder liners.

CYLINDER HEADS – Twelve interchangeable. Four valves per cylinder, with water cooled exhaust valve seats. Roller valve lifters and hydraulic push rods. Flange mounted ignition coils.

ELECTRONIC SERVICE PROGRAM (ESP) – Microsoft® Windows-based program provided on CD-ROM for programming and interface to ESM. Includes E-Help for troubleshooting any ESM faults. Serial harness is provided for connection of a customer supplied laptop to the ECU RS-232 port.

ENGINE MONITORING DEVICES – Factory mounted and wired sensors for lube oil pressure and temperature; intake manifold temperature and pressure; overspeed; and jacket water temperature; all accessible through ESM®. ESM continually monitors combustion performance through accelerometers to provide detonation protection. Dual magnetic pick-ups are used for accurate engine speed monitoring. ESM provides predictive spark plug diagnostics as well as advanced diagnostics of engine and all ESM sensors and logs any faults into non-volatile flash memory.

ENGINE ROTATION – Counterclockwise when facing flywheel.

EXHAUST OUTLET – Single vertical at rear. Flexible stainless steel connection with 8" (203 mm) pipe flange.

FLYWHEEL – Approx. WR^2 = 155000 lb-in²; with ring gear (208 teeth), machined to accept two drive adapters: 31.88" (810 mm) pilot bore, 30.25" (768 mm) bolt circle, (12) 0.75" - 10 tapped holes; or 28.88" (734 mm) pilot bore, 27.25" (692 mm) bolt circle, (12) 0.625"-11 tapped holes and (12) 0.75"-10 tapped holes.

FLYWHEEL HOUSING – No. 00 SAE.

FUEL SYSTEM – Single 3" ANSI flange fuel inlet connection. Two natural gas, 4" (102 mm) updraft carburetors and two mounted Mooney Flowgrid 250, 2" (51 mm) gas regulators. 30-60 psi (207-414 kPa) fuel inlet pressure required. 10 foot (3 m) harness provided for ESM control of customer supplied fuel shutoff valve.

GOVERNOR – Electric throttle actuator controlled by ESM with throttle position feedback. Governor tuning is performed using ESP. ESM includes option of a load-coming feature to improve engine response to step loads.

IGNITION SYSTEM – Ignition Power Module (IPM) controlled by ESM, with spark timing optimized for any speed-load condition. Dual voltage energy levels automatically controlled by ESM to maximize spark plug life. Shielded ignition components that meet Canadian Standard Association Class 1, Division 2, Group D hazardous location requirements.

INTERCOOLER – Air-to-water.

LEVELING BOLTS

LIFTING EYES – Requires 9.5 ton Working Load Limit (W.L.L.) anchor shackles.

LUBRICATION – Full pressure, gear type pump. Engine mounted full flow lube oil micro-fiberglass filters. MICROSPIN® bypass filter, engine mounted. Lube oil strainer, mounted. Air/gas motor driven prelube pump, requires final piping.

MANIFOLDS – Exhaust, (2) water cooled.

OIL COOLER – Shell and tube type, with thermostatic temperature controller and pressure regulating valve. Factory mounted.

OIL PAN – Deep sump type. 190 gallon (719 L) capacity, including filter and cooler.

PAINT – Oilfield orange primer.

PISTONS – Aluminum with floating pin. Oil cooled. 8.2:1 compression ratio.

SHIPPING SKID – For domestic truck or rail.

TURBOCHARGERS – (2) with water-cooled bearing housing and differential wastegates.

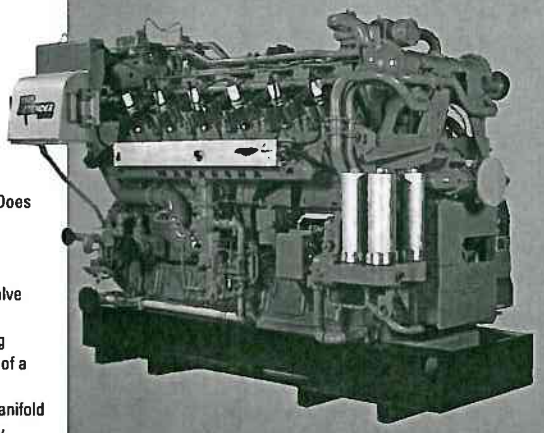
VIBRATION DAMPER – Viscous type.

WATER CIRCULATING SYSTEM, AUXILIARY CIRCUIT – Belt driven water circulating high capacity pump for intercooler and lube oil cooler. See S6543-38 performance curve for use with standard 10" diameter crankshaft pulley.

WATER CIRCULATING SYSTEM, ENGINE JACKET – Belt driven water circulating pump. Cluster type thermostatic temperature regulating valve, full flow bypass type with 165°-170° F (74°-77°C) start to open thermostats. Flange connections and mating flanges for (2) 4" (102 mm) inlets and (1) 5" (127 mm) outlet.

