Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Mon, Dec 2, 2024 at 12:22 PM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Jeff,

1) CT-01 was not included in the Subpart OOOOa requirements for reciprocating compressors because of the compressor driven by the turbine, but rather because of the electrically driven reciprocating compressor associated with the turbine's recompression system. The section of the fact sheet which discusses Subpart OOOOa applicability includes that the centrifugal compressor driven by the turbine is not subject to Subpart OOOOa because it uses dry gas seals. However, the electrically driven reciprocating compressor of the turbine's recompression system was constructed within the applicability dates of the rule and is subject to Subpart OOOOa.

2) Because the requirements of Condition 5.1.2.a.3. are from the underlying NSR permit (Condition 6.1.2.a.iii. of R13-3561), the NSR permit will need to be revised before this change can be included in the Title V permit. Due to my deadline to issue this permit, I will not be able to include this revision in the initial Title V permit.

I am hoping that the permit will be able to go out for the public and EPA comment periods later this week or early next week at the latest. Please let me know if you have any further comments or questions as soon as practicable.

Thanks,
- Sarah

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Mon, Dec 2, 2024 at 9:32 AM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Good Morning Sarah,

1. The permit shows the turbine driving a reciprocating compressor. This is incorrect as the turbine drives a centrifugal compressor. Due to this error, the following corrections will be needed:
   a. TOC – Page 2: Subpart OOOOa Requirements for the Reciprocating Compressors associated with CE-01 to CE-04 ~~and~~ ~~CT-01~~
   b. Section 6.0 – Page 34: Subpart OOOOa Requirements for the Reciprocating Compressors associated with CE-01 to CE-04 ~~and~~ ~~CT-01~~
2. Condition 5.1.2.a.3 on Page 29 states "Emissions of sulfur dioxide (SO2) shall not exceed 0.003 lbs of SO2/mmBTU heat input. For purposes of demonstrating compliance with this limit, the permittee shall maintain the Federal Energy Regulatory Commission (FERC) tariff limit on total sulfur content of 20 grains of sulfur or less per 100 standard cubic feet of natural gas combusted in the turbines." While a tariff will be used to demonstrate compliance with the applicable SO2 emission limit, the turbine is not subject to FERC requirements (as Ridgeline is not a transmission compressor station). As such, I would request that the permit language is updated to remove reference to FERC.

[Quoted text hidden]

UC Defaulted Accounts Search Results

Sorry, no records matching your criteria were found.

FEIN:	
Business name:	APPALACHIA MIDSTREAM SERVICES, L.L.C.
Doing business as/Trading as:	

Please use your browsers back button to try again.

WorkforceWV	Unemployment Compensation	Offices of the Insurance Commissioner

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APPALACHIA MIDSTREAM SERVICES, L.L.C.

Organization Information

Org Type	Effective Date	Established Date	Filing Date	Charter	Class	Sec Type	Termination Date	Termination Reason
LLC | Limited Liability Company	3/9/2009		3/9/2009	Foreign	Profit			

Organization Information

Business Purpose	2212 - Utilities - Utilities - Natural Gas Distribution	**Capital Stock**	
Charter County		**Control Number**	99DMI
Charter State	OK	**Excess Acres**	
At Will Term	A	**Member Managed**	MGR
At Will Term Years		**Par Value**	
Authorized Shares		**Young Entrepreneur**	Not Specified

Addresses

Type	Address
Designated Office Address	ONE WILLIAMS CENTER, MD 47 TULSA, OK, 74172
Mailing Address	ONE WILLIAMS CENTER-MD-47 TULSA, OK, 74172 USA
Notice of Process Address	C T CORPORATION SYSTEM 5098 WASHINGTON ST W STE 407 CHARLESTON, WV, 253131561
Principal Office Address	ONE WILLIAMS CENTER-MD-47 TULSA, OK, 74172 USA
Type	Address

Officers

Type	Name/Address
Manager	LARRY C. LARSEN ONE WILLIAMS CENTER-MD-47 TULSA, OK, 74172
Type	Name/Address

Annual Reports

Filed For
2024
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013

2012
2011
2010
Date filed

For more information, please contact the Secretary of State's Office at 304-558-8000.

Monday, December 2, 2024 — 1:25 PM

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov>
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Mon, Nov 25, 2024 at 12:37 PM

Hi Jeff,

November 27th will be fine.

Thanks,
- Sarah

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Mon, Nov 25, 2024 at 12:27 PM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Hi Sarah,

Any chance I could have this extended to 11/27? Apologies for the delayed review, but working on getting there.

From: Barron, Sarah K <sarah.k.barron@wv.gov>
Sent: Monday, November 25, 2024 7:16 AM
To: Steeber, Jeff <Jeff.Steeber@Williams.com>
Subject: [EXTERNAL] Re: Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Mon, Nov 25, 2024 at 7:16 AM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Jeff,

Have you had a chance to review the pre-draft permit and fact sheet for the Ridgeline Compressor Station? Please let me know if you have any comments or questions as soon as practicable.

Thanks,
- Sarah

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Pre-Draft Permit; Appalachia Midstream, LLC; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Thu, Nov 7, 2024 at 5:41 PM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Jeff,

Attached are the Ridgeline Compressor Station's pre-draft permit and fact sheet for you to review.

The requirement to maintain the manufacturer's specifications for the thermal oxidizers has been revised in order to address your concerns about the format of the records.

Please let me know if you have any questions or comments as soon as practicable, but preferably no later than November 22, 2024.

Thanks,
- Sarah

--
Sarah Barron
Engineer Trainee
West Virginia Department of Environmental Protection
Division of Air Quality
(304) 414-1915
sarah.k.barron@wv.gov

2 attachments

DPFactSheet R30-05100261-2024.pdf
533K

DPPermit R30-05100261-2024.pdf
792K

West Virginia Department of Environmental Protection
Division of Air Quality

Fact Sheet

For Draft/Proposed Permitting Action Under 45CSR30 and Title V of the Clean Air Act

Permit Number: **R30-05100261-2024**
Application Received: **February 2, 2024**
Plant Identification Number: **03-54-051-00261**
Permittee: **Appalachia Midstream Services, L.L.C.**
Facility Name: **Ridgeline Compressor Station**
Mailing Address: **100 Teletech Drive, Suite 2, Moundsville, WV 26041**

Physical Location:	Cameron, Marshall County, West Virginia
UTM Coordinates:	537.78 km Easting • 4,403.01 km Northing • Zone 17
Directions:	From Cameron, head Southeast on US-250/Maple Avenue for approximately 5.1 miles. The compressor station is located on the left.

Facility Description

The Ridgeline Compressor Station receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site; there is no on-site storage of condensate liquids. The facility operates four 5,000-HP compressor engines; one 11,252-HP compressor turbine; one 1,468-HP generator engine; one 250-mmscfd dehydration unit and one 160-mmscfd dehydration unit (each comprised of a flash tank, still vent, and reboiler); four 400-bbl produced water storage tanks; other various storage tanks; and truck load out.
SIC: 1389, NAICS: 213112

Emissions Summary

Plantwide Emissions Summary [Tons per Year]		
Regulated Pollutants	**Potential Emissions**	**2023 Actual Emissions**
Carbon Monoxide (CO)	112.26	27.46
Nitrogen Oxides (NO_X)	115.84	82.76
Particulate Matter ($PM_{2.5}$)	11.27	9.35
Particulate Matter (PM_{10})	11.27	9.35
Total Particulate Matter (TSP)	11.27	9.35
Sulfur Dioxide (SO_2)	1.64	1.28
Volatile Organic Compounds (VOC)	102.23	30.85

PM_{10} is a component of TSP.

Hazardous Air Pollutants	Potential Emissions	2023 Actual Emissions
Acetaldehyde	2.54	2.16
Acrolein	1.56	1.33
Benzene	0.43	None Reported
1,3-Butadiene	0.08	None Reported
Ethylbenzene	0.47	None Reported
Formaldehyde	9.19	1.15
n-Hexane	2.61	0.38
Methanol	0.95	0.72
Polycyclic Organic Matter (POM/PAH)	0.12	None Reported
Toluene	1.17	0.05
2,2,4-Trimethylpentane	0.21	None Reported
Xylenes	2.18	0.22
Other/Trace HAP	0.11	None Reported
Total HAPs	21.62	6.01

Some of the above HAPs may be counted as PM or VOCs.

Title V Program Applicability Basis

This facility has the potential to emit 112.26 tpy of Carbon Monoxide, 115.84 tpy of Nitrogen Oxides, and 102.23 tpy of Volatile Organic Compounds. Due to this facility's potential to emit over 100 tons per year of criteria pollutants, Appalachia Midstream Services, L.L.C. is required to have an operating permit pursuant to Title V of the Federal Clean Air Act as amended and 45CSR30.

Legal and Factual Basis for Permit Conditions

The State and Federally-enforceable conditions of the Title V Operating Permits are based upon the requirements of the State of West Virginia Operating Permit Rule 45CSR30 for the purposes of Title V of the Federal Clean Air Act and the underlying applicable requirements in other state and federal rules.

This facility has been found to be subject to the following applicable rules:

Federal and State:	45CSR2	Control of Particulate Matter Air Pollution from the Combustion of Fuel in Indirect Heat Exchangers.
	45CSR6	Control of Air Pollution from Combustion of Refuse.
	45CSR11	Standby plans for emergency episodes.
	45CSR13	Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation.
	45CSR16	Standards of Performance for New Stationary Sources.
	WV Code § 22-5-4 (a) (15)	The Secretary can request any pertinent information such as annual emission inventory reporting.
	45CSR30	Requirements for Operating Permits.
	45CSR34	Emission Standards for Hazardous Air Pollutants.
	40 C.F.R. Part 60 Subpart JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.
	40 C.F.R. Part 60 Subpart KKKK	Standards of Performance for Stationary Combustion Turbines.
	40 C.F.R. Part 60 Subpart OOOOa	Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced After September 18, 2015 and On or Before December 6, 2022.
	40 C.F.R. Part 61	Asbestos inspection and removal.
	40 C.F.R. Part 63 Subpart HH	National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities.
	40 C.F.R. Part 63 Subpart ZZZZ	National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.
	40 C.F.R. Part 82 Subpart F	Ozone depleting substances.
State Only:	45CSR4	No objectionable odors.
	45CSR17	To Prevent and Control Particulate Matter Air Pollution from Materials Handling, Preparation, Storage and Other Sources of Fugitive Particulate Matter.

Each State and Federally-enforceable condition of the Title V Operating Permit references the specific relevant requirements of 45CSR30 or the applicable requirement upon which it is based. Any condition of the Title V permit that is enforceable by the State but is not Federally-enforceable is identified in the Title V permit as such.

The Secretary's authority to require standards under 40 C.F.R. Part 60 (NSPS), 40 C.F.R. Part 61 (NESHAPs), and 40 C.F.R. Part 63 (NESHAPs MACT) is provided in West Virginia Code §§ 22-5-1 *et seq.*, 45CSR16, 45CSR34 and 45CSR30.

Active Permits/Consent Orders

Permit or Consent Order Number	Date of Issuance
R13-3561	July 29, 2022

Conditions from this facility's Rule 13 permit(s) governing construction-related specifications and timing requirements will not be included in the Title V Operating Permit but will remain independently enforceable under the applicable Rule 13 permit(s). All other conditions from this facility's Rule 13 permit(s) governing the source's operation and compliance have been incorporated into this Title V permit in accordance with the "General Requirement Comparison Table," which may be downloaded from DAQ's website.

Determinations and Justifications

Appalachia Midstream Services, L.L.C.'s Ridgeline Compressor Station is an existing facility that was initially permitted under the General Permit G35-D137 and later modified under G35-D137A. The general permit has been superseded by the NSR Permit R13-3561. With the issuance of the Modification Permit R13-3561, the facility became subject to Title V due to a potential to emit over 100 tpy of carbon monoxide (CO), nitrogen oxides (NO_X), and volatile organic compounds (VOCs).

The Emission Units Table of Section 1.0. includes one lube oil storage tank (TK-05), one used oil storage tank (TK-06), one coolant storage tank (TK-07), one used coolant storage tank (TK-08), five hydrate inhibitor storage tanks (TK-09 to -13), four engine oil storage tanks (TK-14 to -17), four compressor oil storage tanks (TK-18 to -21), two TEG storage tanks (TK-22 and -23), and one defoamer storage tank (TK-24). These tanks have negligible emissions of VOCs and HAPs. None of the tanks are currently subject to any applicable requirements under this operating permit.

This section outlines the applicable requirements that have been included in the initial Title V operating permit.

Section 3.0. – Facility-Wide Requirements

The following conditions were added to Section 3.0.:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
3.1.9.	Facility-wide HAP emissions are limited to ensure the facility remains a minor source of HAPs.	45CSR13	4.1.2.
3.1.10.	Operation and Maintenance of Air Pollution Control Equipment.	45CSR13	4.1.3., 7.1.7., and 11.1.6.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
3.1.11.	Only the permitted emission units and *de minimis* sources are authorized at the facility.	45CSR13	4.1.5.
3.1.12.	Fugitive particulate matter may not be discharged beyond the boundary lines of the facility.	45CSR§17-3.1.	N/A
3.4.1.	Record of Monitoring Information.	45CSR13 45CSR§30-5.1.c.2.A.	4.1.1.
3.4.2.	Retention of Records.	45CSR13 45CSR§30-5.1.c.2.B.	3.4.1.
3.4.4.	Record of Malfunctions of Air Pollution Control Equipment.	45CSR13	4.1.4.
3.7.2.	Permit Shield. This condition contains the standards that are currently inapplicable to the facility and for which the permittee requested a permit shield. These determinations have also been included in the Non-Applicability Determinations section of this Fact Sheet.	45CSR§30-5.6.	N/A

Section 4.0. – Compressor Engines and Generator Engine [Emission Point IDs: 1E to 4E and 8E]

The Ridgeline Compressor Station operates four spark ignition (SI) reciprocating internal combustion engines (RICEs) (Emission Units: CE-01 to CE-04; Emission Point IDs: 1E to 4E). These engines are used to drive the natural gas reciprocating compressors. The RICEs are Caterpillar G3616LE-A4 engines, and each has a maximum power rating of 5,000 HP. The compressor engines are fueled by natural gas. An oxidation catalyst (OxCat-01 to OxCat-04) is operated with each compressor engine to control emissions of carbon monoxide (CO) with a control efficiency of 89.0%, emissions of volatile organic compounds (VOCs) with a control efficiency of 65.1%, and emissions of formaldehyde with a control efficiency of 80.0%.

A generator engine (Emission Unit: GE-01; Emission Point ID: 8E) is also operated at the facility. This generator engine is used to provide electrical power to the facility. The generator is a Caterpillar G3512LE which is a SI RICE with a maximum power rating of 1,468 HP. The generator is fueled by natural gas. An oxidation catalyst (OxCat-05) is operated with the generator to control emissions of CO with a control efficiency of 87.0%, emissions of VOCs with a control efficiency of 49.5%, and emissions of formaldehyde with a control efficiency of 83.3%.

The RICEs are subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

2. **45CSR16** – *Standards of Performance for New Stationary Sources*

3. **40 C.F.R. Part 60 Subpart JJJJ** – *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*

   Construction of the engines CE-01 to CE-04 and GE-01 commenced after June 12, 2006; the manufacture date of each engine is after July 1, 2007; and each engine is a SI ICE with a maximum engine power greater than 1,350 HP. Therefore, the compressor engines and the generator engine are subject to Subpart JJJJ per 40 C.F.R. §§60.4230(a)(4) and (a)(4)(i).

CE-01 to CE-04 and GE-01 are non-emergency, 4-stroke lean burn (4SLB) engines with a maximum engine power greater than 100 HP. Therefore, the engines are subject to the emission standards for NO_X, CO, and VOCs per 40 C.F.R. §60.4233(e). The engines are non-certified under Subpart JJJJ. As the engines CE-01 to CE-04 and GE-01 are non-certified under Subpart JJJJ, compliance with the emission standards is demonstrated through periodic performance tests as specified in §60.4244 as well as the reporting and recordkeeping requirements of §60.4245.

4. **45CSR34** – *Emission Standards for Hazardous Air Pollutants*

5. **40 C.F.R. Part 63 Subpart ZZZZ** – *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Combustion Engines*

   According to 40 C.F.R. §63.6590(a)(2)(iii), CE-01 to CE-04 and GE-01 are considered new stationary RICEs as the engines are located at an area source of HAPs and construction of the engines commenced after June 12, 2006. As new stationary RICEs located at an area source of HAPs, these engines demonstrate compliance with the requirements of Subpart ZZZZ through compliance with the requirements of Part 60 Subpart JJJJ per 40 C.F.R. §§63.6590(c) and (c)(1).

The table below describes each condition added to Section 4.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
4.1.1.	Emission limitations for NO_X, CO, VOCs, and Formaldehyde from the compressor engines CE-01 to CE-04.	45CSR13	5.1.1.
4.1.2.	Emission limitations for NO_X, CO, and VOCs from the generator engine GE-01.	45CSR13	5.1.2.
4.1.3.	The emission limitations in Conditions 4.1.1. and 4.1.2. apply at all times, except during periods of start-up and shutdown. The engines must be operated in a manner consistent with good air pollution control practices for minimizing emissions at all times.	45CSR13	5.1.3.
4.1.4.	Requirements for the use of the catalytic reduction devices (OxCat-01 to OxCat-05). NOTE: The generator engine GE-01 is a lean-burn natural gas engine equipped with an oxidation catalyst control device (OxCat-05) and must be fitted with a closed-loop automatic air-to-fuel ratio feedback controller in accordance with paragraph a. of this condition. Therefore, a reference to the emission limits of GE-01 in Condition 4.1.2. was added to paragraph a.	45CSR13	5.1.4.
4.1.5.	Applicability of 40 C.F.R. Part 60 Subpart JJJJ to the engines CE-01 to CE-04 and GE-01.	45CSR13 45CSR16 40 C.F.R. §§60.4230(a), (a)(4), and (a)(4)(i)	12.1.1.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
4.1.6.	Emission standards for NO_X, CO, and VOCs from Table 1 to Subpart JJJJ of Part 60 that are applicable to CE-01 to CE-04 and GE-01.	45CSR13 45CSR16 40 C.F.R. §60.4233(e) Table 1 to Subpart JJJJ of Part 60	12.1.2.
4.1.7.	CE-01 to CE-04 and GE-01 must be operated and maintained to achieve the emissions standards of 40 C.F.R. §60.4233(e) over the entire life of each engine.	45CSR13 45CSR16 40 C.F.R. §60.4234	12.1.3.
4.1.8.	Deadline for installing stationary ICE with a maximum engine power over 500 HP that do not meet the applicable requirements of 40 C.F.R. §60.4233.	45CSR13 45CSR16 40 C.F.R. §60.4236(b)	12.2.1.
4.1.9.	The requirements of 40 C.F.R. §60.4236 do not apply to engines that are modified, reconstructed, or reinstalled at a new location.	45CSR13 45CSR16 40 C.F.R. §60.4236(e)	12.2.2.
4.1.10.	Propane may be used as an alternative fuel during emergency operations for up to 100 hours.	45CSR16 40 C.F.R. §60.4243(e)	N/A
4.1.11.	An air-to-fuel ratio controller must be used with the operation of three-way catalysts/non-selective catalytic reduction.	45CSR16 40 C.F.R. §60.4243(g)	N/A
4.1.12.	For a new or reconstructed RICE located at an area source, compliance with 40 C.F.R. Part 63 Subpart ZZZZ must be demonstrated upon startup. NOTE: The NSR permit condition contains the date by which an existing SI RICE at an area source of HAPs must be in compliance with the applicable provisions of Subpart ZZZZ, per §63.6595(a)(1). This requirement is inapplicable to the engines at the compressor station which are considered new RICEs at an area source under Subpart ZZZZ and, therefore, has been replaced with the requirement described above.	45CSR13 45CSR34 40 C.F.R. §63.6595(a)(7)	15.1.1.
4.1.13.	For the engines CE-01 to CE-04 and GE-01, compliance with 40 C.F.R. Part 63 Subpart ZZZZ is demonstrated through compliance with 40 C.F.R. Part 60 Subpart JJJJ.	45CSR13 45CSR34 40 C.F.R. §§63.6590(c) and (c)(1)	15.1.2.
4.2.1.	Monitoring requirements for catalytic oxidizer control devices (OxCat-01 to OxCat-05).	45CSR13	5.2.1.
4.2.2.	Requirements for non-certified engines under Subpart JJJJ to demonstrate compliance with the emission standards of 40 C.F.R. §60.4233(e). A performance test of each engine must be completed every 8,760 hours or 3 years, whichever comes first.	45CSR13 45CSR16 40 C.F.R. §§60.4243(b), (b)(2), and (b)(2)(ii)	12.3.1.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
4.3.1.	Procedures for performance tests under Subpart JJJJ. NOTE: In R13-3561, Condition 5.3.1. specifies that this requirement will demonstrate compliance with Condition 5.1.1. which contains the emission limits established under the NSR permit for the compressor engines CE-01 to CE-04, and Condition 12.4.1. specifies that this requirement will demonstrate compliance with Condition 12.3.1.b.i. which contains the requirements of §60.4243(b)(2)(ii). As the compressor engines CE-01 to CE-04 and the generator engine GE-01 are subject to the emission standards of §60.4233(e) and to the performance testing requirements of §60.4243(b)(2)(ii), this requirement has been updated in the operating permit to include a reference to Condition 4.1.6. which contains the standards of §60.4233(e) and to Condition 4.1.2. which contains the NO_X, CO, and VOC emission limits established under the NSR permit for GE-01.	45CSR13 45CSR16 40 C.F.R. §60.4244	5.3.1. and 12.4.1.
4.4.1.	Maintain records of the maintenance performed on each engine to demonstrate compliance with the requirements for the use of catalytic reduction devices in Condition 4.1.4. NOTE: In R13-3561, Condition 5.4.1. states that maintaining records of maintenance performed on each engine will demonstrate compliance with the emission limitations for the generator engine (GE-01) in Condition 5.1.2. However, in addition to containing maintenance requirements for each of the engines at the facility, the requirements for the use of catalytic reduction devices in Condition 5.1.4.a. and c. of R13-3561 are derived from Condition 12.1.3. of the General Permit G35-E with which a registrant demonstrates compliance by maintaining records of maintenance performed on each RICE/generator (Condition 12.3.1.). Therefore, this reference has been corrected in the operating permit to the requirements for the use of catalytic reduction devices in Condition 4.1.4.	45CSR13	5.4.1.
4.4.2.	Maintain records of the maintenance performed on each catalytic reduction device to demonstrate compliance with the catalytic reduction device requirements in Condition 4.2.1.	45CSR13	5.4.2.
4.4.3.	Maintain a copy of the site-specific maintenance plan or the manufacturer maintenance plan.	45CSR13	5.4.3.
4.4.4.	Maintain the records required in Conditions 4.4.1. through 4.4.3. in accordance with the requirements for the Retention of Records in Condition 3.4.2. of the operating permit. NOTE: In R13-3561, Condition 5.4.4. states records must be maintained in accordance with Condition 3.5.1. which contains the reporting requirements for the responsible official. In the Title V permit, this has been corrected to require that records must be maintained according to the requirements for the retention of records (Condition 3.4.2. of the Title V permit; Condition 3.4.1. of R13-3561).	45CSR13	5.4.4.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
4.4.5.	Recordkeeping requirements from 40 C.F.R. Part 60 Subpart JJJJ that are applicable to uncertified engines.	45CSR13 45CSR16 40 C.F.R. §§60.4245(a), (a)(1), (a)(2), and (a)(4)	12.5.1.a.
4.5.1.	40 C.F.R. Part 60 Subpart JJJJ reporting requirements.	45CSR13 45CSR16 40 C.F.R. §§60.4245(d), (f), and (g)	12.5.1.d.

NOTE: The following conditions of R13-3561 have not been included in this operating permit.

1. Condition 12.1.1.b. contains the applicability requirement of 40 C.F.R. §60.4230(a)(5) and applies to stationary SI ICEs that were modified or reconstructed after June 12, 2006. However, as construction of the engines CE-01 to CE-04 and GE-01 commenced after June 12, 2006, this requirement has not been included in the operating permit.

2. Condition 12.5.1.c. contains the requirements of 40 C.F.R. §60.4245(c) which required the permittee to submit an initial notification of construction as required under 40 C.F.R. §60.7(a)(1). The DAQ received the notification that construction of the compressor engines CE-01 to CE-04 had commenced on January 7, 2020 and that construction of the generator engine GE-01 had commenced on November 16, 2021.

Section 5.0. – Turbine [Emission Point IDs: 9E and 10E]

The Ridgeline Compressor Station operates a Solar Taurus 70-10802S stationary combustion turbine (Emission Unit: CT-01; Emission Point ID: 9E) to drive a natural gas centrifugal compressor. The turbine is fueled by natural gas, has a site rating of 11,252 HP, and a maximum throughput of 83.87 mmBTU/hr. The number of turbine start and stop events (Emission Unit: TSS; Emission Point ID: 10E) is limited to 104 events per year based on a twelve-month rolling total.

The turbine is equipped with a SoLoNO$_X$ combustion system which reduces emissions of nitrogen oxides and carbon monoxide. The turbine is operated in SoLoNO$_X$ mode during normal operations, except for short periods of time during start-up and shutdown of the turbine. Emissions from the turbine are vented directly to the atmosphere.

The turbine CT-01 is subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

2. **45CSR16** – *Standards of Performance for New Stationary Sources*

3. **40 C.F.R. Part 60 Subpart KKKK** – *Standards of Performance for Stationary Combustion Turbines*

   Subpart KKKK establishes emission standards for the control of nitrogen oxides (NO$_X$) and sulfur dioxide (SO$_2$) from stationary combustion turbines. Construction of the turbine began after February 18, 2005, and the turbine has a heat input at peak load equal to or greater than 10.7 gigajoules (10 mmBTU) per hour, based on the higher heating value of the fuel. Therefore, per 40 C.F.R. §60.4305(a), CT-01 is subject to Subpart KKKK.

The turbine is natural gas-fired and has a heat input at peak load of greater than 50 mmBTU/hr and less than 850 mmBTU/hr. Thus, the turbine is subject to the NO_X emission standard of 25 ppm at 15% O_2 as well as the alternative NO_X emission standard of 150 ppm at 15% O_2 when operating at less than 75% of peak load or at temperatures below 0°F, in accordance with §60.4230(a) and Table 1 to Subpart KKKK. Under R13-3561, the turbine is required to meet a more stringent NO_X emission standard of 15 ppm at 15% O_2 when operating at or above 75% peak load or at temperatures at or above 0°F. Compliance with the NO_X emission standards is demonstrated through annual performance testing as specified in §60.4340(a) and §60.4400. A written report of the results of the testing must be submitted per §60.4375(b).

Per 40 C.F.R. §60.4330(a)(2), the fuel used in the turbine must not have total potential sulfur emissions in excess of 0.060 lbs SO_2/mmBTU. Under R13-3561, the turbine is required to meet a more stringent SO_2 emission standard of 0.003 lbs of SO_2/mmBTU. Compliance with the limits will be demonstrated by maintaining documentation that the natural gas used to fuel the turbine has a maximum total sulfur content of 20 grains of sulfur or less per 100 cubic feet of natural gas.

The table below describes each condition added to Section 5.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
5.1.1.	The turbine shall be operated and maintained in accordance with the manufacturer's recommendations and specifications. The turbine shall only burn natural gas.	45CSR13	6.1.1.
5.1.2.	Paragraph a. contains the limitations for nitrogen oxide (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), and volatile organic compound (VOC) emissions from the turbine as established in R13-3561 and/or Table 1 to Subpart KKKK of Part 60. Paragraph b. requires the permittee to operate and maintain the turbine, any air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices.	45CSR13 45CSR16 40 C.F.R. §§60.4320(a), 60.4330(a)(2), 60.4333(a), and 60.4365(a) Table 1 to Subpart KKKK of Part 60	6.1.2. and 6.1.3.
5.1.3.	Annual limit for the number of turbine start and stop events.	45CSR13	6.1.4.
5.2.1.	Compliance with the emission limitations in Condition 5.1.2. is demonstrated by monitoring and recording the number of hours and conditions during which the turbine is operated.	45CSR13	6.2.1.
5.3.1.	To demonstrate compliance with the NO_X emission standard, the permittee must conduct annual performance testing of the turbine. On October 6, 2023, the DAQ received the results for the initial performance test which was conducted on August 31, 2023. Therefore, the requirements to conduct an initial performance test under §60.8(a) and §60.4400(a) were not included in the operating permit.	45CSR13 45CSR16 40 C.F.R. §§60.4340(a) 60.4400	6.3.1.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
5.3.2.	Subpart KKKK requirements for performance testing of NO_X emissions from the turbine.	45CSR13 45CSR16 40 C.F.R. §60.4400	6.3.1.
5.4.1.	Maintain records of the amount of natural gas consumed and the hours of operation of the turbine to demonstrate compliance with the emission limits in Condition 5.1.2.	45CSR13	6.4.1.
5.4.2.	The permittee must maintain current and valid documentation that the natural gas consumed by the turbine has a maximum total sulfur content of 20 grains of sulfur or less per 100 cubic feet of natural gas.	4CSR13 45CSR16 40 C.F.R. §60.4365(a)	6.4.2.
5.4.3.	Compliance with the emission limitations of Condition 5.1.2. must be demonstrated by monitoring and recording the monthly operating hours for each parameter listed in Condition 5.2.1. and calculating the monthly emissions for each pollutant. NOTE: In Condition 6.4.3. of R13-3561, the numbers of the referenced requirements (the emission limitations in Condition 6.1.2. and the monitoring for hours of operation in Condition 6.2.1.) were transposed. These references were corrected in the operating permit.	45CSR13	6.4.3.
5.5.1.	The permittee must submit a report with the results of the performance testing required in condition 5.3.1. of the operating permit. NOTE: In R13-3561, Condition 6.5.2. includes a reference to the requirements of Section 6.2. This appears to be a typo and was corrected in the operating permit to reference the Section 5.3. testing requirements.	45CSR13 45CSR16 40 C.F.R. §60.4375(b)	6.5.2.

NOTE: Condition 6.5.1. of R13-3561 contains the general provision of 40 C.F.R. §60.7(a)(3) which requires the permittee to submit a notification of the actual date of the initial startup of the turbine. The DAQ received this notification on March 16, 2023. Therefore, this requirement has not been included in the operating permit.

Sections 6.0. and 7.0. – 40 C.F.R. Part 60 Subpart OOOOa Requirements

Sections 6.0. and 7.0. contain the applicable requirements of 40 C.F.R. Part 60 Subpart OOOOa. Subpart OOOOa contains the standards for the control of VOC, SO_2, and Greenhouse Gas (GHG) emissions from affected facilities in the crude oil and natural gas source category that commenced construction after September 18, 2015, and on or before December 6, 2022.

At the Ridgeline Compressor Station, the potential affected facilities constructed within the applicability dates of Subpart OOOOa include centrifugal compressors (§60.5365a(b)), reciprocating compressors (§60.5365a(c)), pneumatic controllers (§60.5365a(d)), storage vessels (§60.5365a(e)), and the fugitive emissions components (§60.5365a(j)).

1. A centrifugal compressor affected facility under Subpart OOOOa is a single centrifugal compressor using wet seals. The centrifugal compressor driven by the turbine CT-01 uses dry gas seals and, therefore, is not subject to the Subpart OOOOa requirements for centrifugal compressors.

2. The five reciprocating compressors which are operated at the Ridgeline Compressor Station were constructed within the applicability dates of Subpart OOOOa and, therefore, are subject to the requirements of Subpart OOOOa. Four of the compressors are driven by the natural gas-fired engines CE-01 to CE-04 to compress the incoming natural gas. The fifth reciprocating compressor is an electrically driven compressor associated with the turbine's dry gas seal recompression system. The requirements applicable to the reciprocating compressors have been included in Section 6.0. of this operating permit.

3. A pneumatic controller that is not located at a natural gas processing plant is considered an affected facility under Subpart OOOOa only if the unit is natural gas-driven and operates at a natural gas bleed rate greater than 6 scfh. The pneumatic controllers located at the Ridgeline Compressor Station are either compressed air-driven or operate at a natural gas bleed rate less than or equal to 6 scfh. Therefore, the Ridgeline Compressor Station is not subject to the standards for pneumatic controllers under Subpart OOOOa.

4. A single storage vessel which commenced construction, reconstruction, or modification after November 16, 2020 is an affected facility under Subpart OOOOa if the storage vessel has potential VOC emissions equal to or greater than 6 tpy as determined according to §60.5365a(e)(2). Each of the produced water storage tanks (TK-01 to TK-04) located at the Ridgeline Compressor Station have potential VOC emissions less than 6 tpy and, therefore, are not subject to the Subpart OOOOa requirements for storage vessels.

5. As the compressors were installed within the applicability dates of Subpart OOOOa, the standards for the collection of fugitive emissions components at a compressor station are applicable to the Ridgeline Compressor Station. The applicable requirements have been included in Section 7.0. of the operating permit.

Section 6.0. – Subpart OOOOa Requirements for the Reciprocating Compressors associated with CE-01 to CE-04 and CT-01

The four reciprocating compressors associated with the engines CE-01 to CE-04 and the reciprocating compressor associated with the turbine CT-01's dry gas seal recompression system are subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

2. **45CSR16** – *Standards of Performance for New Stationary Sources*

3. **40 C.F.R. Part 60 Subpart OOOOa** – *Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced After September 18, 2015 and On or Before December 6, 2022*

The table below describes each condition added to Section 6.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
6.1.1.	Affected facilities under Subpart OOOOa must be operated in a manner consistent with good air pollution control practice for minimizing emissions.	45CSR16 40 C.F.R. §60.5370a(b)	N/A

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
6.1.2.	VOC and Methane standards from Subpart OOOOa for reciprocating compressor affected facilities.	45CSR13 45CSR16 40 C.F.R. §60.5385a	13.1.1.
6.2.1.	Requirements to demonstrate initial compliance with the Subpart OOOOa standards for reciprocating compressors.	45CSR13 45CSR16 40 C.F.R. §§60.5410a and 60.5410a(c)	13.2.1.
6.2.2.	Requirements to demonstrate continuous compliance with the Subpart OOOOa standards for reciprocating compressors.	45CSR13 45CSR16 40 C.F.R. §60.5415a(c)	13.3.1.
6.4.1.	Applicable recordkeeping requirements for the reciprocating compressors.	45CSR13 45CSR16 40 C.F.R. §§60.5420a(c), (c)(3), (c)(6) to (c)(8), and (c)(17)	13.4.3.
6.5.1.	Applicable reporting requirements for the reciprocating compressors.	45CSR13 45CSR16 40 C.F.R. §§60.5420a(b), (b)(1), (b)(4), (b)(11), and (b)(12)	13.4.2. and 13.4.3.

NOTE: The following requirements were not included in the operating permit.

1. Condition 13.4.1. of R13-3561 has not been included in the operating permit. This condition requires the permittee to submit the notifications specified in 40 C.F.R. §§60.5420a(a)(1) and (a)(2). However, (a)(1) does not require the notifications of 40 C.F.R. §§60.7(a)(1), (a)(3), and (a)(4) and §60.15(d) for reciprocating compressors, and the notifications of (a)(2) are applicable to well affected facilities.

2. Conditions 13.1.1.d. and 13.4.3. of R13-3561 require the permittee to maintain records as required by 40 C.F.R. §60.5420a(c)(9). However, this recordkeeping requirement was marked as reserved and, therefore, has not been included in the operating permit.

Section 7.0. – Subpart OOOOa Requirements for Fugitive Emissions Components

Per 40 C.F.R. §60.5430a, a fugitive emissions component is "any component that has the potential to emit fugitive emissions of methane or VOC at a compressor station, including valves, connectors, pressure relief devices, open-ended lines, flanges, covers and closed vent systems not subject to §60.5411 or §60.5411a, thief hatches or other openings on a controlled storage vessel not subject to §60.5395 or §60.5395a, compressors, instruments, and meters. Devices that vent as part of normal operations, such as natural gas-driven pneumatic controllers or natural gas-driven pumps, are not fugitive emissions components, insofar as the natural gas discharged from the device's vent is not considered a fugitive emission. Emissions originating from other than the device's vent, such as the thief hatch on a controlled storage vessel, would be considered fugitive emissions."

The collection of fugitive emissions components is subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

2. **45CSR16** – *Standards of Performance for New Stationary Sources*

3. **40 C.F.R. Part 60 Subpart OOOOa** – *Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced After September 18, 2015 and On or Before December 6, 2022*

The table below describes each condition added to Section 7.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
7.1.1.	Affected facilities under Subpart OOOOa must be operated in a manner consistent with good air pollution control practice for minimizing emissions.	45CSR16 40 C.F.R. §60.5370a(b)	N/A
7.1.2.	Methane and VOC standards from Subpart OOOOa for fugitive emissions components affected facilities.	45CSR13 45CSR16 40 C.F.R. §§60.5397a(a) through (e), (f)(2), (g), (g)(2) through (4), and (h) through (j)	14.1.1.
7.2.1.	Requirements to demonstrate initial compliance with the Subpart OOOOa standards for fugitive emissions components.	45CSR16 40 C.F.R. §§60.5410a and 60.5410a(j)	N/A
7.2.2.	Requirements to demonstrate continuous compliance with the Subpart OOOOa standards for fugitive emissions components.	45CSR16 40 C.F.R. §60.5415a(h)	N/A
7.4.1.	Applicable recordkeeping requirements for fugitive emissions components.	45CSR16 40 C.F.R. §§60.5420a(c), (c)(15), and (c)(15)(i), (vi) to (ix)	N/A
7.5.1.	Applicable reporting requirements for fugitive emissions components.	45CSR16 40 C.F.R. §§60.5420a(b), (b)(1), (b)(7), (b)(7)(i)(A), (b)(7)(i)(B), (b)(7)(ii) to (iv), and (b)(11)	N/A

Section 8.0. – Natural Gas Dehydration Units Controlled by Thermal Oxidizers [Emission Point IDs: 12E, 13E, 15E, 16E, 24E, and 25E]

Two triethylene glycol (TEG) dehydration units are operated at the facility to remove water vapor from the inlet wet gas stream to meet pipeline specifications. Each dehydrator is comprised of a contactor/absorber tower, a flash tank

(Emission Units: DFT-01 and DFT-02; Emission Point IDs: 12E and 15E), and a regenerator/still vent (Emission Units: DSV-01 and DSV-02; Emission Point IDs: 13E and 16E). Two reboilers (Emission Units: RBV-01 and RBV-02; Emission Point IDs: 14E and 17E) are used to supply heat to the dehydration units. The applicable requirements for the reboilers are included in Section 9.0. of this operating permit.

In the dehydration process, the inlet wet gas stream flows through a contactor tower where the gas is contacted with lean glycol. The lean glycol absorbs the water in the gas stream and becomes rich glycol laden with water and trace amounts of hydrocarbons. The rich glycol is then routed to a flash tank where the glycol pressure is reduced to liberate the lighter hydrocarbons, primarily methane. The lighter hydrocarbons are routed from the flash tank to the reboiler for use as fuel, and the excess hydrocarbons vented to one of the thermal oxidizers (Emission Units: TOx-01 and TOx-02; Emission Point IDs: 24E and 25E). The rich glycol is then sent from the flash tank to the regenerator/still where the TEG is heated to drive off the water vapor and any remaining hydrocarbons. The off gases from the regenerator/still are vented to the thermal oxidizers.

The primary pollutants emitted in this process are VOCs and HAPs. The thermal oxidizers TOx-01 and TOx-02 are each operated to achieve a 99.5% destruction efficiency of these pollutants. TOx-01 has a maximum design heat input of 7.61 mmBTU/hr, and TOx-02 has a maximum design heat input of 6.70 mmBTU/hr.

The TEG dehydration units and the thermal oxidizers are subject to the following regulations:

1. **45CSR6** – *Control of Air Pollution from Combustion of Refuse*

   This rule establishes emission standards to control the particulate matter emissions from the combustion of refuse. Under 45CSR§6-2.8., incineration is defined as "the destruction of combustible refuse by burning in a furnace designed for that purpose. For the purposes of this rule, the destruction of any combustible liquid or gaseous material by burning in a flare or flare stack, thermal oxidizer, or thermal catalytic oxidizer stack shall be considered incineration". As the thermal oxidizers combust waste vapors from the dehydration units, the emission standards of 45CSR§6-4 are applicable to TOx-01 and TOx-02.

   a. Per 45CSR§6-4.1., PM emission limits for each unit are established using the following formula:

   $$F \times Incinerator\ Capacity\ (tons/hr) = Emissions\ (lbs/hr)$$

   The maximum rate at which the gas/waste gas is sent to TOx-01 is 573.71 lbs/hr (0.287 tons/hr) and to TOx-02 is 416.63 lbs/hr (0.208 tons/hr). Since the incinerator capacity of each thermal oxidizer is less than 15,000 lbs/hr, the factor F is 5.43 for each unit in accordance with Table 45-6 of 45CSR§6-4.1.

   The PM emission limit of TOx-01 is:

   $$5.43 \times 0.287\ tons/hr = 1.56\ lbs/hr$$

   The PM emission limit of TOx-02 is:

   $$5.43 \times 0.208\ tons/hr = 1.13\ lbs/hr$$

   The thermal oxidizer TOx-01 has the potential to emit PM at a rate of 0.06 lbs/hr, and the thermal oxidizer TOx-02 has the potential to emit PM at a rate of 0.05 lbs/hr. Therefore, as the limits established above are much greater than the potential emissions of PM from either thermal oxidizer, compliance should be demonstrated through the NSR permit requirements to route vapors from the dehydration unit still vents and excess gas from the flash tanks to the thermal oxidizers at all times (Condition 8.1.3.a.), to operate the thermal oxidizers with a flame present at all times (Condition 8.1.3.b.), and to continuously monitor for the presence of the pilot flame (Condition 8.2.1.).

b. Although the facility is located in Mashall County, 45CSR§6-4.2. is inapplicable to the thermal oxidizers because industrial incinerators are exempt from the requirement.

c. The thermal oxidizers must meet the 20% opacity limit of 45CSR§6-4.3., except as specified in 45CSR§6-4.4. Compliance with the requirements should be demonstrated by operating the units with a flame present at all times (Condition 8.1.3.b.), by operating the units with no visible emissions except for periods not to exceed a total of five minutes in any two-hour period (Condition 8.1.3.e.), and conducting a Method 22 opacity test (Condition 8.3.1.).

d. The thermal oxidizers are also subject to the standards in 45CSR§§6-4.5. and -4.6. which prohibit the emission of unburned refuse and require the prevention of objectionable odors from the units, respectively.

e. At the discretion of the Secretary, the permittee may also be required to conduct stack testing to determine particulate matter loading in accordance with 45CSR§§6-7.1. and -7.2.

2. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

3. **45CSR34** – *Emission Standards for Hazardous Air Pollutants*

4. **40 C.F.R. Part 63 Subpart HH** – *National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities*

   Subpart HH of the NESHAP is applicable to facilities in the oil and natural gas production source category, which includes compressor stations that transport natural gas prior to a natural gas processing plant or the point of custody transfer. As the Ridgeline Compressor Station is located prior to this point, the compressor station is a "production field facility" subject to Subpart HH.

   Per the definition of a major source in 40 C.F.R. §63.761, the major source determination for production field facilities is determined by aggregating HAP emissions from only the glycol dehydration units and the storage vessels. As the potential HAP emissions are below Title V major source thresholds, the Ridgeline Compressor Station is an area source of HAPs. Therefore, the Ridgeline Compressor Station is an area source of HAPs under Subpart HH, and, in accordance with 40 C.F.R. §63.760(b)(2), the TEG dehydration units are the only affected sources subject to Subpart HH.

   Provided that the actual average benzene emissions from the dehydration units remain less than 0.90 megagrams per year (1 tpy), 40 C.F.R. §§63.764(e)(1) and (e)(1)(ii) exempt the TEG dehydration units from the standards set forth in §63.764(d). With the exemption, the permittee is subject to the general requirements of §63.764(j); the monitoring requirements of §63.772(b)(2)(i); and the recordkeeping requirements of §§63.774(d)(1) and (d)(1)(ii). The conditional requirement of 40 C.F.R. §63.760(c) has also been included in the operating permit; the permittee is subject to this requirement if actual emissions of HAPs exceed or previously exceeded 5 tpy for a single HAP or 12.5 tpy for a combination of HAPs.

The table below describes each condition added to Section 8.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
8.1.1.	The maximum throughput of dry natural gas for each dehydration unit's flash tank and still vent shall not exceed: 250 mmscfd for DFT-01/DSV-01 and 160 mmscfd for DFT-02/DSV-02.	45CSR13	7.1.1.
8.1.2.	Emissions from the dehydration units must be controlled by the thermal oxidizers TOx-01 and TOx-02, which shall be designed to achieve a guaranteed control efficiency of 99.5% for VOC and HAP emissions.	45CSR13	7.1.2.
8.1.3.	Design and operation requirements for the thermal oxidizers TOx-01 and TOx-02. The manufacturer guaranteed control efficiency of 99.5% is achieved if the thermal oxidizers are operated at a minimum combustion chamber temperature of 1,700°F. The minimum combustion chamber temperature has been added to paragraph c. of this condition. The applicable emission standards of 45CSR6 have been added as paragraphs f.1. through f.5. of this condition. NOTE: The following references in the R13-3561 requirements of Condition 7.1.3. have been corrected in the operating permit. a. 7.1.3.b. requires the thermal oxidizers to be operated with a flame present at all times as determined by the methods in 6.2.1. The reference to 6.2.1. is likely a typo and has been corrected in the operating permit to the requirement to use a thermocouple to monitor for the presence of a pilot flame (8.2.1. of the operating permit). b. 7.1.3.e. contains the visible emission requirements for the thermal oxidizers and refers to the compliance demonstration methods of 6.3.1. The reference to 6.3.1. is likely a typo and has been corrected in the operating permit to refer to the Method 22 opacity test requirements (8.3.1. of the operating permit).	45CSR§§6-4.1. and -4.3. through -4.6. 45CSR13 45CSR§30-5.1.c.	7.1.3.
8.1.4.	Maximum hourly and annual emission limits for NO_X, CO, VOCs, and aggregate HAPs from the thermal oxidizers.	45CSR13	7.1.4.
8.1.5.	The major source determination for Subpart HH must be updated annually if actual emissions are greater than 5 tpy for a single HAP or 12.5 tpy for aggregate HAPs.	45CSR13 45CSR34 40 C.F.R. §63.760(c)	7.1.5.
8.1.6.	The permittee is exempt from the requirements of 40 C.F.R. §63.764(d) if the actual average emissions of benzene from the TEG dehydration unit are less than 0.90 megagram per year (1 tpy).	45CSR13 45CSR34 40 C.F.R. §§63.764(e), (e)(1), and (e)(1)(ii)	7.1.6.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
8.1.7.	Any affected source must be operated and maintained in a manner consistent with safety and good air pollution control practices for minimizing emissions.	45CSR34 40 C.F.R. §63.764(j)	N/A
8.2.1.	Compliance with the thermal oxidizers' operation requirements in Conditions 8.1.3.b. and d. is demonstrated by monitoring the pilot flame with a thermocouple.	45CSR13	7.2.1.
8.2.2.	The dry natural as throughput to each of the dehydration units must be monitored.	45CSR13	7.2.2.
8.2.3.	The combustion chamber temperature shall be continuously monitored and recorded. Any deviations below the minimum temperature must be reported.	45CSR§30-5.1.c.	N/A
8.3.1.	To demonstrate compliance with the opacity requirements for the thermal oxidizers, the permittee must conduct Method 22 visible emissions testing. NOTE: In the underlying Condition 7.3.1. of R13-3561, this requirement is stated to demonstrate compliance with the opacity requirements of the nonexistent Condition 7.1.2.f. In this operating permit, this reference has been corrected to the thermal oxidizers' visible emission requirements in Condition 8.1.3.e. (Condition 7.1.3.e. of R13-3561).	45CSR13	7.3.1.
8.3.2.	Upon request of the Director, compliance shall be demonstrated with the VOC and HAP emission limits of Condition 8.1.4. using GLYCalc Version 3.0 or higher.	45CSR13	7.3.2.
8.3.3.	Procedure to determine the actual average benzene emissions from the glycol dehydration units.	45CSR13 45CSR34 40 C.F.R. §§63.772(b)(2) and (b)(2)(i)	7.3.3.
8.3.4.	Parameters that must be included if the ProMax model is used as an alternative to the GLYCalc model.	45CSR13	7.3.4.
8.3.5.	The permittee must notify the responsible agency before the use of the ProMax model as an alternative to the GLYCalc model.	45CSR13	7.3.5.
8.3.6.	The permittee must continue to use the ProMax model as an alternative until approved to use another method.	45CSR13	7.3.6.
8.3.7.	Particulate matter emissions testing for each thermal oxidizer must be conducted at such reasonable times as the Secretary may designate.	45CSR§§6-7.1. and -7.2.	N/A

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
8.4.1.	Maintain records of testing conducted to demonstrate compliance with the VOC and HAP emissions thresholds. NOTE: In the underlying permit R13-3561, Condition 7.4.1. states that compliance with Conditions 7.1.3. and 6.3.2. will be demonstrated by maintaining records of testing conducted in accordance with Condition 7.3.2. The conditions referenced have been corrected in the operating permit as described below. a. R13-3561 does not contain a requirement numbered 6.3.2. and is likely a typo. Therefore, the reference has been updated in the operating permit to refer to the requirements to demonstrate compliance with the VOC and HAP emission thresholds using GLYCalc Version 3.0 (8.3.2. of the operating permit). b. The reference to 7.1.3., which contains the design and operation requirements of the thermal oxidizers, is also likely an error, because 7.3.2. is stated to demonstrate compliance with 7.1.4. (VOC and HAP emission limits) and requires the permittee to demonstrate compliance with the VOC and HAP emission thresholds using GLYCalc Version 3.0 or higher. Therefore, this condition has been updated in the operating permit to reference the VOC and HAP emission limits of Condition 8.1.4.	45CSR13	7.4.1.
8.4.2.	Maintain the records specified by the monitoring requirements of Section 8.2. and the testing requirements of Section 8.3.	45CSR13	7.4.2.
8.4.3.	Maintain records of the potential-to-emit calculations for hazardous air pollutants.	45CSR13	7.4.3.
8.4.4.	Maintain records of the dry natural gas throughput through the dehydration system.	45CSR13	7.4.4.
8.4.5.	Maintain records of the actual average benzene emissions to demonstrate that the permittee is exempt from the requirements of 40 C.F.R. §63.764(d).	45CSR13 45CSR34 40 C.F.R. §§63.764(e), 63.774(d)(1) and (d)(1)(ii)	7.4.5.
8.4.6.	Records of Conditions 8.4.1. through 8.4.5. must be maintained on-site or in a readily accessible off-site location for a period of five years. NOTE: Condition 7.4.6. of R13-3561 references the records of Section 6.4. This typo has been corrected in the operating permit.	45CSR13	7.4.6.
8.4.7.	Records of each thermal oxidizer’s combustion chamber temperature must be maintained.	45CSR§30-5.1.c.	N/A
8.4.8.	A copy of the manufacturer’s operation and maintenance specifications for each thermal oxidizer must be maintained.	45CSR§30-5.1.c.	N/A

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
8.5.1.	If testing is required to demonstrate compliance with Condition 8.3.3., the permittee must submit testing protocol at least thirty days prior and a notification of the testing date at least fifteen days prior to testing.	45CSR13	7.5.1.
8.5.2.	The permittee must report any deviations from the allowable visible emission requirements.	45CSR13	7.5.2.
8.5.3.	The permittee must report any deviations from the thermal oxidizer design and operation criteria in Condition 8.1.3.	45CSR13	7.5.3.
8.5.4.	Exemption to the reporting requirements for area sources meeting the benzene exemption and subject to 40 C.F.R. Part 63 Subpart HH.	45CSR34 40 C.F.R. §§63.775(c) and (c)(8)	N/A

Section 9.0. – Reboilers [Emission Point IDs: 14E and 17E]

Each TEG dehydration unit is associated with a 2.00 mmBTU/hr reboiler (RBV-01, RBV-02) which supplies heat to the regenerator/still. Lighter hydrocarbons formed in the flash tanks during dehydration operations are routed to the respective reboiler for fuel.

The reboilers are subject to the following regulations:

1. **45CSR2** – *Control of Particulate Matter Air Pollution from the Combustion of Fuel in Indirect Heat Exchangers*

   45CSR2 establishes particulate matter emission standards and requirements for fuel burning units. Per 45CSR§2-2.10., a fuel burning unit includes any furnace, boiler apparatus, device, mechanism, stack, or structure used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer. Therefore, the reboilers are subject to the particulate matter emission standards of this rule.

   The reboilers are subject to the visible emissions standards in 45CSR§2-3. The 10% opacity limit of 45CSR§2-3.1. has been included in the operating permit as Condition 9.1.2. Compliance with this limit is demonstrated through visible emission checks conducted in accordance with Method 9 of 40 C.F.R. Part 60 Appendix A, as designated by the Director (45CSR§2-3.2.; Condition 9.3.1.). The permittee is also required to maintain records of each visible emission check (Condition 9.4.1.) and to report any deviations discovered during the observations (Condition 9.5.1.).

   As each of the reboilers have a maximum design heat input of less than 10 mmBTU/hr, the permittee is exempt from the weight emission standards of Section 4; the control of fugitive particulate matter standards of Section 5; the registration standards of Section 6; the testing, monitoring, recordkeeping, and reporting requirements of Section 8; and the start-up, shutdown, and malfunction requirements of Section 9 of this rule per 45CSR§2-11.1.

2. **45CSR10** – *Control of Air Pollution from the Emission of Sulfur Oxides*

   45CSR10 establishes sulfur oxides emission standards and requirements for fuel burning units. Per 45CSR§10-2.8., a fuel burning unit includes any furnace, boiler apparatus, device, mechanism, stack or structure used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer. Therefore, the reboilers are subject to the emission standards of this rule.

However, per 45CSR§10-10.1., fuel burning units with a design heat input of less than 10 mmBTU/hr are exempt from the weight emission standards of Section 3; the permit requirements of Section 7; and the testing, monitoring, recordkeeping, and reporting requirements of Section 8. Furthermore, Section 4 is inapplicable because the reboilers are not part of a manufacturing process, and Section 5 is inapplicable because the units do not combust a refinery or other process gas stream.

Therefore, although the reboilers RBV-01 and RBV-02 are subject to 45CSR10, the emission units currently have no applicable requirements under this rule.

3. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

The table below describes each condition added to Section 9.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
9.1.1.	Maximum design heat input of the reboilers.	45CSR13	8.1.1.
9.1.2.	45CSR2 visible emission limit.	45CSR§2-3.1. 45CSR13	8.1.2.
9.2.1.	Method 9 visible emissions observations shall be conducted at such times the Secretary may designate.	45CSR13	8.2.1.
9.3.1.	Testing methods for visible emissions observations.	45CSR§2-3.2. 45CSR13	8.3.1.
9.4.1.	Compliance with Condition 9.2.1. shall be demonstrated by maintaining records of each visible emissions check.	45CSR13	8.4.1.
9.5.1.	The permittee must report any deviations from the allowable visible emissions limit.	45CSR13	8.5.1.

Section 10.0. – Produced Water Storage Tanks [Emission Point IDs: 18E to 21E]

Four 400-bbl storage tanks (Emission Units: TK-01 to TK-04) with applicable requirements are operated at the Ridgeline Compressor Station. The produced water from the inlet separators and the dehydrators is stored in these tanks. Emissions from the storage tanks are not controlled. The produced water is removed from the facility via tanker truck.

The produced water storage tanks are subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

The table below describes each condition added to Section 10.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
10.1.1.	The maximum annual throughput of produced water to the storage tanks shall not exceed 5,040,000 gallons.	45CSR13	9.1.1.
10.1.2.	Hourly and annual limits for VOC emissions from the storage tanks TK-01 to TK-04.	45CSR13	9.1.2.
10.1.3.	Requirements for the thief hatch of each storage tank.	45CSR13	9.1.3.
10.2.1.	The permittee must monitor the throughput of produced water to the storage tanks.	45CSR13	9.2.1.
10.4.1.	Records for TK-01 to TK-04 must be kept in accordance with Condition 3.4.2. of this operating permit.	45CSR13	9.3.1.
10.4.2.	Records of the aggregate throughput for the storage tanks must be maintained.	45CSR13	9.3.2.

Section 11.0. – Truck Load-Out [Emission Point ID: 22E]

Produced water collected into the storage tanks is removed from the facility via tanker trucks. Emissions from the truck loading operations are not controlled.

The truck loading operations are subject to the following regulations:

1. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation*

The table below describes each condition added to Section 11.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
11.1.1.	All above-ground piping, valves, pumps, etc. shall be installed, maintained, and operated to prevent any substantive fugitive emissions.	45CSR13	10.1.1.
11.1.2.	The maximum annual throughput of produced water loaded shall not exceed 5,040,000 gallons.	45CSR13	10.1.2.
11.1.3.	Annual emission limits for VOCs and aggregate HAPs from truck loading operations.	45CSR13	10.1.3.
11.1.4.	Truck loading shall be operated according to the plans and specifications in Permit Application R13-3561.	45CSR13	10.1.4.
11.4.1.	Records for truck loading operations must be kept in accordance with Condition 3.4.2. of this operating permit.	45CSR13	10.3.1.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
11.4.2.	Records of the throughput for truck loading operations must be maintained to demonstrate compliance with the throughput limit and the emission limits.	45CSR13	10.3.2.

Section 12.0. – Compressor Blowdown and Pigging Operations controlled by an Elevated Flare [Emission Point IDs: 7E, 23E, and 26E]

Compressor blowdown and emergency shutdown testing operations (Emission Unit: BD) as well as pigging operations (Emission Unit: PIG) are conducted at the facility. Emissions from BD and PIG are routed to the elevated flare (Emission Unit: FLR-01). The elevated flare has a control efficiency of 98% for VOCs and HAPs.

The compressor blowdown operations, pigging operations, and the elevated flare are subject to the following regulations:

1. **45CSR6** – *Control of Air Pollution from Combustion of Refuse*

   This rule establishes emission standards to control the particulate matter (PM) emissions from the combustion of refuse. Under 45CSR§6-2.8., incineration is defined as "the destruction of combustible refuse by burning in a furnace designed for that purpose. For the purposes of this rule, the destruction of any combustible liquid or gaseous material by burning in a flare or flare stack, thermal oxidizer, or thermal catalytic oxidizer stack shall be considered incineration." As the flare combusts waste vapors from the compressor blowdown events and the pigging events, the emission standards of 45CSR§6-4 are applicable to the flare FLR-01.

   a. Per 45CSR§6-4.1., PM emission limits for each unit are established using the following formula:

   $$F \times Incinerator\ Capacity\ (tons/hr) = Emissions\ (lbs/hr)$$

   The rate at which gas is sent to the flare is 295.03 lbs/hr (0.15 tons/hr). Since the incinerator capacity of the flare is less than 15,000 lbs/hr, the factor F is 5.43 in accordance with Table 45-6 of 45CSR§6-4.1.

   Therefore, the PM emission limit of the flare is:

   $$5.43 \times 0.15\ tons/hr = 0.81\ lbs/hr$$

   The flare FLR-01 has the potential-to-emit PM at a rate of 0.05 lbs/hr. Therefore, as the limit established above is much greater than the potential emissions from the flare, compliance should be demonstrated through the NSR permit requirements to monitor the waste gas throughput of the flare (Conditions 12.1.6. and 12.2.2.), to operate the flare with a pilot flame when emissions are vented (Condition 12.1.8.), and to continuously monitor for the presence of the pilot flame (Condition 12.2.1.).

   b. Although the facility is located in Marshall County, 45CSR§6-4.2 is inapplicable to FLR-01 because the operation of flares is exempt from the requirement.

   c. The flare must meet the 20% opacity limit of 45CSR§6-4.3., except as specified in 45CSR§6-4.4. As the potential PM emissions from the flare are minimal, compliance with the requirements should be demonstrated by operating the flare with a pilot flame when emissions are vented as required by Condition 12.1.8., by continuously monitoring for the presence or absence of a pilot flame using a thermocouple (Condition 12.2.1.), and by conducting Method 9 emission observations (Condition 12.3.1.).

d. The flare is also subject to the standards in 45CSR§§6-4.5. and -4.6. which prohibit the emission of unburned refuse and require the prevention of objectionable odors from the flare, respectively.

e. At the discretion of the Secretary, the permittee may be required to conduct stack testing in accordance with 45CSR§§6-7.1. and -7.2.

2. **45CSR13** – *Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, Permission to Commence Construction, and Procedures for Evaluation.*

The table below describes each condition added to Section 12.0. of the Title V operating permit:

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
12.1.1.	The annual limits for the number of compressor blowdown events and the volume per event.	45CSR13	11.1.1.
12.1.2.	The annual limits for the number of pigging events and the volume per event.	45CSR13	11.1.2.
12.1.3.	The annual limits for the number of plant shutdown events and the maximum volume per event.	45CSR13	11.1.3.
12.1.4.	The waste gas from the compressor blowdown and pigging operations must be controlled by the flare at all times to achieve a 98% control efficiency for VOCs and HAPs.	45CSR13	11.1.4.
12.1.5.	Annual emission limits for nitrogen oxides, carbon monoxide, and volatile organic compounds from the flare FLR-01.	45CSR13	11.1.5.
12.1.6.	Annual limit for the volume of gas consumed in the flare.	45CSR13	11.1.7.
12.1.7.	45CSR6 applicable requirements for the flare, including the opacity requirement of Condition 11.1.8. of R13-3561.	45CSR§§6-4.1. and -4.3. through -4.6. 45CSR13	11.1.8.
12.1.8.	The pilot flame of the flare must be operated at all times when emissions may be vented.	45CSR13	11.1.9.
12.1.9.	The flare shall be operated and designed in accordance with the application for R13-3561.	45CSR13	11.1.10.
12.2.1.	Compliance with Condition 12.1.8. will be demonstrated by using a thermocouple to monitor for the presence or absence of a flare pilot flame.	45CSR13	11.2.1.
12.2.2.	Compliance with Condition 12.1.6. will be demonstrated by monitoring the throughput to the flare.	45CSR13	11.2.2.
12.3.1.	Compliance with the visible emissions requirements of 45CSR§§6-4.3. (Condition 12.1.7.b.) and -4.4. (Condition 12.1.7.c.) shall be demonstrated by conducting Method 9 emission observations as designated by the Secretary.	45CSR13	11.3.1.

Title V Permit Condition	Summary of Permit Condition	Regulatory Citation	R13-3561 Condition
12.3.2.	Particulate matter emissions testing for the flare.	45CSR§§6-7.1. and -7.2.	N/A
12.4.1.	Records required in Section 12.4. must be kept in accordance with Condition 3.4.2.	45CSR13	11.4.1.
12.4.2.	Compliance with 12.1.1. is demonstrated by maintaining a record of compressor blowdown events and the estimated volume per event.	45CSR13	11.4.2.
12.4.3.	Compliance with 12.1.2. is demonstrated by maintaining a record of pigging events and the estimated volume per event.	45CSR13	11.4.3.
12.4.4.	Compliance with 12.1.3. is demonstrated by maintaining a record of shutdown events and the estimated volume per event.	45CSR13	11.4.4.
12.4.5.	Compliance with Conditions 12.1.8. and 12.2.1. is demonstrated by maintaining a record of the times and duration of periods when the pilot flame is absent.	45CSR13	11.4.5.
12.4.6.	Compliance with the visible emission requirements of 45CSR§§6-4.3. (Condition 12.1.7.b.) and -4.4. (Condition 12.1.7.c.) are demonstrated by maintaining records of testing conducted according to 12.3.1.	45CSR13	11.4.6.
12.4.7.	Records must be kept for the monitoring requirements of Section 12.2. and the testing requirements of Section 12.3.	45CSR13	11.4.7.
12.5.1.	The results of visible emissions testing conducted according to Condition 12.3.1. must be submitted within sixty days.	45CSR13	11.5.1.
12.5.2.	Any deviations from the allowable visible emissions requirements discovered during observations must be reported within ten calendar days.	45CSR13	11.5.2.
12.5.3.	Any deviations from the flare design and operation criteria of Condition 12.1.9. and the Permit Application for R13-3561 must be reported within ten calendar days.	45CSR13	11.5.3.
12.5.4.	Emergency use of the flare must be reported to the Director.	45CSR13	11.5.4.
12.5.5.	The permittee must report within ten calendar days any time the flare is not operating when emissions are vented to it.	45CSR13	11.5.5.

NOTE: Condition 11.1.11. of R13-3561 has not been included in this operating permit. This condition requires the permittee to comply with the emergency and affirmative defense requirements contained in Section 2.12. of the NSR permit. However, following the issuance of R13-3561, the emergency requirements were removed from the boilerplate requirements of NSR permits and Title V operating permits.

Non-Applicability Determinations

The following requirements have been determined not to be applicable to the subject facility due to the following:

1. **45CSR21** – *Regulation to Prevent and Control Air Pollution from the Emission of Volatile Organic Compounds* – This rule applies to sources located in Putnam County, Kanawha County, Cabell County, Wayne County, and Wood County. The facility is located in Marshall County, and, therefore, the rule is inapplicable.

2. **45CSR27** – *To Prevent and Control the Emissions of Toxic Air Pollutants* – This rule does not apply to the Ridgeline Compressor Station because, per 45CSR§27-2.4., the equipment used in the production and distribution of petroleum products is not considered a chemical processing unit, provided that such equipment does not produce or contact materials containing more than 5% benzene by weight.

3. **40 C.F.R. Part 60 Subparts D, Da, Db, and Dc** – *Standards of Performance for Steam Generators* – As there are no steam generating units with a maximum design heat input equal to or greater than 10 mmBTU/hr operated at the facility, Subparts D, Da, Db, and Dc do not apply to the Ridgeline Compressor Station per 40 C.F.R. §§60.40(a), 60.40Da(a), 60.40b(a), and 60.40c(a), respectively.

4. **40 C.F.R. Part 60 Subparts K, Ka, Kb, and Kc** – *Standards of Performance for Storage Vessels for Petroleum Liquids/Volatile Organic Liquids* – Subparts K and Ka do not apply to the Ridgeline Compressor Station because construction of the storage vessels used at the facility began after the applicability dates of each subpart (Subpart K – after June 11, 1973 and prior to May 19, 1978; Subpart Ka – after May 18, 1978 and prior to July 23, 1984). Subpart Kc does not apply to the Ridgeline Compressor Station because construction of the storage vessels used at the facility began before the applicability date of the subpart (Subpart Kc – after October 4, 2023). Per 40 C.F.R. §60.110b(a), Subpart Kb does not apply to the facility because each volatile organic liquid storage vessel has a capacity less than 75 m^3 (471.73 bbl or 19,812.9 gallons).

5. **40 C.F.R. Part 60 Subpart GG** – *Standards of Performance for Stationary Gas Turbines* – The facility's compressor turbine, CT-01, is subject to the requirements of 40 C.F.R. Part 60 Subpart KKKK in accordance with §60.4305(a). Therefore, per §60.4305(b), CT-01 is exempt from the requirements of Subpart GG.

6. **40 C.F.R. Part 60 Subpart KKK** – *Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants for which Construction, Reconstruction, or Modification Commenced after January 20, 1984 and on or before August 23, 2011* – The Ridgeline Compressor Station is not a natural gas processing plant as defined in 40 C.F.R. §60.631 and, therefore, is not subject to the provisions of Subpart KKK.

7. **40 C.F.R. Part 60 Subpart LLL** – *Standards of Performance for SO_2 Emissions from Onshore Natural Gas Processing for which Construction, Reconstruction, or Modification Commenced after January 20, 1984 and on or before August 23, 2011* – Per 40 C.F.R. §60.640(a), Subpart LLL does not apply because no sweetening units are operated at the compressor station.

8. **40 C.F.R. Part 60 Subpart IIII** – *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines* – This subpart does not apply because only spark ignition internal combustion engines are operated at the Ridgeline Compressor Station.

9. **40 C.F.R. Part 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* – Construction of the equipment at the Ridgeline Compressor Station began after the applicability date of this subpart. Therefore, Subpart OOOO is inapplicable to the facility.

10. **40 C.F.R. Part 60 Subpart OOOOb** – *Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced after December 6, 2022* – Construction of the

equipment at the Ridgeline Compressor Station began prior to the applicability date of this subpart. Therefore, Subpart OOOOb is inapplicable to the facility.

11. **40 C.F.R. Part 63 Subpart HHH** – *National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities* – The Ridgeline Compressor Station is not a natural gas transmission and storage facility that transports or stores natural gas prior to entering a pipeline to a local distribution company or to a final end user. Additionally, the facility is not a major source of HAP emissions. Therefore, per 40 C.F.R. §63.1270(a), the Ridgeline Compressor Station is not subject to Subpart HHH.

12. **40 C.F.R. Part 63 Subpart YYYY** – *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines* – Per 40 C.F.R. §63.6080, Subpart YYYY applies to stationary combustion turbines located at major sources of HAP emissions. As the Ridgeline Compressor Station is not a major source of HAPs, Subpart YYYY is inapplicable to the facility.

13. **40 C.F.R. Part 63 Subpart DDDDD** – *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters* – Per 40 C.F.R. §63.7485, Subpart DDDDD applies to boilers and process heaters located at major sources of HAP emissions. As the Ridgeline Compressor Station is not a major source of HAPs, Subpart DDDDD is inapplicable to the facility.

14. **40 C.F.R. Part 63 Subpart JJJJJJ** – *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources* – Per 40 C.F.R. §63.11195(e), gas-fired boilers are exempt from the standards of Subpart JJJJJJ. Therefore, the natural gas-fired reboilers (RBV-01 and RBV-02) operated at the Ridgeline Compressor Station are not subject to Subpart JJJJJJ.

15. **40 C.F.R. Part 64** – *Compliance Assurance Monitoring (CAM)*

    Emissions of VOCs from the pigging operations (PIG) are controlled by the flare FLR-01, and emissions of CO, VOCs, and Formaldehyde from the generator engine (GE-01) are controlled by the oxidation catalyst (OxCat-05). However, as the pre-control device emissions from neither the pigging operations nor from the generator engine exceed the Title V major source thresholds, the emission units are not subject to CAM, per 40 C.F.R. §64.2(a)(3).

    The CAM rule is applicable to each of the compressor engines (CE-01 to CE-04) for emissions of CO and Formaldehyde and to the dehydration units (DFT-01/DSV-01 and DFT-02/DSV-02) and the compressor blowdown operations (BD) for emissions of VOCs.

    a. Although the compressor engines CE-01 to CE-04 are subject to the provisions of 40 C.F.R. Part 60 Subpart JJJJ and 40 C.F.R. Part 63 Subpart ZZZZ, the NSR permit contains more stringent limits for NO_X, CO, and VOCs and neither Subpart JJJJ nor Subpart ZZZZ contain emission limits for Formaldehyde. Therefore, the CAM exemption of 40 C.F.R. §64.2(b)(1)(i) is inapplicable to the NSR emission limits for these pollutants.

       Emissions of CO and Formaldehyde from the engines are controlled by the oxidation catalysts OxCat-01 to OxCat-04 (§64.2(a)(2)); each of the engines are subject to emission limits for CO and Formaldehyde under Condition 5.1.1. of R13-3561 (§64.2(a)(1)); and each engine has pre-control device emissions for CO and Formaldehyde which exceed the Title V major source thresholds for criteria pollutants and individual HAPs, respectively (CE-01 to CE-04 each have pre-control device CO emissions of 119.73 tpy and pre-control device Formaldehyde emissions of 10.15 tpy) (§64.2(a)(3)).

       The pre-control device emissions of VOCs from each compressor engine are below the Title V major source threshold for criteria pollutants, and, therefore, the compressor engines are not subject to CAM for emissions of VOCs in accordance with §64.2(a)(3). The oxidation catalysts do not control emissions of NO_X from the engines, and, therefore, the compressor engines are not subject to CAM for emissions of NO_X in accordance with §64.2(a)(2).

b. Emissions of VOCs from the dehydration units are controlled by the thermal oxidizers TOx-01 and TOx-02 (§64.2(a)(2)); each thermal oxidizer is subject to an emission limit for VOCs under the NSR permit (§64.2(a)(1)); and each dehydration unit has pre-control device VOC emissions which exceed the Title V major source threshold (DFT-01/DSV-01 has pre-control device VOC emissions of 768 tpy and DFT-02 has pre-control device VOC emissions of 744 tpy) (§64.2(a)(3)).

   The dehydration units also meet the CAM applicability requirements for emissions of HAPs. However, as the dehydration units are subject to Subpart HH of the NESHAP, the dehydration units are exempt from CAM for emissions of HAPs per §64.2(b)(1)(i).

c. Emissions of VOCs due to compressor blowdown operations are controlled by the elevated flare FLR-01 (§64.2(a)(2)); the flare is subject to emission limits for VOCs under the NSR permit (§64.2(a)(1)); and the compressor blowdown operations have pre-control device VOC emissions of 121 tpy which exceeds the Title V major source threshold (§64.2(a)(3)).

However, as the post-control device CO and Formaldehyde emissions from the compressor engines, the post-control device VOC emissions from the dehydration units, and the post-control device VOC emissions from the compressor blowdown operations are below the Title V major source thresholds, each of these units are considered "Other Pollutant-Specific Emissions Units" in accordance with §64.5(b). Therefore, the submission of a CAM Plan is deferred until the renewal application is submitted for this operating permit.

Request for Variances or Alternatives
None.

Insignificant Activities
Insignificant emission unit(s) and activities are identified in the Title V application.

Comment Period
Beginning Date:
Ending Date:

Point of Contact
All written comments should be addressed to the following individual and office:

Sarah Barron
West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street SE
Charleston, WV 25304
304/414-1915
sarah.k.barron@wv.gov

Procedure for Requesting Public Hearing
During the public comment period, any interested person may submit written comments on the draft permit and may request a public hearing, if no public hearing has already been scheduled. A request for public hearing shall be in writing and shall state the nature of the issues proposed to be raised in the hearing. The Secretary shall grant such a request for a hearing if he/she concludes that a public hearing is appropriate. Any public hearing shall be held in the general area in which the facility is located.

Response to Comments (Statement of Basis)
Not applicable.

West Virginia Department of Environmental Protection

Harold D. Ward

Cabinet Secretary

Permit to Operate

Pursuant to

Title V

of the Clean Air Act

Issued to:

Appalachia Midstream Services, L.L.C.

Ridgeline Compressor Station

R30-05100261-2024

Laura M. Crowder

Director, Division of Air Quality

Issued: [Date of issuance] • Effective: [Equals issue date plus two weeks]
Expiration: [5 years after issuance date] • Renewal Application Due: [6 months prior to expiration]

Permit Number: **R30-05100261-2024**
Permittee: **Appalachia Midstream Services, L.L.C.**
Facility Name: **Ridgeline Compressor Station**
Permittee Mailing Address: **100 Teletech Drive, Suite 2, Moundsville, WV 26041**

This permit is issued in accordance with the West Virginia Air Pollution Control Act (West Virginia Code §§ 22-5-1 et seq.) and 45CSR30 C Requirements for Operating Permits. The permittee identified at the above-referenced facility is authorized to operate the stationary sources of air pollutants identified herein in accordance with all terms and conditions of this permit.

Facility Location:	Cameron, Marshall County, West Virginia
Facility Mailing Address:	249 US-250, Cameron, WV 26033
Telephone Number:	(304) 843-3125
Type of Business Entity:	L.L.C.
Facility Description:	The compressor station receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site; there is no-onsite storage of condensate liquids.
SIC Codes:	1389
UTM Coordinates:	537.78 km Easting • 4,403.01 km Northing • Zone 17

Permit Writer: Sarah Barron

Any person whose interest may be affected, including, but not necessarily limited to, the applicant and any person who participated in the public comment process, by a permit issued, modified or denied by the Secretary may appeal such action of the Secretary to the Air Quality Board pursuant to article one [§§ 22B-1-1 et seq.], Chapter 22B of the Code of West Virginia. West Virginia Code §22-5-14.

Issuance of this Title V Operating Permit does not supersede or invalidate any existing permits under 45CSR13, 14 or 19, although all applicable requirements from such permits governing the facility's operation and compliance have been incorporated into the Title V Operating Permit.

