# Air Quality Permit Application for Permit to Construct

Permit: T5-O14013

# Watford City Gas Plant

McKenzie County, North Dakota

January 2025

PREPARED FOR:

**Hiland Partners Holdings LLC**

McKenzie County, North Dakota

SPIRIT PROJECT: 24274.00A

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# 1.0 Introduction

Hiland Partners Holding, LLC (Hiland) is submitting this permit modification application for the Watford City Gas Plant (Title V Operating Permit T5-O14013), a natural gas processing plant located near Alexander, in McKenzie County, North Dakota. The Watford City Gas Plant employs a cryogenic separation process to extract natural gas liquids (NGL) from field gas and then fractionates extracted liquids into ethane, butane, propane, and natural gasoline. In addition, field condensate is trucked into the facility where it is stabilized and stored in pressurized vessels prior to being trucked from the plant.

## 1.1 Proposed Modification

This permit request is for the construction of a new triethylene glycol (TEG) dehydration system, which will be controlled by the existing benzene, toluene, ethylbenzene, and xylene (BTEX) combustor [Emission Unit (EU) COM-1], replacement of a compressor engine with one of higher horsepower (hp), and installation of associated fugitive components.

Emissions from the proposed changes can be found in Attachment A. Equipment specifications can be found in Attachment B. The ProMax simulation report can be found in Attachment C.

## 1.2 Application

In accordance with North Dakota Division of Air Quality requirements, permit application forms have been completed and are included in Section 5.0.

## 1.3 Public Notice

Per North Dakota Administrative Code (NDAC) Section 33.1-15-14-02.6 – 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:

**NDAC Section 33.1-15-14-02-6.a(1)**

This facility is not an affected facility per 40 CFR 61 – National Emission Standards For Hazardous Air Pollutants (NESHAP) as incorporated by NDAC Chapter 33.1-15-13. Hazardous Air Pollutant (HAP) emission calculations indicate that potential HAP emissions at the Watford City Gas Plant

will not equal or exceed the major source thresholds of 10 tons per year (tpy) of any individual HAP or 25 tpy of any combination of HAPs.

**NDAC Section 33.1-15-14-02-6.a(2)**

The gas plant has the potential to emit more than 100 tpy of particulate matter (PM, $PM_{10}$, $PM_{2.5}$), sulfur dioxide ($SO_2$), hydrogen sulfide ($H_2S$), nitrogen oxides ($NO_X$) carbon monoxide (CO), or volatile organic compounds (VOCs). It operates under permit to operate T5-O14013 and is subject to the Title V operating permit program. The site is not a new source required to obtain a permit to operate under section 33.1-15-14-06.

**NDAC Section 33.1-15-14-02-6.a(3)**

The potential to emit (PTE) will not increase by more than 100 tpy of any criteria pollutant, 10 tpy or more of any individual HAP or 25 tpy or more of any combination of HAPs (NDAC 33.1-15-14-02.01.a(3)).

**NDAC Section 33.1-15-14-02-6.a(4)**

Potential emissions as reported in Appendix A are not expected to have a "major impact on air quality."

**NDAC Section 33.1-15-14-02-6.a(5) & (6)**

As of the application date, no request for a public comment period has been received and it is anticipated that this project will not generate a significant degree of public interest.

**NDAC Section 33.1-15-14-02-6.a(7)**

Hiland does not request in this application federally enforceable permit conditions that limit their potential to emit (synthetic minor permit).

## 1.4 Site Location

The Watford City Gas Plant is located approximately seven (7) miles northwest of Alexander in the SE ¼, SE ¼ of Section 6, Township 151 North, Range 102 West, in McKenzie County, North Dakota. The general UTM coordinates are Zone 13, Easting: 591,172 meters, and Northing: 5,308,427 meters. The site elevation is approximately 2,265 feet above sea level. A map of the

facility location can be found in Figure 1-1. A plot plan of the facility location can be found in Figure 1-2.

## 1.5 Site Description

The terrain surrounding the facility is characterized as flat to slightly 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 Code of Federal Regulations (CFR) 81.335]. There are no non-attainment areas within a reasonable distance of the site.

## Figure 1-1 Watford City Gas Plant Area Map

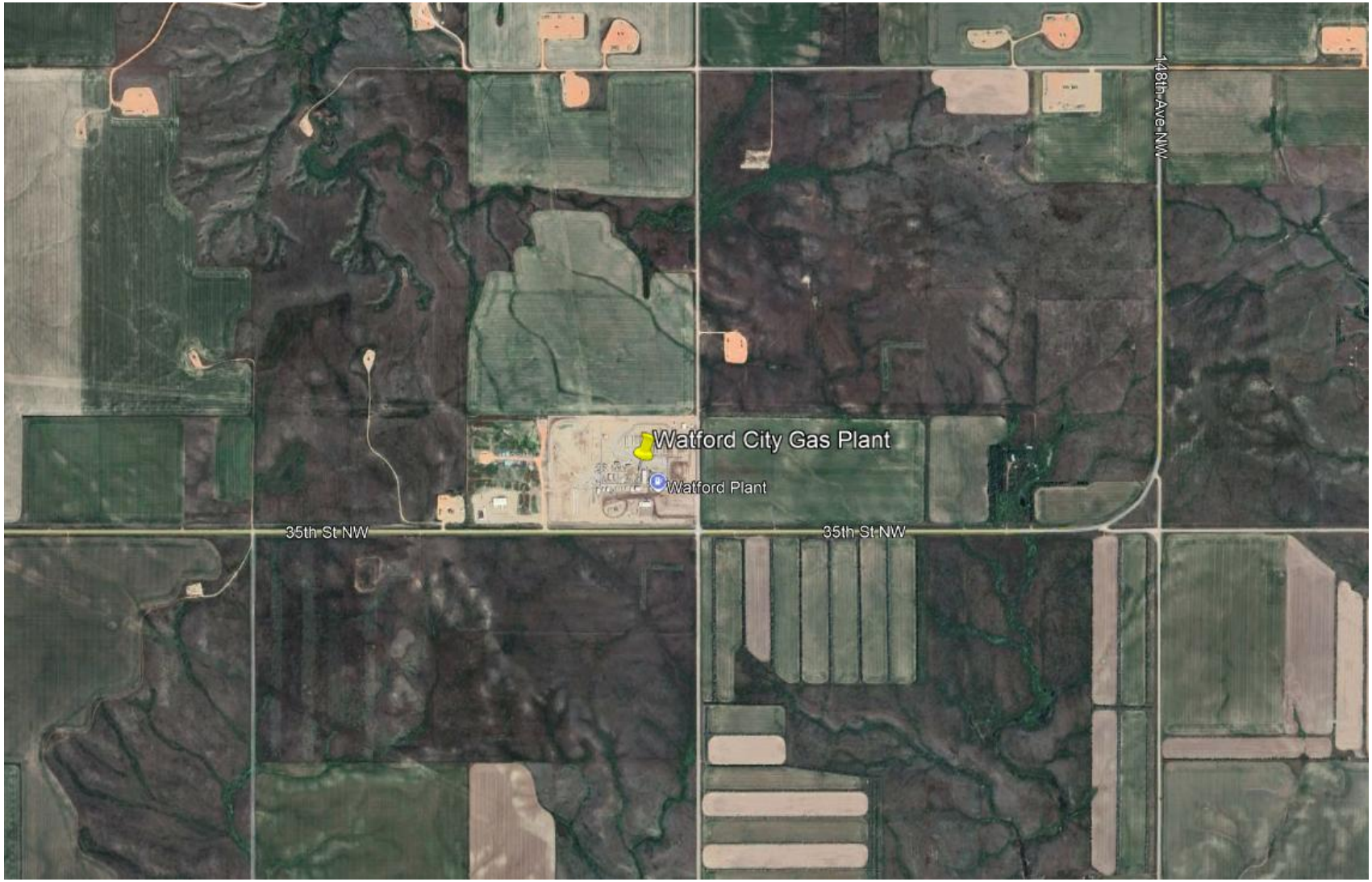
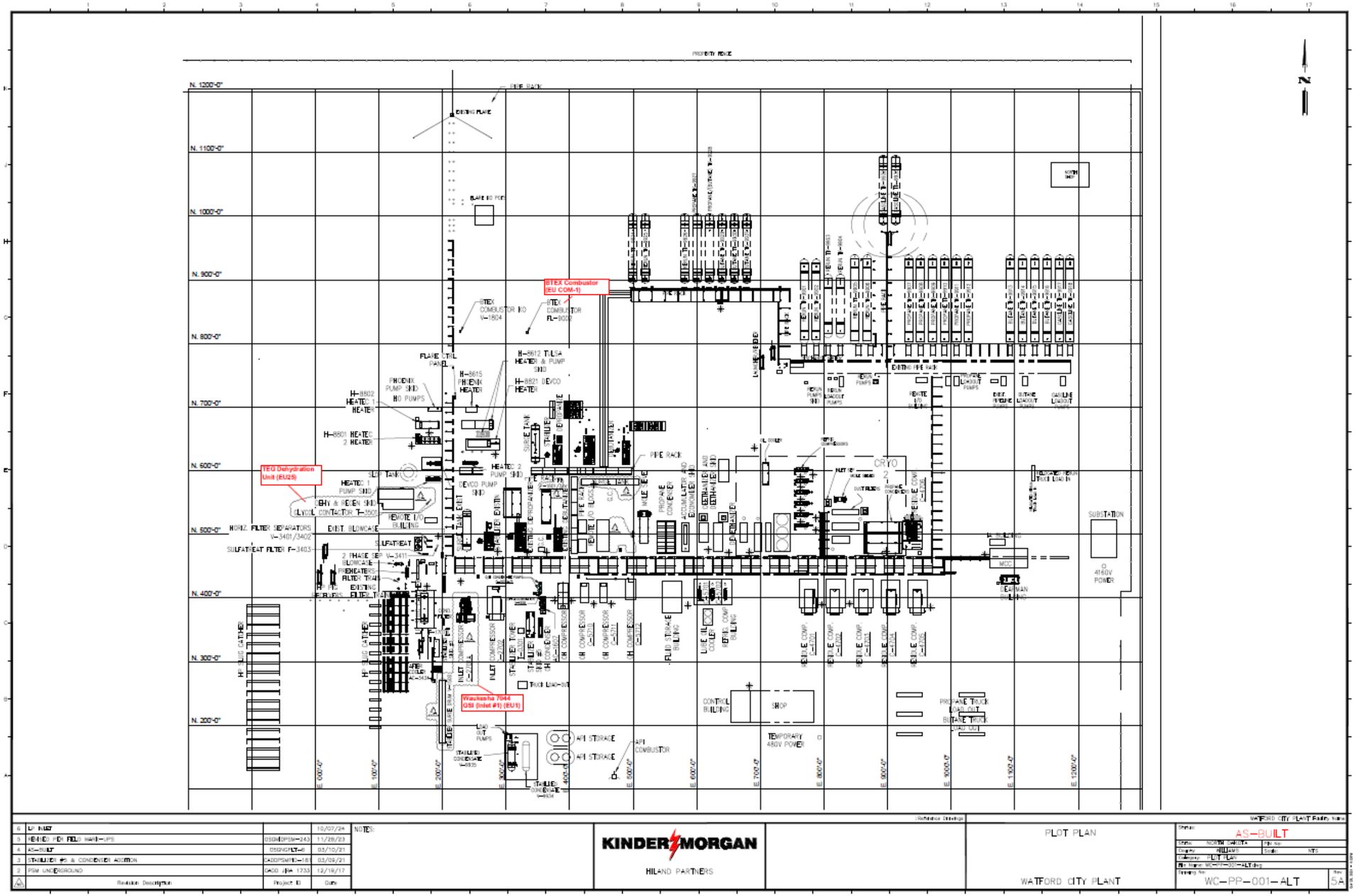


**Figure 1-2 Watford City Gas Plant Facility Layout**



# 2.0 Process Description

The Watford City Gas Plant employs a cryogenic separation process to extract NGLs from the field gas and then fractionates the extracted liquids into ethane, butane, propane, and natural gasoline. The residue gas, mostly methane, is compressed and exits the facility by the residue gas pipeline. Ethane is blended with residue gas. Propane, butane, and natural gasoline are stored in tanks and removed from the facility by tank trucks and/or by pipelines. In addition, the Watford City Gas Plant receives field condensate via truck unloading. The condensate is stabilized and then stored in pressurized storage vessels prior to being loaded and trucked out of the plant.

Emission sources currently at the plant include the following:

- Two (2) natural gas-fired compressor engines to compress the low-pressure inlet gas;
- Six (6) natural-gas fired compressor engines to compress the residue gas;
- Five (5) natural-gas fired hot oil heaters, including (EU 22), to provide heat medium for the plant;
- Two (2) TEG dehydration units used to dehydrate low pressure inlet gas, stabilizer overhead gas, and regeneration gas for mol sieves;
- One (1) process/emergency flare used for planned and emergency purposes and burns blowdowns from equipment and releases from pressure control devices;
- Four (4) atmospheric tanks for storing water and condensate liquids knocked out of the process which are controlled by the API tank flare;
- One (1) tank combustor used to control four atmospheric tanks that store water and condensate liquid that are residual from plant processes;
- One (1) BTEX combustor used to control the TEG dehydration units;
- One (1) heavy truck loading rack; and
- Piping components, including meters, connectors, valves, flanges, etc.

Emission sources proposed to be added to the plant, as outlined in Section 1.0, include the following:

- One (1) Waukesha 7044 GSI inlet compressor engine to replace the existing Ajax DCP-2804 LE (EU1); and

- One (1) TEG dehydration unit used to dehydrate low pressure inlet gas, stabilizer overhead gas, and regeneration gas for mol sieves.

# 3.0 Emission Estimates

Air pollutants emitted from the Watford City Gas Plant are as follows: NOx, PM, $PM_{10}$, $PM_{2.5}$, $SO_2$, VOCs, CO, and various HAPs.

This application contains PTE calculations for the proposed TEG dehydration unit (EU25), existing BTEX combustor (EU COM-1) used to control the proposed TEG dehydration unit (EU25), proposed inlet compressor engine replacement (EU1), and associated fugitive emissions (EU FUG 1).

Calculation of potential emissions from the proposed TEG dehydration unit (EU25) are based on a ProMax simulation using an inlet gas analysis and plant specific operating parameters. The vent stream will be controlled by the existing BTEX combustor (EU COM-1). The combustor may be down for maintenance for up to 100 hours per year. During that time, the TEG dehydration unit will vent to atmosphere.