VHP® Series Four® Gas Engine Extender Series®

920 - 1380 BHP
(686 - 1029 kWb)



Engine shown with options.

Model L5794GSI with ESM®

Turbocharged and Intercooled, Twelve Cylinder, Four-Cycle Gas Fueled Engine

SPECIFICATIONS

Cylinders	**Lube Oil Capacity**
V 12	190 gal.
Piston Displacement	(719 L)
5788 cu. in.	**Starting System**
(95 L)	125 - 150 psi
Bore & Stroke	air/gas
8.5" x 8.5"	24/32 V electric
(216 x 216 mm)	**Dry Weight**
Compression Ratio	22,750 lb.
8.2:1	(10,320 kg)
Jacket Water System Capacity	
107 gal.	
(405 L)	

POWER RATINGS: L5794GSI VHP® SERIES FOUR® GAS ENGINE

Model	I.C. Water Inlet Temp. °F (°C) (Tcra)	C.R.	Brake Horsepower (kWb Output) 800 rpm	900 rpm	1000 rpm	1100 rpm	1200 rpm
L5794GSI	130° (54°)	8.2:1	920 (686)	1035 (772)	1150 (858)	1265 (943)	1380 (1029)

Rating Standard: All models: Ratings are based on ISO 3046/1-1995 with mechanical efficiency of 90% and auxiliary water temperature Tcra (clause 10.1) as specified above limited to ± 10° F (± 5° C). Ratings are also valid for SAE J1349, BS5514, DIN6271 and AP17B-11C standard atmospheric conditions.

ISO Standard Power/Continuous Power Rating: The highest load and speed which can be applied 24 hours a day, seven days a week, 365 days per year except for normal maintenance. It is permissible to operate the engine at up to 10% overload, or maximum load indicated by the intermittent rating, whichever is lower, for two hours in each 24 hour period.

All natural gas engine ratings are based on a fuel of 900 Btu/ft³ (35.3 MJ/nm³) SLHV, with a 91 WKI®.

For conditions or fuels other than standard, contact the Dresser Waukesha Application Engineering Department.

PERFORMANCE: L5794GSI VHP® SERIES FOUR® GAS ENGINE

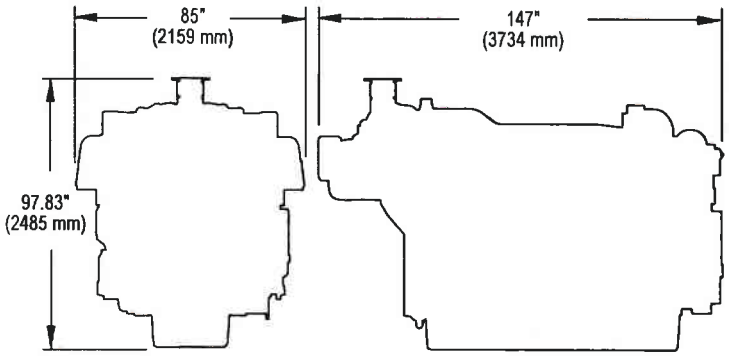
	English 130° F I.C. Water Temperature		
Catalyst Settings	**RPM**	**1200**	**1000**
	Power (Bhp)	1380	1150
	BSFC (Btu/bhp-hr)	7510	7350
	NOx (grams/bhp-hr)	13.9	15.0
	CO (grams/bhp-hr)	8.8	8.8
	NMHC (grams/bhp--hr)	0.3	0.3

	Metric 54° C I.C. Water Temperature		
Catalyst Settings	**RPM**	**1200**	**1000**
	Power (kWb)	1029	858
	BSFC (kJ/kW-hr)	10625	10395
	NOx (g/nm³)	5.2	5.6
	CO (g/nm³)	3.3	3.2
	NMHC (g/nm³)	0.10	0.11

NOTES:

1) Fuel consumption and exhaust emissions are based on ISO 3046/1-1995 standard reference conditions and commercial quality natural gas of 900 Btu/ft³ (35.38 MJ/m³ [25, V(0; 101.325)]) saturated lower heat value, Waukesha Knock Index® of 91 and 93% methane content by volume. ISO 3046/1-1995 standard reference conditions are 77°F (25°C) ambient temperature, 29.54 inches Hg (100 kPa) barometric pressure, 30% relative humidity (1kPa/0.3 inches Hg water vapor pressure).
2) S.I. exhaust emissions are corrected to 5% O_2 (0°C and 101.325 kPa).
3) Data will vary due to variations in site conditions. For conditions and/or fuels other than standard, consult the Dresser Waukesha Application Engineering Department.
4) Fuel consumption based on ISO 3046/1-1995 with a +5% tolerance for commercial quality natural gas having a 900 Btu/ft³ saturated low heat valve

Consult your local Waukesha Distributor for system application assistance. The manufacturer reserves the right to change or modify without notice, the design or equipment specifications as herein set forth without incurring any obligation either with respect to equipment previously sold or in the process of construction except where otherwise specifically guaranteed by the manufacturer.



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