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1.0 Emission Units and Active R13, R14, and R19 Permits

1.1. Emission Units

Emission Unit ID	Emission Point ID	Emission Unit Description	Year Installed	Design Capacity	Control Device
CE-01	1E	Compressor Engine 01 – CAT G3616LE A4	2021	5,000 HP	OxCat-01
CE-02	2E	Compressor Engine 02 – CAT G3616LE A4	2021	5,000 HP	OxCat-02
CE-03	3E	Compressor Engine 03 – CAT G3616LE A4	2021	5,000 HP	OxCat-03
CE-04	4E	Compressor Engine 04 – CAT G3616LE A4	2021	5,000 HP	OxCat-04
ECC	5E	Engine Crankcase Emissions (CE-01 to CE-04, GE-01)	2021	5 Engines	None
CRP	6E	Compressor Rod Packing (Comp-01 to Comp-04)	2021	4 Compressors	None
BD	7E	Blowdown (Compressor Blowdown and Emergency Shutdown Testing Operations)	2021	6 Compressors	FLR-01 (26E)
GE-01	8E	Generator Engine – CAT G3512LE	2021	1,468 HP	OxCat-05
CT-01	9E	Compressor Turbine 01 – Solar Taurus 70-10802S	2022	11,252 HP	None
TSS	10E	Compressor Turbine Start/Stop	2022	104 events/yr	None
DGS	11E	Centrifugal Compressor Dry Gas Seal Leaks	2022	N/A	None
DFT-01	12E	Dehydrator 01 – Flash Tank	2021	250 mmscfd	TOx-01 (24E)
DSV-01	13E	Dehydrator 01 – Still Vent	2021	250 mmscfd	TOx-01 (24E)
RBV-01	14E	Dehydrator 01 – Reboiler	2021	2.00 mmBTU/hr	None
DFT-02	15E	Dehydrator 02 – Flash Tank	2022	160 mmscfd	TOx-02 (25E)
DSV-02	16E	Dehydrator 02 – Still Vent	2022	160 mmscfd	TOx-02 (25E)
RBV-02	17E	Dehydrator 02 – Reboiler	2022	2.00 mmBTU/hr	None
TK-01	18E	Storage Tank 01 – Produced Water	2021	400 bbl	None
TK-02	19E	Storage Tank 02 – Produced Water	2021	400 bbl	None
TK-03	20E	Storage Tank 03 – Produced Water	2021	400 bbl	None
TK-04	21E	Storage Tank 04 – Produced Water	2021	400 bbl	None
TLO	22E	Truck Load-Out – Produced Water	2021	120,000 bbl/yr	None
PIG	23E	Pigging Operations	2021	4 units	FLR-01 (26E)
TOx-01	24E	DFT-01/DSV-01 Thermal Oxidizer (Zeeco Z-HTO)	2021	7.61 mmBTU/hr	N/A
TOx-02	25E	DFT-02/DSV-02 Thermal Oxidizer (Zeeco Z-VTO)	2022	6.70 mmBTU/hr	N/A

Emission Unit ID	Emission Point ID	Emission Unit Description	Year Installed	Design Capacity	Control Device
FLR-01	26E	BD/PIG Elevated Flare (Zeeco MJ-16)	2021	7.00 mmBTU/hr	N/A
TK-05	TK-05	Lube Oil Storage Tank	2021	4,200 gal	None
TK-06	TK-06	Used Oil Storage Tank	2021	4,200 gal	None
TK-07	TK-07	Coolant Storage Tank	2021	4,200 gal	None
TK-08	TK-08	Used Coolant Storage Tank	2021	4,200 gal	None
TK-09	TK-09	Hydrate Inhibitor (Methanol Blend) Storage Tank	2021	500 gal	None
TK-10	TK-10	Hydrate Inhibitor (Methanol Blend) Storage Tank	2021	500 gal	None
TK-11	TK-11	Hydrate Inhibitor (Methanol Blend) Storage Tank	2021	500 gal	None
TK-12	TK-12	Hydrate Inhibitor (Methanol Blend) Storage Tank	2021	500 gal	None
TK-13	TK-13	Hydrate Inhibitor (Methanol Blend) Storage Tank	2021	500 gal	None
TK-14	TK-14	Engine Oil Storage Tank	2021	520 gal	None
TK-15	TK-15	Engine Oil Storage Tank	2021	520 gal	None
TK-16	TK-16	Engine Oil Storage Tank	2021	520 gal	None
TK-17	TK-17	Engine Oil Storage Tank	2021	520 gal	None
TK-18	TK-18	Compressor Oil Storage Tank	2021	520 gal	None
TK-19	TK-19	Compressor Oil Storage Tank	2021	520 gal	None
TK-20	TK-20	Compressor Oil Storage Tank	2021	520 gal	None
TK-21	TK-21	Compressor Oil Storage Tank	2021	520 gal	None
TK-22	TK-22	TEG Storage Tank	2021	1,000 gal	None
TK-23	TK-23	TEG Storage Tank	2021	300 gal	None
TK-24	TK-24	Defoamer Storage Tank	2021	500 gal	None
FUG-G	1F (Fugitive)	Process Piping and Equipment Leaks – Gas	2021	4,981 Fittings	LDAR
FUG-L	2F (Fugitive)	Process Piping and Equipment Leaks – Light Oil	2021	2,271 Fittings	LDAR

1.2. Active R13, R14, and R19 Permits

The underlying authority for any conditions from R13, R14, and/or R19 permits contained in this operating permit is cited using the original permit number (e.g. R13-1234). The current applicable version of such permit(s) is listed below.

Permit Number	Date of Issuance
R13-3561	July 29, 2022

2.0 General Conditions

2.1. Definitions

2.1.1. All references to the "West Virginia Air Pollution Control Act" or the "Air Pollution Control Act" mean those provisions contained in W.Va. Code §§ 22-5-1 to 22-5-18.

2.1.2. The "Clean Air Act" means those provisions contained in 42 U.S.C. §§ 7401 to 7671q, and regulations promulgated thereunder.

2.1.3. "Secretary" means the Secretary of the Department of Environmental Protection or other person to whom the Secretary has delegated authority or duties pursuant to W.Va. Code §§ 22-1-6 or 22-1-8 (45CSR§30-2.39.). The Director of the Division of Air Quality is the Secretary's designated representative for the purposes of this permit.

2.1.4. Unless otherwise specified in a permit condition or underlying rule or regulation, all references to a "rolling yearly total" shall mean the sum of the monthly data, values or parameters being measured, monitored, or recorded, at any given time for the previous twelve (12) consecutive calendar months.

2.2. Acronyms

CAAA	Clean Air Act Amendments
CBI	Confidential Business Information
CEM	Continuous Emission Monitor
CES	Certified Emission Statement
C.F.R. ***or*** **CFR**	Code of Federal Regulations
CO	Carbon Monoxide
C.S.R. ***or*** **CSR**	Codes of State Rules
DAQ	Division of Air Quality
DEP	Department of Environmental Protection
FOIA	Freedom of Information Act
HAP	Hazardous Air Pollutant
HON	Hazardous Organic NESHAP
HP	Horsepower
lbs/hr ***or*** **lb/hr**	Pounds per Hour
LDAR	Leak Detection and Repair
m	Thousand
MACT	Maximum Achievable Control Technology
mm	Million
mmBtu/hr	Million British Thermal Units per Hour
mmft^3/hr ***or*** **mmcf/hr**	Million Cubic Feet Burned per Hour
NA ***or*** **N/A**	Not Applicable
NAAQS	National Ambient Air Quality Standards
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NO_x	Nitrogen Oxides
NSPS	New Source Performance Standards
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10μm in diameter
pph	Pounds per Hour
ppm	Parts per Million
PSD	Prevention of Significant Deterioration
psi	Pounds per Square Inch
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TAP	Toxic Air Pollutant
TPY	Tons per Year
TRS	Total Reduced Sulfur
TSP	Total Suspended Particulate
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VEE	Visual Emissions Evaluation
VOC	Volatile Organic Compounds

2.3. Permit Expiration and Renewal

2.3.1. Permit duration. This permit is issued for a fixed term of five (5) years and shall expire on the date specified on the cover of this permit, except as provided in 45CSR§30-6.3.b. and 45CSR§30-6.3.c.
[45CSR§30-5.1.b.]

2.3.2. A permit renewal application is timely if it is submitted at least six (6) months prior to the date of permit expiration.
[45CSR§30-4.1.a.3.]

2.3.3. Permit expiration terminates the source's right to operate unless a timely and complete renewal application has been submitted consistent with 45CSR§30-6.2. and 45CSR§30-4.1.a.3.
[45CSR§30-6.3.b.]

2.3.4. If the Secretary fails to take final action to deny or approve a timely and complete permit application before the end of the term of the previous permit, the permit shall not expire until the renewal permit has been issued or denied, and any permit shield granted for the permit shall continue in effect during that time.
[45CSR§30-6.3.c.]

2.4. Permit Actions

2.4.1. This permit may be modified, revoked, reopened and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or of a notification of planned changes or anticipated noncompliance does not stay any permit condition.
[45CSR§30-5.1.f.3.]

2.5. Reopening for Cause

2.5.1. This permit shall be reopened and revised under any of the following circumstances:

a. Additional applicable requirements under the Clean Air Act or the Secretary's legislative rules become applicable to a major source with a remaining permit term of three (3) or more years. Such a reopening shall be completed not later than eighteen (18) months after promulgation of the applicable requirement. No such reopening is required if the effective date of the requirement is later than the date on which the permit is due to expire, unless the original permit or any of its terms and conditions has been extended pursuant to 45CSR§§30-6.6.a.1.A. or B.

b. Additional requirements (including excess emissions requirements) become applicable to an affected source under Title IV of the Clean Air Act (Acid Deposition Control) or other legislative rules of the Secretary. Upon approval by U.S. EPA, excess emissions offset plans shall be incorporated into the permit.

c. The Secretary or U.S. EPA determines that the permit contains a material mistake or that inaccurate statements were made in establishing the emissions standards or other terms or conditions of the permit.

d. The Secretary or U.S. EPA determines that the permit must be revised or revoked and reissued to assure compliance with the applicable requirements.

[45CSR§30-6.6.a.]

2.6. Administrative Permit Amendments

2.6.1. The permittee may request an administrative permit amendment as defined in and according to the procedures specified in 45CSR§30-6.4.
[45CSR§30-6.4.]

2.7. Minor Permit Modifications

2.7.1. The permittee may request a minor permit modification as defined in and according to the procedures specified in 45CSR§30-6.5.a.
[45CSR§30-6.5.a.]

2.8. Significant Permit Modification

2.8.1. The permittee may request a significant permit modification, in accordance with 45CSR§30-6.5.b., for permit modifications that do not qualify for minor permit modifications or as administrative amendments.
[45CSR§30-6.5.b.]

2.9. Emissions Trading

2.9.1. No permit revision shall be required, under any approved economic incentives, marketable permits, emissions trading, and other similar programs or processes for changes that are provided for in the permit and that are in accordance with all applicable requirements.
[45CSR§30-5.1.h.]

2.10. Off-Permit Changes

2.10.1. Except as provided below, a facility may make any change in its operations or emissions that is not addressed nor prohibited in its permit and which is not considered to be construction nor modification under any rule promulgated by the Secretary without obtaining an amendment or modification of its permit. Such changes shall be subject to the following requirements and restrictions:

a. The change must meet all applicable requirements and may not violate any existing permit term or condition.

b. The permittee must provide a written notice of the change to the Secretary and to U.S. EPA within two (2) business days following the date of the change. Such written notice shall describe each such change, including the date, any change in emissions, pollutants emitted, and any applicable requirement that would apply as a result of the change.

c. The change shall not qualify for the permit shield.

d. The permittee shall keep records describing all changes made at the source that result in emissions of regulated air pollutants, but not otherwise regulated under the permit, and the emissions resulting from those changes.

e. No permittee may make any change subject to any requirement under Title IV of the Clean Air Act (Acid Deposition Control) pursuant to the provisions of 45CSR§30-5.9.

f. No permittee may make any changes which would require preconstruction review under any provision of Title I of the Clean Air Act (including 45CSR14 and 45CSR19) pursuant to the provisions of 45CSR§30-5.9.

[45CSR§30-5.9.]

2.11. Operational Flexibility

2.11.1. The permittee may make changes within the facility as provided by § 502(b)(10) of the Clean Air Act. Such operational flexibility shall be provided in the permit in conformance with the permit application and applicable requirements. No such changes shall be a modification under any rule or any provision of Title I of the Clean Air Act (including 45CSR14 and 45CSR19) promulgated by the Secretary in accordance with Title I of the Clean Air Act and the change shall not result in a level of emissions exceeding the emissions allowable under the permit.
[45CSR§30-5.8]

2.11.2. Before making a change under 45CSR§30-5.8., the permittee shall provide advance written notice to the Secretary and to U.S. EPA, describing the change to be made, the date on which the change will occur, any changes in emissions, and any permit terms and conditions that are affected. The permittee shall thereafter maintain a copy of the notice with the permit, and the Secretary shall place a copy with the permit in the public file. The written notice shall be provided to the Secretary and U.S. EPA at least seven (7) days prior to the date that the change is to be made, except that this period may be shortened or eliminated as necessary for a change that must be implemented more quickly to address unanticipated conditions posing a significant health, safety, or environmental hazard. If less than seven (7) days notice is provided because of a need to respond more quickly to such unanticipated conditions, the permittee shall provide notice to the Secretary and U.S. EPA as soon as possible after learning of the need to make the change.
[45CSR§30-5.8.a.]

2.11.3. The permit shield shall not apply to changes made under 45CSR§30-5.8., except those provided for in 45CSR§30-5.8.d. However, the protection of the permit shield will continue to apply to operations and emissions that are not affected by the change, provided that the permittee complies with the terms and conditions of the permit applicable to such operations and emissions. The permit shield may be reinstated for emissions and operations affected by the change:

a. If subsequent changes cause the facility's operations and emissions to revert to those authorized in the permit and the permittee resumes compliance with the terms and conditions of the permit, or

b. If the permittee obtains final approval of a significant modification to the permit to incorporate the change in the permit.

[45CSR§30-5.8.c.]

2.11.4. "Section 502(b)(10) changes" are changes that contravene an express permit term. Such changes do not include changes that would violate applicable requirements or contravene enforceable permit terms and conditions that are monitoring (including test methods), recordkeeping, reporting, or compliance certification requirements.
[45CSR§30-2.40]

2.12. Reasonably Anticipated Operating Scenarios

2.12.1. The following are terms and conditions for reasonably anticipated operating scenarios identified in this permit.

a. Contemporaneously with making a change from one operating scenario to another, the permittee shall record in a log at the permitted facility a record of the scenario under which it is operating and to document the change in reports submitted pursuant to the terms of this permit and 45CSR30.

b. The permit shield shall extend to all terms and conditions under each such operating scenario; and

c. The terms and conditions of each such alternative scenario shall meet all applicable requirements and the requirements of 45CSR30.

[45CSR§30-5.1.i.]

2.13. Duty to Comply

2.13.1. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the West Virginia Code and the Clean Air Act and is grounds for enforcement action by the Secretary or USEPA; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.
[45CSR§30-5.1.f.1.]

2.14. Inspection and Entry

2.14.1. The permittee shall allow any authorized representative of the Secretary, upon the presentation of credentials and other documents as may be required by law, to perform the following:

a. At all reasonable times (including all times in which the facility is in operation) enter upon the permittee's premises where a source is located or emissions related activity is conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times (including all times in which the facility is in operation) any facilities, equipment (including monitoring and air pollution control equipment), practices, or operations regulated or required under the permit;

d. Sample or monitor at reasonable times substances or parameters to determine compliance with the permit or applicable requirements or ascertain the amounts and types of air pollutants discharged.

[45CSR§30-5.3.b.]

2.15. Schedule of Compliance

2.15.1. For sources subject to a compliance schedule, certified progress reports shall be submitted consistent with the applicable schedule of compliance set forth in this permit and 45CSR§30-4.3.h., but at least every six (6) months, and no greater than once a month, and shall include the following:

a. Dates for achieving the activities, milestones, or compliance required in the schedule of compliance, and dates when such activities, milestones or compliance were achieved; and

b. An explanation of why any dates in the schedule of compliance were not or will not be met, and any preventative or corrective measure adopted.

[45CSR§30-5.3.d.]

2.16. Need to Halt or Reduce Activity not a Defense

2.16.1. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. However, nothing in this paragraph shall be construed as precluding consideration of a need to halt or reduce activity as a mitigating factor in determining penalties for noncompliance if the health, safety, or environmental impacts of halting or reducing operations would be more serious than the impacts of continued operations.
[45CSR§30-5.1.f.2.]

2.17. Reserved.

2.18. Federally-Enforceable Requirements

2.18.1. All terms and conditions in this permit, including any provisions designed to limit a source's potential to emit and excepting those provisions that are specifically designated in the permit as "State-enforceable only", are enforceable by the Secretary, USEPA, and citizens under the Clean Air Act.
[45CSR§30-5.2.a.]

2.18.2. Those provisions specifically designated in the permit as “State-enforceable only” shall become “Federally-enforceable” requirements upon SIP approval by the USEPA.

2.19. Duty to Provide Information

2.19.1. The permittee shall furnish to the Secretary within a reasonable time any information the Secretary may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the Secretary copies of records required to be kept by the permittee. For information claimed to be confidential, the permittee shall furnish such records to the Secretary along with a claim of confidentiality in accordance with 45CSR31. If confidential information is to be sent to USEPA, the permittee shall directly provide such information to USEPA along with a claim of confidentiality in accordance with 40 C.F.R. Part 2.
[45CSR§30-5.1.f.5.]

2.20. Duty to Supplement and Correct Information

2.20.1. Upon becoming aware of a failure to submit any relevant facts or a submittal of incorrect information in any permit application, the permittee shall promptly submit to the Secretary such supplemental facts or corrected information.
[45CSR§30-4.2.]

2.21. Permit Shield

2.21.1. Compliance with the conditions of this permit shall be deemed compliance with any applicable requirements as of the date of permit issuance provided that such applicable requirements are included and are specifically identified in this permit or the Secretary has determined that other requirements specifically identified are not applicable to the source and this permit includes such a determination or a concise summary thereof.
[45CSR§30-5.6.a.]

2.21.2. Nothing in this permit shall alter or affect the following:

a. The liability of an owner or operator of a source for any violation of applicable requirements prior to or at the time of permit issuance; or

b. The applicable requirements of the Code of West Virginia and Title IV of the Clean Air Act (Acid Deposition Control), consistent with § 408 (a) of the Clean Air Act.

c. The authority of the Administrator of U.S. EPA to require information under § 114 of the Clean Air Act or to issue emergency orders under § 303 of the Clean Air Act.

[45CSR§30-5.6.c.]

2.22. Credible Evidence

2.22.1. Nothing in this permit shall alter or affect the ability of any person to establish compliance with, or a violation of, any applicable requirement through the use of credible evidence to the extent authorized by law. Nothing in this permit shall be construed to waive any defenses otherwise available to the permittee including but not limited to any challenge to the credible evidence rule in the context of any future proceeding.
[45CSR§30-5.3.e.3.B.]

2.23. Severability

2.23.1. The provisions of this permit are severable. If any provision of this permit, or the application of any provision of this permit to any circumstance is held invalid by a court of competent jurisdiction, the remaining permit terms and conditions or their application to other circumstances shall remain in full force and effect.
[45CSR§30-5.1.e.]

2.24. Property Rights

2.24.1. This permit does not convey any property rights of any sort or any exclusive privilege.
[45CSR§30-5.1.f.4]

2.25. Acid Deposition Control

2.25.1. Emissions shall not exceed any allowances that the source lawfully holds under Title IV of the Clean Air Act (Acid Deposition Control) or rules of the Secretary promulgated thereunder.

a. No permit revision shall be required for increases in emissions that are authorized by allowances acquired pursuant to the acid deposition control program, provided that such increases do not require a permit revision under any other applicable requirement.

b. No limit shall be placed on the number of allowances held by the source. The source may not, however, use allowances as a defense to noncompliance with any other applicable requirement.

c. Any such allowance shall be accounted for according to the procedures established in rules promulgated under Title IV of the Clean Air Act.

[45CSR§30-5.1.d.]

2.25.2. Where applicable requirements of the Clean Air Act are more stringent than any applicable requirement of regulations promulgated under Title IV of the Clean Air Act (Acid Deposition Control), both provisions shall be incorporated into the permit and shall be enforceable by the Secretary and U. S. EPA.
[45CSR§30-5.1.a.2.]

3.0 Facility-Wide Requirements

3.1. Limitations and Standards

3.1.1. **Open burning.** The open burning of refuse by any person is prohibited except as noted in 45CSR§6-3.1.
[45CSR§6-3.1.]

3.1.2. **Open burning exemptions.** The exemptions listed in 45CSR§6-3.1 are subject to the following stipulation: Upon notification by the Secretary, no person shall cause or allow any form of open burning during existing or predicted periods of atmospheric stagnation. Notification shall be made by such means as the Secretary may deem necessary and feasible.
[45CSR§6-3.2.]

3.1.3. **Asbestos.** The permittee is responsible for thoroughly inspecting the facility, or part of the facility, prior to commencement of demolition or renovation for the presence of asbestos and complying with 40 C.F.R. § 61.145, 40 C.F.R. § 61.148, and 40 C.F.R. § 61.150. The permittee, owner, or operator must notify the Secretary at least ten (10) working days prior to the commencement of any asbestos removal on the forms prescribed by the Secretary if the permittee is subject to the notification requirements of 40 C.F.R. § 61.145(b)(3)(i). The USEPA, the Division of Waste Management and the Bureau for Public Health - Environmental Health require a copy of this notice to be sent to them.
[40 C.F.R. §61.145(b) and 45CSR34]

3.1.4. **Odor.** No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor at any location occupied by the public.
[45CSR§4-3.1 State-Enforceable only.]

3.1.5. **Standby plan for reducing emissions.** When requested by the Secretary, the permittee shall prepare standby plans for reducing the emissions of air pollutants in accordance with the objectives set forth in Tables I, II, and III of 45CSR11.
[45CSR§11-5.2]

3.1.6. **Emission inventory.** The permittee is responsible for submitting, on an annual basis, an emission inventory in accordance with the submittal requirements of the Division of Air Quality.
[W.Va. Code § 22-5-4(a)(15)]

3.1.7. **Ozone-depleting substances.** For those facilities performing maintenance, service, repair or disposal of appliances, the permittee shall comply with the standards for recycling and emissions reduction pursuant to 40 C.F.R. Part 82, Subpart F, except as provided for Motor Vehicle Air Conditioners (MVACs) in Subpart B:

a. Persons opening appliances for maintenance, service, repair, or disposal must comply with the prohibitions and required practices pursuant to 40 C.F.R. §§ 82.154 and 82.156.

b. Equipment used during the maintenance, service, repair, or disposal of appliances must comply with the standards for recycling and recovery equipment pursuant to 40 C.F.R. § 82.158.

c. Persons performing maintenance, service, repair, or disposal of appliances must be certified by an approved technician certification program pursuant to 40 C.F.R. § 82.161.

[40 C.F.R. 82, Subpart F]

3.1.8. **Risk Management Plan.** Should this stationary source, as defined in 40 C.F.R. § 68.3, become subject to Part 68, then the owner or operator shall submit a risk management plan (RMP) by the date specified in 40 C.F.R. § 68.10 and shall certify compliance with the requirements of Part 68 as part of the annual compliance certification as required by 40 C.F.R. Part 70 or 71.
[40 C.F.R. 68]

3.1.9. **Minor Source of Hazardous Air Pollutants (HAP).** HAP emissions from the facility shall be less than 10 tpy of any single HAP or 25 tpy of any combination of HAPs. Compliance with this condition shall ensure that the facility is a minor HAP source.
[45CSR13, R13-3561, 4.1.2.]

3.1.10. **Operation and Maintenance of Air Pollution Control Equipment.** The permittee shall, to the extent practicable, install, maintain, and operate all pollution control equipment listed in Section 1.0. and associated monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions, or comply with any more stringent limits set forth in this permit or as set forth by any State rule, Federal regulation, or alternative control plan approved by the Secretary.
[45CSR13, R13-3561, 4.1.3., 7.1.7., and 11.1.6.]

3.1.11. Only those emission units/sources as identified in the Emission Units Table of Section 1.1., with the exception of any *de minimis* sources as identified under Table 45-13B of 45CSR13, are authorized at the permitted facility.
[45CSR13, R13-3561, 4.1.5.]

3.1.12. No person shall cause, suffer, allow or permit fugitive particulate matter to be discharged beyond the boundary lines of the property on which the discharge originates or at any public or residential location, which causes or contributes to statutory air pollution.
[45CSR§17-3.1.]

3.2. Monitoring Requirements

3.2.1. None.

3.3. Testing Requirements

3.3.1. **Stack testing.** As per provisions set forth in this permit or as otherwise required by the Secretary, in accordance with the West Virginia Code, underlying regulations, permits and orders, the permittee shall conduct test(s) to determine compliance with the emission limitations set forth in this permit and/or established or set forth in underlying documents. The Secretary, or his duly authorized representative, may at his option witness or conduct such test(s). Should the Secretary exercise his option to conduct such test(s), the operator shall provide all necessary sampling connections and sampling ports to be located in such manner as the Secretary may require, power for test equipment and the required safety equipment, such as scaffolding, railings and ladders, to comply with generally accepted good safety practices. Such tests shall be conducted in accordance with the methods and procedures set forth in this permit or as otherwise approved or specified by the Secretary in accordance with the following:

a. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with 40 C.F.R. Parts 60, 61, and 63, if applicable, in accordance with the Secretary's delegated authority and any established equivalency determination methods which are applicable.

b. The Secretary may on a source-specific basis approve or specify additional testing or alternative testing to the test methods specified in the permit for demonstrating compliance with applicable requirements which do not involve federal delegation. In specifying or approving such alternative testing to the test methods, the Secretary, to the extent possible, shall utilize the same equivalency criteria as would be used in approving such changes under Section 3.3.1.a. of this permit. If a testing method is specified or approved which effectively replaces a test method specified in this permit, the permit shall be revised in accordance with 45CSR§30-6.4. or 45CSR§30-6.5., as applicable.

c. All periodic tests to determine mass emission limits from or air pollutant concentrations in discharge stacks and such other tests as specified in this permit shall be conducted in accordance with an approved test protocol. Unless previously approved, such protocols shall be submitted to the Secretary in writing at least thirty (30) days prior to any testing and shall contain the information set forth by the Secretary. In addition, the permittee shall notify the Secretary at least fifteen (15) days prior to any testing so the Secretary may have the opportunity to observe such tests. This notification shall include the actual date and time during which the test will be conducted and, if appropriate, verification that the tests will fully conform to a referenced protocol previously approved by the Secretary.

d. The permittee shall submit a report of the results of the stack test within 60 days of completion of the test. The test report shall provide the information necessary to document the objectives of the test and to determine whether proper procedures were used to accomplish these objectives. The report shall include the following: the certification described in paragraph 3.5.1; a statement of compliance status, also signed by a responsible official; and, a summary of conditions which form the basis for the compliance status evaluation. The summary of conditions shall include the following:

1. The permit or rule evaluated, with the citation number and language.

2. The result of the test for each permit or rule condition.

3. A statement of compliance or non-compliance with each permit or rule condition.

[WV Code §§ 22-5-4(a)(15-16) and 45CSR13]

3.4. Recordkeeping Requirements

3.4.1. **Monitoring information.** The permittee shall keep records of monitoring information that include the following:

a. The date, place as defined in this permit and time of sampling or measurements;

b. The date(s) analyses were performed;

c. The company or entity that performed the analyses;

d. The analytical techniques or methods used;

e. The results of the analyses; and

f. The operating conditions existing at the time of sampling or measurement.

[45CSR§30-5.1.c.2.A.; 45CSR13, R13-3561, 4.1.1.]

3.4.2. **Retention of records.** The permittee shall retain records of all required monitoring data and support information for a period of at least five (5) years from the date of monitoring sample, measurement, report, application, or record creation date. Support information includes all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation, and copies of all reports required by the permit. Where appropriate, records may be maintained in computerized form in lieu of the above records.
[45CSR§30-5.1.c.2.B.; 45CSR13, R13-3561, 3.4.1.]

3.4.3. **Odors.** For the purposes of 45CSR4, the permittee shall maintain a record of all odor complaints received, any investigation performed in response to such a complaint, and any responsive action(s) taken.
[45CSR§30-5.1.c. State-Enforceable only.]

3.4.4. **Record of Malfunctions of Air Pollution Control Equipment.** For all air pollution control equipment listed in Section 1.0., the permittee shall maintain records of the occurrence and duration of any malfunction or operational shutdown of the air pollution control equipment during which excess emissions occur. For each such case, the following information shall be recorded:

a. The equipment involved.

b. Steps taken to minimize emissions during the event.

c. The duration of the event.

d. The estimated increase in emissions during the event.

For each such case associated with an equipment malfunction, the additional information shall also be recorded:

e. The cause of the malfunction.

f. Steps taken to correct the malfunction.

g. Any changes or modifications to equipment or procedures that would help prevent future recurrences of the malfunction.

[45CSR13, R13-3561, 4.1.4.]

3.5. Reporting Requirements

3.5.1. **Responsible official.** Any application form, report, or compliance certification required by this permit to be submitted to the DAQ and/or USEPA shall contain a certification by the responsible official that states that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate and complete.
[45CSR§§30-4.4. *and* 5.1.c.3.D.]

3.5.2. A permittee may request confidential treatment for the submission of reporting required under 45CSR§30-5.1.c.3. pursuant to the limitations and procedures of W.Va. Code § 22-5-10 and 45CSR31.
[45CSR§30-5.1.c.3.E.]

3.5.3. Except for the electronic submittal of the annual compliance certification and semi-annual monitoring reports to the DAQ and USEPA as required in 3.5.5 and 3.5.6 below, all notices, requests, demands, submissions and other communications required or permitted to be made to the Secretary of DEP and/or USEPA shall be made in writing and shall be deemed to have been duly given when delivered by hand, or mailed first class or by private carrier with postage prepaid to the address(es), or submitted in electronic format by e-mail as set forth below or to such other person or address as the Secretary of the Department of Environmental Protection may designate:

DAQ:	**US EPA:**
Director WVDEP Division of Air Quality 601 57th Street SE Charleston, WV 25304	Section Chief U. S. Environmental Protection Agency, Region III Enforcement and Compliance Assurance Division Air, RCRA, and Toxics Branch (3ED21) Four Penn Center 1600 John F. Kennedy Boulevard Philadelphia, PA 19103-2852

DAQ Compliance and Enforcement[1]:
DEPAirQualityReports@wv.gov

[1]For all self-monitoring reports (MACT, GACT, NSPS, etc.), stack tests and protocols, Notice of Compliance Status reports, Initial Notifications, etc.

3.5.4. **Fees.** The permittee shall pay fees on an annual basis in accordance with 45CSR§30-8.
[45CSR§30-8.]

3.5.5. **Compliance certification.** The permittee shall certify compliance with the conditions of this permit on the forms provided by the DAQ. In addition to the annual compliance certification, the permittee may be required to submit certifications more frequently under an applicable requirement of this permit. The annual certification shall be submitted to the DAQ and USEPA on or before March 15 of each year, and shall certify compliance for the period ending December 31. The permittee shall maintain a copy of the certification on site for five (5) years from submittal of the certification. The annual certification shall be submitted in electronic format by e-mail to the following addresses:

DAQ:	**US EPA:**
DEPAirQualityReports@wv.gov	R3_APD_Permits@epa.gov

[45CSR§30-5.3.e.]

3.5.6. **Semi-annual monitoring reports.** The permittee shall submit reports of any required monitoring on or before September 15 for the reporting period January 1 to June 30 and on or before March 15 for the reporting period July 1 to December 31. All instances of deviation from permit requirements must be clearly identified in such reports. All required reports must be certified by a responsible official consistent with 45CSR§30-4.4. The semi-annual monitoring reports shall be submitted in electronic format by e-mail to the following address:

DAQ:
DEPAirQualityReports@wv.gov

[45CSR§30-5.1.c.3.A.]

3.5.7. **Reserved.**

3.5.8. **Deviations.**

a. In addition to monitoring reports required by this permit, the permittee shall promptly submit supplemental reports and notices in accordance with the following:

1. Reserved.

2. Any deviation that poses an imminent and substantial danger to public health, safety, or the environment shall be reported to the Secretary immediately by telephone or email. A written report of such deviation, which shall include the probable cause of such deviation, and any corrective actions or preventative measures taken, shall be submitted by the responsible official within ten (10) days of the deviation.

3. Deviations for which more frequent reporting is required under this permit shall be reported on the more frequent basis.

4. All reports of deviations shall identify the probable cause of the deviation and any corrective actions or preventative measures taken.

[45CSR§30-5.1.c.3.C.]

b. The permittee shall, in the reporting of deviations from permit requirements, including those attributable to upset conditions as defined in this permit, report the probable cause of such deviations and any corrective actions or preventive measures taken in accordance with any rules of the Secretary.
[45CSR§30-5.1.c.3.B.]

3.5.9. **New applicable requirements.** If any applicable requirement is promulgated during the term of this permit, the permittee will meet such requirements on a timely basis, or in accordance with a more detailed schedule if required by the applicable requirement.
[45CSR§30-4.3.h.1.B.]

3.6. Compliance Plan

3.6.1. None.

3.7. Permit Shield

3.7.1. The permittee is hereby granted a permit shield in accordance with 45CSR§30-5.6. The permit shield applies provided the permittee operates in accordance with the information contained within this permit.

3.7.2. The following requirements specifically identified are not applicable to the source based on the determinations set forth below. The permit shield shall apply to the following requirements provided the conditions of the determinations are met.

a. **45CSR21** – *Regulation to Prevent and Control Air Pollution from the Emission of Volatile Organic Compounds* – This rule applies to sources located in Putnam County, Kanawha County, Cabell County, Wayne County, and Wood County. The facility is located in Marshall County, and, therefore, the rule is inapplicable.

b. **45CSR27** – *To Prevent and Control the Emissions of Toxic Air Pollutants* – This rule does not apply to the Ridgeline Compressor Station because, per 45CSR§27-2.4., the equipment used in the production and distribution of petroleum products is not considered a chemical processing unit, provided that such equipment does not produce or contact materials containing more than 5% benzene by weight.

c. **40 C.F.R. Part 60 Subparts D, Da, Db, and Dc** – *Standards of Performance for Steam Generators* – As there are no steam generating units with a maximum design heat input equal to or greater than 10 mmBTU/hr operated at the facility, Subparts D, Da, Db, and Dc do not apply to the Ridgeline Compressor Station per 40 C.F.R. §§60.40(a), 60.40Da(a), 60.40b(a), and 60.40c(a), respectively.

d. **40 C.F.R. Part 60 Subparts K, Ka, Kb, and Kc** – *Standards of Performance for Storage Vessels for Petroleum Liquids/Volatile Organic Liquids* – Subparts K and Ka do not apply to the Ridgeline Compressor Station because construction of the storage vessels used at the facility began after the applicability dates of each subpart (Subpart K – after June 11, 1973 and prior to May 19, 1978; Subpart Ka – after May 18, 1978 and prior to July 23, 1984). Subpart Kc does not apply to the Ridgeline Compressor Station because construction of the storage vessels used at the facility began before the applicability date of the subpart (Subpart Kc – after October 4, 2023). Per 40 C.F.R. §60.110b(a), Subpart Kb does not apply to the facility because each volatile organic liquid storage vessel has a capacity less than 75 m^3 (471.73 bbl or 19,812.9 gallons).

e. **40 C.F.R. Part 60 Subpart GG** – *Standards of Performance for Stationary Gas Turbines* – The facility's compressor turbine, CT-01, is subject to the requirements of 40 C.F.R. Part 60 Subpart KKKK in accordance with §60.4305(a). Therefore, per §60.4305(b), CT-01 is exempt from the requirements of Subpart GG.

f. **40 C.F.R. Part 60 Subpart KKK** – *Standards of Performance for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants for which Construction, Reconstruction, or Modification Commenced after January 20, 1984 and on or before August 23, 2011* – The Ridgeline Compressor Station is not a natural gas processing plant as defined in 40 C.F.R. §60.631 and, therefore, is not subject to the provisions of Subpart KKK.

g. **40 C.F.R. Part 60 Subpart LLL** – *Standards of Performance for SO_2 Emissions from Onshore Natural Gas Processing for which Construction, Reconstruction, or Modification Commenced after January 20, 1984 and on or before August 23, 2011* – Per 40 C.F.R. §60.640(a), Subpart LLL does not apply because no sweetening units are operated at the compressor station.

h. **40 C.F.R. Part 60 Subpart IIII** – *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines* – This subpart does not apply because only spark ignition internal combustion engines are operated at the Ridgeline Compressor Station.

i. **40 C.F.R. Part 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* – Construction of the Ridgeline Compressor Station began after the applicability date, and, therefore, Subpart OOOO does not apply to the facility.

j. **40 C.F.R. Part 60 Subpart OOOOb** – *Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced after December 6, 2022* – Construction of the equipment at the Ridgeline Compressor Station began prior to the applicability date of this subpart. Therefore, Subpart OOOOb is inapplicable to the facility.

k. **40 C.F.R. Part 63 Subpart HHH** – *National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities* – The Ridgeline Compressor Station is not a natural gas transmission and storage facility that transports or stores natural gas prior to entering a pipeline to a local distribution company or to a final end user. Additionally, the facility is not a major source of HAP emissions. Therefore, per 40 C.F.R. §63.1270(a), the Ridgeline Compressor Station is not subject to Subpart HHH.

l. **40 C.F.R. Part 63 Subpart YYYY** – *National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines* – Per 40 C.F.R. §63.6080, Subpart YYYY applies to stationary combustion turbines located at major sources of HAP emissions. As the Ridgeline Compressor Station is not a major source of HAPs, Subpart YYYY is inapplicable to the facility.

m. **40 C.F.R. Part 63 Subpart DDDDD** – *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters* – Per 40 C.F.R. §63.7485, Subpart DDDDD applies to boilers and process heaters located at major sources of HAP emissions. As the Ridgeline Compressor Station is not a major source of HAPs, Subpart DDDDD is inapplicable to the facility.

n. **40 C.F.R. Part 63 Subpart JJJJJJ** – *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources* – Per 40 C.F.R. §63.11195(e), gas-fired boilers are exempt from the standards of Subpart JJJJJJ. Therefore, the natural gas-fired reboilers (RBV-01 and RBV-02) operated at the Ridgeline Compressor Station are not subject to Subpart JJJJJJ.

4.0 Compressor Engines and Generator Engine [Emission Point IDs: 1E to 4E and 8E]

4.1. Limitations and Standards

4.1.1. Maximum emissions from each of the 5,000 HP natural gas-fired reciprocating engines equipped with oxidation catalysts, Caterpillar G3616LE A4 (CE-01 to CE-04), shall not exceed the following limits:

Pollutants	Maximum Hourly Emissions (lbs/hr)	Maximum Annual Emissions (tpy)
Nitrogen Oxides	4.41	19.31
Carbon Monoxide	3.01	13.17
Volatile Organic Compounds (including Formaldehyde)	3.18	13.92
Formaldehyde	0.46	2.03

[45CSR13, R13-3561, 5.1.1.]

4.1.2. Maximum emissions from the 1,468 HP natural gas-fired generator engine equipped with an oxidation catalyst, Caterpillar G3512LE (GE-01) shall not exceed the following limits:

Pollutants	Maximum Hourly Emissions (lbs/hr)	Maximum Annual Emissions (tpy)
Nitrogen Oxides	1.62	7.09
Carbon Monoxide	0.81	3.54
Volatile Organic Compounds (including Formaldehyde)	1.09	4.78

[45CSR13, R13-3561, 5.1.2.]

4.1.3. The emission limitations specified in Conditions 4.1.1. and 4.1.2. shall apply at all times except during periods of start-up and shutdown provided that the duration of these periods does not exceed 30 minutes per occurrence. The permittee shall operate the engines in a manner consistent with good air pollution control practices for minimizing emissions at all times, including periods of start-up and shutdown. The emissions from start-up and shutdown shall be included in the twelve (12) month rolling total of emissions. The permittee shall comply with all applicable start-up and shutdown requirements in accordance with 40 C.F.R. Part 60 Subpart JJJJ and 40 C.F.R. Part 63 Subpart ZZZZ.
[45CSR13, R13-3561, 5.1.3.]

4.1.4. Requirements for the Use of Catalytic Reduction Devices (OxCat-01 to OxCat-05)

a. Lean-burn natural gas engine(s) equipped with oxidation catalyst air pollution control devices shall be fitted with a closed-loop automatic air-to-fuel ratio feedback controller to ensure emissions of regulated pollutants do not exceed Conditions 4.1.1. and 4.1.2. for any engine/oxidation catalyst combination under varying load. The closed-loop, automatic air-to-fuel ratio controller shall control a fuel metering valve to ensure a lean-rich mixture.

b. No person shall knowingly:

1. Remove or render inoperative any air pollution or auxiliary air pollution control device installed subject to the requirements of this permit;

2. Install any part or component when the principal effect of the part or component is to bypass, defeat or render inoperative any air pollution control device or auxiliary air pollution control device installed subject to the requirements of this permit; or

3. Cause or allow the engine exhaust gases to bypass any catalytic reduction device.

c. The permittee shall follow a written operation and maintenance plan that provides the periodic and annual maintenance requirements.

[45CSR13, R13-3561, 5.1.4.]

4.1.5. The provisions of 40 C.F.R. Part 60 Subpart JJJJ are applicable to stationary spark ignition (SI) internal combustion engines (ICE) (CE-01 to CE-04, GE-01) as specified below. For the purposes of Subpart JJJJ, the date that construction commences is the date the engine is ordered by the permittee.

a. Owners and operators of stationary SI ICE that commence construction after June 12, 2006, where the stationary SI ICE are manufactured:

1. 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).

[45CSR13, R13-3561, 12.1.1.; 45CSR16; 40 C.F.R. §§60.4230(a), (a)(4), and (a)(4)(i)]

4.1.6. The following emission standards from Table 1 to Subpart JJJJ of Part 60 apply to the compressor engines CE-01 to CE-04 and GE-01:

Engine Type and Fuel	Maximum Engine Power	Manufacture Date	Emission Standards[1]					
			g/HP-hr			ppmvd at 15% O_2		
			NO_X	CO	VOC[2]	NO_X	CO	VOC[2]
Non-Emergency SI Natural Gas	HP ≥ 500	7/1/2010	1.0	2.0	0.7	82	270	60

[1] Owners and operators of stationary non-certified SI engines may choose to comply with the emission standards in units of either g/HP-hr or ppmvd at 15 percent O_2.
[2] For the purposes of Subpart JJJJ, when calculating emissions of volatile organic compounds, emissions of formaldehyde should not be included.

[45CSR13, R13-3561, 12.1.2.; 45CSR16; 40 C.F.R. §60.4233(e); Table 1 to Subpart JJJJ of Part 60]

4.1.7. The permittee shall operate and maintain the engines CE-01 to CE-04 and GE-01 so that each engine achieves the emission standards as required in 40 C.F.R. §60.4233 over the entire life of the engine.
[45CSR13, R13-3561, 12.1.3.; 45CSR16; 40 C.F.R. §60.4234]

4.1.8. After July 1, 2009, the permittee may not install a stationary SI ICE with a maximum engine power of greater than or equal to 500 HP that does not meet the applicable requirements in 40 C.F.R. §60.4233, except that lean burn engines with a maximum engine power greater than or equal to 500 HP and less than 1,350 HP that do not meet the applicable requirements in §60.4233 may not be installed after January 1, 2010.
[45CSR13, R13-3561, 12.2.1.; 45CSR16; 40 C.F.R. §60.4236(b)]

4.1.9. The requirements of 40 C.F.R. §60.4236 do not apply to owners and operators of stationary SI ICE that have been modified or reconstructed, and they do not apply to engines that were removed from one existing location and reinstalled at a new location.
[45CSR13, R13-3561, 12.2.2.; 45CSR16; 40 C.F.R. §60.4236(e)]

4.1.10. Owners and operators of stationary SI natural gas-fired engines may operate their engines using propane for a maximum of 100 hours per year as an alternative fuel solely during emergency operations, but must keep records of such use. If propane is used for more than 100 hours per year in an engine that is not certified to the emission standards when using propane, the owners and operators are required to conduct a performance test to demonstrate compliance with the emission standards of 40 C.F.R. §60.4233.
[45CSR16; 40 C.F.R. §60.4243(e)]

4.1.11. It is expected that air-to-fuel ratio controllers will be used with the operation of three-way catalysts/non-selective catalytic reduction. The air-to-fuel ratio controller must be maintained and operated appropriately in order to ensure proper operation of the engine and control device to minimize emissions at all times.
[45CSR16; 40 C.F.R. §60.4243(g)]

4.1.12. For each new or reconstructed stationary RICE located at an area source of HAP emissions, the permittee must comply with the applicable emission limitations and operating limitations in 40 C.F.R. Part 63 Subpart ZZZZ upon startup of the affected source.
[45CSR13, R13-3561, 15.1.1.; 45CSR34; 40 C.F.R. §63.6595(a)(7)]

4.1.13. **Stationary RICE subject to Regulations under 40 C.F.R. Part 60.** An affected source that meets any of the criteria in 40 C.F.R. §§63.6590(c)(1) through (c)(7) must meet the requirements of 40 C.F.R. Part 63 Subpart ZZZZ by meeting the requirements of 40 C.F.R. Part 60 Subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under Subpart ZZZZ.

The permittee meets the criteria of §63.6590(c)(1), which is for a new or reconstructed stationary RICE located at an area source. The permittee must meet the requirements of 40 C.F.R. Part 63 Subpart ZZZZ by meeting the requirements of 40 C.F.R. Part 60 Subpart JJJJ.

[45CSR13, R13-3561, 15.1.2.; 45CSR34; 40 C.F.R. §§63.6590(c) and (c)(1)]

4.2. Monitoring Requirements

4.2.1. Catalytic Oxidizer Control Devices (OxCat-01 to OxCat-05)

a. The permittee shall monitor the temperature to the inlet of the catalyst and in accordance with the manufacturer's specifications; a high temperature alarm shall shut off the engine before thermal deactivation of the catalyst occurs. If the engine shuts off due to high temperature, the permittee shall check for thermal deactivation of the catalyst before normal operations are resumed.

b. The permittee shall regularly inspect, properly maintain and/or replace catalytic reduction devices and auxiliary air pollution control devices to ensure functional and effective operation of the engine's physical and operational design. The permittee shall ensure proper operation, maintenance and performance of catalytic reduction devices and auxiliary air pollution control devices by:

1. Maintaining proper operation of the automatic air-to-fuel ratio controller or automatic feedback controller.

2. Following operating and maintenance recommendations of the catalyst element manufacturer.

[45CSR13, R13-3561, 5.2.1.]

4.2.2. For the stationary SI ICE CE-01 to CE-04 and GE-01, the permittee must demonstrate compliance with the emission standards specified in 40 C.F.R. §60.4233(e) according to the following:

a. Purchasing a non-certified engine and demonstrating compliance with the emission standards specified in 40 C.F.R. §60.4233(e) and according to the requirements specified in §60.4244, as applicable, and according to paragraph a.1. of this condition.

1. For a stationary SI ICE greater than 500 HP, the permittee must keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, the permittee must conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter to demonstrate compliance.

[45CSR13, R13-3561, 12.3.1.; 45CSR16; 40 C.F.R. §§60.4243(b), (b)(2), and (b)(2)(ii)]

4.3. Testing Requirements

4.3.1. In order to demonstrate compliance with Conditions 4.1.1., 4.1.2., 4.1.6., and 4.2.2.a.1., the permittee shall conduct performance tests following the procedures in paragraphs a. through f. of this condition.

a. Each performance test must be conducted within 10 percent of 100 percent peak (or the highest achievable) load and according to the requirements in 40 C.F.R. §60.8 and under the specific conditions that are specified by Table 2 to Subpart JJJJ of Part 60.

b. The permittee may not conduct performance tests during periods of startup, shutdown, or malfunction, as specified in 40 C.F.R. §60.8(c). If the permittee's stationary SI ICE is non-operational, the permittee does not need to startup the engine solely to conduct a performance test; however, the permittee must conduct the performance test immediately upon startup of the engine.

c. The permittee must conduct three separate test runs for each performance test required in this condition, as specified in 40 C.F.R. §60.8(f). Each test run must be conducted within 10 percent of 100 percent peak (or the highest achievable) load and last at least 1 hour.

d. To determine compliance with the NO_X mass per unit output emission limitation, convert the concentration of NO_X in the engine exhaust using Equation 1 of this condition:

$$ER = \frac{C_d \times 1.912 \times 10^{-3} \times Q \times T}{HP-hr} \qquad \text{Eq. 1}$$

Where:
ER = Emission rate of NO_X in g/HP-hr
C_d = Measured NO_X concentration in parts per million by volume (ppmv)
1.912×10^{-3} = Conversion constant for ppm NO_X to grams per standard cubic meter at 20° Celsius
Q = Stack gas volumetric flow rate, in standard cubic meters per hour, dry basis
T = Time of test run, in hours
HP-hr = Brake work of the engine, in horsepower-hour (HP-hr)

e. To determine compliance with the CO mass per unit output emission limitation, convert the concentration of CO in the engine exhaust using Equation 2 of this condition:

$$ER = \frac{C_d \times 1.164 \times 10^{-3} \times Q \times T}{HP-hr} \qquad \text{Eq. 2}$$

Where:
ER = Emission rate of CO in g/HP-hr
C_d = Measured CO concentration in ppmv
1.164×10^{-3} = Conversion constant for ppm CO to grams per standard cubic meter at 20° Celsius
Q = Stack gas volumetric flow rate, in standard cubic meters per hour, dry basis
T = Time of test run, in hours
HP-hr = Brake work of the engine, in HP-hr

f. For the purposes of 40 C.F.R. Part 60 Subpart JJJJ, when calculating emissions of VOC, emissions of formaldehyde should not be included. To determine compliance with the VOC mass per unit output emission limitation, convert the concentration of VOC in the engine exhaust using Equation 3 of this condition:

$$ER = \frac{C_d \times 1.833 \times 10^{-3} \times Q \times T}{HP-hr} \qquad \text{Eq. 3}$$

Where:
ER = Emission rate of VOC in g/HP-hr
C_d = VOC concentration measured as propane in ppmv
1.833×10^{-3} = Conversion constant for ppm VOC measured as propane, to grams per standard cubic meter at 20° Celsius
Q = Stack gas volumetric flow rate, in standard cubic meters per hour, dry basis
T = Time of test run, in hours
HP-hr = Brake work of the engine, in HP-hr

g. If the permittee chooses to measure VOC emissions using either Method 18 of 40 C.F.R. Part 60 Appendix A or Method 320 of 40 C.F.R. Part 63 Appendix A, then the permittee has the option of correcting the measured VOC emissions to account for the potential differences in measured values between these methods and Method 25A. The results from Method 18 and Method 320 can be corrected for response factor differences using Equations 4 and 5 of this condition. The corrected VOC concentration can then be placed on a propane basis using Equation 6 of this condition.

$$RF_i = \frac{C_{Mi}}{C_{Ai}} \quad \text{Eq. 4}$$

Where:
RF_i = Response factor of compound i when measured with EPA Method 25A
C_{Mi} = Measured concentration of compound i in ppmv as carbon
C_{Ai} = True concentration of compound i in ppmv as carbon

$$C_{icorr} = RF_i \times C_{imeas} \quad \text{Eq. 5}$$

Where:
C_{icorr} = Concentration of compound i corrected to the value that would have been measured by EPA Method 25A, ppmv as carbon
C_{imeas} = Concentration of compound i measured by EPA Method 320, ppmv as carbon

$$C_{Peq} = 0.6098 \times C_{icorr} \quad \text{Eq. 6}$$

Where:
C_{Peq} = Concentration of compound i in mg of propane equivalent per DSCM

[45CSR13, R13-3561, 5.3.1. and 12.4.1.; 45CSR16; 40 C.F.R. §60.4244]

4.4. Recordkeeping Requirements

4.4.1. To demonstrate compliance with Condition 4.1.4., the permittee shall maintain records of maintenance performed on each engine.
[45CSR13, R13-3561, 5.4.1.]

4.4.2. To demonstrate compliance with Condition 4.2.1., the permittee shall maintain records of all catalytic reduction device maintenance.
[45CSR13, R13-3561, 5.4.2.]

4.4.3. The permittee shall maintain a copy of the site-specific maintenance plan or manufacturer maintenance plan.
[45CSR13, R13-3561, 5.4.3.]

4.4.4. All records required in Conditions 4.4.1. through 4.4.3. shall be maintained in accordance with Condition 3.4.2. of this operating permit.
[45CSR13, R13-3561, 5.4.4.]

4.4.5. Owners and operators of all stationary SI ICE must keep records of the information in paragraphs a. through c. of this condition.

a. All notifications submitted to comply with 40 C.F.R. Part 60 Subpart JJJJ and all documentation supporting any notification.

b. Maintenance conducted on the engine.

c. If the stationary SI ICE is not a certified engine or is a certified engine operating in a non-certified manner and subject to 40 C.F.R. §60.4243(a)(2), documentation that the engine meets the emission standards.

[45CSR13, R13-3561, 12.5.1.a.; 45CSR16; 40 C.F.R. §60.4245(a), (a)(1), (a)(2), and (a)(4)]

4.5. Reporting Requirements

4.5.1. a. Owners and operators of stationary SI ICE that are subject to performance testing must submit a copy of each performance test as conducted in 40 C.F.R. §60.4244 within 60 days after the test has been completed. Performance test reports using EPA Method 18, EPA Method 320, or ASTM D6348-03 (incorporated by reference – see 40 C.F.R. §60.17) to measure VOC require reporting of all QA/QC data. For Method 18, report results from sections 8.4 and 11.1.1.4; for Method 320, report results from sections 8.6.2, 9.0, and 13.0; and for ASTM D6348-03 report results of all QA/QC procedures in Annexes 1-7. Beginning on February 26, 2025, performance tests must be reported electronically according to paragraph b. of this condition.
[45CSR13, R13-3561, 12.5.1.d.]

b. Beginning on February 26, 2025, within 60 days after the date of completing each performance test, the permittee must submit the results following the procedures specified in 40 C.F.R. §60.4245(g). Data collected using test methods that are supported by the EPA's Electronic Reporting Tool (ERT) as listed on the EPA's ERT website (https://www.epa.gov/electronic-reporting-air-emissions/electronic-reporting-tool-ert) at the time of the test must be submitted in a file format generated using the EPA's ERT. Alternatively, the permittee may submit an electronic file consistent with the extensible markup language (XML) schema listed on the EPA's ERT website. Data collected using test methods that are not supported by the EPA's ERT as listed on the EPA's ERT website at the time of the test must be included as an attachment in the ERT or an alternate electronic file.

c. The permittee must submit notifications or reports to the EPA via the Compliance and Emissions Data Reporting Interface (CEDRI), which can be accessed through the EPA's Central Data Exchange (CDX) (https://cdx.epa.gov/). The EPA will make all the information submitted through CEDRI available to the public without further notice.

[45CSR16; 40 C.F.R. §§60.4245(d), (f), and (g)]

4.6. Compliance Plan

4.6.1. None.

5.0 Turbine [Emission Point IDs: 9E and 10E]

5.1. Limitations and Standards

5.1.1. The Solar Taurus 70 Combustion Turbine (CT-01) shall be operated and maintained in accordance with the manufacturer's recommendations and specifications and in a manner consistent with good operating practices and shall only burn natural gas.
[45CSR13, R13-3561, 6.1.1.]

5.1.2. The following conditions and requirements are specific to the Solar Taurus 70 Combustion Turbine (CT-01):

a. Emissions from the combustion turbine shall not exceed the following:

1. Emissions of nitrogen oxides (NO_X) shall be controlled with the combustion controls when ambient temperatures are above 0°F and the load is at or above 50%. The turbine shall not discharge NO_X emissions in excess of 15 ppm at 15 percent O_2 when operating at load conditions at or above 75 percent of peak load and/or when operating temperatures are at or above 0°F. When the operating loads of the turbine are less than 75% of peak load and/or operating temperatures are less than 0°F, the NO_X emissions rate from the turbine shall not exceed 150 ppm at 15 percent O_2. Annual NO_X emissions from the turbine shall not exceed 20.46 tpy on a 12-month rolling total. This limit applies at all times, including periods of startup, shutdown, or malfunction.
[45CSR16; 40 C.F.R. §60.4320(a); Table 1 to Subpart KKKK of Part 60]

2. Emissions of carbon monoxide (CO) from the combustion turbine shall not exceed 24.45 tpy on a rolling 12-month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction.

3. Emissions of sulfur dioxide (SO_2) shall not exceed 0.003 lbs of SO_2/mmBTU heat input. For purposes of demonstrating compliance with this limit, the permittee shall maintain the Federal Energy Regulatory Commission (FERC) tariff limit on total sulfur content of 20 grains of sulfur or less per 100 standard cubic feet of natural gas combusted in the turbines.
[45CSR16; 40 C.F.R. §§60.4330(a)(2) and 60.4365(a)]

4. Emissions of volatile organic compounds (VOC) shall not exceed 3.41 tpy on a rolling 12-month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction. This limit does not apply to the fugitives from the compressor.

b. The permittee must operate and maintain the stationary combustion turbine, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction.
[45CSR16; 40 C.F.R. §60.4333(a)]

[45CSR13, R13-3561, 6.1.2. and 6.1.3.]

5.1.3. The maximum number of turbine start and stop events per year shall not exceed 104 events. Compliance shall be determined using a twelve-month rolling total. A twelve-month rolling total shall mean the sum of the turbine start and stop events at any given time during the previous twelve consecutive calendar months.
[45CSR13, R13-3561, 6.1.4.]

5.2. Monitoring Requirements

5.2.1. For the purpose of determining compliance with the annual limits for the Solar Taurus 70 Combustion Turbine (CT-01), the permittee shall monitor and record the following for each calendar month:

a. Hours the turbine operated at normal conditions (SoLoNO$_X$ Mode), which is when the turbine is at or above 50% load, and the ambient temperature is above 0°F.

b. Hours the turbine operated at low-load conditions, which is when the turbine load is less than 50% load or when the turbine is operating in non-SoLoNO$_X$ mode due to low-load conditions. If the turbine is configured in a manner that it cannot to be operated at low-load conditions, then monitoring at such conditions is not required.

c. Hours the turbine operated at low ambient temperature conditions, which is when the ambient temperature is less than 0°F.

d. Hours the turbine operated at very low ambient temperature conditions, which is when the ambient temperature is less than -20°F.

e. The number of startup and shutdown cycles that occurred during the month. Maintenance and readiness checks of the turbine which include start-up and shutdown of the turbine in one hour shall be counted as one complete cycle.

Such records shall be maintained in accordance with Condition 3.4.2. of this operating permit.

[45CSR13, R13-3561, 6.2.1.]

5.3. Testing Requirements

5.3.1. For the purposes of demonstrating compliance with the NO$_X$ emission standards in Condition 5.1.2.a.1. of this operating permit and 40 C.F.R. §60.4320(a), the permittee shall conduct a performance test annually (no more than 14 months following the previous test) unless the previous results demonstrate that the affected units achieved compliance of less than or equal to 75 percent of the NO$_X$ emission limit, then the permittee may reduce the frequency of subsequent tests to once every two years (no more than 26 calendar months following the previous test) as allowed under 40 C.F.R. §60.4340(a). If the results of any subsequent performance test exceed 75 percent of the NO$_X$ emission limit, then the permittee must resume annual performance tests. Such testing shall be conducted in accordance with Condition 3.3.1. of this operating permit and 40 C.F.R. §60.4400. Records of such testing shall be maintained in accordance with Condition 3.4.2. of this operating permit.
[45CSR13, R13-3561, 6.3.1.; 45CSR16; 40 C.F.R. §§60.4340(a) and 60.4400]

5.3.2. a. NO$_X$ performance tests shall be conducted on an annual basis (no more than 14 calendar months following the previous performance test).

1. There are two general methodologies that the permittee may use to conduct the performance tests. For each test run:

i. Measure the NO$_X$ concentration (in parts per million (ppm)), using EPA Method 7E or EPA Method 20 in 40 C.F.R. Part 60, Appendix A. For units complying with the output-based standard, concurrently measure the stack gas flow rate, using EPA Methods 1 and 2 in 40 C.F.R. Part 60, Appendix A, and measure and record the electrical and thermal output from the unit. Then, use the following equation to calculate the NO_X emission rate:

$$E = \frac{1.194 \times 10^{-7} \times (NO_X)_c \times Q_{std}}{P} \qquad \text{Eq. 7}$$

Where:
E = NO_X emission rate, in lbs/MWh
1.194×10^{-7} = conversion constant, in lbs/dscf-ppm
$(NO_X)_c$ = average NO_X concentration for the run, in ppm
Q_{std} = stack gas volumetric flow rate, in dscf/hr
P = gross electrical and mechanical energy output of the combustion turbine, in MW (for simple-cycle operation), for combined-cycle operation, the sum of all electrical and mechanical output from the combustion and steam turbines, or, for combined heat and power operation, the sum of all electrical and mechanical output from the combustion and steam turbines plus all useful recovered thermal output not used for additional electric or mechanical generation, in MW, calculated according to 40 C.F.R. §60.4350(f)(2)

ii. Measure the NO_X and diluent gas concentrations, using either EPA Methods 7E and 3A, or EPA Method 20 in 40 C.F.R. Part 60, Appendix A. Concurrently measure the heat input to the unit, using a fuel flowmeter (or flowmeters), and measure the electrical and thermal output of the unit. Use EPA Method 19 in 40 C.F.R. Part 60, Appendix A to calculate the NO_X emission rate in lbs/mmBTU. Then, use Equations 1 and, if necessary, 2 and 3 in 40 C.F.R. §60.4350(f) to calculate the NO_X emission rate in lbs/MWh.

[40 C.F.R. §60.4400(a)(1)]

2. Sampling traverse points for NO_X and (if applicable) diluent gas are to be selected following EPA Method 20 or EPA Method 1 (non-particulate procedures), and sampled for equal time intervals. The sampling must be performed with a traversing single-hole probe, or, if feasible, with a stationary multi-hole probe that samples each of the points sequentially. Alternatively, a multi-hole probe designed and documented to sample equal volumes from each hole may be used to sample simultaneously at the required points.
[40 C.F.R. §60.4400(a)(2)]

3. Notwithstanding paragraph a.2. of this condition, the permittee may test at fewer points than are specified in EPA Method 1 or EPA Method 20 in 40 C.F.R. Part 60, Appendix A if the following conditions are met:

i. The permittee may perform a stratification test for NO_X and diluent pursuant to the procedures specified in section 6.5.6.1(a) through (e) of 40 C.F.R. Part 75, Appendix A.

ii. Once the stratification sampling is completed, the permittee may use the following alternative sample point selection criteria for the performance test:

a. If each of the individual traverse point NO_X concentrations is within ±10 percent of the mean concentration for all traverse points, or the individual traverse point diluent concentrations differs by no more than ±5 ppm or ±0.5 percent CO_2 (or O_2) from the mean for all traverse points, then the permittee may use three points (located either 16.7, 50.0 and 83.3 percent of the way across the stack or duct, or, for circular stacks or ducts greater than 2.4 meters (7.8 feet) in diameter, at 0.4, 1.2, and 2.0 meters from the wall). The three points must be located along the measurement line that exhibited the highest average NO_X concentration during the stratification test; or

b. For turbines with a NO_X standard greater than 15 ppm at 15% O_2, the permittee may sample at a single point, located at least 1 meter from the stack wall or at the stack centroid if each of the individual traverse point NO_X concentrations is within ±5 percent of the mean concentration for all traverse points, or the individual traverse point diluent concentrations differs by no more than ±3 ppm or ±0.3 percent CO_2 (or O_2) from the mean for all traverse points.

[40 C.F.R. §§60.4400(a)(3), (a)(3)(i), (a)(3)(ii), (a)(3)(ii)(A), and (a)(3)(ii)(B)]

[40 C.F.R. §60.4400(a)]

b. The performance test must be done at any load condition within plus or minus 25 percent of 100 percent of peak load. The permittee may perform testing at the highest achievable load point, if at least 75 percent of peak load cannot be achieved in practice. The permittee must conduct three separate test runs for each performance test. The minimum time per run is 20 minutes.

1. Compliance with the applicable emission limit in 40 C.F.R. §60.4320 must be demonstrated at each tested load level. Compliance is achieved if the three-run arithmetic average NO_X emission rate at each tested level meets the applicable emission limit in 40 C.F.R. §60.4320.

2. The ambient temperature must be greater than 0°F during the performance test.

[40 C.F.R. §§60.4400(b), (b)(4), and (b)(6)]

[45CSR13, R13-3561, 6.3.1.; 45CSR16; 40 C.F.R. §60.4400]

5.4. Recordkeeping Requirements

5.4.1. To demonstrate compliance with Condition 5.1.2., the permittee shall maintain records of the amount of natural gas consumed and the hours of operation of the Solar Taurus 70 Combustion Turbine (CT-01).
[45CSR13, R13-3561, 6.4.1.]

5.4.2. The permittee shall maintain current and valid documentation that the natural gas consumed by the combustion turbine (CT-01) has maximum total sulfur content of 20 grains of sulfur or less per 100 cubic feet of natural gas. Said documentation can be purchase contracts, tariff sheets, or transportation contracts. Such records shall be maintained in accordance with Condition 3.4.2., except that these records can be maintained off-site but must be made available for inspection within 15 days of the request. By satisfying this requirement the permittee is exempted from the total sulfur monitoring requirement of 40 C.F.R. §60.4370.
[45CSR13, R13-3561, 6.4.2.; 45CSR16; 40 C.F.R. §60.4365(a)]

5.4.3. In order to demonstrate compliance with the emission limitations of Condition 5.1.2., the permittee will monitor and record the monthly operating hours for each operating parameter listed in Condition 5.2.1. Monthly emissions for each pollutant will be calculated using the following equation:

$$MEP_X = DLNP_X \times DLN\ hrs + LLP_X \times LL\ hrs + LTP_X \times LT\ hrs + SSP_X \times SS\ cycles \quad \text{Eq. 8}$$

Where:
MEP_X = the monthly emissions for each pollutant
$DLNP_X$ = the unit emission rate (lbs/hr) for pollutant X during normal (DLN) operation
LLP_X = the unit emission rate (lbs/hr) for pollutant X during low-load (LL) operation
LTP_X = the unit emission rate (lbs/hr) for pollutant X during low-temperature (LT) operation
SSP_X = the unit emission rate (lbs/cycle) for pollutant X during startup/shutdown (SS) operation

Hourly emission rates used in the above calculation shall be based on best available data which is data collected during source specific testing or the data for specific model turbine provided or published by the manufacturer. This determination shall be performed within 30 days after the end of the calendar month and the monthly emissions shall be summed for the preceding 12 months to determine compliance with the annual limits in Condition 5.1.2. Records of the monthly total and 12 month rolling totals shall be maintained in accordance with Condition 3.4.2.

[45CSR13, R13-3561, 6.4.3.]

5.5. Reporting Requirements

5.5.1. The permittee shall submit a written report of the results of the testing required in Condition 5.3.1. of this permit before the close of business on the 60th day following the completion of such testing to the Director. Such report(s) shall include all records and readings taken during such testing, as appropriate for the required report.
[45CSR13, R13-3561, 6.5.2.; 45CSR16; 40 C.F.R. §60.4375(b)]

5.6. Compliance Plan

5.6.1. None.

6.0 Subpart OOOOa Requirements for the Reciprocating Compressors associated with CE-01 to CE-04 and CT-01

6.1. Limitations and Standards

6.1.1. At all times, including periods of startup, shutdown, and malfunction, owners and operators shall maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. The provisions for exemption from compliance during periods of startup, shutdown and malfunctions provided for in 40 C.F.R. §60.8(c) do not apply to Subpart OOOOa.
[45CSR16; 40 C.F.R. §60.5370a(b)]

6.1.2. The permittee must reduce GHG (in the form of a limitation on emissions of methane) and VOC emissions by complying with the standards in paragraphs a. through d. of this condition for each reciprocating compressor affected facility.

a. The permittee must replace the reciprocating compressor rod packing according to either paragraph a.1. or a.2. of this condition, or the permittee must comply with paragraph a.3. of this condition.

1. On or before the compressor has operated for 26,000 hours. The number of hours of operation must be continuously monitored beginning upon initial startup of the reciprocating compressor affected facility or the date of the most recent reciprocating compressor rod packing replacement, whichever is later.

2. Prior to 36 months from the date of the most recent rod packing replacement, or 36 months from the date of startup for a new reciprocating compressor for which the rod packing has not yet been replaced.

3. Collect the methane and VOC emissions from the rod packing using a rod packing emissions collection system that operates under negative pressure and route the rod packing emissions to a process through a closed vent system that meets the requirements of 40 C.F.R. §§60.5411a(a) and (d).

b. The permittee must demonstrate initial compliance with standards that apply to reciprocating compressor affected facilities as required by Condition 6.2.1.

c. The permittee must demonstrate continuous compliance with the standards that apply to reciprocating compressor affected facilities as required by Condition 6.2.2.

d. The permittee must perform the reporting as required by Condition 6.5.1.a. and b. and the recordkeeping as required by Condition 6.4.1., as applicable.

[45CSR13, R13-3561, 13.1.1.; 45CSR16; 40 C.F.R. §60.5385a]

6.2. Monitoring Requirements

6.2.1. The permittee must determine initial compliance with the standards for each affected facility using the requirements of this condition. The initial compliance period begins upon initial startup and ends no later than one year after the initial startup date for the affected facility. The initial compliance period may be less than one full year.

a. To achieve initial compliance with the standards for each reciprocating compressor affected facility, the permittee must comply with paragraphs a.1. through 4. of this condition.

1. If complying with Condition 6.1.2.a.1. or a.2., during the initial compliance period, the permittee must continuously monitor the number of hours of operation or track the number of months since initial startup or since the last rod packing replacement, whichever is later.

2. If complying with Condition 6.1.2.a.3., the permittee must operate the rod packing emissions collection system under negative pressure and route emissions to a process through a closed vent system that meets the requirements of §§60.5411a(a) and (d).

3. The permittee must submit the initial annual report for each reciprocating compressor as required in Condition 6.5.1.a. and b.

4. The permittee must maintain the records as specified in Condition 6.4.1.a. for each reciprocating compressor affected facility.

[45CSR13, R13-3561, 13.2.1.; 45CSR16; 40 C.F.R. §§60.5410a and 60.5410a(c)]

6.2.2. For each reciprocating compressor affected facility complying with Condition 6.1.2.a.1. or a.2., the permittee must demonstrate continuous compliance according to paragraphs a. through c. of this condition. For each reciprocating compressor affected facility complying with Condition 6.1.2.a.3., the permittee must demonstrate continuous compliance according to paragraph d. of this condition.

a. The permittee must continuously monitor the number of hours of operation for each reciprocating compressor affected facility or track the number of months since initial startup or since the date of the most recent reciprocating compressor rod packing replacement, whichever is later.

b. The permittee must submit the annual reports as required in Condition 6.5.1.a. and b. and maintain records as required in Condition 6.4.1.a.

c. The permittee must replace the reciprocating compressor rod packing on or before the total number of hours of operation reaches 26,000 hours or the number of months since the most recent rod packing replacement reaches 36 months.

d. The permittee must operate the rod packing emissions collection system under negative pressure and continuously comply with the cover and closed vent requirements in 40 C.F.R. §§60.5416a(a) and (b).

[45CSR13, R13-3561, 13.3.1.; 45CSR16; 40 C.F.R. §60.5415a(c)]

6.3. Testing Requirements

6.3.1. None.

6.4. Recordkeeping Requirements

6.4.1. **Recordkeeping requirements.** The permittee must maintain the records identified as specified in 40 C.F.R. §60.7(f) and in this condition. All records required by 40 C.F.R. Part 60 Subpart OOOOa must be maintained either onsite or at the nearest local field office for at least 5 years. Any records required to be maintained by Subpart OOOOa that are submitted electronically via the EPA's CDX may be maintained in electronic format.

a. For each reciprocating compressor affected facility, the permittee must maintain the records in paragraphs a.1. through a.3. of this condition.

1. Records of the cumulative number of hours of operation or number of months since initial startup or since the previous replacement of the reciprocating compressor rod packing, whichever is later. Alternatively, a statement that emissions from the rod packing are being routed to a process through a closed vent system under negative pressure.

2. Records of the date and time of each reciprocating compressor rod packing replacement, or date of installation of a rod packing emissions collection system and closed vent system as specified in Condition 6.1.2.a.3.

3. Records of deviations in cases where the reciprocating compressor was not operated in compliance with the requirements specified in Condition 6.1.2., including the date and time the deviation began, duration of the deviation, and a description of the deviation.

b. Records of each closed vent system inspection required under 40 C.F.R. §§60.5416a(a)(1), (a)(2), and (b) for reciprocating compressors as required in paragraphs b.1. through b.3. of this condition.

1. A record of each closed vent system inspection or no detectable emissions monitoring survey. The permittee must include an identification number for each closed vent system (or other unique identification description selected by the permittee) and the date of the inspection.

2. For each defect or leak detected during inspections required by 40 C.F.R. §§60.4516a(a)(1) and (a)(2) or (b), the permittee must record the location of the defect or leak, a description of the defect or the maximum concentration reading obtained if using Method 21 of 40 C.F.R. Part 60 Appendix A-7, the date of detection, and the date the repair to correct the defect or leak is completed.

3. If repair of the defect is delayed as described in 40 C.F.R. §60.5416a(b)(10), the permittee must record the reason for the delay and the date the permittee expects to complete the repair.

c. A record of each cover inspection required under 40 C.F.R. §60.5416a(a)(3) for reciprocating compressors as required in paragraphs c.1. through c.3. of this condition.

1. A record of each cover inspection. The permittee must include an identification number for each cover (or other unique identification description selected by the permittee) and the date of the inspection.

2. For each defect detected during inspections required by 40 C.F.R. §60.5416a(a)(3), the permittee must record the location of the defect, a description of the defect, the date of detection, the corrective action taken to repair the defect, and the date the repair to correct the defect is completed.

3. If repair of the defect is delayed as described in 40 C.F.R. §60.5416a(b)(10), the permittee must record the reason for the delay and the date the permittee expects to complete the repair.

d. If subject to the bypass requirements of 40 C.F.R. §60.5416a(a)(4) for reciprocating compressors, the permittee must prepare and maintain a record of each inspection or a record of each time the key is checked out or a record of each time the alarm is sounded.

e. For each closed vent system routing to a control device or process, the records of the assessment conducted according to 40 C.F.R. §60.5411a(d):

1. A copy of the assessment conducted according to 40 C.F.R. §60.5411a(d)(1);

2. A copy of the certification according to 40 C.F.R. §60.5411a(d)(1)(i); and

3. The owner or operator shall retain copies of all certifications, assessments, and any related records for a period of 5 years, and make them available if directed by the delegated authority.

[45CSR13, R13-3561, 13.4.3.; 45CSR16; 40 C.F.R. §§60.5420a(c), (c)(3), (c)(6) to (c)(8), and (c)(17)]

6.5. Reporting Requirements

6.5.1. **Reporting requirements.** The permittee must submit annual reports containing the information specified in paragraphs a., b., and d. of this condition. The permittee must submit annual reports following the procedure specified in paragraph c. of this condition. The initial annual report is due no later than 90 days after the end of the initial compliance period as determined according to §60.5410a. Subsequent annual reports are due no later than the same date each year as the initial annual report. The permittee may submit one report for multiple affected facilities provided the report contains all of the information required as specified in paragraphs a., b., and d. of this condition. Annual reports may coincide with Title V reports as long as all the required elements of the annual report are included. The permittee may arrange with the Administrator a common schedule on which reports required by 40 C.F.R. Part 60 may be submitted as long as the schedule does not extend the reporting period.

a. The general information specified in paragraphs a.1. through a.4. of this condition is required for all reports.

1. The company name, facility site name associated with the affected facility, and address of the affected facility.

2. An identification of each affected facility being included in the annual report.

3. Beginning and ending dates of the reporting period.

4. A certification by a certifying official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

b. For each reciprocating compressor affected facility, the information specified in paragraphs b.1. through b.3. of this condition.

1. The cumulative number of hours of operation or the number of months since initial startup or since the previous reciprocating compressor rod packing replacement, whichever is later. Alternatively, a statement that emissions from the rod packing are being routed to a process through a closed vent system under negative pressure.

2. If applicable, for each deviation that occurred during the reporting period and recorded as specified in Condition 6.4.1.a.3. of this condition, the date and time the deviation began, duration of the deviation and a description of the deviation.

3. If required to comply with Condition 6.1.2.a.3., the information in paragraphs b.3.i. through b.3.iii. of this condition.

i. Dates of each inspection required under 40 C.F.R. §§60.5416a(a) and (b);

ii. Each defect or leak identified during each inspection, and date of repair or date of anticipated repair if repair is delayed; and

iii. Date and time of each bypass alarm or each instance the key is checked out if subject to the bypass requirements of 40 C.F.R. §60.5416a(a)(4).

c. The permittee must submit reports to the EPA via CEDRI, except as outlined in 40 C.F.R. §60.5420a(b)(11). CEDRI can be accessed through the EPA's CDX (https://cdx.epa.gov/). The permittee must use the appropriate electronic report template on the CEDRI website for Subpart OOOOa (https://www.epa.gov/electronic-reporting-air-emissions/cedri/). If the reporting form specific to Subpart OOOOa is not available on the CEDRI website at the time that the report is due, the permittee must submit the report to the Administrator at the appropriate address listed in 40 C.F.R. §60.4. Once the form has been available in CEDRI for at least 90 calendar days, the permittee must begin submitting all subsequent reports via CEDRI. The date reporting forms become available will be listed on the CEDRI website. Unless the Administrator or delegated state agency or other authority has approved a different schedule for submission of reports, the reports must be submitted by the deadlines specified in Subpart OOOOa, regardless of the method in which the reports are submitted. The EPA will make all the information submitted through CEDRI available to the public without further notice.

d. The permittee must submit the certification signed by the qualified professional engineer or in-house engineer according to 40 C.F.R. §60.5411a(d) for each closed vent system routing to a control device or process.

[45CSR13, R13-3561, 13.4.2. and 13.4.3.; 45CSR16; 40 C.F.R. §§60.5420a(b), (b)(1), (b)(4), (b)(11), and (b)(12)]

6.6. Compliance Plan

6.6.1. None.

7.0 Subpart OOOOa Requirements for Fugitive Emissions Components

7.1. Limitations and Standards

7.1.1. At all times, including periods of startup, shutdown, and malfunction, owners and operators shall maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. The provisions for exemption from compliance during periods of startup, shutdown and malfunctions provided for in 40 C.F.R. §60.8(c) do not apply to 40 C.F.R. Part 60 Subpart OOOOa.
[45CSR16; 40 C.F.R. §60.5370a(b)]

7.1.2. For each affected facility under 40 C.F.R. §60.5365a(j), the permittee must reduce GHG (in the form of a limitation on emissions of methane) and VOC emissions by complying with the requirements of paragraphs a. through j. of this condition. The requirements in this condition are independent of the closed vent system and cover requirements in 40 C.F.R. §60.5411a. Alternatively, the permittee may comply with the requirements of 40 C.F.R. §60.5398b, including the notification, recordkeeping, and reporting requirements outlined in 40 C.F.R. §60.5424b. For the purpose of 40 C.F.R. Part 60 Subpart OOOOa, compliance with the requirements in 40 C.F.R. §60.5398b will be deemed compliance with this condition. When complying with 40 C.F.R. §60.5398b, the definitions in 40 C.F.R. §60.5430b shall apply for those activities conducted under 40 C.F.R. §60.5398b.

a. The permittee must monitor all fugitive emission components, as defined in 40 C.F.R. §60.5430a, in accordance with paragraphs b. through g. of this condition. The permittee must repair all sources of fugitive emissions in accordance with paragraph h. The permittee must keep records in accordance with paragraph i. of this condition and report in accordance with paragraph j. of this condition. For the purposes of this condition, fugitive emissions are defined as any visible emission from a fugitive emissions component observed using optical gas imaging or an instrument reading of 500 parts per million (ppm) or greater using Method 21 of appendix A-7 to 40 C.F.R. Part 60.

b. The permittee must develop an emissions monitoring plan that covers the collection of fugitive emissions components at compressor stations within each company-defined area in accordance with paragraphs c. and d. of this condition.

c. Fugitive emissions monitoring plans must include the elements specified in paragraphs c.1. through c.8. of this condition, at a minimum.