Updated calculations of potential emissions from the existing BTEX combustor (EU COM-1) due to the addition of the proposed TEG dehydration unit (EU25) are based on emission factors found in AP-42, Fifth Edition, Volume I, Chapter 1: External Combustion Sources, Section 1.4 Natural Gas Combustion, Tables 1.4-1 and 1.4-2, July 1998.

The proposed engine (EU1) calculations of $NO_X$, CO, and VOC potential emissions are based on permit limitations. Formaldehyde potential emissions from the proposed engine (EU1) are based on manufacturer data. Calculations of PM, $PM_{10}$, $PM_{2.5}$, $SO_2$, and HAP potential emissions are based on emission factors in AP-42 , Fifth Edition, Volume I, Chapter 3: Stationary Internal Combustion Sources, Section 3.2 Natural Gas Fired Reciprocating Engines Table 3.2-3. October 2024.

Potential emissions from proposed fugitive components (FUG-1) are based on estimated component counts at the facility, stream analyses, and emission factors for oil and gas production facilities from Environmental Protection Agency (EPA)’s “Protocol for Equipment Leak Emission Estimates,” November 1995 EPA 4531, R-95-017, Table 2-4.

Emission calculations for the proposed changes can be found in Attachment A. Proposed facility-wide emissions summary can be found in Table 3-1.

## Table 3-1 Emissions Summary

| Emission Unit | Emission Unit Description | PM (tpy) | $PM_{10}$ (tpy) | $PM_{2.5}$ (tpy) | $SO_2$ (tpy) | $NO_X$ (tpy) | CO (tpy) | VOC (tpy) | $CO_2e$ (tpy) | Formaldehyde (tpy) | HAPs (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EU1 | Waukesha 7044 GSI (Inlet #1) | 1.33 | 1.33 | 1.33 | 0.04 | 16.51 | 16.51 | 11.94 | 8,036.53 | 0.02 | 0.43 |
| EU2 | Waukesha L-5794 GSI (Residue #1) | 0.88 | 0.88 | 0.88 | 0.03 | 8.66 | 8.66 | 9.33 | 6,682.44 | 0.13 | 0.44 |
| EU3 | Waukesha 7044 GSI (Residue #2) | 1.24 | 1.24 | 1.24 | 0.03 | 10.54 | 10.54 | 11.36 | 8,364.13 | 0.16 | 0.54 |
| EU4 | Hot Oil Heater - 41.65 MMBtu/hr | 1.36 | 1.36 | 1.36 | 0.11 | 17.89 | 15.02 | 0.98 | 19.743.81 | -- | 0.33 |
| EU5 | TEG Dehydration Unit | -- | -- | -- | -- | -- | -- | 1.67 | -- | -- | 0.17 |
| EU6 | Condensate Tank (210 bbl) | -- | -- | -- | -- | -- | -- | 0.11 | -- | -- | -- |
| EU8 | Process/Emergency Flare | 0.19 | 0.19 | 0.19 | 0.03 | 8.72 | 39.74 | 19.09 | -- | -- | 0.29 |
| EU9 | Waukesha 7044 GSI (Residue #3) | 1.24 | 1.24 | 1.24 | 0.03 | 10.54 | 10.54 | 11.36 | 8,364.13 | 0.16 | 0.54 |
| EU10 | Waukesha 7044 GSI (Residue #4) | 1.24 | 1.24 | 1.24 | 0.03 | 10.54 | 10.54 | 11.36 | 8,364.13 | 0.16 | 0.54 |
| EU11 | Waukesha 7044 GSI (Residue #5) | 1.24 | 1.24 | 1.24 | 0.03 | 10.54 | 10.54 | 11.36 | 8,364.13 | 0.16 | 0.54 |
| EU12 | Waukesha 7044 GSI (Inlet #2) | 1.24 | 1.24 | 1.24 | 0.03 | 10.54 | 10.54 | 11.36 | 8,364.13 | 0.16 | 0.54 |
| EU13 | Hot Oil Heater - 38.74 MMBtu/hr | 1.26 | 1.26 | 1.26 | 0.10 | 8.31 | 13.97 | 0.91 | 16,933.72 | -- | 0.31 |
| EU15 | Condensate Tank (400 bbl) | -- | -- | -- | -- | -- | -- | 0.21 | -- | -- | -- |
| EU16 | Condensate Tank (400 bbl) | -- | -- | -- | -- | -- | -- | 0.21 | -- | -- | -- |
| EU17 | Condensate Tank (400 bbl) | -- | -- | -- | -- | -- | -- | 0.21 | -- | -- | -- |
| EU18 | Hot Oil Heater - 43.5 MMBtu/hr | 1.42 | 1.42 | 1.42 | 0.11 | 18.68 | 15.69 | 1.03 | 19,091.60 | -- | 0.35 |
| EU19 | TEG Dehydration Unit | -- | -- | -- | -- | -- | -- | 0.01 | -- | -- | 0 |
| EU20 | Waukesha 7044 GSI (Residue #6) | 1.22 | 1.22 | 1.22 | 0.04 | 16.22 | 32.44 | 11.36 | 7,294.00 | 0.16 | 0.54 |
| EU21 | Hot Oil Heater - 37.75 MMBtu/hr | 1.44 | 1.44 | 1.44 | 0.11 | 6.63 | 6.73 | 3.14 | 21,517.83 | -- | 0.36 |
| EU22 | Hot Oil Heater - 21.0 MMBtu/hr | 0.73 | 0.73 | 0.73 | 0.06 | 9.64 | 8.09 | 0.53 | 9,405.58 | -- | 0.18 |
| EU23 | Condensate Truck Loading Rack #2 | -- | -- | -- | -- | -- | -- | 2.01 | -- | -- | -- |
| EU24 | Tank Combustor | 4.33E-03 | 4.33E-03 | 4.33E-03 | 1.37E-03 | 0.23 | 0.22 | 0.09 | -- | -- | 1.71E-04 |
| EU25 | TEG Dehydration Unit | -- | -- | -- | -- | -- | -- | 5.93 | -- | -- | 0.08 |
| COM-1 | BTEX Combustor | 0.11 | 0.11 | 0.11 | 0.01 | 1.47 | 1.24 | 0.06 | -- | -- | 0.02 |
| BD | Compressor Blowdowns [1] | -- | -- | -- | -- | -- | -- | 19.70 | -- | -- | 0.03 |
| FUG 1 | Fugitive Emissions | -- | -- | -- | -- | -- | -- | 83.08 | -- | -- | 0.06 |
| **TOTAL WITHOUT FUGITIVES** | | **16.14** | **16.14** | **16.14** | **0.79** | **165.66** | **211.02** | **145.31** | **130,782.35** | **1.12** | **6.20** |
| **TOTAL WITH FUGITIVES** | | **16.14** | **16.14** | **16.14** | **0.79** | **165.66** | **211.02** | **228.38** | **130,782.35** | **1.12** | **6.26** |
| **PROJECT INCREASES** | | **0.04** | **0.04** | **0.04** | **0.02** | **11.82** | **11.77** | **17.72** | **4,024.81** | **-0.68** | **-6.53** |
| **PSD Significance Levels** | | **250.00** | **250.00** | **250.00** | **250.00** | **250.00** | **250.00** | **250.00** | **75,000.00** | **-** | **-** |

Notes:

1. Compressor blowdown emissions from inlet, residue, and overhead compressors.

2. The threshold for $CO_2e$ will only apply if another regulated pollutant exceeds the PSD significance level.

# 4.0 Regulatory Applicability

There are numerous federal and North Dakota regulations and requirements applicable to the Watford City Gas Plant. These requirements were addressed in the initial Title V operating permit application submitted March 18, 2016 and the Title V operating permit modification application submitted June 20, 2020; therefore, are not included in this application. Please refer to these applications for the detailed federal regulatory applicability analyses for the Watford City Gas Plant. This section includes a discussion of applicable regulations specifically in regard to the Watford City Gas Plant's proposed changes.

## 4.1 Federal Regulatory Requirements

This section includes a discussion of applicable federal regulations specifically regarding the Watford City Gas Plant's proposed changes.

### 4.1.1 40 CFR 60, Subpart A – General Provisions

Sources at the Watford City Gas Plant are subject to subparts in 40 CFR 60; therefore, Hiland will comply with the applicable requirements of this subpart.

### 4.1.2 40 CFR 60, Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

The reboiler for the new TEG dehydration unit (EU25) will be heated by an existing heater; therefore, the installation of the new TEG dehydration unit will not change the requirements of this subpart for Hiland.

### 4.1.3 40 CFR 60, Subpart JJJJ – Standards for Stationary Spark Ignition Internal Combustion Engines

Owners and operators are subject to 40 CFR 60 Subpart JJJJ if construction, reconstruction, or modification of the spark ignition internal combustion engine (SI ICE) commenced after June 12, 2006, and if manufactured

- On or after July 1, 2007, for engines with a maximum engine power greater than or equal to 500 hp (except lean-burn engines with a maximum engine power greater than or equal to 500 hp and less than 1,350 hp);

- On or after January 1, 2008, for lean-burn engines with a maximum engine power greater than or equal to 500 hp and less than 1,350 hp;
- On or after July 1, 2008, for engines with a maximum engine power less than 500 hp; or
- On or after January 1, 2009, for emergency engines with a maximum engine power greater than 19 KW (25 hp).

The new 1,900 hp compressor engine (EU1) is a rich-burn engine that was manufactured after July 1, 2007; therefore, Subpart JJJJ is applicable and Hiland will comply with applicable requirements.

### 4.1.4 40 CFR 60, Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced After August 23, 2011, and on or Before September 18, 2015

Owners and operators are subject to Subpart OOOO if they commence construction, modification or reconstruction of an affected facility after August 23, 2011 and on or before September 18, 2015. For a natural gas processing plant, affected facilities include centrifugal compressors, reciprocating compressors, storage vessels, sweetening units, and equipment leaks.

The proposed changes to this site will not affect the current applicability of Subpart OOOO for this site.

### 4.1.5 40 CFR 60, Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after September 18, 2015

Owners and operators are subject to Subpart OOOOa if they commence construction, modification or reconstruction of an affected facility after September 18, 2015. For a natural gas processing plant, affected facilities include centrifugal compressors, reciprocating compressors, storage vessels, pneumatic controllers, sweetening units, and equipment leaks.

The existing compressor (EU1) is being replaced with a compressor with a higher hp compressor engine currently located at another site. Per 40 CFR 60.14(e)(6), the relocation of an existing facility is not considered a modification. However, the new compressor is currently subject to Subpart OOOOa; therefore, the new compressor will continue to comply with the requirements of

this subpart at the Watford City Gas Plant. Other unaffected sources already subject to this subpart will continue to comply with the requirements of this subpart.

### 4.1.6 40 CFR 60, Subpart OOOOb – Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after December 6, 2022

Owners and operators are subject to Subpart OOOOb if they commence construction, modification or reconstruction of an affected facility after December 6, 2022. For a natural gas processing plant, affected facilities include centrifugal compressors, reciprocating compressors, storage vessels, pneumatic controllers, sweetening units, pumps, and equipment leaks.

The construction of the TEG dehydration unit (EU25) and associated fugitives will commence after December 6, 2022; therefore, the affected process unit fugitive components will comply with the requirements of this subpart.

### 4.1.7 40 CFR 63, Subpart A – General Provisions

Sources at the Watford City Gas Plant are subject to subparts in 40 CFR 63; therefore, Hiland will comply with the applicable requirements of this subpart.

### 4.1.8 40 CFR 63, Subpart HH –National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities

Subpart HH sets standards for reducing HAPs from TEG dehydration units, fugitives, and storage vessels at major source or area sources of HAP emissions. This facility is an area source of HAPs; therefore, is subject to the certain requirements applicable to TEG dehydrators. The TEG dehydrator (EU25) will process up to 40 million cubic feet per day (MMcfd) of gas (greater than the exemption threshold of 85 Mcfd). The facility will comply with the applicable requirements of this subpart.

### 4.1.9 40 CFR 63, Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

This regulation applies to any reciprocating internal combustion engine (RICE) located at a major or area source of HAP emissions. Compressor engine EU1 was manufactured after July 1, 2007, and the Watford City Gas Plant is an area HAP source; therefore, engine (EU1) must meet the requirements in Maximum Achievable Control Technology (MACT) Subpart ZZZZ by meeting the requirements in NSPS Subpart JJJJ.

### 4.1.10 40 CFR 63, Subpart DDDDD – National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters

This regulation applies to equipment located at major HAP sources. The Watford City Gas Plant is an area HAP source and will remain an area HAP source following project completion. Therefore, this subpart does not apply.

### 4.1.11 40 CFR 63, Subpart JJJJJ – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources

This regulation applies to existing, new, or reconstructed boilers located at area HAP sources. The Watford City Gas Plant is an area HAP source and will remain an area HAP source. There are no new affected sources.

## 4.2 North Dakota Regulatory Requirements

This section includes a discussion of applicable state regulations specifically regarding the Watford City Gas Plant's proposed changes.

### 4.2.1 NDAC 33.1-15-01 - General Provisions

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

### 4.2.2 NDAC 33.1-15-02 - Ambient Air Quality Standards

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 emission units included in this application are located at a facility that is subject to ambient air quality standards; therefore, Hiland will abide by all standards set forth in this regulation.

### 4.2.3 NDAC 33.1-15-03 - Restriction of Emission of Visible Air Contaminants

NDAC 33.1-15-03 contains regulations governing particulate matter and opacity limits from new and existing sources. The proposed engine (EU1) and existing BTEX combustor (EU COM-1) are subject to 33.1-15-03-02 relating to restrictions applicable to new installations which states: No person may discharge into the ambient air from any single source of emission whatsoever any air contaminant which exhibits an opacity greater than twenty percent except that a maximum of forty percent opacity is permissible for not more than one (1) six-minute period per hour. The engine and combustor will meet the requirements of this regulation.

### 4.2.4 NDAC 33.1-15-04 – Open Burning Restrictions

Hiland will not perform open burning of refuse, trade waste, or other combustible material except as provided for in Section 33.1-15-04-02 or 33.1-15-10-02, and will not conduct, cause, or permit the conduct of a salvage operation by open burning.

### 4.2.5 NDAC 33.1-15-05 - Emissions of Particulate Matter Restricted

The proposed natural gas-fired stationary combustion engine (EU1) and existing BTEX combustor (EU COM-1) will comply with the provisions of Sections 33.1-15-05-01 and 33.1-15-05-04. The engine and combustor combust fuel that generates particulate matter; therefore, are subject to allowable rate limitations that no person shall cause, suffer, allow, or permit the emission of particulate matter in any one (1) hour from any source in excess of the amount shown in 33.1-15-05-01(2)(b) Table 3: Maximum Allowable Rates of Emission of Particulate Matter from Industrial Processes.