1. Frequency for conducting surveys. Surveys must be conducted at least as frequently as required by paragraphs f. and g. of this condition.

2. Technique for determining fugitive emissions (i.e., Method 21 of appendix A-7 to 40 C.F.R. Part 60 or optical gas imaging meeting the requirements in paragraphs c.7.i. through c.7.vii. of this condition).

3. Manufacturer and model number of fugitive emissions detection equipment to be used.

4. Procedures and timeframes for identifying and repairing fugitive emissions components from which fugitive emissions are detected, including timeframes for fugitive emission components that are unsafe to repair. The repair schedule must meet the requirements of paragraph h. of this condition at a minimum.

5. Procedures and timeframes for verifying fugitive emission component repairs.

6. Records that will be kept and the length of time records will be kept.

7. If using optical gas imaging, the plan must also include the elements specified in paragraphs c.7.i. through c.7.vii of this condition.

   i. Verification that the optical gas imaging equipment meets the specifications of paragraphs c.7.i.a. and c.7.i.b. of this condition. This verification is an initial verification and may either be performed by the facility, by the manufacturer, or by a third party. For the purposes of complying with the fugitive emissions monitoring program with optical gas imaging, a fugitive emission is defined as any visible emissions observed using optical gas imaging.

      a. The optical gas imaging equipment must be capable of imaging gases in the spectral range for the compound of highest concentration in the potential fugitive emissions.

      b. The optical gas imaging equipment must be capable of imaging a gas that is half methane, half propane at a concentration of 10,000 ppm at a flow rate of $\leq$ 60 g/hr from a quarter inch diameter orifice.

   ii. Procedure for a daily verification check.

   iii. Procedure for determining the operator's maximum viewing distance from the equipment and how the operator will ensure that this distance is maintained.

   iv. Procedure for determining maximum wind speed during which monitoring can be performed and how the operator will ensure monitoring occurs only at wind speeds below this threshold.

   v. Procedures for conducting surveys, including the items specified in paragraphs c.7.v.a. through c.7.v.c. of this condition.

      a. How the operator will ensure an adequate thermal background is present in order to view potential fugitive emissions.

      b. How the operator will deal with adverse monitoring conditions, such as wind.

      c. How the operator will deal with interferences (e.g., steam).

   vi. Training and experience needed prior to performing surveys.

   vii. Procedures for calibration and maintenance. At a minimum, procedures must comply with those recommended by the manufacturer.

8. If using Method 21 of Appendix A-7 of 40 C.F.R. Part 60, the plan must also include the elements specified in paragraphs c.8.i. through c.8.iii. of this condition. For the purposes of complying with the fugitive emissions monitoring program using Method 21, a fugitive emission is defined as an instrument reading of 500 ppm or greater.

    i. *Verification that monitoring equipment meets the requirements specified in Section 6.0 of Method 21 at 40 C.F.R. Part 60, Appendix A-7.* For purposes of instrument capability, the fugitive emissions definition shall be 500 ppm or greater methane using a FID-based instrument. If the permittee wishes to use an analyzer other than a FID-based instrument, the permittee must develop a site-specific fugitive emission definition that would be equivalent to 500 ppm methane using a FID-based instrument (e.g., 10.6 eV PID with a specified isobutylene concentration as the fugitive emission definition would provide equivalent response to the compound of interest).

    ii. *Procedures for conducting surveys.* At a minimum, the procedures shall ensure that the surveys comply with the relevant sections of Method 21 at 40 C.F.R. Part 60, Appendix A-7, including Section 8.3.1.

    iii. *Procedures for calibration.* The instrument must be calibrated before use each day of its use by the procedures specified in Method 21 of Appendix A-7 of 40 C.F.R. Part 60. At a minimum, the permittee must also conduct precision tests at the interval specified in Method 21 of Appendix A-7 of 40 C.F.R. Part 60, Section 8.1.2, and a calibration drift assessment at the end of each monitoring day. The calibration drift assessment must be conducted as specified in paragraph c.8.iii.a. of this condition. Corrective action for drift assessments is specified in paragraphs c.8.iii.b. and c.8.iii.c. of this condition.

        a. Check the instrument using the same calibration gas that was used to calibrate the instrument before use. Follow the procedures specified in Method 21 of Appendix A-7 of 40 C.F.R. Part 60, Section 10.1, except do not adjust the meter readout to correspond to the calibration gas value. If multiple scales are used, record the instrument reading for each scale used. Divide the arithmetic difference of the initial and post-test calibration response by the corresponding calibration gas value for each scale and multiply by 100 to express the calibration drift as a percentage.

        b. If a calibration drift assessment shows a negative drift of more than 10 percent, then all equipment with instrument readings between the fugitive emission definition multiplied by (100 minus the percent of negative drift/divided by 100) and the fugitive emission definition that was monitored since the last calibration must be re-monitored.

        c. If any calibration drift assessment shows a positive drift of more than 10 percent from the initial calibration value, then, at the owner/operator’s discretion, all equipment with instrument readings above the fugitive emission definition and below the fugitive emission definition multiplied by (100 plus the percent of positive drift/divided by 100) monitored since the last calibration may be re-monitored.

d. Each fugitive emissions monitoring plan must include the elements specified in paragraphs d.1. through d.3. of this condition, at a minimum, as applicable.

1. If using optical gas imaging, the plan must include procedures to ensure that all fugitive emissions components are monitored during each survey. Example procedures include, but are not limited to, a sitemap with an observation path, a written narrative of where the fugitive emissions components are located and how they will be monitored, or an inventory of fugitive emissions components.

2. If using Method 21 of Appendix A-7 of 40 C.F.R. Part 60, the plan must include a list of fugitive emissions components to be monitored and method for determining the location of fugitive emissions components to be monitored in the field (e.g., tagging, identification on a process and instrumentation diagram, etc.).

3. The fugitive emissions monitoring plan must include the written plan developed for all of the fugitive emissions components designated as difficult-to-monitor in accordance with paragraph g.2. of this condition, and the written plan for fugitive emissions components designated as unsafe-to-monitor in accordance with g.3. of this condition.

e. Each monitoring survey shall observe each fugitive emissions component, as defined in 40 C.F.R. §60.5430a, for fugitive emissions.

f. The permittee must conduct an initial monitoring survey within 90 days of the startup of a new compressor station for each collection of fugitive emissions components at the new compressor station. For a modified collection of fugitive emissions components at a compressor station, the initial monitoring survey must be conducted within 90 days of the modification.

g. A monitoring survey of each collection of fugitive emissions components at a compressor station must be performed at the frequencies specified in paragraph g.1. of this condition, with the exceptions noted in paragraphs g.2. and g.3. of this condition.

1. A monitoring survey of the collection of fugitive emissions components at a compressor station must be conducted at least quarterly after the initial survey. Consecutive quarterly monitoring surveys must be conducted at least 60 days apart.

2. Fugitive emissions components that cannot be monitored without elevating the monitoring personnel more than 2 meters above the surface may be designated as difficult-to-monitor. Fugitive emissions components that are designated difficult-to-monitor must meet the specifications of paragraphs g.2.i. through iv. of this condition.

i. A written plan must be developed for all of the fugitive emissions components designated difficult-to-monitor. This written plan must be incorporated into the fugitive emissions monitoring plan required by paragraphs b., c., and d. of this condition.

ii. The plan must include the identification and location of each fugitive emissions component designated as difficult-to-monitor.

iii. The plan must include an explanation of why each fugitive emissions component designated as difficult-to-monitor is difficult-to-monitor.

iv. The plan must include a schedule for monitoring the difficult-to-monitor fugitive emissions components at least once per calendar year.

3. Fugitive emissions components that cannot be monitored because monitoring personnel would be exposed to immediate danger while conducting a monitoring survey may be designated as unsafe-to-monitor. Fugitive emissions components that are designated unsafe-to-monitor must meet the specifications of paragraphs g.3.i. through iv. of this condition.

   i. A written plan must be developed for all of the fugitive emissions components designated unsafe-to-monitor. This written plan must be incorporated into the fugitive emissions monitoring plan required by paragraphs b., c., and d. of this condition.

   ii. The plan must include the identification and location of each fugitive emissions component designated as unsafe-to-monitor.

   iii. The plan must include an explanation of why each fugitive emissions component designated as unsafe-to-monitor is unsafe-to-monitor.

   iv. The plan must include a schedule for monitoring the fugitive emissions components designated as unsafe-to-monitor.

h. Each identified source of fugitive emissions shall be repaired, as defined in 40 C.F.R. §60.5430a, in accordance with paragraphs h.1. and h.2. of this condition.

1. A first attempt at repair shall be made no later than 30 calendar days after detection of the fugitive emissions.

2. Repair shall be completed as soon as practicable, but no later than 30 calendar days after the first attempt at repair as required in paragraph h.1. of this condition.

3. Delay of repair will be allowed if the conditions in paragraphs h.3.i. or h.3.ii. of this section are met.

   i. If the repair is technically infeasible, would require a vent blowdown, a compressor station shutdown, or would be unsafe to repair during operation of the unit, the repair must be completed during the next scheduled compressor station shutdown for maintenance, after a scheduled vent blowdown, or within 2 years of detecting the fugitive emissions, whichever is earliest. For the purposes of this paragraph h.3., a vent blowdown is the opening of one or more blowdown valves to depressurize major production and processing equipment, other than a storage vessel.

   ii. If the repair requires replacement of a fugitive emissions component or a part thereof, but the replacement cannot be acquired and installed within the repair timelines specified in paragraphs h.1. and h.2. of this section due to either of the conditions specified in paragraphs h.3.ii.a. or h.3.ii.b. of this section, the repair must be completed in accordance with paragraph h.3.ii.c. of this section and documented in accordance with Condition 7.4.1.c.9.

      a. Valve assembly supplies had been sufficiently stocked but are depleted at the time of the required repair.

      b. A replacement fugitive emissions component or a part thereof requires custom fabrication.

c. The required replacement must be ordered no later than 10 calendar days after the first attempt at repair. The repair must be completed as soon as practicable, but no later than 30 calendar days after receipt of the replacement component, unless the repair requires a compressor station shutdown. If the repair requires a compressor station shutdown, the repair must be completed in accordance with the timeframe specified in paragraph h.3.i. of this condition.

4. Each identified source of fugitive emissions must be resurveyed to complete repair according to the requirements in paragraphs h.4.i. through h.4.iv. of this condition to ensure that there are no fugitive emissions.

   i. The operator may resurvey the fugitive emissions components to verify the repair using either Method 21 of Appendix A-7 to 40 C.F.R. Part 60 or optical gas imaging.

   ii. For each repair that cannot be made during the monitoring survey when the fugitive emissions are initially found, a digital photograph must be taken of that component or the component must be tagged during the monitoring survey when the fugitives were initially found for identification purposes and subsequent repair. The digital photograph must include the date that the photograph was taken and must clearly identify the component by location within the site (e.g., the latitude and longitude of the component or by other descriptive landmarks visible in the picture).

   iii. Operators that use Method 21 of Appendix A-7 of 40 C.F.R. Part 60 to resurvey the repaired fugitive emissions components are subject to the resurvey provisions specified in paragraphs h.4.iii.a. and h.4.iii.b. of this condition.

      a. A fugitive emissions component is repaired when the Method 21 instrument indicates a concentration of less than 500 ppm above background or when no soap bubbles are observed when the alternative screening procedures specified in Section 8.3.3 of Method 21 of Appendix A-7 of 40 C.F.R. Part 60 are used.

      b. Operators must use the Method 21 monitoring requirements specified in paragraph c.8.ii. of this condition or the alternative screening procedures specified in Section 8.3.3 of Method 21 of Appendix A-7 of 40 C.F.R. Part 60.

   iv. Operators that use optical gas imaging to resurvey the repaired fugitive emissions components, are subject to the resurvey provisions specified in paragraphs h.4.iv.a. and h.4.iv.b. of this condition.

      a. A fugitive emissions component is repaired when the optical gas imaging instrument shows no indication of visible emissions.

      b. Operators must use the optical gas imaging monitoring requirements specified in paragraph c.7. of this condition.

i. Records for each monitoring survey shall be maintained as specified in Condition 7.4.1.

j. Annual reports shall be submitted for each collection of fugitive emissions components at a compressor station that include the information specified in Condition 7.5.1.b. Multiple collection of fugitive emissions components at a compressor station may be included in a single annual report.

[45CSR13, R13-3561, 14.1.1.; 45CSR16; 40 C.F.R. §§60.5397a(a) through (e), (f)(2), (g), (g)(2) through (4), and (h) through (j)]

7.2. Monitoring Requirements

7.2.1. The permittee must determine initial compliance with the standards for each collection of fugitive emissions components at a compressor station using the requirements in paragraphs a. through e. of this condition. The initial compliance period begins upon initial startup and ends no later than 1 year after the initial startup date for the affected facility. The initial compliance period may be less than 1 full year.

a. The permittee must develop a fugitive emissions monitoring plan as required in Condition 7.1.2.b. to d.

b. The permittee must conduct an initial monitoring survey as required in Condition 7.1.2.f.

c. The permittee must maintain the records specified in Condition 7.4.1.

d. The permittee must repair each identified source of fugitive emissions for each affected facility as required in Condition 7.1.2.h.

e. The permittee must submit the initial annual report for each collection of fugitive emissions components at a compressor station as required in Condition 7.5.1.a. and b.

[45CSR16; 40 C.F.R. §§60.5410a and 60.5410a(j)]

7.2.2. For each collection of fugitive emissions components at a compressor station, the permittee must demonstrate continuous compliance with the fugitive emission standards specified in Condition 7.1.2. according to paragraphs a. through d. of this condition.

a. The permittee must conduct periodic monitoring surveys as required in Condition 7.1.2.g.

b. The permittee must repair each identified source of fugitive emissions as required in Condition 7.1.2.h.

c. The permittee must maintain records as specified in Condition 7.4.1.

d. The permittee must submit annual reports for the collection of fugitive emissions components at a compressor station as required in Condition 7.5.1.a. and b.

[45CSR16; 40 C.F.R. §60.5415a(h)]

7.3. Testing Requirements

7.3.1. None.

7.4. Recordkeeping Requirements

7.4.1. The permittee must maintain the records identified as specified in 40 C.F.R. §60.7(f) and specified in this condition for each collection of fugitive emissions components at a compressor station. All records required by 40 C.F.R. Part 60 Subpart OOOOa must be maintained either on-site or at the nearest local field office for at least 5 years. Any records required to be maintained by Subpart OOOOa that are submitted electronically via the EPA's CDX may be maintained in electronic format.

a. The date of the startup or the date of the modification for each collection of fugitive emissions components at a compressor station.

b. The fugitive emissions monitoring plan as required in paragraphs b. through d. of Condition 7.1.2.

c. The records of each monitoring survey as follows:

1. Date of the survey.

2. Beginning and end time of the survey.

3. Name of the operator(s), training, and experience of the operator(s) performing the survey.

4. Monitoring instrument used.

5. Fugitive emissions component identification when Method 21 of 40 C.F.R. Part 60, Appendix A-7 is used to perform the monitoring survey.

6. Ambient temperature, sky conditions, and maximum wind speed at the time of the survey. For compressor stations, operating mode of each compressor (i.e., operating, standby pressurized, and not operating-depressurized modes) at the station at the time of the survey.

7. Any deviations from the monitoring plan or a statement that there were no deviations from the monitoring plan.

8. Records of calibrations for the instrument used during the monitoring survey.

9. Documentation of each fugitive emission detected during the monitoring survey, including the information specified in paragraphs c.9.i. through c.9.ix. of this condition.

i. Location of each fugitive emission identified.

ii. Type of fugitive emissions component, including designation as difficult-to-monitor or unsafe-to-monitor, if applicable.

iii. If Method 21 of Appendix A-7 of 40 C.F.R. Part 60 is used for detection, record the component ID and instrument reading.

iv. For each repair that cannot be made during the monitoring survey when the fugitive emissions are initially found, a digital photograph or video must be taken of that component or the component must be tagged for identification purposes. The digital photograph must include the date that the photograph was taken and must clearly identify the component by location within the site (e.g., the latitude and longitude of the component or by other descriptive landmarks visible in the picture). The digital photograph or identification (e.g., tag) may be removed after the repair is completed, including verification of repair with the resurvey.

v. The date of first attempt at repair of the fugitive emissions component(s).

vi. The date of successful repair of the fugitive emissions component, including the resurvey to verify repair and instrument used for the resurvey.

vii. Identification of each fugitive emission component placed on delay of repair and explanation for each delay of repair.

viii. For each fugitive emission component placed on delay of repair for reason of replacement component unavailability, the operator must document: the date the component was added to the delay of repair list, the date the replacement fugitive component or part thereof was ordered, the anticipated component delivery date (including any estimated shipment or delivery date provided by the vendor), and the actual arrival date of the component.

ix. Date of planned shutdowns that occur while there are any components that have been placed on delay of repair.

d. For each collection of fugitive emissions components at a compressor station complying with an alternative means of emissions limitation under 40 C.F.R. §60.5399a, the permittee must maintain the records specified by the specific alternative fugitive emissions standard for a period of at least 5 years.

e. If complying with the alternative GHG and VOC standard under 40 C.F.R. §60.5398b, in lieu of the information specified in paragraphs b. through c. of this condition, the permittee must maintain the records specified in 40 C.F.R. §60.5424b.

[45CSR16; 40 C.F.R. §§60.5420a(c), (c)(15), and (c)(15)(i), (vi) to (ix)]

7.5. Reporting Requirements

7.5.1. The permittee must submit annual reports containing the information specified in paragraphs a. and b. of this condition. The permittee must submit annual reports following the procedure specified in paragraph c. of this condition. The initial annual report is due no later than 90 days after the end of the initial compliance period as determined according to Condition 7.2.1. Subsequent annual reports are due no later than the same date each year as the initial annual report. The permittee may submit one report for multiple affected facilities provided the report contains all of the information specified in paragraphs a. and b. of this condition. Annual reports may coincide with Title V reports as long as all the required elements of the annual report are included. The permittee may arrange with the Administrator a common schedule on which reports required by 40 C.F.R. Part 60 may be submitted as long as the schedule does not extend the reporting period.

a. The general information specified below is required for all reports:

1. The company name, facility site name associated with the affected facility, and address of the affected facility;

2. An identification of each affected facility being included in the annual report;

3. Beginning and ending dates of the reporting period; and

4. A certification by a certifying official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

b. For the collection of fugitive emissions components at each compressor station, report the information specified in paragraphs b.1. through 3. of this condition, as applicable.

1. i. Designation of the type of site (i.e., well site or compressor station) at which the collection of fugitive emissions components is located.

   ii. For each collection of fugitive emissions components at a compressor station that became an affected facility during the reporting period, the permittee must include the date of startup or the date of modification.

2. For each fugitive emissions monitoring survey performed during the annual reporting period, the information specified in paragraphs b.2.i. through vii. of this condition.

   i. Date of the survey.

   ii. Monitoring instrument used.

   iii. Any deviations from the monitoring plan elements under paragraphs c.1., c.2., c.7., and c.8.i. of Condition 7.1.2. or a statement that there were no deviations from these elements of the monitoring plan.

   iv. Number and type of components for which fugitive emissions were detected.

   v. Number and type of fugitive emissions components that were not repaired as required in Condition 7.1.2.h.

   vi. Number and type of fugitive emission components (including designation as difficult-to-monitor or unsafe-to-monitor, if applicable) on delay of repair and explanation for each delay of repair.

   vii. Date of planned shutdown(s) that occurred during the reporting period if there are any components that have been placed on delay of repair.

3. For each collection of fugitive emissions components at a compressor station complying with an alternative fugitive emissions standard under 40 C.F.R. §60.5399a, in lieu of the information specified in paragraphs b.1. and b.2. of this condition, the permittee must provide the information specified in paragraphs b.3.i. through b.3.iii. of this condition.

   i. The alternative standard with which you are complying.

   ii. The site-specific reports specified by the specific alternative fugitive emissions standard, submitted in the format in which they were submitted to the state, local, or tribal authority. If the report is in hard copy, the permittee must scan the document and submit it as an electronic attachment to the annual report required in this condition.

iii. If the report specified by the specific alternative fugitive emissions standard is not site-specific, the permittee must submit the information specified in paragraphs b.1. and b.2. of this condition for each individual site complying with the alternative standard.

4. If complying with the alternative GHG and VOC standard under 40 C.F.R. §60.5398b, in lieu of the information specified in paragraph b.2. of this condition, the permittee must provide the information specified in 40 C.F.R. §60.5424b.

c. The permittee must submit reports to the EPA via CEDRI, except as outlined in 40 C.F.R. §60.5420a(b)(11). CEDRI can be accessed through the EPA's CDX (https://cdx.epa.gov/). The permittee must use the appropriate electronic report template on the CEDRI website for 40 C.F.R. Part 60 Subpart OOOOa (https://www.epa.gov/electronic-reporting-air-emissions/cedri/). If the reporting form specific to Subpart OOOOa is not available on the CEDRI website at the time that the report is due, the permittee must submit the report to the Administrator at the appropriate address listed in 40 C.F.R. §60.4. Once the form has been available in CEDRI for at least 90 calendar days, the permittee must begin submitting all subsequent reports via CEDRI. The date reporting forms become available will be listed on the CEDRI website. Unless the Administrator or delegated state agency or other authority has approved a different schedule for submission of reports, the reports must be submitted by the deadlines specified in Subpart OOOOa, regardless of the method in which the reports are submitted. The EPA will make all the information submitted through CEDRI available to the public without further notice.

[45CSR16; 40 C.F.R. §§60.5420a(b), (b)(1), (b)(7), (b)(7)(i)(A), (b)(7)(i)(B), (b)(7)(ii) to (iv), and (b)(11)]

7.6. Compliance Plan

7.6.1. None.

8.0 Natural Gas Dehydration Units Controlled by Thermal Oxidizers [Emission Point IDs: 12E, 13E, 15E, 16E, 24E, and 25E]

8.1. Limitations and Standards

8.1.1. **Maximum Throughput Limitation.** The maximum dry natural gas throughput to each of the glycol dehydration units/still columns shall not exceed the following:

Emission Unit ID	Emission Point ID	Emission Unit	Design Capacity
DFT-01/DSV-01	24E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	250 mmscfd
DFT-02/DSV-02	25E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	160 mmscfd

Compliance with the Maximum Throughput Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

[45CSR13, R13-3561, 7.1.1.]

8.1.2. The permittee shall install the following air pollution control devices to control emissions from the glycol dehydration units:

a. A 7.61 mmBTU/hr thermal oxidizer (TOx-01) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-01) and the dehydrator flash tank (DFT-01). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions.

b. A 6.70 mmBTU/hr thermal oxidizer (TOx-02) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-02) and the dehydrator flash tank (DFT-02). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions.

[45CSR13, R13-3561, 7.1.2.]

8.1.3. The thermal oxidizers (TOx-01, TOx-02) shall be designed and operated in accordance with the following:

a. The vapors/overheads from the still vents (DSV-01, DSV-02) and gas from the flash tanks (DFT-01, DFT-02) in excess of that used for fuel shall be routed to the thermal oxidizers at all times;

b. The thermal oxidizers shall be operated, with a flame present at all times as determined by the methods specified in Condition 8.2.1.;

c. The thermal oxidizers shall be operated according to the manufacturer's specifications for residence time and the minimum combustion chamber temperature of 1,700°F;

d. The thermal oxidizers shall be operated at all times when emissions/overheads from the glycol dehydration unit still vents and flash tanks may be vented to it;

e. The thermal oxidizers shall be designed for and operated with no visible emissions as determined by the methods specified in Condition 8.3.1., except for periods not to exceed a total of 5 minutes during any 2 consecutive hours; and

f. The thermal oxidizers are subject to the applicable requirements of 45CSR6.

1. No person shall cause or allow particulate matter to be discharged from the thermal oxidizer TOx-01 into the open air in excess of 1.56 lbs/hr.

   No person shall cause or allow particulate matter to be discharged from the thermal oxidizer TOx-02 into the open air in excess of 1.13 lbs/hr.

   [45CSR§6-4.1.]

2. No person shall cause or allow emission of smoke into the atmosphere from any incinerator which is 20% opacity or greater.
   [45CSR§6-4.3.]

3. The provisions of paragraph f.2. shall not apply to smoke which is less than 40% opacity, for a period or periods aggregating no more than 8 minutes per start-up, or 6 minutes in any 60-minute period for stoking operations.
   [45CSR§6-4.4.]

4. No person shall cause or allow the emission of particles of unburned or partially burned refuse or ash from any incinerator which are large enough to be individually distinguished in the open air.
   [45CSR§6-4.5.]

5. Incinerators, including all associated equipment and grounds, shall be designed, operated and maintained so as to prevent the emission of objectionable odors.
   [45CSR§6-4.6.]

[45CSR6; 45CSR13, R13-3561, 7.1.3.; 45CSR§30-5.1.c.]

8.1.4. Emissions from the thermal oxidizers shall not exceed the following maximum hourly and annual emission limits:

a. Thermal Oxidizer (TOx-01)

Pollutant	Maximum Hourly Emissions (lbs/hr)	Maximum Annual Emissions (tpy)
Nitrogen Oxides	0.75	3.27
Carbon Monoxide	2.36	10.33
Volatile Organic Compounds	0.92	4.02
Total HAPs	0.38	1.68

b. Thermal Oxidizer (TOx-02)

Pollutant	Maximum Hourly Emissions (lbs/hr)	Maximum Annual Emissions (tpy)
Nitrogen Oxides	0.66	2.88
Carbon Monoxide	2.08	9.10
Volatile Organic Compounds	0.89	3.88
Total HAPs	0.37	1.63

[45CSR13, R13-3561, 7.1.4.]

8.1.5. Any source that determines it is not a major source but has actual emissions of 5 tpy or more of a single HAP, or 12.5 tpy or more of a combination of HAPs (i.e., 50 percent of the major source thresholds), shall update its major source determination within 1 year of the prior determination and each year thereafter, using gas composition data measured during the preceding 12 months.
[45CSR13, R13-3561, 7.1.5.; 45CSR34; 40 C.F.R. §63.760(c)]

8.1.6. The permittee is exempt from the requirements of 40 C.F.R. §63.764(d) if the criteria listed in paragraph a. of this condition is met, except that records of the determination of the criteria must be maintained as required in Condition 8.4.5.

a. The actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram per year (1 tpy), as determined by the procedures specified in Condition 8.3.3.

[45CSR13, R13-3561, 7.1.6.; 45CSR34; 40 C.F.R. §§63.764(e), (e)(1), and (e)(1)(ii)]

8.1.7. At all times the permittee must operate and maintain any affected source, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. Determination of whether such operation and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.
[45CSR34; 40 C.F.R. §63.764(j)]

8.2. Monitoring Requirements

8.2.1. To demonstrate compliance with the pilot flame requirements of Conditions 8.1.3.b. and 8.1.3.d., the presence of a pilot flame shall be continuously monitored using a thermocouple or any other equivalent device to detect the presence of a flame when emissions are vented to it. The pilot shall be equipped such that it sounds an alarm, or initiates notification via remote alarm to the nearest field office, when the pilot light is out.
[45CSR13, R13-3561, 7.2.1.]

8.2.2. The permittee shall monitor the throughput of dry natural gas fed to the dehydration system on a monthly basis for each of the glycol dehydration units (DSV-01, DSV-02).
[45CSR13, R13-3561, 7.2.2.]

8.2.3. To demonstrate compliance with the requirement to operate the thermal oxidizer according to the manufacturer's specifications of Condition 8.1.3.c., the combustion chamber temperature shall be continuously monitored and recorded. Any deviations below the minimum combustion chamber temperature while in operation shall be reported in accordance with Condition 8.5.3.
[45CSR§30-5.1.c.]

8.3. Testing Requirements

8.3.1. In order to demonstrate compliance with the opacity requirements of Condition 8.1.3.e., the permittee shall conduct a Method 22 opacity test for at least two hours. This test shall demonstrate no visible emissions are observed for more than a total of 5 minutes during any 2 consecutive hour period using 40 C.F.R. Part 60, Appendix A, Method 22. The permittee shall conduct this test within one (1) year of permit issuance or initial startup whichever is later. The visible emission checks shall determine the presence or absence of visible emissions. At a minimum, the observer must be trained and knowledgeable regarding the effects of background contrast, ambient lighting, observer position relative to lighting, wind, and the presence of uncombined water (condensing water vapor) on the visibility of emissions. This training may be obtained from written materials found in the References 1 and 2 from 40 C.F.R. Part 60, Appendix A, Method 22 or from the lecture portion of 40 C.F.R. Part 60, Appendix A, Method 9 certification course.
[45CSR13, R13-3561, 7.3.1.]

8.3.2. In order to demonstrate compliance with Condition 8.1.4., upon request of the Director, the permittee shall demonstrate compliance with the VOC and HAP emissions thresholds using GLYCalc Version 3.0 or higher. The permittee shall sample in accordance with GPA Method 2166 and analyze the samples utilizing the extended GPA Method 2286 as specified in the GRI-GLYCalc V4 Technical Reference User Manual and Handbook.
[45CSR13, R13-3561, 7.3.2.]

8.3.3. **Determination of glycol dehydration benzene emissions.** In order to demonstrate that the benzene emissions are less than 1 tpy, the permittee shall determine the actual average benzene emissions using the procedure in the paragraph below. Emissions shall be determined either uncontrolled, or with federally enforceable controls in place.

The owner or operator shall determine actual average benzene or BTEX emissions using the model GRI-GLYCalc™, Version 3.0 or higher, and the procedures presented in the associated GRI-GLYCalc™ Technical Reference Manual. Inputs to the model shall be representative of actual operating conditions of the glycol dehydration unit and may be determined using the procedures documented in the Gas Research Institute (GRI) report entitled "Atmospheric Rich/Lean Method for Determining Glycol Dehydrator Emissions" (GRI-95/0368.1).

[45CSR13, R13-3561, 7.3.3.; 45CSR34; 40 C.F.R §§63.772(b)(2) and (b)(2)(i)]

8.3.4. Use of the ProMax model, Version 5.0 or higher, as an alternative to the GLYCalc model is subject to the following caveats.

Inputs to the ProMax, Version 5.0 or above, software shall include the parameters listed below, which must be representative of the actual operating conditions of the glycol dehydration unit:

a. Wet gas flowrate

b. Wet gas composition (dry basis)

c. Wet gas water content (if unknown, can assume a worst-case of 100% saturation)

d. Wet gas (absorber) temperature

e. Wet gas (absorber) pressure

f. Glycol circulation rate (or dry gas water content or glycol circulation ratio)

g. Dry gas water content

h. Lean glycol water content

i. Gas pump volume ratio (when gas injection pump is used)

j. Reboiler temperature

k. Flash tank parameters (when installed)

   1. Temperature

   2. Pressure

l. Control device parameters (when installed)

   1. Combustion device destruction efficiency

   2. Condenser temperature and pressure

m. Stripping gas (if used)

   1. Type (dry gas, flash gas, nitrogen)

   2. Flowrate

[45CSR13, R13-3561, 7.3.4.]

8.3.5. Affected facilities using this alternative (ProMax as an alternative to GLYCalc under Subpart HH) for their affected glycol dehydration units must notify the responsible agency before use of the alternative and notification should include a copy of this letter. Facilities must include a copy of this letter with each report presenting results using the ProMax software.
[45CSR13, R13-3561, 7.3.5.]

8.3.6. Once a facility chooses to use ProMax as an alternative to GLYCalc under one or more of the Subpart HH provisions listed above, the facility must continue to use ProMax in meeting the provision(s) until the owner/operator receives approval from this office for use of a new alternative method or the responsible agency for use of any other options in Subpart HH, including returning to the use of GLYCalc (see §63.7(f)(5)).
[45CSR13, R13-3561, 7.3.6.]

8.3.7. At such reasonable times as the Secretary may designate, the operator of any incinerator shall be required to conduct or have conducted stack tests to determine the particulate matter loading, by using 40 C.F.R. Part 60, Appendix A, Method 5 and 45CSR16 or other equivalent U.S. EPA approved method approved by the Secretary, in exhaust gases. Such tests shall be conducted in such manner as the Secretary may specify and be filed on forms and in a manner acceptable to the Secretary. The Secretary may, at the Secretary's option, witness or conduct such stack tests. Should the Secretary exercise his or her option to conduct such tests, the operator will provide all the necessary sampling connections and sampling ports to be located in such manner as the Secretary may require, power for test equipment and the required safety equipment such as scaffolding, railings and ladders to comply with generally accepted good safety practices.

The Secretary may conduct such other tests as the Secretary may deem necessary to evaluate air pollution emissions other than those noted above.

[45CSR§§6-7.1. and -7.2.]

8.4. Recordkeeping Requirements

8.4.1. For the purpose of demonstrating compliance with the requirements set forth in Conditions 8.1.4. and 8.3.2., the permittee shall maintain records of testing conducted in accordance with Condition 8.3.2.
[45CSR13, R13-3561, 7.4.1.]

8.4.2. The permittee shall document and maintain the corresponding records specified by the on-going monitoring requirements of Section 8.2. and testing requirements of Section 8.3.
[45CSR13, R13-3561, 7.4.2.]

8.4.3. For the purpose of demonstrating compliance with the minor source status of hazardous air pollutants required by Condition 8.1.4., the permittee shall maintain a record of all potential to emit (PTE) HAP calculations for the entire affected facility. These records shall include the natural gas compressor engines and ancillary equipment.
[45CSR13, R13-3561, 7.4.3.]

8.4.4. The permittee shall maintain a record of the dry natural gas throughput through the dehydration system to demonstrate compliance with Condition 8.1.1.
[45CSR13, R13-3561, 7.4.4.]

8.4.5. For a glycol dehydration unit that meets the exemption criteria in 40 C.F.R. §63.764(e)(1)(ii) and Condition 8.1.6., the permittee shall maintain the records specified in paragraph a. of this condition for that glycol dehydration unit.

a. The actual average benzene emissions (in terms of benzene emissions per year) as determined in accordance with §63.772(b)(2) and Condition 8.3.3.

[45CSR13, R13-3561, 7.4.5.; 45CSR34; 40 C.F.R. §§63.764(e), 63.774(d)(1) and (d)(1)(ii)]

8.4.6. All records required under Conditions 8.4.1. through 8.4.5. shall be maintained on-site or in a readily accessible off-site location maintained by the permittee for a period of five (5) years. Said records shall be readily available to the Director of the Division of Air Quality or his/her duly authorized representative for expeditious inspection and review. Any records submitted to the agency pursuant to a requirement of this permit or upon request by the Director shall be certified by a responsible official.
[45CSR13, R13-3561, 7.4.6.]

8.4.7. The permittee shall maintain records of the combustion chamber temperature monitored in Condition 8.2.3.
[45CSR§30-5.1.c.]

8.4.8. The permittee shall maintain a copy of the manufacturer's operation and maintenance specifications for the thermal oxidizers in a form suitable and readily available for expeditious review. Maintenance of the specifications in an electronic format is acceptable.
[45CSR§30-5.1.c.]

8.5. Reporting Requirements

8.5.1. If the permittee is required by the Director to demonstrate compliance with Condition 8.3.3., then the permittee shall submit a testing protocol at least thirty (30) days prior to testing and shall submit a notification of the testing date at least fifteen (15) days prior to testing. The permittee shall submit the testing results within sixty (60) days of testing and provide all supporting calculations and testing data.
[45CSR13, R13-3561, 7.5.1.]

8.5.2. Any deviation(s) of the allowable visible emission requirement for any emission source discovered during observations using 40 C.F.R. Part 60 Appendix A Method 9 must be reported in writing to the Director of the Division of Air Quality as soon as practicable, but within ten (10) calendar days, of the occurrence and shall include, at a minimum, the following information: the results of the visible determination of opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned.
[45CSR13, R13-3561, 7.5.2.]

8.5.3. Any deviation(s) from the thermal oxidizer design and/or operation criteria in Condition 8.1.3. shall be reported in writing to the Director as soon as practicable, but within ten (10) calendar days.
[45CSR13, R13-3561, 7.5.3.]

8.5.4. The TEG dehydration units are located at an area source and each meets the criteria in 40 C.F.R. §63.764(e)(1)(ii). Therefore, the permittee is exempt from the reporting requirements for area sources specified in 40 C.F.R. §§63.775(c)(1) through (7).
[45CSR34; 40 C.F.R. §§63.775(c) and (c)(8)]

8.6. Compliance Plan

8.6.1. None.

9.0 Reboilers [Emission Point IDs: 14E and 17E]

9.1. Limitations and Standards

9.1.1. **Maximum Design Heat Input.** The maximum design heat input for each of the Reboilers (RBV-01, RBV-02) shall not exceed 2.00 mmBTU/hr.
[45CSR13, R13-3561, 8.1.1.]

9.1.2. No person shall cause, suffer, allow or permit emission of smoke and/or particulate matter into the open air from any fuel burning unit which is greater than ten (10) percent opacity based on a six-minute block average.
[45CSR§2-3.1.; 45CSR13, R13-3561, 8.1.2.]

9.2. Monitoring Requirements

9.2.1. At such reasonable times as the Secretary may designate, the permittee shall conduct Method 9 emission observations for the purpose of demonstrating compliance with Condition 9.1.2. Method 9 shall be conducted in accordance with 40 C.F.R. Part 60, Appendix A.
[45CSR13, R13-3561, 8.2.1.]

9.3. Testing Requirements

9.3.1. Compliance with the visible emission requirements of Condition 9.1.2. shall be determined in accordance with 40 C.F.R. Part 60, Appendix A, Method 9 and 45CSR16 or by using measurements from continuous opacity monitoring systems approved by the Secretary. The Secretary may require the installation, calibration, maintenance and operation of continuous opacity monitoring systems and may establish policies for the evaluation of continuous opacity monitoring results and the determination of compliance with the visible emission requirements of Condition 9.1.2. Continuous opacity monitors shall not be required on fuel burning units which employ wet scrubbing systems for emission control.
[45CSR§2-3.2.; 45CSR13, R13-3561, 8.3.1.]

9.4. Recordkeeping Requirements

9.4.1. The permittee shall maintain records of all monitoring data required by Condition 9.2.1. documenting the date and time of each visible emission check, the emission point or equipment/source identification number, the name or means of identification of the observer, the results of the check(s), whether the visible emissions are normal for the process, and, if applicable, all corrective measures taken or planned. The permittee shall also record the general weather conditions (i.e. sunny, approximately 80°F, 6-10 mph NE wind) during the visual emission check(s). Should a visible emission observation be required to be performed per the requirements specified in Method 9, the data records of each observation shall be maintained per the requirements of Method 9.
[45CSR13, R13-3561, 8.4.1.]

9.5. Reporting Requirements

9.5.1. Any deviation(s) from the allowable visible emission requirement for any emission source discovered during observations using 40 C.F.R. Part 60, Appendix A, Method 9 shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but in any case within ten (10) calendar days of the occurrence and shall include at least the following information: the results of the visible determination of

opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned.
[45CSR13, R13-3561, 8.5.1.]

9.6. Compliance Plan

9.6.1. None.

10.0 Produced Water Storage Tanks [Emission Point IDs: 18E to 21E]

10.1. Limitations and Standards

10.1.1. The maximum combined annual throughput of produced water to the storage tanks shall not exceed 5,040,000 gallons per year.
[45CSR13, R13-3561, 9.1.1.]

10.1.2. Maximum emissions from the storage tank battery (TK-01 to TK-04) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lbs/hr)	Maximum Annual Emissions (tpy)
Volatile Organic Compounds	0.04	0.16

[45CSR13, R13-3561, 9.1.2.]

10.1.3. Each storage tank (TK-01 to TK-04) thief hatch shall be weighted and properly seated. The permittee must select gasket material for the hatch based on composition of the fluid in the storage vessel and weather conditions.
[45CSR13, R13-3561, 9.1.3.]

10.2. Monitoring Requirements

10.2.1. The permittee shall monitor the throughput to the storage tanks (TK-01 to TK-04) on a monthly basis.
[45CSR13, R13-3561, 9.2.1.]

10.3. Testing Requirements

10.3.1. None.

10.4. Recordkeeping Requirements

10.4.1. All records required under Section 10.4. shall be kept in accordance with Condition 3.4.2.
[45CSR13, R13-3561, 9.3.1.]

10.4.2. To demonstrate compliance with Condition 10.1.1., the permittee shall maintain a record of the aggregate throughput for the storage tanks on a monthly and rolling twelve-month total.
[45CSR13, R13-3561, 9.3.2.]

10.5. Reporting Requirements

10.5.1. None.

10.6. Compliance Plan

10.6.1. None.

11.0 Truck Load-Out [Emission Point ID: 22E]

11.1. Limitations and Standards

11.1.1. The permittee shall install, maintain, and operate all above-ground piping, valves, pumps, etc. that service lines in the transport of potential sources of regulated air pollutants to prevent any substantive fugitive escape of regulated air pollutants. Any above-ground piping, valves, pumps, etc. that shows signs of excess wear and that have a reasonable potential for substantive fugitive emissions of regulated air pollutants shall be replaced.
[45CSR13, R13-3561, 10.1.1.]

11.1.2. The maximum quantity of produced water from truck loading (TLO) that shall be loaded shall not exceed 5,040,000 gallons per year. Compliance with the Maximum Yearly Operation Limitation shall be determined using a twelve-month rolling total. A twelve-month rolling total shall mean the sum of the throughput at any given time during the previous twelve consecutive calendar months.
[45CSR13, R13-3561, 10.1.2.]

11.1.3. Maximum emissions from the product loadout rack (Emission Point: 22E) shall not exceed the following limits:

Pollutant	Maximum Annual Emissions (tpy)
Volatile Organic Compounds	1.66
Total Hazardous Air Pollutants	0.24

[45CSR13, R13-3561, 10.1.3.]

11.1.4. The Produced Water Truck Loading shall be operated in accordance with the plans and specifications filed in Permit Application R13-3561.
[45CSR13, R13-3561, 10.1.4.]

11.2. Monitoring Requirements

11.2.1. None.

11.3. Testing Requirements

11.3.1. None.

11.4. Recordkeeping Requirements

11.4.1. All records required under Section 11.4. shall be kept in accordance with Condition 3.4.2.
[45CSR13, R13-3561, 10.3.1.]

11.4.2. To demonstrate compliance with Conditions 11.1.2. and 11.1.3., the permittee shall maintain a record of the aggregate throughput for the truck loading (TLO) on a monthly and rolling twelve-month total.
[45CSR13, R13-3561, 10.3.2.]

11.5. Reporting Requirements

11.5.1. None.

11.6. Compliance Plan

11.6.1. None.

12.0 Compressor Blowdown and Pigging Operations controlled by an Elevated Flare [Emission Point IDs: 7E, 23E, and 26E]

12.1. Limitations and Standards

12.1.1. The maximum number of compressor blowdown (BD) events per year shall not exceed 458 events, with an estimated 24,398,000 scf per year. Compliance shall be determined using a twelve-month rolling total. A twelve-month rolling total shall mean the sum of the compressor blowdown events at any given time during the previous twelve consecutive calendar months.
[45CSR13, R13-3561, 11.1.1.]

12.1.2. The maximum number of pigging (PIG) events per year shall not exceed 1,460 events, with an estimated 5,425,000 scf per year. Compliance shall be determined using a twelve-month rolling total. A twelve-month rolling total shall mean the sum of the pigging events at any given time during the previous twelve consecutive calendar months.
[45CSR13, R13-3561, 11.1.2.]

12.1.3. The maximum number of plant shutdown events per year shall not exceed 1 event, with an estimated 1,002,000 scf per event. Compliance shall be determined using a twelve-month rolling total. A twelve-month rolling total shall mean the sum of the plant shutdowns at any given time during the previous twelve consecutive calendar months. Unscheduled emergency shutdowns shall not be counted as plant shutdown events.
[45CSR13, R13-3561, 11.1.3.]

12.1.4. The waste gas from the compressor blowdowns (BD) and pigging (PIG) shall be controlled at all times by the elevated flare (FLR-01). The flare shall have a design capacity of 7.0 mmBTU/hr. The flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions.
[45CSR13, R13-3561, 11.1.4.]

12.1.5. Maximum emissions from the elevated flare (FLR-01) shall not exceed the following limits:

Pollutant	Maximum Annual Emissions (tpy)
Nitrogen Oxides	2.95
Carbon Monoxide	9.34
Volatile Organic Compounds	3.10

[45CSR13, R13-3561, 11.1.5.]

12.1.6. The quantity of waste gas that shall be consumed in the flare shall not exceed 49.60 mmscf per year. Compliance with the gas throughput limit shall be demonstrated using a rolling 12-month total.
[45CSR13, R13-3561, 11.1.7.]

12.1.7. The flare (FLR-01) is subject to the following 45CSR6 requirements:

a. No person shall cause or allow particulate matter to be discharged from any incinerator into the open air in excess of 0.81 lbs/hr.
[45CSR§6-4.1.]

b. No person shall cause or allow emission of smoke into the atmosphere from any incinerator which is 20% opacity or greater.
[45CSR§6-4.3.; 45CSR13, R13-3561, 11.1.8.]

c. The provisions of paragraph b. of this condition shall not apply to smoke which is less than 40% opacity, for a period or periods aggregating no more than 8 minutes per start-up, or 6 minutes in any 60-minute period for stoking operations.
[45CSR§6-4.4.; 45CSR13, R13-3561, 11.1.8.]

d. No person shall cause or allow the emission of particles of unburned or partially burned refuse or ash from any incinerator which are large enough to be individually distinguished into the open air.
[45CSR§6-4.5.]

e. Incinerators, including all associated equipment and grounds, shall be designed, operated and maintained so as to prevent the emission of objectionable odors.
[45CSR§6-4.6.]

12.1.8. The flare (FLR-01) shall be operated with a pilot flame present at all times whenever emissions may be vented.
[45CSR13, R13-3561, 11.1.9.]

12.1.9. The flare (FLR-01) installed shall be operated and designed in accordance with the information filed in Permit Application R13-3561.
[45CSR13, R13-3561, 11.1.10.]

12.2. Monitoring Requirements

12.2.1. In order to demonstrate compliance with the requirements of Condition 12.1.8., the permittee shall monitor the presence or absence of a flare pilot flame using a thermocouple or any other equivalent device.
[45CSR13, R13-3561, 11.2.1.]

12.2.2. In order to demonstrate compliance with Condition 12.1.6., the permittee shall monitor the throughput to the flare (FLR-01) on a monthly basis.
[45CSR13, R13-3561, 11.2.2.]

12.3. Testing Requirements

12.3.1. At such reasonable times as the Secretary may designate, the permittee shall conduct Method 9 emission observations for the purpose of demonstrating compliance with Conditions 12.1.7.b. and c. Method 9 shall be conducted in accordance with 40 C.F.R. Part 60, Appendix A.
[45CSR13, R13-3561, 11.3.1.]

12.3.2. At such reasonable times as the Secretary may designate, the operator of any incinerator shall be required to conduct or have conducted stack tests to determine the particulate matter loading, by using 40 C.F.R. Part 60, Appendix A, Method 5 and 45CSR16 or other equivalent U.S. EPA approved method approved by the Secretary, in exhaust gases. Such tests shall be conducted in such manner as the Secretary may specify and be filed on forms and in a manner acceptable to the Secretary. The Secretary may, at the Secretary's option, witness or conduct such stack tests. Should the Secretary exercise his or her option to conduct such tests, the operator will provide all the necessary sampling connections and sampling ports to be located in such manner as the Secretary may require, power for test equipment and the required safety equipment such as scaffolding, railings and ladders to comply with generally accepted good safety practices.

The Secretary may conduct such other tests as the Secretary may deem necessary to evaluate air pollution emissions other than those noted above.

[45CSR§§6-7.1. and -7.2.]

12.4. Recordkeeping Requirements

12.4.1. All records required under Section 12.4. of this permit shall be kept in accordance with Condition 3.4.2.
[45CSR13, R13-3561, 11.4.1.]

12.4.2. To demonstrate compliance with Condition 12.1.1. of this permit, the permittee shall maintain a record of the compressor blowdown events and estimated volume per event (scf) on a monthly and rolling twelve-month total.
[45CSR13, R13-3561, 11.4.2.]

12.4.3. To demonstrate compliance with Condition 12.1.2. of this permit, the permittee shall maintain a record of the pigging events and estimated volume per event (scf) on a monthly and rolling twelve-month total.
[45CSR13, R13-3561, 11.4.3.]

12.4.4. To demonstrate compliance with Condition 12.1.3. of this permit, the permittee shall maintain a record of the shutdown events and estimated volume per event (scf) on a monthly and rolling twelve-month total.
[45CSR13, R13-3561, 11.4.4.]

12.4.5. For the purpose of demonstrating compliance with Conditions 12.1.8. and 12.2.1., the permittee shall maintain records of the times and duration of all periods which the pilot flame was absent.
[45CSR13, R13-3561, 11.4.5.]

12.4.6. For the purpose of demonstrating compliance with the requirements set forth in Conditions 12.1.7.b. and c., the permittee shall maintain records of testing conducted in accordance with Condition 12.3.1.
[45CSR13, R13-3561, 11.4.6.]

12.4.7. The permittee shall document and maintain the corresponding records specified by the on-going monitoring requirements of Section 12.2. and testing requirements of Section 12.3.
[45CSR13, R13-3561, 11.4.7.]

12.5. Reporting Requirements

12.5.1. If the permittee is required by the Director to demonstrate compliance with Condition 12.3.1., the permittee shall submit the testing results within sixty (60) days of testing and provide all supporting calculations and testing data.
[45CSR13, R13-3561, 11.5.1.]

12.5.2. Any deviation(s) from the allowable visible emission requirement for any emission source discovered during observations using 40 C.F.R. Part 60, Appendix A, Method 9 or 22 shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but in any case within ten (10) calendar days of the occurrence and shall include at least the following information: the results of the visible determination of opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned.
[45CSR13, R13-3561, 11.5.2.]

12.5.3. Any deviation(s) from the flare design and operation criteria in Condition 12.1.9. and Permit Application R13-3561 shall be reported in writing to the Director of the Division of Air Quality as soon as practicable, but no later than ten (10) calendar days of discovery of such deviation.
[45CSR13, R13-3561, 11.5.3.]

12.5.4. The permittee shall report to the Director, the time, cause of event, estimate of emissions and corrective actions taken when the flare was used for an emergency at the facility.
[45CSR13, R13-3561, 11.5.4.]

12.5.5. Any time the air pollution control device is not operating when emissions are vented to it shall be reported in writing to the Director of the DAQ as soon as practicable, but within ten (10) calendar days of the discovery.
[45CSR13, R13-3561, 11.5.5.]

12.6. Compliance Plan

12.6.1. None.

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Thu, Oct 24, 2024 at 12:15 AM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Sorry for the delayed response.

Yes, to combustion chamber like Mountaineer and Pioneer. For the manufacturer's operation and maintenance specifications, they are kept online, and are easily accessible will this be an issue?

From: Barron, Sarah K <sarah.k.barron@wv.gov>
Sent: Wednesday, October 23, 2024 7:09 AM
To: Steeber, Jeff <Jeff.Steeber@Williams.com>

[Quoted text hidden]

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Wed, Oct 23, 2024 at 7:09 AM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Hi, Jeff.

I just wanted to check if you received my previous email about adding monitoring and recordkeeping requirements for the thermal oxidizers at the Ridgeline Compressor Station? Please, let me know as soon as practicable.

Thanks,
- Sarah

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Wed, Oct 16, 2024 at 8:35 AM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Jeff,

Thanks for the information. Similarly to the Title V permit for the Pioneer Compressor Station, further monitoring/recordkeeping is needed to demonstrate compliance with the thermal oxidizers' combustion chamber temperatures. Is there any issue with including requirements to continuously monitor and record the combustion chamber's temperature and to maintain a copy of the manufacturer's operation and maintenance specifications on-site?

Thanks,
- Sarah

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com>
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Tue, Oct 8, 2024 at 3:23 PM

Good Afternoon Sarah,

1. The minimum combustion chamber temperature of the thermal oxidizers will be 1,700F, as provided in the application.
2. Maximum incinerator capacity (lbs/hr):
    a. TOx-01: 573.71 lbs/hr Design Max
    b. TOx-02: 416.63 lbs/hr Design Max
    c. FLR-01: 384,399 lbs/hr Design Max (Average: 295.03 lbs/hr)

Maximum Incinerator Capacity				**ton/hr**	**Applicable factor F (5.43)**	
TOx-01	**Total**	573.71	**lb/hr**	0.29	1.56	lb/hr
TOx-02	**Total**	416.63	**lb/hr**	0.21	1.13	lb/hr
FLR-01 (Average)	**Total**	295.03	**lbs/hr**	0.15	0.40	lb/hr

Please let me know if you have any questions

Jeff

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Tue, Oct 8, 2024 at 10:04 AM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Good Morning Sarah,

1. The minimum combustion chamber temperature of the thermal oxidizers will be 1,700F, as provided in the application.
2. Working through finalization and will have values over this afternoon.

From: Barron, Sarah K <sarah.k.barron@wv.gov>
Sent: Tuesday, May 21, 2024 8:14 AM
To: Steeber, Jeff <Jeff.Steeber@Williams.com>
Subject: [EXTERNAL] Title V Permit - Request for Information; Application No. R30-05100261-2024

Jeff,

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Mon, Sep 30, 2024 at 7:38 AM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Good Morning Sarah,

Apologies I was out of the office last week, I will return this afternoon and follow up with information.

Thanks,

Jeff

From: Barron, Sarah K <sarah.k.barron@wv.gov>
Sent: Tuesday, September 17, 2024 7:07 AM
To: Steeber, Jeff <Jeff.Steeber@Williams.com>
Subject: [EXTERNAL] Re: Title V Permit - Request for Information; Application No. R30-05100261-2024

[Quoted text hidden]

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Tue, Sep 17, 2024 at 7:06 AM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Hi, Jeff.

Do you have an update for the thermal oxidizers and flare at the Ridgeline Compressor Station?

Thanks,
- Sarah

Barron, Sarah K <sarah.k.barron@wv.gov>

Title V Permit - Request for Information; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Tue, May 21, 2024 at 8:14 AM
To: Jeff.Steeber@williams.com

Jeff,

I have a few questions for you regarding the initial Title V permit application for the Ridgeline Compressor Station.

1. Condition 7.1.3.c. of R13-3561 contains a requirement that the thermal oxidizers must be operated according to the manufacturer's specifications for the minimum combustion chamber temperature. Similarly to the initial permit for the Pioneer Compressor Station, the minimum combustion chamber temperature necessary to achieve the 99.5% control efficiency should be added to this requirement. Are the thermal oxidizers' minimum combustion chamber temperatures different from the operating temperatures referenced in the proposals included in the application? If so, would you provide documentation from the manufacturer with the minimum combustion chamber temperature of each unit?

2. The thermal oxidizers and the flare are subject to the particulate matter emissions limit of 45CSR6-4.1. Please send the maximum incinerator capacity (lbs/hr) of the thermal oxidizers and the flare so that this limit can be calculated for each unit and included in the operating permit.

Please let me know if you have any questions or would like to discuss either of these topics further.

Thanks,
- Sarah

--
Sarah Barron
Engineer Trainee
West Virginia Department of Environmental Protection
Division of Air Quality
(304) 414-1915
sarah.k.barron@wv.gov

Barron, Sarah K <sarah.k.barron@wv.gov>

Completeness Determination, Ridgeline Compressor Station, Application No. R30-05100261-2024

3 messages

Barron, Sarah K <sarah.k.barron@wv.gov> Mon, Feb 5, 2024 at 12:59 PM
To: t.j.rinke@williams.com, "Steeber, Jeff" <Jeff.Steeber@williams.com>

Your Title V application for a permit to operate the above referenced facility was received by this Division on February 02, 2024. After review of said application, it has been determined that the application is administratively complete as submitted. Therefore, the above referenced facility qualifies for an Application Shield.

The applicant has the duty to supplement or correct the application. Any applicant who fails to submit any relevant facts or who has submitted incorrect information in a permit application shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant shall provide additional information as necessary to address any requirements that become applicable to the source after the date it filed a complete application but prior to release of a draft permit.

The submittal of a complete application shall not affect the requirement that any source have all **preconstruction permits** required under the rules of the Division.

If during the processing of this application it is determined that additional information is necessary to evaluate or take final action on this application, a request for such information will be made in writing with a reasonable deadline for a response. Until which time as your renewal permit is issued or denied, please continue to operate this facility in accordance with 45CSR30, section 6.3.c. which states: *If the Secretary fails to take final action to deny or approve a timely and complete permit application before the end of the term of the previous permit, the permit shall not expire until the renewal permit has been issued or denied, and any permit shield granted for the permit shall continue in effect during that time.* This protection shall cease to apply if, subsequent to the completeness determination made pursuant to paragraph 6.1.d. of 45CSR30 and as required by paragraph 4.1.b., the applicant fails to submit by the deadline specified in writing any additional information identified as being needed to process the application.

Please remember, **failure of the applicant to timely submit information required or requested to process the application may cause the Application Shield to be revoked.** Should you have any questions regarding this determination, please contact me.

Sincerely,

Sarah Barron

--
Sarah Barron
Technical Analyst Trainee
West Virginia Department of Environmental Protection
Division of Air Quality
(304) 926-0499 ext. 41915
sarah.k.barron@wv.gov

Steeber, Jeff <Jeff.Steeber@williams.com> Mon, Feb 5, 2024 at 1:19 PM
To: "sarah.k.barron@wv.gov" <sarah.k.barron@wv.gov>

Your message

To: Steeber, Jeff
Subject: [EXTERNAL] Completeness Determination, Ridgeline Compressor Station, Application No. R30-05100261-2024
Sent: Monday, February 5, 2024 12:59:14 PM (UTC-05:00) Eastern Time (US & Canada)

was read on Monday, February 5, 2024 1:19:01 PM (UTC-05:00) Eastern Time (US & Canada).

Rinke, TJ <T.J.Rinke@williams.com> Tue, Feb 6, 2024 at 10:10 AM
To: "sarah.k.barron@wv.gov" <sarah.k.barron@wv.gov>

Your message

To: Rinke, TJ
Subject: [EXTERNAL] Completeness Determination, Ridgeline Compressor Station, Application No. R30-05100261-2024
Sent: Monday, February 5, 2024 11:59:14 AM (UTC-06:00) Central Time (US & Canada)

was read on Tuesday, February 6, 2024 9:09:43 AM (UTC-06:00) Central Time (US & Canada).

Barron, Sarah K <sarah.k.barron@wv.gov>

Completeness Determination, Ridgeline Compressor Station, Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Mon, Feb 5, 2024 at 12:53 PM
To: Jeff.Steeber@williams.com, t.j.rinke@williams.com

Your Title V application for a permit to operate the above referenced facility was received by this Division on February 02, 2024. After review of said application, it has been determined that the application is administratively complete as submitted. Therefore, the above referenced facility qualifies for an Application Shield.

The applicant has the duty to supplement or correct the application. Any applicant who fails to submit any relevant facts or who has submitted incorrect information in a permit application shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant shall provide additional information as necessary to address any requirements that become applicable to the source after the date it filed a complete application but prior to release of a draft permit.

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If during the processing of this application it is determined that additional information is necessary to evaluate or take final action on this application, a request for such information will be made in writing with a reasonable deadline for a response. Until which time as your renewal permit is issued or denied, please continue to operate this facility in accordance with 45CSR30, section 6.3.c. which states: *If the Secretary fails to take final action to deny or approve a timely and complete permit application before the end of the term of the previous permit, the permit shall not expire until the renewal permit has been issued or denied, and any permit shield granted for the permit shall continue in effect during that time.* This protection shall cease to apply if, subsequent to the completeness determination made pursuant to paragraph 6.1.d. of 45CSR30 and as required by paragraph 4.1.b., the applicant fails to submit by the deadline specified in writing any additional information identified as being needed to process the application.

Please remember, **failure of the applicant to timely submit information required or requested to process the application may cause the Application Shield to be revoked.** Should you have any questions regarding this determination, please contact me.

Sincerely,

Sarah Barron

--
Sarah Barron
Technical Analyst Trainee
West Virginia Department of Environmental Protection
Division of Air Quality
(304) 926-0499 ext. 41915
sarah.k.barron@wv.gov

Barron, Sarah K <sarah.k.barron@wv.gov>

Ridgeline Compressor Station; Application No. R30-05100261-2024

Steeber, Jeff <Jeff.Steeber@williams.com> Mon, Feb 5, 2024 at 11:41 AM
To: "Barron, Sarah K" <sarah.k.barron@wv.gov>

Hi Sarah,

Apologies about that – appears a bunch of pages accidentally got rearranged.

Here is the complete corrected version.

Thank you,

Jeff

From: Barron, Sarah K <sarah.k.barron@wv.gov>
Sent: Monday, February 5, 2024 11:25 AM
To: Steeber, Jeff <Jeff.Steeber@Williams.com>
Subject: [EXTERNAL] Ridgeline Compressor Station; Application No. R30-05100261-2024

[Quoted text hidden]

2023-000-Ridgeline-TVOP Application-112423.pdf
7809K

Division of Air Quality Permit Application Submittal

Please find attached a permit application for:

Appalachia Midstream Services, LLC; Ridgeline Compressor Station

[Company Name; Facility Location]

- DAQ Facility ID (for existing facilities only): **051-00261**
- Current 45CSR13 and 45CSR30 (Title V) permits associated with this process (for existing facilities only): **NSR: R13-3561**

- Type of NSR Application (check all that apply):
  - ☐ Construction
  - ☐ Modification
  - ☐ Class I Administrative Update
  - ☐ Class II Administrative Update
  - ☐ Relocation
  - ☐ Temporary
  - ☐ Permit Determination

- Type of 45CSR30 (TITLE V) Application:
  - ☒ **Title V Initial**
  - ☐ Title V Renewal
  - ☐ Administrative Amendment**
  - ☐ Minor Modification**
  - ☐ Significant Modification**
  - ☐ Off Permit Change

**If the box above is checked, include the Title V revision information as ATTACHMENT S to the combined NSR/Title V application.

- Payment Type:
  - ☐ Credit Card (Instructions to pay by credit card will be sent in the Application Status email.)
  - ☐ Check (Make checks payable to: WVDEP – Division of Air Quality)
    Mail checks to:
    WVDEP – DAQ – Permitting
    Attn: NSR Permitting Secretary
    601 57th Street, SE Charleston, WV 25304

Please wait until DAQ emails you the Facility ID Number and Permit Application Number. Please add these identifiers to your check or cover letter with your check.

- If the permit writer has any questions, please contact (all that apply):
  - ☐ Responsible Official/Authorized Representative
    - Name:
    - Email:
    - Phone Number:
  - ☒ **Company Contact**
    - Name: **Jeff Steeber, Environmental Specialist**
    - Email: **Jeff.Steeber@Williams.com**
    - Phone Number: **(304) 650-4741**
  - ☐ Consultant
    - Name:
    - Email:
    - Phone Number:

Appalachia Midstream Services, LLC
100 Teletech Drive, Suite 2
Moundsville, WV 26041-2352

February 2, 2024

Via e-mail to: DEPAirQualityPermitting@wv.gov
Appalachia Midstream Services, LLC; Ridgeline Compressor Station

Carrie McCumbers
Title V Permits Program Manager
West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street SE
Charleston, WV 25304-2345

Subject: **Application for 45CSR30 Title V Operating Permit**
Appalachia Midstream Services, LLC – Ridgeline Compressor Station
Plant ID No. 051-00261
Marshall County, West Virginia

Dear Ms. McCumbers:

Appalachia Midstream Services, LLC is submitting an Application for a 45CSR30 Title V Operating Permit for the existing Ridgeline Compressor Station located at 249 US-250, Cameron, in Marshall County, West Virginia.

If you have any questions concerning this submittal, or need additional information, please contact me by telephone at (304) 650-4741 or by e-mail at Jeff.Steeber@Williams.com.

Sincerely,

Jeff Steeber

Jeff Steeber
Environmental Specialist

Attachments:
- Facility-Wide Potential to Emit (PTE)
- Title V Operating Permit Application – Checklist

Enclosures:
- Application for Title V Operating Permit
- Attachments A thru H
- Supplements S1 thru S6

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Facility-Wide Potential to Emit (PTE) [Tons per Year]

Unit ID	Point ID	Control ID	Description	NOX	CO	VOC (w/HCHO)	SO2	PM10/2.5	TOTAL HAPs
Ridgeline Compressor Station - Point Sources									
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	0.22	1.39	0.46	1E-03	0.02	0.15
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	---	---	9.22	---	---	0.70
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	---	---	2.42	---	---	0.18
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	7.09	3.54	4.78	0.03	0.50	1.47
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	20.36	20.65	2.37	1.16	3.40	0.36
TSS	10E	---	Compressor Turbine Start/Stop	0.10	3.80	1.04	---	---	0.08
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	---	---	3.71	---	---	0.28
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	---	---	0.70	---	---	0.03
DSV-01	13E		Dehydrator 01 - Still Vent	---	---	3.14	---	---	1.59
RBV-01	14E	---	Dehydrator 01 - Reboiler	0.86	0.72	0.05	0.01	0.07	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	---	---	0.78	---	---	0.03
DSV-02	16E		Dehydrator 02 - Still Vent	---	---	2.94	---	---	1.55
RBV-02	17E	---	Dehydrator 02 - Reboiler	0.86	0.72	0.05	0.01	0.07	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	---	---	0.04	---	---	0.01
TK-02	19E	---	Storage Tank 02 - Produced Water	---	---	0.04	---	---	0.01
TK-03	20E	---	Storage Tank 03 - Produced Water	---	---	0.04	---	---	0.01
TK-04	21E	---	Storage Tank 04 - Produced Water	---	---	0.04	---	---	0.01
TLO	22E	---	Truck Load-Out - Produced Water	---	---	1.66	---	---	0.24
PIG	23E	FLR-01 (26E)	Pigging Operations	---	---	0.52	---	---	0.04
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	3.27	10.33	0.18	0.02	0.25	0.06
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	2.88	9.10	0.16	0.02	0.22	0.05
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	2.95	9.34	0.16	0.02	0.22	0.06
			Total Point Sources:	**115.84**	**112.26**	**90.15**	**1.64**	**11.27**	**20.10**
Total Fugitive Sources:									
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	---	---	3.15	---	---	0.24
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	---	---	8.94	---	---	1.29
			Total Facility-Wide:	**---**	**---**	**12.08**	**---**	**---**	**1.53**
Ridgeline Compressor Station - Total PTE									
			Total Facility-Wide:	**115.84**	**112.26**	**102.23**	**1.64**	**11.27**	**21.63**

Important Notes: Title V Operating Permit (TVOP) Applicability:

* Criteria pollutant fugitives are **not included** in TVOP major source determinations because the facility is not a listed source category.
* Hazardous air pollutant (HAP) fugitives are **always included** in TVOP major source determinations.
* Greenhouse gases (GHG) are **not included** in TVOP major source determinations.

1 - Emissions based on 100% of rated load for 8,760 hr/yr, including Compressor Blowdown (CBD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01), each with intermittent operations.
2 - VOC is volatile organic compounds, as defined by EPA, includes HCHO (formaldehyde).
3 - HCHO is formaldehyde and is the individual HAP with the highest PTE.
4 - Total HAP is total hazardous air pollutants, including, but not limited to: acetaldehyde, acrolein, benzene, ethylbenzene, formaldehyde (HCHO), n-hexane, methanol (MeOH), toluene, 2,2,4-trimethylpentane (2,2,4-TMP or i-octane), and xylenes.
5 - CO2e is aggregated Greenhouse Gas (GHG) emissions, comprised of: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), as adjusted for Global Warming Potential (GWP).

TITLE V PERMIT APPLICATION CHECKLIST
FOR ADMINISTRATIVE COMPLETENESS

A complete application is demonstrated when all of the information required below is properly prepared, completed and attached. The items listed below are required information which must be submitted with a Title V permit application. Any submittal will be considered incomplete if the required information is not included.*	
☑	A signed copy of the application ("Certification" page must be signed and dated by a Responsible Official as defined in 45CSR30)
☑	*Table of Contents (needs to be included but not for administrative completeness)
☑	Facility information
☑	Description of process and products, including NAICS and SIC codes, and including alternative operating scenarios
☑	Area map showing plant location
☑	Plot plan showing buildings and process areas
☑	Process flow diagram(s), showing all emission units, control equipment, emission points, and their relationships
☑	Identification of all applicable requirements with a description of the compliance status, the methods used for demonstrating compliance, and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the source is not in compliance
☑	Listing of all active permits and consent orders (if applicable)
☑	Facility-wide emissions summary
☑	Identification of Insignificant Activities
☑	ATTACHMENT D – Title V Equipment Table completed for all emission units at the facility except those designated as insignificant activities
☑	ATTACHMENT E – Emission Unit Form completed for each emission unit listed in the Title V Equipment Table (ATTACHMENT D) and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the emission unit is not in compliance
☑	ATTACHMENT G – Air Pollution Control Device Form completed for each control device listed in the Title V Equipment Table (ATTACHMENT D)
☑	ATTACHMENT H – Compliance Assurance Monitoring (CAM) Plan Form completed for each control device for which the "Is the device subject to CAM?" question is answered "Yes" on the Air Pollution Control Device Form (ATTACHMENT G)
☑	General Application Forms signed by a Responsible Official
☐	Confidential Information submitted in accordance with 45CSR31

Application for
45CSR30 Title V Operating Permit

For the:

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Plant ID No. 051-00261

Marshall County, West Virginia

Submitted to:

West Virginia
Department of Environmental Protection
Division of Air Quality

Submitted by:

Appalachia Midstream Services, LLC
100 Teletech Drive, Suite 2
Moundsville, WV 26041-2352

Prepared by:

EcoLogic Environmental Consultants, LLC
864 Windsor Court
Santa Barbara, CA 93111-1037

December 2023

Application for
45CSR30 Title V Operating Permit

Appalachia Midstream Services, LLC
Ridgeline Compressor Station
Plant ID No. 051-00261
Marshall County, West Virginia

Table of Contents

Application for
45CSR30 Title V Operating Permit

- **Section 1. General Information**
- **Section 2. Applicable Requirements**
- **Section 3. Facility-Wide Emissions**
- **Section 4. Insignificant Activities**
- **Section 5. Emission Units, Control Devices, and Emission Points**
- **Section 6. Certification of Information**

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

INITIAL/RENEWAL TITLE V PERMIT APPLICATION - GENERAL FORMS

Section 1: General Information

1. Name of Applicant (As registered with the WV Secretary of State's Office):

Appalachia Midstream Services, LLC

2. Facility Name or Location:

Ridgeline Compressor Station

3. DAQ Plant ID No.:

0 5 1 - 0 0 2 6 1

4. Federal Employer ID No. (FEIN):

2 6 - 3 6 7 8 9 7 2

5. Permit Application Type:

☑ **Initial Permit** — When did operations commence? **2021**
☐ Permit Renewal — What is the expiration date of the existing permit? **na**
☐ Update to Initial/Renewal Permit Application

6. Type of Business Entity:

☐ Corporation ☐ Government Agency ☑ **LLC**
☐ Partnership ☐ Limited Partnership

7. Is the Applicant the:

☐ Owner ☐ Operator ☑ **Both**

If the Applicant is not both the owner and operator, please provide the name and address of the other party.

na

8. Number of On-site Employees:

Less than ten (10)

9. Governmental Code:

☑ **Privately owned and operated; 0**
☐ Federally owned and operated; 1
☐ State government owned and operated; 2
☐ County government owned and operated; 3
☐ Municipality government owned and operated; 4
☐ District government owned and operated; 5

10. Business Confidentiality Claims

Does this application include confidential information (per 45CSR31)? ☐ Yes ☑ **No**

If yes, identify each segment of information on each page that is submitted as confidential, and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's "*PRECAUTIONARY NOTICE-CLAIMS OF CONFIDENTIALITY*" guidance.

11. Mailing Address		
Street or P.O. Box: Appalachia Midstream Services, LLC 100 Teletech Drive, Suite 2		
City: Moundsville	**State:** WV	**Zip:** 26041
Telephone Number: (304) 650-4741	**Fax Number:** na	

12. Facility Location					
Street: 249 US-250		**City:** Cameron		**County:** Marshall	
UTM Easting:	537.78 km E	**UTM Northing:**	4,403.01 km N	**Zone:** ☑ 17 ☐ 18	
Directions: From Cameron: 1) Head Southeast on US-250/Maple Ave ~5.1 mi; 2) Destination is on the Left.					
Portable Source? ☐ Yes ☑ **No**					
Is facility located w/in a nonattainment area? ☐ Yes ☑ **No**				**If yes, for what air pollutants?** na	
Is facility located w/in 50 miles of another state? ☑ **Yes** ☐ No				**If yes, name the affected state(s).** Ohio and Pennsylvania	
Is facility located w/in 100 km of a Class I Area[1]? ☐ Yes ☑ **No** **If no, do emissions impact a Class I Area[1]?** ☐ Yes ☑ **No**				**If yes, name the area(s).** na	

[1] *Class I areas include Dolly Sods and Otter Creek Wilderness Areas in West Virginia, and Shenandoah National Park James River Face Wilderness Area in Virginia.*

13. Contact Information		
Responsible Official: T. J. Rinke	**Title:** Vice President	
Street or P.O. Box: Appalachia Midstream Services, LLC One Williams Center		
City: Tulsa	**State:** OK	**Zip:** 74172-0140
Telephone Number: (918) 573-9968	**Cell Number:** na	
E-mail address: T.J.Rinke@Williams.com		
Environmental Contact: Jeff Steeber	**Title:** Environmental Specialist	
Street or P.O. Box: Appalachia Midstream Services, LLC 100 Teletech Drive, Suite 2		
City: Moundsville	**State:** WV	**Zip:** 26041-2790
Telephone Number: (304) 843-3125	**Cell Number:** (304) 650-4741	
E-mail address: jeff.steeber@williams.com		
Application Preparer: Walter Konkel, III	**Title:** Principal Scientist	
Company: EcoLogic Environmental Consultants, LLC		
Street or P.O. Box: 864 Windsor Court		
City: Santa Barbara	**State:** CA	**Zip:** 93111-1037
Telephone Number: (805) 964-7597	**Cell Number:** na	
E-mail address: wkonkel@elogicllc.com		

14. Facility Description

List all processes, products, NAICS and SIC codes for normal operation, in order of priority. Also list any process, products, NAICS and SIC codes associated with any alternative operating scenarios if different from those listed for normal operation.

Process	Products	NAICS	SIC
Natural Gas Compression	**Compressed and Dehydrated Natural Gas**	**213112***	**1389****
Natural Gas Dehydration			

*** NAICS 213112: Support Activities for Oil and Gas Operations**

**** SIC 1389: Oil and Gas Field Services, Not Elsewhere Classified**

Provide a general description of operations

Appalachia Midstream Services, LLC owns and operates the Ridgeline Compressor Station located at 249 US 250, approximately 3.5 miles South of Cameron in Marshall County, West Virginia.

The facility receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site. There is no on-site storage of condensate liquids.

Please reference SUPPLEMENT 1 – Process Description

15. Provide an **Area Map** showing plant location as **ATTACHMENT A**.

16. Provide a **Plot Plan(s)**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is located as **ATTACHMENT B**. For instructions, refer to "Plot Plan - Guidelines."

17. Provide a detailed **Process Flow Diagram(s)** showing each process or emissions unit as **ATTACHMENT C**. Process Flow Diagrams should show all emission units, control equipment, emission points, and their relationships.

18. Applicable Requirements Summary	
Instructions: Mark all applicable requirements.	
☐ SIP	☐ FIP
☑ **Minor Source NSR (45CSR13)**	☐ PSD (45CSR14)
☐ NESHAP (45CSR34)	☐ Nonattainment NSR (45CSR19)
☑ **Section 111 NSPS (JJJJ, KKKK and OOOOa)**	☑ **Section 112(d) MACT Standard (HH and ZZZZ)**
☐ Section 112(g) Case-by-case MACT	☐ 112(r) RMP
☐ Section 112(i) Early Reduction of HAP	☐ Consumer/Commercial Prod. Reqts., Sect 183(e)
☐ Section 129 Standards/Reqts.	☐ Stratospheric Ozone (Title VI)
☐ Tank Vessel Reqt., Section 183(f)	☐ Emissions Cap 45CSR§30-2.6.2
☐ NAAQS, Increments or Visibility (temp. sources)	☐ 45CSR27 State Enforceable Only Rule (CPU)
☑ **45CSR4 State Enforceable Only Rule (Odors)**	☐ Acid Rain (Title IV, 45CSR33)
☐ Emissions Trading and Banking (45CSR28)	☑ **Compliance Assurance Monitoring (40CFR64)**
☐ CAIR NOx Annual Trading Program (45CSR39)	☐ CAIR NOx Ozone Trading Program (45CSR40)
☐ CAIR SO2 Trading Program (45CSR41)	
<u>Please reference Supplement S2 - Regulatory Discussion</u>	

19. Non Applicability Determinations

List all requirements which the source has determined <u>not applicable</u> and for which a permit shield is requested. The listing shall also include the rule citation and the reason why the shield applies.

<u>Please reference Supplement S2 - Regulatory Discussion</u>

☑ **Permit Shield**

20. Facility-Wide Applicable Requirements

List all facility-wide applicable requirements. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements) .

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

☑ **Permit Shield**

For all facility-wide applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number and/or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

Are you in compliance with all facility-wide applicable requirements?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

21. Active Permits/Consent Orders

Permit or Consent Order Number	Date of Issuance MM/DD/YYYY	List any Permit Determinations that Affect the Permit (if any)
R13-3561	07/29/2022	na

22. Inactive Permits/Obsolete Permit Conditions

Permit Number	Date of Issuance	Permit Condition Number
G35-D137A	06/29/2021	na

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23. Facility-Wide Emissions Summary [Tons per Year] - Reference SUPPLEMENT 03 – Emission Calculations	
Criteria Pollutants	**Potential Emissions**
Carbon Monoxide (CO)	112.26
Nitrogen Oxides (NOx)	115.84
Lead (Pb)	---
Particulate Matter (PM2.5)[1]	11.27
Particulate Matter (PM10)[1]	11.27
Total Particulate Matter (TSP)	11.27
Sulfur Dioxide (SO2)	1.64
Volatile Organic Compounds (VOC)	102.23
Hazardous Air Pollutants[2]	**Potential Emissions**
Acetaldehyde	2.54
Acrolein	1.56
Benzene	0.43
Butadiene, 1,3-	0.08
Ethylbenzene	0.47
Fornaldehyde (HCHO	9.19
Hexane, n-	2.61
Methanol (MeOH)	0.95
Polycyclic Organic Matter (POM/PAH)	0.12
Toluene	1.17
TMP, 2,2,4- (i-Octane)	0.21
Xylenes	2.18
Other/Trace HAP*	0.11
TOTAL HAPs	21.63
Regulated Pollutants other than Criteria and HAP	**Potential Emissions**
Carbon Dioxide (CO_2)	142,078
Nitrous Oxide (N_2O)	1.23
Methane (CH_4)	574.72
CO_2 equivalent (CO_2e)	156,814

[1] *PM2.5 and PM10 are components of TSP.*

[2] *For HAPs that are also considered PM or VOCs, emissions should be included in both the HAPs section and the Criteria Pollutants section.*

* Other/Trace HAPs include: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

24. Insignificant Activities (Check all that apply)		
☑	1	Air compressors and pneumatically operated equipment, including hand tools.
☑	2	Air contaminant detectors or recorders, combustion controllers or shutoffs.
☑	3	Any consumer product used in the same manner as in normal consumer use, provided the use results in a duration and frequency of exposure which are not greater than those experienced by consumer, and which may include, but not be limited to, personal use items; janitorial cleaning supplies, office supplies and supplies to maintain copying equipment.
☑	4	Bathroom/toilet vent emissions.
☑	5	Batteries and battery charging stations, except at battery manufacturing plants.
☑	6	Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents. Many lab fume hoods or vents might qualify for treatment as insignificant (depending on the applicable SIP) or be grouped together for purposes of description.
☐	7	Blacksmith forges.
☐	8	Boiler water treatment operations, not including cooling towers.
☑	9	Brazing, soldering or welding equipment used as an auxiliary to the principal equipment at the source.
☐	10	CO2 lasers, used only on metals and other materials which do not emit HAP in the process.
☑	11	Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources.
☑	12	Combustion units designed and used exclusively for comfort heating that use liquid petroleum gas or natural gas as fuel.
☑	13	Comfort air conditioning or ventilation systems not used to remove air contaminants generated by or released from specific units of equipment.
☐	14	Demineralized water tanks and demineralizer vents.
☐	15	Drop hammers or hydraulic presses for forging or metalworking.
☐	16	Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substances being processed in the ovens or autoclaves or the boilers delivering the steam.
☐	17	Emergency (backup) electrical generators at residential locations.
☐	18	Emergency road flares.
☑	19	Emission units which do not have any applicable requirements and which emit criteria pollutants (CO, NOx, SO2, VOC and PM) into the atmosphere at a rate of less than 1 pound per hour and less than 10,000 pounds per year aggregate total for each criteria pollutant from all emission units. Please specify all emission units for which this exemption applies along with the quantity of criteria pollutants emitted on an hourly and annual basis **- See next page - Misc Storage Tanks.**
☑	20	Emission units which do not have any applicable requirements and which emit hazardous air pollutants into the atmosphere at a rate of less than 0.1 pounds per hour and less than 1,000 pounds per year aggregate total for all HAPs from all emission sources. This limitation cannot be used for any source which emits dioxin/furans nor for toxic air pollutants as per 45CSR27. Please specify all emission units for which this exemption applies along with the quantity of hazardous air pollutants emitted on an hourly and annual basis **-- See next page - Misc Storage Tanks**

24. Insignificant Activities (Check all that apply) (Continued)

Emission Unit ID	Misc. Storage Tanks Emission Unit Description	Design Capacity	VOC		HAP	
			lb/hr	lb/yr	lb/hr	lb/yr
TK-05	Storage Tank - Lube Oil	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-06	Storage Tank - Used Oil	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-07	Storage Tank - Coolant	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-08	Storage Tank - Used Coolant	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-09	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-10	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-11	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-12	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-13	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-14	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-15	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-16	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-17	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-18	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-19	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-20	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-21	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-22	Storage Tank - Triethylene Glycol	1,000 gal	Negligible	Negligible	Negligible	Negligible
TK-23	Storage Tank - Triethylene Glycol	300 gal	Negligible	Negligible	Negligible	Negligible
TK-24	Storage Tank - Defoamer	500 gal	Negligible	Negligible	Negligible	Negligible

☑	21	Environmental chambers not using hazardous air pollutant (HAP) gases.
☑	22	Equipment on the premises of industrial and manufacturing operations used solely for the purpose of preparing food for human consumption.
☐	23	Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.
☑	24	Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis.
☑	25	Equipment used for surface coating, painting, dipping or spray operations, except those that will emit VOC or HAP.
☑	26	Fire suppression systems.
☐	27	Firefighting equipment and the equipment used to train firefighters.
☐	28	Flares used solely to indicate danger to the public.
☑	29	Fugitive emission related to movement of passenger vehicle provided the emissions are not counted for applicability purposes and any required fugitive dust control plan or its equivalent is submitted.
☐	30	Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation.
☑	31	Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic.
☐	32	Humidity chambers.

24. Insignificant Activities (Check all that apply) (Continued)		
☑	33	Hydraulic and hydrostatic testing equipment.
☑	34	Indoor or outdoor kerosene heaters.
☑	35	Internal combustion engines used for landscaping purposes.
☐	36	Laser trimmers using dust collection to prevent fugitive emissions.
☐	37	Laundry activities, except for dry-cleaning and steam boilers.
☑	38	Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.
☐	39	Oxygen scavenging (de-aeration) of water.
☐	40	Ozone generators.
☑	41	Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification. (Cleaning and painting activities qualify if they are not subject to VOC or HAP control requirements. Asphalt batch plant owners/operators must still get a permit if otherwise requested.)
☑	42	Portable electrical generators that can be moved by hand from one location to another. "Moved by Hand" means that it can be moved without the assistance of any motorized or non-motorized vehicle, conveyance, or device.
☐	43	Process water filtration systems and demineralizers.
☑	44	Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification.
☑	45	Repairs or maintenance where no structural repairs are made and where no new air pollutant emitting facilities are installed or modified.
☑	46	Routing calibration and maintenance of laboratory equipment or other analytical instruments.
☐	47	Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants. Shock chambers.
☐	48	Shock chambers.
☐	49	Solar simulators.
☑	50	Space heaters operating by direct heat transfer.
☑	51	Steam cleaning operations.
☐	52	Steam leaks.
☐	53	Steam sterilizers.
☐	54	Steam vents and safety relief valves.
☑	55	Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.
☑	56	Storage tanks, vessels, and containers holding or storing liquid substances that will not emit any VOC or HAP. Exemptions for storage tanks containing petroleum liquids or other volatile organic liquids should be based on size limits such as storage tank capacity and vapor pressure of liquids stored and are not appropriate for this list.
☐	57	Such other sources or activities as the Director may determine.
☑	58	Tobacco smoking rooms and areas.
☑	59	Vents from continuous emissions monitors and other analyzers.

25. Equipment Table
Fill out the **Title V Equipment Table** and provide it as **ATTACHMENT D**.
26. Emission Units
For each emission unit listed in the Title V Equipment Table, fill out and provide an **Emission Unit Form** as **ATTACHMENT E**.
For each emission unit not in compliance with an applicable requirement, fill out a **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**
27. Control Devices
For each control device listed in the **Title V Equipment Table**, fill out and provide an **Air Pollution Control Device Form** as **ATTACHMENT G**.
For any control device that is required on an emission unit in order to meet a standard or limitation for which the potential pre-control device emissions of an applicable regulated air pollutant is greater than or equal to the Title V Major Source Threshold Level, refer to the **Compliance Assurance Monitoring (CAM) Form(s)** for CAM applicability. Fill out and provide these forms, if applicable, for each Pollutant Specific Emission Unit (PSEU) as **ATTACHMENT H**.

Section 6: Certification of Information

28. Certification of Truth, Accuracy and Completeness and Certification of Compliance

Note: This Certification must be signed by a responsible official as defined in 45CSR§30-2.38.

a. Certification of Truth, Accuracy and Completeness

I certify that I am a responsible official (as defined at 45CSR§30-2.38) and am accordingly authorized to make this submission on behalf of the owners or operators of the source described in this document and its attachments. I certify under penalty of law that I have personally examined and am familiar with the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine and/or imprisonment.

b. Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

Responsible official (type or print)

Name:	**Title:**
T. J. Rinke	**Vice President**

Responsible official's signature:

Signature: DocuSigned by: TJ Rinke DE800755CD4A4F0... Signature Date: 1/25/2024 | 9:36 AM PST

(Must be signed and dated in blue ink or have a valid electronic signature)

Note: Please check all applicable attachments included with this permit application:	
☑	**ATTACHMENT A: Area Map**
☑	**ATTACHMENT B: Plot Plan(s)**
☑	**ATTACHMENT C: Process Flow Diagram(s)**
☑	**ATTACHMENT D: Equipment Table**
☑	**ATTACHMENT E: Emission Unit Form(s)**
☐	ATTACHMENT F: Schedule of Compliance Form(s) **(Not Applicable)**
☑	**ATTACHMENT G: Air Pollution Control Device Form(s)**
☑	**ATTACHMENT H: Compliance Assurance Monitoring (CAM) Form(s)**

All of the required forms and additional information can be found and downloaded from, the DEP website at www.dep.wv.gov/daq, requested by phone (304) 926-0475, and/or obtained through the mail.

Attachment A

Area Map

(2016 USGS 7.5 Minute Topo)

“15. Provide an Area Map showing plant location as ATTACHMENT A.”

- **Location:**
  Appalachia Midstream Services, LLC
  Ridgeline Compressor Station
  249 US-250 (~3.5 mi South of Cameron)
  Marshall County, WV 26033

- **Latitude and Longitude:**
  Lat: 39.776224°N x -80.558790°W

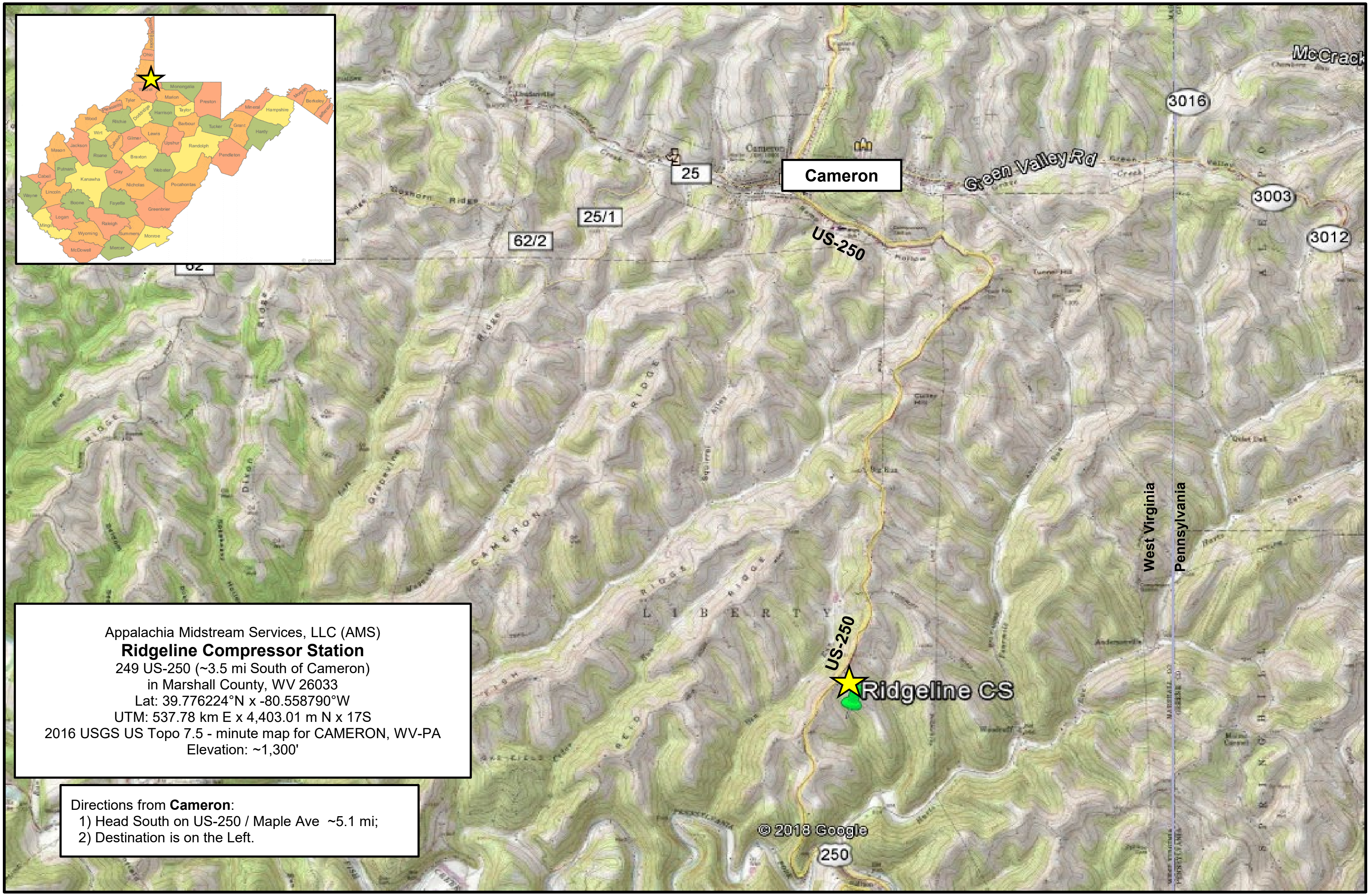
- **UTM:**
  537.78 km E x 4,403.01 m N x 17S

- **Elevation:**
  ~1,300 ft

- **USGS:**
  CAMERON, WV-PA Quadrangle
  7.5" Topographic – 2016

- **Directions:**
  From **Cameron**, West Virginia -
  1) Head South on US-250 / Maple Ave ~5.1 mi;
  2) Destination is on the Left.

Attachment A - Location Map



Appalachia Midstream Services, LLC (AMS)
Ridgeline Compressor Station
249 US-250 (~3.5 mi South of Cameron)
in Marshall County, WV 26033
Lat: 39.776224°N x -80.558790°W
UTM: 537.78 km E x 4,403.01 m N x 17S
2016 USGS US Topo 7.5 - minute map for CAMERON, WV-PA
Elevation: ~1,300'

Directions from **Cameron**:
1) Head South on US-250 / Maple Ave ~5.1 mi;
2) Destination is on the Left.

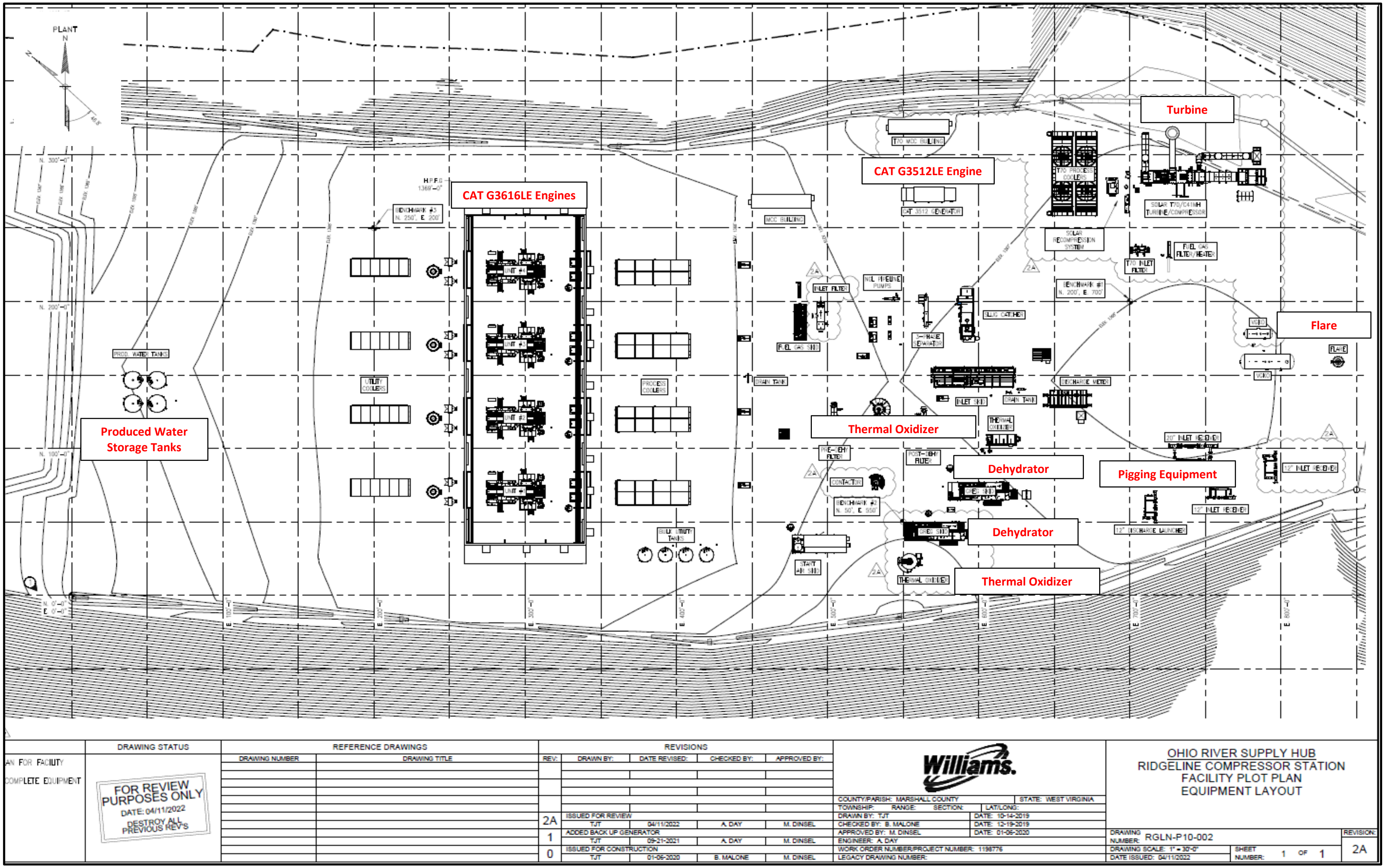
Attachment B

Plot Plan(s)

"16. Provide a Plot Plan(s), e.g., scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is located as ATTACHMENT B. For instructions, refer to Plot Plan - Guidelines."

- **Plot Plan – Ridgeline Compressor Station**

Attachment B - Plot Plan



Attachment C

Process Flow Diagram(s) (PFD)

"17. Provide a detailed Process Flow Diagram(s) showing each process or emissions unit as ATTACHMENT C. Process Flow Diagrams should show all emission units, control equipment, emission points, and their relationships."

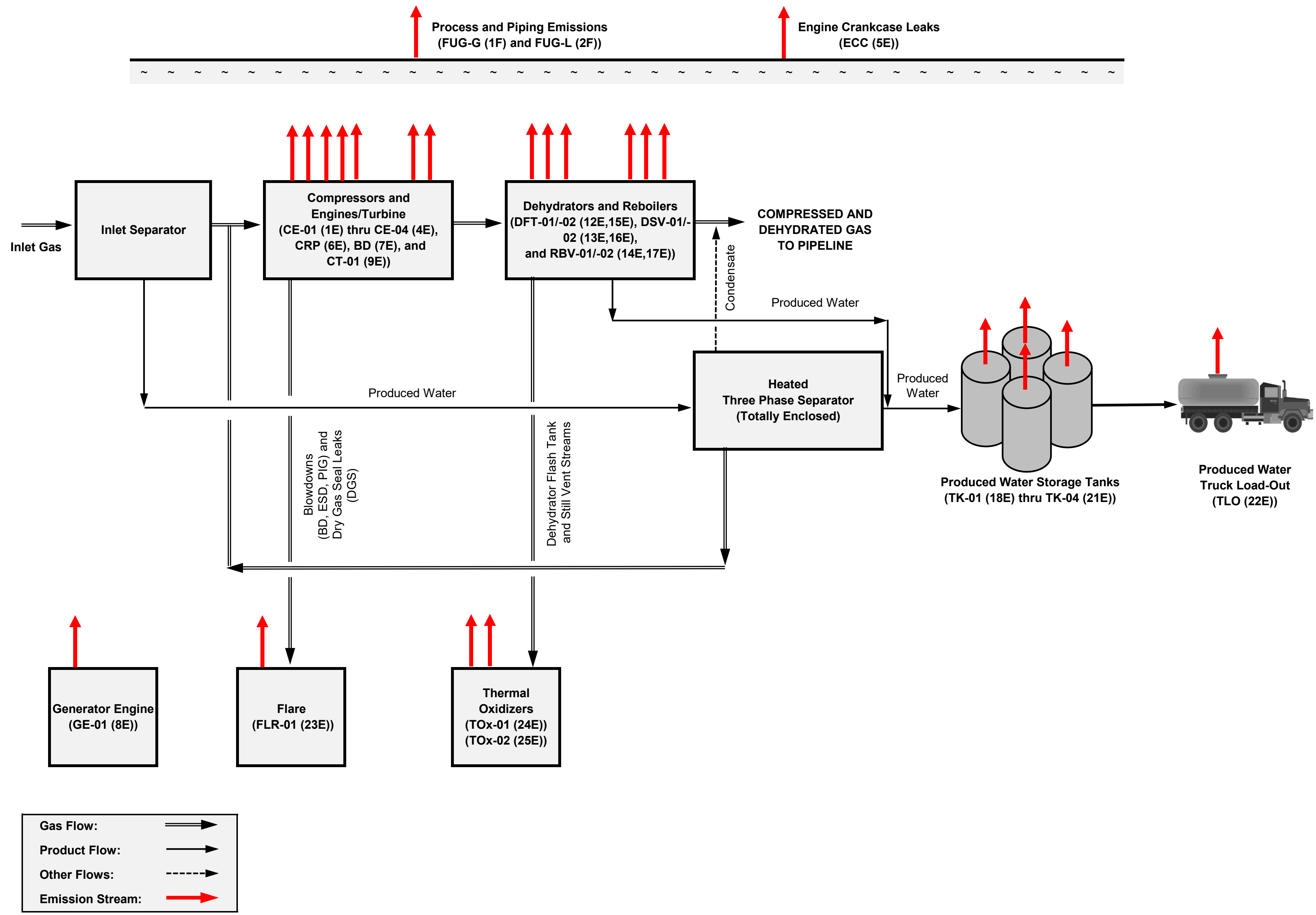
- **Process Flow Diagram (PFD) – Ridgeline Compressor Station**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment F - Process Flow Diagram (PFD)



Attachment D

Equipment Table

"25. Fill out the Title V Equipment Table and provide it as ATTACHMENT D."

- **Title V Equipment Table – Ridgeline Compressor Station**

Attachment D - Title V Equipment Table

(includes all emission units at the facility except those designated as insignificant activities in Section 4, Item 24 of the General Forms)

Emission Unit ID[1]	Emission Point ID[1]	Emission Unit Description	Year Installed	Design Capacity		Control Device[1]
CE-01	1E	Compressor Engine 01 - CAT G3616LE A4	2021	5,000	bhp	OxCat-01
CE-02	2E	Compressor Engine 02 - CAT G3616LE A4	2021	5,000	bhp	OxCat-02
CE-03	3E	Compressor Engine 03 - CAT G3616LE A4	2021	5,000	bhp	OxCat-03
CE-04	4E	Compressor Engine 04 - CAT G3616LE A4	2021	5,000	bhp	OxCat-04
ECC	5E	Engine Crankcase (CE-01 thru -04, GE-01)	2021	5	Engines	---
CRP	6E	Compressor Rod Packing (Comp-01 thru -04)	2021	4	Compr's	---
BD	7E	Blowdown (CBD and ESD)	2021	6	Compr's	FLR-01 (26E)
GE-01	8E	Generator Engine 01 - CAT G3512LE	2021	1,468	bhp	OxCat-05
CT-01	9E	Compressor Turbine 01 - Solar Taurus 70-10802S	2022	11,252	bhp	---
TSS	10E	Compressor Turbine Start/Stop	2022	104	Events/yr	---
DGS	11E	Centrifugal Compressor Dry Gas Seal Leaks	2022	11,252	bhp	---
DFT-01	12E	Dehydrator 01 - Flash Tank	2021	250	MMscfd	TOx-01 (24E)
DSV-01	13E	Dehydrator 01 - Still Vent	2021	250	MMscfd	
RBV-01	14E	Dehydrator 01 - Reboiler	2021	2.0	MMBtu/hr	---
DFT-02	15E	Dehydrator 02 - Flash Tank	2022	160	MMscfd	TOx-02 (25E)
DSV-02	16E	Dehydrator 02 - Still Vent	2022	160	MMscfd	
RBV-02	17E	Dehydrator 02 - Reboiler	2022	2.0	MMBtu/hr	---
TK-01	18E	Storage Tank 01 - Produced Water	2021	400	bbl	---
TK-02	19E	Storage Tank 02 - Produced Water	2021	400	bbl	---
TK-03	20E	Storage Tank 03 - Produced Water	2021	400	bbl	---
TK-04	21E	Storage Tank 04 - Produced Water	2021	400	bbl	---
TLO	22E	Truck Load-Out - Produced Water	2021	120,000	bbl/yr	---
PIG	23E	Pigging Operations	2021	4	Units	FLR-01 (26E)
TOx-01	24E	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	2021	7.61	MMBtu/hr	---
TOx-02	25E	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	2021	6.70	MMBtu/hr	---
FLR-01	26E	CBD/PIG Elevated Flare - Zeeco MJ-16	2021	7.00	MMBtu/hr	---
FUG-G	1F	Process Piping and Equipment Leaks - Gas	2021	4,981	Fittings	LDAR
FUG-L	2F	Process Piping and Equipment Leaks - Light Oil	2021	2,271	Fittings	

[1]For 45CSR13 permitted sources, the numbering system used for the emission points, control devices, and emission units should be consistent with the numbering system used in the 45CSR13 permit. For grandfathered sources, the numbering system should be consistent with registrations or emissions inventory previously submitted to DAQ. For emission points, control devices, and emissions units which have not been previously labeled, use the following 45CSR13 numbering system: 1S, 2S, 3S,... or other appropriate description for emission units; 1C, 2C, 3C,... or other appropriate designation for control devices; 1E, 2E, 3E, ... or other appropriate designation for emission points.

Attachment E

Emissions Unit Form(s)

"26a. For each emission unit listed in the Title V Equipment Table, fill out and provide an Emission Unit Form as ATTACHMENT E."

- Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions
- Engine Crankcase (ECC (5E)) Emissions
- Compressor Rod Packing (CRP (6E)) Emissions
- Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions
- Generator Engine (GE-01 (8E)) Emissions
- Compressor Turbine (CT-01 (9E)) Emissions
- Compressor Turbine Start/Stop (TSS (10E)) Emissions
- Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E)) Emissions
- Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions
- Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions
- Reboiler 01 and 02 (RBV-01 (14E and 17E)) Emissions
- Produced Water - Storage Tank (TK-01 (18E) thru TK-04 (21E)) Emissions
- Produced Water - Truck Load-Out (TLO (22E)) Emissions
- Pigging Operation (PIG (23E)) Emissions
- DFT-01/DSV-01 Thermal Oxidizer 01 (TOx-01 (24E)) Emissions
- DFT-02/DSV-02 Thermal Oxidizer 02 (TOx-02 (25E)) Emissions
- BD/PIG Elevated Flare (FLR-01 (26E)) Emissions
- Process Piping and Equipment Leak (FUG-G (1F)) Emissions – Gas
- Process Piping and Equipment Leak (FUG-L (2F)) Emissions – Liquid

Attachment E - Emission Unit Form

Emission Unit Description		**CE-01 thru CE-04 (each)**
Emission unit ID number: CE-01 thru CE-04 (each)	**Emission unit name:** Compressor Engine	**List any control devices associated with this emission unit:** OxCat-01 thru OxCat-04
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Natural gas-fueled, 4-stroke, lean-burn, reciprocating internal combustion engine (4SLB-RICE); drives a natural gas reciprocating compressor. Exhaust from combustion of the natural gas fuel in the engine is controlled by an oxidation catalyst.		
Manufacturer: Caterpillar	**Model number:** G3616LE	**Serial number(s):** ZZY0855, ZZY0860, ZZY0862, ZZY0940
Construction date: After 07/01/10	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 5,000 bhp		
Maximum Hourly Throughput: 37.33 MMBtu/hr (fuel)	**Maximum Annual Throughput:** 327,011 MMBtu/yr (fuel)	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___No Natural Gas		**If yes, is it?** ___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating: 5,000 bhp		**Type and Btu/hr rating of burners:** 37.33 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 36,598 scf/hr 320.60 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		**CE-01 thru CE-04 (each)**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**3.01**	**13.17**
Nitrogen Oxides (NOX)	**4.41**	**19.31**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.02**	**0.10**
Particulate Matter (PM10)	**0.02**	**0.10**
Total Particulate Matter (TSP)	**0.02**	**0.10**
Sulfur Dioxide (SO2)	**0.37**	**1.63**
Volatile Organic Compounds (VOC)	**3.18**	**13.92**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**0.12**	**0.55**
Acrolein	**0.08**	**0.34**
Benzene	**0.01**	**0.03**
Butadiene, 1,3-	**4E-03**	**0.02**
Ethylbenzene	**6E-04**	**3E-03**
Formaldehyde	**0.46**	**2.03**
Hexane, n-	**0.02**	**0.07**
Methanol	**0.04**	**0.16**
POM/PAH	**0.01**	**0.02**
Toluene	**0.01**	**0.03**
TMP, 2,2,4-	**4E-03**	**0.02**
Xylenes	**3E-03**	**0.01**
Other/Trace HAP	**5E-03**	**0.02**
Total HAP	**0.75**	**3.30**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**4,817**	**21,099**
Methane (CH4) (GWP=25)	**24.91**	**109.12**
Nitrous Oxide (N2O) (GWP=298)	**0.01**	**0.04**
CO2 Equivalent (CO2e)	**5,442**	**23,838**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	CE-01 thru CE-04 (each)

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

5.0. Source-Specific Requirements (Compressor Engines, CE-01 to CE-04, Generator Engine (GE-01))

5.1. Limitations and Standards

5.1.1. Maximum emissions from each of the 5,000 bhp natural gas fired reciprocating engines equipped with oxidation catalysts, Caterpillar G3616LE A4 (CE-01 – CE-04) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	4.41	19.31
Carbon Monoxide	3.01	13.17
Volatile Organic Compounds (includes formaldehyde)	3.18	13.92
Formaldehyde	0.46	2.03

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		ECC
Emission unit ID number: ECC	**Emission unit name:** Engine Crankcase (Sum of Five (5) Units)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Internal combustion results in a small but continual amount of blow-by, which occurs when some of the gases from combustion leak past the piston rings to end up inside the crankcase, causing pressure to build up in the crank case. These engine crankcase blow-by gases are vented to the atmosphere.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr (each)
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		ECC
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.32**	**1.39**
Nitrogen Oxides (NOX)	**0.05**	**0.22**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**3E-04**	**1E-03**
Volatile Organic Compounds (VOC)	**0.11**	**0.46**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**4E-03**	**0.02**
Acrolein	**2E-03**	**0.01**
Benzene	**2E-04**	**8E-04**
Butadiene, 1,3-	**1E-04**	**5E-04**
Ethylbenzene	**2E-05**	**8E-05**
Formaldehyde	**0.03**	**0.12**
Hexane, n-	**5E-04**	**2E-03**
Methanol	**1E-03**	**5E-03**
POM/PAH	**2E-04**	**7E-04**
Toluene	**2E-04**	**8E-04**
TMP, 2,2,4-	**1E-04**	**5E-04**
Xylenes	**8E-05**	**3E-04**
Other/Trace HAP	**1E-04**	**6E-04**
Total HAP	**0.04**	**0.15**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**55.88**	**244.77**
Methane (CH4) (GWP=25)	**0.29**	**1.27**
Nitrous Oxide (N2O) (GWP=298)	**1E-04**	**4E-04**
CO2 Equivalent (CO2e)	**63.14**	**276.54**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**ECC**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

There are no applicable requirements specified for this emissions unit.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		CRP
Emission unit ID number: CRP	**Emission unit name:** Compressor Rod Packing (Sum of Four (4) Units)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The reciprocating compressor operations result in emissions from the wear of mechanical seals around the piston rods over time. These emissions are generated from the compressors associated with the gas-fired compressor engines (CE-01 through CE-04).		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		CRP
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**2.11**	**9.22**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.01**	**0.02**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.01**	**0.02**
Formaldehyde	---	---
Hexane, n-	**0.11**	**0.48**
Methanol	**0.01**	**0.02**
POM/PAH	---	---
Toluene	**0.01**	**0.06**
TMP, 2,2,4-	**0.01**	**0.02**
Xylenes	**0.01**	**0.06**
Other/Trace HAP	---	---
Total HAP	**0.16**	**0.70**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.05**	**0.21**
Methane (CH4) (GWP=25)	**9.09**	**39.80**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**227.24**	**995**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**CRP**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		BD
Emission unit ID number: BD	**Emission unit name:** Compressor Blowdown and Emergency Shutdown Testing	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): When an engine or turbine is shutdown, the natural gas contained within the compressor and associated piping may be evacuated (compressor blowdown, BD). Additionally, there will be other infrequent emissions such as emergency shutdown (ESD) testing.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021-2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**BD**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	0.55	2.42
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	1E-03	0.01
Butadiene, 1,3-	---	---
Ethylbenzene	1E-03	0.01
Formaldehyde	---	---
Hexane, n-	0.03	0.13
Methanol	1E-03	0.01
POM/PAH	---	---
Toluene	3E-03	0.02
TMP, 2,2,4-	1E-03	0.01
Xylenes	3E-03	0.02
Other/Trace HAP	---	---
Total HAP	0.04	0.18
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	0.62	2.70
Methane (CH4) (GWP=25)	2.39	10.45
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	60.29	264

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Mass balance and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**BD**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

11.0. Source-Specific Hazardous Air Pollutant Requirements (CBD, PIG controlled by Elevated Flare, FLR-01)

11.1 Limitations and Standards

11.1.1 The maximum number of compressor blowdown (CBD) events per year shall not exceed 458 events, with an estimated 24,398,000 scf per year. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the compressor blowdown events at any given time during the previous twelve consecutive calendar months.

11.1.3 The maximum number of plant shutdown events per year shall not exceed 1 event, with an estimated 1,002,000 scf per event. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the plant shut downs at any given time during the previous twelve consecutive calendar months. Unscheduled emergency shutdowns shall not be counted as plant shutdown events.

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		GE-01
Emission unit ID number: GE-01	**Emission unit name:** Generator Engine	**List any control devices associated with this emission unit:** OxCat-05
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Natural gas-fueled, 4-stroke, lean-burn, reciprocating internal combustion engine (4SLB-RICE); drives a natural gas reciprocating compressor. Exhaust from combustion of the natural gas fuel in the engine is controlled by an oxidation catalyst.		
Manufacturer: Caterpillar	**Model number:** G3512LE	**Serial number(s):** E2T00222
Construction date: After 07/01/10	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 1,468 bhp		
Maximum Hourly Throughput: 11.38 MMBtu/hr (fuel)	**Maximum Annual Throughput:** 99,677 MMBtu/yr (fuel)	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___No Natural Gas		**If yes, is it?** ___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating: 1,468 bhp		**Type and Btu/hr rating of burners:** 11.38 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 11,156 scf/hr 97.72 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		GE-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.81**	**3.54**
Nitrogen Oxides (NOX)	**1.62**	**7.09**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.01**	**0.03**
Particulate Matter (PM10)	**0.01**	**0.03**
Total Particulate Matter (TSP)	**0.01**	**0.03**
Sulfur Dioxide (SO2)	**0.11**	**0.50**
Volatile Organic Compounds (VOC)	**1.09**	**4.78**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**0.07**	**0.33**
Acrolein	**0.05**	**0.20**
Benzene	**4E-03**	**0.02**
Butadiene, 1,3-	**2E-03**	**0.01**
Ethylbenzene	**4E-04**	**2E-03**
Formaldehyde	**0.16**	**0.71**
Hexane, n-	**0.01**	**0.04**
Methanol	**0.02**	**0.10**
POM/PAH	**3E-03**	**0.01**
Toluene	**4E-03**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**2E-03**	**0.01**
Other/Trace HAP	**3E-03**	**0.01**
Total HAP	**0.33**	**1.47**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**1,589**	**6,960**
Methane (CH4) (GWP=25)	**7.90**	**34.59**
Nitrous Oxide (N2O) (GWP=298)	**3E-03**	**0.01**
CO2 Equivalent (CO2e)	**1,787**	**7,828**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	GE-01

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

5.1.2. Maximum emissions from each of the 1,468 bhp natural gas fired emergency generator equipped with oxidation catalyst, Caterpillar G3512LE (GE-01) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	1.62	7.09
Carbon Monoxide	0.81	3.54
Volatile Organic Compounds (includes formaldehyde)	1.09	4.78

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		CT-01
Emission unit ID number: CT-01	**Emission unit name:** Compressor Turbine	**List any control devices associated with this emission unit:** na

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

Natural gas-fueled, SoLoNOx turbine drives a natural gas centrifugal compressor. Exhaust from combustion of the natural gas fuel in the turbine is vented to the atmosphere.

Manufacturer: Solar Turbines, Inc.	**Model number:** Taurus 70-10802S	**Serial number(s):** 0850B
Construction date: After 07/01/10	**Installation date:** 2022	**Modification date(s):** na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

11,252 bhp

Maximum Hourly Throughput: 83.87 MMBtu/hr (fuel)	**Maximum Annual Throughput:** 734,701 MMBtu/yr (fuel)	**Maximum Operating Schedule:** 8,760 hr/yr

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? _X_ Yes ___No Natural Gas	**If yes, is it?** ___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating: 11,252 bhp	**Type and Btu/hr rating of burners:** 83.87 MMBtu/hr

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

Natural gas 82,225 scf/hr 720.30 MMscf/yr

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		CT-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**5.11**	**20.65**
Nitrogen Oxides (NOX)	**5.04**	**20.36**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.84**	**3.40**
Particulate Matter (PM10)	**0.84**	**3.40**
Total Particulate Matter (TSP)	**0.84**	**3.40**
Sulfur Dioxide (SO2)	**0.29**	**1.16**
Volatile Organic Compounds (VOC)	**0.59**	**2.37**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**3E-03**	**0.01**
Acrolein	**5E-04**	**2E-03**
Benzene	**8E-05**	**3E-04**
Butadiene, 1,3-	**4E-05**	**1E-04**
Ethylbenzene	**3E-03**	**0.01**
Formaldehyde	**0.06**	**0.24**
Hexane, n-	**---**	**---**
Methanol	**---**	**---**
POM/PAH	**3E-03**	**0.01**
Toluene	**0.01**	**0.04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**5E-03**	**0.02**
Other/Trace HAP	**2E-03**	**0.01**
Total HAP	**0.09**	**0.36**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**9,226**	**37,436**
Methane (CH4) (GWP=25)	**2.94**	**11.91**
Nitrous Oxide (N2O) (GWP=298)	**0.25**	**1.02**
CO2 Equivalent (CO2e)	**9,374**	**38,038**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**CT-01**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

6.0. Source-Specific Requirements (Turbine (CT-01))

6.1. Limitations and Standards

6.1.1. The Solar Taurus 70 Combustion Turbine (CT-01) shall be operated and maintained in accordance with the manufacturer's recommendations and specifications and in a manner consistent with good operating practices and shall only burn natural gas.

6.1.2. The following conditions and requirements are specific to the Solar Taurus 70 Combustion Turbine (CT-01):

Emissions from the combustion turbine (CT-01) shall not exceed the following:

i. Emissions of nitrogen oxides (NO_x) shall be controlled with the combustion controls when ambient temperatures are above 0°F and the load is at or above 50%. The turbine shall not discharge nitrogen oxides (NO_x) emissions in excess of 15 ppm at 15 percent O_2 when operating at load conditions at or above 75 percent of peak load and/or when operating temperatures are at or above 0^0F. When the operating loads of the turbine are less than 75% of peak load and/or operating temperatures are less than 0^0F, NO_x emissions rate from the turbine shall not exceed 150 ppm at 15 percent O_2. Annual NO_x emissions from the turbine shall not exceed 20.46 tpy on a 12-month rolling total. This limit applies at all times, including periods of startup, shutdown, or malfunction.
[40CFR§§60.4320(a), Table 1 to Subpart KKKK of Part 60 – Nitrogen Oxides Emission Limits for New Stationary Combustion Turbines]

ii. Emissions of CO from the combustion turbine shall not exceed 24.45 tons per year on a rolling 12 month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction.

iii. Emissions of SO_2 shall not exceed 0.003 lb of SO_2/MMBtu heat input. For purposes of demonstrating compliance with this limit, the permittee shall maintain the Federal Energy Regulatory Commission (FERC) tariff limit on total sulfur content of 20 grains of sulfur or less per 100 standard cubic feet of natural gas combusted in the turbines.
[40 CFR §§60.4330(a)(2) & 60.4365(a) and 40 CSR §10-]

iv. Emissions of VOC shall not exceed 3.41 tons per year on a rolling 12 month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction. This limit does not apply to the fugitives from the compressor.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes**	☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**	

Attachment E - Emission Unit Form

Emission Unit Description		TSS
Emission unit ID number: TSS	**Emission unit name:** Turbine Startup and Shutdown	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The reciprocating compressor operations result in emissions from the wear of mechanical seals around the piston rods over time. These emissions are generated from the compressors associated with the gas-fired compressor engines (CE-01 through CE-04).		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		TSS
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.87**	**3.80**
Nitrogen Oxides (NOX)	**0.02**	**0.10**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.24**	**1.04**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**6E-04**	**3E-03**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**6E-04**	**3E-03**
Formaldehyde	**---**	**---**
Hexane, n-	**0.01**	**0.05**
Methanol	**6E-04**	**3E-03**
POM/PAH	**---**	**---**
Toluene	**1E-03**	**0.01**
TMP, 2,2,4-	**6E-04**	**3E-03**
Xylenes	**1E-03**	**0.01**
Other/Trace HAP	**---**	**---**
Total HAP	**0.02**	**0.08**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**8.03**	**35.15**
Methane (CH4) (GWP=25)	**1.21**	**5.30**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**38.30**	**168**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**TSS**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**DGS**
Emission unit ID number: DGS	**Emission unit name:** Centrifugal Compressor Dry Gas Seal Leaks	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The centrifugal compressor uses tandem dry seals which vent a small amount of seal gas by design. A vent gas recompression system recovers this gas; however, there will be periods when the recompression system is down for maintenance and other reasons, and the dry gas seal leaks will vent to atmosphere for up to three months per year.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**DGS**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.85**	**3.71**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	---	---
Ethylbenzene	**2E-03**	**0.01**
Formaldehyde	---	---
Hexane, n-	**0.04**	**0.19**
Methanol	**2E-03**	**0.01**
POM/PAH	---	---
Toluene	**0.01**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**0.01**	**0.02**
Other/Trace HAP	---	---
Total HAP	**0.06**	**0.28**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.02**	**0.08**
Methane (CH4) (GWP=25)	**3.65**	**16.00**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**91.35**	**400**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**DGS**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**DEHY-01 (DFT-01 and DSV-01)**
Emission unit ID number: DEHY-01 (DFT-01 and DSV-01)	**Emission unit name:** One 250 MMscfd TEG Dehydrator (DHY-01)	**List any control devices associated with this emission unit:** TOx-01
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The dehydrator is comprised of a Contactor/Absorber Tower (DSV-01) and a Flash Tank (DFT-01) with emissions controlled 99.5% by a Thermal Oxidizer (TOx-01).		
Manufacturer: na	**Model number:** na	**Serial number(s):** ---
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 250.0 MMscfd		
Maximum Hourly Throughput: 10.42 MMscf/hr	**Maximum Annual Throughput:** 91,250 MMscf/yr	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		DEHY-01 (DFT-01 and DSV-01)
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.88**	**3.84**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.03**	**0.12**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.02**	**0.09**
Formaldehyde	---	---
Hexane, n-	**0.02**	**0.10**
Methanol	**0.02**	**0.07**
POM/PAH	---	---
Toluene	**0.09**	**0.38**
TMP, 2,2,4-	---	---
Xylenes	**0.20**	**0.86**
Other/Trace HAP	---	---
Total HAP	**0.37**	**1.61**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**3.65**	**15.98**
Methane (CH4) (GWP=25)	**0.42**	**1.82**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**14.03**	**61.46**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

GRI-GLYCalc, Extended Gas Analysis, and Operation Records

Please reference Supplement S3 - Emission Calculations
Also Supplement S6 - Emission Programs

Emission Unit Description	**DEHY-01 (DFT-01 and DSV-01)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.0. Source-Specific Hazardous Air Pollutant Requirements (Natural Gas Dehydration Units DFT-01/DSV01 and DFT02/DSV02 controlled by Thermal Oxidizers TOx-01 – TOx-02)

7.1. Limitations and Standards

7.1.1. Maximum Throughput Limitation. The maximum dry natural gas throughput to each of the glycol dehydration units/still columns shall not exceed the following:

Emission Unit ID#	Emission Point ID#	Emission Unit	Design Capacity
DFT-01/ DSV-01	24E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	250 MMscfd
DFT-02/ DSV-02	25E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	160 MMscfd

Compliance with the Maximum Throughput Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

7.1.2. The permittee shall install the following air pollution control devices to control emissions from the glycol dehydration units:

a. A 7.61 MMBTU/hr thermal oxidizer (TOx-01) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-01) and dehydrator flash tank (DFT-01). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

b. A 6.70 MMBTU/hr thermal oxidizer (TOx-02) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-02) and dehydrator flash tank (DFT-02). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

Emission Unit Description	**DEHY-01 (DFT-01 and DSV-01)**
_X_ Permit Shield	

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		DEHY-02 (DFT-02 and DSV-02)
Emission unit ID number: DEHY-02 (DFT-02 and DSV-02)	**Emission unit name:** One 160 MMscfd TEG Dehydrator (DHY-02)	**List any control devices associated with this emission unit:** TOx-02
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The dehydrator is comprised of a Contactor/Absorber Tower (DSV-01) and a Flash Tank (DFT-01) with emissions controlled 99.5% by a Thermal Oxidizer (TOx-01).		
Manufacturer: na	**Model number:** na	**Serial number(s):** ---
Construction date: na	**Installation date:** 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 160.0 MMscfd		
Maximum Hourly Throughput: 6.67 MMscf/hr	**Maximum Annual Throughput:** 58,400 MMscf/yr	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**DEHY-02 (DFT-02 and DSV-02)**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.85**	**3.71**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.03**	**0.12**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.02**	**0.09**
Formaldehyde	---	---
Hexane, n-	**0.02**	**0.10**
Methanol	**0.02**	**0.07**
POM/PAH	---	---
Toluene	**0.09**	**0.38**
TMP, 2,2,4-	---	---
Xylenes	**0.19**	**0.83**
Other/Trace HAP	---	---
Total HAP	**0.36**	**1.58**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**2.80**	**12.25**
Methane (CH4) (GWP=25)	**0.24**	**1.05**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**8.79**	**38.48**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

GRI-GLYCalc, Extended Gas Analysis, and Operation Records

Please reference Supplement S3 - Emission Calculations
Also Supplement S6 - Emission Programs

Emission Unit Description	**DEHY-02 (DFT-02 and DSV-02)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.0. Source-Specific Hazardous Air Pollutant Requirements (Natural Gas Dehydration Units DFT-01/DSV01 and DFT02/DSV02 controlled by Thermal Oxidizers TOx-01 – TOx-02)

7.1. Limitations and Standards

7.1.1. Maximum Throughput Limitation. The maximum dry natural gas throughput to each of the glycol dehydration units/still columns shall not exceed the following:

Emission Unit ID#	Emission Point ID#	Emission Unit	Design Capacity
DFT-01/ DSV-01	24E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	250 MMscfd
DFT-02/ DSV-02	25E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	160 MMscfd

Compliance with the Maximum Throughput Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

7.1.2. The permittee shall install the following air pollution control devices to control emissions from the glycol dehydration units:

a. A 7.61 MMBTU/hr thermal oxidizer (TOx-01) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-01) and dehydrator flash tank (DFT-01). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

b. A 6.70 MMBTU/hr thermal oxidizer (TOx-02) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-02) and dehydrator flash tank (DFT-02). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

Emission Unit Description	**DEHY-02 (DFT-02 and DSV-02)**
_X_ Permit Shield	

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**RBV-01 and RBV-02**
Emission unit ID number: RBV-01 and RBV-02	**Emission unit name:** Dehydration Unit Reboilers	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): One (1) gas-fueled reboiler is utilized to supply heat to each Dehydrator's Regenerator/Still.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021 & 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 2.00 MMBtu/hr (each)		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr (each)
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 2.00 MMBtu/hr (each)		**Type and Btu/hr rating of burners:** 2.00 MMBtu/hr (each)
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 1,961 scf/hr (each) 17.18 MMscf/yr (each)		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		RBV-01 and RBV-02
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**0.16**	**0.72**
Nitrogen Oxides (NOX)	**0.20**	**0.86**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**1E-03**	**0.01**
Particulate Matter (PM10)	**1E-03**	**0.01**
Total Particulate Matter (TSP)	**1E-03**	**0.01**
Sulfur Dioxide (SO2)	**0.01**	**0.07**
Volatile Organic Compounds (VOC)	**0.01**	**0.05**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**4E-06**	**2E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**1E-04**	**6E-04**
Hexane, n-	**4E-03**	**0.02**
Methanol	**---**	**---**
POM/PAH	**1E-06**	**6E-06**
Toluene	**7E-06**	**3E-05**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**2E-06**	**1E-05**
Total HAP	**4E-03**	**0.02**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**235.29**	**1,031**
Methane (CH4) (GWP=25)	**5E-03**	**0.02**
Nitrous Oxide (N2O) (GWP=298)	**4E-03**	**0.02**
CO2 Equivalent (CO2e)	**236.69**	**1,037**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	RBV-01 and RBV-02

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

10.0. Source-Specific Requirements (Reboilers, Heater Treaters)

10.1. Limitations and Standards

10.1.1. Maximum Design Heat Input. The maximum design heat input (MDHI) shall not exceed the following:

Emission Unit ID#	Emission Unit Description	MDHI (MMBTU/hr)
EURBL-1	Glycol Dehydration Reboiler	1.0
EURBL-2	Glycol Dehydration Reboiler	1.0
EURBL-3	Glycol Dehydration Reboiler	1.0
EUHT-1	Heater Treater	1.0
EUHT-2	Heater Treater	1.0

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**TK-01 thru TK-04 (total)**
Emission unit ID number: TK-01 thru TK-04 (total)	**Emission unit name:** Four (4) Produced Water Storage Tanks	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Four (4) 400 bbl storage tanks are used to hold produced water. Gas vapors from these tanks are vented to atmosphere.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 1,600 bbl (Total)		
Maximum Hourly Throughput: 13.70 bbl/hr (Total)	**Maximum Annual Throughput:** 120,000 bbl/yr (Total)	**Maximum Operating Schedule:** 8,760 hr/yr (each)
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		TK-01 thru TK-04 (total)
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.03**	**0.14**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**3E-05**	**1E-04**
Butadiene, 1,3-	---	---
Ethylbenzene	**7E-04**	**3E-03**
Formaldehyde	---	---
Hexane, n-	**2E-03**	**0.01**
Methanol	**2E-05**	**9E-05**
POM/PAH	---	---
Toluene	**3E-04**	**1E-03**
TMP, 2,2,4-	**2E-04**	**1E-03**
Xylenes	**9E-04**	**4E-03**
Other/Trace HAP	---	---
Total HAP	**5E-03**	**0.02**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	---	---
Methane (CH4) (GWP=25)	---	---
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	---	---

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA TANKS 4.0.9(d)

Please reference Supplement S3 - Emission Calculations
also Supplement S6 - Emission Programs

Emission Unit Description	**TK-01 thru TK-04 (total)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

9.0. Source-Specific Requirements (Produced Water Storage Tanks (TK-01 – TK-04))

9.1. Limitations and Standards

9.1.1. The maximum combined annual throughput of produced water to the storage tanks shall not exceed 5,040,000 gallons per year.

9.1.2. Maximum emissions from the storage tank battery (TK-01 – TK-04) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Volatile Organic Compounds	0.04	0.16

9.1.3. Each Storage Tank (TK-01 – TK-04) thief hatch shall be weighted and properly seated. You must select gasket material for the hatch based on composition of the fluid in the storage vessel and weather conditions.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**TLO**
Emission unit ID number: TLO	**Emission unit name:** Produced Water Truck Load-Out	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Loading of Produced Water into tanker trucks occurs at the facility. Gas vapors from these operations are vented to atmosphere.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: 13.70 bbl/hr (Ave)	**Maximum Annual Throughput:** 120,000 bbl/yr	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		TLO
Criteria Pollutants	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Carbon Monoxide (CO)	**---**	**---**
Nitrogen Oxides (NOX)	**---**	**---**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.38**	**1.66**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**3E-04**	**1E-03**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**0.01**	**0.03**
Formaldehyde	**---**	**---**
Hexane, n-	**0.03**	**0.13**
Methanol	**2E-04**	**1E-03**
POM/PAH	**---**	**---**
Toluene	**4E-03**	**0.02**
TMP, 2,2,4-	**3E-03**	**0.01**
Xylenes	**0.01**	**0.05**
Other/Trace HAP	**---**	**---**
Total HAP	**0.05**	**0.24**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Carbon Dioxide (CO2)	**---**	**---**
Methane (CH4) (GWP=25)	**---**	**---**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**---**	**---**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	TLO

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

10.0. Source-Specific Requirements (Truck Loading, TLO)

10.1. Limitations and Standards

10.1.1. The permittee shall install, maintain, and operate all above-ground piping, valves, pumps, etc. that service lines in the transport of potential sources of regulated air pollutants to prevent any substantive fugitive escape of regulated air pollutants. Any above-ground piping, valves, pumps, etc. that shows signs of excess wear and that have a reasonable potential for substantive fugitive emissions of regulated air pollutants shall be replaced.

10.1.2. The maximum quantity of produced water from truck loading (TLO) that shall be loaded shall not exceed 5,040,000 gallons per year. Compliance with the Maximum Yearly Operation Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the throughput at any given time during the previous twelve consecutive calendar months.

10.1.3. Maximum emissions from the product loadout rack (22E) shall not exceed the following limits:

Pollutant	Maximum Annual Emissions (ton/year)
Volatile Organic Compounds	1.66
Total Hazardous Air Pollutants	0.24

10.1.4. The Produced Water Truck Loading shall be operated in accordance with the plans and specifications filed in Permit Application R13-3561.

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		PIG
Emission unit ID number: PIG	**Emission unit name:** Pigging Operations Four (4) Pig Traps	**List any control devices associated with this emission unit:** FLR-01

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

Emissions from pigging operations result from releases of gas vapor in the pig launcher/receiver for removal of the pig. Gas vapors from the pigging operations are vented to the atmosphere

Manufacturer:	**Model number:**	**Serial number(s):**
na	na	na
Construction date:	**Installation date:**	**Modification date(s):**
na	2021	na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

na

Maximum Hourly Throughput:	**Maximum Annual Throughput:**	**Maximum Operating Schedule:**
na	na	na

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? ___ Yes _X_No	**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na	**Type and Btu/hr rating of burners:** na

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

na

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		PIG
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.12**	**0.52**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**3E-04**	**1E-03**
Butadiene, 1,3-	---	---
Ethylbenzene	**3E-04**	**1E-03**
Formaldehyde	---	---
Hexane, n-	**0.01**	**0.03**
Methanol	**3E-04**	**1E-03**
POM/PAH	---	---
Toluene	**7E-04**	**3E-03**
TMP, 2,2,4-	**3E-04**	**1E-03**
Xylenes	**7E-04**	**3E-03**
Other/Trace HAP	---	---
Total HAP	**0.01**	**0.04**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.13**	**0.58**
Methane (CH4) (GWP=25)	**0.51**	**2.23**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**12.88**	**56.39**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Mass balance and engineering judgment

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**PIG**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

11.1.2. The maximum number of pigging (PIG) events per year shall not exceed 1,460 events, with an estimated 5,425,000 scf per year. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the pigging events at any given time during the previous twelve consecutive calendar months.

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		TOx-01
Emission unit ID number: TOx-01	**Emission unit name:** Thermal Oxidizer 01	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Thermal oxidizer used to control emissions from Dehydrator 01		
Manufacturer: Zeeco	**Model number:** Z-HTO	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 7.61 MMBtu/hr		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 7.61 MMBtu/hr		**Type and Btu/hr rating of burners:** 7.61 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 12,576 scf/hr 110.17 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		TOx-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.36**	**10.33**
Nitrogen Oxides (NOX)	**0.75**	**3.27**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.06**	**0.25**
Volatile Organic Compounds (VOC)	**0.04**	**0.18**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**2E-05**	**7E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**6E-04**	**2E-03**
Hexane, n-	**0.01**	**0.06**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**3E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**9E-06**	**4E-05**
Total HAP	**0.01**	**0.06**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**894.73**	**3,919**
Methane (CH4) (GWP=25)	**0.02**	**0.08**
Nitrous Oxide (N2O) (GWP=298)	**2E-03**	**0.01**
CO2 Equivalent (CO2e)	**895.66**	**3,923**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**TOx-01**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.1.4. Emissions from the thermal oxidizers shall not exceed the following maximum hourly and annual emission limits:

a. Thermal Oxidizer (TOx-01)

Pollutant	**Maximum Hourly Emissions (lb/hr)**	**Maximum Annual Emissions (ton/year)**
Nitrogen Oxides	0.75	3.27
Carbon Monoxide	2.36	10.33
Volatile Organic Compounds	0.92	4.02
Total HAPs	0.38	1.68

7.1.3. The Thermal Oxidizers (TOx-01, TOx-02) shall be designed and operated in accordance with the following:

a. The vapors/overheads from the still vents (DSV-01, DSV-02) and gas from flash tanks in excess of that used for fuel (DFT-01, DFT-02) shall be routed to the thermal oxidizers at all times;

b. The thermal oxidizers shall be operated, with a flame present at all times as determined by the methods specified in permit condition 6.2.1;

c. The thermal oxidizers shall be operated according to the manufacturer's specifications for residence time and minimum combustion chamber temperature;

d. The thermal oxidizers shall be operated at all times when emissions/overheads from the glycol dehydration unit still vents and flash tanks may be vented to it;

e. The thermal oxidizers shall be designed for and operated with no visible emissions as determined by the methods specified in permit condition 6.3.1, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours;

f. The thermal oxidizers are subject to the applicable requirements of 45CSR6.
[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		TOx-02
Emission unit ID number: TOx-02	**Emission unit name:** Thermal Oxidizer 02	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Thermal oxidizer used to control emissions from Dehydrator 02		
Manufacturer: Zeeco	**Model number:** Z-VTO	**Serial number(s):** na
Construction date: na	**Installation date:** 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 6.70 MMBtu/hr		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 6.70 MMBtu/hr		**Type and Btu/hr rating of burners:** 6.70 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 8,904 scf/hr 78.00 MMscf/yr		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		TOx-02
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.08**	**9.10**
Nitrogen Oxides (NOX)	**0.66**	**2.88**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.05**	**0.22**
Volatile Organic Compounds (VOC)	**0.04**	**0.16**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**1E-05**	**6E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**5E-04**	**2E-03**
Hexane, n-	**0.01**	**0.05**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**2E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**8E-06**	**3E-05**
Total HAP	**0.01**	**0.05**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**788.09**	**3,452**
Methane (CH4) (GWP=25)	**0.02**	**0.07**
Nitrous Oxide (N2O) (GWP=298)	**1E-03**	**0.01**
CO2 Equivalent (CO2e)	**788.91**	**3,455**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	TOx-02

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

b. Thermal Oxidizer (TOx-02)

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	0.66	2.88
Carbon Monoxide	2.08	9.10
Volatile Organic Compounds	0.89	3.88
Total HAPs	0.37	1.63

7.1.3. The Thermal Oxidizers (TOx-01, TOx-02) shall be designed and operated in accordance with the following:

a. The vapors/overheads from the still vents (DSV-01, DSV-02) and gas from flash tanks in excess of that used for fuel (DFT-01, DFT-02) shall be routed to the thermal oxidizers at all times;

b. The thermal oxidizers shall be operated, with a flame present at all times as determined by the methods specified in permit condition 6.2.1;

c. The thermal oxidizers shall be operated according to the manufacturer's specifications for residence time and minimum combustion chamber temperature;

d. The thermal oxidizers shall be operated at all times when emissions/overheads from the glycol dehydration unit still vents and flash tanks may be vented to it;

e. The thermal oxidizers shall be designed for and operated with no visible emissions as determined by the methods specified in permit condition 6.3.1, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours;

f. The thermal oxidizers are subject to the applicable requirements of 45CSR6.

[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		FLR-01
Emission unit ID number: FLR-01	**Emission unit name:** Flare 01	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Flare used to control emissions from blowdowns and pigging operations.		
Manufacturer: Zeeco	**Model number:** MJ-16	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 7.00 MMBtu/hr		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 7.00 MMBtu/hr		**Type and Btu/hr rating of burners:** 7.00 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 5,663 scf/hr 49.60 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		FLR-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.13**	**9.34**
Nitrogen Oxides (NOX)	**0.67**	**2.95**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.05**	**0.22**
Volatile Organic Compounds (VOC)	**0.04**	**0.16**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**1E-05**	**6E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**5E-04**	**2E-03**
Hexane, n-	**0.01**	**0.05**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**2E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**8E-06**	**4E-05**
Total HAP	**0.01**	**0.06**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**808.87**	**3,543**
Methane (CH4) (GWP=25)	**0.02**	**0.07**
Nitrous Oxide (N2O) (GWP=298)	**2E-03**	**0.01**
CO2 Equivalent (CO2e)	**809.71**	**3,547**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	FLR-01

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

11.1.5. Maximum emissions from the elevated flare (FLR-01) shall not exceed the following limits:

Pollutant	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	2.95
Carbon Monoxide	9.34
Volatile Organic Compounds	3.10

11.1.6. *Operation and Maintenance of Flare (FLR-01).* The permittee shall, to the extent practicable, install, maintain, and operate the flare and associated monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions, or comply with any more stringent limits set forth in this permit or as set forth by any State rule, Federal regulation, or alternative control plan approved by the Secretary.
[45CSR§13-5.10.]

11.1.7 The quantity of waste gas that shall be consumed in the flare shall not exceed 49.60 MMscf per year. Compliance with the gas throughput limit shall be demonstrated using a rolling 12-month total.
[45CSR§13-5.10.]

11.1.8. The flare (FLR-01) is subject to the opacity requirements in 45CSR6.

11.1.9. The flare (FLR-01) shall be operated with a pilot flame present at all times whenever emissions may be vented.
[45CSR§13-5.10.]

11.1.10. The flare (FLR-01) installed shall be operated and designed in accordance with the information filed in permit application R13-3561.
[45CSR§13-5.10.]

11.1.11. The permittee shall comply with the requirements of Section 2.12 of this permit during emergency operation of the flare (FLR-01).
[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**FUG-G**
Emission unit ID number: FUG-G	**Emission unit name:** Process Piping and Equipment Leaks – Gas (FUG-G)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Process Piping and Equipment leaks includes each pump, pressure relief device, open-ended valve or line, valve, and flange or other connector that is in VOC service or in wet gas service.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		FUG-G
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**---**	**---**
Nitrogen Oxides (NOX)	**---**	**---**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.72**	**3.15**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**2E-03**	**0.01**
Formaldehyde	**---**	**---**
Hexane, n-	**0.04**	**0.16**
Methanol	**---**	**0.01**
POM/PAH	**---**	**---**
Toluene	**5E-03**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**5E-03**	**0.02**
Other/Trace HAP	**---**	**---**
Total HAP	**0.05**	**0.24**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.02**	**0.07**
Methane (CH4) (GWP=25)	**3.10**	**13.58**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**77.50**	**339.46**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA Emission Factors

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	FUG-G

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

14.0 Source-Specific Requirements (40CFR60 Subpart OOOOa Requirements Fugitive Emissions)

14.1 Limitations and Standards

14.1.1. The permittee shall comply with the applicable fugitive emission requirements specified in 40 CFR Part 60, Subpart OOOOa.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**FUG-L**
Emission unit ID number: **FUG-L**	**Emission unit name:** **Process Piping and Equipment Leaks – Liquid (FUG-L)**	**List any control devices associated with this emission unit:** **na**
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): **Process Piping and Equipment leaks includes each pump, pressure relief device, open-ended valve or line, valve, and flange or other connector that is in VOC service or in wet gas service.**		
Manufacturer: **na**	**Model number:** **na**	**Serial number(s):** **na**
Construction date: **na**	**Installation date:** **2021**	**Modification date(s):** **na**
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): **na**		
Maximum Hourly Throughput: **na**	**Maximum Annual Throughput:** **na**	**Maximum Operating Schedule:** **8,760 hr/yr**
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** **___ Indirect ___ Direct**
Maximum design heat input and/or maximum horsepower rating: **na**		**Type and Btu/hr rating of burners:** **na**
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. **na**		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		FUG-L
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**2.04**	**8.94**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.04**	**0.19**
Formaldehyde	---	---
Hexane, n-	**0.16**	**0.69**
Methanol	**1E-03**	**0.01**
POM/PAH	---	---
Toluene	**0.02**	**0.09**
TMP, 2,2,4-	**0.01**	**0.06**
Xylenes	**0.06**	**0.24**
Other/Trace HAP	---	---
Total HAP	**0.29**	**1.29**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	---	---
Methane (CH4) (GWP=25)	---	---
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	---	---

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA Emission Factors

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**FUG-L**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

14.0. Source-Specific Requirements (40CFR60 Subpart OOOOa Requirements, Fugitive Emission Components)

14.1. Limitations and Standards

14.1.1. For each affected facility under §60.5365a(j), you must reduce GHG (in the form of a limitation on emissions of methane) and VOC emissions by complying with the requirements of paragraphs (a) through (j) of this section. These requirements are independent of the closed vent system and cover requirements in §60.5411a.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment F
Schedule of Compliance
(Not Applicable)

"26b. For each emission unit not in compliance with an applicable requirement, fill out a Schedule of Compliance Form as ATTACHMENT F."

- **Schedule of Compliance Form – Not Applicable**

Attachment F

NOT APPLICABLE

Schedule of Compliance Form

ATTACHMENT F - Schedule of Compliance Form	
Complete this section if you indicated noncompliance with any of the applicable requirements identified in the permit application. For each emission unit which is not in compliance, identify the applicable requirement, the reason(s) for noncompliance, a description of how the source will achieve compliance, and a detailed schedule of compliance. If there is a consent order that applies to this requirement, attach a copy to this form.	
1. Applicable Requirement	
Unit(s):	**Applicable Requirement:**
2. Reason for Noncompliance:	
3. How will Compliance be Achieved?	
4. Consent Order Number (if applicable):	
5. **Schedule of Compliance.** Provide a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance, including a date for final compliance.	
Remedial Measure or Action	Date to be Achieved
6. Submittal of Progress Reports.	
Content of Progress Report:	**Report starting date:** MM/DD/YYYY **Submittal frequency:**

Attachment G

Air Pollution Control Device Forms

"27a. For each control device listed in the Title V Equipment Table, fill out and provide an Air Pollution Control Device Form as ATTACHMENT G."

- **Oxidation Catalyst (OxCat-01 thru OxCat-04) (Serves CE-01 thru CE-04)**
- **Oxidation Catalyst (OxCat-05) (Serves GE-01)**
- **Dehydrator Thermal Oxidizer 01 (TOx-01) (Serves DHY-01)**
- **Dehydrator Thermal Oxidizer 02 (TOx-02) (Serves DHY-02)**
- **Flare 01 (FLR-01) (Serves BD and PIG)**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description **Oxidation Catalyst**

Control device ID number:	**List all emission units associated with this control device.**	
OxCat-01 thru OxCat-04	**CE-01 thru CE-04**	
Manufacturer:	**Model Number:**	**Installation Date:**
Catalytic Combustion	**REMB-3615F-D-15HF-HFX4**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	___ Flare	**_X_ Other: Oxidation Catalyst**
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutant	Capture Efficiency	Control Efficiency
NOx	**100%**	**---**
CO	**100%**	**89.0%**
VOC	**100%**	**65.1%**
HCHO	**100%**	**80.0%**

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Design Flow Rate: 30,842 acf/min 823 ^{o}F

Is this device subject to the CAM requirements of 40 C.F.R. 64? ___ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: Subject to NSPS JJJJ

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Oxidation Catalyst**
Control device ID number:	**List all emission units associated with this control device.**	
OxCat-05	**GE-01**	
Manufacturer:	**Model Number:**	**Installation Date:**
Miratech	**SP-ZCSS-30-TBD-HSG-0**	**2022**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	___ Flare	**_X_ Other: Oxidation Catalyst**
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutant	Capture Efficiency	Control Efficiency
NOx	**100%**	**---**
CO	**100%**	**87.0%**
VOC	**100%**	**49.5%**
HCHO	**100%**	**83.3%**

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Design Flow Rate: **9,156 acf/min** **959 °F**

Is this device subject to the CAM requirements of 40 C.F.R. 64? ___ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: Pre-control emissions less than 100 TPY

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Thermal Oxidizer**
Control device ID number:	**List all emission units associated with this control device.**	
TOx-01	**DHY-01 (DFT-01 and DSV-01)**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**Z-HTO**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
_X_ **Thermal Incinerator**	___ Flare	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	Capture Efficiency	Control Efficiency
Volatile Organic Compounds	100%	99.5%
V-HAP	100%	99.5%
Methane	100%	99.5%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: Emission source does not utilize a control device

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Thermal Oxidizer**
Control device ID number:	**List all emission units associated with this control device.**	
TOx-02	**DHY-02 (DFT-02 and DSV-02)**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**Z-VTO**	**2022**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
_X_ **Thermal Incinerator**	___ Flare	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	Capture Efficiency	Control Efficiency
Volatile Organic Compounds	100%	99.5%
V-HAP	100%	99.5%
Methane	100%	99.5%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ **Yes** _X_ **No**

If Yes, Complete Attachment H

If No, Provide justification: Emission source does not utilize a control device

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Flare**
Control device ID number:	**List all emission units associated with this control device.**	
FLR-01	**BD and PIG**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**MJ-16**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	**_X_ Flare**	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	Capture Efficiency	Control Efficiency
Volatile Organic Compounds	**100%**	**98.0%**
V-HAP	**100%**	**98.0%**
Methane	**100%**	**98.0%**

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: **Emission source does not utilize a control device**

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Attachment H

Compliance Assurance Monitoring (CAM) Forms

"27b. For any control device that is required on an emission unit in order to meet a standard or limitation for which the potential pre-control device emissions of an applicable regulated air pollutant is greater than or equal to the Title V Major Source Threshold Level, refer to the Compliance Assurance Monitoring (CAM) Form(s) for CAM applicability. Fill out and provide these forms, if applicable, for each Pollutant Specific Emission Unit (PSEU) as ATTACHMENT H."

Attachment H

ATTACHMENT H - Compliance Assurance Monitoring (CAM) Plan Form

For definitions and information about the CAM rule, please refer to 40 CFR Part 64. Additional information (including guidance documents) may also be found at http://www.epa.gov/ttn/emc/cam.html

CAM APPLICABILITY DETERMINATION

1) Does the facility have a PSEU (Pollutant-Specific Emissions Unit considered separately with respect to **EACH** regulated air pollutant) that is subject to CAM (40 CFR Part 64), which must be addressed in this CAM plan submittal? To determine applicability, a PSEU must meet **all** of the following criteria (*If No, then the remainder of this form need not be completed*):

☐ YES ☒ NO

Per § 64.5(b), CAM plan is due with renewal application.

a. The PSEU is located at a major source that is required to obtain a Title V permit;

b. The PSEU is subject to an emission limitation or standard for the applicable regulated air pollutant that is NOT exempt;

LIST OF EXEMPT EMISSION LIMITATIONS OR STANDARDS:

- NSPS (40 CFR Part 60) or NESHAP (40 CFR Parts 61 and 63) proposed after 11/15/1990.
- Stratospheric Ozone Protection Requirements.
- Acid Rain Program Requirements.
- Emission Limitations or Standards for which a WVDEP Division of Air Quality Title V permit specifies a continuous compliance determination method, as defined in 40 CFR §64.1.
- An emission cap that meets the requirements specified in 40 CFR §70.4(b)(12).

c. The PSEU uses an add-on control device (as defined in 40 CFR §64.1) to achieve compliance with an emission limitation or standard;

d. The PSEU has potential pre-control device emissions of the applicable regulated air pollutant that are equal to or greater than the Title V Major Source Threshold Levels; AND

e. The PSEU is NOT an exempt backup utility power emissions unit that is municipally-owned.

BASIS OF CAM SUBMITTAL

2) Mark the appropriate box below as to why this CAM plan is being submitted as part of an application for a Title V permit:

☐ RENEWAL APPLICATION. **ALL** PSEUs for which a CAM plan has NOT yet been approved need to be addressed in this CAM plan submittal.

☐ INITIAL APPLICATION (submitted after 4/20/98). **ONLY** large PSEUs (i. e., PSEUs with potential post-control device emissions of an applicable regulated air pollutant that are equal to or greater than Major Source Threshold Levels) need to be addressed in this CAM plan submittal.

☐ SIGNIFICANT MODIFICATION TO LARGE PSEUs. **ONLY** large PSEUs being modified after 4/20/98 need to be addressed in this cam plan submittal. For large PSEUs with an approved CAM plan, Only address the appropriate monitoring requirements affected by the significant modification.

Supplement S1

Process Description

"14. Provide a general description of operations."

- **Process Description**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for Title V Operating Permit

Supplement S1

Process Description

Project Overview

Appalachia Midstream Services, LLC (AMS) is submitting an application for 45CSR30 Title V Operating Permit for the existing Ridgeline Compressor Station located at 249 US 250, approximately 3.5 miles South of Cameron in Marshall County, West Virginia. (See Attachment B – Area Map). The facility receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site. There is no on-site storage of condensate liquids.

Compressor Engines (CE-01 (1E) thru CE-04 (4E))

Four (4) natural gas-fueled reciprocating engines are utilized at the facility. These engines drive a natural gas compressor to increase the pressure of the natural gas. Emissions result from the combustion of natural gas fuel.

Engine Crankcase Emissions (ECC (5E))

Internal combustion results in a small but continual amount of blow-by, which occurs when some of the gases from combustion leak past the piston rings (that is, blow-by them) to end up inside the crankcase, causing pressure to build up in the crank case. These blow-by gases are vented to the atmosphere.

Compressor Rod Packing Leaks (CRP (6E))

The reciprocating compressors driven by the Caterpillar G3616LE engines result in emissions from the wear of mechanical seals around the piston rods over time. The reciprocating compressor associated with Solar's vent recompression system has its rod packing leaks circulated to the suction inlet through an integral line resulting in no leaks to the atmosphere.

Blowdown (BD (7E))

As part of facility operation, the compressor engines undergo periods of startup and shutdown. When an engine is shutdown, the natural gas contained within the compressor and associated piping must be evacuated (compressor blowdown (CBD). Additionally, there are other infrequent emissions from various maintenance activities at the facility that are not associated with compressor blowdowns, such as emergency shutdown (ESD) testing. Gas vapor from these blowdown operations are routed to a Flare (FLR-01) for 98% CH_4, VOC, and HAP destruction.

Generator Engine (GE-01 (8E))

One (1) natural gas-fueled generator engine is utilized to provide electrical power to the facility.

Compressor Turbine (CT-01 (9E))

One (1) natural gas-fueled stationary combustion turbine is utilized at the facility. The turbine drives a natural gas compressor to increase the pressure of the natural gas. Emissions result from the combustion of natural gas fuel.

Compressor Turbine Start/Stop (TSS (10E))

During startup and shutdown of the stationary combustion turbine, there are short periods of time when the turbine operates in non-SoLoNOx mode. Operation during non-SoLoNOx mode results in elevated emissions.

Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E))

The centrifugal compressor uses tandem dry seals which vent a small amount of seal gas by design. A vent gas recompression system recovers this gas with 100% collection efficiency. There are periods when the recompression system is down for maintenance and other reasons, and it is assumed the dry gas seal leaks vent to atmosphere for up to three months per year.

Tri-Ethylene Glycol (TEG) Dehydrators (DFT-01/-02 (12E,15E) and DSV-01/-02 (13E,16E)

Two (2) Triethylene Glycol (TEG) Dehydrators are utilized at the facility. Each dehydrator is comprised of a Contactor/Absorber Tower (no vented emissions), a Flash Tank (DFT-01 and DFT-02), and a Regenerator/Still Vent (DSV-01 and DSV-02).