### 4.2.6 NDAC 33.1-15-06 - Emissions of Sulfur Compounds Restricted

This facility combusts field gas or pipeline quality natural gas containing no more than 2.0 grains of sulfur per 100 standard cubic feet. This fuel restriction ensures compliance with NDAC 33.1-15-06-01.

### 4.2.7 NDAC 33.1-15-07 - Control of Organic Compounds Emissions

The compressor that will have an engine (EU1) replacement will be equipped and will operate with properly maintained seals designed for its specific product service and operating conditions. Emissions for organic compounds from the TEG dehydration unit will be combusted per the requirements of NDAC 33.1-15-07-02.

### 4.2.8 NDAC 33.1-15-08 - Control of Air Pollution from Vehicles and Other Internal Combustion Engines

Engine (EU1) is a natural gas-fired internal combustion engine and will comply with the restricted emissions regulation of Section 33.1-15-08-01.

### 4.2.9 NDAC 33.1-15-10 - Control of Pesticides

Hiland will comply with the provisions of NDAC 33.1-15-10 should pesticides be used at this facility.

### 4.2.10 NDAC 33.1-15-11 – Prevention of Air Pollution Emergency Episodes

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

### 4.2.11 NDAC 33.1-15-12 - Standards of Performance for New Stationary Sources

The applicability of New Source Performance Standards (NSPS) is discussed in Section 4.1.

### 4.2.12 NDAC 33.1-15-13 – Emission Standards for Hazardous Air Pollutants

This facility is not an affected facility per 40 CFR 61 – NESHAP as incorporated by NDAC Chapter 33.1-15-13. HAP emission calculations indicate that potential HAP emissions at the Watford City

Gas Plant will not equal or exceed the major source thresholds of 10 tpy any individual HAP or 25 tpy of any combination of HAPs.

### 4.2.13 NDAC 33.1-15-14 - Designated Air Contaminant Sources, Permit to Construct, Minor Source Permit to Operate, Title V Permit to Operate

Hiland is submitting this application per the Title V Permit to Construct requirements of this section to request construction authorization for the proposed engine replacement, TEG dehydration system installation, and associated fugitive component installation. The Watford City Gas Plant currently has the potential to emit more than 100 tons per year of NOx, CO, and VOC emissions. The facility is subject to the Title V operating permit program per NDAC 33.1-15-14-06, and currently operates under Permit to Operate T5-O14013.

In addition, the changes in potential emissions from the existing facility do not exceed the thresholds listed in the Criteria Pollutant Modeling Requirements for a Permit to Construct memorandum; therefore, modeling is not required for this project.

### 4.2.14 NDAC 33.1-15-15 - Prevention of Significant Deterioration of Air Quality

PSD permitting regulations apply to major stationary sources. A major stationary source is defined as a listed facility with the potential to emit 100 tons per year or more of any regulated pollutant or a non-listed facility with the potential to emit 250 tons per year or more of any regulated pollutant. Since the Watford City Gas Plant is not a listed facility, does not have the potential to emit greater than 250 tons per year of any regulated pollutant, PSD is not applicable.

Sitewide carbon dioxide equivalents ($CO_2e$) emissions exceed 75,000 tpy; however, the site is not an existing major source for any other regulated pollutant, and this project will not cause a significant emission increase of any other regulated pollutant; therefore, is not considered subject to regulation per 40 CFR 52.21(b)(49)(iv)(A).

### 4.2.15 NDAC 33.1-15-16 - Restriction of Odorous Air Contaminants

Hiland will comply with all requirements concerning odorous air contaminants at the Watford City Gas Plant 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.

### 4.2.16 NDAC 33.1-15-17- Restriction of Fugitive Emissions

Hiland will comply with all requirements by taking reasonable precautions to prevent fugitive emissions causing air pollution as defined in NDAC 33.1-15-01-04. Hiland will comply with the fugitive emissions standards in 40 CFR 60 Subpart OOOO, OOOOa, and OOOOb as applicable.

### 4.2.17 NDAC 33.1-15-18 - Stack Heights

Hiland will utilize good engineering practices relating to the installation of proposed engine EU1 and TEG dehydration unit (EU25). Emissions from EU1 and EU25 are vented from a stack height greater than or equal to 1.5 times the nearest building height. EU25 vents from EU COM-1.

### 4.2.18 NDAC 33.1-15-22- Emissions Standards for Hazardous Air Pollutants

The applicability of 40 CFR 63 – MACT for Source Categories is discussed in Section 4.1.

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

Proposed engine EU1 is a listed source in NDAC 33.1-15-14-01. Therefore, per the applicability section of the North Dakota Air Toxics Policy, this engine is subject to these regulations. The Dispersion Modeling Requirements, Compressor Engines and Glycol Dehydration Memorandum was rescinded on December 18, 2023.

# 5.0 ND DEQ Forms

The following forms are included in this application:

- FORM 8516 - Permit Application for Air Contaminant Sources
- FORM 8891 - Permit Application for Internal Combustion Engines and Turbines
- FORM 8532 - Permit Application for Air Pollution Control Equipment (EU1)
- FORM 8329 - Permit Application for Hazardous Air Pollutant (HAP) Sources (EU1)
- FORM 58923 - Permit Application for Glycol Dehydration Units
- FORM 8532 - Permit Application for Air Pollution Control Equipment (EU25)
- FORM 8329 - Permit Application for Hazardous Air Pollutant (HAP) Sources (EU25)

# PERMIT APPLICATION FOR AIR CONTAMINANT SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8516 (9-2021)

## SECTION A - FACILITY INFORMATION

| | | |
|---|---|---|
| Name of Firm or Organization<br>Hiland Partners Holdings LLC | | |
| Applicant's Name<br>Alex Schmidt | | |
| Title<br>Director, Operations | Telephone Number<br>(701) 833-6426 | E-mail Address<br>alex_schmidt@kindermorgan.com |
| Contact Person for Air Pollution Matters<br>Jason Burow | | |
| Title<br>EHS Engineer | Telephone Number<br>(713) 420-2813 | E-mail Address<br>jason_burow@kindermorgan.com |
| Mailing Address (Street & No.)<br>1001 Louisiana Street, Suite 1000 | | |
| City<br>Houston | State<br>TX | ZIP Code<br>77002 |
| Facility Name<br>Watford City Gas Plant | | |
| Facility Address (Street & No.)<br>3507 149th Avenue NW | | |
| City<br>Alexander | State<br>ND | ZIP Code<br>58831 |

| | | |
|---|---|---|
| County<br>McKenzie | Coordinates NAD 83 in Decimal Degrees (to forth decimal degree) | |
| | Latitude<br>47.92263000 | Longitude<br>-103.77926800 |

Legal Description of Facility Site

| | | | | |
|---|---|---|---|---|
| Quarter<br>SE | Quarter<br>SE | Section<br>6 | Township<br>151N | Range<br>102W |

| | |
|---|---|
| Land Area at Facility Site<br>30 Acres (or) _____ Sq. Ft. | MSL Elevation at Facility<br>2265 ft. |

## SECTION B – GENERAL NATURE OF BUSINESS

| Describe Nature of Business | North American Industry Classification System Number | Standard Industrial Classification Number (SIC) |
|---|---|---|
| Gas Plant | 211112 | 1312 |
| | | |
| | | |
| | | |

## 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<br>5/2025 | Planned End Construction Date<br>10/2025 |

## 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 |
| 1 | Compressor Engine | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 25 | TEG Dehydration Unit | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| COM-1 | BTEX Combustor | ☐ | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| FUG 1 | Fugitives | ☐ | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| | | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

Add additional pages if necessary

## SECTION D2 – APPLICABLE REGULATIONS

| Source ID No. | Applicable Regulations (NSPS/MACT/NESHAP/etc.) |
|---|---|
| Facility-wide | NSPS OOOO, OOOOa - Fugitives |
| 1 | NSPS OOOOa - Reciprocating Compressor |
| 1 | NSPS JJJJ - Compressor Engine, MACT ZZZZ - Compressor Engine |
| 5,19, 25 | MACT HH - TEG Dehydration Unit |
| 25 | NSPS OOOOb - Process Units Fugitives |

## SECTION E – TOTAL POTENTIAL EMISSIONS

| Pollutant | Amount (Tons Per Year) |
|---|---|
| $NO_x$ | 165.66 |
| CO | 211.02 |
| PM | 16.14 |

| Pollutant | Amount (Tons Per Year) |
|---|---|
| $PM_{10}$ (filterable and condensable) | 16.14 |
| $PM_{2.5}$ (filterable and condensable) | 16.14 |
| $SO_2$ | 0.79 |
| VOC | 228.38 |
| GHG (as $CO_2e$) | 130,782.35 |
| Largest Single HAP | 1.12 |
| Total HAPS | 6.26 |

*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 Report | 4. | ProMax Report |
| 2. | Emission Calculations | 5. | |
| 3. | Engine Spec Sheet | 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 |
|---|---|
| Abe Schmidt | 1-15-25 |

# INSTRUCTIONS

## SITE PLANS TO BE ATTACHED TO APPLICATION:

**Prepare and attach a plot plan drawn to scale or properly dimensioned, showing at least the following:**

a. The property involved and the outlines and heights of all buildings on the property. Identify property lines plainly. Also, indicate if there is a fence around the property that prevents public access.

b. Location and identification of all existing or proposed equipment, manufacturing processes, etc., and points of emission or discharge of air contaminants to the atmosphere.

c. Location of the facility or property with respect to the surrounding area, including residences, businesses and other permanent structures, streets and roadways. Identify all such structures and roadways. Indicate direction (**NORTH**) on the drawing and the prevailing wind direction.

## EQUIPMENT PLANS AND SPECIFICATIONS FOR PERMIT TO CONSTRUCT:

**Supply plans and specifications, including as a minimum an assembly drawing, dimensioned and to scale, in plan, elevation and as many sections as are needed to show clearly the design and operation of the equipment and the means by which air contaminants are controlled.**

The following must be shown:

a. Size and shape of the equipment. Show exterior and interior dimensions and features.

b. Locations, sizes, and shape details of all features which may affect the production, collection, conveying, or control of air contaminants of any kind, location, size, and shape details concerning all material handling equipment.

c. All data and calculations used in selecting or designing the equipment.

d. Horsepower rating of all internal combustion engines driving the equipment.

NOTE: **STRUCTURAL DESIGN CALCULATIONS AND DETAILS ARE NOT REQUIRED.** WHEN STANDARD COMMERCIAL EQUIPMENT IS TO BE INSTALLED, THE MANUFACTURER'S CATALOG DESCRIBING THE EQUIPMENT MAY BE SUBMITTED IN LIEU OF ITEMS a, b, c, and d OF ABOVE, WHICH THE CATALOG COVERS. ALL INFORMATION REQUIRED ABOVE THAT THE CATALOG DOES NOT CONTAIN MUST BE SUBMITTED BY THE APPLICANT.

## ADDITIONAL INFORMATION MAY BE REQUIRED:

**If the application is signed by an authorized representative of the owner, a LETTER OF AUTHORIZATION must be attached to the application.**

## SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# PERMIT APPLICATION FOR INTERNAL COMBUSTION ENGINES AND TURBINES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8891 (9-2021)

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 | Watford City Gas Plant |

## SECTION B – FACILITY AND UNIT INFORMATION

Source ID Number (From form SFN 8516)
1

| Type of Unit (check all that apply) | | |
|---|---|---|
| | ☒ Stationary Natural Gas-Fired Engine | ☐ Emergency Use Only |
| | ☐ Stationary Diesel and Dual Fuel Engine | ☒ Non-Emergency Use |
| | ☐ Stationary Gasoline Engine | ☐ Peaking |
| | ☐ Stationary Natural Gas-Fired Turbine | ☐ Demand Response |
| | ☐ Other – Specify: | |

## SECTION C – MANUFACTURER DATA

| Make | Model | Date of Manufacture |
|---|---|---|
| Waukesha | L7044 GSI | 08/01/2019 |

Reciprocating Internal Combustion Engine

☒ Spark Ignition ☐ Compression Ignition ☐ Lean Burn
☒ 4 Stroke ☐ 2 Stroke ☒ Rich Burn

| Maximum Rating (BHP @ rpm) | Operating Capacity (BHP @ rpm) |
|---|---|
| 1900 @ 1200 rpm | 1900 @ 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 (for compressors)
- ☒ 40 CFR 60, Subpart OOOOa (for compressors)

Turbine
Dry Low Emissions? ☐ Yes ☐ No

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

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

## SECTION D – FUELS USED

| Natural Gas ($10^6$ cu ft/year) | Percent Sulfur | Percent $H_2S$ |
|---|---|---|
| 134.67 | Negligible | Negligible |
| Oil (gal/year) | Percent Sulfur | Grade No. |
| | | |
| LP Gas (gal/year) | Other – Specify: | |
| | | |

## SECTION E – NORMAL OPERATING SCHEDULE

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

## SECTION F – STACK PARAMETERS

| Emission Point ID Number | | Stack Height Above Ground Level (feet) | |
|---|---|---|---|
| 1 | | 1.5 x Building Height (approximately 35 ft) | |
| Stack Diameter (feet at top) | Gas Discharged (SCFM) | Exit Temp (°F) | Gas Velocity (FPS) |
| 12 inches | 8683 | 1,140 | 184.3 |

## 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* |
|---|---|---|---|
| $NO_x$ | 3.77 | 16.51 | Vendor Data/Permit Limit |
| CO | 3.77 | 16.51 | Vendor Data/Permit Limit |
| PM | 0.30 | 1.33 | AP-42 Table 3.2-3 |
| $PM_{10}$ (filterable and condensable) | 0.30 | 1.33 | AP-42 Table 3.2-3 |
| $PM_{2.5}$ (filterable and condensable) | 0.30 | 1.33 | AP-42 Table 3.2-3 |
| $SO_2$ | 0.01 | 0.04 | AP-42 Table 3.2-3 |
| VOC | 2.73 | 11.94 | Permit Limit |
| GHG (as $CO_2e$) | 1,825 | 7,994 | AP-42 Table 3.2-3 |
| Largest Single HAP | 0.02 | 0.11 | AP-42 Table 3.2-3 |
| Total HAPS | 0.10 | 0.43 | 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
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8532 (9-2021)

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 | Watford City Gas Plant |

Source ID No. of Equipment being Controlled
1

## SECTION B – EQUIPMENT

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

| Name of Manufacturer | Model Number | Date to Be Installed |
|---|---|---|
| Waukesha | L7044 GSI | 2025 |

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

| Pollutants Removed | NOx | CO | VOC | |
|---|---|---|---|---|
| Design Efficiency (%) | 92.4% | 90.7% | 20% | |
| Operating Efficiency (%) | TBD | TBD | TBD | |

Describe method used to determine operating efficiency:

## SECTION CD – GAS CONDITIONS

| Gas Conditions | | | Inlet | Outlet |
|---|---|---|---|---|
| Gas Volume (SCFM; 68°F; 14.7 psia) | | | | 8683 |
| Gas Temperature (°F) | | | | 1,140 |
| Gas Pressure (in. $H_2O$) | | | | |
| Gas Velocity (ft/sec) | | | | 184.3 |
| Pollutant Concentration (Specify Pollutant and Unit of Concentration) | Pollutant | Unit of Concentration | | |
| | NOx | g/bhp-hr | 11.7 | 0.15 (permitting 0.9) |
| | CO | g/bhp-hr | 9.9 | 0.3 (permitting 0.9) |
| | VOC | g/bhp-hr | 0.5 | 0.04 (permitting 0.65) |
| | | | | |

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

# INSTRUCTIONS FOR PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

1. Complete this form for each piece of equipment or process, which has air pollution control equipment installed, described in the following Permit Applications: Hazardous Air Pollutant (HAP) Sources (SFN 8329), Fuel Burning Equipment for Indirect Heating (SFN 8518); Manufacturing or Processing Equipment (SFN 8520); Incinerators/Crematories (SFN 8522); Internal Combustion Engines and Turbines (SFN 8891); and Glycol Dehydration Units (SFN 58923). Print or type all information. If an item does not apply, place NA in the appropriate space.

2. Type of Equipment - If the type is not one of those listed; provide enough information so the operating principal of the equipment can be determined.

3. List each pollutant which the device is intended to control, the efficiency of removal intended by the designer, and the actual efficiency under operating conditions.

4. Please attach the following:

   - A brief description and sketch of the air pollution control device if it is of unusual design or used in conjunction with other control devices. Show any bypass of the device and specify the conditions under which the bypass is used.

   - A description of what is done with collected air contaminants from the time they are collected until they reach the final disposal point. Include a description of the transportation methods used.

   - If a stack test has been conducted, attach a copy of the results, date of the test, a description of the techniques used, and the name and address of the organization which performed the test.

5. If the control device is a combustor (e.g.: thermal oxidizer, vapor combustion unit, etc.), include an estimate of potential greenhouse gas emissions ($CO_2e$).

<u>SUBMIT YOUR APPLICATION WITH ALL SUPPORTING DOCUMENTS, ALONG WITH THE FORMS SPECIFIED IN THE FIRST PARAGRAPH ABOVE, TO:</u>

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# PERMIT APPLICATION FOR HAZARDOUS AIR POLLUTANT (HAP) SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8329 (9-2021)

## SECTION A1 - APPLICANT INFORMATION

| | | |
|---|---|---|
| Name of Firm or Organization<br>Hiland Partners Holdings LLC | | |
| Applicant's Name<br>Jess Coleman | | |
| Title<br>Director, Operations | Telephone Number<br>(701) 648-9361 | E-mail Address<br>jess_coleman@kindermorgan.com |
| Mailing Address (Street & No.)<br>1001 Louisiana Street, Suite 1000 | | |
| City<br>Houston | State<br>TX | ZIP Code<br>77002 |

## SECTION A2 - FACILITY INFORMATION

| | | |
|---|---|---|
| Contact Person for Air Pollution Matters<br>Jason Burow | | |
| Title<br>EHS Engineer | Telephone Number<br>(713) 420-2813 | E-mail Address<br>jason_burow@kindermorgan.com |
| Facility Address (Street & No. or Lat/Long to Nearest Second)<br>3507 149th Avenue NW | | |
| City<br>Alexander | State<br>ND | ZIP Code<br>58831 |
| County<br>McKenzie | Number of Employees at Location<br>90 | |
| Land Area at Plant Site<br>30 Acres (or) Sq. Ft. | MSL Elevation at Plant<br>2265 | |

Describe Nature of Business/Process

Natural gas processing plant

## SECTION B – STACK DATA

| | | |
|---|---|---|
| Inside Diameter (ft)<br>12 inches | Height Above Grade (ft)<br>1.5 X Building Height (approximately 35 ft) | |
| Gas Temperature at Exit (°F)<br>1,140 | Gas Velocity at Exit (ft/sec)<br>184.3 | Gas Volume (scfm)<br>8683 |
| 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<br>Residence | Distance (ft)<br>4,704 | Direction<br>East |
| Nearest Property Line<br>Property Line | Distance (ft)<br>325 | Direction<br>South |

## SECTION C – EMISSION STREAM DATA

| | |
|---|---|
| Source ID Number<br>SFN 8516 1 | Mean Particle Diameter (um)<br>Unknown |
| Flow Rate (scfm)<br>8683 | Drift Velocity (ft/sec)<br>Unknown |
| Stream Temperature (°F)<br>1,140 | Particulate Concentration (gr/dscf)<br>Unknown |
| Moisture Content (%)<br>Unknown | Halogens or Metals Present?<br>Unknown |
| Pressure (in. Hg)<br>749.9 | Organic Content (ppmv)<br>Unknown |
| Heat Content (Btu/scfm)<br>Unknown | $O_2$ Content (%)<br>Unknown |

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

| | |
|---|---|
| Pollutant Emitted<br>Methanol | Chemical Abstract Services (CAS) Number<br>67-56-1 |
| Proposed Emission Rate (lb/hr)<br>0.02 | Emission Source (describe)<br>1900 hp Compressor Engine #1 |
| Source Classification<br>(process point, process fugitive, area fugitive)<br>Process point | Pollutant Class and Form<br>(organic/inorganic - particulate/vapor)<br>Organic - Vapor |
| Concentration in Emission Stream (ppmv)<br>Unknown | Vapor Pressure (in. Hg @ °F)<br>unknown |
| Solubility<br>unknown | Molecular Weight (lb/lb-mole)<br>32.04 |
| Absorptive Properties<br>Unknown | |

| | |
|---|---|
| Pollutant Emitted<br>See calculations for remaining HAPs | Chemical Abstract Services (CAS) Number |
| Proposed Emission Rate (lb/hr) | Emission Source (describe) |
| Source Classification<br>(process point, process fugitive, area fugitive) | Pollutant Class and Form<br>(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<br>Alex Schmidt | Date<br>1-15-25 |

SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# PERMIT APPLICATION FOR GLYCOL DEHYDRATION UNITS

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 58923 (9-2021)

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 | Watford Gas Plant |

## 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 Dehydration Unit | 25 | COM-1 | VOC | 1.35 | 5.93 | BTEX Combustor |
| TEG Dehydration Unit | 25 | COM-1 | HAPs | 0.02 | 0.08 | BTEX Combustor |
| | | | | | | |
| | | | | | | |
| | | | | | | |

* *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) Wet Gas | Water Content (lb/MMSCF) Dry Gas | Glycol Recirc. Rate (gal/min) | VOC Emissions (ton/yr) |
| 25 | 40 | 40 | 893 | 124 | Saturated | 2.51 | 13 | 5.93 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## SECTION D – STACK DATA

| | | |
|---|---|---|
| Inside Diameter (ft)<br>N/A | Height Above Grade (ft)<br>N/A | Gas Volume (scfm)<br>unknown |
| Gas Temperature at Exit (°F)<br>unknown | Gas Velocity at Exit (ft/sec)<br>unknown | |
| Are Emission Control Devices in Place? If YES – Complete SFN 8532 ☒ Yes ☐ No | | |
| Nearest Residence or Building<br>Residence | Distance (ft)<br>4723 | Direction<br>East |
| Nearest Property Line<br>Property Line | Distance (ft)<br>525 | Direction<br>South |

SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701)328-5188

# PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8532 (9-2021)

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 | Watford City Gas Plant |

Source ID No. of Equipment being Controlled
25

## SECTION B – EQUIPMENT

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

| Name of Manufacturer | Model Number | Date to Be Installed |
|---|---|---|
| Unknown | Unknown | Existing -Installed 2021 |

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

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

Describe method used to determine operating efficiency:
The combustor's operating efficiency is the same as the design efficiency. It's assumed the combustor will be down 100 hr/yr for maintenance.

## 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 | 43.39 | 1.35 |
| | HAPs | lb/hr | 0.56 | 0.02 |
| | | | | |
| | | | | |

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

# INSTRUCTIONS FOR PERMIT APPLICATION FOR AIR POLLUTION CONTROL EQUIPMENT

1. Complete this form for each piece of equipment or process, which has air pollution control equipment installed, described in the following Permit Applications: Hazardous Air Pollutant (HAP) Sources (SFN 8329), Fuel Burning Equipment for Indirect Heating (SFN 8518); Manufacturing or Processing Equipment (SFN 8520); Incinerators/Crematories (SFN 8522); Internal Combustion Engines and Turbines (SFN 8891); and Glycol Dehydration Units (SFN 58923). Print or type all information. If an item does not apply, place NA in the appropriate space.

2. Type of Equipment - If the type is not one of those listed; provide enough information so the operating principal of the equipment can be determined.

3. List each pollutant which the device is intended to control, the efficiency of removal intended by the designer, and the actual efficiency under operating conditions.

4. Please attach the following:

   - A brief description and sketch of the air pollution control device if it is of unusual design or used in conjunction with other control devices. Show any bypass of the device and specify the conditions under which the bypass is used.

   - A description of what is done with collected air contaminants from the time they are collected until they reach the final disposal point. Include a description of the transportation methods used.

   - If a stack test has been conducted, attach a copy of the results, date of the test, a description of the techniques used, and the name and address of the organization which performed the test.

5. If the control device is a combustor (e.g.: thermal oxidizer, vapor combustion unit, etc.), include an estimate of potential greenhouse gas emissions ($CO_2e$).

<u>SUBMIT YOUR APPLICATION WITH ALL SUPPORTING DOCUMENTS, ALONG WITH THE FORMS SPECIFIED IN THE FIRST PARAGRAPH ABOVE, TO:</u>

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# PERMIT APPLICATION FOR HAZARDOUS AIR POLLUTANT (HAP) SOURCES

NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
SFN 8329 (9-2021)

## SECTION A1 - APPLICANT INFORMATION

| | | |
|---|---|---|
| Name of Firm or Organization<br>Hiland Partners Holdings LLC | | |
| Applicant's Name<br>Alex Schmidt | | |
| Title<br>Director, Operations | Telephone Number<br>(701) 833-6426 | E-mail Address<br>alex_schmidt@kindermorgan.com |
| Mailing Address (Street & No.)<br>14933 35th St. NW | | |
| City<br>Alexander | State<br>ND | ZIP Code<br>58831 |

## SECTION A2 - FACILITY INFORMATION

| | | |
|---|---|---|
| Contact Person for Air Pollution Matters<br>Jason Burow | | |
| Title<br>EHS Engineer | Telephone Number<br>(713) 420-2813 | E-mail Address<br>jason_burow@kindermorgan.com |
| Facility Address (Street & No. or Lat/Long to Nearest Second)<br>3507 149th Avenue NW | | |
| City<br>Alexander | State<br>ND | ZIP Code<br>58831 |

| | |
|---|---|
| County<br>McKenzie | Number of Employees at Location<br>90 |
| Land Area at Plant Site<br>30 Acres (or) Sq. Ft. | MSL Elevation at Plant<br>2265 |

Describe Nature of Business/Process

Natural gas processing plant

## SECTION B – STACK DATA

| | | |
|---|---|---|
| Inside Diameter (ft)<br>Unknown | Height Above Grade (ft)<br>Unknown | |
| Gas Temperature at Exit (°F)<br>Unknown | Gas Velocity at Exit (ft/sec)<br>Unknown | Gas Volume (scfm)<br>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<br>Residence | Distance (ft)<br>4,723 | Direction<br>East |
| Nearest Property Line<br>Property Line | Distance (ft)<br>525 | Direction<br>South |

## SECTION C – EMISSION STREAM DATA

| | |
|---|---|
| Source ID Number<br>SFN 8516 25 | Mean Particle Diameter (um)<br>Unknown |
| Flow Rate (scfm)<br>Unknown | Drift Velocity (ft/sec)<br>Unknown |
| Stream Temperature (°F)<br>Unknown | Particulate Concentration (gr/dscf)<br>Unknown |
| Moisture Content (%)<br>Unknown | Halogens or Metals Present?<br>Unknown |
| Pressure (in. Hg)<br>Unknown | Organic Content (ppmv)<br>Unknown |
| Heat Content (Btu/scfm)<br>Unknown | $O_2$ Content (%)<br>Unknown |

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

| | |
|---|---|
| Pollutant Emitted<br>Benzene | Chemical Abstract Services (CAS) Number<br>71-43-2 |
| Proposed Emission Rate (lb/hr)<br>0.01 | Emission Source (describe)<br>TEG Dehydration Unit |
| Source Classification<br>(process point, process fugitive, area fugitive)<br>Process point | Pollutant Class and Form<br>(organic/inorganic - particulate/vapor)<br>Organic - Vapor |
| Concentration in Emission Stream (ppmv)<br>Unknown | Vapor Pressure (in. Hg @ °F)<br>Unknown |
| Solubility<br>Unknown | Molecular Weight (lb/lb-mole)<br>78.11 |
| Absorptive Properties<br>Unknown | |

| | |
|---|---|
| Pollutant Emitted | Chemical Abstract Services (CAS) Number |
| Proposed Emission Rate (lb/hr) | Emission Source (describe) |
| Source Classification<br>(process point, process fugitive, area fugitive) | Pollutant Class and Form<br>(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 |
|---|---|
| Alex Schmidt | 1-15-25 |

SEND COMPLETED APPLICATION AND ALL ATTACHMENTS TO:

North Dakota Department of Environmental Quality
Division of Air Quality
4201 Normandy Street, 2nd Floor
Bismarck, ND 58503-1324
(701) 328-5188