The TEG Dehydrators are used to remove water vapor from the inlet wet gas stream to meet pipeline specifications. In the dehydration process, the wet inlet gas stream flows through a contactor tower where the gas is contacted with lean glycol. The lean glycol absorbs the water in the gas stream and becomes rich glycol laden with water and trace amounts of hydrocarbons.

The rich glycol is then routed to a flash tank where the glycol pressure is reduced to liberate the lighter end hydrocarbons (especially methane). The lighter end hydrocarbons are routed from the flash tank to the reboiler for use as fuel with the excess hydrocarbons vented to a thermal oxidizer with minimum VOC/HAP destruction efficiency of 99.5 percent.

The rich glycol is sent from the flash tank to the regenerator/still where the TEG is heated to drive off the water vapor and any remaining hydrocarbons. The off-gases from the regenerator/still are vented to a thermal oxidizer with minimum VOC/HAP destruction efficiency of 99.5 percent.

After regeneration, the glycol is returned to a lean state and used again in the process.

Reboilers (RBV-01 and RBV-02 (14E and 17E))

Two (2) gas-fueled reboilers are utilized to supply heat to the Dehydrators Regenerator/Still.

Storage Tanks (TK-01 (18E) thru TK-04 (21E) and Misc. Tanks)

Four (4) 400 bbl storage tanks are used to hold produced water from the inlet separator and the dehydrators.

There are also tanks at the facility used to store various materials, including fresh and used lube oil, fresh and spent TEG, hydrate inhibitor (methanol blend), etc. Each of these miscellaneous storage tanks generate de-minimis (negligible) emissions.

<u>Truck Load-Out (TLO (22E))</u>

Loading of produced water into tanker trucks occurs at the facility. The liquid loading produces small quantities of VOC emissions.

<u>Thermal Oxidizers (TOx-01 and TOx-02 (24E and 25E))</u>

Two (2) Thermal Oxidizers (TOx-01 and TOx-02), each with 99.5% CH4/VOC/HAPs destruction efficiency are used to control the Dehydrators Flash Tank (DFT-01 and DFT-02) and Still Vent (DSV-01 and DSV-02) streams.

<u>Flare (FLR-01 (2C))</u>

One (1) Flare with 98% CH4/VOC/HAPs destruction efficiency is used to control emissions from Blowdown (BD) and Pigging Operations (PIG).

<u>Process Piping and Equipment Leak Emissions (FUG-G (1F) and FUG-L (2F))</u>

Piping and process equipment generate leaks from different component types (connectors, valves, pumps, etc.) in gas-vapor service and light-oil (condensate) service.

Supplement S2

Regulatory Discussion

"19. **Non-Applicability Determinations**. List all requirements which the source has determined not applicable and for which a permit shield is requested. The listing shall also include the rule citation and the reason the shield applies."

"20. **Facility-Wide Applicable Requirements**. List all facility-wide applicable requirements. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number."

- **Regulatory Discussion**
  A. Potential to Emit (PTE)
  B. Applicability of New Source Performance Standards (NSPS)
  C. Applicability of National Emission Standards for Hazardous Air Pollutants (NESHAP)
  D. Compliance Assurance Monitoring (CAM)
  E. Chemical Accident Prevention Provisions (Risk Management Plan (RMP))
  F. Mandatory Greenhouse Gas Reporting (GHGRP)
  G. Applicability of State Regulations

Supplement S2

Regulatory Discussion

A. Potential-to-Emit (PTE) (Major Source Classification)
40CFR§50.1-§50.19

1. Non-Attainment New Source Review (NNSR)
40CFR§51.165 [Not Applicable]

This rule does not apply. The facility is in Marshall County, WV, which is currently classified as Attainment, Unclassified, or Maintenance for all national ambient air quality standards (https://www3.epa.gov/airquality/greenbook/anayo_wv.html).

2. Title V Operating Permit (TVOP) [Applicable]

This rule does apply. The AMS-Ridgeline Compressor Station is a Major Source of Criteria Pollutants (i.e., NOx and CO); and therefore, subject to the Title V Operating Permit (TVOP) regulations (45CSR30); as follows:

- **NOx: Title V Major Source with Controlled PTE greater than 100 tpy**
- **CO: Title V Major Source with Controlled PTE greater than 100 tpy**
- VOC: Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- PM10/2.5 Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- SO2: Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- Each HAP: Title V Synthetic Minor (Area) Source with Controlled PTE less than 10 tpy
- Total HAPs: Title V Synthetic Minor (Area) Source with Controlled PTE less than 25 tpy
- GHG: Not Applicable for TVOP Major Source determination

Important Notes:

* Criteria pollutant fugitive emissions **are not included** in TVOP major source determinations because the facility is not a listed source category.

* Hazardous air pollutant (HAP) fugitive emissions **are included** in TVOP major source determinations regardless of whether the facility is a listed source category.

* Greenhouse gases (GHG) **are not included** in TVOP major source determinations.

3. Major Source of Hazardous Air Pollutants (HAPs)
40CFR§63.1-§63.16 [Not Applicable]

This rule does not apply because the subject facility qualifies as a "HAP Area Source" as follows:

- Each HAP: HAP Area Source with Controlled PTE < 10 tpy
- Total HAPs: HAP Area Source with Controlled PTE < 25 tpy

Important Note:

* Hazardous air pollutant (HAP) fugitive emissions are included in HAP Major Source determinations (§63.2).

4. Prevention of Significant Deterioration (PSD) [Not Applicable]

This rule does not apply because the facility is a "PSD Minor Source" for each regulated pollutant, as follows:

- NOx: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- CO: PSD Synthetic Minor Source with Controlled PTE less than 250 tpy
- VOC: PSD Synthetic Minor Source with Controlled PTE less than 250 tpy
- PM10/2.5: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- SO2: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- CO2e: Not Applicable for PSD Major Source determination

Important Notes:

* Criteria pollutant fugitive emissions are not included in PSD Major Source determinations because the subject facility is not a "listed source" category (§52.21(b)(1)(iii)).
* Greenhouse gases (GHG/CO2e) are not treated as air pollutants for PSD Major Source determinations; however, GHG/CO2e must be included in the permit if potential emissions exceed 100,000 tpy and the facility is "otherwise" subject to PSD requirements (US Supreme Court, No. 12-1146, June 23, 2014).
* The designation of PSD Major Source status is determined on a pollutant specific basis; however, if a facility exceeds a PSD Major Source threshold for a single NSR regulated pollutant, it becomes PSD Major Source for any other regulated NSR pollutant emitted at or above its significant level, regardless of whether that pollutant exceeds the major stationary source threshold.
* A PSD Major Modification is a change at an existing PSD Major Source which would result in both a significant emission increase and a significant net emission increase of any regulated pollutant.

B. Applicability of New Source Performance Standards (NSPS)

The following federal regulations are potentially applicable to natural gas compressor stations. Applicability to the subject facility has been determined as follows:

1. NSPS A, General Provisions
40CFR§60.1-§60.19 [Applicable]

This rule does apply to all sources subject to an NSPS (unless a specific provision is excluded within the source NSPS). Requirements include notification (§60.7); recordkeeping and reporting (§60.7); source testing (§60.8, §60.11); and control device requirements (§60.18).

2. NSPS A, Control Devices - Flares
40CFR§60.18(b) [Not Applicable]

This rule does not apply to the Elevated Flare (FLR-01) or to the Thermal Oxidizers (TOx-01 and TOx-02) because none are subject to any New Source Performance Standard (NSPS).

3. NSPS D (also Da, Db, and Dc), Steam Generating Units
40CFR§60.40-§60.48 [Not Applicable]

These rules do not apply because there are no steam generating units (including line heaters) at the facility with a maximum design heat input capacity equal to or greater than 10 MMBtu/hr (§60.40c(a)).

4. NSPS K (also Ka and Kb), Volatile Organic Liquid Storage Vessels
40CFR§60.40-§60.48 [Not Applicable]

This rule does not apply because there is no Storage Vessel/Tank with capacity equal to or greater than 75 m3 (471.7 bbl or 19,813 gal) that is used to store volatile organic liquids (VOL) at the facility (§60.110(a)).

5. NSPS GG, Stationary Gas Turbines
40CFR§60.330-§60.335 [Not Applicable]

This rule does not apply because the stationary gas turbine at the facility (CT-01) is subject to NSPS KKKK; see below. Stationary combustion turbines regulated under NSPS KKKK are exempt from the requirements of NSPS GG (§60.4305(b)).

6. NSPS KKK, Leaks from Natural Gas Processing Plants
40CFR§60.630-§60.636 [Not Applicable]

This rule does not apply because the facility is not a natural gas processing plant (§60.630(a)).

7. NSPS LLL, Onshore Natural Gas Processing: SO2 Emissions
40CFR§60.640-§60.648 [Not Applicable]

This rule does not apply because there is no gas sweetening operation at the facility (§60.640(a)).

8. NSPS IIII, Compression Ignition Reciprocating Internal Combustion Engines
40CFR§60.4200-§60.4219 [Not Applicable]

This rule does not apply because there is no stationary compression ignition reciprocating internal combustion engine (RICE) at the facility that was manufactured on or after April 1, 2006 (§60.4200(a)).

9. NSPS JJJJ, Stationary Spark Ignition (SI) Internal Combustion Engines (ICE)
40CFR§60.4230-§60.4248 [Applicable]

This rule does apply to the four (4) 5,000 bhp CAT G3616LE A4 lean burn compressor engines (CE-01 thru CE-04) because the maximum engine power of each engine is greater than 1,340 bhp and each engine was manufactured or reconstructed on or after 07/01/07 (§60.4230(a)(4)(i)).

This rule does apply to the 1,468 bhp CAT G3512LE lean burn generator engine (GE-01) because the maximum engine power is greater than 1,340 bhp and the engine was manufactured or reconstructed on or after 07/01/07 (§60.4230(a)(4)(i)).

Requirements include NOx, CO and VOC emission limits (§60.4233(e-f)); operating limits (§60.4243); performance testing (§60.4244); maintenance plan, and notification and recordkeeping (§60.4245).

10. NSPS KKKK, Stationary Combustion Turbines
40CFR§60.4300-§60.4420 [Applicable]

This rule does apply because the 11,252 bhp Solar Taurus 70-10802S Compressor Turbine (CT-01) has a heat input at peak load ≥ 10 MMBtu/hr and construction, modification, or reconstruction commenced after 02/18/05 (§60.4305(a)).

Requirements include NOx emission limits (§60.4320); SO2 emission limits (§60.4330); and initial and subsequent performance testing (§60.4400).

11. NSPS OOOO, Crude Oil and Natural Gas Production
40CFR§60.5360-§60.5430 [Not Applicable]

This rule does not apply because the facility was constructed after September 18, 2015 (§60.5360).

12. NSPS OOOOa, Crude Oil and Natural Gas Production
40CFR§60.5360a-§60.5430a [Applicable]

This rule does apply to the reciprocating compressors driven by the CAT G3616LE A4 Engines (CE-01 thru CE-04) because the facility is identified within the natural gas production segment and each compressor commenced construction after 09/18/15 (§60.5360 and §60.5365(c)).

This rule does apply to the new electrically driven reciprocating compressor (associated with Solar Turbines' dry gas seal recompression system) because it was constructed after 09/18/15 (§60.5360 and §60.5365(c)).

Requirements include replacing rod packing systems on a specified schedule (CE-01 thru CE-04) and collecting the VOC emissions from the rod packing using a rod packing emissions collection system that operates under negative pressure and route the rod packing emissions to a process through a closed vent system (electric compressor) ((§60.5385(a)), notification, monitoring, recordkeeping and reporting (§60.5410(c), §60.5415(c), §60.5420(b)(1) and §60.5420(b)(4)).

This rule does apply to the fugitive emission components at a compressor station.

Requirements include reducing GHG and VOC emissions by developing a fugitive emission monitoring plan, monitoring all fugitive emission components, repairing all sources of fugitive emissions, and recordkeeping and reporting. For the purposes of this section, fugitive emissions are defined as: Any visible emission from a fugitive emissions component observed using optical gas imaging or an instrument reading of 500 ppm or greater using Method 21.

This rule does not apply to the produced water storage tanks (TK-01 thru TK-04) (nor any other tank) at the facility because each tank does not have the potential to emit more than 6 tpy of VOCs. Note, however, there is a requirement to document that the VOC PTE is less than 6 tpy per tank (§60.5420).

This rule <u>does not apply</u> to the pneumatic controllers because they are compressed air driven, otherwise they have a bleed rate ≤ 6 scfh, are located between the wellhead and point of custody transfer, and they are not located at a natural gas processing plant (§60.5365(d)(1)).

Other requirements of this rule <u>do not apply</u> because the facility is a) not a well, b) does not have a centrifugal compressor using wet seals, and c) does not have a process unit associated with the processing of natural gas.

13. NESHAP Part 61 - Designated Source Standards

40CFR§61.01-§61.359 [Not Applicable]

This rule <u>does not apply</u> because the facility is not a NESHAP Designated Facility (or Source).

Specifically, NESHAP J - Equipment Leaks (Fugitive Emission Sources) of Benzene and NESHAP V - Equipment Leaks (Fugitive Emission Sources) do not apply because all the fluids (liquid or gas) at the facility are less than 10 wt% volatile hazardous air pollutant (VHAP) ((§61.111 and §61.241).

14. NESHAP Part 63 (aka: MACT) - General Provisions

40CFR§63.1-§63.16 <u>[Applicable/Exempt]</u>

This rule <u>does apply</u> to the Compressor Engines (CE-01 thru CE-04); however, they are each subject to, but exempted from, the requirements of NESHAP ZZZZ. This rule <u>does apply</u> to the dehydrators (DFT-01/DFT-02 and DSV-01/DSV-02); however, they are each subject to, but exempted from, the requirements of NESHAP HH.

This rule <u>does not apply</u> to storage tanks, compressors, or ancillary equipment because the facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.

15. NESHAP HH, Oil and Natural Gas Production Facilities

40CFR§63.760-§63.779 <u>[Applicable/Exempt]</u>

This rule <u>does apply</u> to the dehydrators (DFT-01/DFT-02 and DSV-01/DSV-02). However, because the facility is an area source of HAP emissions, and the actual average emissions of benzene from each glycol dehydration unit process vent to the atmosphere is less than 0.90 megagram per year (1.0 tpy), the dehydration units are exempt. The only requirement is to maintain records of the actual average benzene emissions per year (§63.774(d)(1)(i)).

This rule <u>does not apply</u> to storage vessels (tanks), compressors, or ancillary equipment because the facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.

16. NESHAP HHH, Natural Gas Transmission and Storage Facilities

40CFR§63.1270-§63.1289 [Not Applicable]

This rule <u>does not apply</u> because the facility is not a natural gas transmission or storage facility transporting or storing natural gas prior to local distribution (§63.1270(a)).

17. NESHAP YYYY, Stationary Combustion Turbines

40CFR§63.6080-§63.6175 [Not Applicable]

This rule does not apply because the facility is not a major source of HAP emissions (§63.6080).

18. NESHAP ZZZZ, Stationary Reciprocating Internal Combustion Engines (RICE)

40CFR§63.6580-§63.6675 [Applicable/Exempt]

This rule does apply to the 5,000 bhp CAT G3616LE A4 compressor engines (CE-01 thru CE-04) and 1,468 bhp CAT 3512LE generator engine (GE-01). However, because each engine is "new" (i.e., commenced construction or reconstruction on or after 06/12/06) (§63.6590(a)(2)(iii)); the only requirement is compliance with §60.4230-§60.4248 (NSPS JJJJ) for Spark Ignition Internal Combustion Engines.

19. NESHAP DDDDD, Industrial, Commercial, and Institutional Boilers and Process Heaters – Major Sources

40CFR§63.7480 – §63.7575 [Not Applicable]

This rule does not apply because the facility is not a major source of HAP emissions (§63.7485).

20. NESHAP JJJJJJ, Industrial, Commercial, and Institutional Boilers and Process Heaters – Area Sources

40CFR§63.11193 – §63.11237 [Not Applicable]

This rule does not apply because the gas-fired reboilers (RBV-01 and RBV-02) do not meet the definition of "boiler" in §63.11237. Specifically, "boiler" is defined as an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the form of steam and/or hot water. Furthermore, waste heat boilers, process heaters, and autoclaves are excluded from the definition of "boiler".

21. Compliance Assurance Monitoring (CAM)

40CFR§64.1-§64.10 [Applicable]

This rule does apply because the facility is a major source required to obtain a Title V Operating Permit (§64.2(a)). A CAM plan will be developed for the Title V Operating Permit renewal application (§64.5(b)).

22. Chemical Accident Prevention Provisions (Risk Management Plan (RMP))

40CFR§68.1-§68.220 [Not Applicable]

This rule does not apply because the facility does not store more than a threshold quantity of a regulated substance in a process. Specifically, "Prior to entry into a natural gas processing plant or a petroleum refining process unit, regulated substances in naturally occurring hydrocarbon mixtures need not be considered when determining whether more than a threshold quantity is present at a stationary source" (§68.115(b)(2)(iii)).

23. Mandatory Greenhouse Gases (GHG) Reporting
40CFR§98.1-§98.9 [Applicable]

This rule does apply because the CO2e emissions from all stationary sources combined within the hydrocarbon basin as defined in 40 CFR Part 98 is ≥ 25,000 metric ton/yr (§98.2(a)(3)).

Requirements include monitoring, recordkeeping, and annual reporting of GHG from stationary fuel combustion sources (§98.2(a)(3)).

C. Applicability of Source Aggregation

The operations of the facility have not been aggregated with any other gas production, midstream service facilities, or transportation operations because there are no other oil and gas facilities or operations that are both a) "contiguous and adjacent" and b) "under common control" to the facility.

D. Applicability of State Regulations

The following state regulations are potentially applicable to natural gas compressor stations. Applicability to the facility has been determined as follows:

1. Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers
§45CSR2 [Applicable]

This rule does apply; however, because the reboilers (RBV-01 and RBV-02) each have a maximum design heat input (MDHI) rating less than 10 MMBtu/hr, the only requirement is to limit visible emissions to less than 10% opacity during normal operations (§45-02-3.1). The reboiler combusts only natural gas which inherently conforms to the visible emission standards.

2. Prevent and Control the Discharge of Air Pollutants into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors
§45CSR4 [Applicable]

This rule does apply and states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable.

3. Control of Air Pollution from Combustion of Refuse
§45CSR6 [Applicable]

This rule does apply to the Elevated Flare (FLR-01) and to the Thermal Oxidizers (TOx-01 and TOx-02); however, these units combust waste from natural gas operations which inherently conforms to the particulate emission and opacity standards.

4. **Prevent and Control Air Pollution from the Emission of Sulfur Oxides**
§45CSR10 [Not Applicable]

This rule does not apply to the Compressor Engines (CE-01 thru CE-04), Generator Engine (GE-01), Elevated Flare (FLR-01), Reboilers (RBV-01 and RBV-02), Thermal Oxidizers (TOx-01 and TOx-02) or any other fuel burning units, manufacturing process sources, or combustion sources because each combust only natural gas (§45-10A-3.1.b).

5. **Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation**
§45CSR13 [Applicable]

This rule does apply. The facility is currently operating under 45CSR13 Modification Permit R13-3561, issued July 29, 2022.

6. **Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants for Prevention of Significant Deterioration**
45CSR14 [Not Applicable]

The rule does not apply because the facility is neither a new PSD major source of pollutants nor is the proposed facility a modification to an existing PSD major source.

7. **Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60**
45CSR16 [Applicable]

The rule does apply to this source by reference to §40CFR60 Subparts JJJJ, KKKK and OOOOa. The facility is subject to the notification, testing, monitoring, recordkeeping and reporting requirements of these Subparts.

8. **Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution Which Cause or Contribute to Nonattainment**
45CSR19 [Not Applicable]

This rule does not apply because the facility is a minor (or “deferred”) source of all regulated pollutants.

9. **Regulation of Volatile Organic Compounds (VOC)**
45CSR21 [Not Applicable]

This rule does not apply because the facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

10. **Air Quality Management Fees Program**
45CSR22 [Applicable]

This rule does apply. It establishes a program to collect fees for certificates to operate and for permits to construct, modify, or relocate sources of air pollution.

11. Prevent and Control Emissions of Toxic Air Pollutants (Best Available Control Technology (BAT))
45CSR27 [Not Applicable]

This rule does not apply because the equipment used in the production and distribution of petroleum products is exempt, provided the product contains no more than 5% benzene by weight (§45-27-2.4).

12. Air Pollution Emissions Banking and Trading
45CSR28 [Not Applicable]

This rule does not apply because the facility does not choose to participate in the voluntarily statewide air pollutant emissions trading program.

13. Emission Statements for VOC and NOx
45CSR29 [Not Applicable]

This rule does not apply because the facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

14. Requirements for Operating Permits
45CSR30 [Applicable]

This rule does apply because the facility qualifies as a "Title V Major Source" (See section A.2 above.)

15. Emission Standards for Hazardous Air Pollutants (HAP)
45CSR34 [Not Applicable]

This rule does not apply because the facility is an area source of HAP emissions. Note: The provisions under Subparts HH and ZZZZ of 40 CFR Part 63 which apply to non-major area sources of hazardous air pollutants are excluded.

Supplement S3

Emission Calculations

- **Emission Summary Spreadsheets**
    - Potential to Emit (PTE) – Criteria Pollutants – Controlled
    - Potential to Emit (PTE) – Hazardous Air Pollutants (HAP) – Controlled – 1 of 2
    - Potential to Emit (PTE) – Hazardous Air Pollutants (HAP) – Controlled – 2 of 2
    - Potential to Emit (PTE) – Greenhouse Gases (GHG) – Controlled
    - Potential to Emit (PTE) – Regulated Pollutants – PRE-Controlled
- **Unit-Specific Emission Spreadsheets**
    - Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions
    - Engine Crankcase (ECC (5E)) Emissions
    - Compressor Rod Packing (CRP (6E)) Emissions
    - Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions
    - Generator Engine (GE-01 (8E)) Emissions
    - Compressor Turbine (CT-01 (9E)) Emissions
    - Compressor Turbine Start/Stop (TSS (10E)) Emissions
    - Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E)) Emissions
    - Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions
    - Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions
    - Reboiler 01 and 02 (RBV-01 (14E and 17E)) Emissions
    - Produced Water - Storage Tank (TK-01 (18E) thru TK-04 (21E)) Emissions
    - Produced Water - Truck Load-Out (TLO (22E)) Emissions
    - Pigging Operation (PIG (23E)) Emissions
- **Air Pollution Control Equipment (APCE) Emission Spreadsheets**
    - DFT-01/DSV-01 Thermal Oxidizer 01 (TOx-01 (24E)) Emissions
    - DFT-02/DSV-02 Thermal Oxidizer 02 (TOx-02 (25E)) Emissions
    - BD/PIG Elevated Flare (FLR-01 (26E)) Emissions
- **Fugitive Emissions**
    - Process Piping and Equipment Leak (FUG-G (1F)) Emissions – Gas
- Process Piping and Equipment Leak (FUG-L (2F)) Emissions – Liquid
- Selected AP-42 and GHG Emission Factors

Potential-to-Emit (PTE) - Criteria Pollutants - Controlled

Unit ID	Point ID	Control ID	Description	Site Rating		NOX		CO		VOC (w/HCHO)		SO2		PM10/2.5	
						lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources															
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000	bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000	bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000	bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000	bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5	Engines	0.05	0.22	0.32	1.39	0.11	0.46	3E-04	1E-03	4E-03	0.02
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4	Compr's	---	---	---	---	2.11	9.22	---	---	---	---
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6	Compr's	---	---	---	---	0.55	2.42	---	---	---	---
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468	bhp	1.62	7.09	0.81	3.54	1.09	4.78	0.01	0.03	0.11	0.50
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252	bhp	5.04	20.36	5.11	20.65	0.59	2.37	0.29	1.16	0.84	3.40
TSS	10E	---	Compressor Turbine Start/Stop	104	Events/yr	0.02	0.10	0.87	3.80	0.24	1.04	---	---	---	---
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252	bhp	---	---	---	---	0.85	3.71	---	---	---	---
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0	MMscfd	---	---	---	---	0.16	0.70	---	---	---	---
DSV-01	13E		Dehydrator 01 - Still Vent			---	---	---	---	0.72	3.14	---	---	---	---
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00	MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-03	0.01	0.01	0.07
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0	MMscfd	---	---	---	---	0.18	0.78	---	---	---	---
DSV-02	16E		Dehydrator 02 - Still Vent			---	---	---	---	0.67	2.94	---	---	---	---
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00	MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-03	0.01	0.01	0.07
TK-01	18E	---	Storage Tank 01 - Produced Water	400	bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-02	19E	---	Storage Tank 02 - Produced Water	400	bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-03	20E	---	Storage Tank 03 - Produced Water	400	bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-04	21E	---	Storage Tank 04 - Produced Water	400	bbl	---	---	---	---	0.01	0.04	---	---	---	---
TLO	22E	---	Truck Load-Out - Produced Water	120,000	bbl/yr	---	---	---	---	0.38	1.66	---	---	---	---
PIG	23E	FLR-01 (26E)	Pigging Operations	4	Units	---	---	---	---	0.12	0.52	---	---	---	---
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61	MMBtu/hr	0.75	3.27	2.36	10.33	0.04	0.18	4E-03	0.02	0.06	0.25
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70	MMBtu/hr	0.66	2.88	2.08	9.10	0.04	0.16	4E-03	0.02	0.05	0.22
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00	MMBtu/hr	0.67	2.95	2.13	9.34	0.04	0.16	4E-03	0.02	0.05	0.22
				Total Point Sources:		**26.84**	**115.84**	**26.03**	**112.26**	**20.63**	**90.15**	**0.39**	**1.64**	**2.64**	**11.27**
				TVOP Threshold:**		**---**	**100**	**---**	**100**	**---**	**100**	**---**	**100**	**---**	**100**
Ridgeline Compressor Station - Fugitive Sources															
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	4,981	Fittings	---	---	---	---	0.72	3.15	---	---	---	---
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271	Fittings	---	---	---	---	2.04	8.94	---	---	---	---
				Total Fugitive Sources:		**---**	**---**	**---**	**---**	**2.76**	**12.08**	**---**	**---**	**---**	**---**
Ridgeline Compressor Station - Total PTE															
				Total Facility-Wide:		**26.84**	**115.84**	**26.03**	**112.26**	**23.39**	**102.23**	**0.39**	**1.64**	**2.64**	**11.27**
				TVOP Threshold:**		**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**
						lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
						NOX		**CO**		**VOC (w/HCHO)**		**SO2**		**PM10/2.5**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Hazardous Air Pollutants (HAP) - Controlled - 1 of 2

Unit ID	Point ID	Control ID	Description	Site Rating	Acetaldehyde		Acrolein		Benzene		Butadiene, 1,3-		Ethylbenzene		HCHO		n-Hexane	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources																		
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	4E-03	0.02	2E-03	0.01	2E-04	8E-04	1E-04	5E-04	2E-05	8E-05	0.03	0.12	5E-04	2E-03
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	---	---	---	0.01	0.02	---	---	0.01	0.02	---	---	0.11	0.48
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	---	---	---	1E-03	6E-03	---	---	1E-03	6E-03	---	---	0.03	0.13
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	0.07	0.33	0.05	0.20	4E-03	0.02	0.00	0.01	4E-04	2E-03	0.16	0.71	0.01	0.04
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	3E-03	0.01	5E-04	2E-03	8E-05	3E-04	4E-05	1E-04	3E-03	1E-02	0.06	0.24	---	---
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	---	---	---	---	6E-04	3E-03	---	---	6E-04	3E-03	---	---	0.01	0.05
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	---	---	---	2E-03	1E-02	---	---	2E-03	1E-02	---	---	0.04	0.19
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	3E-04	1E-03	---	---	7E-05	3E-04	---	---	0.01	0.02
DSV-01	13E		Dehydrator 01 - Still Vent		---	---	---	---	0.03	0.12	---	---	0.02	0.09	---	---	0.02	0.08
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	---	---	---	---	4E-06	2E-05	---	---	---	---	1E-04	6E-04	4E-03	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	3E-04	1E-03	---	---	8E-05	3E-04	---	---	0.01	0.03
DSV-02	16E		Dehydrator 02 - Still Vent		---	---	---	---	0.03	0.12	---	---	0.02	0.09	---	---	0.02	0.07
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	---	---	---	---	4E-06	2E-05	---	---	---	---	1E-04	6E-04	4E-03	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	---	---	---	3E-04	1E-03	---	---	8E-03	3E-02	---	---	0.03	0.13
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	---	---	---	3E-04	1E-03	---	---	3E-04	1E-03	---	---	6E-03	0.03
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	---	---	---	---	2E-05	7E-05	---	---	---	---	6E-04	2E-03	0.01	0.06
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	---	---	---	---	1E-05	6E-05	---	---	---	---	5E-04	2E-03	0.01	0.05
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	---	---	---	---	1E-05	6E-05	---	---	---	---	5E-04	2E-03	0.01	0.05
				Total Point Sources:	**0.58**	**2.54**	**0.36**	**1.56**	**0.10**	**0.42**	**0.02**	**0.08**	**0.06**	**0.28**	**2.10**	**9.19**	**0.40**	**1.75**
				TVOP Threshold:**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
Ridgeline Compressor Station - Fugitive Sources																		
FUG-G	1F	LDAR	Process Piping Fugitives - Gas	4,981 Fittings	---	---	---	---	2E-03	0.01	---	---	2E-03	0.01	---	---	0.04	0.16
FUG-L	2F		Process Piping Fugitives - Light Oil	2,271 Fittings	---	---	---	---	2E-03	0.01	---	---	0.04	0.19	---	---	0.16	0.69
				Total Fugitive Sources:	**---**	**---**	**---**	**---**	**3E-03**	**0.02**	**---**	**---**	**0.04**	**0.19**	**---**	**---**	**0.20**	**0.85**
Ridgeline Compressor Station - Total PTE																		
				Total Facility-Wide:	**0.58**	**2.54**	**0.36**	**1.56**	**0.10**	**0.43**	**0.02**	**0.08**	**0.11**	**0.47**	**2.10**	**9.19**	**0.60**	**2.61**
				TVOP Threshold:**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**
					lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
					Acetaldehyde		**Acrolein**		**Benzene**		**Butadiene, 1,3-**		**Ethylbenzene**		**HCHO**		**n-Hexane**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Hazardous Air Pollutants (HAP) - Controlled - 2 of 2

Unit ID	Point ID	Control ID	Description	Site Rating	Methanol		POM/PAH		Toluene		TMP, 2,2,4-		Xylenes		Other HAP		TOTAL HAPs	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources																		
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	1E-03	5E-03	2E-04	7E-04	2E-04	8E-04	1E-04	5E-04	8E-05	3E-04	1E-04	6E-04	**0.04**	**0.15**
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	0.01	0.02	---	---	0.01	0.06	0.01	0.02	0.01	0.06	---	---	**0.16**	**0.70**
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	1E-03	6E-03	---	---	3E-03	2E-02	1E-03	6E-03	3E-03	2E-02	---	---	**0.04**	**0.18**
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	0.02	0.10	3E-03	0.01	4E-03	0.02	2E-03	0.01	2E-03	0.01	3E-03	0.01	**0.33**	**1.47**
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	---	---	3E-03	0.01	1E-02	0.04	---	---	5E-03	0.02	2E-03	0.01	**0.09**	**0.36**
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	6E-04	3E-03	---	---	1E-03	0.01	6E-04	0.00	1E-03	0.01	---	---	**0.02**	**0.08**
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	2E-03	1E-02	---	---	5E-03	0.02	2E-03	0.01	5E-03	0.02	---	---	**0.06**	**0.28**
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	5E-04	2E-03	---	---	4E-04	2E-03	---	---	**0.01**	**0.03**
DSV-01	13E		Dehydrator 01 - Still Vent		0.02	0.07	---	---	0.09	0.38	---	---	0.20	0.86	---	---	**0.36**	**1.59**
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	---	---	1E-06	6E-06	7E-06	3E-05	---	---	---	---	2E-06	1E-05	**4E-03**	**0.02**
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	6E-04	3E-03	---	---	5E-04	2E-03	---	---	**0.01**	**0.03**
DSV-02	16E		Dehydrator 02 - Still Vent		0.02	0.07	---	---	0.09	0.38	---	---	0.19	0.83	---	---	**0.35**	**1.55**
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	---	---	1E-06	6E-06	7E-06	3E-05	---	---	---	---	2E-06	1E-05	**4E-03**	**0.02**
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	2E-04	1E-03	---	---	4E-03	0.02	3E-03	0.01	0.01	0.05	---	---	**0.05**	**0.24**
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	3E-04	1E-03	---	---	7E-04	3E-03	3E-04	1E-03	7E-04	3E-03	---	---	**9E-03**	**0.04**
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	---	---	5E-06	2E-05	3E-05	1E-04	---	---	---	---	9E-06	4E-05	**0.01**	**0.06**
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	---	---	5E-06	2E-05	2E-05	1E-04	---	---	---	---	8E-06	3E-05	**0.01**	**0.05**
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	---	---	5E-06	2E-05	2E-05	1E-04	---	---	---	---	8E-06	4E-05	**0.01**	**0.06**
				Total Point Sources:	**0.21**	**0.94**	**0.03**	**0.12**	**0.24**	**1.06**	**0.03**	**0.14**	**0.44**	**1.92**	**0.02**	**0.11**	**4.60**	**20.10**
				TVOP Threshold:**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Ridgeline Compressor Station - Fugitive Sources																		
FUG-G	1F	LDAR	Process Piping Fugitives - Gas	4,981 Fittings	2E-03	0.01	---	---	5E-03	0.02	2E-03	0.01	5E-03	0.02	---	---	**0.05**	**0.24**
FUG-L	2F		Process Piping Fugitives - Light Oil	2,271 Fittings	1E-03	0.01	---	---	0.02	0.09	0.01	0.06	0.06	0.24	---	---	**0.29**	**1.29**
				Total Fugitive Sources:	**3E-03**	**0.01**	**---**	**---**	**0.03**	**0.11**	**0.02**	**0.07**	**0.06**	**0.26**	**---**	**---**	**0.35**	**1.53**
Ridgeline Compressor Station - Total PTE																		
				Total Facility-Wide:	**0.22**	**0.95**	**0.03**	**0.12**	**0.27**	**1.17**	**0.05**	**0.21**	**0.50**	**2.18**	**0.02**	**0.11**	**4.95**	**21.63**
				TVOP Threshold:**	---	10	---	10	---	10	---	10	---	10	---	10	---	25
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
					Methanol		POM/PAH		Toluene		TMP, 2,2,4-		Xylenes		Other HAP		TOTAL HAPs	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Greenhouse Gas (GHG) Pollutants - Controlled

Unit ID	Point ID	Control ID	Description	Site Rating	Heat Input MMBtu/hr (HHV)	Hours of Operation hr/yr*	CO2 tpy	CO2e (GWP: 1.00) tpy	CH4 tpy	CO2e (GWP: 25.00) tpy	N2O tpy	CO2e (GWP: 298.00) tpy	TOTAL CO2e lb/hr*	TOTAL CO2e tpy
Ridgeline Compressor Station - Point Sources														
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	---	8,760	244.77	244.77	1.27	31.65	4E-04	0.12	**63.14**	**277**
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	8,760	0.21	0.21	39.80	995	---	---	**227.24**	**995**
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	8,760	2.70	2.70	10.45	261	---	---	**60.29**	**264**
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	11.38	8,760	6,960	6,960	34.59	864.70	0.01	3.27	**1,787**	**7,828**
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	83.87	8,760	37,436	37,436	11.91	297.79	1.02	304.25	**8,684**	**38,038**
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	---	8,760	35	35	5.30	132.60	---	---	**38**	**168**
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	2,160	0.08	0.08	16.00	400.05	---	---	**370**	**400**
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	8,760	8.15	8.15	0.95	23.69	---	---	**7.27**	**32**
DSV-01	13E		Dehydrator 01 - Still Vent		---	8,760	7.83	7.83	0.87	21.79	---	---	**6.76**	**30**
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	2.00	8,760	1,031	1,031	0.02	0.49	2E-02	5.63	**236.69**	**1,037**
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	8,760	6.57	6.57	1.00	24.89	---	---	**7.18**	**31**
DSV-02	16E		Dehydrator 02 - Still Vent		---	8,760	5.68	5.68	0.05	1.35	---	---	**1.60**	**7**
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	2.00	8,760	1,031	1,031	0.02	0.49	2E-02	5.63	**236.69**	**1,037**
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	8,760	---	---	---	---	---	---	**---**	**---**
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	8,760	0.58	0.58	2.23	55.82	---	---	**---**	**56**
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	7.61	8,760	3,919	3,919	0.08	1.88	0.01	2.19	**895.66**	**3,923**
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	6.70	8,760	3,452	3,452	0.07	1.65	0.01	1.93	**788.91**	**3,455**
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	7.00	8,760	3,543	3,543	0.07	1.70	0.01	1.98	**809.71**	**3,547**
						Total Point Sources:	**142,078**	**142,078**	**561.14**	**14,029**	**1.23**	**367.97**	**35,991**	**156,475**
						TVOP Threshold:**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
Ridgeline Compressor Station - Fugitive Sources														
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	4,981 Fittings	---	8,760	0.07	0.07	13.58	339	---	---	**77.50**	**339**
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271 Fittings	---	8,760	---	---	---	---	---	---	**---**	**---**
						Total Fugitive Sources:	**0.07**	**0.07**	**13.58**	**339.39**	**---**	**---**	**77.50**	**339**
Ridgeline Compressor Station - Total PTE														
						Total Facility-Wide:	**142,078**	**142,078**	**574.72**	**14,368**	**1.23**	**367.97**	**36,069**	**156,814**
						TVOP Threshold:**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**
							tpy CO2	**tpy CO2e**	**tpy CH4**	**tpy CO2e**	**tpy N2O**	**tpy CO2e**	**lb/hr* TOTAL CO2e**	**tpy TOTAL CO2e**

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) – Regulated Pollutants - PRE-Controlled

Unit ID	Point ID	Control ID	Description	Site Rating	NOX		CO		VOC (w/HCHO)		HCHO		Total HAP	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources														
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	0.05	0.22	0.32	1.39	0.11	0.46	0.03	0.12	0.04	0.15
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	---	---	---	2.11	9.22	---	---	0.16	0.70
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	---	---	---	27.65	121.12	---	---	2.09	9.14
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	1.62	7.09	6.21	27.22	3E-03	4.54	0.97	4.25	1.19	5.22
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	5.04	20.36	5.11	20.65	0.59	2.37	0.06	0.24	0.09	0.36
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	0.02	0.10	0.87	3.80	0.24	1.04	---	---	0.02	0.08
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	---	---	---	0.85	3.71	---	---	0.06	0.28
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	31.87	139.59	---	---	1.28	5.61
DSV-01	13E		Dehydrator 01 - Still Vent		---	---	---	---	143.55	628.74	---	---	72.40	317.10
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-04	6E-04	4E-03	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	35.45	155.26	---	---	1.47	6.45
DSV-02	16E		Dehydrator 02 - Still Vent		---	---	---	---	134.11	587.38	---	---	70.71	309.73
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-04	6E-04	4E-03	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	---	---	---	0.38	1.66	---	---	0.05	0.24
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	---	---	---	5.91	25.87	---	---	0.45	4.71
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	No Pre-Controlled Emissions from the Thermal Oxider (TOx-01)									
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	No Pre-Controlled Emissions from the Thermal Oxider (TOx-02)									
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	No Pre-Controlled Emissions from the Flare 01 (FLR-01)									
				Total Point Sources:	**24.76**	**106.74**	**122.19**	**533.44**	**407.98**	**1,791**	**10.32**	**45.17**	**162.18**	**713.07**
				TVOP Threshold:**	**---**	**100**	**---**	**100**	**---**	**100**	**---**	**10**	**---**	**25**
Ridgeline Compressor Station - Fugitive Sources														
FUG-G	1F	---	Process Piping and Equipment Leaks - Gas	4,981 Fittings	---	---	---	---	3.06	13.41	---	---	0.23	1.01
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271 Fittings	---	---	---	---	7.45	32.65	---	---	1.08	4.71
				Total Fugitive Sources:	**---**	**---**	**---**	**---**	**10.52**	**46.06**	**---**	**---**	**1.31**	**5.72**
Ridgeline Compressor Station - Total PTE														
				Total Facility-Wide:	**24.76**	**106.74**	**122.19**	**533.44**	**418.50**	**1,837**	**10.32**	**45.17**	**163.49**	**718.80**
				TVOP Threshold:**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**
					lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
					NOX		**CO**		**VOC (w/HCHO)**		**HCHO**		**Total HAP**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions		
				g/bhp-hr	lb/MMBtu	lb/hr	tpy		g/bhp-hr	lb/hr	tpy
	Compressor Engines 01 thru 04 (Each) (OxCat-01 thru OxCat-04)	Vendor Data	NOX	0.40	0.12	4.41	19.31	---	**0.40**	**4.41**	**19.31**
		Vendor Data	CO	2.48	0.73	27.34	119.74	89.0%	**0.27**	**3.01**	**13.17**
		Vendor Data	NMNEHC	0.57	0.17	6.28	27.52	60.0%	**0.23**	**2.51**	**11.01**
	Caterpillar (CAT) G3616LE A4 (4SLB)	Sum	VOC (w/Aldehydes)*	0.83	0.24	9.10	39.87	65.1%	**0.29**	**3.18**	**13.92**
		AP-42 Table 3.2-2	SO2	1.99E-03	5.88E-04	0.02	0.10	---	**2E-03**	**0.02**	**0.10**
		AP-42 Table 3.2-2	PM10/2.5	3.38E-02	9.99E-03	0.37	1.63	---	**0.03**	**0.37**	**1.63**
	5,000 bhp (Each)	AP-42 Table 3.2-2	*Acetaldehyde	2.83E-02	8.36E-03	0.31	1.37	60.0%	**0.01**	**0.12**	**0.55**
	8,760 hr/yr (Each)	AP-42 Table 3.2-2	*Acrolein	1.74E-02	5.14E-03	0.19	0.84	60.0%	**7E-03**	**0.08**	**0.34**
	1,000 rpm, 16 cyl	AP-42 Table 3.2-2	Benzene	1.49E-03	4.40E-04	0.02	0.07	60.0%	**6E-04**	**0.01**	**0.03**
	20,698 in3 Displacement	AP-42 Table 3.2-2	Butadiene, 1,3-	9.04E-04	2.67E-04	0.01	0.04	60.0%	**4E-04**	**4E-03**	**0.02**
CE-01 (1E) CE-02 (2E) CE-03 (3E) CE-04 (4E)	1,294 in3/cyl	AP-42 Table 3.2-2	Ethylbenzene	1.34E-04	3.97E-05	1E-03	6E-03	60.0%	**5E-05**	**6E-04**	**3E-03**
		Vendor Data	*Formaldehyde	0.21	0.06	2.31	10.14	80.0%	**0.04**	**0.46**	**2.03**
	823 Exhaust Temp (oF)	AP-42 Table 3.2-2	n-Hexane	3.76E-03	1.11E-03	0.04	0.18	60.0%	**2E-03**	**0.02**	**0.07**
(Each)	30,842 Exhaust Flow (acfm)	AP-42 Table 3.2-2	Methanol	8.47E-03	2.50E-03	0.09	0.41	60.0%	**3E-03**	**0.04**	**0.16**
		AP-42 Table 3.2-2	POM/PAH	1.26E-03	3.74E-04	0.01	0.06	60.0%	**5E-04**	**0.01**	**0.02**
	MFD: > 08/23/11	AP-42 Table 3.2-2	Toluene	1.38E-03	4.08E-04	0.02	0.07	60.0%	**6E-04**	**0.01**	**0.03**
	NSPS JJJJ Affected	AP-42 Table 3.2-2	TMP, 2,2,4-	9.04E-04	2.67E-04	0.01	0.04	60.0%	**4E-04**	**4E-03**	**0.02**
		AP-42 Table 3.2-2	Xylenes	6.23E-04	1.84E-04	0.01	0.03	60.0%	**2E-04**	**3E-03**	**0.01**
	7,466 Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	Other/Trace HAP	1.09E-03	3.21E-04	0.01	0.05	60.0%	**4E-04**	**0.00**	**0.02**
	37.33 MMBtu/hr (HHV) (Each)	AP-42 Table 3.2-2	Total HAP	0.28	0.08	3.04	13.31	75.2%	**0.07**	**0.75**	**3.30**
	36,598 scf/hr (Each)	Vendor Data	CO2 (GWP=1)	437	129.04	4,817	21,099	---	**437.00**	**4,817**	**21,099**
	320.60 MMscf/yr (Each)	Vendor Data	CH4 (GWP=25)	2.26	0.67	24.91	109.12	---	**2.26**	**24.91**	**109.12**
	1,020 Btu/scf (HHV)	40CFR98 - Table C2	N2O (GWP=298)	7.47E-04	2.20E-04	0.01	0.04	---	**7E-04**	**0.01**	**0.04**
		Weighted Sum	CO2e	493.72	145.79	5,442	23,838	---	**493.72**	**5,442**	**23,838**

* = As per vendor data, the VOC Emission Factor is the sum of NMNEHC plus Aldehydes.

Notes:

1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - As per vendor data, emission values are based on adjustment to specified NOX level, all other emission values are "Not to Exceed" (i.e., Vendor Guarantee).

3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

4 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

5 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.

6 - Total NMNEHC, VOC, HCHO, HAP and CO2e emissions include Compressor Rod Packing (CRP), Compressor Blowdown (CBD), Engine Start-up (ESU), and Engine Crankcase (ECC) Emissions:

Description (Each Engine w/ Compressor)	NMNEHC	VOC	HCHO	Tot HAP	CO2e
Engine Operations (See Above)	11.01 tpy	13.92 tpy	2.03 tpy	3.30 tpy	23,838 tpy
Compressor Rod Packing (CRP)	2.31 tpy	2.31 tpy	---	0.17 tpy	249 tpy
Compressor Blowdown (CBD)	0.54 tpy	0.54 tpy	---	0.04 tpy	59 tpy
Engine Start-up (ESU)	Electric or Pneumatic Starters are Utilized				
Engine Crankcase (ECC)	0.08 tpy	0.11 tpy	0.03 tpy	0.04 tpy	64.41 tpy
TOTAL:	**13.94 tpy**	**16.88 tpy**	**2.06 tpy**	**3.55 tpy**	**24,210 tpy**

Engine Crankcase (ECC (5E)) Emissions

Unit ID	Source ID	Site Rating	Operations	CAT G3616 A4 Emission Rates 0.41 scf/bhp-hr	NOx 4.41 lb/hr; 5.79 lb/MMscf		CO 27.34 lb/hr; 35.91 lb/MMscf		VOC 9.10 lb/hr; 11.96 lb/MMscf		SO2 0.02 lb/hr; 0.03 lb/MMscf		PM 0.37 lb/hr; 0.49 lb/MMscf	
				MMscf/yr	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	CE-01	5,000 bhp	8,760 hr/yr	18.02	0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03
	CE-02	5,000 bhp	8,760 hr/yr	18.02	0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03
	CE-03	5,000 bhp	8,760 hr/yr	18.02	0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03
	CE-04	5,000 bhp	8,760 hr/yr	18.02	0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03
	GE-01	1,468 bhp	8,760 hr/yr	5.29	3E-03	0.02	0.02	0.09	0.01	0.03	2E-05	8E-05	3E-04	1E-03
	TOTAL:	**21,468 bhp**	**43,800 hr/yr**	**77.36** Total:	**0.05**	**0.22**	**0.32**	**1.39**	**0.11**	**0.46**	**3E-04**	**1E-03**	**4E-03**	**0.02**
				Pre-Control:	0.05	0.22	0.32	1.39	0.11	0.46	3E-04	1E-03	4E-03	0.02

Unit ID	Source ID	CO2 4,817 lb/hr; 6,328 lb/MMscf		CH4 24.91 lb/hr; 32.72 lb/MMscf		N2O 0.01 lb/hr; 0.01 lb/MMscf		CO2e 5,442 lb/hr; 7,149 lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	CE-01	13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-02	13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-03	13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-04	13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	GE-01	3.82	16.74	0.02	0.09	7E-06	3E-05	4.32	18.91
	Total:	**55.88**	**244.77**	**0.29**	**1.27**	**1E-04**	**4E-04**	**63.14**	**276.54**
	Pre-:	55.88	244.77	0.29	1.27	1E-04	4E-04	63.14	276.54

Unit ID	Acetaldehyde 0.31 lb/hr; 0.41 lb/MMscf		Acrolein 0.19 lb/hr; 0.25 lb/MMscf		Benzene 0.02 lb/hr; 0.02 lb/MMscf		Butadiene 0.01 lb/hr; 0.01 lb/MMscf		Ethylbenzene 1E-03 lb/hr; 2E-03 lb/MMscf		HCHO 2.31 lb/hr; 3.04 lb/MMscf		n-Hexane 0.04 lb/hr; 0.05 lb/MMscf	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04
	2E-04	1E-03	2E-04	7E-04	1E-05	6E-05	8E-06	3E-05	1E-06	5E-06	0.00	0.01	3E-05	1E-04
Total	**4E-03**	**0.02**	**2E-03**	**0.01**	**2E-04**	**8E-04**	**1E-04**	**5E-04**	**2E-05**	**8E-05**	**0.03**	**0.12**	**5E-04**	**2E-03**
Pre-Control:	4E-03	0.02	2E-03	0.01	2E-04	8E-04	1E-04	5E-04	2E-05	8E-05	0.03	0.12	5E-04	2E-03

Unit ID	Methanol 0.09 lb/hr; 0.12 lb/MMscf		POM/PAH 0.01 lb/hr; 0.02 lb/MMscf		Toluene 0.02 lb/hr; 0.02 lb/MMscf		TMP, 2,2,4- 0.01 lb/hr; 0.01 lb/MMscf		Xylenes 0.01 lb/hr; 0.01 lb/MMscf		Other/Trace 0.01 lb/hr; 0.02 lb/MMscf		Total HAPs 3.04 lb/hr; 3.99 lb/MMscf	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	7E-05	3E-04	1E-05	5E-05	1E-05	5E-05	8E-06	3E-05	5E-06	2E-05	9E-06	4E-05	0.00	0.01
Total	**1E-03**	**5E-03**	**2E-04**	**7E-04**	**2E-04**	**8E-04**	**1E-04**	**5E-04**	**8E-05**	**3E-04**	**1E-04**	**6E-04**	**0.04**	**0.15**
Pre-Control:	1E-03	5E-03	2E-04	7E-04	2E-04	8E-04	1E-04	5E-04	8E-05	3E-04	1E-04	6E-04	0.04	0.15

Notes: 1 - As per Caterpillar's Application & Installation Guide - Crankcase Ventilation Systems:
"[B]low-by on a new engine is approx. 0.5 ft3 /bhp-hr
and design for a worn engine should be 1.0 ft3 /bhp-hr."
http://s7d2.scene7.com/is/content/Caterpillar/CM20160713-53120-62603

2 - Blowby emission rates converted from "actual" cubic feet to "standard" cubic feet:

scf = acf * [(P+14.6959)/14.6959] * [527.67/(T+459.67)]

Actual to Standard Conversions (@ 823 oF vs. 68 oF (Ignore Δ psi):	**1.0 acf =**	**0.41 scf**

3 - Engine Exhaust Flow Rates converted from "actual" cubic feet per minute to "standard" cubic feet per minute:

scf = acf * [(P+14.6959)/14.6959] * [527.67/(T+459.67)]

Actual to Standard Conversions (@ 823 oF vs. 68 oF (Ignore Δ psi):	**30,842 acfm =**	**12,688 scfm**

Compressor Rod Packing (CRP (6E)) Emissions

Unit ID	Unit Description (Compressor Rod Packing)	No of Cylinders	scfh per Cylinder	Contin-gency	Total Fugitive Leak Rate		Pre-Control VOC 9,537 lb/MMscf		Control Efficiency	VOC 9,537 lb/MMscf		CO2 (w/o Control) 213 lb/MMscf		CH4 41,158 lb/MMscf		CO2e CH4 GWP = 25	
					scfh	MMscfy	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CRP (6E)	Recip Compressor - 01 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31	na	0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 02 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 03 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 04 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
				TOTAL:	**220.80**	**1.93**	**2.11**	**9.22**	**TOTAL:**	**2.11**	**9.22**	**0.05**	**0.21**	**9.09**	**39.80**	**227.24**	**995**
				Pre-Control:	220.80	1.93	2.11	9.22	Pre-Cont:	2.11	9.22	0.05	0.21	9.09	39.80	227.24	995

Unit ID	Unit Description (Compressor Rod Packing)	Benzene 25.00 lb/MMscf		E-Benzene 25.00 lb/MMscf		n-Hexane 500 lb/MMscf		Methanol 25.00 lb/MMscf		Toluene 60.00 lb/MMscf		2,2,4-TMP 25.00 lb/MMscf		Xylene 60.00 lb/MMscf		Tot HAP 720 lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CRP (6E)	Recip Compressor - 01 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 02 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 03 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 04 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	TOTAL:	**0.01**	**0.02**	**0.01**	**0.02**	**0.11**	**0.48**	**0.01**	**0.02**	**0.01**	**0.06**	**0.01**	**0.02**	**0.01**	**0.06**	**0.16**	**0.70**
	Pre-Control:	0.01	0.02	0.01	0.02	0.11	0.48	0.01	0.02	0.01	0.06	0.01	0.02	0.01	0.06	0.16	0.70

Notes:

1 - As per the manufacturer (Ariel): "Packing in new and broken-in condition will leak 5-10 scfh through the vent. This leakage rate will increase over time due to wear of the non-metallic sealing rings." The Williams' engineering department provides a conservative leak rate estimate of 12 scfh/cylinder.

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

	Min. Contingency:	20% VOC and GHG		
Pollutant	**Wet Gas**	**Worst Case**	**%Total**	**%VOC**
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

3 - Each engine drives a four throw Ariel KBZ/4 reciprocating compressor.

4 - The reciprocating compressor associated with Solar's vent recompression system has its rod packing leaks circulated to the suction inlet through a dedicated line resulting in no leaks to the atmosphere.

Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions

Unit ID	Unit Description	Site Rating	Emission Factor	Blowdown Gas	Blowdown and ESD	Total Gas Vented	Pre-Control VOC 9,537 Gas lb/MMscf		Flare Control %	VOC 9,537 Gas lb/MMscf		CO2 (w/o Control) 213 Gas lb/MMscf		CH4 41,158 Gas lb/MMscf		CO2e CH4 GWP = 25	
		bhp	scf/bhp	scf/Event	Events/yr	Mscf/yr	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
BD (7E)	Recip Comp - 01 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14	98%	0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 02 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 03 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 04 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Centrifugal Comp - 01 (Turbine CBD)	11,252	4.76	53,533	30	1,606	1.75	7.66		0.03	0.15	0.04	0.17	0.15	0.66	3.81	16.70
	Recip Comp - 05 (Electric) (CBD)	75	26.67	2,000	12	24	0.03	0.11		5E-04	2E-03	6E-04	3E-03	2E-03	0.01	0.06	0.25
	Emergency Shutdown (ESD) Testing	---	---	1,001,610	1	1,002	1.09	4.78		0.02	0.10	0.02	0.11	0.09	0.41	2.38	10.41
Assumes 1 hr/Event				**TOTAL:**	**459**	**25,400**	**27.65**	**121.12**	**TOTAL:**	**0.55**	**2.42**	**0.62**	**2.70**	**2.39**	**10.45**	**13.51**	**264.06**
							1,383	6,056	Pre-Control:	27.65	121.12	0.62	2.70	119.34	523	2,984	13,070

Unit ID	Unit Description	Benzene 25.00 Gas lb/MMscf		Ethylbenzene 25.00 Gas lb/MMscf		n-Hexane 500.00 Gas lb/MMscf		Methanol 25.00 Gas lb/MMscf		Toluene 60.00 Gas lb/MMscf		2,2,4-TMP 25.00 Gas lb/MMscf		Xylene 60.00 Gas lb/MMscf		Total HAP 720.00 Gas lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
BD (7E)	Recip Comp - 01 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 02 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 03 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 04 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Centrifugal Comp - 01 (Turbine CBD)	9E-05	4E-04	9E-05	4E-04	2E-03	0.01	9E-05	4E-04	2E-04	1E-03	9E-05	4E-04	2E-04	1E-03	3E-03	0.01
	Recip Comp - 05 (Electric) (CBD)	1E-06	6E-06	1E-06	6E-06	3E-05	1E-04	1E-06	6E-06	3E-06	1E-05	1E-06	6E-06	3E-06	1E-05	4E-05	2E-04
	Emergency Shutdown (ESD) Testing	6E-05	3E-04	6E-05	3E-04	1E-03	5E-03	6E-05	3E-04	1E-04	6E-04	6E-05	3E-04	1E-04	6E-04	2E-03	7E-03
Assumes 1 hr/Event	**TOTAL:**	**1E-03**	**0.01**	**1E-03**	**0.01**	**0.03**	**0.13**	**1E-03**	**0.01**	**3E-03**	**0.02**	**1E-03**	**0.01**	**3E-03**	**0.02**	**0.04**	**0.18**
	Pre-Control:	0.07	0.32	0.07	0.32	1.45	6.35	0.07	0.32	0.17	0.76	0.07	0.32	0.17	0.76	2.09	9.14

Notes: 1 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Min. Contingency: Wet Gas	20% VOC and GHG Worst Case	%Total	%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

ATTACHMENT S – BLOWDOWN AND PIGGING OPERATIONS

Type	Events	scf/Event	MW Gas	Total tpy	VOC%	VOC-tpy
CBD	416	Varies	20.05	13.96	15.55	2.17
ESD	1	1,001,610	20.05	0.61	15.55	0.10
LO-PIG	1095	2,668	20.05	1.79	15.55	0.28
HI-PIG	365	2,503	20.05	1.53	15.55	0.24

Type	Events	scf/Event	MW Gas	Total tpy	HAP%	HAP-tpy
CBD	416	Varies	20.05	13.96	1.17	0.16
ESD	1	1,001,610	20.05	0.61	1.17	0.007
LO-PIG	1095	2,668	20.05	1.79	1.17	0.02
HI-PIG	365	2,503	20.05	1.53	1.17	0.02

2 - The lb/hr emission estimates are tpy averaged over 8,760 hr/yr.

3 - The electric compressor blowdown volume is conservatively estimated at 2,000 scf.

Generator Engine (GE-01 (8E)) Emissions

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions		
				g/bhp-hr	lb/MMBtu	lb/hr	tpy		g/bhp-hr	lb/hr	tpy
	Generator Engine 01 (OxCat-05)	Vendor Data	NOX	0.50	0.14	1.62	7.09	---	**0.50**	**1.62**	**7.09**
		Vendor Data	CO	1.92	0.55	6.21	27.22	87.0%	**0.25**	**0.81**	**3.54**
		Vendor Data	NMNEHC	0.32	0.09	1.04	4.54	21.9%	**0.25**	**0.81**	**3.54**
	Caterpillar (CAT)	Sum	VOC (w/Aldehydes)*	0.67	0.19	2.16	9.46	49.5%	**0.34**	**1.09**	**4.78**
	G3512LE (4SLB)	AP-42 Table 3.2-2	SO2	2.07E-03	5.88E-04	0.01	0.03	---	**2E-03**	**0.01**	**0.03**
		AP-42 Table 3.2-2	PM10/2.5	3.51E-02	9.99E-03	0.11	0.50	---	**0.04**	**0.11**	**0.50**
	1,468 bhp	AP-42 Table 3.2-2	*Acetaldehyde	2.94E-02	8.36E-03	0.10	0.42	21.9%	**0.02**	**0.07**	**0.33**
	8,760 hr/yr	AP-42 Table 3.2-2	*Acrolein	1.81E-02	5.14E-03	0.06	0.26	21.9%	**1E-02**	**0.05**	**0.20**
	1,800 rpm, 16 cyl	AP-42 Table 3.2-2	Benzene	1.55E-03	4.40E-04	0.01	0.02	21.9%	**1E-03**	**4E-03**	**0.02**
		AP-42 Table 3.2-2	Butadiene, 1,3-	9.39E-04	2.67E-04	3E-03	0.01	21.9%	**7E-04**	**2E-03**	**0.01**
		AP-42 Table 3.2-2	Ethylbenzene	1.40E-04	3.97E-05	5E-04	2E-03	21.9%	**1E-04**	**4E-04**	**2E-03**
GE-01 (8E)		Vendor Data	*Formaldehyde	0.30	0.09	0.97	4.25	83.3%	**0.05**	**0.16**	**0.71**
	959 Exhaust Temp (oF)	AP-42 Table 3.2-2	n-Hexane	3.90E-03	1.11E-03	0.01	0.06	21.9%	**3E-03**	**0.01**	**0.04**
	9,156 Exhaust Flow (acfm)	AP-42 Table 3.2-2	Methanol	8.79E-03	2.50E-03	0.03	0.12	21.9%	**7E-03**	**0.02**	**0.10**
		AP-42 Table 3.2-2	POM/PAH	1.31E-03	3.74E-04	4E-03	0.02	21.9%	**1E-03**	**3E-03**	**0.01**
	MFD: > 08/23/11	AP-42 Table 3.2-2	Toluene	1.43E-03	4.08E-04	5E-03	0.02	21.9%	**1E-03**	**4E-03**	**0.02**
	NSPS JJJJ Affected	AP-42 Table 3.2-2	TMP, 2,2,4-	9.39E-04	2.67E-04	3E-03	0.01	21.9%	**7E-04**	**2E-03**	**0.01**
		AP-42 Table 3.2-2	Xylenes	6.47E-04	1.84E-04	2E-03	0.01	21.9%	**5E-04**	**2E-03**	**7E-03**
	7,751 Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	Other/Trace HAP	1.13E-03	3.21E-04	4E-03	0.02	21.9%	**9E-04**	**3E-03**	**0.01**
	11.38 MMBtu/hr (HHV)	AP-42 Table 3.2-2	Total HAP	0.37	0.10	1.19	5.22	71.9%	**0.10**	**0.33**	**1.47**
	11,156 scf/hr	Vendor Data	CO2 (GWP=1)	491	139.65	1,589	6,960	---	**491.00**	**1,589**	**6,960**
	97.72 MMscf/yr	Vendor Data	CH4 (GWP=25)	2.44	0.69	7.90	34.59	---	**2.44**	**7.90**	**34.59**
	1,020 Btu/scf (HHV)	40CFR98 - Table C2	N2O (GWP=298)	7.75E-04	2.20E-04	3E-03	0.01	---	**8E-04**	**3E-03**	**0.01**
		Weighted Sum	CO2e	552.23	157.07	1,787	7,828	---	**552.23**	**1,787**	**7,828**

* = As per vendor data, the VOC Emission Factor is the sum of NMNEHC plus Aldehydes.

Notes:

1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - As per vendor data, emission values are based on adjustment to specified NOX level, all other emission values are "Not to Exceed" (i.e., Vendor Guarantee).

3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

4 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

5 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.

6 - Total NMNEHC, VOC, HCHO, HAP and CO2e emissions include Compressor Rod Packing (CRP), Compressor Blowdown (CBD), Engine Start-up (ESU), and Engine Crankcase (ECC) Emissions:

Description (Each Engine w/ Compressor)	**NMNEHC**	**VOC**	**HCHO**	**Tot HAP**	**CO2e**
Engine Operations (See Above)	3.54 tpy	4.78 tpy	0.71 tpy	1.47 tpy	7,828 tpy
Compressor Rod Packing (CRP)	2.31 tpy	2.31 tpy	---	0.17 tpy	249 tpy
Compressor Blowdown (CBD)	0.54 tpy	0.54 tpy	---	0.04 tpy	59 tpy
Engine Start-up (ESU)	Electric or Pneumatic Starters are Utilized				
Engine Crankcase (ECC)	0.08 tpy	0.11 tpy	0.03 tpy	0.04 tpy	64.41 tpy
TOTAL:	**6.47 tpy**	**7.73 tpy**	**0.74 tpy**	**1.72 tpy**	**8,200 tpy**

Compressor Turbine (CT-01) Emissions

Unit ID	Description		Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions	
					lb/MMBtu (0^oF)	lb/MMBtu (50^oF)	lb/hr (0^oF)	tpy (50^oF)		lb/hr (0^oF)	tpy (50^oF)
CT-01 (9E)	**Compressor Turbine 01**		Vendor Data	NOx (15 ppm)	0.100	0.100	5.04	20.36	---	**5.04**	**20.36**
			Vendor Data	CO (25 ppm)	0.122	0.122	5.11	20.65	---	**5.11**	**20.65**
	Solar Taurus 70-10802S		Vendor Data	UHC (CH4) (25 ppm)	0.035	0.035	2.93	11.83	---	**2.93**	**11.83**
			Vendor Data (PIL 168)	VOC (UHC*20%)	0.007	0.007	0.59	2.37	---	**0.59**	**2.37**
	11,252	**bhp (Max @ 0oF)**	AP-42 Table 3.2-2	SO2	0.003	0.003	0.29	1.16	---	**0.29**	**1.16**
	10,747	**bhp (Avg @ 50oF)**	Vendor Data (PIL 171)	PM10/2.5	0.010	0.010	0.84	3.40	---	**0.84**	**3.40**
	8,760	hr/yr	AP-42 Table 3.2-2	Acetaldehyde	4.00E-05	4.00E-05	3E-03	0.01	---	**3E-03**	**0.01**
	12,852	rpm (Max @ 0oF)	AP-42 Table 3.2-2	Acrolein	6.40E-06	6.40E-06	5E-04	2E-03	---	**5E-04**	**2E-03**
	12,852	rpm (Typ @ 50oF)	AP-42 Table 3.2-2	Benzene	9.10E-07	9.10E-07	8E-05	3E-04	---	**8E-05**	**3E-04**
			AP-42 Table 3.2-2	Butadiene, 1,3-	4.30E-07	4.30E-07	4E-05	1E-04	---	**4E-05**	**1E-04**
	Manufactured ≥ 02/18/05		AP-42 Table 3.2-2	Ethylbenzene	3.20E-05	3.20E-05	3E-03	0.01	---	**3E-03**	**0.01**
	NSPS KKKK Affected		Vendor Data (PIL 168)	Formaldehyde	7.10E-04	7.10E-04	0.06	0.24	---	**0.06**	**0.24**
			AP-42 Table 3.2-2	n-Hexane	---	---	---	---	---	**---**	**---**
	932	Exhaust Temp (oF)	AP-42 Table 3.2-2	Methanol	---	---	---	---	---	**---**	**---**
	208,678	Exhaust Flow (lb/hr)	AP-42 Table 3.2-2	POM/PAH	3.47E-05	3.47E-05	3E-03	0.01	---	**3E-03**	**0.01**
			AP-42 Table 3.2-2	Toluene	1.30E-04	1.30E-04	0.01	0.04	---	**0.01**	**0.04**
	7,229	Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	TMP, 2,2,4-	---	---	---	---	---	**---**	**---**
	83.87	MMBtu/hr (Max @ 0oF)	AP-42 Table 3.2-2	Xylenes	6.40E-05	6.40E-05	5E-03	0.02	---	**5E-03**	**0.02**
	77.70	MMBtu/hr (Typ @ 50oF)	AP-42 Table 3.2-2	Other/Trace HAP	2.90E-05	2.90E-05	2E-03	0.01	---	**2E-03**	**0.01**
	82,225	scf/hr (Max @ 0oF)	Sum	Total HAP	1.05E-03	1.05E-03	0.09	0.36	---	**0.09**	**0.36**
	76,176	scf/hr (Typ @ 50oF)	AP-42 Table 3.2-2	CO2 (GWP=1)	110	110.00	9,226	37,436	---	**9,226**	**37,436**
	667	MMscf/yr	Vendor Data	CH4 (GWP=25)	0.035	0.035	2.94	11.91	---	**2.94**	**11.91**
	1,020	Btu/scf (HHV)	AP-42 Table 3.2-2	N2O (GWP=298)	0.003	0.003	0.25	1.02	---	**0.25**	**1.02**
			Weighted Sum	CO2e	112	111.77	9,374	38,038	---	**9,374**	**38,038**

Notes:
1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

3 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

4 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate. (It does NOT impact the emission estimates.)

5 - Total VOC, HCHO, HAP and CO2e emissions include Compressor Turbine Operations (CT-01), Compressor Turbine Start+Stop (TSS), Dry Gas Seals (DGS), and Compressor Blowdown (CBD) emissions:

Description (Each Engine w/ Compressor)	VOC	HCHO	Tot HAP
Compressor Turbine Operations (See Above)	2.37 tpy	0.24 tpy	0.36 tpy
Compressor Turbine Start-Stop (TSS)	1.04 tpy	---	0.08 tpy
Dry Gas Seals (DGS)	3.71 tpy	---	0.28 tpy
Compressor Blowdown (CBD)	0.15 tpy	---	1E-02 tpy
TOTAL:	**7.27 tpy**	**0.24 tpy**	**0.73 tpy**

Combustion Turbine Start/Stop (TSS) Emissions

Unit ID	Description	Start+Stop per year	NOX		CO		VOC		CO2		CH4 (UHC)		CO2e	
			lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
TSS (10E)	Solar Taurus 70-10802S	104	2 lb/(Start+Stop)		73 lb/(Start+Stop)		20 lb/(Start+Stop)		676 lb/(Start+Stop)		102 lb/(Start+Stop)		3,226 lb/(Start+Stop)	
			0.02	0.10	0.87	3.80	0.24	1.04	8.03	35.15	1.21	5.30	38.30	167.75
	TOTAL:	**104**	**0.02**	**0.10**	**0.87**	**3.80**	**0.24**	**1.04**	**8.03**	**35.15**	**1.21**	**5.30**	**38.30**	**167.75**
		Pre-Control:	0.02	0.10	0.87	3.80	0.24	1.04	8.03	35.15	1.21	5.30	38.30	167.75

* lb/hr is tpy averaged over 8,760 hr/yr

Unit ID	Benzene 0.26% VOC		Ethylbenzene 0.26% VOC		n-Hexane 5.24% VOC		Methanol 0.26% VOC		Toluene 0.63% VOC		2,2,4-TMP 0.26% VOC		Xylene 0.63% VOC		Total HAP 7.55% VOC	
	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
TSS (10E)	6E-04	3E-03	6E-04	3E-03	0.01	0.05	6E-04	3E-03	1E-03	0.01	6E-04	3E-03	1E-03	0.01	0.02	0.08
	6E-04	**3E-03**	**6E-04**	**3E-03**	**0.01**	**0.05**	**6E-04**	**3E-03**	**1E-03**	**0.01**	**6E-04**	**3E-03**	**1E-03**	**0.01**	**0.02**	**0.08**
Pre-Control:	6E-04	3E-03	6E-04	3E-03	0.01	0.05	6E-04	3E-03	1E-03	0.01	6E-04	3E-03	1E-03	0.01	0.02	0.08

Notes: 1 - The emission factors for start-up and shutdown events are provided by the vendor in PIL 170, summarized below: (See Attachment C1 - Vendor Data)

Start/Stop Emissions Rate in lb/Event	Taurus 60-7000S					
	NOX	CO	VOC	CO2	CH4	CO2e
lb/Start	1	37	10	381	52	1,681
lb/Stop	1	36	10	295	50	1,545
Total lb/(Start+Stop)	**2**	**73**	**20**	**676**	**102**	**3,226**

Table 4: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units with Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7802S (Post 9/2020 Orders)	1	5	4	1	247	1	7	6	1	235
Taurus 70 10802S (Post 2/2018 Orders)	1	37	52	10	381	1	36	50	10	295

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Inlet Gas	Minimum Contingency: Worst Case	%Total	20% %VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.23%
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.55%
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.18%
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.00%
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.26%
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.26%
n-Hexane	227.09 lb/MMscf	500 lb/MMscf	0.815	5.24%
Methanol	--- lb/MMscf	25 lb/MMscf	0.041	0.26%
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.63%
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.26%
Xylenes	19.58 lb/MMscf	60 lb/MMscf	0.098	0.63%
Total HAP	270.21 lb/MMscf	720 lb/MMscf	1.174	7.55%

Centrifugal Compressor Dry Gas Seal (DGS) Emissions

Unit ID	Unit Description (Compressor Dry Gas Seals)	Operating Time	Leak Rate (Solar PIL 251)		Pre-Control VOC 9,537 lb/MMscf		Control %	VOC 9,537 lb/MMscf		CO2 (w/o Control) 213 lb/MMscf		CH4 41,158 lb/MMscf		CO2e CH4 GWP = 25	
		Hours	scfm	MMscf/yr	lb/hr*	tpy		lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
DGS (11E)	Comp Turbine 01	6,600	6.00	2.38	2.59	11.33	100%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2,160	6.00	0.78	0.85	3.71	0%	0.85	3.71	0.02	0.08	3.65	16.00	91.35	400.13
				TOTAL:	**3.43**	**15.04**	**TOTAL:**	**0.85**	**3.71**	**0.02**	**0.08**	**3.65**	**16.00**	**91.35**	**400**
							Pre-Control:	3.43	15.04	0.08	0.34	14.82	64.90	370	1,623

Source ID	Benzene 25.00 lb/MMscf		Ethylbenzene 25.00 lb/MMscf		n-Hexane 500.00 lb/MMscf		Methanol 25.00 lb/MMscf		Toluene 60.00 lb/MMscf		2,2,4-TMP 25.00 lb/MMscf		Xylene 60.00 lb/MMscf		Total HAP 720.00 lb/MMscf	
	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
DGS (11E)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2E-03	0.01	2E-03	0.01	0.04	0.19	2E-03	0.01	5E-03	0.02	2E-03	0.01	5E-03	0.02	0.06	0.28
	2E-03	**0.01**	**2E-03**	**0.01**	**0.04**	**0.19**	**2E-03**	**0.01**	**5E-03**	**0.02**	**2E-03**	**0.01**	**5E-03**	**0.02**	**0.06**	**0.28**
Pre-Control:	9E-03	0.04	9E-03	0.04	0.18	0.79	0.01	0.04	2E-02	0.09	9E-03	0.04	2E-02	0.09	0.26	1.14

Notes:

1 - The Solar Taurus 70 Compressor Turbines (CT-01) drives one (1) Solar C41MH centrifugal compressor

2 - Dry gas seal leak rate provided by Solar Turbines and based on PIL 251 and historical operating pressure. A conservative contingency has been added to the estimate leak rate.

5.0 scfm * 120% Contingency = 6.00 scfm

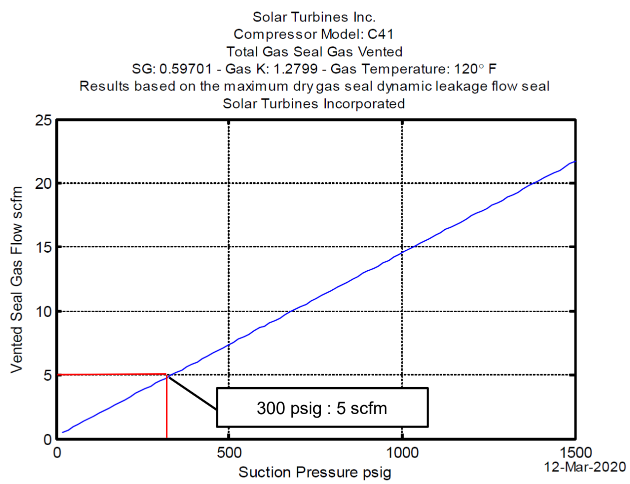


Figure 8: C41

3 - The results of a representative Extended Gas Analysis were used to determine the following worst-case VOC and HAP components (See Attachment C1 - Lab Analysis):

Pollutant	Inlet Gas	Worst-Case (Minimum Contingency: 20%)	Wgt%	Wt%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

4 - A dry seal recompression system is used to capture the centrifugal compressor dry gas seal leaks for reinjection to the station suction or discharge header. This recompression system achieves 100% capture of the seal leaks. There will be occasional maintenance performed on the recompression system and it is assumed up to 3 months (2,160 hours) of recompression system downtime may occur over the course of a year.

Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions

Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Pre-Control Emissions		Worst-Case Pre-Control VOC/GHG: 20% Margin HAP: 20% Margin		T-Ox Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
DFT-01 (12E)	Dehydrator Flash Tank Flash Tank Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 250.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	26.56	116.32	31.87	140	99.5%	**0.16**	**0.70**
			GRI-GLYCalc 4.0	Benzene	0.04	0.19	0.05	0.23		**3E-04**	**1E-03**
			GRI-GLYCalc 4.0	Ethylbenzene	0.01	0.05	0.01	0.06		**7E-05**	**3E-04**
			GRI-GLYCalc 4.0	n-Hexane	0.85	3.71	1.02	4.46		**0.01**	**0.02**
			Process Simulation	Methanol	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Toluene	0.09	0.39	0.11	0.47		**5E-04**	**2E-03**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	0.07	0.33	0.09	0.39		**4E-04**	**2E-03**
			GRI-GLYCalc 4.0	Tot HAP	1.07	4.67	1.28	5.61		**0.01**	**0.03**
			GRI-GLYCalc 4.0	CO2	1.55	6.79	1.86	8.15	---	**1.86**	**8.15**
			GRI-GLYCalc 4.0	CH4	36.06	158	43.28	190	99.5%	**0.22**	**0.95**
			40CFR98 - Table A-1	CO2e	903.17	3,956	1,084	4,747	99.3%	**7.27**	**31.84**
DSV-01 (13E)	Dehydrator Still Vent Still Vent Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 250.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	119.62	523.95	143.55	628.74	99.5%	**0.72**	**3.14**
			GRI-GLYCalc 4.0	Benzene	4.47	19.58	5.37	23.50		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.33	14.59	4.00	17.50		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	2.91	12.77	3.50	15.32		**0.02**	**0.08**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.44	63.25	17.33	75.89		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	32.56	142.63	39.08	171.16		**0.20**	**0.86**
			GRI-GLYCalc 4.0	Tot HAP	60.85	266.54	72.40	317.10		**0.36**	**1.59**
			GRI-GLYCalc 4.0	CO2	1.49	6.53	1.79	7.83	---	**1.79**	**7.83**
			GRI-GLYCalc 4.0	CH4	33.17	145.27	39.80	174.32	99.5%	**0.20**	**0.87**
			40CFR98 - Table A-1	CO2e	829.16	3,638	996.78	4,366	99.3%	**6.76**	**29.62**
DHY-01	Dehydrator (Total)	Flow Rate 250.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	146.18	640.27	175	768	99.5%	**0.88**	**3.84**
			GRI-GLYCalc 4.0	Benzene	4.52	19.78	5.42	23.73		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.34	14.63	4.01	17.56		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	3.76	16.48	4.52	19.78		**0.02**	**0.10**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.53	63.63	17.43	76.36		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	32.64	142.96	39.17	171.55		**0.20**	**0.86**
			GRI-GLYCalc 4.0	Tot HAP	61.92	271.21	73.68	323		**0.37**	**1.61**
			GRI-GLYCalc 4.0	CO2	3.04	13.32	3.65	15.98	---	**3.65**	**15.98**
			GRI-GLYCalc 4.0	CH4	69.23	303	83.08	364	99.5%	**0.42**	**1.82**
			40CFR98 - Table A-1	CO2e	1732	7,594	2,081	9,113	99.3%	**14.03**	**61**

Notes:
1 - Used GRI-GLYCalc V4.0 to calculate Flash Tank and Regenerator/Still Vent emissions (see Supplement S4 - Emission Programs). Process Simulation used to calculate MeOH emissions. Total VOC includes MeOH.
2 - GRI-GLYCalc 4.0 Model Results are based on the following input:

Wet Gas:	80 oF and 1,000 psig, H2O Saturated	Glycol Pump:	Electric Pump
Wet Gas Analysis:	See Supplement S1 - Wet Gas Summary	Flash Tank:	110 oF, 60 psig, 99.5% Combustion
Dry Gas:	250.0 MMscfd, 7.0 lb-H2O/MMscf	Stripping Gas:	Dry Gas @ 15 scfm
Lean Glycol:	1.5 wt% H2O, 24.0 gpm	Regen Control:	99.5% Combustion

3 - A contingency has been added to the GRI-GLYCalc model results to account for potential future changes in gas composition.

Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions

Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Pre-Control Emissions		Worst-Case Pre-Control VOC/GHG: 20% Margin HAP: 20% Margin		T-Ox Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
DFT-02 (15E)	Dehydrator Flash Tank Flash Tank Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	29.54	129.38	35.45	155	99.5%	**0.18**	**0.78**
			GRI-GLYCalc 4.0	Benzene	0.05	0.23	0.06	0.27		**3E-04**	**1E-03**
			GRI-GLYCalc 4.0	Ethylbenzene	0.01	0.06	0.02	0.07		**8E-05**	**3E-04**
			GRI-GLYCalc 4.0	n-Hexane	0.98	4.29	1.17	5.15		**0.01**	**0.03**
			Process Simulation	Methanol	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Toluene	0.10	0.44	0.12	0.53		**6E-04**	**3E-03**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	0.08	0.36	0.10	0.43		**5E-04**	**2E-03**
			GRI-GLYCalc 4.0	Tot HAP	1.23	5.37	1.47	6.45		**0.01**	**0.03**
			GRI-GLYCalc 4.0	CO2	1.25	5.48	1.50	6.57	---	**1.50**	**6.57**
			GRI-GLYCalc 4.0	CH4	37.88	166	45.46	199	99.5%	**0.23**	**1.00**
			40CFR98 - Table A-1	CO2e	948.33	4,154	1,138	4,984	99.4%	**7.18**	**31.46**
DSV-02 (16E)	Dehydrator Still Vent Still Vent Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	111.75	489.49	134.11	587.38	99.5%	**0.67**	**2.94**
			GRI-GLYCalc 4.0	Benzene	4.49	19.69	5.39	23.63		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.30	14.45	3.96	17.34		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	2.73	11.95	3.28	14.35		**0.02**	**0.07**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.40	63.07	17.28	75.69		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	31.39	137.50	37.67	165.00		**0.19**	**0.83**
			GRI-GLYCalc 4.0	Tot HAP	59.45	260.40	70.71	309.73		**0.35**	**1.55**
			GRI-GLYCalc 4.0	CO2	1.08	4.73	1.30	5.68	---	**1.30**	**5.68**
			GRI-GLYCalc 4.0	CH4	2.05	8.98	2.46	10.78	99.5%	**0.01**	**0.05**
			40CFR98 - Table A-1	CO2e	51.27	229	62.82	275	97.4%	**1.60**	**7.02**
DHY-02	Dehydrator (Total)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	141.29	619	170	743	99.5%	**0.85**	**3.71**
			GRI-GLYCalc 4.0	Benzene	4.55	19.91	5.46	23.90		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.31	14.51	3.97	17.41		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	3.71	16.24	4.45	19.49		**0.02**	**0.10**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.50	63.52	17.40	76.22		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	31.48	137.86	37.77	165.43		**0.19**	**0.83**
			GRI-GLYCalc 4.0	Tot HAP	60.68	265.77	72.19	316		**0.36**	**1.58**
			GRI-GLYCalc 4.0	CO2	2.33	10.21	2.80	12.25	---	**2.80**	**12.25**
			GRI-GLYCalc 4.0	CH4	39.93	175	47.92	210	99.5%	**0.24**	**1.05**
			40CFR98 - Table A-1	CO2e	1000	4,383	1,201	5,260	99.3%	**8.79**	**38**

Notes:
1 - Used GRI-GLYCalc V4.0 to calculate Flash Tank and Regenerator/Still Vent emissions (see Supplement S4 - Emission Programs). Process Simulation used to calculate MeOH emissions. Total VOC includes MeOH.
2 - GRI-GLYCalc 4.0 Model Results are based on the following input:

Wet Gas:	80 oF and 1,000 psig, H2O Saturated	Glycol Pump:	Electric Pump
Wet Gas Analysis:	See Supplement S1 - Wet Gas Summary	Flash Tank:	110 oF, 50 psig, 99.5% Combustion
Dry Gas:	160.0 MMscfd, 7.0 lb-H2O/MMscf	Stripping Gas:	na
Lean Glycol:	1.5 wt% H2O, 24.6 gpm	Regen Control:	99.5% Combustion

3 - A contingency has been added to the GRI-GLYCalc model results to account for potential future changes in gas composition.

Reboiler 01 and 02 (RBV-01 (14E) and RBV-02 (17E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor lb/MMscf	Emission Factor lb/MMBtu	Emissions lb/hr	Emissions tpy
RBV-01 (14E) RBV-02 (17E)	Reboiler	EPA AP-42 Table 1.4-1	NOX	100	9.80E-02	**0.20**	**0.86**
		EPA AP-42 Table 1.4-1	CO	84	8.24E-02	**0.16**	**0.72**
		EPA AP-42 Table 1.4-2	NMNEHC	5.4	5.32E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-2	VOC	5.5	5.39E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-2	SO2	0.6	5.88E-04	**1E-03**	**0.01**
		EPA AP-42 Table 1.4-2	PM10/2.5	7.6	7.45E-03	**0.01**	**0.07**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
	2.00 MMBtu/hr (HHV) (ea)	EPA AP-42 Table 1.4-3	Benzene	2.10E-03	2.06E-06	**4E-06**	**2E-05**
		EPA AP-42 Table 1.4-4	Butadiene, 1,3-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Formaldehyde	7.50E-02	7.35E-05	**1E-04**	**6E-04**
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	POM/PAH	6.98E-04	6.85E-07	**1E-06**	**6E-06**
		EPA AP-42 Table 1.4-3	Toluene	3.40E-03	3.33E-06	**7E-06**	**3E-05**
		EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Other/Trace HAP	1.20E-03	1.18E-06	**2E-06**	**1E-05**
		SUM	Total HAP	1.88	1.85E-03	**4E-03**	**0.02**
	1,961 scf/hr	EPA AP-42 Table 1.4-3	CO2 (GWP=1)	118	117.65	**235.29**	**1,031**
	47.06 Mscfd	EPA AP-42 Table 1.4-3	CH4 (GWP=25)	2.30	2.25E-03	**5E-03**	**0.02**
	17.18 MMscf/yr	EPA AP-42 Table 1.4-3	N2O (GWP=298)	2.20	2.16E-03	**4E-03**	**2E-02**
		40CFR98 - Table A-1	CO2e	831	118.35	**236.69**	**1,037**

Notes:
1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr. Actual load and operating hours will be less.
2 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.
3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5
4 - "Other/Trace HAPs" includes: CarbonTetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

Produced Water - Storage Tank TK-01 thru TK-04 (18E-21E) Emissions

Unit ID	Material Stored	Capacity		Thruput	EPA TANKS 4.0.9d				Control Efficiency (FLR)	VOC 100.00 %VOC		CO2 (w/o Control) --- VOC		CH4 --- VOC		CO2e CH4 GWP = 25	
					Working	Breathing	Total										
		bbl	bbl/day	bbl/yr	lb/yr	lb/yr	lb/yr	tpy/yr		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TK-01 (18E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04	na	0.01	0.04	Negligible GHG Emissions from Produced Water (PW)					
TK-02 (19E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
TK-03 (20E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
TK-04 (21E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
	TOTAL:	**1,600**		120,000					**TOTAL:**	**0.03**	**0.14**	**---**	**---**	**---**	**---**	**---**	**---**
									PRE-Control SC/TK:	0.03	0.14	---	---	---	---	---	---

Unit ID	Benzene 0.08 %VOC		Ethylbenzene 2.09 %VOC		n-Hexane (C6) 7.72 %VOC		Methanol (MeOH) 0.06 %VOC		Toluene (C7) 1.05 %VOC		2,2,4-TMP 0.70 %VOC		Xylenes (C8) 2.73 %VOC		Total HAP 14.43 %VOC	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TK-01 (18E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-02 (19E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-03 (20E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-04 (21E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TOTAL:	**3E-05**	**1E-04**	**7E-04**	**3E-03**	**2E-03**	**0.01**	**2E-05**	**9E-05**	**3E-04**	**1E-03**	**2E-04**	**1E-03**	**9E-04**	**4E-03**	**5E-03**	**0.02**
PRE-PW/TK:	3E-05	1E-04	7E-04	3E-03	2E-03	1E-02	2E-05	9E-05	3E-04	1E-03	2E-04	1E-03	9E-04	4E-03	5E-03	0.02

Notes:

1 - Produced water storage tanks are heated to approximately 60 degrees Fahrenheit to prevent freezing. Breathing losses are zero due to constant temperature.

2 - The results of a **Condensate Analysis** were used to determine the following worst-case components (See Supplement S1- Condensate Summary):

	Min. Contingency:	20% VOC 20% HAP		
Pollutant	**Condensate**	**Worst Case**	**%Total**	**%VOC**
CO2	--- lb/MMscf	--- lb/MMscf	---	---
Methane (CH4)	--- lb/MMscf	--- lb/MMscf	---	---
N2/Water/Ethane/Etc	--- lb/MMscf	--- lb/MMscf	---	---
VOC	268,162 lb/MMscf	321,795 lb/MMscf	100	100
TOTAL Gas	268,162 lb/MMscf	321,795 lb/MMscf	100	---
Benzene	127 lb/MMscf	253 lb/MMscf	0.08	0.08
Ethylbenzene	3,357 lb/MMscf	6,714 lb/MMscf	2.09	2.09
n-Hexane	12,422 lb/MMscf	24,843 lb/MMscf	7.72	7.72
Methanol	--- lb/MMscf	200 lb/MMscf	0.06	0.06
Toluene	1,687 lb/MMscf	3,375 lb/MMscf	1.05	1.05
2,2,4-TMP	1,132 lb/MMscf	2,264 lb/MMscf	0.70	0.70
Xylenes	4,395 lb/MMscf	8,790 lb/MMscf	2.73	2.73
Total HAP	23,120 lb/MMscf	46,439 lb/MMscf	14.43	14.43

3 - The TANKS 4.0.9d program was used to determine storage tank emissions (See Supplement S4 - TANKS 4.0.9d Output)

Produced Water - Truck Load-Out (TLO (22E)) Emissions

Unit ID	Description	S	P	M	T	CE (FLR)	L_L	T-Put	VOC 100.00%		CO2 --- VOC		CH4 --- VOC		CO2e CH4 GWP = 25	
		sat. fac.	psia	lb/lb-mol	°R	%	lb/Mgal	Mgal/yr	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TLO (22E)	Produced Water	0.60	1.50	30.00	510	na	0.66	5,040	0.38	1.66	---	---	---	---	---	---
							TOTAL:	**5,040**	**0.38**	**1.66**	**---**	**---**	**---**	**---**	**---**	**---**
							PRE-Control:		0.38	1.66	---	---	---	---	---	---

Unit ID	Benzene 0.08 %VOC		Ethylbenzene 2.09 %VOC		n-Hexane (C6) 7.72 %VOC		Methanol 0.06 %VOC		Toluene (C7) 1.05 %VOC		2,2,4-TMP 0.70 %VOC		Xylenes (C8) 2.73 %VOC		Total HAP 14.43 %VOC	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TLO (22E)	3E-04	1E-03	0.01	0.03	0.03	0.13	2E-04	1E-03	4E-03	0.02	3E-03	0.01	0.01	0.05	0.05	0.24
TOTAL:	**3E-04**	**1E-03**	**0.01**	**0.03**	**0.03**	**0.13**	**2E-04**	**1E-03**	**4E-03**	**0.02**	**3E-03**	**0.01**	**0.01**	**0.05**	**0.05**	**0.24**
PRE-Control:	3E-04	1E-03	0.01	0.03	0.03	0.13	2E-04	1E-03	4E-03	0.02	3E-03	0.01	0.01	0.05	0.05	0.24

Notes: 1 - Emission factors and formulas are from AP-42 Section 5.2 "Transportation and Marketing of Petroleum Liquids":

L_L = 12.46 x S x P x M / T x (1 - CE)

where:
- L_L = loading loss, lb/1000 gal of liquid loaded
- S = saturation factor, use 0.60 for submerged fill.
- P = true vapor pressure of liquid loaded, psia.
- M = molecular weight of vapors, lb/lb-mol.
- T = temperature of bulk liquid loaded, °R = °F + 460
- CE = overall emission reduction efficiency (70% collection efficiency x 98% FLR).

2 - Vapor pressure (P), molecular weight (M), and temperature (T) derived from EPA TANKS 4.0.9d.
(See Supplement S4 - Emission Program Results.)

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight
Produced Water (95% Water + 5% Condensate)	All	51.94	47.06	56.81	50.33	0.2465	0.2101	0.2893	28.3522			18.75
Gasoline (RVP 12)						5.4430	4.9447	5.9807	64.0000	0.0500	0.5080	92.00
Water						0.1930	0.1614	0.2307	18.0000	0.9500	0.4920	18.00

Pigging Operation (PIG (23E) Emissions

Unit ID	Unit Description	Blowdown Volume	Blowdown and ESD	Total Gas Vented	Pre-Control VOC 9,537 Gas lb/MMscf		FLR Control %	VOC 9,537 Gas lb/MMscf		CO2 (w/o Control) 213 Gas lb/MMscf		CH4 41,158 Gas lb/MMscf		CO2e CH4 GWP = 25	
		scf/Event	Events/yr	Mscf/yr	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PIG (23E)	12" Receiver A (PIG)	1,612	365	588	0.64	2.81	98%	0.01	0.06	0.01	0.06	0.06	0.24	1.40	6.12
	12" Receiver B (PIG)	1,612	365	588	0.64	2.81		0.01	0.06	0.01	0.06	0.06	0.24	1.40	6.12
	20" Receiver B (PIG)	4,781	365	1,745	1.90	8.32		0.04	0.17	0.04	0.19	0.16	0.72	4.14	18.14
	16" Launcher A (PIG)	6,858	365	2,503	2.73	11.94		0.05	0.24	0.06	0.27	0.24	1.03	5.94	26.02
Assumes 1 hr/Event		TOTAL:	**1,460**	**5,425**	**5.91**	**25.87**	TOTAL:	**0.12**	**0.52**	**0.13**	**0.58**	**0.51**	**2.23**	**12.88**	**56.39**
							Pre-Control:	5.91	25.87	6.59	28.88	25.49	111.63	644	2,820

Unit ID	Unit Description	Benzene 25.00 Gas lb/MMscf		Ethylbenzene 25.00 Gas lb/MMscf		n-Hexane 500.00 Gas lb/MMscf		Methanol 25.00 Gas lb/MMscf		Toluene 60.00 Gas lb/MMscf		2,2,4-TMP 25.00 Gas lb/MMscf		Xylene 60.00 Gas lb/MMscf		Total HAP 720.00 Gas lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PIG (23E)	12" Receiver A (PIG)	3E-05	1E-04	3E-05	1E-04	7E-04	3E-03	3E-05	1E-04	8E-05	4E-04	3E-05	1E-04	8E-05	4E-04	1E-03	4E-03
	12" Receiver B (PIG)	3E-05	1E-04	3E-05	1E-04	7E-04	3E-03	3E-05	1E-04	8E-05	4E-04	3E-05	1E-04	8E-05	4E-04	1E-03	4E-03
	20" Receiver B (PIG)	1E-04	4E-04	1E-04	4E-04	2E-03	9E-03	1E-04	4E-04	2E-04	1E-03	1E-04	4E-04	2E-04	1E-03	3E-03	0.01
	16" Launcher A (PIG)	1E-04	6E-04	1E-04	6E-04	3E-03	1E-02	1E-04	6E-04	3E-04	2E-03	1E-04	6E-04	3E-04	2E-03	4E-03	0.02
Assumes 1 hr/Event	TOTAL:	**3E-04**	**1E-03**	**3E-04**	**1E-03**	**0.01**	**0.03**	**3E-04**	**1E-03**	**7E-04**	**3E-03**	**3E-04**	**1E-03**	**7E-04**	**3E-03**	**0.01**	**0.04**
	Pre-Control:	0.02	0.07	0.02	0.07	0.31	1.36	0.02	0.07	0.04	0.16	0.02	0.07	0.04	0.16	0.45	1.95

Notes:

1 - Volume of gas vented during each Pigging Operation was conservatively estimated as follows:
(Lower temperature (T) is more conservative and higher pressure (P) is more conservative.)

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
20" Receiver:	23.0	9.0	26.0	60	720	0.93	1,420
	19.0	24.0	47.3				2,584
	9.3	30.0	14.0				766
	1.6	15.0	0.2				11
		Total Vacf:	87.4			**Total Vscf:**	**4,781**

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
12" Receiver	15.0	7.0	8.6	120	720	0.76	514
	11.0	20.0	13.2				790
	7.4	17.0	5.0				300
	1.6	8.5	0.1				7
		Total Vacf:	26.9			**Total Vscf:**	**1,612**

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
16" Launcher	20.0	10.0	21.8	120	1,440	0.76	2,586
	16.0	14.5	20.2				2,400
	12.0	9.0	7.1				838
	8.0	25.0	8.7				1,034
		Total Vacf:	57.9			**Total Vscf:**	**6,858**

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Min. Contingency: Wet Gas	20% VOC and GHG Worst Case	%Total	%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227.09 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	19.58 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270.21 lb/MMscf	720 lb/MMscf	1.174	7.550

Where: Vacf = 3.1416 * (Din/12/2)^2 * Lft
Vscf = Vacf * 528/(ToF+460) * (Ppsig+14.70)/14.70 / Z
Compressibility Factor (Z) from https://checalc.com/solved/naturalgasZ.html

DFT/DSV Thermal Oxidizer (TOx-01 (24E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor		Emissions	
				lb/MMscf	lb/MMBtu	lb/hr	tpy
TOx-01 (24E)	Zeeco Z-HTO Thermal Oxidizer (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	59	0.10	**0.75**	**3.27**
		EPA AP-42 Table 13.5-1	CO	187	0.31	**2.36**	**10.33**
		EPA AP-42 Table 1.4-2	NMNEHC	3.22	5.32E-03	**0.04**	**0.18**
	Controls Dehydrator (DHY-01) Flash Tank (DFT-01 (12E) and Still Vent (DSV-01 (13E))	EPA AP-42 Table 1.4-2	VOC	3.26	5.39E-03	**0.04**	**0.18**
		EPA AP-42 Table 1.4-2	SO2	0.36	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	4.51	7.45E-03	**0.06**	**0.25**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	1.25E-03	2.06E-06	**2E-05**	**7E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	Site Rating	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	7.61 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Formaldehyde	0.04	7.35E-05	**6E-04**	**2E-03**
	99.5% Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	1.07	1.76E-03	**0.01**	**0.06**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	4.1E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	2.0E-03	3.33E-06	**3E-05**	**1E-04**
	605 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Other/Trace HAP	7.1E-04	1.18E-06	**9E-06**	**4E-05**
		SUM	Total HAP	1.12	1.85E-03	**0.01**	**0.06**
	12,576 scf/hr	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	71,146	117.65	**894.73**	**3,919**
	302 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	1.36	2.25E-03	**0.02**	**0.08**
	110.17 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.13	2.20E-04	**2E-03**	**0.01**
		40CFR98 - Table A-1	CO2e	71,220	117.77	**895.66**	**3,923**

Notes:

1 - Dehydrator flash tank off-gases are generally burned as fuel in the reboiler. However, to be conservative, all flash tank off-gases are shown as being routed to the Thermal Oxidizer (TOx-01).

2 - Heat Input to the Thermal Oxidizer was determined as follows:

Waste/Pilot Gas Stream	scf/hr	Btu/scf (HHV)	MMBtu/hr
DFT-01 - Flash Tank Off-Gas	1,400	1,447	2.03
RSV-01 - Regenerator/Still Vent Gas	8,230	399	3.28
Purge, Fuel and Pilot Gas	850	1,214	1.03
20% Contingency	2,096	605	1.27
Total Gas to the Thermal Oxidizer:	**12,576**	**605**	**7.61**

3 - Reference: GRI-GLYCalc Results, Worst-Case Gas Analysis, Vendor Data, and Engineering Judgment.

DFT/DSV Thermal Oxidizer (TOx-02 (25E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor		Emissions	
				lb/MMscf	lb/MMBtu	lb/hr	tpy
TOx-02 (25E)	Zeeco Z-VTO Thermal Oxidizer (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	74	0.10	**0.66**	**2.88**
		EPA AP-42 Table 13.5-1	CO	233	0.31	**2.08**	**9.10**
		EPA AP-42 Table 1.4-2	NMNEHC	4.00	5.32E-03	**0.04**	**0.16**
	Controls Dehydrator (DHY-02) Flash Tank (DFT-02 (15E) and Still Vent (DSV-02 (16E))	EPA AP-42 Table 1.4-2	VOC	4.06	5.39E-03	**0.04**	**0.16**
		EPA AP-42 Table 1.4-2	SO2	0.44	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	5.61	7.45E-03	**0.05**	**0.22**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	1.55E-03	2.06E-06	**1E-05**	**6E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	Site Rating	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	6.70 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Formaldehyde	0.06	7.35E-05	**5E-04**	**2E-03**
	99.5% Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	1.33	1.76E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	5.1E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	2.5E-03	3.33E-06	**2E-05**	**1E-04**
	752 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Other/Trace HAP	8.9E-04	1.18E-06	**8E-06**	**3E-05**
		SUM	Total HAP	1.39	1.85E-03	**0.01**	**0.05**
	8,904 scf/hr	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	88,510	117.65	**788.09**	**3,452**
	214 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	1.70	2.25E-03	**0.02**	**0.07**
	78.00 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.17	2.20E-04	**1E-03**	**0.01**
		40CFR98 - Table A-1	CO2e	88,602	117.77	**788.91**	**3,455**

Notes:

1 - Dehydrator flash tank off-gases are generally burned as fuel in the reboiler. However, to be conservative, all flash tank off-gases are shown as being routed to the Thermal Oxidizer (TOx-01).

2 - Heat Input to the Thermal Oxidizer was determined as follows:

Waste/Pilot Gas Stream	scf/hr	Btu/scf (HHV)	MMBtu/hr
DFT-02 - Flash Tank Off-Gas	1,490	1,464	2.18
RSV-02 - Regenerator/Still Vent Gas	4,930	444	2.19
Purge, Fuel and Pilot Gas	1,000	1,214	1.21
20% Contingency	1,484	752	1.12
Total Gas to the Thermal Oxidizer:	**8,904**	**752**	**6.70**

3 - Reference: GRI-GLYCalc Results, Worst-Case Gas Analysis, Vendor Data, and Engineering Judgment.

BD/PIG Elevated Flare (FLR-01 (26E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor		Emissions	
				lb/MMscf	lb/MMBtu	lb/hr	tpy
FLR-01 (26E)	Zeeco MJ-16 Elevated Flare (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	119.04	0.10	**0.67**	**2.95**
		EPA AP-42 Table 13.5-1	CO	376.40	0.31	**2.13**	**9.34**
		EPA AP-42 Table 1.4-2	NMNEHC	6.46	5.32E-03	**0.04**	**0.16**
	Controls Compressor Blowdown and Emergency Shutdown (BD (7E), and PIG (23E)	EPA AP-42 Table 1.4-2	VOC	6.55	5.39E-03	**0.04**	**0.16**
		EPA AP-42 Table 1.4-2	SO2	0.71	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	9.05	7.45E-03	**0.05**	**0.22**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	2.50E-03	2.06E-06	**1E-05**	**6E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	Site Rating	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	7.00 MMBtu/hr (HHV) (Ave)	EPA AP-42 Table 1.4-3	Formaldehyde	0.09	7.35E-05	**5E-04**	**2E-03**
	98.0% Net Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	2.14	1.76E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	8.3E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	4.0E-03	3.33E-06	**2E-05**	**1E-04**
	1,214 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr (intermittent)	EPA AP-42 Table 1.4-3	Other/Trace HAP	1.4E-03	1.18E-06	**8E-06**	**4E-05**
		SUM	Total HAP	2.24	1.85E-03	**0.01**	**0.06**
	5,663 scf/hr (Ave)	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	142,845	117.65	**808.87**	**3,543**
	136 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	2.74	2.25E-03	**0.02**	**0.07**
	49.60 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.27	2.20E-04	**2E-03**	**7E-03**
		40CFR98 - Table A-1	CO2e	142,993	117.77	**809.71**	**3,547**

Notes: 1 - The average Heat Input to FLR-01 (26E) was determined as follows:

Waste/Pilot Gas Stream	scf/hr (ave)	Btu/scf (HHV)	MMBtu/hr (ave)
Recip Comp - 01 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 02 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 03 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 04 (Gas Engine) (CBD)	650	1,214	0.79
Centrifugal Comp - 01 (Turbine CBD)	183	1,214	0.22
Recip Comp - 05 (Electric) (CBD)	3	1,214	3E-03
Emergency Shutdown (ESD) Testing	114	1,214	0.14
Pigging Operations (PIG)	619	1,214	0.75
Purge, Fuel, and Pilot Gas	1,200	1,214	1.46
20% Contingency	944	1,214	1.15
Total Gas to FLR-01 (26E)	**5,663**	**1,214**	**6.88**
		Round-Up:	**7.00**

2 - Reference: Worst-Case Wet Gas Analysis, Vendor Data, and Engineering Judgment.

Process Piping and Equipment Leaks – Gas (FUG-G (1F)) Emissions

Unit ID	Description	Component (Unit) Type (Gas)	Unit Count	Cons'tive Multiplier 150%	Leak Factor lb/hr/Unit	Pre-Controlled Leaks lb/hr	Pre-Controlled Leaks tpy	LDAR Control Credit	Controlled Leaks lb/hr	Controlled Leaks tpy	VOC 15.55 Wgt% lb/hr	VOC tpy	CO2 2.23% VOC lb/hr	CO2 tpy	CH4 432% VOC lb/hr	CH4 tpy	CO2e CH4 GWP = 25 lb/hr	CO2e tpy
FUG-G (1F)	Process Piping and Equipment Leaks (Gas)	Valves	960	1,440	9.92E-03	14.29	62.57	92%	1.14	5.01	0.18	0.78	4E-03	0.02	0.77	3.36	19.18	84.01
		Pump Seals	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	72	108	1.94E-02	2.10	9.18	---	2.10	9.18	0.33	1.43	7E-03	0.03	1.41	6.16	35.17	154.03
		Connectors	3,132	4,698	4.41E-04	2.07	9.07	93%	0.15	0.64	0.02	0.10	5E-04	2E-03	0.10	0.43	2.43	10.66
		Flanges	783	1,175	8.60E-04	1.01	4.42	---	1.01	4.42	0.16	0.69	4E-03	0.02	0.68	2.97	16.95	74.23
		Open-ended Lines	34	51	4.41E-03	0.22	0.98	---	0.22	0.98	0.03	0.15	8E-04	3E-03	0.15	0.66	3.77	16.53
		TOTAL:	**4,981**	**7,472**						**TOTAL:**	**0.72**	**3.15**	**0.02**	**0.07**	**3.10**	**13.58**	**77.50**	**339.46**
										PRE Control:	3.06	13.41	0.07	0.30	13.21	57.88	330.42	1447.24

Unit ID	Description	Component (Unit) Type (Gas)	Benzene 0.262% VOC lb/hr	Benzene tpy	Ethylbenzene 0.262% VOC lb/hr	Ethylbenzene tpy	n-Hexane (C6) 5.24% VOC lb/hr	n-Hexane tpy	Methanol 0.26% VOC lb/hr	Methanol tpy	Toluene (C7) 0.629% VOC lb/hr	Toluene tpy	2,2,4-TMP 0.262% VOC lb/hr	2,2,4-TMP tpy	Xylenes (C8) 0.629% VOC lb/hr	Xylenes tpy	Total HAP 7.550% VOC lb/hr	Total HAP tpy
FUG-G (1F)	Process Piping and Equipment Leaks (Gas)	Valves	5E-04	2E-03	5E-04	2E-03	9E-03	0.04	5E-04	2E-03	1E-03	5E-03	5E-04	2E-03	1E-03	5E-03	0.01	0.06
		Pump Seals	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	9E-04	4E-03	9E-04	4E-03	0.02	0.07	9E-04	4E-03	2E-03	9E-03	9E-04	4E-03	2E-03	9E-03	0.02	0.11
		Connectors	6E-05	3E-04	6E-05	3E-04	1E-03	5E-03	6E-05	3E-04	1E-04	6E-04	6E-05	3E-04	1E-04	6E-04	2E-03	7E-03
		Flanges	4E-04	2E-03	4E-04	2E-03	8E-03	0.04	4E-04	2E-03	1E-03	4E-03	4E-04	2E-03	1E-03	4E-03	0.01	0.05
		Open-ended Lines	9E-05	4E-04	9E-05	4E-04	2E-03	8E-03	9E-05	4E-04	2E-04	1E-03	9E-05	4E-04	2E-04	1E-03	3E-03	1E-02
		TOTAL:	**2E-03**	**0.01**	**2E-03**	**0.01**	**0.04**	**0.16**	**2E-03**	**0.01**	**5E-03**	**0.02**	**2E-03**	**0.01**	**5E-03**	**0.02**	**0.05**	**0.24**
		PRE Control:	5.10	35.80	2.76	12.08	0.16	0.70	0.01	0.04	0.02	0.08	0.01	0.04	0.02	0.08	0.23	1.01

Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.

2 - Gas/Vapor emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995; Table 2-4, Oil and Gas Production Operations:

Equipment Type	Gas kg/hr	Gas lb/hr/unit	Light Oil kg/hr	Light Oil lb/hr/unit	Water/Oil kg/hr	Water/Oil lb/hr/unit
Valves	4.5E-03	9.92E-03	2.5E-03	5.51E-03	9.8E-05	2.16E-04
Pump Seals	---	---	1.3E-02	2.87E-02	2.4E-05	5.29E-05
Others	8.8E-03	1.94E-02	7.5E-03	1.65E-02	1.4E-02	3.09E-02
Connectors	2.0E-04	4.41E-04	2.1E-04	4.63E-04	1.1E-04	2.43E-04
Flanges	3.9E-04	8.60E-04	1.1E-04	2.43E-04	2.9E-06	6.39E-06
Open-Ended Lines	2.0E-03	4.41E-03	1.4E-03	3.09E-03	2.5E-04	5.51E-04

3 - "Other" components include pressure relief devices (PRD), compressors, diaphragms, drains, meters, etc.

4 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Min. Contingency: Wet Gas	20% VOC Worst Case	%Total	%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25.00 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25.00 lb/MMscf	0.041	0.262
n-Hexane	227.09 lb/MMscf	500.00 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25.00 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60.00 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25.00 lb/MMscf	0.041	0.262
Xylenes	19.58 lb/MMscf	60.00 lb/MMscf	0.098	0.629
Total HAP	270.21 lb/MMscf	720.00 lb/MMscf	1.174	7.550

Process Piping and Equipment Leaks – Light Oil (FUG-L (2F)) Emissions

Unit ID	Description	Component (Unit) Type (Light Oil)	Unit Count	Cons'tive Multiplier 150%	Leak Factor lb/hr/Unit	Pre-Controlled Leaks lb/hr	Pre-Controlled Leaks tpy	LDAR Control Credit	Controlled Leaks lb/hr	Controlled Leaks tpy	VOC 100.00 Wgt% lb/hr	VOC 100.00 Wgt% tpy	CO2 --- VOC lb/hr	CO2 --- VOC tpy	CH4 --- VOC lb/hr	CH4 --- VOC tpy	CO2e CH4 GWP = 25 lb/hr	CO2e CH4 GWP = 25 tpy
FUG-L (2F)	Process Piping and Equipment Leaks (Light Oil)	Valves	576	864	5.51E-03	4.76	20.86	88%	0.57	2.50	0.57	2.50	---	---	---	---	---	---
		Pump Seals	12	18	2.87E-02	0.52	2.26	75%	0.13	0.56	0.13	0.56	---	---	---	---	---	---
		Other	43	65	1.65E-02	1.07	4.67	---	1.07	4.67	1.07	4.67	---	---	---	---	---	---
		Connectors	1,296	1,944	4.63E-04	0.90	3.94	93%	0.06	0.28	0.06	0.28	---	---	---	---	---	---
		Flanges	324	486	2.43E-04	0.12	0.52	---	0.12	0.52	0.12	0.52	---	---	---	---	---	---
		Open-ended Lines	20	30	3.09E-03	0.09	0.41	---	0.09	0.41	0.09	0.41	---	---	---	---	---	---
		TOTAL:	**2,271**	**3,407**						**TOTAL:**	**2.04**	**8.94**	**---**	**---**	**---**	**---**	**---**	**---**
										PRE Control:	7.45	32.65	---	---	---	---	---	---

Unit ID	Description	Component (Unit) Type (Light Oil)	Benzene 0.079% VOC lb/hr	Benzene 0.079% VOC tpy	Ethylbenzene 2.09% VOC lb/hr	Ethylbenzene 2.09% VOC tpy	n-Hexane (C6) 7.72% VOC lb/hr	n-Hexane (C6) 7.72% VOC tpy	Methanol 0.06% VOC lb/hr	Methanol 0.06% VOC tpy	Toluene (C7) 1.05% VOC lb/hr	Toluene (C7) 1.05% VOC tpy	2,2,4-TMP 0.70% VOC lb/hr	2,2,4-TMP 0.70% VOC tpy	Xylenes (C8) 2.73% VOC lb/hr	Xylenes (C8) 2.73% VOC tpy	Total HAP 14.43% VOC lb/hr	Total HAP 14.43% VOC tpy
FUG-L (2F)	Process Piping and Equipment Leaks (Light Oil)	Valves	4E-04	2E-03	0.01	0.05	0.04	0.19	4E-04	2E-03	6E-03	0.03	4E-03	0.02	0.02	0.07	0.08	0.36
		Pump Seals	1E-04	4E-04	3E-03	0.01	0.01	0.04	8E-05	4E-04	1E-03	6E-03	9E-04	4E-03	4E-03	0.02	0.02	0.08
		Other	8E-04	4E-03	0.02	0.10	0.08	0.36	7E-04	3E-03	0.01	0.05	8E-03	0.03	0.03	0.13	0.15	0.67
		Connectors	5E-05	2E-04	1E-03	6E-03	5E-03	0.02	4E-05	2E-04	7E-04	3E-03	4E-04	2E-03	2E-03	0.01	0.01	0.04
		Flanges	9E-05	4E-04	2E-03	0.01	0.01	0.04	7E-05	3E-04	1E-03	5E-03	8E-04	4E-03	3E-03	0.01	0.02	0.07
		Open-ended Lines	7E-05	3E-04	2E-03	0.01	0.01	0.03	6E-05	3E-04	1E-03	4E-03	7E-04	3E-03	3E-03	0.01	0.01	0.06
		TOTAL:	**2E-03**	**0.01**	**0.04**	**0.19**	**0.16**	**0.69**	**1E-03**	**6E-03**	**0.02**	**0.09**	**1E-02**	**6E-02**	**0.06**	**0.24**	**0.29**	**1.29**
		PRE Control:	6E-03	0.03	0.16	0.68	0.58	2.52	5E-03	0.02	0.08	0.34	5E-02	0.23	0.20	0.89	1.08	4.71

Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.

2 - Light Oil emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995; Table 2-4, Oil and Gas Production Operations:

Equipment Type	Gas kg/hr	Gas lb/hr/unit	Light Oil kg/hr	Light Oil lb/hr/unit	Water/Oil kg/hr	Water/Oil lb/hr/unit
Valves	4.5E-03	9.92E-03	2.5E-03	5.51E-03	9.8E-05	2.16E-04
Pump Seals	---	---	1.3E-02	2.87E-02	2.4E-05	5.29E-05
Others	8.8E-03	1.94E-02	7.5E-03	1.65E-02	1.4E-02	3.09E-02
Connectors	2.0E-04	4.41E-04	2.1E-04	4.63E-04	1.1E-04	2.43E-04
Flanges	3.9E-04	8.60E-04	1.1E-04	2.43E-04	2.9E-06	6.39E-06
Open-Ended Lines	2.0E-03	4.41E-03	1.4E-03	3.09E-03	2.5E-04	5.51E-04

3 - "Other" components include pressure relief devices (PRD), diaphragms, drains, meters, etc.

4 - The results of a representative **Condensate Analysis** were used to determine the following worst-case components (See Supplement S1 - Condensate Summary):

Pollutant	Min. Contingency: Condensate	20% VOC 100% HAP Worst Case	%Total	%VOC
CO2	--- lb/MMscf	--- lb/MMscf	---	---
Methane (CH4)	--- lb/MMscf	--- lb/MMscf	---	---
N2/Water/Ethane/Etc	--- lb/MMscf	--- lb/MMscf	---	---
VOC	268,162 lb/MMscf	321,795 lb/MMscf	100.000	100.000
TOTAL Condenate	268,162 lb/MMscf	321,795 lb/MMscf	100.000	---
Benzene	126.59 lb/MMscf	253.18 lb/MMscf	0.079	0.079
Ethylbenzene	3,357.16 lb/MMscf	6,714.31 lb/MMscf	2.087	2.087
n-Hexane	12,421.65 lb/MMscf	24,843.30 lb/MMscf	7.720	7.720
Methanol (MeOH)	--- lb/MMscf	200.00 lb/MMscf	0.062	0.062
Toluene	1,687.46 lb/MMscf	3,374.93 lb/MMscf	1.049	1.049
2,2,4-TMP	1,131.80 lb/MMscf	2,263.61 lb/MMscf	0.703	0.703
Xylenes	4,395.08 lb/MMscf	8,790.15 lb/MMscf	2.732	2.732
Total HAP	23,119.74 lb/MMscf	46,439.48 lb/MMscf	14.431	14.431

Potentially Applicable

AP-42 and GHG EMISSION FACTORS

(Preferentially use test data or vendor data where available)

	Pollutant	Natural Gas-Fired Reciprocating Engines			Stationary Gas-Fired Turbines	
		AP-42 Table 3.2-1; 3.2-2; 3.2-3 07/00			AP-42 Table 3.1-1; 3.1-2a; 3.1-3 04/00	
		2SLB lb/MMBtu	4SLB lb/MMBtu	4SRB lb/MMBtu	Uncontrolled lb/MMBtu	Lean Pre-Mix# lb/MMBtu
CRITERIA	NOx (≥ 90% Load)	3.17E+00	4.08E+00	2.21E+00	3.23E-01	9.91E-02
	CO (≥ 90% Load)	3.86E-01	3.17E-01	3.72E+00	8.23E-02	1.51E-02
	VOC (NMNEHC w/o Aldehydes*)	4.93E-02	5.17E-02	3.68E-03	2.06E-03	2.06E-03
	VOC (NMNEHC w/ Aldehydes*)	1.20E-01	1.18E-01	2.96E-02	2.82E-03	2.13E-03
	SO2 (2,000 gr-S/MMscf ≈ 0.0007 W%)	5.88E-04	5.88E-04	5.88E-04	3.40E-03	3.40E-03
	PM10/2.5 (Condensible and Filterable)	4.83E-02	9.99E-03	1.94E-02	6.63E-03	6.63E-03
HAPs	Acetaldehyde*	7.76E-03	8.36E-03	2.79E-03	4.00E-05	4.00E-05
	Acrolein*	7.78E-03	5.14E-03	2.63E-03	6.40E-06	6.40E-06
	Benzene	1.94E-03	4.40E-04	1.58E-03	1.20E-05	9.10E-07
	Butadiene, 1,3-	8.20E-04	2.67E-04	6.63E-04	4.30E-07	4.30E-07
	Ethylbenzene	1.08E-04	3.97E-05	2.48E-05	3.20E-05	3.20E-05
	Formaldehyde (HCHO)*	5.52E-02	5.28E-02	2.05E-02	7.10E-04	2.00E-05
	n-Hexane	4.45E-04	1.11E-03	---	---	---
	Methanol (MeOH)	2.48E-03	2.50E-03	3.06E-03	---	---
	Polycyclic Organic Matter (POM/PAH)	2.68E-04	3.74E-04	2.38E-04	3.47E-05	3.47E-05
	Toluene	9.63E-04	4.08E-04	5.58E-04	1.30E-04	1.30E-04
	Trimethylpentane, 2,2,4- (i-Octane)	8.46E-04	2.50E-04	---	---	---
	Xylenes	2.68E-04	1.84E-04	1.95E-04	6.40E-05	6.40E-05
	Other/Trace HAP**	6.57E-04	3.21E-04	1.79E-04	2.90E-05	2.90E-05
	TOTAL HAP	7.95E-02	7.22E-02	3.24E-02	1.06E-03	3.57E-04
GHG	CO2 (GWP=1)	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02
	CH4 (GWP=25)	1.45E+00	1.25E+00	2.30E-01	8.64E-03	8.64E-03
	N2O (GWP=298)	Use 40CFR98	Use 40CFR98	Use 40CFR98	3.00E-03	3.00E-03
	CO2e	Use 40CFR98	Use 40CFR98	Use 40CFR98	Use 40CFR98	Use 40CFR98

(#Lean Pre-Mix - aka: Dry Low Emissions (DLE or DLN) or SoLoNOx)

	Pollutant	Natural Gas (External) Combustion			Industrial Flares	Diesel Engines
		AP-42 Table 1.4-1; 1.4-2; 1.4-3 (<100 MMBtu/hr) 07/98			13.5-1 06/17	3.3-1; 3.3-2 10/96
		Uncontrolled lb/MMBtu	LoNOx Burners lb/MMBtu	Flue Gas Recirc lb/MMBtu	Combustion lb/MMBtu	Uncontrolled lb/MMBtu
CRITERIA	NOx (≥ 90% Load)	9.80E-02	4.90E-02	3.14E-02	Use Ext. Comb.	4.41E+00
	CO (≥ 90% Load)	8.24E-02	8.24E-02	8.24E-02	3.10E-01	9.50E-01
	VOC (NMNEHC w/o Aldehydes*)	5.32E-03	5.32E-03	5.32E-03		3.60E-01
	VOC (NMNEHC w/ Aldehydes*)	5.39E-03	5.39E-03	5.39E-03	Use Ext. Comb.	3.62E-01
	SO2 (2,000 gr-S/MMscf ≈ 0.0007 W%)	5.88E-04	5.88E-04	5.88E-04		2.90E-01
	PM10/2.5 (Condensible and Filterable)	7.45E-03	7.45E-03	7.45E-03		3.10E-01
HAPs	Acetaldehyde*	---	---	---		7.67E-04
	Acrolein*	---	---	---		9.25E-05
	Benzene	2.06E-06	2.06E-06	2.06E-06		9.33E-04
	Butadiene, 1,3-	---	---	---		3.91E-05
	Ethylbenzene	---	---	---		---
	Formaldehyde (HCHO)*	7.35E-05	7.35E-05	7.35E-05		1.18E-03
	n-Hexane	1.76E-03	1.76E-03	1.76E-03	Use Ext. Comb.	---
	Methanol (MeOH)	---	---	---		---
	Polycyclic Organic Matter (POM/PAH)	6.85E-07	6.85E-07	6.85E-07		1.68E-04
	Toluene	3.33E-06	3.33E-06	3.33E-06		4.09E-04
	Trimethylpentane, 2,2,4- (i-Octane)	---	---	---		---
	Xylenes	---	---	---		2.85E-04
	Other/Trace HAP**	1.18E-06	1.18E-06	1.18E-06		---
	TOTAL HAP	1.85E-03	1.85E-03	1.85E-03		3.87E-03
GHG	CO2 (GWP=1)	1.18E+02	1.18E+02	1.18E+02		1.64E+02
	CH4 (GWP=25)	2.25E-03	2.25E-03	2.25E-03	Use Ext. Comb.	
	N2O (GWP=298)	2.16E-03	6.27E-04	6.27E-04		Use 40CFR98
	CO2e	Use 40CFR98	Use 40CFR98	Use 40CFR98		

40CFR98 - Default Greenhouse Gas (GHG) Emission Factors					
Fuel Type		Table C-1 to Subpart C of Part 98	Table C-2 to Subpart C of Part 98		Weighted Sum
	Default HHV	Carbon Dioxide lb CO2/MMBtu	Methane lb CH4/MMBtu	Nitrous Oxide lb N2O/MMBtu	CO2e lb CO2e/MMBtu
Fuel Oil No. 2 (Diesel)	138,000 Btu/gal	1.63E+02	6.61E-03	1.32E-03	1.64E+02
Propane	91,000 Btu/gal	1.39E+02	6.61E-03	1.32E-03	1.39E+02
Natural Gas	1,026 Btu/scf	1.17E+02	2.20E-03	2.20E-04	1.17E+02

* Aldehyde (not measured in EPA Test Method 25)

** Other/Trace HAPs include: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, ,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Naphthalene, Phenol, Propylene, Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

Global Warming Potential (100 Yr) (GWP)		
Table A-1 to Subpart A of Part 98		
CO2	CH4	N2O
1	25	298

Supplement S4
Lab Analysis

- **Inlet Gas – Summary – Ridgeline Compressor Station**
- **Inlet Gas – Lab Analysis – Ridgeline Compressor Station**
- **Condensate Liquid – Summary – Ridgeline Compressor Station**
- **Condensate Liquid – Lab Analysis – Ridgeline Compressor Station**
- **Btu Loading – Zeeco Z-HTO Thermal Oxidizer (TOx-01)**
- **Btu Loading – Zeeco V-HTO Thermal Oxidizer (TOx-02)**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Inlet Gas - Summary

Sampled: 01/25/21 Jamison CRP (Intertek Analysis) GPSA-Sec 23

Component	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Wgt Sum (MW*Mol Fraction)	lb/MMscf (WS/UGC#)	Weight % Total	Weight % THC	Weight % VOC	Component Btu/scf (HHV)	Btu/scf (HHV)
Water	109-86-4	H2O	18.015	---	---	---	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.010	0.1530	0.067	177.44	0.3358	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.086	---	---	---	---	---	---	637.6	---
Nitrogen	7727-37-9	N2	28.013	0.4250	0.119	313.73	0.5938	---	---	---	---
Methane*	75-82-8	CH4	16.042	81.1320	13.015	34,297.98	64.9148	65.5239	---	1,010.0	819.433
Ethane*	74-84-0	C2H6	30.069	12.7450	3.832	10,098.68	19.1135	19.2928	---	1,769.7	225.548
Propane**	74-98-6	C3H8	44.096	3.3880	1.494	3,936.81	7.4511	7.5210	49.5349	2,516.2	85.249
iso-Butane**	75-28-5	i-C4H10	58.122	0.4750	0.276	727.51	1.3769	1.3899	9.1539	3,252.0	15.447
n-Butane**	106-97-8	n-C4H10	58.122	0.7340	0.427	1,124.20	2.1277	2.1477	14.1453	3,262.4	23.946
iso-Pentane**	78-78-4	i-C5H12	72.149	0.2190	0.158	416.37	0.7880	0.7954	5.2390	4,000.9	8.762
n-Pentane**	109-66-0	n-C5H12	72.149	0.1750	0.126	332.72	0.6297	0.6356	4.1864	4,008.9	7.016
Cyclopentane**	287-92-3	C5H10	70.100	0.0210	0.015	38.79	0.0734	0.0741	0.4881	3,763.6	0.790
Cyclohexane**	110-82-7	C6H12	84.162	0.0200	0.017	44.36	0.0840	0.0847	0.5581	4,481.6	0.896
Other Hexanes**	Various	C6H14	86.175	0.1840	0.159	417.84	0.7908	0.7982	5.2574	4,750.3	8.741
Heptanes**	142-82-5	C7H16	100.205	0.1030	0.103	271.98	0.5148	0.5196	3.4222	5,502.5	5.668
Methylcyclohexane**	108-87-2	C7H14	98.186	0.0310	0.030	80.21	0.1518	0.1532	1.0092	5,215.9	1.617
C8+ Heavies**	Various	C8+	138.00 est.	0.0788	0.109	286.56	0.5424	0.5474	3.6056	7,000.0	5.516
Benzene***	71-43-2	C6H6	78.112	0.0030	0.002	6.18	0.0117	0.0118	0.0777	3,741.9	0.112
Ethylbenzene***	100-41-4	C8H10	106.165	0.0010	0.001	2.80	0.0053	0.0053	0.0352	5,222.0	0.052
n-Hexane***	110-54-3	C6H14	86.175	0.1000	0.086	227.09	0.4298	0.4338	2.8573	4,756.0	4.756
Methanol (MeOH)	67-56-1	CH4O	32.042	---	---	---	---	---	---	866.9	---
Toluene***	108-88-3	C7H8	92.138	0.0060	0.006	14.57	0.0276	0.0278	0.1833	4,474.9	0.268
2,2,4-Trimethylpentane***	540-84-1	C8H18	114.229	---	---	---	---	---	---	6,213.6	---
Xylenes***	1330-20-7	C8H10	106.165	0.0070	0.007	19.58	0.0371	0.0374	0.2464	5,208.7	0.365
		Totals:	20.05	100.00	20.05	52,835	100.00	---	---	Calculated Btu/scf (HHV):	1,214
		THC:	19.98	99.42	19.86	52,344	99.07	100.00	---		
		Total VOC:	54.38	5.55	3.02	7,948	15.04	15.18	100.00	Worst-Case Btu/scf (HHV):	1,020
		Total HAP:	87.64	0.12	0.10	270	0.51	0.52	3.40		

#UGC (Universal Gas Constant)
= 379.482 scf/lb-mol @ 60 oF and 14.6959 psia.

lb "X"/scf =
(M% of "X") x (MW of "X") / #UGC

Component	Representative Wet Gas Analysis			Assumed "Worst-Case" 120% VOC and GHG		Margin for Changes in Future Gas Composition
	Mole %	Wgt %	lb/MMscf	Wgt %	lb/MMscf	
CO2	0.15	0.34	177	0.35	213	20% Margin
Methane*	81.13	64.91	34,298	67.12	41,158	20% Margin
Other (N2, C2, O2, CO, H2O)	13.17	19.71	10,412	16.98	10,412	0% Margin
VOC**	5.55	15.04	7,948	15.55	9,537	20% Margin
TOTAL GAS	100.00	100.00	52,835	100.00	61,320	
Benzene***	0.003	0.012	6.18	0.02	25	305% Margin
Ethylbenzene***	0.001	0.005	2.80	0.04	25	794% Margin
n-Hexane***	0.100	0.430	227	0.82	500	120% Margin
Methanol (MeOH)	---	---	---	0.04	25	--- Margin
Toluene***	0.006	0.028	14.57	0.10	60	312% Margin
2,2,4-Trimethylpentane***	---	---	---	0.04	25	--- Margin
Xylenes***	0.007	0.037	19.58	0.10	60	206% Margin
Total HAP***	0.12	0.51	270	1.17	720	

* = Hydrocarbon (HC)
** = also Volatile Organic Compound (VOC)
*** = also Hazardous Air Pollutant (HAP)

Inlet Gas - Summary

Inlet Gas - Lab Analysis

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

Williams Energy

ID:	**Jamison Sample 1 of 2**	LINE PRESSURE:	**927 PSI**
AREA:		LINE TEMPERATURE:	**85.9 F**
METER:	**25976A**	CYLINDER NUMBER:	**4099**
LEASE:		EFFECTIVE DATE:	
OPERATOR:		SAMPLED BY:	**Client**
STATION:		ANALYZED BY:	**Intertek**
SAMPLE DATE:	**1/25/2021**	ANALYZED DATE:	**1/28/2021**
SAMPLE OF:	**Gas**	SAMPLE TYPE:	**Natural Gas**

For: Williams Energy
Attn: Callie Emmerling
37905 Crimm Rd
Scio, OH 43988

Physical Properties per GPA 2145-09 | Calculations per GPA 2286-03

Note: Zero = Less than detection limit

	MOL%	WEIGHT%	GPM @ 14.696
NITROGEN	0.425	0.594	
CARBON DIOXIDE	0.153	0.336	
METHANE	81.132	64.951	
ETHANE	12.745	19.124	3.411
PROPANE	3.388	7.456	0.934
ISOBUTANE	0.475	1.378	0.156
N-BUTANE	0.734	2.129	0.232
2,2-Dimethylpropane	0.012	0.043	0.005
` ISOPENTANE	0.219	0.789	0.080
N-PENTANE	0.163	0.587	0.059
HEXANES PLUS	0.554	2.613	0.234
	100.000	100.000	5.111

BTU	Vol. Ideal Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.696 PSIA (DRY)	1213.9	1217.8
BTU @ 14.696 PSIA (SAT.)	1192.3	1196.5
Specific Gravity	0.6919	0.6938
Compressibility (Z)	0.9968	

<u>Gasoline Content (Gallons Per Thousand - GPM)</u>

Ethane & Heavier	5.111
Propane & Heavier	1.700
Butane & Heavier	0.766
Pentane & Heavier	0.373
Total 26 psi Reid V.P. Gasoline GPM	0.590

Secondary BTU Psia Base	Vol. IDEAL Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.696 PSIA (DRY)	1213.9	1217.8
BTU @ 14.696 PSIA (SAT.)	1192.3	1196.5

Compressibility (Z) at 14.696 = 0.9968

Remarks: US360-0021499
Remarks:

Wet Gas - Lab Analysis - Continued

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

COMPANY: **Williams Energy** **SAMPLE DATE:** **1/25/2021**
AREA / FIELD:
LEASE:

	MOL%	WEIGHT%	GPM @ 14.696
NITROGEN	0.425	0.594	0.047
CARBON DIOXIDE	0.153	0.336	0.026
METHANE	81.132	64.951	13.763
ETHANE	12.745	19.124	3.411
PROPANE	3.388	7.456	0.934
ISOBUTANE	0.475	1.378	0.156
N-BUTANE	0.734	2.129	0.232
2,2-Dimethylpropane	0.012	0.043	0.005
ISOPENTANE	0.219	0.789	0.080
N-PENTANE	0.163	0.587	0.059
2,2-Dimethylbutane	0.019	0.082	0.008
2,3-Dimethylbutane & Cyclopentane	0.021	0.090	0.009
2-Methylpentane	0.100	0.430	0.041
3-Methylpentane	0.065	0.280	0.027
n-Hexane	0.100	0.430	0.041
2,2-Dimethylpentane	0.004	0.020	0.002
Methylcyclopentane	0.008	0.034	0.003
2,4-Dimethylpentane	0.004	0.020	0.002
2,2,3- Trimethylbutane	0.001	0.005	0.000
Benzene	0.003	0.012	0.001
3,3-Dimethylpentane	0.003	0.015	0.001
Cyclohexane	0.012	0.050	0.004
2-Methylhexane	0.025	0.125	0.012
2,3-Dimethylpentane	0.008	0.040	0.004
1,1-Dimethylcyclopentane	0.000	0.000	0.000
3-Methylhexane	0.025	0.125	0.011
l,t-3-Dimethylcyclopentane	0.000	0.000	0.000
1,c-3-Dimethylcyclopentane & 3-Ethylpentane	0.004	0.020	0.002
l,t-2-Dimethylcyclopentane & 2,2,4- Trimethylpentane	0.001	0.005	0.000
n-Heptane	0.033	0.165	0.015
Methylcyclohexane	0.025	0.123	0.010
1,1,3- Trimethylcyclopentane & 2,2-Dimethylhexane	0.000	0.000	0.000
2,5-Dimethylhexane & 2,4-Dimethylhexane	0.006	0.034	0.003
Ethylcyclopentane	0.001	0.005	0.000
2,2,3- Trimethylpentane & 1,t-2,c-4- Trimethylcyclopentane	0.000	0.000	0.000
3,3-Dimethylhexane & 1,t-2,c-3- Trimethylcyclopentane	0.000	0.000	0.000
2,3,4- Trimethylpentane & 2,3.Dimethylhexane	0.000	0.000	0.000
Toluene	0.006	0.028	0.002
1,1,2- Trimethylcyclopentane	0.000	0.000	0.000
3,4-Dimethylhexane	0.000	0.000	0.000
2-Methylheptane	0.010	0.057	0.005
4-Methylheptane	0.004	0.023	0.002
1,c-2,t-4- Trimethylcyclopentane	0.000	0.000	0.000
3-Methylheptane & 3,4-Dimethylhexane	0.008	0.046	0.004

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Wet Gas - Lab Analysis - Continued

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

COMPANY: **Williams Energy** **SAMPLE DATE:** **1/25/2021**
AREA / FIELD:
LEASE:

	MOL%	WEIGHT%	GPM @ 14.696
1,c-3-Dimethylcyclohexane & 3-Ethylhexane	0.003	0.017	0.001
l,t-4-Dimethylcyclohexane & 1,c2,t3- Trimethylcyclopentane	0.000	0.000	0.000
2,2,5-Trimethylhexane & 1,1-Dimethylcyclohexane	0.000	0.000	0.000
Methyl-Ethylcyclopentane's & 2,2,4- Trimethylhexane	0.000	0.000	0.000
n-Octane	0.013	0.074	0.007
1,t2 Dimethylcyclohexane & 2,2,4,4- Tetramethylpentane	0.001	0.006	0.000
1,t-3-Dimethylcyclohexane & 1,c-4-Dimethylcyclohexane	0.001	0.006	0.000
Dimethylheptanes & 1 ,c-2,c-3- Trimethylcyclopentane	0.000	0.000	0.000
Isopropylcyclopentane	0.000	0.000	0.000
Dimethylheptanes & Trimethylhexanes	0.000	0.000	0.000
1,c-2-Dimethylcyclohexane	0.002	0.011	0.001
Dimethylheptanes	0.000	0.000	0.000
Ethylcyclohexane	0.002	0.011	0.001
n-Propylcyclopentane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
Ethylbenzene	0.001	0.005	0.000
Dimethylheptanes & Trimethylhexanes	0.000	0.000	0.000
m-Xylene & p-Xylene	0.006	0.032	0.002
2 & 4 Methyloctane & 3,4-Dimethylheptane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
3-Methyloctane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
o-Xylene	0.001	0.005	0.000
Trimethylcyclohexanes & Isobutylcyclopentane	0.000	0.000	0.000
n-Nonane	0.011	0.070	0.006
C9 Naphthenes & C10 Paraffins & Trimethylcyclohexanes	0.000	0.000	0.000
Isopropylbenzene & Trimethylcyclohexanes	0.001	0.006	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
Isopropylcyclohexane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins & Cyclooctane	0.003	0.018	0.001
N-Propylcyclohexane	0.002	0.013	0.001
C9 Naphthenes & C10 Paraffins & n-Butylcyclopentane	0.000	0.000	0.000
n-Propylbenzene	0.001	0.006	0.000
C9 Naphthenes & C10 Paraffins & EthylBenzenes	0.000	0.000	0.000
m-Ethyltoluene	0.000	0.000	0.000
p-Ethyltoluene	0.000	0.000	0.000
1,3,5- Trimethylbenzene & 4 & 5 Methylnonane	0.001	0.007	0.001
2-Methylnonane & 3-Ethyloctane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
O-Ethyltoluene & 3-Methylnonane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
tert-Butylbenzene	0.000	0.000	0.000
1,2,4 Trimethylbenzene & Methylcyclooctane	0.002	0.012	0.001
Isobutylcyclohexane & tert- Butylcyclohexane	0.000	0.000	0.000
n-Decane Plus	0.007	0.050	0.003
	100.000	100.000	18.947

Stabilized Condensate - Summary

Sampled: **From Pioneer CF Process Simulation**

GPSA-Sec 23

Component	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Mole Fraction (MF)	lb/MMscf (WS/UGC#)	Weight % Total	Weight % THC	Weight % VOC	Component Btu/scf (HHV)	Btu/scf (HHV)
Water	109-86-4	H2O	18.015	**---**	---	---	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.010	**---**	---	---	---	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.086	**---**	---	---	---	---	---	637.6	---
Nitrogen	7727-37-9	N2	28.013	**---**	---	---	---	---	---	---	---
Methane*	75-82-8	CH4	16.042	**---**	---	---	---	---	---	1,010.0	---
Ethane*	74-84-0	C2H6	30.069	**0.0001**	0.00002	0.05	**0.00002**	0.00002	---	1,769.7	0.001
Propane**	74-98-6	C3H8	44.096	**1.1300**	0.498	1,313.05	**0.4896**	0.4896	0.4896	2,516.2	28.433
iso-Butane**	75-28-5	i-C4H10	58.122	**1.7000**	0.988	2,603.75	**0.9710**	0.9710	0.9710	3,252.0	55.284
n-Butane**	106-97-8	n-C4H10	58.122	**9.2900**	5.400	14,228.74	**5.3060**	5.3060	5.3060	3,262.4	303.077
iso-Pentane**	78-78-4	i-C5H12	72.149	**4.3300**	3.124	8,232.39	**3.0699**	3.0699	3.0699	4,000.9	173.239
n-Pentane**	109-66-0	n-C5H12	72.149	**9.4400**	6.811	17,947.74	**6.6929**	6.6929	6.6929	4,008.9	378.440
Cyclopentane**	287-92-3	C5H10	70.100	**---**	---	---	**---**	---	---	3,763.6	---
Cyclohexane**	110-82-7	C6H12	84.162	**1.2750**	1.073	2,827.71	**1.0545**	1.0545	1.0545	4,481.6	57.140
Other Hexanes**	Various	C6H14	86.175	**8.6600**	7.463	19,665.72	**7.3335**	7.3335	7.3335	4,750.3	411.376
C8+ Heavies**	Various	C8+	138.00 est.	**33.8747**	46.747	123,186.69	**45.9374**	45.9374	45.9374	7,000.0	2371.231
Benzene***	71-43-2	C6H6	78.112	**0.0615**	0.048	126.59	**0.0472**	0.0472	0.0472	3,741.9	2.301
Ethylbenzene***	100-41-4	C8H10	106.165	**1.2000**	1.274	3,357.16	**1.2519**	1.2519	1.2519	5,222.0	62.664
n-Hexane***	110-54-3	C6H14	86.175	**5.4700**	4.714	12,421.65	**4.6321**	4.6321	4.6321	4,756.0	260.153
Methanol (MeOH)	67-56-1	CH4O	32.042	**---**	---	---	**---**	---	---	866.9	---
Toluene***	108-88-3	C7H8	92.138	**0.6950**	0.640	1,687.46	**0.6293**	0.6293	0.6293	4,474.9	31.101
2,2,4-Trimethylpentane***	540-84-1	C8H18	114.229	**0.3760**	0.429	1,131.80	**0.4221**	0.4221	0.4221	6,213.6	23.363
Xylenes***	1330-20-7	C8H10	106.165	**1.5710**	1.668	4,395.08	**1.6390**	1.6390	1.6390	5,208.7	81.828

#UGC (Universal Gas Constant)
= 379.482 scf/lb-mol @ 60 oF and 14.6959 psia.

lb "X"/scf =
(M% of "X") x (MW of "X") / #UGC

	Mole %	Mole Fraction	lb/MMscf	Weight % Total	Weight % THC	Weight % VOC
Totals:	**100.00**	**101.76**	**268,162**	**100.00**	**---**	**---**
THC:	**100.00**	**101.76**	**268,162**	**100.00**	**100.00**	**---**
Total VOC:	**100.00**	**101.76**	**268,162**	**100.00**	**100.00**	**100.00**
Total HAP:	**9.37**	**8.77**	**23,120**	**8.62**	**8.62**	**8.62**

Calculated Btu/scf (HHV): **5,379**

Component	Representative Condensate Analysis			Assumed "Worst-Case" 120% VOC and GHG		Margin for Changes in Future Condensate Composition
	Mole %	Wgt %	lb/MMscf	Wgt %	lb/MMscf	
CO2	---	---	---	---	---	**--- Margin**
Methane*	---	---	---	---	---	**--- Margin**
Other (N2, C2, O2, CO, H2O)	---	---	---	---	---	**--- Margin**
VOC**	100.00	100.00	268,162	100.00	321,795	**20% Margin**
TOTAL CONDENSATE	**100.00**	**100.00**	**268,162**	**100.00**	**321,795**	
Benzene***	0.06	0.05	126.59	0.08	253	**100% Margin**
Ethylbenzene***	1.20	1.25	3,357.16	2.09	6,714	**100% Margin**
n-Hexane***	5.47	4.63	12,422	7.72	24,843	**100% Margin**
Methanol (MeOH)	---	---	---	0.06	200	**--- Margin**
Toluene***	0.70	0.63	1,687.46	1.05	3,375	**100% Margin**
2,2,4-Trimethylpentane***	0.38	0.42	1,131.80	0.70	2,264	**--- Margin**
Xylenes***	1.57	1.64	4,395.08	2.73	8,790	**100% Margin**
Total HAP***	**9.37**	**8.62**	**23,120**	**14.43**	**46,439**	

* = Hydrocarbon (HC)
** = also Volatile Organic Compound (VOC)
*** = also Hazardous Air Pollutant (HAP)

Stabilized Condensate - Lab Analysis

Appalachia Midstream Services, LLC
PIONEER COMPRESSION FACILITY
Application for G35-D General Permit Class I Administrative Update
Attachment U - Gas Analysis

Stabilized Condensate Composition

Constituent	Mol%
Water	2.70E-09
Methane	1.57E-11
CO2	1.91E-10
Ethane	6.66E-05
Propane	1.13E+00
i-Butane	1.70E+00
n-Butane	9.29E+00
i-Pentane	4.33E+00
n-Pentane	9.44E+00
2,3-Dimethylbutane	4.83E+00
3-Methylpentane	3.83E+00
Hexane	5.47E+00
2,2-Dimethylpentane	6.94E-02
Methylcyclopentane	4.42E-01
Benzene	6.15E-02
3,3-Dimethylpentane	7.28E-02
Cyclohexane	8.33E-01
2-Methylhexane	3.54E+00
2,3-Dimethylpentane	1.10E-01
3-Methylhexane	3.37E+00
Heptane	9.07E+00
Toluene	6.95E-01
Octane	7.55E+00
Ethylbenzene	1.20E+00
o-Xylene	2.54E-01
2-Methylheptane	4.62E+00
Methylcyclohexane	4.17E+00
2,5-Dimethylhexane	6.79E-01
1,t-3-Dimethylcyclohexane	3.34E-01
Nonane	6.00E+00
n-Undecane	9.70E-01
n-Decane	3.64E+00
Dodecane	3.23E-01
Tridecane	1.05E-01
Tetradecane	3.65E-02
Pentadecane	3.00E-02
Hexadecane	8.63E-02
Heptadecane	6.20E-02
Octadecane	7.37E-02
Nonadecane	6.68E-02
Eicosane	8.65E-02
C21	2.46E-01
C22	6.64E-01
C23	1.38E+00
C24	1.65E-01
m-Xylene	6.65E-01
p-Xylene	6.52E-01
2,2,4-Trimethylpentane	3.76E-01
2,4-Dimethylpentane	2.75E-02
3-Ethylpentane	4.97E-01
2,4-Dimethylhexane	6.62E-01
trans-1,2-Dimethylcyclohexane	3.69E+00
cis-1,2-Dimethylcyclohexane	1.91E+00
cis-1,3-Dimethylcyclohexane	4.91E-01

Btu Loading – Zeeco Z-HTO Thermal Oxidizer (TOx-01)

Component	Component Btu/scf (HHV)	DFT-01 - Flash Gas Ave Flowrate: 1,400 scf/hr		DSV-01 - Still Vent Ave Flowrate: 8,230 scf/hr		--- Ave Flowrate: ---		--- Ave Flowrate: ---		--- Ave Flowrate: ---		TOTAL Ave Flowrate: 9,630
		Vol%	MMBtu/hr	Vol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	MMBtu/Hr
Water	---	0.1520	---	81.7000	---	---	---	---	---	---	---	---
Carbon Monoxide	---	---	---	---	---	---	---	---	---	---	---	---
Nitrogen	---	0.3820	---	0.0505	---	---	---	---	---	---	---	---
Oxygen	---	---	---	---	---	---	---	---	---	---	---	---
Hydrogen Sulfide	637.64	---	---	---	---	---	---	---	---	---	---	---
Carbon Dioxide	---	0.9550	---	0.1560	---	---	---	---	---	---	---	---
Methane	1,010.00	61.1000	0.8640	9.5400	0.7930	---	---	---	---	---	---	1.6569
Ethane	1,769.70	24.2000	0.5996	2.3600	0.3437	---	---	---	---	---	---	0.9433
Propane	2,516.20	7.6600	0.2698	1.0700	0.2216	---	---	---	---	---	---	0.4914
i-Butane	3,252.00	1.1800	0.0537	0.2210	0.0591	---	---	---	---	---	---	0.1129
n-Butane	3,262.40	2.0800	0.0950	0.4790	0.1286	---	---	---	---	---	---	0.2236
Cyclopentane	3,763.60	---	---	---	---	---	---	---	---	---	---	0.0000
i-Pentane	4,000.90	0.5300	0.0297	0.1440	0.0474	---	---	---	---	---	---	0.0771
n-Pentane	4,008.90	0.4770	0.0268	0.1560	0.0515	---	---	---	---	---	---	0.0782
Cyclohexane	4,481.60	0.0764	0.0048	0.1670	0.0616	---	---	---	---	---	---	0.0664
Other Hexanes	4,750.30	0.4690	0.0312	0.2100	0.0821	---	---	---	---	---	---	0.1133
Methylcyclohexane	5,215.90	0.0922	0.0067	0.2670	0.1146	---	---	---	---	---	---	0.1213
Heptanes	5,502.50	0.2530	0.0195	0.3050	0.1381	---	---	---	---	---	---	0.1576
C8+ Heavies	7,150.00 est	0.0284	0.0028	0.3840	0.2260	---	---	---	---	---	---	0.2288
Benzene	3,741.90	0.0155	0.0008	0.2640	0.0813	---	---	---	---	---	---	0.0821
Ethylbenzene	5,222.00	0.0029	---	---	---	---	---	---	---	---	---	0.0000
n-Hexane	4,756.00	0.2670	0.0178	0.1560	0.0611	---	---	---	---	---	---	0.0788
Toluene	4,474.90	0.0261	0.0016	0.7230	0.2663	---	---	---	---	---	---	0.2679
2,2,4-TMP (i-Octane)	6,213.60	---	---	---	---	---	---	---	---	---	---	0.0000
Xylenes	5,208.67	0.0191	0.0014	1.4100	0.6044	---	---	---	---	---	---	0.6058
		99.97		99.76								
		Average MMBtu/hr:	2.03		3.28		---		---		---	5.31
		Average scf/hr:	1,400		8,230		---		---		---	9,630
		Average Btu/scf:	1,447		399		---		---		---	551

Mol%=Vol% Values from GRI-GLYCalc Model Results

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Btu Loading – Zeeco Z-VTO Thermal Oxidizer (TOx-02)

Component	Component Btu/scf (HHV)	DFT-02 - Flash Gas Ave Flowrate: 1,490 scf/hr		DSV-02 - Still Vent Ave Flowrate: 4,930 scf/hr		--- Ave Flowrate: ---		--- Ave Flowrate: ---		--- Ave Flowrate: ---		TOTAL Ave Flowrate: 6,420
		Vol%	MMBtu/hr	Vol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	MMBtu/Hr
Water	---	0.1350	---	88.1000	---	---	---	---	---	---	---	---
Carbon Monoxide	---	---	---	---	---	---	---	---	---	---	---	---
Nitrogen	---	0.3780	---	0.0060	---	---	---	---	---	---	---	---
Oxygen	---	---	---	---	---	---	---	---	---	---	---	---
Hydrogen Sulfide	637.64	---	---	---	---	---	---	---	---	---	---	---
Carbon Dioxide	---	0.9960	---	0.2180	---	---	---	---	---	---	---	---
Methane	1,010.00	60.3000	0.9075	0.9830	0.0489	---	---	---	---	---	---	0.9564
Ethane	1,769.70	24.4000	0.6434	1.5100	0.1317	---	---	---	---	---	---	0.7751
Propane	2,516.20	7.8600	0.2947	1.0800	0.1340	---	---	---	---	---	---	0.4287
i-Butane	3,252.00	1.2300	0.0596	0.2670	0.0428	---	---	---	---	---	---	0.1024
n-Butane	3,262.40	2.1900	0.1065	0.6370	0.1025	---	---	---	---	---	---	0.2089
Cyclopentane	3,763.60	0.0973	0.0055	0.1730	0.0321	---	---	---	---	---	---	0.0376
i-Pentane	4,000.90	0.5610	0.0334	0.1950	0.0385	---	---	---	---	---	---	0.0719
n-Pentane	4,008.90	0.5090	0.0304	0.2240	0.0443	---	---	---	---	---	---	0.0747
Cyclohexane	4,481.60	0.0838	0.0056	0.2870	0.0634	---	---	---	---	---	---	0.0690
Other Hexanes	4,750.30	0.5050	0.0357	0.3160	0.0740	---	---	---	---	---	---	0.1097
Methylcyclohexane	5,215.90	0.1010	0.0078	0.4600	0.1183	---	---	---	---	---	---	0.1261
Heptanes	5,502.50	0.2770	0.0227	0.5050	0.1370	---	---	---	---	---	---	0.1597
C8+ Heavies	7,150.00 est	0.0305	0.0032	0.6620	0.2334	---	---	---	---	---	---	0.2366
Benzene	3,741.90	0.0170	0.0009	0.4420	0.0815	---	---	---	---	---	---	0.0825
Ethylbenzene	5,222.00	0.0031	---	0.2390	---	---	---	---	---	---	---	0.0000
n-Hexane	4,756.00	0.2900	0.0206	0.2440	0.0572	---	---	---	---	---	---	0.0778
Toluene	4,474.90	0.0280	0.0019	1.2000	0.2647	---	---	---	---	---	---	0.2666
2,2,4-TMP (i-Octane)	6,213.60	---	---	---	---	---	---	---	---	---	---	0.0000
Xylenes	5,208.67	0.0198	0.0015	2.2700	0.5829	---	---	---	---	---	---	0.5844
		100.01		100.02								
	Average MMBtu/hr:		2.18		2.19		---		---		---	4.37
	Average scf/hr:		1,490		4,930		---		---		---	6,420
	Average Btu/scf:		1,464		444		---		---		---	680

Mol%=Vol% Values from GRI-GLYCalc Model Results

Supplement S5

Vendor Data

- **5,000 bhp Caterpillar G3616LE A4 Compressor Engine w/ OxCat (CE-01 (1E) thru CE-04 (4E))**
- **1,468 bhp Caterpilar G3512LE Generator Engine (GE-01 (8E))**
- **11,252 bhp Solar Taurus 70-10802S Compressor Turbine (CT-01 (9E))**
    - PIL 168 – VOC, SO2, and HCHO Emission Estimates
    - PIL 170 – Emission Estimates at Start-up, Shutdown, and Commissioning
    - PIL 171 – Particulate Matter Emission Estimates
    - PIL 251 – Emissions from Gas Seal Systems
    - PIL 279 – Primary Vent Dry Gas Seal Recompression
    - PIL 280 – Process Gas Vent Recompression
- **Zeeco Z-HTO Thermal Oxidizer 01 (DHY-01 (DFT-01/DSV-01) TOx-01 (24E))**
- **Zeeco V-HTO Thermal Oxidizer 02 (DHY-02 (DFT-02/DSV-02) TOx-02 (25E))**
- **Zeeco Elevated Flare (BD (CBD/ESD) and PIG) FLR-01 (26E))**

G3616

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Ridgeline Compressor Station

CATERPILLAR®

GAS COMPRESSION APPLICATION

ENGINE SPEED (rpm):	1000
COMPRESSION RATIO:	7.6
AFTERCOOLER TYPE:	SCAC
AFTERCOOLER - STAGE 2 INLET (°F):	130
AFTERCOOLER - STAGE 1 INLET (°F):	174
JACKET WATER OUTLET (°F):	190
ASPIRATION:	TA
COOLING SYSTEM:	JW+1AC, OC+2AC
CONTROL SYSTEM:	ADEM4
EXHAUST MANIFOLD:	DRY
COMBUSTION:	LOW EMISSION
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5
SET POINT TIMING:	17

RATING STRATEGY:	STANDARD
FUEL SYSTEM:	GAV WITH AIR FUEL RATIO CONTROL
SITE CONDITIONS:	
FUEL:	Gas Analysis
FUEL PRESSURE RANGE(psig): (See note 1)	58.0-70.3
FUEL METHANE NUMBER:	57.7
FUEL LHV (Btu/scf):	1104
ALTITUDE(ft):	1365
INLET AIR TEMPERATURE(°F):	77
STANDARD RATED POWER:	5000 bhp@1000rpm

				MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING		**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**50%**
ENGINE POWER	(WITHOUT FAN)	(2)	bhp	5000	5000	3750	2500
INLET AIR TEMPERATURE			°F	77	77	77	77
ENGINE DATA							
FUEL CONSUMPTION (LHV)		(3)	Btu/bhp-hr	6689	6689	6876	7346
FUEL CONSUMPTION (HHV)		(3)	Btu/bhp-hr	7382	7382	7588	8108
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(4)(5)	ft3/min	12065	12065	9096	6224
AIR FLOW	(WET)	(4)(5)	lb/hr	53495	53495	40334	27597
FUEL FLOW (60ºF, 14.7 psia)			scfm	505	505	389	277
INLET MANIFOLD PRESSURE		(6)	in Hg(abs)	101.5	101.5	76.2	53.6
EXHAUST TEMPERATURE - ENGINE OUTLET		(7)	°F	830	830	889	956
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(8)(5)	ft3/min	30831	30831	24339	17515
EXHAUST GAS MASS FLOW	(WET)	(8)(5)	lb/hr	55091	55091	41565	28473
EMISSIONS DATA - ENGINE OUT				Use NOX @ 0.40 g/bhp-hr			
NOx (as NO2)		(9)(10)	g/bhp-hr	0.50	0.50	0.50	0.50
CO		(9)(10)	g/bhp-hr	2.48	2.48	2.48	2.48
THC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	3.54	3.54	3.84	4.02
NMHC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	1.28	1.28	1.39	1.46
NMNEHC (VOCs) (mol. wt. of 15.84)		(9)(10)(11)	g/bhp-hr	0.57	0.57	0.62	0.65
HCHO (Formaldehyde)		(9)(10)	g/bhp-hr	0.21	0.21	0.22	0.24
CO2		(9)(10)	g/bhp-hr	437	437	450	479
EXHAUST OXYGEN		(9)(12)	% DRY	11.0	11.0	10.7	10.3
HEAT REJECTION							
HEAT REJ. TO JACKET WATER (JW)		(13)	Btu/min	53106	53106	42952	36275
HEAT REJ. TO ATMOSPHERE		(13)	Btu/min	17723	17723	16216	14746
HEAT REJ. TO LUBE OIL (OC)		(13)	Btu/min	30615	30615	27037	23538
HEAT REJ. TO A/C - STAGE 1 (1AC)		(13)(14)	Btu/min	43321	43321	21417	4805
HEAT REJ. TO A/C - STAGE 2 (2AC)		(13)(14)	Btu/min	11190	11190	7712	4742

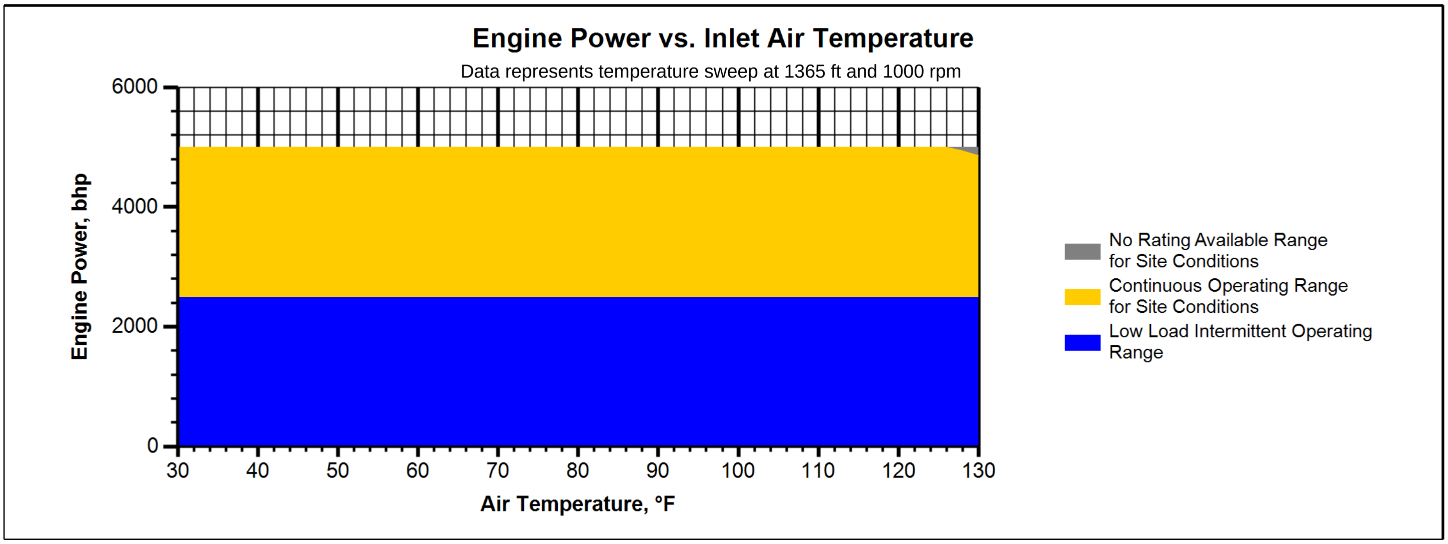
COOLING SYSTEM SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+1AC)	(14)(15)	Btu/min	103904
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (OC+2AC)	(14)(15)	Btu/min	48488
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.			