# 6.0 Appendices

Appendix A – Supporting Emission Calculations

Appendix B – Manufacturer Specifications

Appendix C – ProMax Report

**Hiland Partners Holdings LLC**
**Watford City Gas Plant**
**Engine (EU1) Emissions**
**Equipment Data**

| | | | |
|---|---|---|---|
| **Emission Unit (EU):** | EU1 | | |
| **Emission Unit Name:** | Waukesha 7044 GSI (Inlet #1) | | |
| **Engine Type:** | 4SRB | | |
| **Fuel Usage:** | 134.67 | MMscf/yr | (Calculated value based on max fuel combustion rate.) |
| **Horsepower:** | 1,900 | bhp | |
| **Speed:** | 1,200 | rpm | |
| **Hours of Operation:** | 8,760 | hr/yr | |
| **Max. Fuel Combustion Rate (HHV):** | 8,253 | Btu/bhp-hr | (Based on Manufacturer Specs) |
| **Fuel Heating Value (HHV):** | 1,020 | Btu/scf | |
| **Max. Heat Rate (HHV):** | 15.68 | MMBtu/hr | |
| **$CO_2$ GWP (100 year):** | 1 | | |
| **$CH_4$ GWP (100 year):** | 28 | | |
| **$N_2O$ GWP (100 year):** | 265 | | |

| Pollutant | Emission Factor[1,2,3] | Units | Emission Factor Reference | Hourly Emissions (lb/hr) | Annual Emissions (ton/yr) |
|---|---|---|---|---|---|
| PM-10 (Front and Back Half) | 0.0194 | lb/MMBtu | AP-42 Table 3.2-3 (10/24) | 0.30 | 1.33 |
| NOx | 0.90 | g/BHP-hr | Engine Vendor | 3.77 | 16.51 |
| CO | 0.90 | g/BHP-hr | Engine Vendor | 3.77 | 16.51 |
| SO2 | 5.88E-04 | lb/MMBtu | AP-42 Table 3.2-3 (10/24) | 0.01 | 0.04 |
| VOC | 0.65 | g/BHP-hr | Permit Limit | 2.73 | 11.94 |
| Total HAPs | **See EU1 HAPs Emissions Calcs** | | Engine Vendor/AP-42 Table 3.2-3 (10/24) | 0.10 | 0.43 |
| Formaldehyde | 0.001 | g/BHP-hr | Engine Vendor | 4.19E-03 | 0.02 |
| **Pollutant** | **Emission Factor** | **Units** | **Emission Factor Reference** | **Hourly Emissions (lb/hr)** | **Annual Emissions (ton/yr)** |
| $CO_2e$ | -- | -- | -- | 1,835 | 8,037 |
| GHG | -- | -- | -- | 1,729 | 7,571 |
| $CO_2$ | 110 | lb/MMBtu | AP-42 Table 3.2-3 (10/24) | 1,725 | 7,555 |
| $CH_4$ | 0.23 | lb/MMBtu | AP-42 Table 3.2-3 (10/24) | 3.61 | 15.80 |
| $N_2O$ | 2.2 | lb/MMscf | AP-42 Table 1.4-2 (07/00) | 0.03 | 0.15 |

Notes:

1. NOx, CO and VOC emissions based on permitted EFs for the engine at it's previous location. Formaldehyde emissions are based on manufacturer data. $PM/PM_{10}$ and $SO_2$ emissions based on AP-42 Table 3.2-3.
2. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter. $PM = PM_{10} = PM_{2.5}$
3. VOC emissions include formaldehyde.

**Sample Calculation:**

PM-10 Emissions (ton/yr) = (Emission Factor, lb/MMBtu) x (Max Heat Input Rate (HHV), MMBtu/hr) x (Hours of Operation, hr/yr) / (2,000 lb/ton
PM-10 Emissions (ton/yr) = (0.01941 lb/MMBtu) x (15.68 MMBtu/hr) x (8,760 hr/yr) / (2,000 lb/ton) = 1.33 ton/y

VOC Emissions (ton/yr) = (Emission Factor, g/bhp-hr) x (Horsepower, bhp) x (Hours of Operation, hr/yr) / (2,000 lb/ton) / (453.59 grams/1 lb)
VOC Emissions (ton/yr) = (0.65 g/bhp-hr) x (1900 bhp) x (8,760 hr/yr) / (2,000 lb/ton) / (453.59 g/lb) = 11.94 ton/y

$CO_2e$ Emissions (ton/yr) = ($CO_2$ emissions x 1) + ($CH_4$ emissions x 25) + ($N_2O$ emissions x 298)
$CO_2e$ Emissions (ton/yr) = ((7554.96 ton/yr x 1) + (15.80 ton/yr x 28) + (0.15 ton/yr x 265)) = 8036.53 ton/yr

GHG Emissions (ton/yr) = ($CO_2$ emissions) + ($CH_4$ emissions) + ($N_2O$ emissions)
GHG Emissions (ton/yr) = (7554.96 ton/yr) + (15.80 ton/yr) + (0.15 ton/yr) = 7570.91 ton/y

**Hiland Partners Holdings LLC**
**Watford City Gas Plant**
**Engine (EU1) HAPs Emissions**
**Equipment Data**

| | | | | | |
|---|---|---|---|---|---|
| **Emission Unit (EU):** | EU1 | | | | |
| **Emission Unit Name:** | Waukesha 7044 GSI (Inlet #1) | | | | |
| **Engine Type:** | 4SRB | | | | |
| **Engines** | **Horsepower (hp)** | **Hours per Year** | **Heat Input (MMBtu/hr)** | **Heat Input (MMBtu/yr)** | **Fuel Input (MMscf/yr)** |
| Engine EU1 | 1,900 | 8,760 | 16 | 137,363 | 134.67 |

| **HAPs** | **Emission Factor (lb/MMBtu)** | **Emission Factor (g/bhp-hr)** | **Control Efficiency (%)** | **Controlled Emissions (lb/hr)** | **Controlled Emissions (tpy)** | **Notes** |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 2.53E-05 | -- | 50% | 1.98E-04 | 8.69E-04 | 1,3 |
| 1,1,2-Trichloroethane | 1.53E-05 | -- | 50% | 1.20E-04 | 5.25E-04 | 1,3 |
| 1,1-Dichloroethane | 1.13E-05 | -- | 50% | 8.86E-05 | 3.88E-04 | 1,3 |
| 1,2-Dichloroethane | 1.13E-05 | -- | 50% | 8.86E-05 | 3.88E-04 | 1,3 |
| 1,2-Dichloropropane | 1.30E-05 | -- | 50% | 1.02E-04 | 4.46E-04 | 1,3 |
| 1,3-Butadiene | 6.63E-04 | -- | 50% | 0.01 | 0.02 | 1,3 |
| 1,3-Dichloropropene | 1.27E-05 | -- | 50% | 9.96E-05 | 4.36E-04 | 1,3 |
| Acetaldehyde | 2.79E-03 | -- | 50% | 0.02 | 0.10 | 1,3 |
| Acrolein | 2.63E-03 | -- | 50% | 0.02 | 0.09 | 1,3 |
| Benzene | 1.58E-03 | -- | 50% | 0.01 | 0.05 | 1,3 |
| Carbon Tetrachloride | 1.77E-05 | -- | 50% | 1.39E-04 | 6.08E-04 | 1,3 |
| Chlorobenzene | 1.29E-05 | -- | 50% | 1.01E-04 | 4.43E-04 | 1,3 |
| Chloroform | 1.37E-05 | -- | 50% | 1.07E-04 | 4.70E-04 | 1,3 |
| Ethylbenzene | 2.48E-05 | -- | 50% | 1.94E-04 | 8.52E-04 | 1,3 |
| Ethylene Dibromide | 2.13E-05 | -- | 50% | 1.67E-04 | 7.31E-04 | 1,3 |
| Formaldehyde | -- | 1.00E-03 | -- | 4.19E-03 | 0.02 | 2 |
| Methanol | 3.06E-03 | -- | 50% | 0.02 | 0.11 | 1,3 |
| Methylene Chloride | 4.12E-05 | -- | 50% | 3.23E-04 | 1.41E-03 | 1,3 |
| Naphthalene | 9.71E-05 | -- | 50% | 7.61E-04 | 3.33E-03 | 1,3 |
| PAH | 1.41E-04 | -- | 50% | 1.11E-03 | 4.84E-03 | 1,3 |
| Styrene | 1.19E-05 | -- | 50% | 9.33E-05 | 4.09E-04 | 1,3 |
| Toluene | 5.58E-04 | -- | 50% | 4.37E-03 | 0.02 | 1,3 |
| Vinyl Chloride | 7.18E-06 | -- | 50% | 5.63E-05 | 2.47E-04 | 1,3 |
| Xylene | 1.95E-04 | -- | 50% | 1.53E-03 | 0.01 | 1,3 |

Notes:

1. Emission factor from AP-42 Table 3.2-3, Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines (October 2024)
2. Vendor Information.
3. Control efficiency from the dual catalytic converter unit was conservatively assumed to be 50% per verbal guidance by NDDH on 4/29/10.

**Hiland Partners Holdings LLC**
**Watford City Gas Plant**
**Dehy Emissions**
**Equipment Data**

| | | |
|---|---|---|
| **Emission Unit (EU):** | EU5 EU19 EU25 | |
| **Emission Unit Name:** | TEG Dehydration Unit | |
| **Hours of Operation:** | 8,760 | hr/yr |
| **Flow (EU5):** | 30.00 | MMscfd |
| **Flow (EU19):** | 4.00 | MMscfd |
| **Flow (EU25):** | 40.00 | MMscfd |
| **Total Flow:** | 27,010 | MMscf |
| **Combustor Maintenance Downtime:** | 100 | hr/yr |
| **Combustor Destruction Efficiency:** | 98% | |

| Pollutant | EU5 Condenser Outlet Emissions | | EU19 Condenser Outlet Emissions | | EU25 Condenser Outlet Emissions | | EU5, EU19, EU26 Annual Emissions | |
|---|---|---|---|---|---|---|---|---|
| | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) |
| **VOC** | **12.21** | **53.47** | **0.05** | **0.22** | **43.39** | **190.07** | **55.65** | **243.76** |
| -Propane | 4.74 | 20.75 | 0.05 | 0.21 | 21.31 | 93.36 | 26.10 | 114.32 |
| -Isobutane | 0.90 | 3.95 | 4.00E-04 | 1.75E-03 | 2.78 | 12.17 | 3.68 | 16.12 |
| -n-Butane | 3.70 | 16.22 | 1.60E-03 | 0.01 | 12.23 | 53.55 | 15.93 | 69.78 |
| -Isopentane | 0.45 | 1.98 | 0 | 0 | 2.20 | 9.62 | 2.65 | 11.60 |
| -n-Pentane | 0.74 | 3.24 | 0 | 0 | 3.05 | 13.34 | 3.79 | 16.58 |
| -Cyclopentane | 0.06 | 0.25 | 0 | 0 | 0 | 0 | 0.06 | 0.25 |
| -n-Hexane | 0.06 | 0.28 | 0 | 0 | 0 | 0 | 0.06 | 0.28 |
| -Cyclohexane | 0.10 | 0.42 | 0 | 0 | 0 | 0 | 0.10 | 0.42 |
| -Other Hexanes | 0.10 | 0.45 | 0 | 0 | 1.20 | 5.27 | 1.31 | 5.72 |
| -Heptanes | 0.11 | 0.50 | 0 | 0 | 0.07 | 0.30 | 0.18 | 0.80 |
| -Methylcyclohexane | 0.04 | 0.16 | 0 | 0 | 0 | 0 | 0.04 | 0.16 |
| -2,2,4-Trimethylpentane | 1.80E-03 | 0.01 | 0 | 0 | 0 | 0 | 1.80E-03 | 0.01 |
| -Benzene | 0.67 | 2.94 | 0 | 0 | 0.45 | 1.96 | 1.12 | 4.90 |
| -Toluene | 0.24 | 1.03 | 0 | 0 | 0.10 | 0.44 | 0.34 | 1.47 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 1.74E-03 | 0.01 | 1.74E-03 | 0.01 |
| -Xylenes | 0.28 | 1.22 | 0 | 0 | 0.01 | 0.04 | 0.29 | 1.26 |
| -C8+ Heavies | 0.02 | 0.07 | 0 | 0 | 0.01 | 0.02 | 0.02 | 0.09 |
| **HAPs** | **1.25** | **5.48** | **0** | **0** | **0.56** | **2.44** | **1.81** | **7.93** |
| -n-Hexane | 0.06 | 0.28 | 0 | 0 | 0 | 0 | 0.06 | 0.28 |
| -2,2,4-Trimethylpentane | 1.80E-03 | 0.01 | 0 | 0 | 0 | 0 | 1.80E-03 | 0.01 |
| -Benzene | 0.67 | 2.94 | 0 | 0 | 0.45 | 1.96 | 1.12 | 4.90 |
| -Toluene | 0.24 | 1.03 | 0 | 0 | 0.10 | 0.44 | 0.34 | 1.47 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 1.74E-03 | 0.01 | 1.74E-03 | 0.01 |
| -Xylenes | 0.28 | 1.22 | 0 | 0 | 0.01 | 0.04 | 0.29 | 1.26 |
| **BTEX** | **1.19** | **5.19** | **0** | **0** | **0.56** | **2.44** | **1.74** | **7.64** |
| -Benzene | 0.67 | 2.94 | 0 | 0 | 0.45 | 1.96 | 1.12 | 4.90 |
| -Toluene | 0.24 | 1.03 | 0 | 0 | 0.10 | 0.44 | 0.34 | 1.47 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 1.74E-03 | 0.01 | 1.74E-03 | 0.01 |
| -Xylenes | 0.28 | 1.22 | 0 | 0 | 0.01 | 0.04 | 0.29 | 1.26 |