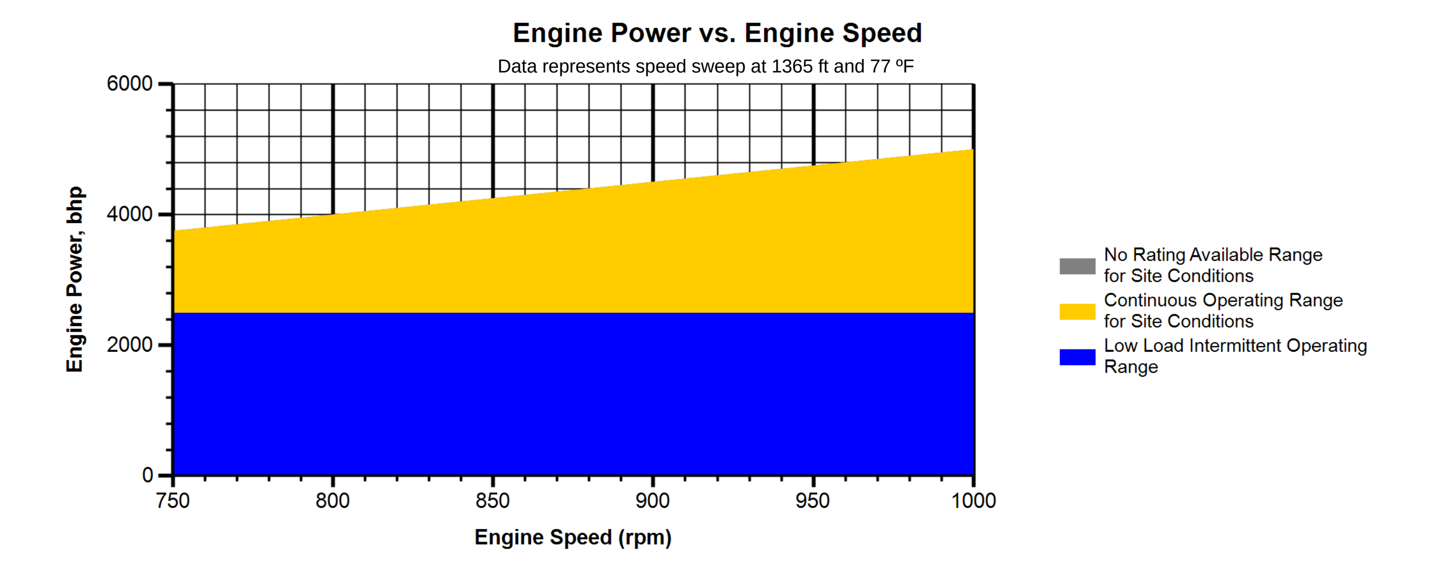
CONDITIONS AND DEFINITIONS

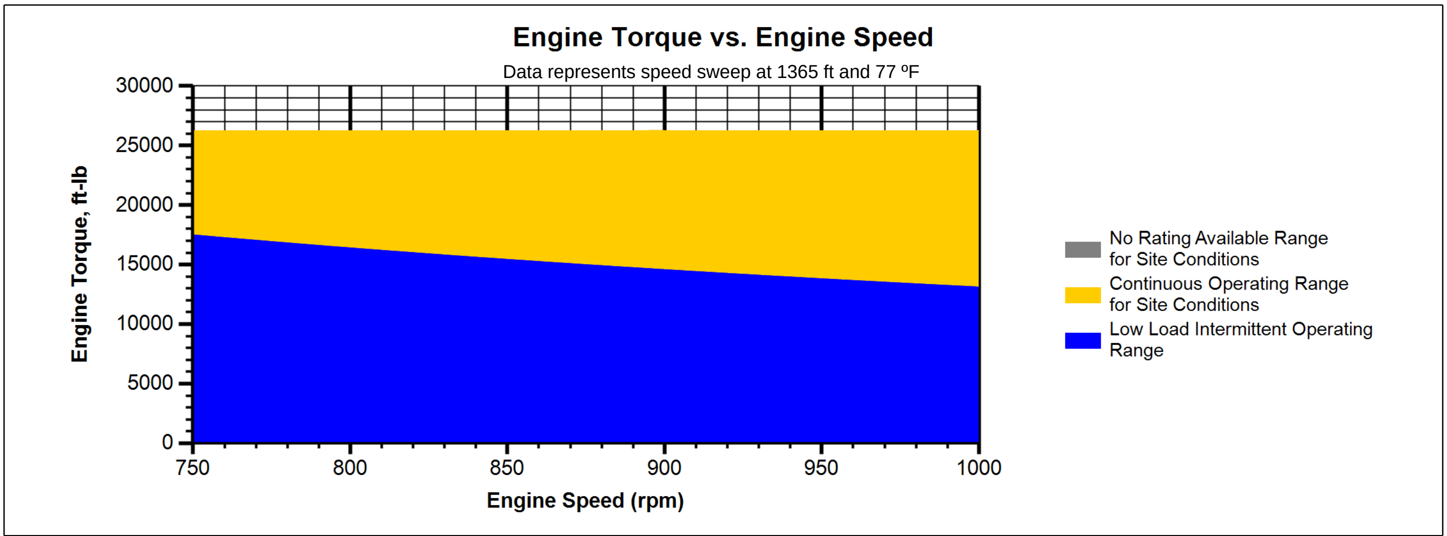
Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY: ,
Data generated by GERP Web Version 1.5.1
Ref. Data Set EM0455-08-001, Printed 16Mar2021







Note:
At site conditions of 1365 ft and 77°F inlet air temp., constant torque can be maintained down to 750 rpm.The minimum speed for loading at these conditions is 750 rpm.

NOTES:

1. Fuel pressure range specified is to the engine gas shutoff valve (GSOV). Additional fuel train components should be considered in pressure and flow calculations.

2. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.

3. Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site ambient temperature.

4. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

5. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.

6. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

7. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

8. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

9. Emissions data is at engine exhaust flange prior to any after treatment.

10. Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.

11. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

12. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

13. Heat rejection values are nominal. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for radiation, ± 20% for lube oil circuit, and ± 5% for aftercooler circuit.

14. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.

15. Cooling system sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

G3616

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Ridgeline Compressor Station

CATERPILLAR®

GAS COMPRESSION APPLICATION

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	81.1320	81.1314
Ethane	C2H6	12.7450	12.7449
Propane	C3H8	3.3880	3.3880
Isobutane	iso-C4H10	0.4750	0.4750
Norbutane	nor-C4H10	0.7340	0.7340
Isopentane	iso-C5H12	0.2190	0.2190
Norpentane	nor-C5H12	0.1960	0.1960
Hexane	C6H14	0.3070	0.3070
Heptane	C7H16	0.1400	0.1400
Nitrogen	N2	0.4250	0.4250
Carbon Dioxide	CO2	0.1530	0.1530
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0868	0.0868
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0008	100.0001

Fuel Makeup:	Gas Analysis
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	57.7
Lower Heating Value (Btu/scf):	1104
Higher Heating Value (Btu/scf):	1218
WOBBE Index (Btu/scf):	1327
THC: Free Inert Ratio:	172.01
Total % Inerts (% N2, CO2, He):	0.578%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.997
Stoich A/F Ratio (Vol/Vol):	11.46
Stoich A/F Ratio (Mass/Mass):	16.57
Specific Gravity (Relative to Air):	0.692
Fuel Specific Heat Ratio (K):	1.287

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

PREPARED BY: ,
Data generated by GERP Web Version 1.5.1
Ref. Data Set EM0455-08-001, Printed 16Mar2021

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Tel: (715) 568-2882 • Fax: (715)568-2884
Email bweninger@catalyticcombustion.com

CATALYTIC COMBUSTION
EMISSION TECHNOLOGIES

To Williams
Attn
Via E-mail

Our Ref. 001-00-263673.03
Date: 16 February, 2021

QUOTATION

For :
Project/Location : Ridgeline

Engine Parameters

Engine Manufacturer	Caterpillar			Raw Exhaust	
Engine Model	G3616 - 0.5/5000		NOx	0.50	g/bhp-hr
Horsepower	5000	bhp	CO	2.48	g/bhp-hr
Speed	1000	rpm	NMHC	1.28	g/bhp-hr
Exhaust Flowrate	30831	acfm	NMNEHC (VOC)	0.57	g/bhp-hr
Exhaust Temperature	830	° F	HCHO	0.21	g/bhp-hr
Fuel	Natural Gas		Oxygen	11.00	%

Use NOX @ 0.40 g/bhp-hr

Catalyst Description and Performance Expectations

Catalyst Model	REMB-3615F-D-15HF-HFX4	Overall Dimensions	35.88 x 14.88 x 3.7
Cell Pattern, Substrate	15HF	Catalyst Qty Required	8 per Unit
Formulation	HFX4	Pressure Drop	2.3 inches of H2O
Warranty Period [hrs]	12000		

	Required		Required		Expected Fresh Performance	
NOx						
CO	0.31	g/bhp-hr	88	% Conversion	100	% Conversion
NMHC						
NMNEHC (VOC)	0.16	g/bhp-hr	72	% Conversion	83	% Conversion
HCHO	-	g/bhp-hr	-	% Conversion	94	% Conversion

Use CO @ 89% Reduction
Use NMNEHC @ 60% Reduction
Use HCHO @ 80% Reduction

General Terms and Conditions of Sale and Manufacturers Warranty documents are available upon request.

Thank you for the opportunity to quote these products for you. Please contact us if you have any questions regarding this quotation or to let us know how we can be of further help.

Best regards,

Brian Weninger

Brian Weninger
Product and Application Engineer, Catalytic Combustion Corporation

G3512

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	9.7	PACKAGE TYPE:	WITH RADIATOR
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	STANDBY
AFTERCOOLER - STAGE 2 INLET (°F):	130	FUEL:	NAT GAS
AFTERCOOLER - STAGE 1 INLET (°F):	198	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
JACKET WATER OUTLET (°F):	210	FUEL PRESSURE RANGE(psig): (See note 1)	0.5-5.0
ASPIRATION:	TA	FUEL METHANE NUMBER:	85
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL LHV (Btu/scf):	905
CONTROL SYSTEM:	ADEM4 W/ IM	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	5069
EXHAUST MANIFOLD:	DRY	POWER FACTOR:	0.8
COMBUSTION:	LOW EMISSION	VOLTAGE(V):	440-4160
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5		
FAN POWER (bhp):	50		

RATING		NOTES	LOAD	100%	75%	50%
PACKAGE POWER	(WITH FAN)	(2)(3)	ekW	1000	750	500
PACKAGE POWER	(WITH FAN)	(2)(3)	kVA	1250	938	625
ENGINE POWER	(WITHOUT FAN)	(3)	bhp	1468	1113	763
GENERATOR EFFICIENCY		(2)	%	94.5	94.6	94.0
PACKAGE EFFICIENCY(@ 1.0 Power Factor)	(ISO 3046/1)	(4)	%	34.5	33.2	30.4
THERMAL EFFICIENCY		(5)	%	49.6	50.4	51.6
TOTAL EFFICIENCY (@ 1.0 Power Factor)		(6)	%	84.1	83.6	82.0

ENGINE DATA						
PACKAGE FUEL CONSUMPTION	(ISO 3046/1)	(7)	Btu/ekW-hr	10089	10460	11432
PACKAGE FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/ekW-hr	10285	10663	11654
ENGINE FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/bhp-hr	7004	7187	7637
AIR FLOW (77°F, 14.7 psia)	(WET)	(8)	ft3/min	3257	2543	1830
AIR FLOW	(WET)	(8)	lb/hr	14441	11277	8114
FUEL FLOW (60ºF, 14.7 psia)			scfm	189	147	107
COMPRESSOR OUT PRESSURE			in Hg(abs)	92.3	75.1	56.5
COMPRESSOR OUT TEMPERATURE			°F	335	293	225
AFTERCOOLER AIR OUT TEMPERATURE			°F	136	135	133
INLET MAN. PRESSURE		(9)	in Hg(abs)	84.9	67.2	48.6
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(10)	°F	136	135	133
TIMING		(11)	°BTDC	32	32	32
EXHAUST TEMPERATURE - ENGINE OUTLET		(12)	°F	961	955	966
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(13)	ft3/min	9280	7217	5235
EXHAUST GAS MASS FLOW	(WET)	(13)	lb/hr	14958	11679	8407
MAX INLET RESTRICTION		(14)	in H2O	10.04	10.04	10.04
MAX EXHAUST RESTRICTION		(14)	in H2O	20.07	20.07	20.07

EMISSIONS DATA - ENGINE OUT					
NOx (as NO2)	(15)(16)	g/bhp-hr	0.50	0.50	0.50
CO	(15)(17)	g/bhp-hr	1.92	1.94	1.96
THC (mol. wt. of 15.84)	(15)(17)	g/bhp-hr	2.91	3.25	3.74
NMHC (mol. wt. of 15.84)	(15)(17)	g/bhp-hr	0.47	0.52	0.60
NMNEHC (VOCs) (mol. wt. of 15.84)	(15)(17)(18)	g/bhp-hr	0.32	0.36	0.41
HCHO (Formaldehyde)	(15)(17)	g/bhp-hr	0.30	0.30	0.32
CO2	(15)(17)	g/bhp-hr	491	513	542
EXHAUST OXYGEN	(15)(19)	% DRY	9.6	9.5	9.4
LAMBDA	(15)(19)		1.74	1.75	1.73

ENERGY BALANCE DATA						
LHV INPUT		(20)	Btu/min	171417	133293	97113
HEAT REJECTION TO JACKET WATER (JW)		(21)(29)	Btu/min	24308	20989	17610
HEAT REJECTION TO ATMOSPHERE	(INCLUDES GENERATOR)	(22)	Btu/min	8839	7118	6377
HEAT REJECTION TO LUBE OIL (OC)		(23)(29)	Btu/min	4650	4156	3562
HEAT REJECTION TO EXHAUST (LHV TO 77°F)		(24)(25)	Btu/min	61072	47528	34807
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(24)	Btu/min	47835	37030	27102
HEAT REJECTION TO A/C - STAGE 1 (1AC)		(26)(29)	Btu/min	6798	3665	757
HEAT REJECTION TO A/C - STAGE 2 (2AC)		(27)(30)	Btu/min	5806	4110	2490
PUMP POWER		(28)	Btu/min	971	971	971

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	40	45	50	55	60	65	70	75	80	85	100
SET POINT TIMING	-	26	29	32	32	32	32	32	32	32	32
DERATION FACTOR	0	1	1	1	1	1	1	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
120	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
110	0.84	0.79	0.74	0.70	0.66	0.63	0.59	0.55	0.51	No Rating	No Rating	No Rating	No Rating
100	1	1	1	0.98	0.92	0.87	0.81	0.75	0.70	0.64	0.58	0.52	No Rating
90	1	1	1	1	1	0.95	0.89	0.83	0.77	0.71	0.65	0.58	0.52
80	1	1	1	1	1	1	0.94	0.89	0.84	0.78	0.72	0.65	0.58
70	1	1	1	1	1	1	0.96	0.91	0.86	0.81	0.77	0.70	0.63
60	1	1	1	1	1	1	0.97	0.92	0.87	0.82	0.78	0.72	0.66
50	1	1	1	1	1	1	0.98	0.93	0.88	0.83	0.78	0.73	0.67

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
120	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
110	1.22	1.27	1.32	1.38	1.43	1.49	1.49	1.49	1.49	No Rating	No Rating	No Rating	No Rating
100	1.15	1.20	1.25	1.30	1.35	1.41	1.41	1.41	1.41	1.41	1.41	1.41	No Rating
90	1.07	1.12	1.17	1.22	1.28	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
80	1	1.05	1.10	1.15	1.20	1.25	1.26	1.26	1.26	1.26	1.26	1.26	1.26
70	1	1	1.02	1.07	1.12	1.17	1.18	1.18	1.18	1.18	1.18	1.18	1.18
60	1	1	1	1	1.04	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
50	1	1	1	1	1	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:

This table shows the derate factor and full load set point timing required for a given fuel. Note that deration and set point timing adjustment may be required as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar methane number calculation.

ALTITUDE DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site. The derate factors shown assume a specific air-to-core temperature rise and zero additional air flow restriction on the standard packaged radiator. Refer to TMI Systems Data for fan air flow and air-to-core temperature rise values. Increased fan airflow restriction or a different air-to-core rise value requires a Special Rating Request to determine actual engine power at your site. Additional rating may be available with a larger, custom radiator.

ACTUAL ENGINE RATING:

To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).

1) Fuel Usage Guide Deration
2) 1-((1-Altitude/Temperature Deration) + (1-RPC))

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):

To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See notes 29 and 30 for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

INLET AND EXHAUST RESTRICTIONS FOR ALTITUDE CAPABILITY:

The altitude derate chart is based on the maximum inlet and exhaust restrictions provided on page 1. Contact factory for restrictions over the specified values. Heavy Derates for higher restrictions will apply.

NOTES:

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.
2. Generator efficiencies, power factor, and voltage are based on standard generator. [Package Power (ekW) is calculated as: (Engine Power (bkW) - Fan Power (bkW)) x Generator Efficiency], [Package Power (kVA) is calculated as: (Engine Power (bkW) - Fan Power (bkw)) x Generator Efficiency / Power Factor]
3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load.
4. Package Efficiency published in accordance with ISO 3046/1, based on a 1.0 power factor.
5. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248ºF with engine operation at ISO 3046/1 Package Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.
6. Total efficiency is calculated as: Package Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.
7. ISO 3046/1 Package fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal package and engine fuel consumption tolerance is ± 3.0% of full load data at the specified power factor.
8. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.
9. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
10. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
11. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
12. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
13. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
14. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.
15. Emissions data is at engine exhaust flange prior to any after treatment.
16. NOx tolerances are ± 18% of specified value.
17. CO, CO2, THC, NMHC, NMNEHC, and HCHO are the maximum values expected under steady state conditions. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
18. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
19. Exhaust Oxygen tolerance is ± 0.5; Lambda tolerance is ± 0.05. Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
20. LHV rate tolerance is ± 3.0%.
21. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
22. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
23. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
24. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
25. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
26. Heat rejection to A/C - Stage 1 based on treated water. Tolerance is ±5% of full load data.
27. Heat rejection to A/C - Stage 2 based on treated water. Tolerance is ±5% of full load data.
28. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
29. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2) + (1AC x 1.05) + [0.78 x (1AC + 2AC) x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
30. Total Second Stage Aftercooler Circuit heat rejection is calculated as: (2AC x 1.05) + [(1AC + 2AC) x 0.22 x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

FREE FIELD MECHANICAL & EXHAUST NOISE

MECHANICAL: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	125.5	108.0	109.6	114.9	111.5	108.8	113.4	112.6	112.7	111.8	110.2
750	75	1113	122.9	107.6	109.4	113.8	110.7	108.2	113.1	111.5	112.0	111.4	109.6
500	50	763	121.9	106.9	108.1	113.4	109.1	107.9	112.9	111.8	111.0	110.5	109.3

MECHANICAL: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	110.5	109.7	109.7	108.2	109.5	107.7	106.3	105.5	118.4	119.0	106.1
750	75	1113	109.8	108.9	108.5	106.8	107.5	106.4	104.8	106.5	111.8	103.5	100.8
500	50	763	109.5	108.4	107.6	105.8	106.0	104.6	105.4	106.6	100.9	98.7	97.7

EXHAUST: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	129.7	115.0	123.2	117.2	119.3	119.7	123.3	121.5	113.6	114.3	115.0
750	75	1113	128.5	113.8	121.6	115.1	117.8	120.1	121.9	120.1	113.0	113.7	114.1
500	50	763	126.7	113.4	120.7	113.5	114.5	117.4	119.5	118.9	112.4	112.1	111.8

EXHAUST: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	111.2	106.4	106.1	102.8	101.6	102.0	98.3	94.4	100.2	102.0	88.9
750	75	1113	110.5	105.9	104.5	99.9	99.0	99.2	96.2	93.1	96.7	88.2	83.5
500	50	763	108.7	104.7	102.7	96.6	95.9	95.9	94.1	92.4	88.2	85.0	80.4

SOUND PARAMETER DEFINITION:

Sound Power Level Data - DM8702-03

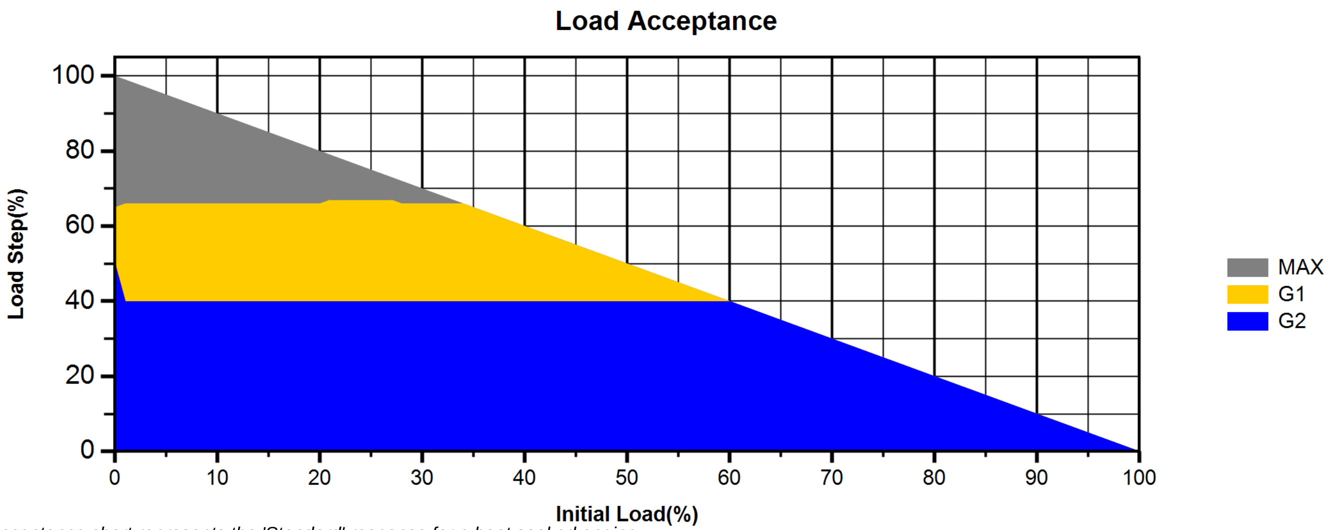
Sound power is defined as the total sound energy emanating from a source irrespective of direction or distance. Sound power level data is presented under two index headings:
Sound power level -- Mechanical
Sound power level -- Exhaust

Mechanical: Sound power level data is calculated in accordance with ISO 3747. The data is recorded with the exhaust sound source isolated.

Exhaust: Sound power level data is calculated in accordance with ISO 6798 Annex A. Exhaust data is post-catalyst on gas engine ratings labeled as "Integrated Catalyst".

Measurements made in accordance with ISO 3747 and ISO 6798 for mechanical and exhaust sound level only. Frequency bands outside the displayed ranges are not measured, due to physical test, and environmental conditions that affect the accuracy of the measurement. No cooling system noise is included unless specifically indicated. Sound level data is indicative of noise levels recorded on one engine sample in a survey grade 3 environment.

How an engine is packaged, installed and the site acoustical environment will affect the site specific sound levels. For site specific sound level guarantees, sound data collection needs to be done on-site or under similar conditions.



Load Acceptance chart represents the 'Standard' response for a heat soaked engine

Transient Load Acceptance

Load Step	Frequency Deviation +/- (%)	Voltage Deviation +/- (%)	Recovery Time (sec)	Classification as Defined by ISO 8528 - 5	Notes
100	+2/-22	+1/-53	6/12.5		(4)
75	+1/-21	+1/-43	7.7/7.1		(4)
50	+2/-12	+4/-21	3.7/5.4	G1	(2)(4)
40	+2/-10	+1/-20	3.5	G2	(3)
30	+2/-8	+3/-15	4.5	G2	(3)
25	+2/-7	+3/-12	4	G2	(3)
20	+2/-6	+2/-10	3.5	G2	(3)
15	+3/-5	+2/-7	3	G2	(3)
10	+3/-4	+1/-5	3	G2	(3)
-10	+3/-3	+2/-4	4.5		
-50	+6/-4	+10/-3	3.7		
-75	+8/-3	+16/-3	4.3		
Breaker Open	+11/-1	+26/-2	3		(1)
Recovery Specification	+1.75/-1.75	+5/-5			
Steady State Specification	+0.5/-0.5	+0.25/-0.25			(5)

Transient Information

The transient load steps listed above are stated as a percentage of the engine's full rated load as indicated in the appropriate performance technical data sheet. Site ambient conditions, fuel quality, inlet/exhaust restriction and emissions settings will all affect engine response to load change. Engines that are not operating at the standard conditions stated in the Technical data sheet should be set up according to the guidelines included in the technical data; applying timing changes and/or engine derates as needed. Adherence to the engine settings guidelines will allow the engines to retain the transient performance stated in the tables above as a percentage of the site derated power (where appropriate).Fuel supply pressure and stability is critical to transient performance. Proper installation requires that all fuel train components (including filters, shut off valves, and regulators) be sized to ensure adequate fuel be delivered to the engine. The following are fuel pressure requirements to be measured at the engine mounted fuel control valve.

a. Steady State Fuel Pressure Stability +/- .15 psi/sec
b. Transient fuel Pressure Stability +/- .15 psi/sec

Inlet water temperature to the SCAC must be maintained at specified value for all engines. It is important that the external cooling system design is able to maintain the Inlet water temp to the SCAC to within +/- 1 °C during all engine-operating cycles. The SCAC inlet temperature stability criterion is to maintain stable inlet manifold air temperature. The Air Fuel Ratio control system requires up to 180 seconds to converge after a load step has been performed for NOx to return to nominal setting. If the stabilization time is not met between load steps the transient performance listed in the document may not be met. Differences in generator inertia may change the transient response of engine. Engine Governor gains and Voltage regulator settings may need to be tuned for site conditions. Engines must be maintained in accordance to guidelines specified in the Caterpillar Service Manuals applicable to each engine. Wear of components outside of the specified tolerances will affect the transient capability of the engine.

NOTES:

1. For unloading the engine to 0% load from a loaded condition no external input is needed. The engine control algorithm employs a load sensing strategy to determine a load drop. In the event that the local generator breaker opens the strategy provides control to the engine that resets all control inputs to the rated idle condition. This prevents engine over speeding and will allow the engine to remain running unloaded at the rated synchronous speed.
2. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G1 transient performance as defined by ISO 8528 - 5 with exceptions.
3. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G2 transient performance as defined by ISO 8528 - 5 with exceptions.
4. Air flow is critical for turbocharged engines during transients. As the exhaust temperature increases, the air flow or turbo response increases to enhance the genset transient response. Therefore, the recovery time for an engine's "First" load step after start up may differ from the "Standard" response for a heat soaked engine. If different, the load step recovery times are illustrated as Standard/First .
5. Steady state voltage and frequency stability specified at +/-2 sigma or better.

Application & Performance Warranty Data

Project Information

Site Location:	PA
Project Name:	Williams Ridgeline - G3512 1000kW
Application:	Prime Power
Number Of Engines:	1
Operating Hours per Year:	8760

Engine Specifications

Engine Manufacturer:	CAT
Model Number:	G3512
Rated Speed:	1800 RPM
Generator Power:	1019 ekW
Type of Fuel:	Natural Gas
Type of Lube Oil:	0.6 wt% sulfated ash or less
Lube Oil Consumption:	0.1 % Fuel Consumption
Number of Exhaust Manifolds:	1

Engine Cycle Data

Load	Speed	Power	Exhaust Flow	Exhaust Temp.	Fuel Cons.	CO	NMNEHC	CH_2O	O_2	H_2O
%		*bhp*	*acfm (cfm)*	*F*		*g/bhp-hr*	*g/bhp-hr*	*g/bhp-hr*	*%*	*%*
100	Rated	1,468	9,280	961		1.92	0.32	0.3	9.6	12

Emission Data (100% Load)

Emission	Raw Engine Emissions						Target Outlet Emissions						Calculated Reduction
	g/bhp-hr	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	*g/bhp-hr*	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	
CO	1.92	27.22	245	469	2.575	5.68	0.25	3.54	32	61	0.335	0.74	87%
NMNEHC*	0.32	4.54	71	137	0.429	0.95	0.25	3.54	56	107	0.335	0.74	21.9%
CH_2O	0.3	4.25	36	68	0.402	0.89	0.05	0.71	6	11	0.067	0.15	83.3%

System Specifications

Oxidation System Specifications (SP-ZCSS-30-TBD)

Design Exhaust Flow Rate:	9,280 acfm (cfm)
Design Exhaust Temperature[1]:	961°F
Housing Model Number:	SP-ZCSS-30-TBD-HSG-0
Element Model Number:	MECB-OX-SB2969-1550-2475-350
Number of Catalyst Elements:	2
Number of Spare Catalyst Tracks:	1
System Pressure Loss:	5.0 inches of WC (Clean) (12.5 mBar)
Sound Attenuation:	22-29 dBA insertion loss
Exhaust Temperature Limits**:	550 – 1250°F (catalyst inlet); 1350°F (catalyst outlet) 288 – 677°C (catalyst inlet); 732°C (catalyst outlet)

* MW referenced as CH_4. Propane in the exhaust shall not exceed 15% by volume of the NMNEHC compounds in the exhaust, excluding aldehydes. The 15% (vol.) shall be established on a wet basis, reported on a methane molecular weight basis. The measurement of exhaust NMNEHC composition shall be based upon EPA method 320 (FTIR), and shall exclude formaldehyde.

** General catalyst temperature operating range. Performance is based on the Design Exhaust Temperature.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	Engine Model **TAURUS 70-10802S** **CS/MD STANDARD**
Job ID	
Inquiry Number	Fuel Type: **CHOICE GAS** — Water Injection: **NO**
Run By: **David Anthony Pocengal** — Date Run: **3-Feb-22**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 11252 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	22.06	22.39	12.82
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.60	0.61	0.35
lbm/hr	5.04	5.11	2.93
2 — 11206 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.46	21.77	12.47
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.59	0.59	0.34
lbm/hr	4.90	4.97	2.85
3 — 11111 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.90	21.21	12.15
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.58	0.58	0.33
lbm/hr	4.77	4.84	2.77

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	Engine Model **TAURUS 70-10802S** **CS/MD STANDARD**
Job ID	
Inquiry Number	Fuel Type: **CHOICE GAS** — Water Injection: **NO**
Run By: **David Anthony Pocengal** — Date Run: **3-Feb-22**	Engine Emissions Data **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 10235 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	19.61	19.90	11.40
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.59	0.60	0.34
lbm/hr	4.48	4.54	2.60
5 — 9278 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	18.22	18.49	10.59
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr) (gas turbine shaft pwr)	0.60	0.61	0.35
lbm/hr	4.16	4.22	2.42
6 — 8198 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	16.65	16.89	9.67
lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
lbm/(MW-hr) (gas turbine shaft pwr)	0.62	0.63	0.36
lbm/hr	3.80	3.86	2.21

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar’s typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer	Model **TAURUS 70-10802S**
	Package Type **CS/MD**
Job ID	Match **STANDARD**
Run By **David Anthony Pocengal** / Date Run **3-Feb-22**	Fuel System **GAS**
Engine Performance Code **REV. 4.20.2.27.13** / Engine Performance Data **REV. 1.0**	Fuel Type **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	1300
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	23.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	0	20.0	40.0	60.0	80.0	100.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	11971	11895	11773	11486	11177	10781
Specified Load	HP	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	HP	11252	11206	11111	10235	9278	8198
Fuel Flow	mmBtu/hr	83.87	81.64	79.66	75.02	70.17	64.89
Heat Rate	Btu/HP-hr	7453	7286	7170	7330	7563	7915
Therm Eff	%	34.139	34.922	35.488	34.715	33.645	32.148
Engine Exhaust Flow	lbm/hr	226503	220160	213754	202216	189602	174495
PT Exit Temperature	deg F	910	912	921	943	968	1001
Exhaust Temperature	deg F	901	909	921	943	968	1001

Fuel Gas Composition (Volume Percent)

Methane (CH4)	81.65
Ethane (C2H6)	12.60
Propane (C3H8)	3.46
I-Butane (C4H10)	0.48
N-Butane (C4H10)	0.76
I-Pentane (C5H12)	0.21
N-Pentane (C5H12)	0.17
Hexane (C6H14)	0.15
Heptane (C7H16)	0.07
Octane (C8H18)	0.04
Carbon Dioxide (CO2)	0.13
Water Vapor (H2O)	0.02
Nitrogen (N2)	0.26
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	1090.3	Specific Gravity	0.6831	Wobbe Index at 60F	1319.2

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	Engine Model **TAURUS 70-10802S** **CS/MD STANDARD**
Job ID	
Inquiry Number	Fuel Type: **CHOICE GAS** — Water Injection: **NO**
Run By: **David Anthony Pocengal** — Date Run: **3-Feb-22**	Engine Emissions Data **REV. 0.1**

1	10747 HP 100.0% Load	Elev. 1300 ft	Rel. Humidity 60.0%	Temperature 50.0 Deg. F

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.36	20.65	11.83
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.58	0.59	0.34
lbm/hr	4.65	4.72	2.70

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer	
Job ID	
Run By: David Anthony Pocengal	Date Run: 3-Feb-22
Engine Performance Code: REV. 4.20.2.27.13	Engine Performance Data: REV. 1.0

Model	TAURUS 70-10802S
Package Type	CS/MD
Match	STANDARD
Fuel System	GAS
Fuel Type	CHOICE GAS

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	1300
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	23.8
Engine Inlet Temperature	deg F	50.0
Relative Humidity	%	60.0
Driven Equipment Speed	RPM	11645
Specified Load	HP	FULL
Net Output Power	HP	10747
Fuel Flow	mmBtu/hr	77.70
Heat Rate	Btu/HP-hr	7229
Therm Eff	%	35.195
Engine Exhaust Flow	lbm/hr	208678
PT Exit Temperature	deg F	932
Exhaust Temperature	deg F	932

Fuel Gas Composition (Volume Percent)

Methane (CH4)	81.65
Ethane (C2H6)	12.60
Propane (C3H8)	3.46
I-Butane (C4H10)	0.48
N-Butane (C4H10)	0.76
I-Pentane (C5H12)	0.21
N-Pentane (C5H12)	0.17
Hexane (C6H14)	0.15
Heptane (C7H16)	0.07
Octane (C8H18)	0.04
Carbon Dioxide (CO2)	0.13
Water Vapor (H2O)	0.02
Nitrogen (N2)	0.26
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	1090.3	Specific Gravity	0.6831	Wobbe Index at 60F	1319.2

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Volatile Organic Compound, Sulfur Dioxide, and Formaldehyde Emission Estimates

Leslie Witherspoon

PURPOSE

This Product Information Letter (PIL) summarizes emission factors commonly utilized to estimate emissions of volatile organic compounds (VOC), sulfur dioxide (SO_2), and formaldehyde from gas turbines.

Volatile Organic Compounds

Many permitting agencies require gas turbine users to include emissions of VOC, a subpart of the unburned hydrocarbon (UHC) emissions, during the air permitting process. Volatile organic compounds, non-methane hydrocarbons (NMHC), and reactive organic gases (ROG) are different ways of referring to the non-methane (and non-ethane) portion of an "unburned hydrocarbon" emission estimate.

For natural gas fuel, Solar's customers often use 10-20% of the UHC emission rate to conservatively estimate VOC emissions. Solar can offer a 5 ppm VOC warranty level upon request. For liquid fuel, it is appropriate to estimate that 100% of the UHC estimate is VOC. The emissions estimates are assumed valid at ambient temperatures >0 °F (-17.8 °C) and for natural gas from 50-100% load (40-100% for the Titan™ 250 and 80-100% load for the Saturn® 20) or for liquid fuel from 65-100% load (80-100% for the Saturn 20 and Centaur® 40).

Environmental Protection Agency (EPA's) AP-42[1] document and WebFIRE[2] database also contain VOC emission estimates for gas turbines. These sources are not commonly used by Solar's customers.

Sulfur Dioxide

Sulfur dioxide emissions are produced by conversion of any sulfur in the fuel to SO_2. Solar customers usually either use a mass balance calculation or reference AP-42 to estimate SO_2 emissions. Because Solar does not control the amount of sulfur in the fuel, no SO_2 emissions warranty is available.

The mass balance method assumes that any sulfur in the fuel converts to SO_2. For reference, the typical mass balance equation is shown below.

$$\frac{\text{lb SO2}}{\text{hr}} = \left(\frac{\text{wt\% Sulfur}}{100}\right)\left(\frac{\text{lb fuel}}{\text{Btu}}\right)\left(\frac{10^6\ \text{Btu}}{\text{MMBtu}}\right)\left(\frac{\text{MMBtu fuel}}{\text{hr}}\right)\left(\frac{\text{MW SO2}}{\text{MW Sulfur}}\right)$$

Variables: wt% of sulfur in fuel
Btu/lb fuel (LHV)
MMBtu/hr fuel flow (LHV)

As an alternative to the mass balance calculation, EPA's AP-42 document can be used. AP-42 (Table 3.1-2a, April 2000) suggests emission factors of 0.94S lb/MMBtu (HHV) (where S=Sulfur % in fuel) or 0.0034 lb/MMBtu (HHV) for gas fuel and 1.01S lb/MMBtu (HHV) (where S=Sulfur% in fuel) or 0.33 lb/MMBtu (HHV) for liquid fuel.

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[1] AP-42 is an EPA document containing a compilation of air pollutant emission factors by source category.
[2] WebFIRE is an EPA electronic based repository and retrieval tool for emission factors.

Formaldehyde

For gas turbines, formaldehyde emissions are a result of incomplete combustion and are unstable in the exhaust stream. In this section, regulatory background, recommended emission factors, and testing considerations are discussed.

Regulatory Background and Emissions Factors – U.S. and EU

In 2004 the U.S. EPA published a Maximum Achievable Control Technology (MACT) standard (40 CFR 63 Subpart YYYY) for natural gas fired combustion turbines with a formaldehyde limit of 91 ppb (15% O2). The standard was stayed a few months later for the natural gas subcategories essentially rendering the regulation "on hold". The stay was lifted on March 9, 2022. After ~18 years of not having to comply with the MACT standard, natural gas fired combustion turbines located **at major sources of hazardous air pollutants** need to comply with the standard. The initial compliance date is September 4, 2022. With the lifting of the stay, four of the eight subcategories outlined in the Subpart YYYY must comply with the MACT standard. They are:

- stationary lean premix combustion turbines when firing gas and when firing oil at sites where all turbines fire oil no more than an aggregate total of 1,000 hours annually
- stationary lean premix combustion turbines when firing oil at sites where all turbines fire oil more than an aggregate total of 1,000 hours annually
- stationary diffusion flame combustion turbines when firing gas and when firing oil at sites where all turbines fire oil no more than an aggregate total of 1,000 hours annually
- stationary diffusion flame combustion turbines when firing oil at sites where all turbines fire oil more than an aggregate total of 1,000 hours annually

For U.S. customers with a combustion turbine that must comply with Subpart YYYY, an emission factor of 91 ppb @ 15% O2 (~0.00021 lb/MMBtu HHV) is recommended.

The formaldehyde emissions estimate of 91 ppb @15%O2 (~0.00021 lb/MMbtu HHV) can be used for all new, current production, SoLoNOx models and ratings when firing pipeline quality natural gas or ultra-low sulfur (ULSD) diesel fuel. The emissions estimate is valid for natural gas from 50-100% load (40-100% load for Titan 250) or for liquid fuel from 65-100% load (80-100% load for the Centaur 40) and at ambient temperatures >0 °F (> -20 °F for Titan 250).

Alternative emission factors for combustion turbines **not** affected by Subpart YYYY (or non-U.S. based combustion turbines) are from U.S. EPA's AP-42 document and are 0.00071 lb/MMBtu (HHV) for natural gas and 0.00028 lb/MMBtu (HHV) for distillate oil[3]. Note that both of the aforementioned formaldehyde emission factors are higher than the MACT standard. Since ~2003 many gas turbine users have used the emission factors found in an EPA memo Revised HAP Emission Factors for Stationary Combustion Turbines[4] for estimating hazardous air pollutant emissions. The memo presents hazardous air pollutant emission factor data in several categories. While the memo presents several formaldehyde emissions factors, the most common formaldehyde emission factor used to estimate emissions from gas turbines from this document is 0.00288 lb/MMBtu HHV (Table 16). Note that this emission factor is an order of magnitude higher than the MACT standard.

In the EU, Germany has established a formaldehyde limit of 5 mg/Nm3 for combustion turbines (13.BImSchV Section 33). This limit applies for operation at 70-100% load and it is anticipated that something similar will be adopted in other EU member states. The 5 mg/Nm3 limit is equivalent to ~0.0038 kg/GJ or ~3.7 ppm.

Formaldehyde Emissions Testing Considerations

Actual emissions of formaldehyde from Solar's gas turbines, in the SoLoNOx operating range, are predicted to be less than 91 ppb @15%O2. However, **the 91 ppb level can only be verified if the proper testing equipment is utilized.** To properly measure formaldehyde emissions, Fourier Transform Infrared (FTIR) instrumentation with limits of detection well below the standard must be utilized. Most "traditional" FTIR systems have formaldehyde

[3] AP-42, Table 3.1-3 for Natural Gas and Table 3.1-4 for Distillate Oil, 4/00.

[4] Revised HAP Emission Factors for Stationary Combustion Turbines, OAR-2002-0060, IV-B-09,8/22/03.

limits of detection in the 120-150 ppb range and are not suitable to measure formaldehyde from combustion turbines.

Solar recommends the MKS Multi Gas 2030 FTIR with StarBoost™ System, the Spectrum WaveRunIR-EXT or an equivalent system with similar path lengths and detection levels.

EPA Method 320 (or equivalent method for non-U.S. testing) should be used to measure formaldehyde. Testing should include three – 120-minute test runs. To ensure accurate formaldehyde measurements, the testing company, in addition to following the requirements of Method 320 (or equivalent method), should take necessary steps to optimize signal-to-noise, verify the FTIR is fully temperature stabilized and purged, ensure the FTIR signal is optimized before testing by maximizing alignment and cleanliness of optics, minimize sampling line bias by using clean sample lines at 250°F to prevent off-gassing and minimize contamination with other compounds, verify absence of sampling system bias via system zero measurements, measure a source specific moisture spectrum while at the test site using a water/N2 delivery systems at +/-10% of turbine moisture content, and use the source specific water spectrum as an interferent in the analysis.

Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNOx™ Combustion Products

Leslie Witherspoon

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide emission estimates for start-up and shutdown events for Solar® gas turbines with SoLoNOx™ dry low emissions combustion systems.[1] For start-up and shutdown emissions estimates for conventional combustion turbines, landfill gas, digester gas, or other alternative fuel applications, contact Solar's Environmental Programs team.

INTRODUCTION

The information presented in this document is representative for both generator set (GS) and compressor set/mechanical drive (CS/MD) SoLoNOx combustion turbine applications. Operation of duct burners and/or any add-on control equipment is not accounted for in the emissions estimates. Emissions estimates related to the start-up, shutdown, and commissioning of combustion turbines will not be warranted. The estimates in this document are based on limited engine testing and analysis. The engine testing was conducted at idle and other non-SoLoNOx mode load points. An actual start-up/shutdown event was not measured.

The start-up and shutdown estimates are most commonly used for potential to emit calculations to determine air permitting status. **Solar discourages customers from accepting the estimates in this document as permit limits, with or without source testing requirements.** Accurately measuring emissions during a – non-steady state – start-up or shutdown event with steady state source test methods may prove to be very challenging. In the event customers take permit limits and accept compliance testing permit conditions, Solar recommends adding significant margin to the estimates in this document.

START-UP PROCESS

The duration of a nominal start-up is the same for a cold start, warm start, or hot start (e.g., a Solar Turbine is programmed to start-up in "x" minutes whether it's a cold, warm, or hot start).

The start-up and shutdown time for a Solar turbine in a simple-cycle or combine heat and power application is the same. Heat recovery steam generator (HRSG) steam pressure is usually 250 psig or less. At 250 psig or less, thermal stress within the HRSG is minimized and, therefore, firing ramp-up/ramp-down is not limited. However, some combined heat and power plant applications will desire or dictate longer start-up/shutdown times due to external requirements.

The start-up sequence and attaining SoLoNOx combustion mode takes three steps:

1. Purge-crank
2. Ignition and acceleration to idle
3. Loading/thermal stabilization

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[1]Start-up and shutdown emissions for the Mercury™50 engine are found in PIL 205

During the "purge-crank" step, rotation of the turbine shaft is accomplished with a starter motor to remove any residual fuel gas in the engine flow path and exhaust. During "ignition and acceleration to idle," fuel is introduced into the combustor and ignited in a diffusion flame mode and the engine rotor is accelerated to idle speed.

The third step consists of applying up to 50% load[2] while allowing the combustion flame to transition and stabilize. Once 50% load is achieved, the turbine transitions to SoLoNOx combustion mode and the engine control system begins to maintain the combustion primary zone temperature and limit pilot fuel to achieve the targeted nitrogen oxides (NOx), carbon monoxide (CO), and unburned hydrocarbons (UHC) emission levels.

SHUTDOWN PROCESS

Normal, planned cool down/shutdown duration varies by engine model. Once the shutdown process starts the engine unloads and moves into a cooldown mode.

START-UP AND SHUTDOWN EMISSIONS ESTIMATES

Tables 1 through 5 summarize the estimated pounds of emissions per start-up and shutdown event for SoLoNOx products. The mass emissions estimates are calculated using exhaust characteristics at ISO conditions in conjunction with ppm emissions estimates at various load points. The estimates in Tables 1 and 2 are representative of new production units ordered from 2006 up until the implementation of Enhanced Emissions Control (EEC). Tables 3 and 4 summarize emissions estimates for turbine models and ratings equipped with EEC. Enhanced Emission Control (EEC) is a new control regime that will result in lower CO and UHC values at lower loads thus reducing the estimated emissions per start-up and shutdown sequence. The Titan™ 250 and the Titan 130 23001/23502 (and 22401/22402) ratings have always been equipped with EEC. As testing is completed and other models/ratings are qualified and able to be equipped with the updated controls PIL170 will be updated. Reference PIL 220, specifically pages 7 and 8, for additional information about Enhanced Emission Control. Table 5 summarizes start-up and shutdown emissions estimates for liquid fuel applications.

Please contact Solar Environmental Programs, Leslie Witherspoon (858.694.6609) or Anthony Pocengal (858.505.8554) for support.

COMMISSIONING EMISSIONS

Commissioning generally takes place over a two-week period. Static testing, where no combustion occurs, usually requires one week and no emissions are expected. Dynamic testing, where combustion will occur, typically includes a number of engine start and shutdown cycles and a variety of loads will be placed on the system. It is impossible to predict how long the turbine will run and in what combustion/emissions mode it will be running. The dynamic testing period is generally followed by one to two days of final commissioning during which the turbine is running at various loads.

[2] 40% load for the Titan 250 Engine on natural gas. 65% load for all engines on liquid fuel (except 80% load for the Centaur™ 40).

Table 1: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications

Nominal Start-up and Shutdown, Natural Gas Fuel

Production Units from 2006 and without Enhanced Emissions Control

Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4701S	1	66	62	12	247	1	67	67	13	228
Centaur 50 6201S	1	67	84	17	333	1	67	88	18	316
Taurus™ 60 7901S	1	86	110	22	338	1	89	119	24	311
Taurus 65 8701S	1	74	67	13	376	1	75	74	15	347
Taurus 70 10801S	1	78	67	13	544	1	58	52	10	411
Mars™ 90 13000S GSC	1	84	41	8	640	1	80	44	9	605
Mars 100 15000S/16000S GSC	1	81	39	8	669	1	76	42	8	616
Titan 130 20501S	3	172	138	28	832	3	174	151	30	768

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 2: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units from 2006 and without Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4702S	1	21	17	3	188	1	19	18	4	194
Centaur 50 6102S	1	21	17	3	184	1	20	19	4	169
Taurus 60 7802S	1	22	17	3	180	1	20	18	4	161
Taurus 70 10802S	1	88	88	18	381	1	78	83	17	295
Mars 90 13000S CS/MD	1	45	20	4	437	1	56	28	6	590
Mars 100 15000S/16000S CS/MD	1	46	20	4	385	1	58	28	6	490
Titan 130 20502S	1	55	37	7	662	1	61	43	9	751

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.
Assumes unit is operating at >50% load prior to shutdown.
Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 3: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units with Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7901S GSC (Post 9/2020 Orders)	1	114	65	13	368	1	140	80	16	345
Taurus 70 10801S GSC (Post 2/2018 Orders)	1	34	45	9	552	1	28	36	7	419
Taurus 70 11101S GSC (Post 2/2018 Orders)	1	35	45	9	563	1	28	37	7	427
Mars 90 13000S GSC (Post 9/2020 Orders)	1	33	25	5	727	1	37	27	5	682
Mars 90 15000S GSC (Post 9/2020 Orders)	1	40	33	7	760	1	44	35	7	710
Mars 100 16000S GSC (Post 8/2017 Orders)	1	32	24	5	789	1	35	25	5	733
Titan 130 19501S (Post 9/2020 Orders)	1	31	35	7	842	1	35	40	8	795
Titan 130 20501S (Post 2/2018 Orders)	2	70	80	16	839	2	83	95	19	782
Titan 130 23001S (All Units)	1	20	23	5	943	1	21	24	5	885
Titan 250 30000S GSC (All Units)	2	38	15	3	1502	2	30	12	2	1159
Titan 250 31900S GSC (All Units)	2	41	16	3	1280	2	33	13	3	975

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.
Assumes unit is operating at >50% load prior to shutdown.
Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 4: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications

Nominal Start-up and Shutdown, Natural Gas Fuel

Production Units with Enhanced Emissions Control

Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7802S (Post 9/2020 Orders)	1	5	4	1	247	1	7	6	1	235
Taurus 70 10802S (Post 2/2018 Orders)	1	37	52	10	381	1	36	50	10	295
Mars 100 13000S CS/MD (Post 9/2020 Orders)	1	16	12	2	437	1	23	17	3	564
Mars 100 15000S CS/MD (Post 9/2020 Orders)	1	21	13	3	474	1	31	19	4	612
Mars 100 16000S CS/MD (Post 8/2017 Orders)	1	18	12	2	496	1	25	17	3	642
Titan 130 20502S (Post 9/2020 Orders)	1	11	6	1	682	1	13	7	1	762
Titan 130 22402S (All Units)	1	13	15	3	690	1	15	17	3	775
Titan 130 23502S (All Units)	1	16	18	4	767	1	19	22	4	869
Titan 250 30000S CS/MD (All Units)	2	32	12	2	1172	2	28	11	2	1036
Titan 250 31900S CS/MD (All Units)	1	24	9	2	987	1	21	8	2	880

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 5: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications

Nominal Start-up and Shutdown, Liquid Fuel (Diesel #2)

Emissions estimates will NOT be warranted.

Engine	Total Emissions per Start (lbs)					Total Emissions per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4701S	4	140	23	23	419	4	153	26	26	386
Centaur 50 6201S	3	130	22	22	472	3	143	24	24	440
Taurus 60 7901S	4	147	25	25	483	4	163	28	28	435
Taurus 70 10801S	6	251	42	42	754	5	201	34	34	568
Mars 100 16000S GSC	4	119	20	20	854	4	150	25	25	857
Titan 130 20501S	8	336	57	57	1164	8	371	63	63	1058
Titan 130 23001S	4	138	23	23	1206	4	133	22	22	1086
Titan 250 30000S GSC	8	280	47	47	2189	6	220	37	37	1656
Titan 250 31900S GSC	8	292	49	49	2112	6	230	39	39	1588

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Particulate Matter Emission Estimates

Leslie Witherspoon

PURPOSE

This Product Information Letter (PIL) summarizes Solar's recommended $PM_{10/2.5}$ emission levels for our combustion turbines. The recommended levels are based on an analysis of emissions tests collected from customer sites.

PARTICULTE MATTER DEFINITION

National Ambient Air Quality Standards (NAAQS) for particulate matter were first set in 1971. Total suspended particulate (TSP) was the first indicator used to represent suspended particles in the ambient air. Since July 1, 1987, the Environmental Protection Agency (EPA) has used the indicator PM_{10}, which includes only the particles with aerodynamic diameter smaller than 10 micrometers (µm). PM_{10} (coarse particles) come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic.

The EPA added a $PM_{2.5}$ ambient air standard in 1997. $PM_{2.5}$ includes particles with an aerodynamic diameter less than 2.5 µm. $PM_{2.5}$ (fine particles) are generally emitted from industrial and residential combustion and from vehicle exhaust. Fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxide, and volatile organic compounds, emitted by combustion activities, are transformed by chemical reactions.

Nearly all particulate matter from gas turbines exhaust is less than one micrometer (micron) in diameter. Thus the emission rates of TSP, PM_{10}, and $PM_{2.5}$ from gas turbines are theoretically equivalent although source testing will show variation due to test method detection levels and processes.

TESTING FOR PARTICULATE MATTER

The turbine combustion process has little effect on the particulate matter generated and measured. The largest contributor to particulate matter emissions for gas and liquid fired combustion turbines is measurement technique and error. Other, minor contributing, sources of particulate matter emissions include carbon, ash, fuel-bonded sulfur, artifact sulfate formation, compressor/lubricating oils, and inlet air.

Historical customer particulate matter source test data show that there is significant variability from test to test. The source test results support the common industry argument that particulate matter from natural gas fired combustion sources is difficult to measure accurately. The reference test methods for particulate matter were developed primarily for measuring emissions from coal-fired power plants and other major emitters of particulates. Particulate concentrations from gas turbine can be 100 10,000 times lower than the "traditional" particulate sources. The test methods were not developed or verified for low emission levels. There are interferences, insignificant at higher exhaust particulate matter concentrations that result in emissions greater than the actual emissions from gas turbines. New methods are being developed to address this problem.

Due to measurement and procedural errors, the measured results may not be representative of actual particulate matter emitted. There are many potential error sources in measuring particulate matter. Most of these have to do with contamination of the samples, material from the sampling apparatus getting into the samples, and human error in samples and analysis. Over the past few years, source test firms are gaining experience in measuring particulate matter and the historical variability from test to test and the emissions levels measured have decreased.

RECOMMENDED PARTICULATE MATTER EMISSION FACTORS

When necessary to support the air permitting process Solar recommends the following $PM_{10/2.5}$ emission factors for all models and ratings except for the Mercury™ 50. Please refer to PIL 205 for the Mercury 50. The emission factors below are intended to include both the front half (filterable) and the back half (condensable).

- Pipeline Natural Gas*: 0.01 lb/MMBtu fuel input (HHV)
- Landfill/Digester Gas+: 0.03 lb/MMBtu fuel input (HHV)
- Liquid Fuel#: 0.02 lb/MMBtu fuel input (HHV)

  *Pipeline natural gas emissions factor assumes <1 grains of Sulfur per 100 standard cubic feet.
  +Landfill/digester gas emissions factor assumes <.15lb SO2/MMBtu heat input
  #Liquid fuel emission factor assumes fuel Sulfur content is <500 ppm and ash content is <0.005% by wt.

Contact Solar's Environmental Programs group for particulate matter emissions estimates for fuels not listed above.

The conversion of particulate matter emissions request from mg/Nm^3 to lb/MMBtu (HHV) units involves several specific turbine parameters. Please contact Solar if you need the calculation performed.

Recent customer source testing has shown that AP-42 (EPA AP-42 "Compilation of Air Pollutant Emission Factors") emission factors for natural gas are achievable in the field, when the test method recommendations shown below are followed. Customers generally choose a particulate matter emissions factor at or above the AP-42 level that works for their site permitting recognizing that the lower the emissions factor the higher the risk for source testing.

TEST METHOD RECOMMENDATION

Solar recommends that EPA Methods 201/201A[1] be used to measure the "front half." "Front half" represents filterable particulate matter.

EPA Method 202[2] (with Nitrogen purge and field blanks) should be used to measure the "back half." "Back half" measurements represent the condensable portion of particulate matter.

EPA Method 5[3], which measures the front and back halves may be substituted (e.g. where exhaust temperatures do not allow the use of Method 202).

The turbine should have a minimum of 300 operating ours prior to conducting particulate matter source testing. The turbine should be running for 3-4 hours prior to conducting a particulate matter source test so that the turbine and auxiliary equipment is in a sustained "typical" operating mode prior to gathering samples.

Testing should include three 4-hour test runs.

Solar recommends using the aforementioned test methods until more representative test methods are developed and widely commercially available

REFERENCES

[1]EPA Method 201, Determination of PM10 Emissions, Exhaust Gas Recycle Procedure. EPA Method 201A. Determination of PM10 Emissions, Constant Sampling Rate Procedure, 40 CFR 60, Part 60, Appendix A.
[2]EPA Method 202, Determination of Condensable Particulate Emissions from Station Sources, 40 CFR 60, Part 60. Appendix A.
[3]EPA Method 5, Determination of Particulate Emissions from Station Sources, 40 CFR 60, Part 60, Appendix A.

Emissions from Centrifugal Compressor Dry Gas Seal System

Anthony Pocengal and Sean Garceau

PURPOSE

This product information letter (PIL) provides estimates of methane emitted from the dry gas seal systems installed in Solar® centrifugal gas compressors.

INTRODUCTION

The standard design of dry seal systems includes characteristic 'seal leakage' which in most configurations results in methane emissions to the atmosphere from the primary seal vent. Figure 1 below shows a cutaway diagram of a typical compressor shaft and dry seal system showing some of the basic components. The primary seal uses a high-pressure seal gas to maintain the process gas within the gas compressor body. The seal gas is typically pressurized process gas, i.e. methane for a typical natural gas compression station, and since the seal gas pressure is slightly higher than the suction and discharge pressures, most of the seal gas is returned to the compression process thru the labyrinth seal passage. A portion of the seal gas leaks across the primary seal face per design and is emitted through the primary vent to atmosphere. The volume of methane emitted from the seal vent is directly proportional to the operating suction pressure of the gas compressor.

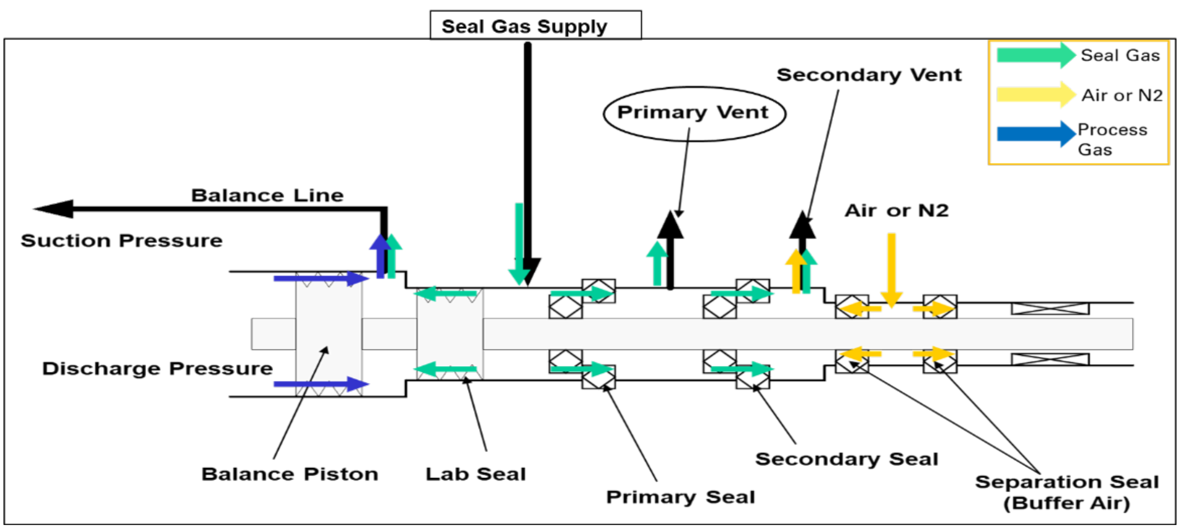

Figure 1: Centrifugal Compressor Dry Gas Seal System – Basic Components

Solar offers a dry seal emissions recompression system which captures the emissions from the primary vent and allows routing of these emissions back into the compression process or for another beneficial use onsite. Solar PIL 279 has further information on this application which virtually eliminates methane emissions from the dry seal system.

DRY GAS SEAL EMISSIONS DATA

The figures below may be used to estimate dry gas seal emissions ('seal leakage') emitted through the primary vent based on the compressor suction pressure (P1). The charts show the maximum expected leakage rates per each compressor. Actual emissions are expected to be lower.

For further technical information on Dry Gas Seal systems refer to PIL 140 Dry Gas Face Seals for Solar Gas Compressors.

Note regarding PIL 140: The maximum dynamic leakage rates from PIL 140 Table 1a are the highest possible guaranteed flow rates and are based on maximum allowable speed and pressure and should not be utilized for emission inventories or expected emissions from Solar compressors.

TABLE OF FIGURES

Centrifugal compressor dry gas seal leakage estimates

The charts shown below provide estimates for the seal leakage from the two primary dry gas seals on Solar gas compressors. The dry gas seal leakage flow is a function of the compressor suction pressure. The charts show seal gas vented flow (scfm) vs compressor suction pressure (psig)