| Pollutant | Post Combustor Emissions | | Post Combustor Emissions | | Post Combustor Emissions | | EU5, EU19, EU25 Annual Emissions | |
|---|---|---|---|---|---|---|---|---|
| | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) | (lb/hr) | (ton/yr) |
| **VOC** | **0.38** | **1.67** | **1.59E-03** | **0.01** | **1.35** | **5.93** | **0.38** | **7.60** |
| -Propane | 0.15 | 0.65 | 1.53E-03 | 0.01 | 0.66 | 2.91 | 0.81 | 3.57 |
| -Isobutane | 0.03 | 0.12 | 1.25E-05 | 5.46E-05 | 0.09 | 0.38 | 0.11 | 0.50 |
| -n-Butane | 0.12 | 0.51 | 4.99E-05 | 2.19E-04 | 0.38 | 1.67 | 0.50 | 2.18 |
| -Isopentane | 0.01 | 0.06 | 0 | 0 | 0.07 | 0.30 | 0.08 | 0.36 |
| -n-Pentane | 0.02 | 0.10 | 0 | 0 | 0.09 | 0.42 | 0.12 | 0.52 |
| -Cyclopentane | 1.75E-03 | 0.01 | 0 | 0 | 0 | 0 | 1.75E-03 | 0.01 |
| -n-Hexane | 2.02E-03 | 0.01 | 0 | 0 | 0 | 0 | 2.02E-03 | 0.01 |
| -Cyclohexane | 3.01E-03 | 0.01 | 0 | 0 | 0 | 0 | 3.01E-03 | 0.01 |
| -Other Hexanes | 3.18E-03 | 0.01 | 0 | 0 | 0.04 | 0.16 | 0.04 | 0.18 |
| -Heptanes | 3.57E-03 | 0.02 | 0 | 0 | 2.13E-03 | 0.01 | 0.01 | 0.02 |
| -Methylcyclohexane | 1.11E-03 | 4.88E-03 | 0 | 0 | 0 | 0 | 1.11E-03 | 4.88E-03 |
| -2,2,4-Trimethylpentane | 5.61E-05 | 2.46E-04 | 0 | 0 | 0 | 0 | 5.61E-05 | 2.46E-04 |
| -Benzene | 0.02 | 0.09 | 0 | 0 | 0.01 | 0.06 | 0.03 | 0.15 |
| -Toluene | 0.01 | 0.03 | 0 | 0 | 3.11E-03 | 0.01 | 0.01 | 0.05 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 5.42E-05 | 2.4E-04 | 5.42E-05 | 2.37E-04 |
| -Xylenes | 0.01 | 0.04 | 0 | 0 | 2.98E-04 | 1.3E-03 | 0.01 | 0.04 |
| -C8+ Heavies | 5.08E-04 | 2.23E-03 | 0 | 0 | 1.63E-04 | 7.14E-04 | 6.71E-04 | 2.94E-03 |
| **HAPs** | **0.04** | **0.17** | **0** | **0** | **0.02** | **0.08** | **0.06** | **0.25** |
| -n-Hexane | 2.02E-03 | 0.01 | 0 | 0 | 0 | 0 | 2.02E-03 | 0.01 |
| -2,2,4-Trimethylpentane | 5.61E-05 | 2.46E-04 | 0 | 0 | 0 | 0 | 5.61E-05 | 2.46E-04 |
| -Benzene | 0.02 | 0.09 | 0 | 0 | 0.01 | 0.06 | 0.03 | 0.15 |
| -Toluene | 0.01 | 0.03 | 0 | 0 | 3.11E-03 | 0.01 | 0.01 | 0.05 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 5.42E-05 | 2.37E-04 | 5.42E-05 | 2.37E-04 |
| -Xylenes | 0.01 | 0.04 | 0 | 0 | 2.98E-04 | 1.30E-03 | 0.01 | 0.04 |
| **BTEX** | **0.04** | **0.16** | **0** | **0** | **0.02** | **0.08** | **0.04** | **0.24** |
| -Benzene | 0.02 | 0.09 | 0 | 0 | 0.01 | 0.06 | 0.02 | 0.15 |
| -Toluene | 0.01 | 0.03 | 0 | 0 | 3.11E-03 | 0.01 | 0.01 | 0.05 |
| -Ethylbenzene | 0 | 0 | 0 | 0 | 5.42E-05 | 2.37E-04 | 0 | 2.37E-04 |
| -Xylenes | 0.01 | 0.04 | 0 | 0 | 2.98E-04 | 1.30E-03 | 0.01 | 0.04 |

**Hiland Partners Holdings LLC**
**Watford City Gas Plant**
**BTEX Combustor Emissions**
**Equipment Data**

| | | |
|---|---|---|
| **Emission Unit (EU):** | COM-1 | |
| **Emission Unit Name:** | BTEX Combustor | |
| **Annual Hours of Operation:** | 8760 | hr/yr |
| **Condenser Overhead:** | 7.60 | MMscf |
| **Pilot Gas + Assist Gas:** | 21.81 | MMscf |

| **Criteria Pollutant Emissions** | | | | **Condenser Overhead** | | **Pilot + Assist Gas** | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|
| **Pollutant** | **Emission Factor** | **Units** | **EF Source** | **lb/hr** | **ton/yr** | **lb/hr** | **ton/yr** | **lb/hr** | **ton/yr** |
| NOx | 100 | lb/MMscf | AP-42 Table 1.4-1 | 0.09 | 0.38 | 0.25 | 1.09 | 0.34 | 1.47 |
| CO | 84 | lb/MMscf | AP-42 Table 1.4-1 | 0.07 | 0.32 | 0.21 | 0.92 | 0.28 | 1.24 |
| VOC[1] | 5.5 | lb/MMscf | AP-42 Table 1.4-2 | 0 | 0 | 0.01 | 0.06 | 0.01 | 0.06 |
| PM Condenseable | 5.7 | lb/MMscf | AP-42 Table 1.4-2 | 4.94E-03 | 0.02 | 0.01 | 0.06 | 0.02 | 0.08 |
| PM Filterable | 1.9 | lb/MMscf | AP-42 Table 1.4-2 | 1.65E-03 | 0.01 | 4.73E-03 | 0.02 | 0.01 | 0.03 |
| PM Total | 7.6 | lb/MMscf | AP-42 Table 1.4-2 | 0.01 | 0.03 | 0.02 | 0.08 | 0.03 | 0.11 |
| $SO_2$ | 0.6 | lb/MMscf | AP-42 Table 1.4-2 | 5.20E-04 | 2.28E-03 | 1.49E-03 | 0.01 | 2.01E-03 | 0.01 |

| **HAPs Emissions[1]** | | | | **Condenser Overhead** | | **Pilot + Assist Gas** | | **Total** | |
|---|---|---|---|---|---|---|---|---|---|
| **Pollutant** | **Emission Factor** | **Units** | **EF Source** | **lb/hr** | **ton/yr** | **lb/hr** | **ton/yr** | **lb/hr** | **ton/yr** |
| Benzene | 2.10E-03 | lb/MMscf | AP-42 Table 1.4-3 | 0 | 0 | 5.23E-06 | 2.29E-05 | 5.23E-06 | 2.29E-05 |
| Formaldehyde | 0.08 | lb/MMscf | AP-42 Table 1.4-3 | 0 | 0 | 1.87E-04 | 8.18E-04 | 1.87E-04 | 8.18E-04 |
| Toluene | 3.40E-03 | lb/MMscf | AP-42 Table 1.4-3 | 0 | 0 | 8.47E-06 | 3.71E-05 | 8.47E-06 | 3.71E-05 |
| n-hexane | 1.80 | lb/MMscf | AP-42 Table 1.4-3 | 0 | 0 | 4.48E-03 | 0.02 | 4.48E-03 | 0.02 |

| **Condenser Vent Stream** | | | | | | |
|---|---|---|---|---|---|---|
| | **129.00 scf/hr total** | | **8.12 scf/hr total** | | **781.63 scf/hr total** | |
| | **GLYCalc Output** | | **GLYCalc Output** | | **ProMax Output** | |
| **Component** | **mol%** | **scf/hr** | **mol%** | **scf/hr** | **mol %** | **scf/hr** |
| Water | 12.30 | -- | 12.40 | -- | 0.81 | -- |
| CO2 | 2.97 | -- | 9.95 | -- | 2.05 | -- |
| Nitrogen | 0.00 | -- | 1.04 | -- | 0.97 | -- |
| Methane | 0.50 | 0.65 | 28.20 | 2.29 | 29.00 | 226.67 |
| Ethane | 19.00 | 24.51 | 43.00 | 3.49 | 26.58 | 207.76 |
| Propane | 31.50 | 40.64 | 5.19 | 0.42 | 23.47 | 183.45 |
| Isobutane | 4.55 | 5.87 | 0.03 | 0.00 | 2.32 | 18.13 |
| n-Butane | 18.70 | 24.12 | 0.13 | 0.01 | 10.21 | 79.80 |
| IsoPentane | 1.84 | 2.37 | -- | -- | 1.48 | 11.57 |
| n-Pentane | 3.01 | 3.88 | -- | -- | 2.05 | 16.02 |
| Cyclopentane | 0.23 | 0.30 | -- | -- | 0.00 | 0.00 |
| n-Hexane | 0.22 | 0.29 | -- | -- | 0.00 | 0.00 |
| Cyclohexane | 0.34 | 0.43 | -- | -- | 0.00 | 0.00 |
| Other hexanes | 0.35 | 0.45 | -- | -- | 0.68 | 5.32 |
| Heptanes | 0.34 | 0.43 | -- | -- | 0.03 | 0.23 |
| Methylcyclohexane | 0.11 | 0.14 | -- | -- | 0.00 | 0.00 |
| 2,2,4-Triemethylpentane | 0.00 | 0.01 | -- | -- | 0.00 | 0.00 |
| Benzene | 2.52 | 3.25 | -- | -- | 0.28 | 2.19 |
| Toluene | 0.75 | 0.97 | -- | -- | 0.05 | 0.39 |
| Xylenes | 0.77 | 0.99 | -- | -- | 0.00 | 0.03 |
| TEG | -- | -- | -- | -- | 0.00 | 8.19E-18 |
| C8 + | 0.03 | 0.04 | -- | -- | 0.00 | 0.02 |
| **Total** | **100** | **109.33** | **100** | **6.22** | **100** | **751.59** |

Notes:

1. VOC and HAPs emissions are shown at EU5, EU19, and EU25.

**Hiland Partners Holdings LLC**
**Watford City Gas Plant**
**Fugitive Emissions**
**Equipment Data**

| | | |
|---|---|---|
| **Emission Unit (EU):** | FUG 1 | |
| **Emission Unit Name:** | Fugitive Emissions | |
| **Annual Operating Days:** | 365 | days/yr |
| **Annual Operating Hours:** | 8760 | hr/yr |

| **Equipment Information - Monitored Components Subject to 40 CFR 60 Subpart KKK, OOOO, OOOOa & OOOOb** | | | | | | | **Uncontrolled** | | **Controlled** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Source Type/Service** | **Number of Sources[1]** | **Emission Factor[2] (lb-hr/source)** | **Control Efficiency[3] (%)** | **TOC lb/hr** | **TOC ton/yr** | **VOC[4] Wt%** | **VOC lb/hr** | **VOC ton/yr** | **VOC lb/hr** | **VOC ton/yr** |
| Valve - Gas | 4659 | 9.92E-03 | 67.00% | 46.22 | 202.43 | 39.14% | 18.09 | 79.22 | 5.97 | 26.14 |
| Connectors - Gas | 9274 | 4.41E-04 | 67.00% | 4.09 | 17.91 | 39.14% | 1.60 | 7.01 | 0.53 | 2.31 |
| Compressor Seals - Gas | 23 | 0.0194 | 75.00% | 0.45 | 1.95 | 39.14% | 0.17 | 0.76 | 0.04 | 0.19 |
| Other - Gas | 810 | 0.0194 | 97.00% | 15.71 | 68.83 | 39.14% | 6.15 | 26.94 | 0.18 | 0.81 |
| **Total (Gas Components)** | | | | **66.47** | **291.13** | | **26.01** | **113.93** | **6.73** | **29.46** |
| Valves - Light Oil | 3812 | 5.51E-03 | 61.00% | 21.00 | 92.00 | 100.00% | 8.22 | 92.00 | 3.21 | 35.88 |
| Connectors - Light Oil | 18002 | 4.63E-04 | 61.00% | 8.33 | 36.51 | 100.00% | 3.26 | 36.51 | 1.27 | 14.24 |
| Open-Ended Lines - Light Oil | 0 | 3.09E-03 | 97.00% | 0.00 | 0.00 | 100.00% | 0.0 | 0.0 | 0.0 | 0.0 |
| Other - Light Oil | 800 | 0.0005 | 97.00% | 0.37 | 1.62 | 100.00% | 0.14 | 1.62 | 4.35E-03 | 0.05 |
| Pump Seals - Light Oil | 50 | 0.0287 | 45.00% | 1.44 | 6.29 | 100.00% | 0.56 | 6.29 | 0.31 | 3.46 |
| **Total (Liquid Components)** | | | | **31.14** | **136.41** | | **12.19** | **136.41** | **4.79** | **53.62** |
| **Total (Gas + Liquid Components)** | | | | **97.61** | **427.54** | | **38.20** | **250.35** | **11.52** | **83.08** |

Notes

1: Counts from July-December 2022 SA LDAR reports from TEAM. Distribution of valves and connectors based on 2018 Title V application.

2: Emission factors are for oil and gas production facilities (not refineries) from EPA's "Protocol for Equipment Leak Emission Estimates", November 1995, EPA 4531, R-95-017, Table 2-4.

3: Control efficiencies based on NSPS KKK LDAR Program under 10,000 ppm leak definition monitored quarterly (applied % control to connectors as well since all monitored under OOOO/OOOOa/OOOOb).

4: Speciated gas sampled from plant inlet analysis from October 2023 and light liquid assumed 100% VOC.

| **Component** | **Gas (wt%)** | **Gas/Vapor Emissions** | |
|---|---|---|---|
| | | **(lb/hr)** | **(tpy)** |
| $CO_2$ | 1.40 | 0.09 | 0.41 |
| Nitrogen | 1.53 | 0.10 | 0.45 |
| $H_2S$ | 0.00 | 0.00 | 0.00 |
| Methane | 25.47 | 1.71 | 7.50 |
| Ethane | 32.46 | 2.18 | 9.56 |
| Propane | 26.46 | 1.78 | 7.79 |
| i-Butane | 2.95 | 0.20 | 0.87 |
| n-Butane | 7.32 | 0.49 | 2.16 |
| i-Pentane | 0.77 | 0.05 | 0.23 |
| n-Pentane | 0.84 | 0.06 | 0.25 |
| Benzene | 0.01 | 0.00 | 0.00 |
| n-Hexane | 0.18 | 0.01 | 0.05 |
| Hexanes | 0.34 | 0.02 | 0.10 |
| Toluene | 0.00 | 0.00 | 0.00 |
| Heptanes | 0.26 | 0.02 | 0.08 |
| 2,2,4-Trimethylpentane | 0.00 | 0.00 | 0.00 |
| Ethylbenzene | 0.00 | 0.00 | 0.00 |
| Xylenes | 0.00 | 0.00 | 0.00 |
| Octanes | 0.01 | 0.00 | 0.00 |
| Nonanes | 0.00 | 0.00 | 0.00 |
| C10+ | 0.00 | 0.00 | 0.00 |
| **Total** | **100.00** | **6.73** | **29.46** |
| **Total VOC** | **39.14** | **2.63** | **11.53** |
| **Total HAPs** | **0.21** | **0.01** | **0.06** |

# VHP - L7044GSI S5

Gas Compression

| | | | |
|---|---|---|---|
| ENGINE SPEED (rpm): | 1200 | NOx SELECTION (g/bhp-hr): | Customer Catalyst |
| DISPLACEMENT (in3): | 7040 | COOLING SYSTEM: | JW, IC + OC |
| COMPRESSION RATIO: | 9.7:1 | INTERCOOLER WATER INLET (°F): | 130 |
| IGNITION SYSTEM: | ESM2 | JACKET WATER OUTLET (°F): | 180 |
| EXHAUST MANIFOLD: | Water Cooled | JACKET WATER CAPACITY (gal): | 100 |
| COMBUSTION: | Rich Burn, Turbocharged | AUXILIARY WATER CAPACITY (gal): | 11 |
| ENGINE DRY WEIGHT (lbs): | 24250 | LUBE OIL CAPACITY (gal): | 190 |
| AIR/FUEL RATIO SETTING: | 0.38% CO | MAX. EXHAUST BACKPRESSURE (in. H2O): | 20 |
| ENGINE SOUND LEVEL (dBA) | 102.7 | MAX. AIR INLET RESTRICTION (in. H2O): | 15 |
| IGNITION TIMING: | ESM2 Controlled | EXHAUST SOUND LEVEL (dBA) | 98.9 |

**SITE CONDITIONS:**

| | | | |
|---|---|---|---|
| FUEL: | Natural Gas | ALTITUDE (ft): | 3000 |
| FUEL PRESSURE RANGE (psig): | 40 - 60 | MAXIMUM INLET AIR TEMPERATURE (°F): | 100 |
| FUEL HHV (BTU/ft3): | 1,274.3 | FUEL WKI: | 59.7 |
| FUEL LHV (BTU/ft3): | 1,151.9 | | |

**SITE SPECIFIC TECHNICAL DATA**

| POWER RATING | UNITS | | MAX RATING AT 100 °F AIR TEMP | SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 100 °F | | |
|---|---|---|---|---|---|---|
| | | | | 100% | 75% | 51% |
| CONTINUOUS ENGINE POWER | BHP | | 1881 | 1881 | 1411 | 950 |
| OVERLOAD | % 2/24 hr | | 0 | 0 | - | - |
| MECHANICAL EFFICIENCY (LHV) | % | | 34.1 | 34.1 | 33.5 | 31.7 |
| CONTINUOUS POWER AT FLYWHEEL | BHP | | 1881 | 1881 | 1411 | 950 |
| *based on no auxiliary engine driven equipment* | | | | | | |
| AVAILABLE TURNDOWN SPEED RANGE | RPM | | 900 - 1200 | | | |
| **FUEL CONSUMPTION** | | | | | | |
| FUEL CONSUMPTION (LHV) | BTU/BHP-hr | | 7461 | 7461 | 7609 | 8033 |
| FUEL CONSUMPTION (HHV) | BTU/BHP-hr | | 8253 | 8253 | 8417 | 8886 |
| FUEL FLOW *based on fuel analysis LHV* | SCFM | | 203 | 203 | 155 | 110 |
| **HEAT REJECTION** | | | | | | |
| JACKET WATER (JW) | BTU/hr x 1000 | | 3842 | 3842 | 3061 | 2291 |
| LUBE OIL (OC) | BTU/hr x 1000 | | 497 | 497 | 453 | 399 |
| INTERCOOLER (IC) | BTU/hr x 1000 | | 726 | 726 | 405 | 155 |
| EXHAUST | BTU/hr x 1000 | | 3844 | 3844 | 2856 | 1975 |
| RADIATION | BTU/hr x 1000 | | 609 | 609 | 576 | 544 |
| **EMISSIONS (ENGINE OUT):** | | | | | | |
| NOx (NO + NO2) | g/bhp-hr | | 11.8 | 11.8 | 13.1 | 13.7 |
| CO | g/bhp-hr | | 9.7 | 9.7 | 9.6 | 9.8 |
| THC | g/bhp-hr | | 0.3 | 0.3 | 0.3 | 0.3 |
| NMHC | g/bhp-hr | | 0.12 | 0.12 | 0.21 | 0.31 |
| NM,NEHC (VOC) | g/bhp-hr | | 0.05 | 0.05 | 0.08 | 0.12 |
| CO2 | g/bhp-hr | | 480 | 480 | 490 | 517 |
| CO2e | g/bhp-hr | | 484 | 484 | 496 | 526 |
| CH2O | g/bhp-hr | | 0.001 | 0.001 | 0.001 | 0.001 |
| CH4 | g/bhp-hr | | 0.14 | 0.14 | 0.24 | 0.35 |
| **AIR INTAKE / EXHAUST GAS** | | | | | | |
| INDUCTION AIR FLOW | SCFM | | 2626 | 2626 | 2009 | 1429 |
| EXHAUST GAS MASS FLOW | lb/hr | | 12210 | 12210 | 9339 | 6643 |
| EXHAUST GAS FLOW *at exhaust temp, 14.5 psia* | ACFM | | 8683 | 8683 | 6512 | 4538 |
| EXHAUST TEMPERATURE | °F | | 1140 | 1140 | 1109 | 1077 |

| HEAT EXCHANGER SIZING[12] | | | |
|---|---|---|---|
| TOTAL JACKET WATER CIRCUIT (JW) | BTU/hr x 1000 | | 4357 |
| TOTAL AUXILIARY WATER CIRCUIT (IC + OC) | BTU/hr x 1000 | | 1387 |

| COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS | | |
|---|---|---|
| JACKET WATER PUMP MIN. DESIGN FLOW | GPM | 450 |
| JACKET WATER PUMP MAX. EXTERNAL RESTRICTION | psig | 16 |
| AUX WATER PUMP MIN. DESIGN FLOW | GPM | 79 |
| AUX WATER PUMP MAX. EXTERNAL RESTRICTION | psig | 36 |

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

Data Generated by EngCalc Program Version 3.7 GE Distributed Power, Inc.

8/3/2018 3:22 PM

# VHP - L7044GSI S5

Gas Compression

## FUEL COMPOSITION

| HYDROCARBONS: | | Mole or Volume % |
|---|---|---|
| Methane | CH4 | 69.39 |
| Ethane | C2H6 | 19.31 |
| Propane | C3H8 | 6.64 |
| Iso-Butane | I-C4H10 | 0.43 |
| Normal Butane | N-C4H10 | 0.88 |
| Iso-Pentane | I-C5H12 | 0.0692 |
| Normal Pentane | N-C5H12 | 0.0815 |
| Hexane | C6H14 | 0.1201 |
| Heptane | C7H16 | 0 |
| Ethene | C2H4 | 0 |
| Propene | C3H6 | 0 |
| | SUM HYDROCARBONS | 96.921 |
| NON-HYDROCARBONS: | | |
| Nitrogen | N2 | 2.183 |
| Oxygen | O2 | 0 |
| Helium | He | 0 |
| Carbon Dioxide | CO2 | 0.8857 |
| Carbon Monoxide | CO | 0 |
| Hydrogen | H2 | 0 |
| Water Vapor | H2O | 0 |
| | TOTAL FUEL | 99.99 |

| | |
|---|---|
| FUEL: | Natural Gas |
| FUEL PRESSURE RANGE (psig): | 40 - 60 |
| FUEL WKI: | 59.7 |
| FUEL SLHV (BTU/ft3): | 1131.89 |
| FUEL SLHV (MJ/Nm3): | 44.51 |
| FUEL LHV (BTU/ft3): | 1151.93 |
| FUEL LHV (MJ/Nm3): | 45.30 |
| FUEL HHV (BTU/ft3): | 1274.26 |
| FUEL HHV (MJ/Nm3): | 50.11 |
| FUEL DENSITY (SG): | 0.75 |

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

## FUEL CONTAMINANTS

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

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

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

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

# VHP - L7044GSI S5

Gas Compression

| | | | |
|---|---|---|---|
| ENGINE SPEED (rpm): | 1200 | NOx SELECTION (g/bhp-hr): | 0.15 |
| DISPLACEMENT (in3): | 7040 | COOLING SYSTEM: | JW, IC + OC |
| COMPRESSION RATIO: | 9.7:1 | INTERCOOLER WATER INLET (°F): | 130 |
| IGNITION SYSTEM: | ESM2 | JACKET WATER OUTLET (°F): | 180 |
| EXHAUST MANIFOLD: | Water Cooled | JACKET WATER CAPACITY (gal): | 100 |
| COMBUSTION: | Rich Burn, Turbocharged | AUXILIARY WATER CAPACITY (gal): | 11 |
| ENGINE DRY WEIGHT (lbs): | 24250 | LUBE OIL CAPACITY (gal): | 190 |
| AIR/FUEL RATIO SETTING: | 0.38% CO | MAX. EXHAUST BACKPRESSURE (in. H2O): | 20 |
| ENGINE SOUND LEVEL (dBA) | 102.7 | MAX. AIR INLET RESTRICTION (in. H2O): | 15 |
| IGNITION TIMING: | ESM2 Controlled | EXHAUST SOUND LEVEL (dBA) | 98.9 |

**SITE CONDITIONS:**

| | | | |
|---|---|---|---|
| FUEL: | Natural Gas | ALTITUDE (ft): | 3000 |
| FUEL PRESSURE RANGE (psig): | 40 - 60 | MAXIMUM INLET AIR TEMPERATURE (°F): | 100 |
| FUEL HHV (BTU/ft3): | 1,274.3 | FUEL WKI: | 59.7 |
| FUEL LHV (BTU/ft3): | 1,151.9 | | |

**SITE SPECIFIC TECHNICAL DATA**

| POWER RATING | UNITS | | MAX RATING AT 100 °F AIR TEMP | SITE RATING AT MAXIMUM INLET AIR TEMPERATURE OF 100 °F | | |
|---|---|---|---|---|---|---|
| | | | | 100% | 95% | 76% |
| CONTINUOUS ENGINE POWER | BHP | | 1881 | 1881 | 1787 | 1425 |
| OVERLOAD | % 2/24 hr | | 0 | 0 | - | - |
| MECHANICAL EFFICIENCY (LHV) | % | | 34.1 | 34.1 | 34.1 | 33.5 |
| CONTINUOUS POWER AT FLYWHEEL | BHP | | 1881 | 1881 | 1787 | 1425 |
| *based on no auxiliary engine driven equipment* | | | | | | |
| AVAILABLE TURNDOWN SPEED RANGE | RPM | | 900 - 1200 | | | |
| **FUEL CONSUMPTION** | | | | | | |
| FUEL CONSUMPTION (LHV) | BTU/BHP-hr | | 7461 | 7461 | 7479 | 7601 |
| FUEL CONSUMPTION (HHV) | BTU/BHP-hr | | 8253 | 8253 | 8273 | 8409 |
| FUEL FLOW *based on fuel analysis LHV* | SCFM | | 203 | 203 | 193 | 157 |
| **HEAT REJECTION** | | | | | | |
| JACKET WATER (JW) | BTU/hr x 1000 | | 3842 | 3842 | 3687 | 3085 |
| LUBE OIL (OC) | BTU/hr x 1000 | | 497 | 497 | 489 | 455 |
| INTERCOOLER (IC) | BTU/hr x 1000 | | 726 | 726 | 657 | 413 |
| EXHAUST | BTU/hr x 1000 | | 3844 | 3844 | 3639 | 2885 |
| RADIATION | BTU/hr x 1000 | | 609 | 609 | 602 | 577 |
| **EMISSIONS (CATALYST OUT):** | | | | | | |
| NOx (NO + NO2) | g/bhp-hr | | 0.15 | 0.15 | 0.15 | 0.15 |
| CO | g/bhp-hr | | 0.3 | 0.3 | 0.3 | 0.3 |
| THC | g/bhp-hr | | 0.2 | 0.2 | 0.2 | 0.2 |
| NMHC | g/bhp-hr | | 0.09 | 0.09 | 0.09 | 0.14 |
| NM,NEHC (VOC) | g/bhp-hr | | 0.04 | 0.04 | 0.04 | 0.06 |
| CO2 | g/bhp-hr | | 480 | 480 | 482 | 490 |
| CO2e | g/bhp-hr | | 483 | 483 | 484 | 494 |
| CH2O | g/bhp-hr | | 0.001 | 0.001 | 0.001 | 0.001 |
| CH4 | g/bhp-hr | | 0.11 | 0.11 | 0.11 | 0.16 |
| **AIR INTAKE / EXHAUST GAS** | | | | | | |
| INDUCTION AIR FLOW | SCFM | | 2626 | 2626 | 2501 | 2027 |
| EXHAUST GAS MASS FLOW | lb/hr | | 12210 | 12210 | 11627 | 9424 |
| EXHAUST GAS FLOW *at exhaust temp, 14.5 psia* | ACFM | | 8683 | 8683 | 8237 | 6572 |
| EXHAUST TEMPERATURE | °F | | 1140 | 1140 | 1134 | 1109 |

| HEAT EXCHANGER SIZING[12] | | | |
|---|---|---|---|
| TOTAL JACKET WATER CIRCUIT (JW) | BTU/hr x 1000 | | 4357 |
| TOTAL AUXILIARY WATER CIRCUIT (IC + OC) | BTU/hr x 1000 | | 1387 |

| COOLING SYSTEM WITH ENGINE MOUNTED WATER PUMPS | | |
|---|---|---|
| JACKET WATER PUMP MIN. DESIGN FLOW | GPM | 450 |
| JACKET WATER PUMP MAX. EXTERNAL RESTRICTION | psig | 16 |
| AUX WATER PUMP MIN. DESIGN FLOW | GPM | 79 |
| AUX WATER PUMP MAX. EXTERNAL RESTRICTION | psig | 36 |

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

Data Generated by EngCalc Program Version 3.7 GE Distributed Power, Inc.

8/3/2018 3:21 PM

# VHP - L7044GSI S5

Gas Compression

## FUEL COMPOSITION

| HYDROCARBONS: | | Mole or Volume % |
|---|---|---|
| Methane | CH4 | 69.39 |
| Ethane | C2H6 | 19.31 |
| Propane | C3H8 | 6.64 |
| Iso-Butane | I-C4H10 | 0.43 |
| Normal Butane | N-C4H10 | 0.88 |
| Iso-Pentane | I-C5H12 | 0.0692 |
| Normal Pentane | N-C5H12 | 0.0815 |
| Hexane | C6H14 | 0.1201 |
| Heptane | C7H16 | 0 |
| Ethene | C2H4 | 0 |
| Propene | C3H6 | 0 |
| | SUM HYDROCARBONS | 96.921 |
| NON-HYDROCARBONS: | | |
| Nitrogen | N2 | 2.183 |
| Oxygen | O2 | 0 |
| Helium | He | 0 |
| Carbon Dioxide | CO2 | 0.8857 |
| Carbon Monoxide | CO | 0 |
| Hydrogen | H2 | 0 |
| Water Vapor | H2O | 0 |
| | TOTAL FUEL | 99.99 |

| | |
|---|---|
| FUEL: | Natural Gas |
| FUEL PRESSURE RANGE (psig): | 40 - 60 |
| FUEL WKI: | 59.7 |
| FUEL SLHV (BTU/ft3): | 1131.89 |
| FUEL SLHV (MJ/Nm3): | 44.51 |
| FUEL LHV (BTU/ft3): | 1151.93 |
| FUEL LHV (MJ/Nm3): | 45.30 |
| FUEL HHV (BTU/ft3): | 1274.26 |
| FUEL HHV (MJ/Nm3): | 50.11 |
| FUEL DENSITY (SG): | 0.75 |

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

## FUEL CONTAMINANTS

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

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

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

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

**NOTES**

1. All data is based on engines with standard configurations unless noted otherwise.

2. Power rating is adjusted for fuel, site altitude, and site air inlet temperature, in accordance with ISO 3046/1 with tolerance of ± 3%.

3. Fuel consumption is presented in accordance with ISO 3046/1 with a tolerance of -0 / +5% at maximum rating. Fuel flow calculation based on fuel LHV and fuel consumption with a tolerance of -0/+5 %. For sizing piping and fuel equipment, it is recommended to include the 5% tolerance.

4. Heat rejection tolerances are ± 30% for radiation, and ± 8% for jacket water, lube oil, intercooler, and exhaust energy.

5. Emission levels for engines with GE supplied 3-way catalyst are given at catalyst outlet flange. For all other engine models, emission levels are given at engine exhaust outlet flange prior to any after treatment. Values are based on a new engine operating at indicated site conditions, and adjusted to the specified timing and air/fuel ratio at rated load. Catalyst out emission levels represent emission levels the catalyst is sized to achieve. Manual adjustment may be necessary to achieve compliance as catalyst/engine age. Catalyst-out emission levels are valid for the duration of the engine warranty. Emissions are at an absolute humidity of 75 grains H2O/lb (10.71 g H2O/kg) of dry air. Emission levels may vary subject to instrumentation, measurement, ambient conditions, fuel quality, and engine variation. Engine may require adjustment on-site to meet emission values, which may affect engine performance and heat output. NOx, CO, THC, and NMHC emission levels are listed as a not to exceed limit, all other emission levels are estimated. CO2 emissions based on EPA Federal Register/Vol. 74, No. 209/Friday, October 30, 2009 Rules and Regulations 56398, 56399 (3) Tier 3 Calculation Methodology, Equation C-5.

6. Air flow is based on undried air with a tolerance of ± 7%.

7. Exhaust temperature given at engine exhaust outlet flange with a tolerance of ± 50°F (28°C).

8. Exhaust gas mass flow value is based on a "wet basis" with a tolerance of ± 7%.

9. Inlet air restrictions based on full rated engine load. Exhaust backpressure based on 178.1 PSI BMEP and 1200 RPM. Refer to the engine specification section of Waukesha's standard technical data for more information.

10. Cooling circuit capacity, lube oil capacity, and engine dry weight values are typical.

11. Fuel must conform to Waukesha's "Gaseous Fuel Specification" S7884-7 or most current version. Fuel may require treatment to meet current fuel specification.

12. Heat exchanger sizing values given as the maximum heat rejection of the circuit, with applied tolerances and an additional 5% reserve factor.

13. Fuel volume flow calculation in english units is based on 100% relative humidity of the fuel gas at standard conditions of 60°F and 14.696 psia (29.92 inches of mercury; 101.325 kPa).

14. Fuel volume flow calculation in metric units is based on 100% relative humidity of the fuel gas at a combustion temperature of 25°C and metering conditions of 0°C and 101.325 kPa (14.696 psia; 29.92 inches of mercury). This is expressed as [25, V(0;101.325)].

15. Engine sound data taken with the microphone at 1 m (3.3 ft) from the side of the engine at the approximate front-to-back centerline. Microphone height was at intake manifold level. Engine sound pressure data may be different at front, back and opposite side locations. Exhaust sound data taken with microphone 1 meter (3.3 ft) away and 1 meter (3.3 ft) to the side of the exhaust outlet.

16. Due to variation between test conditions and final site conditions, such as exhaust configuration and background sound level, sound pressure levels under site conditions may be different than those tabulated above.

17. Cooling system design flow is based on minimum allowable cooling system flow. Cooling system maximum external restriction is defined as the allowable restriction at the minimum cooling system flow.

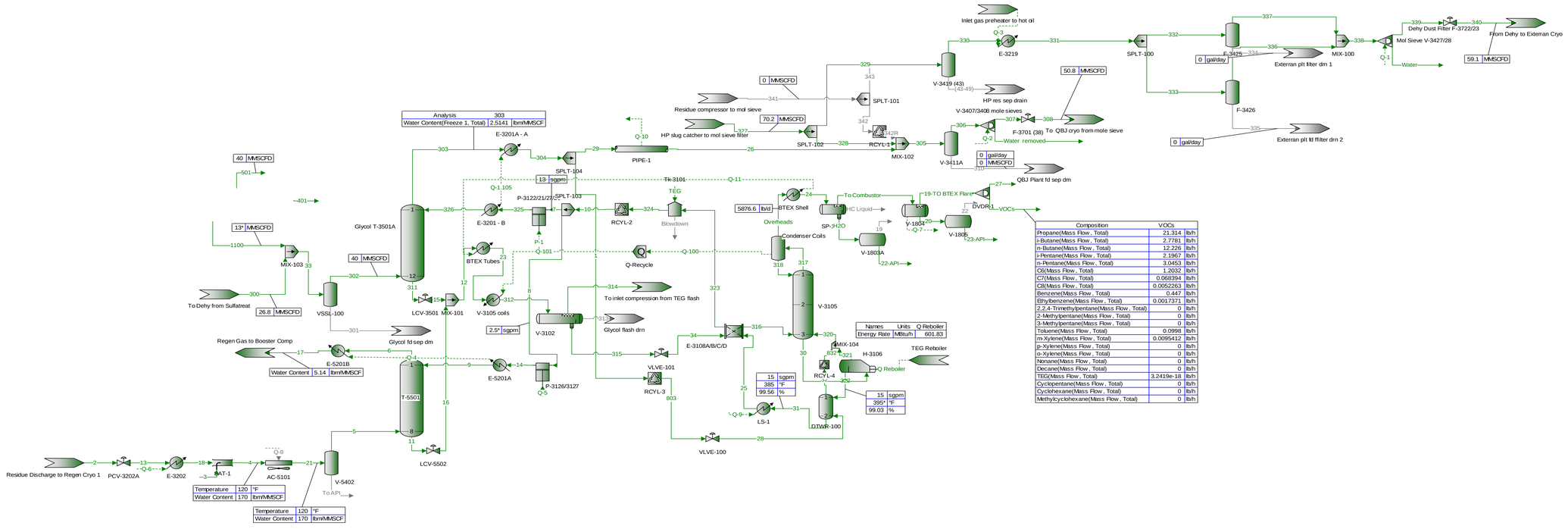
18. Continuous Power Rating: The highest load and speed that can be applied 24 hours per day, seven days per week, 365 days per year except for normal maintenance at indicated ambient reference conditions and fuel. No engine overload power rating is available.

19. emPact emission compliance available for entire range of operable fuels; however, fuel system and/or O2 set point may need to be adjusted in order to maintain compliance.

20. In cold ambient temperatures, heating of the engine jacket water, lube oil and combustion air may be required. See Waukesha Technical Data.

21. Available Turndown Speed Range refers to the constant torque speed range available. Reduced power may be available at speeds outside of this range. Contact application engineering.

**SPECIAL REQUIREMENTS**




| Composition | VOCs | |
|---|---|---|
| Propane(Mass Flow , Total) | 21.314 | lb/h |
| i-Butane(Mass Flow , Total) | 2.7781 | lb/h |
| n-Butane(Mass Flow , Total) | 12.226 | lb/h |
| i-Pentane(Mass Flow , Total) | 2.1967 | lb/h |
| n-Pentane(Mass Flow , Total) | 3.0453 | lb/h |
| C6(Mass Flow , Total) | 1.2032 | lb/h |
| C7(Mass Flow , Total) | 0.068394 | lb/h |
| C8(Mass Flow , Total) | 0.0052263 | lb/h |
| Benzene(Mass Flow , Total) | 0.447 | lb/h |
| Ethylbenzene(Mass Flow , Total) | 0.0017371 | lb/h |
| 2,2,4-Trimethylpentane(Mass Flow , Total) | 0 | lb/h |
| 2-Methylpentane(Mass Flow , Total) | 0 | lb/h |
| 3-Methylpentane(Mass Flow , Total) | 0 | lb/h |
| Toluene(Mass Flow , Total) | 0.0998 | lb/h |
| m-Xylene(Mass Flow , Total) | 0.0095412 | lb/h |
| p-Xylene(Mass Flow , Total) | 0 | lb/h |
| o-Xylene(Mass Flow , Total) | 0 | lb/h |
| Nonane(Mass Flow , Total) | 0 | lb/h |
| Decane(Mass Flow , Total) | 0 | lb/h |
| TEG(Mass Flow , Total) | 3.2419e-18 | lb/h |
| Cyclopentane(Mass Flow , Total) | 0 | lb/h |
| Cyclohexane(Mass Flow , Total) | 0 | lb/h |
| Methylcyclohexane(Mass Flow , Total) | 0 | lb/h |

| Process Streams | | 19-TO BTEX Flare | 27 | 302 | VOCs |
|---|---|---|---|---|---|
| Composition | Status: | Solved | Solved | Solved | Solved |
| Phase: Total | From Block: | V-1804 | DVDR-1 | VSSL-100 | DVDR-1 |
| | To Block: | DVDR-1 | -- | Glycol T-3501A | -- |
| Mole Fraction | % | | | | |
| N2 | | 0.97 | 1.64 | 1.55 | 0.00 |
| CO2 | | 2.05 | 3.46 | 0.67 | 0.00 |
| Methane | | 29.00 | 48.80 | 43.43 | 0.00 |
| Ethane | | 26.58 | 44.73 | 28.61 | 0.00 |
| Propane | | 23.47 | 0.00 | 18.15 | 57.83 |
| i-Butane | | 2.32 | 0.00 | 1.57 | 5.72 |
| n-Butane | | 10.21 | 0.00 | 4.66 | 25.17 |
| i-Pentane | | 1.48 | 0.00 | 0.50 | 3.64 |
| n-Pentane | | 2.05 | 0.00 | 0.56 | 5.05 |
| C6 | | 0.68 | 0.00 | 0.11 | 1.67 |
| C7 | | 0.03 | 0.00 | 0.00 | 0.08 |
| C8 | | 0.00 | 0.00 | 0.00 | 0.01 |
| Water | | 0.81 | 1.37 | 0.19 | 0.00 |
| H2S | | 0.00 | 0.00 | 0.00 | 0.00 |
| Oxygen | | 0.00 | 0.00 | 0.00 | 0.00 |
| Benzene | | 0.28 | 0.00 | 0.00 | 0.68 |
| Ethylbenzene | | 0.00 | 0.00 | 0.00 | 0.00 |
| 2,2,4-Trimethylpentane | | 0.00 | 0.00 | 0.00 | 0.00 |
| 2-Methylpentane | | 0.00 | 0.00 | 0.00 | 0.00 |
| 3-Methylpentane | | 0.00 | 0.00 | 0.00 | 0.00 |
| Toluene | | 0.05 | 0.00 | 0.00 | 0.13 |
| m-Xylene | | 0.00 | 0.00 | 0.00 | 0.01 |
| p-Xylene | | 0.00 | 0.00 | 0.00 | 0.00 |
| o-Xylene | | 0.00 | 0.00 | 0.00 | 0.00 |
| Nonane | | 0.00 | 0.00 | 0.00 | 0.00 |
| Decane | | 0.00 | 0.00 | 0.00 | 0.00 |
| TEG | | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyclopentane | | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyclohexane | | 0.00 | 0.00 | 0.00 | 0.00 |
| Methylcyclohexane | | 0.00 | 0.00 | 0.00 | 0.00 |
| Therminol 55 | | | | | |
| Argon | | | | | |

| Process Streams | | 19-TO BTEX Flare | 27 | 302 | VOCs |
|---|---|---|---|---|---|
| Properties | Status: | Solved | Solved | Solved | Solved |
| Phase: Total | From Block: | V-1804 | DVDR-1 | VSSL-100 | DVDR-1 |
| | To Block: | DVDR-1 | -- | Glycol T-3501A | -- |
| Property | Units | | | | |
| Mole Fraction Vapor | % | 100.0 | 99.4 | 100.0 | 99.6 |
| Temperature | °F | 40.0 | 40.0 | 123.9 | 40.0 |
| Pressure | psia | 0.30 | 0.30 | 893.00 | 0.30 |
| Molar Flow | lbmol/h | 2 | 1 | 4368 | 1 |
| Mass Flow | lb/h | 72 | 29 | 125892 | 43 |
| Mass Enthalpy | Btu/lb | -1252.61 | -1683.73 | -1348.49 | -970.85 |
| Molecular Weight | lb/lbmol | 35.04 | 23.51 | 28.82 | 51.92 |
| Mass Density | lb/ft^3 | 0.10 | 0.07 | 6.49 | 0.15 |
| Std Vapor Volumetric Flow | MMSCFD | 0 | 0 | 40 | 0 |
| Std Liquid Volumetric Flow | sgpm | 0 | 0 | 626 | 0 |
| Compressibility | | 0.987 | 0.989 | 0.644 | 0.969 |
| Specific Gravity | | 1.210 | | 0.995 | |
| Mass Cp | Btu/(lb*°F) | 0.398 | 0.427 | 0.770 | 0.382 |
| Dynamic Viscosity | cP | 0.009 | | 0.014 | |
| Kinematic Viscosity | cSt | 5.444 | | 0.139 | |
| Thermal Conductivity | Btu/(h*ft*°F) | 0.011 | | 0.021 | |
| Surface Tension | lbf/ft | | | | |
| Net Ideal Gas Heating Value | Btu/ft^3 | 1789.3 | 1168.0 | 1510.0 | 2699.0 |
| Gross Ideal Gas Heating Value | Btu/ft^3 | 1951.3 | 1285.2 | 1652.7 | 2926.8 |
| Pseudo Critical Temperature | °F | 99.8 | -7.8 | 33.9 | 257.4 |
| Pseudo Critical Pressure | psia | 623.15 | 704.43 | 638.07 | 558.64 |
| Vapor Volumetric Flow | ft^3/h | 727 | 433 | 19404 | 289 |
| Liquid Volumetric Flow | gpm | 91 | 54 | 2419 | 36 |