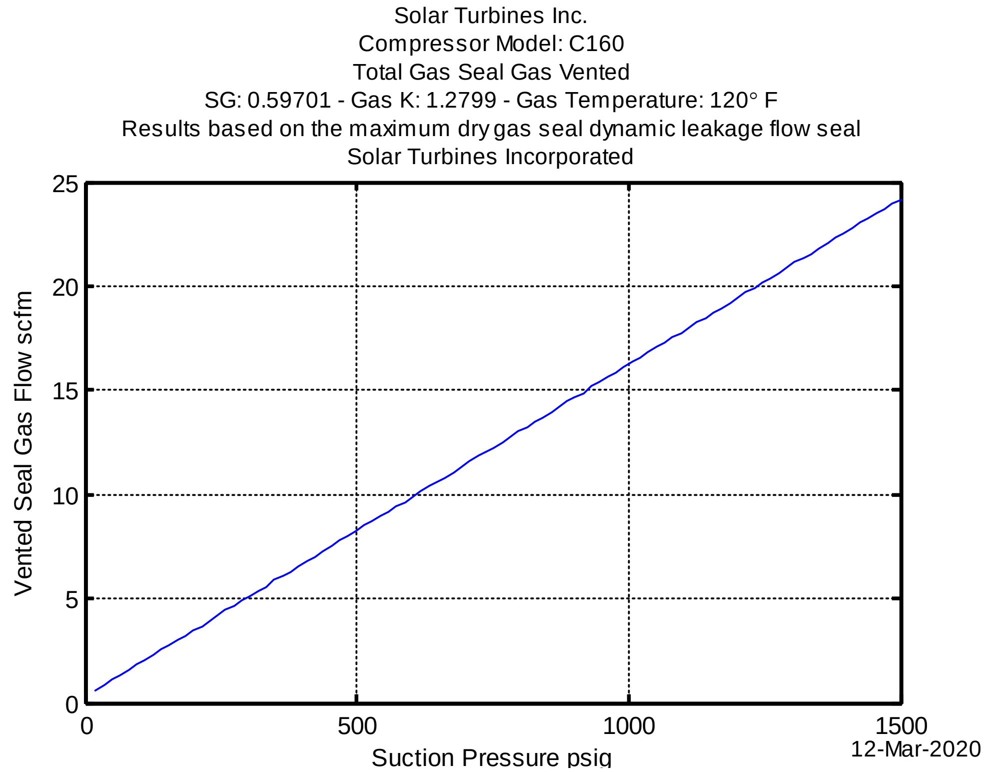

Figure 2: C16, C28

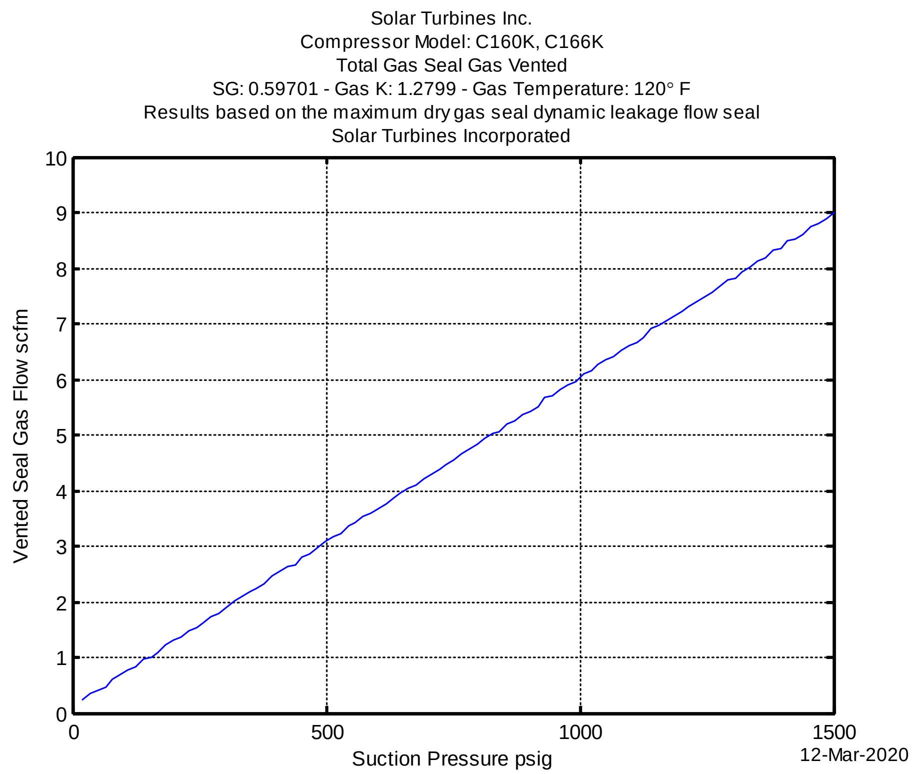

Figure 3: C160K, C166K

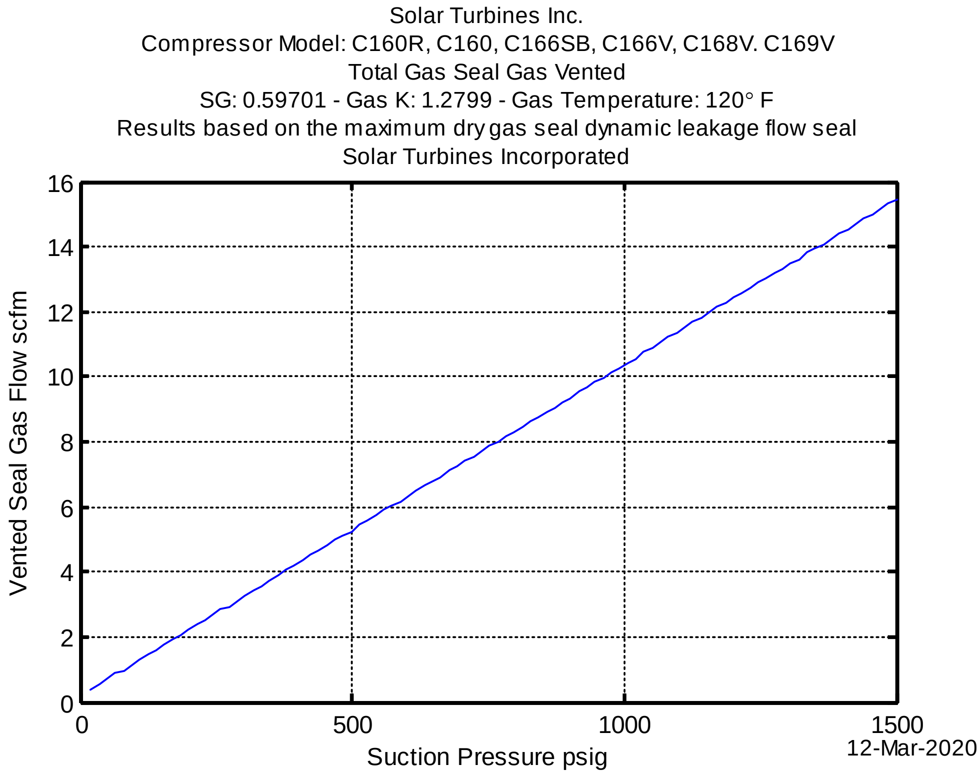

Figure 4: C160R, C160, C166SB, C166V, C168V, C169V

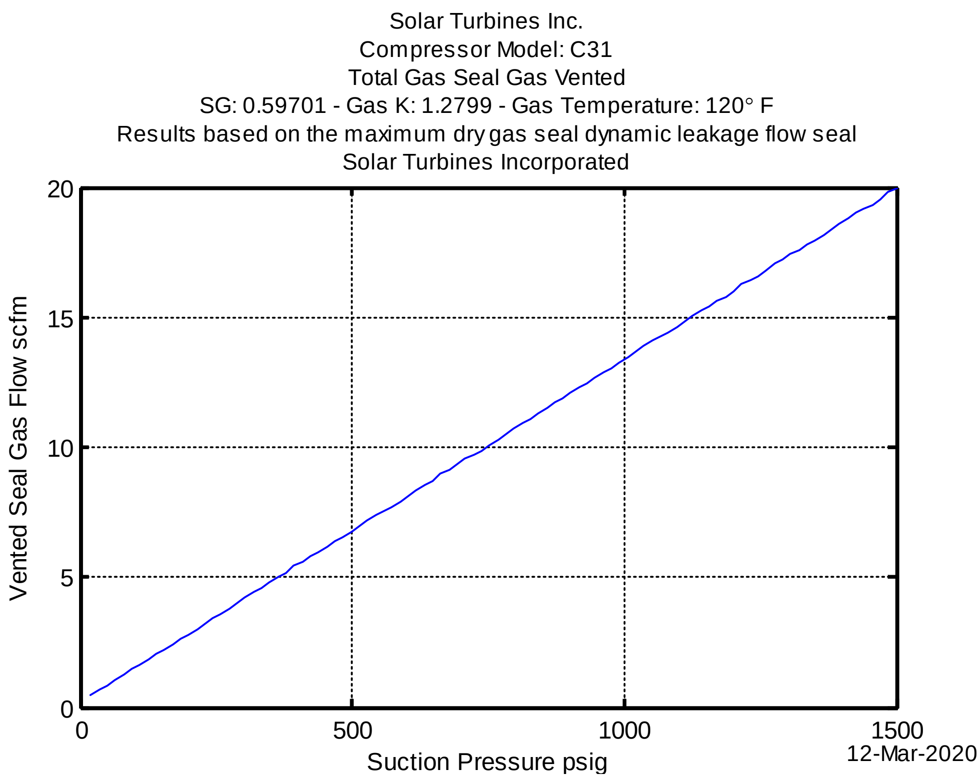

Figure 5: C31

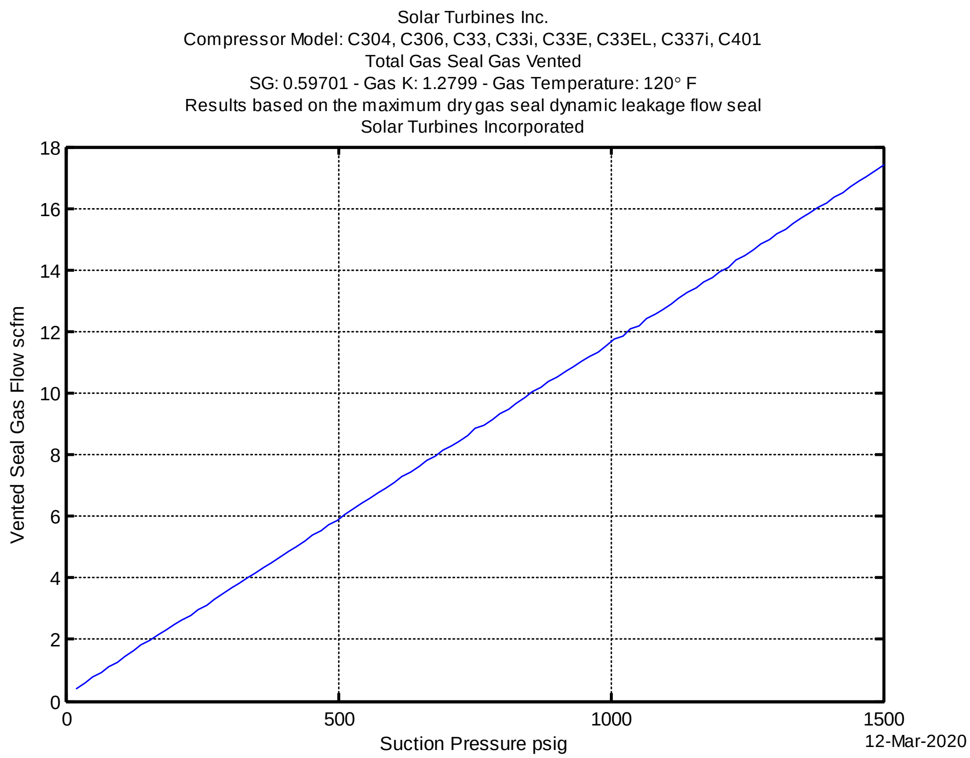

Figure 6: C304. C306, C33, C33i, C33E, C33EL, C337i, C401

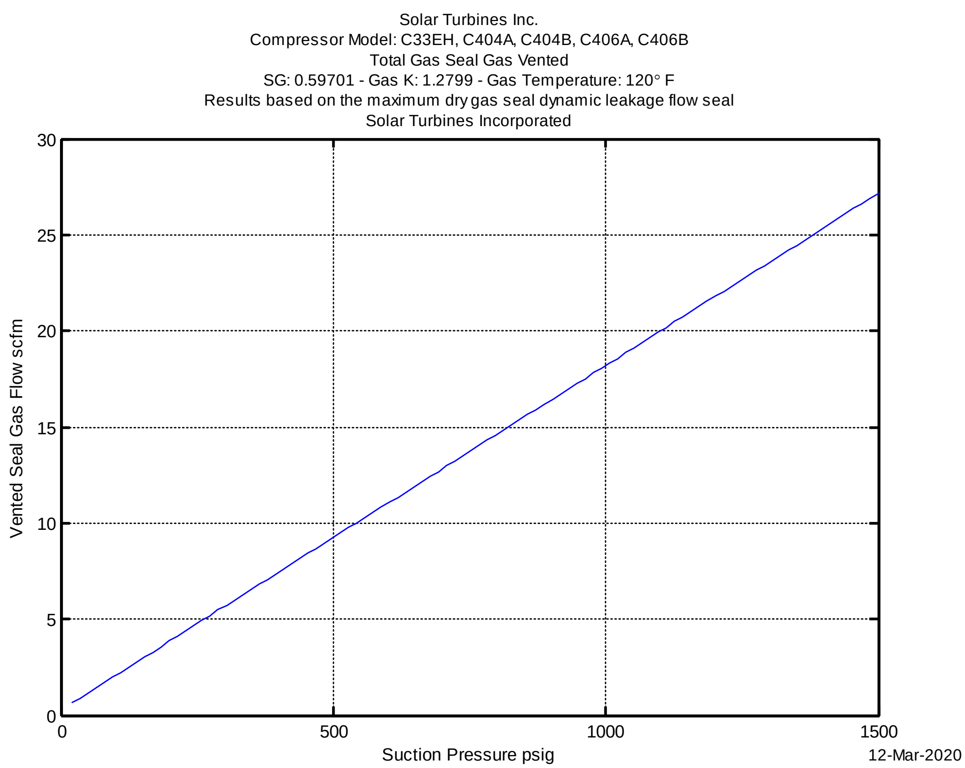

Figure 7: C33EH, C404A, A404B, C406A, C406B

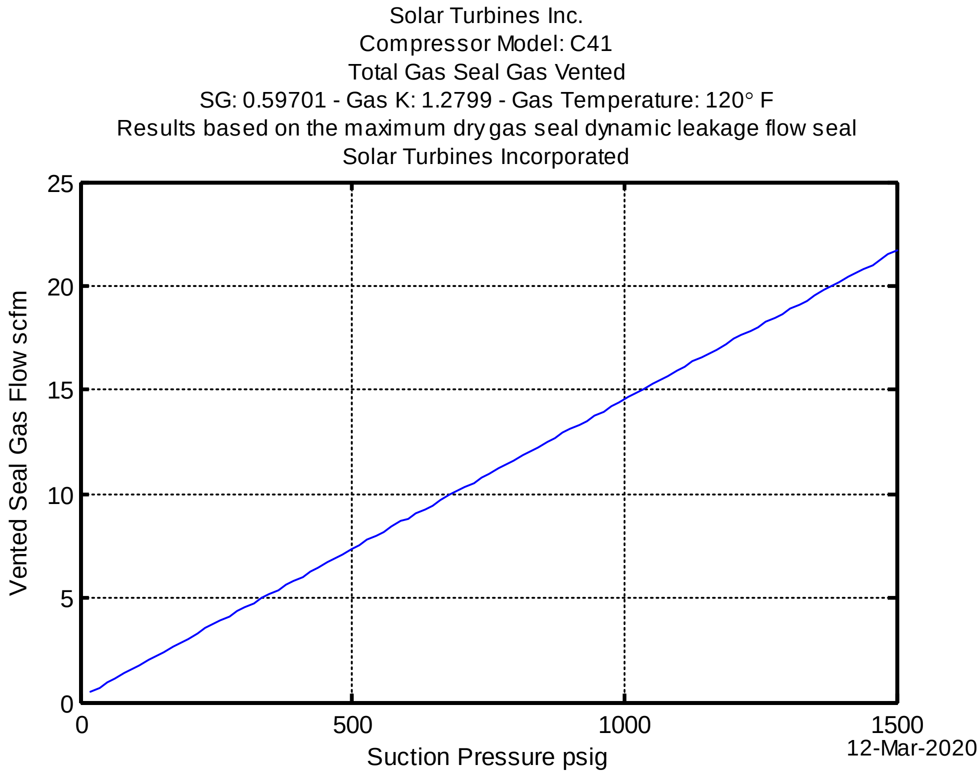

Figure 8: C41

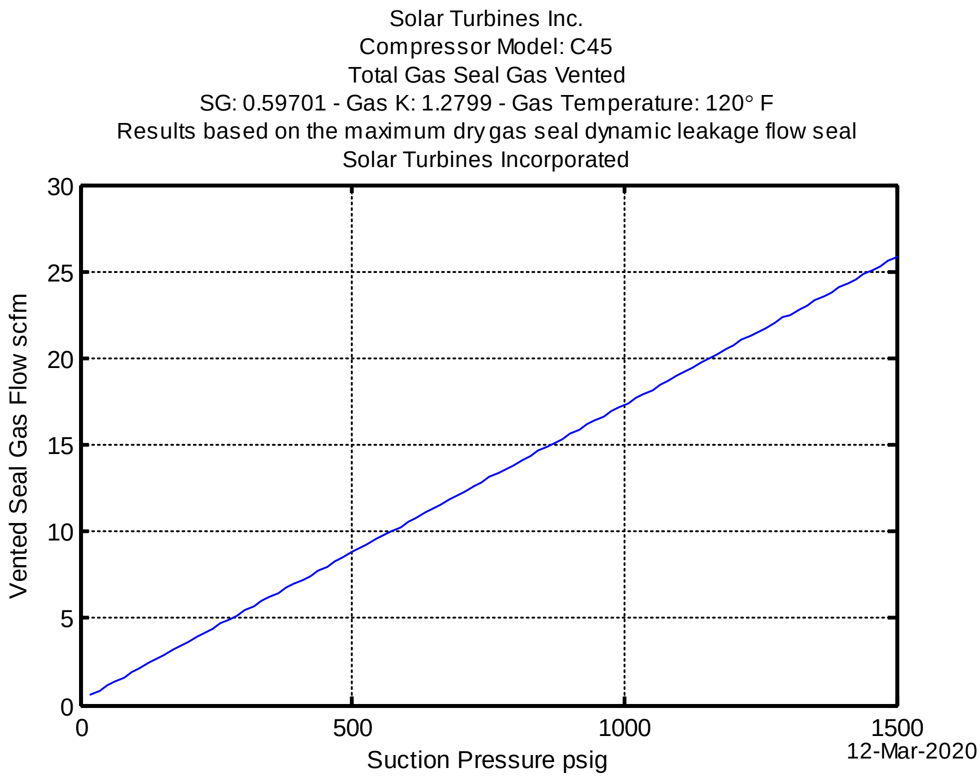

Figure 9: C45

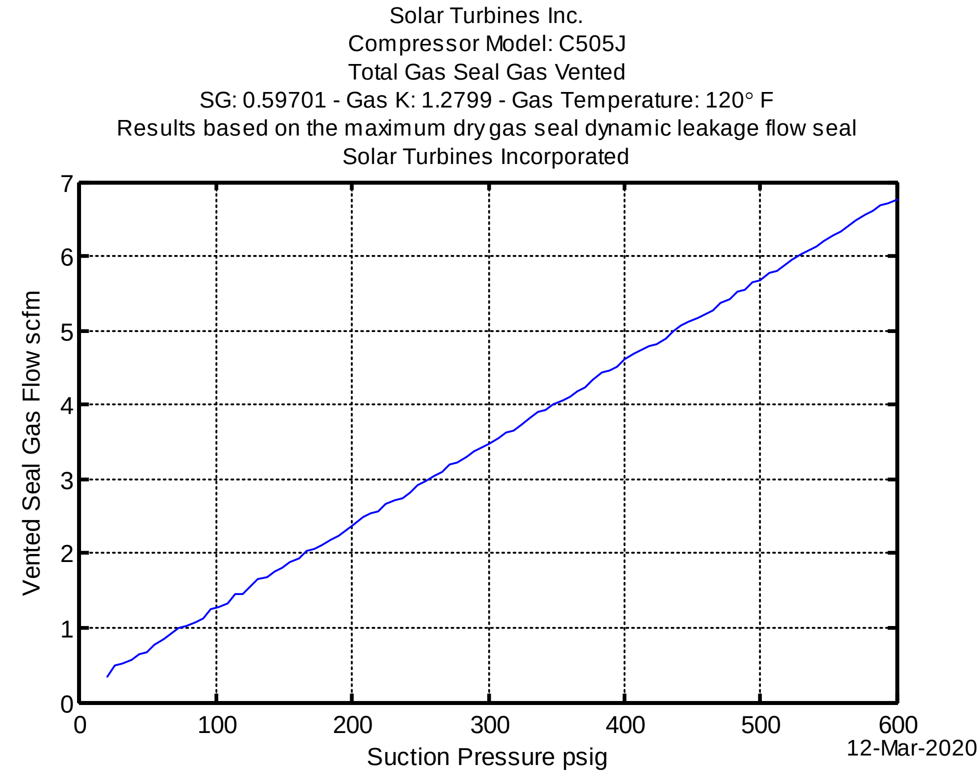

Figure 10: C505J

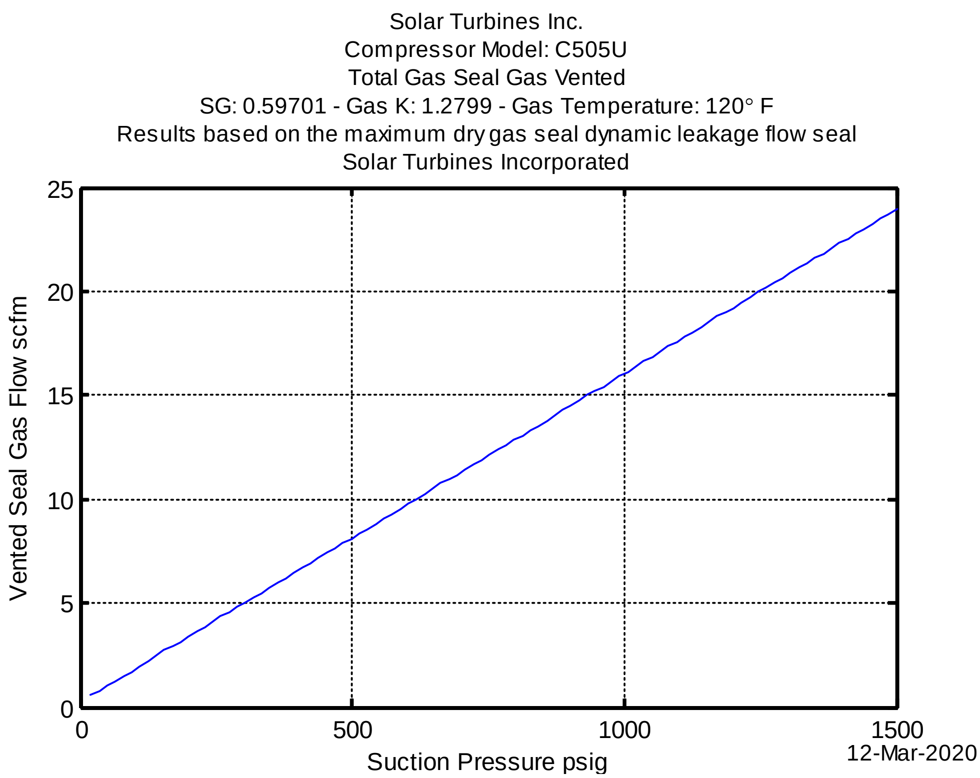

Figure 11: C505 U

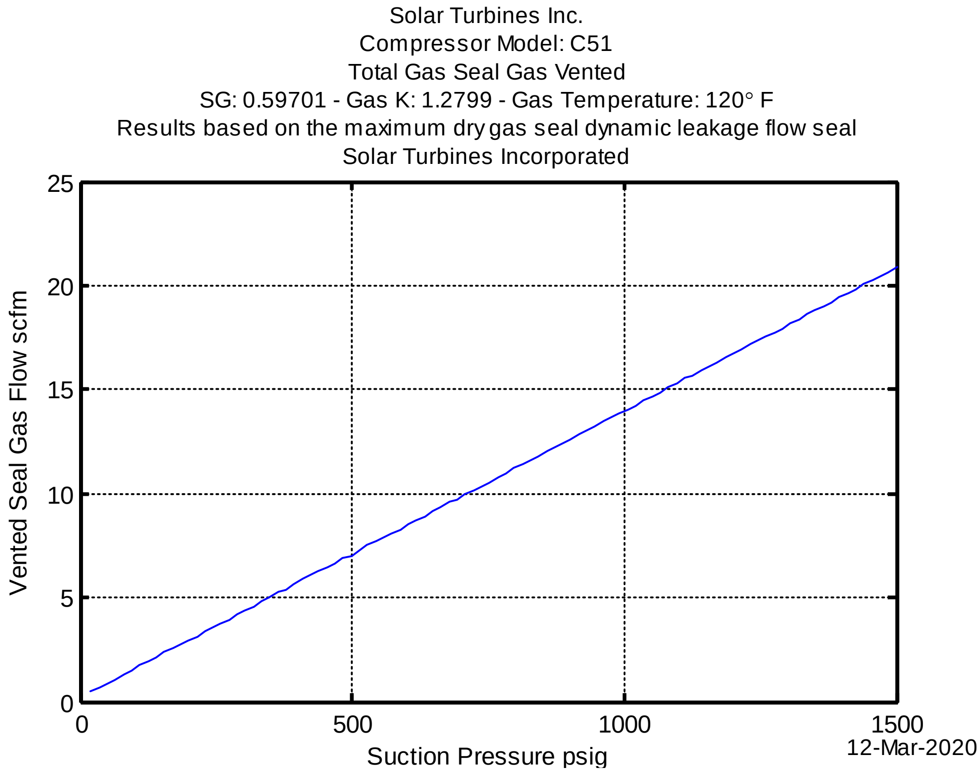

Figure 12: C51

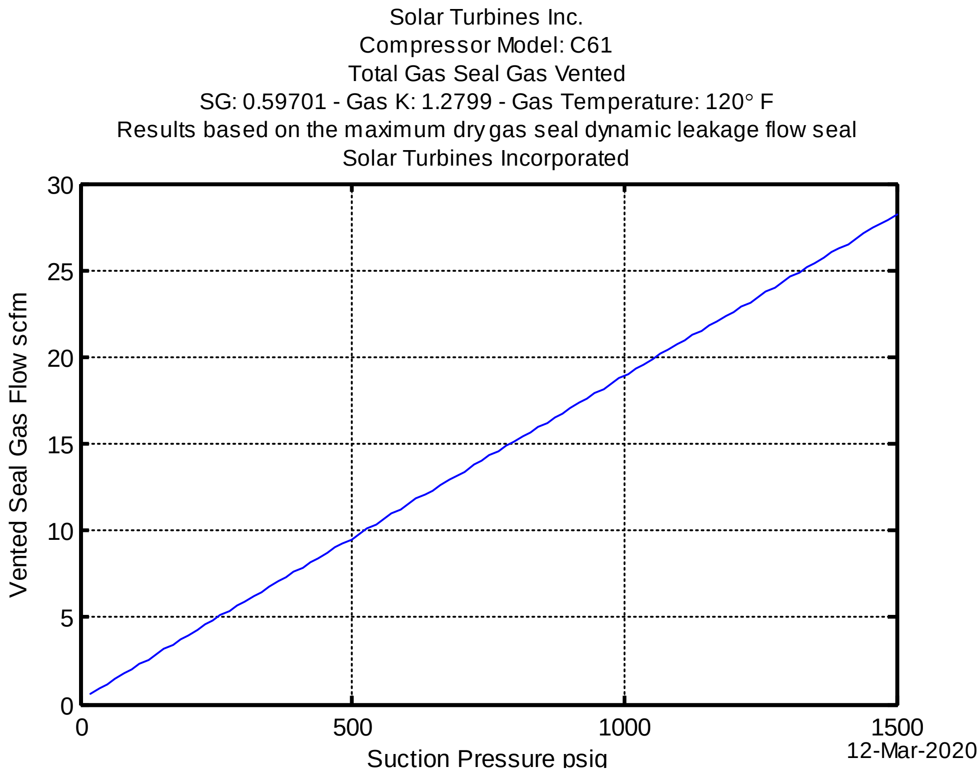

Figure 13: C61

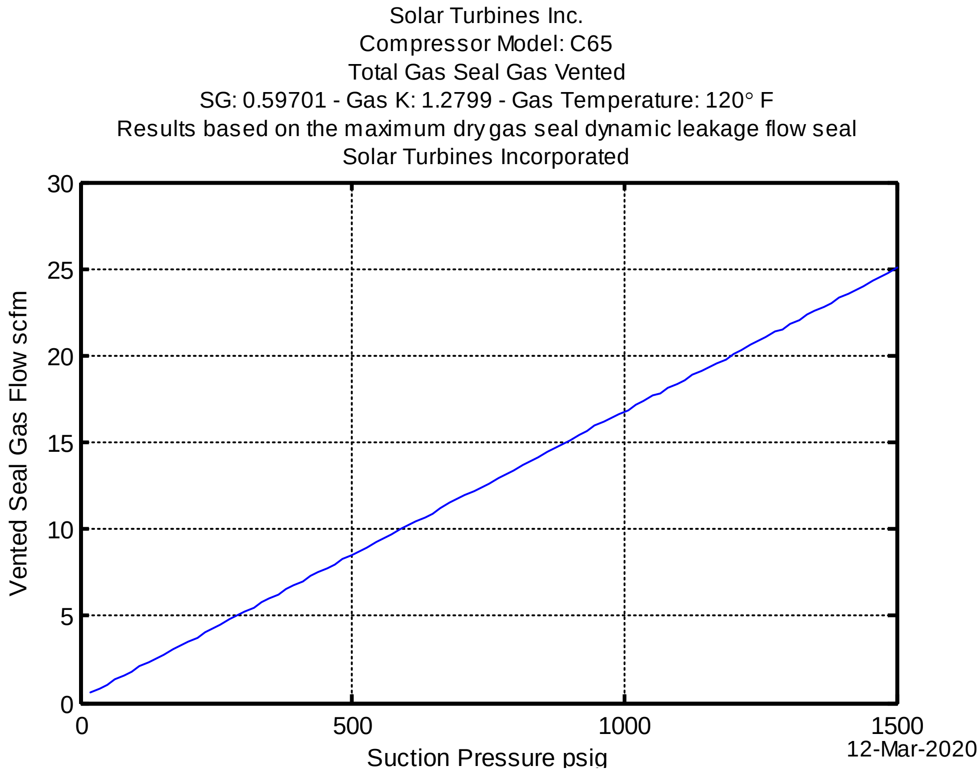

Figure 14: C65

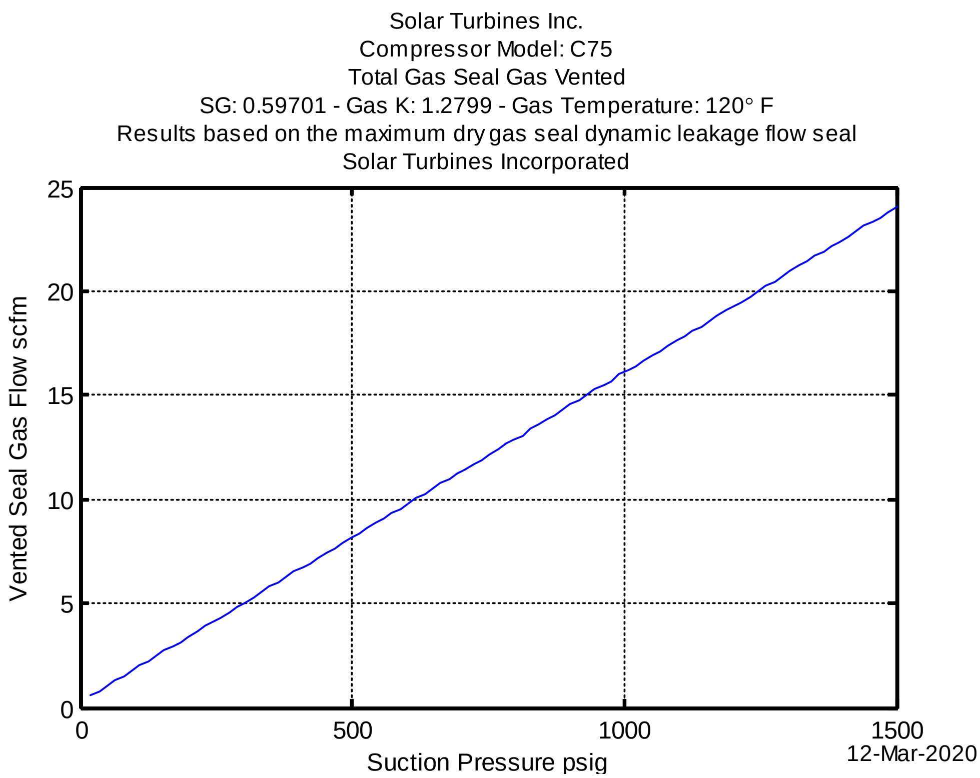

Figure 15: C75

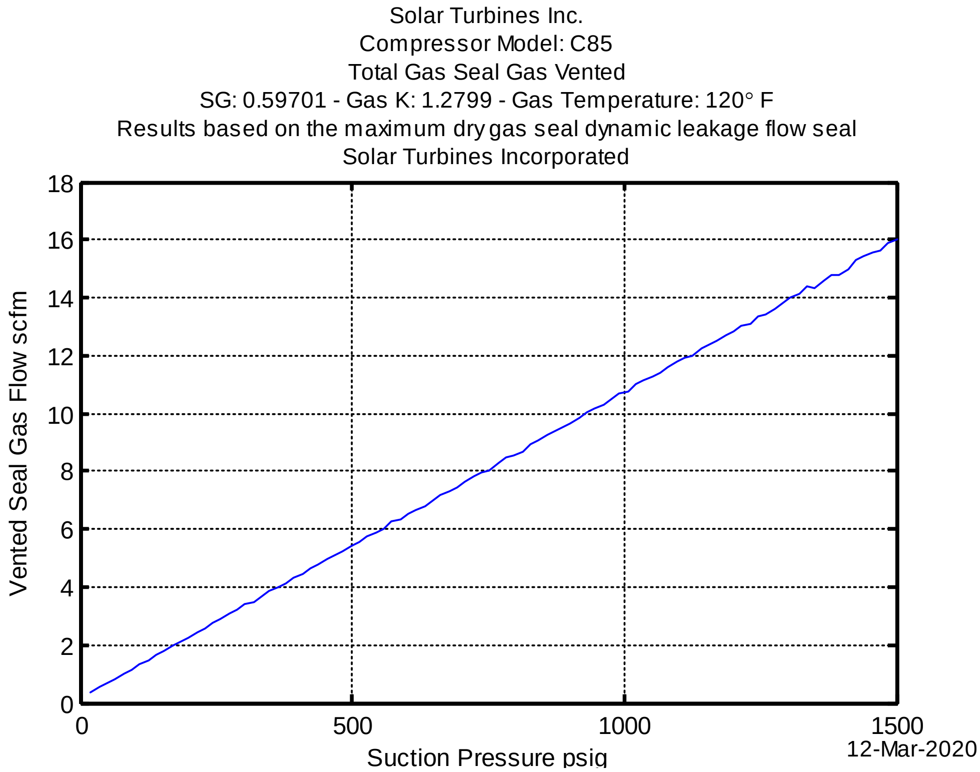

Figure 16: C85

SUMMARY

The figures provided in this PIL may be used to estimate dry gas seal emissions ('seal leakage') emitted through the primary vent based on the compressor suction pressure (P1). The charts show the maximum expected leakage rates per each compressor. Actual emissions are expected to be lower. For further technical information on Dry Gas Seal systems refer to PIL 140 Dry Gas Face Seals for Solar Gas Compressors.

Emissions Management Methane Reduction Solutions Primary Vent Dry Gas Seal Recompression

Sean Garceau

PURPOSE

The purpose of this Product Information Letter is to provide an overview of Solar Turbines' primary vent dry gas seal recompression system which has been developed to help customers achieve near-zero methane emissions targets and to reduce the environmental impact of greenhouse gas (GHG) emissions.

A comprehensive study by the EPA[1] found that emissions from compressor stations, blow down and purge accounted for 97.7 Bscf or just over 31% of the total methane emissions attributed to the natural gas industry. The oil & gas industry and environmental agencies around the world are working to find solutions to reduce greenhouse gas emissions. With methane (CH_4) having 25 times the impact on global warming compared to carbon dioxide (CO_2), developing solutions to further mitigate methane emissions from centrifugal gas compressors and from process gas vents becomes necessary as the industry moves towards near-zero targets.

Solar's primary vent dry gas seal recompression system is designed to meet customers' needs in compressor pipeline applications, gas transmissions, gas gathering and production applications. It is compatible with all gas turbine and electric motor drive applications.

For information on Solar's process gas vent recompression system, designed to address methane emissions from the process vent, refer to PIL 280.

KEY BENEFITS

For centrifugal compressors with tandem dry seals, each primary seal leaks on average, 4 to 10 scfm (6.4 to 16 Nm3/hr) depending upon the product configuration; refer to PIL 140 and PIL 251 for additional information. For example, a Solar C41 gas compressor operating at 750 psig and operating 4,400 hours per year leaks an average 2.6 M cubic feet of fugitive methane annually. This is a CO_2 equivalent of 1,000 tons which is the same as CO_2 emissions from 112,524 gallons of gasoline consumed or GHG emissions from 216 passenger vehicles driven for one year.[1] The key benefits of implementing Solar's primary vent dry gas seal recompression system are reduction of fugitive methane emissions to the atmosphere, potential cost savings, and the ability to reach near-zero emissions targets.

GENERAL DESCRIPTION

The primary vent dry gas seal recompression system is a solution designed to capture and reuse the fugitive methane from the Solar compressor's primary seal vent while the compressor is in operation.

The design is a three-module system consisting of the following:

- Backpressure module
- Accumulation module
- Recompression module

[1] epa.gov/energy/greenhouse-gas-equivalencies-calculator

The backpressure module is used to increase the primary seal vent pressure to above atmospheric pressure. The accumulation module is used as a reservoir for the captured methane until it reaches a specific pressure. The recompression module increases the pressure of the gas so it can be reinjected into the process system without any impact to the operation of the process compressor package/equipment.

The backpressure module is located within or adjacent to the main compressor package. The accumulation and recompression modules can be installed inside or outside of the gas compressor building.

The size of the dry gas seal recompression system is based on the flow of the gas compressor's primary vent guaranteed flow rate (per PIL 140). The size selection is dictated by the process gas compressor model and suction pressures.

The three-module dry gas seal recompression system is designed per compressor package. For stations with multiple compressor packages, additional information such as station operating conditions and compressor suction pressures are required to optimize the number of compressor packages per dry gas seal recompression system.

Solar's dry gas seal recompression system is designed to integrate Solar Turbines' process compressors with a suction pressure equal to or less than 1500 psig, including settle out pressure. Upon recompression, the system has customer interface provisions for use of the gas into applications with a pressure equal to or less than 1500 psig. It is the customer's responsibility to integrate the dry seal recompression solution into their application. The customer must provide over-pressure protection for their systems including tubing, piping, and other equipment. Solar Turbines can provide dry gas seal recompression system integration services upon request.

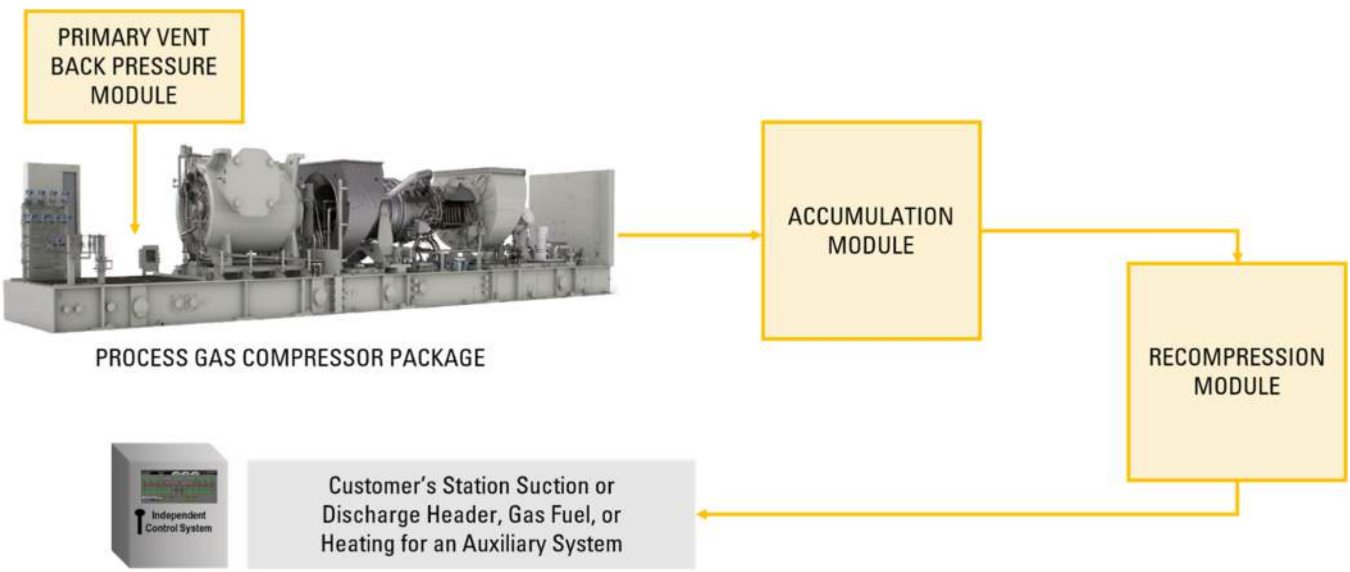

Figure 1: Primary Vent Dry Seal Recompression System (DSR)

BACKPRESSURE MODULE

Solar Turbines gas compressors use tandem dry seals, termed primary and secondary seals. The primary seal is supplied with clean dry seal gas which acts as a medium to ensure process gas does not contaminate the dry seals. Most of the seal gas is fed back into the compressor case, however, a small amount (by design) is leaked across the primary seal rings and eventually out the primary vent.

For the backpressure module to effectively use the dry gas seals' vent gas, the primary vent pressure needs to be increased above atmospheric pressure. This involves adding several new components to the primary vent. The increase in primary vent pressure does not compromise or affect the safe operation of the tandem dry seal. The backpressure module can be located on-skid or near skid and is provisioned with overhead lift points. The estimated weight and dimensions are shown in Table 3.

ACCUMULATION MODULE

From the backpressure module, gas is gathered into a vessel until it reaches a specified pressure. On the main compressor package, a second skid edge primary vent line connection must be added to route the methane from the primary vent backpressure module to the accumulation module. The customer must provide a connection from the new skid edge connection to the accumulation system inlet connection.

The estimated accumulation module weight and dimensions are shown in Table 3. The module is provisioned with overhead lift points. All electrical connections are instrumentation signals using nominal 24VDC. Air is supplied from the recompression module, which regulates the pressure to 90 psig (6.2 bar).

RECOMPRESSION MODULE

The main component of the recompression module is an electric motor-driven reciprocating compressor. The recompression module increases the pressure from 3 psi (0.2 bar) to 2000 psi (138 bar) for reinjection into the station suction or discharge headers, the gas fuel supply, or for heating auxiliary systems.

The recompression module includes a control box for enablement, local shutdown, and to indicate operation status. The recompression module and the control box are fixed on a skid that includes provisions for lifting with a forklift or a crane via straps. The estimated weights and dimensions are shown in Table 3.

Table 1: Electrical Specifications for the Recompression Module

Description	
Compressor AC Motor[1]	25 or 40 HP, 380-480VAC, 50/60 4Hz
Compressor Motor Heater	38 W, 120/220/240 VAC, 50/60 Hz
Compressor Thermal Switch	Discrete
Lube Oil Heater[2]	0.5 kW

Notes:
[1] Shielded cable shall be used.
[2] Heater voltage is either 120VAC, 190-220VAC, or 230-240 VAC 50/60HZ. All single-phase heaters.

All systems are offered with an option of a 575/600 VAC, 50/60HZ motor for NEC and CEC applications. The motors are controlled using a Variable Frequency Drive (VFD). PIL 231 shall be used for line harmonics, wire type, and wire sizing. The recompression module has a local user interface box, which is NEC, CEC, and ATEX certified and include the following switches and lights:

- Emergency Stop Switch
- Stop Switch
- Enable / Disable Switch
- Running Light
- Disabled Light
- Stop Light

Air supply for actuation of automatic valves shall be supplied by the customer. The air pressure is regulated to 90 psig (6.2 bar) on the recompression module and distributed to the accumulation module.

PRODUCT OPTIONS

Solar's primary vent dry gas seal recompression system is designed to meet customers' needs with a variety of available options to choose from as described below.

- Weatherproof enclosure for the recompression module
- Integration of system logic into unit control panel with Turbotronic™ 4 or newer
- Auxiliary recapture tank for reduced emissions
    - Allows for a recapture rate of methane >99%
    - Eliminates the need for dedicated liquid/gas drain connection
- 100% x-ray of pipe assemblies
    - Required for all Pressure Equipment Directive (PED) and Canadian applications

CONTROL SYSTEM

A standard dedicated control system is supplied to control the dry gas seal recompression system. The control system is equipped with a Human Machine Interface (HMI) and appropriate lights and buttons for the operator to control the system. The programmable logic controller and I/O modules are compliant for the application.

For applications where there is a single dry gas seal recompression system per turbomachinery package and the unit control system is Turbotronic 4 or newer, the dry gas seal recompression system may be controlled by the unit control system.

AMBIENT DESIGN CONDITIONS

Ambient, Operating (Standard): -4°F to +104°F (-20°C to 40°C) for NEC and CEC applications
Ambient, Operating (High Temp): -4°F to +140°F (-20°C to 60°C) for ATEX applications

For operation in ambient temperatures below 32°F (0°C), the recompression module requires a weatherproof enclosure. For operation below -4°F (-20°C), contact Solar Turbines for available enclosure options. Enclosed system can be installed in ambient conditions up to 110°F (43°C).

NOISE

Noise level is 87 dB(A) at 1m for an unenclosed recompression module operating at full speed. Solar Turbines' option for weatherproof enclosure is designed to meet 85 dB(A) at 1m, if required.

DOCUMENTATION

Solar will provide the following documents for the dry gas seal recompression system:

- Electrical Loop Schematic
- Process and Instrumentation Diagram
- Mechanical Interface Drawing
- Utility List
- Operation, Maintenance, and Inspection (OMI) Manual
- Illustrated Parts List

SYSTEM UTILITY REQUIREMENTS

The customer shall provide the following utilities:

Instrument air:

- 100 psig (6.9 bar) to 200 psig (13.8 bar) per Solar Turbines Engineering Specification ES 9-98 Fuel, Air, Water for Solar Gas Turbine Engines

Electrical:

- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/50Hz) to support a 25/40 HP motor
- 120VAC/1/60Hz (208-240VAC/1/50-60Hz) to support motor space heaters
- Motor control center space for a VFD

TRANSPORTATION

Contact Solar Turbines for specific transportation options and procedure associated with the product.

Special Handling Notes:

- Solar recommends using air-ride trucks
- Solar provides courtesy loading at Solar's Mabank, Texas and Kearny Mesa, California facilities
- Cargo must be picked up on flatbed or step deck type trucks; trucks will be turned away if this requirement is not followed
- Items not connected with the main systems will be packed per PIL 097 and PIL 254

CODES AND STANDARDS

The primary vent dry gas seal recompression system complies with the following codes and standards:

Pressure Vessels:	ASME BPVC Section VIII, Division 1; Pressure Equipment Directive 2014/68/EU; Canadian Registration Number per CSA B51
Heater Terminal Box (Type/IP):	NEMA 4X (NEC/CSA) or IP 65 Exe (IEC Certified)
Control Panel (Type):	UL Type 4/7, NEC, UL(C) 508 Listed or Exd IP 66, IEC Certified
System Certification:	Solar Turbines uses a Zone classification process based on IEC 60079. The standard products are certified to meet the following requirements: NEC Class 1, Division 2 and CEC Class 1, Division 2, Gas Group D ATEX Zone 2, Gas Group IIA Based on the selection of the devices on the package, the system can be electrically certified for use in: NEC Class 1, Division 1 and CEC Class 1, Division 1, Gas Group D ATEX Zone 1, Gas Group IIA

	Modules are shipped from Solar Turbines as pre-wired assemblies. In NEC and CEC applications, the assemblies are not pre-certified assemblies. ATEX modules are shipped by Solar Turbines as certified ATEX and PED assemblies. ATEX modules can also be shipped by Solar Turbines as CE marked assemblies
Tubing and Piping:	ASME B31.3, ASME B16.5
NACE:	On request

CONCLUSION

The modular design of the primary vent dry gas seal recompression system allows for simple integration into turbine and electric motor drive compressor packages with dry gas seal-equipped centrifugal compressors. Solar works directly with customers to select the appropriate model based on package configuration, flow, and operating conditions. Solar can also assist in identifying the best location to reinject the captured fugitive methane to help customers achieve near-zero methane emissions targets and to reduce the environmental impact of greenhouse gas (GHG) emissions. The dry gas seal recompression system is supported by Solar’s global customer services team. Please contact your local district office for additional information on system maintenance or service parts support.

REFERENCES

Table 2: Supporting Solar Product Information Letters

DOCUMENT	PRODUCT INFORMATION LETTER
PIL 097	Package Preservation and Preparation for Shipment
PIL 140	Dry Gas Face Seals for Solar Gas Compressors
PIL 231	Variable Frequency Drives
PIL 251	Emissions from Centrifugal Compressor Gas Seal Systems
PIL 254	Service Parts Packaging and Procedures
PIL 280	Methane Emissions Reduction Solutions: Process Gas Vent Recompression

Table 3: Estimated Weights and Dimensions (Unenclosed)

Module	Length	Width	Height	Estimated Weight
Backpressure Module	1.9 ft (0.58 m)	1.7 ft (0.52 m)	1.5 ft (0.46 m)	150 lbs (68 kg)
Accumulation Module	3.8 ft (1.2 m)	4.6 ft (1.4 m)	7.8 ft (2.4 m)	1000 lbs (454 kg)
Recompression Module	10.9 ft (3.3 m)	7.5 in (2.3 m)	4.7 ft (1.4 m)	4695 lbs (2129 kg)

Emissions Management Methane Reduction Solutions

Process Gas Vent Recompression

Sean Garceau, Michella Thomas

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide an overview of Solar Turbines' process vent recompression system which has been developed to help customers achieve near-zero methane emissions targets, and to reduce the environmental impact of greenhouse gas (GHG) emissions.

A comprehensive study by the EPA[1] found that emissions from compressor stations, blow down and purge accounted for 97.7 Bscf or just over 31% of the total methane emissions attributed to the natural gas industry. The oil & gas industry and environmental agencies around the world are working to find solutions to reduce greenhouse gas emissions. With methane (CH_4) having 25 times the impact on global warming compared to carbon dioxide (CO_2), developing solutions to further mitigate methane emissions from centrifugal gas compressors and from process gas vents becomes necessary as the industry moves towards near-zero targets.

Solar's process vent recompression product is designed to meet customers' needs in compressor pipeline applications, gas transmissions, gas gathering and production applications. It is compatible with all gas turbine and electric motor drive applications, and all centrifugal and reciprocating compressors.

For information on Solar's dry seal recompression system, designed to address methane emissions from the primary vent of Solar compressors, refer to PIL 279.

KEY BENEFITS

For compressor stations having to perform non-emergency shutdown events due to planed or scheduled maintenance, compressors will either be put into a pressurized hold or operations will require unit or station blow down. The amount of methane emitted into the atmosphere during a blow down event is significant, with a typical volume upwards of 52,000 cubic feet per event. The CO_2 equivalent is 29.1 tons which equates to CO_2 emissions from 2,966 gallons of gasoline consumed or GHG emissions from 64,446 miles driven by an average passenger vehicle.[1] Recompression of gas emitted from the process vent offers an alternative to pressurized hold or unit blow down with key benefits of reducing large amounts of methane emissions to the atmosphere, potential cost savings, and the ability to reach near-zero emission targets.

GENERAL DESCRIPTION

The process vent recompression system is a solution designed to capture gas between the compressor suction and discharge valves using a recovery and conditioning system. During operation of the process vent recompression system, the compressor dry seal supply gas shall be sourced internal to the compressor suction and discharge valve to eliminate the addition of gas into the system.

The gas process includes the components, piping, and equipment containing gas between the unit suction and discharge valves. The gas process vent is the atmospheric vent of that contained volume. The venting of this

[1] epa.gov/energy/greenhouse-gas-equivalencies-calculator

volume is the largest contributor of methane emissions and the greatest opportunity to reduce large periodic equipment emissions.

The process vent recompression system is connected to the gas process piping between the process compressor suction and discharge valves. When the process compressor is in pressurized hold and the user decides to depressurize the compressor, the process gas conditioning skid opens its shutoff valve. Gas is filtered, heated, and regulated for supply to the recompression module. The gas is fed into a recompression module to boost the pressure for reinjection into a location upstream or downstream of the process suction and discharge valves.

The 2-module recompression system consists of a gas conditioning system module and a recompression system module. The recompression system is sized per compressors package process vent. For stations with multiple compressor packages that accommodate separate and independent depressurization times, a single process vent recompression system to support each compressor package process vent is an option. System isolation and check valves are available upon request.

The standard process vent recompression system is designed to integrate with all compressor station process vent systems with a suction pressure equal to or less than 1500 psig, including settle out pressure. Higher pressure can be accommodated when requested. It is the customer's responsibility to integrate the process vent recompression solution into their application. Seal gas must be an internal source. The customer must provide over-pressure protection for their systems including tubing, piping, and other equipment. Solar Turbines can provide process vent recompression system integration services upon request.

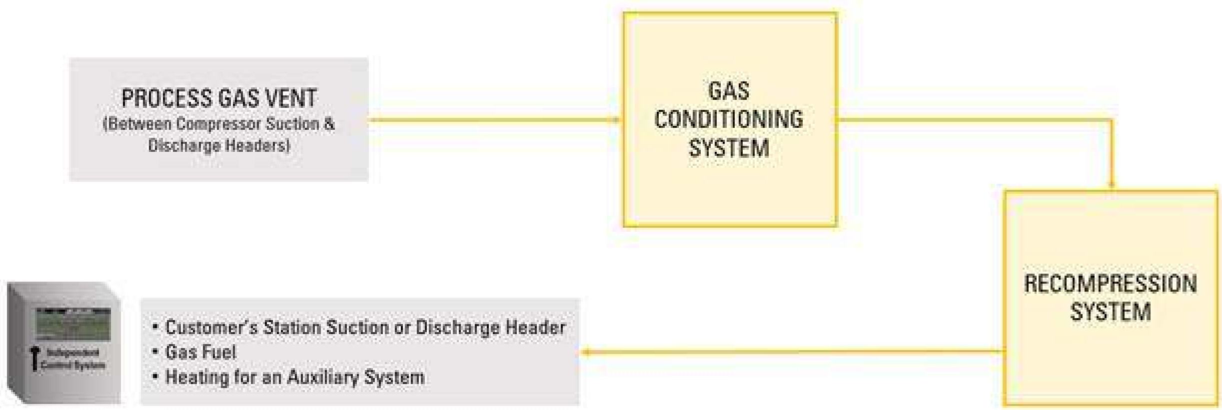

Figure 1: Process Vent Recompression (PVR) System

CONDITIONING MODULE

The process gas capture and conditioning module is connected to the compressor suction or discharge process piping. The process gas conditioning module is designed to clean, heat, and regulate the process gas, which feeds the recompression module. The conditioning module is located off-skid. Estimated weights and dimensions are shown in Table 4 of this document. The module is provisioned with overhead lift points.

A simplified seal gas conditioning module is offered, which excludes the coarse filter and heater. In application where the percent of methane is above 90% and the process gas supplied to the module is below 800 psig, the simplified version could be used. A dew point analysis and temperature expansion study are recommended prior to selection of the simplified module.

RECOMPRESSION MODULE

The main component of the recompression module is an electric motor-driven reciprocating compressor. The standard recompression module increases the pressure from 3 psi (0.2 bar) to 2000 psi (138 bar) for reinjection into the station suction or discharge headers; the gas fuel supply; or for heating auxiliary systems. The package compressor will be depressurized to at least 30 psig (2.07 bar) before the unit process vent is opened.

The recompression module includes a control box for enablement, local shutdown, and to indicate operation status. The recompression module and the control box are fixed on the skid. The estimated weights and dimensions are shown in Table 4 of this document. The skid has provisions for lifting with a forklift or a crane via straps.

Table 1: Electrical Specifications for the Recompression Module

Description	
Compressor AC Motor[1]	75 HP, 380-480VAC 50/60 Hz
Compressor Motor Heater	55 W, 120/220/240 VAC, 50/60 Hz
Compressor Thermal Switch	Discrete
Lube Oil Heater[2]	0.5 kW

Notes:

[1] Variable frequency drives, shielded cable shall be used.

[2] Heater voltage is either 120VAC, 190-220VAC, or 230-240VAC 50/60Hz. All single-phase heaters.

All systems are offered with an option of 575/600VAC, 50/60Hz – motor for NEC and CEC applications. The recompression module has a local user interface box, which is NEC, CEC, and ATEX certified. The interface box includes the following switches and lights.

- Emergency stop switch
- Stop switch
- Enable/disable switch
- Running light
- Disabled light
- Stop light

Air supply for actuation of automatic valves shall be supplied by the customer at 100-200 psig (6.9-13.8 bar). The air pressure is regulated to 90 psig (6.2 bar) on the recompression module and distributed to the process gas conditioning modules.

Product options

The process vent recompression system is designed to meet customers' needs with a variety of available options to choose from as described below.

- Enclosure for the recompression system modules
- Integration of system logic into unit control panel with Turbotronic™ 4 or newer
- Auxiliary recapture tank for reduced emissions
    - Allow for a recapture rate of methane >99%
    - Eliminates the need for dedicated liquid/gas drain connection
- 100% x-ray of pipe assemblies
    - Required for all Pressure Equipment Directive (PED) and Canadian applications

CONTROL SYSTEM

A standard dedicated control system is supplied to control the process vent recompression system. The control system is equipped with a Human Machine Interface (HMI) and appropriate lights and buttons for the operator to control the system. The programmable logic controller and I/O modules are compliant for the application.

For applications where there is a single recompression system per turbomachinery package and the gas compressor package control system is Turbotronic™ 4 or newer, the process vent recompression system may be controlled by the unit control system.

PROCESS VENT SYSTEM APPLICATIONS

The time to capture and recompress the process gas will be determined during the execution of the project.

AMBIENT DESIGN CONDITIONS

Ambient, operating (standard): -4°F to +104°F (-20°C to 40°C) for NEC and CEC applications and ATEX PVR100
Ambient, operating (high temp): -4°F to +140°F (-20°C to 60°C) for ATEX applications except the PVR100

For operation in ambient temperatures below 32°F (0°C), the recompression module requires a weatherproof enclosure. Enclosed system can be installed in ambient conditions up to 110°F (43°C). For operation below -4°F (-20°C) or above 110°F (43°C), contact Solar Turbines for available enclosure options.

NOISE

Noise level at 1 m [dB(A)]: PVR100 is 91 for an unenclosed recompression module operating at full speed. Solar Turbines' option for weatherproof enclosure is designed to meet 85 dB(A) at 1m, if required. Lower noise levels can be review when requested.

DOCUMENTATION

Solar will provide the following documents for the process vent recompression system.

- Electrical schematic
- Process and instrumentation diagram
- Mechanical interface drawing
- Utility list
- Operation, maintenance, and inspection (OMI) manual
- Illustrated part list

SYSTEM UTILITY REQUIREMENTS

The customer shall provide the following utilities:

Instrument air:

- 100 psig (6.9 bar) to 200 psig (13.8 bar) per Solar Turbines Engineering Specification ES 9-98 Fuel, Air, Water for Solar Gas Turbine Engines

Electrical:

- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/60HZ) to support a 75 HP motor
- 120VAC/1/60Hz (208-240VAC/1/50Hz) to support motor space heaters
- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/60HZ) support 10kW heater
- Motor Control Space for a Variable Frequency Drive

TRANSPORTATION

Contact Solar Turbines for specific transportation options and procedure associated with the product.

SPECIAL HANDLING NOTES

- Solar recommends using air-ride trucks
- Solar provides courtesy loading at Solar's Mabank, Texas and Kearny Mesa, California facilities
- Cargo must be picked up on flatbed or step deck type trucks; trucks will be turned away if this requirement is not followed
- Items not connected with the main systems will be packed per PIL097 and PIL254

CODES AND STANDARDS

The process vent recompression system complies with the following codes and standards:

Pressure Vessels:	ASME BPVC Section VIII, Division 1; Pressure Equipment Directive 2014/68/EU; Canadian Registration Number per CSA B51
Heater Terminal Box (Type/IP):	NEMA 4X (NEC/CSA) or IP 65 Exe (IEC Certified)
Control Panel (Type):	UL Type 4/7, NEC, UL(C) 508 Listed or Exd IP 66, IEC Certified
System Certification:	Solar Turbines uses a Zone classification process based on IEC 60079. The standard products are certified to meet the following requirements: NEC Class 1, Division 2 and CEC Class 1, Division 2, Gas Group D ATEX Zone 2, Gas Group IIA Based on the selection of the devices on the package, the system can be electrically certified for use in: NEC Class 1, Division 1 and CEC Class 1, Division 1, Gas Group D ATEX Zone 1, Gas Group IIA Modules are shipped from Solar Turbines as pre-wired assemblies. In NEC and CEC applications, the assemblies are not pre-certified assemblies. ATEX modules are shipped by Solar Turbines as certified ATEX and PED assemblies. ATEX modules can also be shipped by Solar Turbines as CE marked assemblies
Tubing and Piping:	ASME B31.3, ASME B16.5
NACE:	On request

CONCLUSION

The modular design of the process vent recompression system allows for simple integration into gas compression stations. Solar works directly with customers to select the appropriate process vent recompression model per package configuration, flow, and operating conditions. Solar can also assist in identifying the best location to reinject the captured fugitive methane to help customers achieve near-zero methane emissions targets, and to reduce the environmental impact of greenhouse gas (GHG) emissions. The process vent recompression system is supported by Solar's global customer services team. Please contact your local district office for additional information on system maintenance or service parts support.

REFERENCES

Table 3: Supporting Solar Product Information Letters

DOCUMENT	PRODUCT INFORMATION LETTER
PIL 097	Package Preservation and Preparation for Shipment
PIL 140	Dry Gas Face Seals for Solar Gas Compressors
PIL 231	Variable Frequency Drives
PIL 251	Emissions from Centrifugal Compressor Gas Seal Systems
PIL 254	Service Parts Packaging and Procedures
PIL 280	Methane Emissions Reduction Solutions: Process Gas Vent Recompression

Table 4: Estimated Weights and Dimensions (Unenclosed)

Module	Model No.	Length	Width	Height	Estimated Weight
Conditioning System	Simple	5.2 ft (1.6 m)	3.2 ft (1.0 m)	3.2 ft (1.0 m)	942 lbs. (427 kg)
	Full	13 ft (4.0 m)	2.5 ft (0.8 m)	4.8 ft (1.5 m)	2927 lbs. (1328 kg)
Recompression System	PVR-100	10.9 ft (3.3 m)	7.5 in (2.3 m)	4.7 ft (1.4 m)	5600 lbs. (2540 kg)

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April 23, 2018

Williams - NE G&P
2000 Commerce Drive
Pittsburgh, PA 15275

Attention: Austin Day
Austin.Day@williams.com

Reference: Ridgeline Thermal Oxidizer
Zeeco Proposal No. 2018-02569IN-01 Rev 0

Dear Mr. Day:

Thank you for your inquiry. We appreciate this opportunity to provide our proposal to provide the following equipment:

- ~~One (1) Zeeco Standard, Direct Fired Horizontal Thermal Oxidizer Package- Two Dehy Design~~
- One (1) Zeeco Standard, Direct Fired Horizontal Thermal Oxidizer Package- Single Dehy Design

The attached proposal describes specific features and performance of Zeeco's standard thermal oxidizer system. Our design incorporates a proven thermal process to effectively treat the waste gas stream from your process. The design and materials of construction have been chosen to maximize on-line time and operational life.

Please note that the base of the thermal oxidizer is mounted on a pre-wired and pre-piped rectangular structural steel skid that will also house the fuel rack and control panel. This is intended to reduce installation time associated with interconnecting piping and wiring between the fuel rack/control panel and the thermal oxidizer.

Furthermore, the unit is ***NFPA 86 compliant*** to ensure personnel and equipment safety.

Again, we appreciate the opportunity to quote on your combustion equipment requirements. After you have had an opportunity to review our proposal, should you have any questions or require additional information, please contact me at (918)893-8416 or email me at sydney_levine@zeeco.com.

Best regards,

Sydney Levine

Sydney Levine
Applications Engineer

Cc: Ryan B. Tate, Zeeco- Broken Arrow

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1.0 INTRODUCTION

Zeeco has been designing and manufacturing burners, flares, incinerators, air pre-heaters, and combustion systems for world wide use since 1980.

Zeeco's Engineering Staff offers over 1,000 years of experience in the development, design, and testing of Combustion Systems. Zeeco has the proven skills and innovative abilities to design a practical and environmentally friendly combustion system to thermally treat virtually any industrial waste. This learned "art" gained by research and design efforts which are refined by testing and field experience has been implemented in the process plants of numerous industries throughout the world.

From project planning through design, procurement, manufacturing, installation, and even start-up, Zeeco will provide project management and support as deemed necessary. It is our world class HANDS ON type design skills, quality products, experienced staff, and especially our responsiveness to our customers needs that truly set Zeeco apart from our competition.

Quality: Our customers expect it. We demand it!

4.0 DESIGN BASIS

4.1 Site Conditions

Elevation, feet	1,250
Barometric Pressure, psia	13.9
Temperature, °F (Min/Max)	-20* / 100
Design Relative Humidity	90% (assumed)
Wind Design	ASCE 7-10, 120MPH

*Note: The Thermal Oxidizer package is acceptable to -20°F with the exception of the HMI, which is guaranteed to 32°F.

4.2 Waste Stream Summary

RIDGELINE (Two Dehy Case)				
Components	Waste Gas 1 Mol %	Waste Gas 2 Mol %	Waste Gas 3 Mol %	Waste Gas 4 Mol %
Water	0.142373717	86.21186646	0.142373717	86.21186646
TEG	0.000130897	6.84E-05	0.000130897	6.84E-05
Nitrogen	0.05601957	0.000421556	0.05601957	0.000421556
CO2	0.599489677	0.226822026	0.599489677	0.226822026
Methane	62.88109505	2.113740939	62.88109505	2.113740939
Ethane	23.14590683	3.048986051	23.14590683	3.048986051
Propane	8.405789072	2.32283657	8.405789072	2.32283657
i-Butane	1.068157584	0.37047711	1.068157584	0.37047711
n-Butane	2.015033149	1.049989348	2.015033149	1.049989348
i-Pentane	0.551954871	0.548688563	0.551954871	0.548688563
n-Pentane	0.463895654	0.567115895	0.463895654	0.567115895
Neopentane	0.022464835	0.01117731	0.022464835	0.01117731
2,2-Dimethylbutane	0.032125073	0.047370468	0.032125073	0.047370468
2,3-Dimethylbutane	0.148625999	0.302190842	0.148625999	0.302190842
3-Methylpentane	0.087076479	0.20375093	0.087076479	0.20375093
Hexane	0.128435584	0.315479281	0.128435584	0.315479281
2,2-Dimethylpentane	0.013916747	0.038571139	0.013916747	0.038571139
Methylcyclopentane	0.044555216	0.370953246	0.044555216	0.370953246
Benzene	0.004232043	0.212335939	0.004232043	0.212335939
3,3-Dimethylpentane	0.004275088	0.01883755	0.004275088	0.01883755
Cyclohexane	0.015864116	0.12044048	0.015864116	0.12044048
2-Methylhexane	0.034458362	0.131713244	0.034458362	0.131713244
2,3-Dimethylpentane	0.011761746	0.057628052	0.011761746	0.057628052
3-Methylhexane	0.037990982	0.179641089	0.037990982	0.179641089
2,2,4-Trimethylpentane	0.001809807	0.009070139	0.001809807	0.009070139

Heptane	0.035123576	0.184493202	0.035123576	0.184493202
cis-1,2-Dimethylcyclopentane	0.002214401	0.038198546	0.002214401	0.038198546
2,5-Dimethylhexane	0.003975826	0.018795111	0.003975826	0.018795111
Toluene	0.008011101	0.77537816	0.008011101	0.77537816
2-Methylheptane	0.01193309	0.082243148	0.01193309	0.082243148
3-Ethylhexane	0.007903255	0.069464299	0.007903255	0.069464299
trans-1,2-Dimethylcyclohexane	0.000789823	0.013718834	0.000789823	0.013718834
1,1-Dimethylcyclohexane	0.00066575	0.009872933	0.00066575	0.009872933
Octane	0.007847464	0.071765179	0.007847464	0.071765179
1,t-3-Dimethylcyclohexane	0.000768767	0.014533001	0.000768767	0.014533001
m-Xylene	2.85E-09	4.31E-07	2.85E-09	4.31E-07
o-Xylene	0.00014847	0.029939815	0.00014847	0.029939815
Nonane	0.001192295	0.021136926	0.001192295	0.021136926
m-Ethyltoluene	0.000265614	0.043561941	0.000265614	0.043561941
p-Ethyltoluene	0.000410201	0.084055794	0.000410201	0.084055794
2-Methylnonane	0.000104122	0.003015635	0.000104122	0.003015635
n-Decane	0.000106215	0.003556708	0.000106215	0.003556708
2,2,4-Trimethylhexane	0.000265482	0.00118502	0.000265482	0.00118502
3-Methyloctane	0.000248647	0.00348681	0.000248647	0.00348681
Isopropylcyclohexane	0.000163713	0.006771658	0.000163713	0.006771658
n-Propylcyclohexane	7.43E-05	2.71E-03	7.43E-05	2.71E-03
Butylbenzene	6.37E-05	2.03E-02	6.37E-05	2.03E-02
1-Methyl-2-Propylbenzene	3.33E-05	9.16E-03	3.33E-05	9.16E-03
1,2-Dimethyl-4-Ethylbenzene	2.38E-05	7.48E-03	2.38E-05	7.48E-03
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	0.000229023	0.00496988	0.000229023	0.00496988
PRESSURE (psig)	57	0.1	57	0.1
TEMPERATURE (F)	106.8	205	106.8	205
MW	24.2	22.87	24.2	22.87
FLOW RATE (lb/hr)	102.333	177.375	102.333	177.375

Waste streams are assumed to be in vapor phase, no liquid has been considered within this design. It has been assumed that Waste Streams 1 & 3 are in one pipe coming to the thermal oxidizer, and Waste Streams 2 & 4 are in one pipe coming to the thermal oxidizer. The continuous waste streams are assumed to be running simultaneously to the thermal oxidizer.

RIDGELINE (Single Dehy Case)		
Components	**Waste Gas 1 Mol %**	**Waste Gas 2 Mol %**
Water	0.212110491	92.57222234

TEG	0.000131107	6.93E-05
Nitrogen	0.056587763	0.000238192
CO2	0.60289967	0.12480453
Methane	62.98098525	1.168332526
Ethane	23.04102455	1.652829998
Propane	8.348543894	1.243047131
i-Butane	1.06053381	0.197347732
n-Butane	2.006377838	0.560151156
i-Pentane	0.551463114	0.290852674
n-Pentane	0.463185551	0.297794264
Neopentane	0.022311696	0.005926674
2,2-Dimethylbutane	0.032152632	0.024860966
2,3-Dimethylbutane	0.149513476	0.159963702
3-Methylpentane	0.08772097	0.108389747
Hexane	0.129207154	0.165143786
2,2-Dimethylpentane	0.014031235	0.020326532
Methylcyclopentane	0.045290713	0.195752311
Benzene	0.004357429	0.114913228
3,3-Dimethylpentane	0.004326211	0.009915344
Cyclohexane	0.01609812	0.064062671
2-Methylhexane	0.034849263	0.069139229
2,3-Dimethylpentane	0.011921192	0.030342687
3-Methylhexane	0.038507372	0.094244109
2,2,4-Trimethylpentane	0.001837374	0.004751308
Heptane	0.035598806	0.096278714
cis-1,2-Dimethylcyclopentane	0.002262287	0.020294309
2,5-Dimethylhexane	0.004017117	0.009650835
Toluene	0.008313742	0.422433006
2-Methylheptane	0.012122808	0.042953672
3-Ethylhexane	0.008038114	0.036334185
trans-1,2-Dimethylcyclohexane	0.000805756	0.007149828
1,1-Dimethylcyclohexane	0.000678244	0.005105629
Octane	0.007984875	0.037224678
1,t-3-Dimethylcyclohexane	0.000784947	0.007545462
m-Xylene	4.27E-10	3.42E-08
o-Xylene	0.000156867	0.017205918
Nonane	0.001220327	0.010931621
m-Ethyltoluene	0.000275898	0.024419444
p-Ethyltoluene	0.000429672	0.048755563
2-Methylnonane	0.000107003	0.001543912
n-Decane	0.00010907	0.001819762

2,2,4-Trimethylhexane	0.000267037	0.000600294
3-Methyloctane	0.000253849	0.001804282
Isopropylcyclohexane	0.000167681	0.003617079
n-Propylcyclohexane	7.61E-05	0.001441825
Butylbenzene	6.82E-05	0.013554302
1-Methyl-2-Propylbenzene	3.53E-05	0.006256256
1,2-Dimethyl-4-Ethylbenzene	2.54E-05	0.005153657
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	0.000233099	0.002503613
PRESSURE (psig)	57	0.1
TEMPERATURE (F)	108.1	208.5
MW	24.15723074	20.61041879
FLOW RATE (lb/hr)	104.6771627	297.2279686

Waste streams are assumed to be in vapor phase, no liquid has been considered within this design. It has been assumed that Waste Stream 1 and 2 will be continuously flowing to the thermal oxidizer in separate pipes. It is assumed waste stream 1 will not be sent to the thermal oxidizer without waste gas 2, they will be entering the system simultaneously.

4.3 Utilities

Electrical Power	460V / 3 Phase / 60 Hz
Instrument Air, SCFH	2000
Fuel Gas Required During Normal Operation	1 MMBtu/Hr

4.4 Flue Gas Summary

Ridgeline (Two Dehy Case) at 1800°F	
Components	**Waste Gas 1, 2, 3 & 4 Mol%**
Carbon Dioxide	4.69
Water	16.14
Nitrogen	69.11
Oxygen	10.06
Total, mol/hr	511.60
Mol. Wt.	27.55

Ridgeline (Single Dehy Case) at 1700°F	
Components	**Waste Gas 1 & 2 Mol%**
Carbon Dioxide	4.37
Water	17.45

Nitrogen	67.97
Oxygen	10.21
Total, mol/hr	310.65
Mol. Wt.	27.38

4.5 System Performance

Stack Parameter	Guaranteed Values
VOC Destruction Efficiency	**99.5 %**

These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the design summary and for the waste(s) stipulated in the design basis sections of this proposal. VOC is defined as non-methane and on-ethane hydrocarbons.

5.0 PROCESS DESCRIPTION

The Horizontal Forced Draft Thermal Oxidizer is equipped with one (1) GB-Series Fuel Gas Burner. The system is purged using the combustion blower provided. When the purge cycle is complete, the burner pilot is ignited via electric ignition. Once the burner pilot flame is proven, the main burner flame is ignited.

The thermal oxidizer is then allowed to achieve a waste permissive temperature of 1800°F for the two dehy design and 1700F for the single dehy design. Waste gas can then be introduced into the thermal oxidizer. The thermal oxidizer controlled temperature and residence time ensures that the waste gasses are destroyed using a minimum fuel quantity. The flue gases from the thermal oxidizer exit to atmosphere via the refractory lined vent stack.

6.0 EQUIPMENT DESCRIPTION

6.1 Standard Horizontal Thermal Oxidizer- Two Dehy Design

One (1) standard horizontal thermal oxidizer is offered. It is designed to operate at 1800°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 5'-0" O.D. x 20'-0" overall skid length
- Includes 2'-6" O.D. Stack
- Discharge height of 20'-0" above grade
- Thermal oxidizer and Stack Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
    - Blast clean: SP5
    - Coat 1 & Coat 2: 228HS- Grey
- The base portion of the thermal oxidizer shall be mounted on a structural steel skid, along with the waste gas piping, fuel metering rack, and control panel. Skid dimensions will be approximately 8' W x 20 L x 8' H.
- The stack portion of the thermal oxidizer shall be shipped loose for bolting to the base portion in the field.

6.2 Standard Horizontal Thermal Oxidizer- Single Dehy Design

One (1) standard horizontal thermal oxidizer is offered. It is designed to operate at 1800°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 5'-0" O.D. x 20'-0" overall skid length
- Includes 2'-0" O.D. Stack
- Discharge height of 20'-0" above grade
- Thermal oxidizer and Stack Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
    - Blast clean: SP5
    - Coat 1 & Coat 2: 228HS- Grey
- The base portion of the thermal oxidizer shall be mounted on a structural steel skid, along with the waste gas piping, fuel metering rack, and control panel. Skid dimensions will be approximately 8' W x 20 L x 8' H.
  The stack portion of the thermal oxidizer shall be shipped loose for bolting to the base portion in the field.

6.3 Burner- Two Dehy Design

One (1) Forced Draft Burner Assembly is offered and will consist of One (1) Zeeco GB-Series Burner. The Burner is specially designed for forced draft operation and has the following features:

- Maximum Fuel Gas release is 6 MMBTU/hr
- High Energy Electric Spark Ignition System
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
  - Blast clean: SP5
  - Coat 1 & Coat 2: 228HS- Grey
- 10:1 Fuel Gas Turndown
- Waste gas nozzle connections to be SS material

6.4 Burner- Single Dehy Design

One (1) Forced Draft Burner Assembly is offered and will consist of One (1) Zeeco GB-Series Burner. The Burner is specially designed for forced draft operation and has the following features:

- Maximum Fuel Gas release is 6 MMBTU/hr
- High Energy Electric Spark Ignition System
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
  - Blast clean: SP5
  - Coat 1 & Coat 2: 228HS- Grey
- 10:1 Fuel Gas Turndown
- Waste gas nozzle connections to be SS material

6.5 Combustion Air Blower- Two Dehy Design

- 3456 ACFM at 100°F
- 5” H_2O static pressure
- < 5 HP Motor
- Manufacturer’s standard construction
- Manufacturer’s standard paint system

6.6 Combustion Air Blower- Single Dehy Design

- 2076 ACFM at 100°F
- 5” H_2O static pressure
- < 5 HP Motor
- Manufacturer’s standard construction
- Manufacturer’s standard paint system

6.7 Refractory- Two Dehy and Single Dehy Designs

The refractory will be supplied and shop installed by Zeeco. Refractory material proposed within the thermal oxidizer chamber and stack is a hard castable lining supplied by Zeeco standard suppliers.

6.8 Instrumentation and Controls- Two Dehy and Single Dehy Designs

Zeeco's Standard Burner Management System Instrumentation and Controls scope is offered by Zeeco Standard Suppliers:

1. Pre-assembled fuel gas and instrument air control rack, skid mounted.
2. Instrument and piping connections from rack to field instruments and other field equipment by others.
3. Rack mounted local control panel with BMS and Process Control.
4. The BMS complies with NFPA 86; this proposal offers an Allen Bradley Compact Guard Logix with a Zeeco Standard VFD included in the Panel.
5. Zeeco has considered the control of waste gas valves as detailed in Section 3.1, above.
6. Zeeco has included an oxygen analyzer within the base scope of supply.

Zeeco has not included waste gas piping and instrumentation, these items are to be provided by others.

7.0 PERFORMANCE WARRANTY

Zeeco warranties the system performance stated in this proposal. These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the **DESIGN SUMMARY** for the waste (s) stipulated in the **DESIGN BASIS** sections of this proposal.

The purchaser, at his option and cost, may conduct a performance test to determine if the performance warranties are being met. The purchaser shall provide sufficient written notice to Zeeco so that a representative of Zeeco can witness the test. Additionally, Zeeco will be given access to all operating data and laboratory analysis that would bear on the final determination of performance. All analysis of operating data will be done in accordance with generally accepted engineering practice and only published physical data will be used.

ZEECO QUOTATION

CLIENT: WILLIAMS

END USER: WILLIAMS

ZEECO QUOTE #: 2021-17325IN-01

QUOTE REV #: 4

DATE OF ISSUE: 01/07/2022

APPLICATION ENGINEER: SREE KRISHNAN

BURNERS | FLARES | THERMAL OXIDIZERS
VAPOR CONTROL | RENTALS | AFTERMARKET

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Date: January 7th, 2022

Customer: Williams
2000 Commerce Drive
Pittsburgh, PA 15275

Attention: Mr. Austin Day
Project Engineer
Email: Austin.Day@Williams.com
Cell: +1 (412) 759-4873

Reference: Thermal Oxidizer Proposal for the Williams Ridgeline CF Expansion Project
Zeeco Proposal No. 2021-17325IN-01-R3

Dear Austin,

Thank you for your inquiry. We appreciate this opportunity to provide you with our proposal for the following equipment:

- One (1) Zeeco Standard, Direct Fired Vertical Thermal Oxidizer Package

The attached proposal describes specific features and performance of Zeeco's Standard Thermal Oxidizer System. Our design incorporates a proven thermal process to effectively treat the waste gas stream from your process. The design and materials of construction have been chosen to maximize on-line time and operational life.

Please note that the base of the Thermal Oxidizer is mounted on a pre-wired and pre-piped rectangular structural steel skid that will also house the Fuel Rack and Control Panel. This is intended to reduce installation time associated with interconnecting piping and wiring between the Fuel Rack/Control Panel and the Thermal Oxidizer. Furthermore, the unit is NFPA 86 compliant to ensure personnel and equipment safety.

Again, we appreciate the opportunity to quote on your combustion equipment requirements. After you have had an opportunity to review our proposal, should you have any questions or require additional information, please contact me at (918) 893-8606 or by email at sree_krishnan@zeeco.com.

Best Regards,

Sreeram "Sree" Krishnan
Applications Engineer - Thermal Oxidizers & Combustion Systems
Zeeco World Headquarters

CC: Sydney Levine, *Midstream & End User Business Manager - Thermal Oxidizers & Combustion Systems*

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TABLE OF CONTENTS

1.0 INTRODUCTION

Zeeco has designed and manufactured burners, flares, incinerators, air pre-heaters, and combustion systems for worldwide use since 1980.

Zeeco's Incineration Division offers over 1,000 years of experience in the development, design, and testing of combustion systems. Zeeco has the proven skills and innovative abilities to design a practical and environmentally friendly combustion system to thermally treat virtually any industrial waste. This learned "art", gained by research and design efforts which are refined by testing and field experience, has been implemented in the process plants of numerous industries throughout the world.

From project planning through design, procurement, manufacturing, installation, and even start-up, Zeeco will provide project management and support to ensure the success of the project. It is our world-class, HANDS ON type design skills, quality products, experienced staff, and especially our responsiveness to our customers' needs that truly set Zeeco apart from our competition.

Quality: Our customers expect it. We demand it!

3.3 General Terms and Conditions

Please refer to Attachment B for Zeeco's General Terms and Conditions associated with this proposal.

3.4 Invoices

Please refer to Attachment D for Zeeco's Standard Payment Terms associated with this proposal.

3.5 Shipment & Delivery Basis

4.4.1 The proposed Zeeco Standard, skid-mounted Vertical Thermal Oxidizer Package shall be ready for shipment **20-24 weeks** from the date of firm order commitment and approval / release to proceed with procurement of raw materials.

4.4.2 Please note that the above pricing is based on current material availability and the use of the Zeeco's existing Standard Design. This offer also considers the current Engineering, Drafting, and Manufacturing Schedules required to supply the equipment and materials detailed within this proposal.

4.4.3 Expedited delivery is available, if required. Please contact Zeeco for an updated proposal.

3.6 Preliminary Equipment Weights & Dimensions

The preliminary weights and dimensions for the *major* equipment items within Zeeco's Base Scope of Supply have been noted in Table 3.6.1 below.

TABLE 3.6.1: PRELIMINARY EQUIPMENT WEIGHTS & DIMENSIONS

Item	Qty	Approximate Weight (lbs)	Approximate Dimensions
Vertical Thermal Oxidizer Skid	1	30,000	12' (L) x 12' (W) x 8' (H)
Thermal Oxidizer Vent Stack	1	20,000	6' O.D. x 38' (L)

3.6.1 The preliminary weights and dimensions noted in the above table reflect the fully assembled and skidded equipment, including all relevant refractory material and external attachments, as described in Section 6.0 of this proposal.

3.6.2 Please note that all equipment described within this proposal shall be shop assembled by Zeeco to the maximum extent possible, given the local, state, and federal shipping / transit limitations. The extent of shop assembly for external attachments and equipment has been detailed in Section 6.0 of this proposal.

3.7 Drawing and Documentation

3.7.1 Key submission drawings associated with Invoicing Milestone 2 of Zeeco's Standard Payment Terms (Attachment D) have been defined as the P&ID and Thermal Oxidizer General Arrangement and Foundation Drawings.

3.7.2 The delivery schedule noted in Section 3.5 of this proposal includes two (2) review / approval cycles for all submitted Documents and Drawings, as noted below:

3.7.2.1 Customer / Buyer review cycle within fourteen (14) calendar days from the date of document and drawing submission by Zeeco

3.7.2.2 Document and Drawing revision and resubmission by Zeeco within fourteen (14) calendar days from the return date from the Customer / Buyer

3.7.3 Zeeco shall comply with all relevant requirements listed in the following Williams Specifications, as shown in Table 3.7.3 below:

TABLE 3.7.3: WILLIAMS SPECIFICATIONS

SPEC. NO.	REVISION	DESCRIPTION
09 96 10C	04.00	Above-Ground Protective Coatings
26 00 11D	02.02	Electrical Area Classification Design Manual
26 05 00C	01.04	Electrical Installation
33 08 61F1	01.02	ASME B31.3 Pre-Approval & Pressure Test Record
33 52 30C	01.01	Onshore Nondestructive Examination (NDE) of Steel Pipe System Welds
40 05 08E	04.02	Pipe Supports & Spans
40 05 27E	03.23	Piping Specification
40 05 41C	04.02	Bolt Tensioning and Alignment for Standard Flange Connections
40 05 48E	02.01	Pipe Nipple Design Manual
40 15 20P	01	Exhaust Gas Sample Port Configuration
40 61 10C	01.03	Instrumentation and Controls
40 61 10E	01.01	Instrumentation and Controls
40 63 44E	01.01	Alley Bradley Programmable Logic Controller Engineering Specification
40 67 17P	01.01	Onshore Control Panel Procurement Specification
43 42 01P	02.01	Unfired ASME Section VIII Pressure Vessels

3.8 Start-Up, Commissioning, and Installation

3.8.1 Start-up and Commissioning services have not been included in this proposal but can be purchased separately as per Zeeco's Standard Rates noted in Attachment C.

3.8.2 Installation, Erection, and Construction services have not been included in this proposal, however, Zeeco can provide a separate price for these services upon request.

3.9 Limited Liability

Seller shall not be liable for any loss of profit, special, indirect, incidental or consequential damages whether arising under warranty, contract, strict liability, indemnification, or any other cause or combination of causes whatsoever. This limitation shall apply notwithstanding any failure of essential purpose of any limited remedy.

Seller's cumulative liability, inclusive of insurance proceeds paid to Agent under Seller's insurance policies and liquidated damages paid to Agent, shall in no event be in excess of the value of the purchase price, whether arising under warranty, contract, strict liability, indemnification, or any other cause or combination of causes whatsoever. These limitations shall prevail over any conflicting or inconsistent provisions stated elsewhere.

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4.0 DESIGN BASIS

Zeeco has designed all equipment within this proposal based on the following parameters and assumptions, as per your inquiry and Zeeco's Standard Design:

4.1 Site Conditions

Elevation (ft)	~1255
Barometric Pressure (psia)	13.8
Ambient Temperature, Min / Max (°F)	-20 / 105
Relative Design Humidity (%)	95% (*assumed*)
Wind Design	ASCE 7-10, 120 MPH
Snow Design	30 lb/ft^2

4.2 Waste Stream Summary

Constituent	Still Vent Gas *Mol %*	Flash Gas *Mol %*
Water	92.46183	0.30333
TEG	0.00022	0.00023
Oxygen	0.00000	0.00000
Nitrogen	0.00057	0.13017
Methane	0.99780	53.65338
CO2	0.08474	0.44373
Ethane	1.81764	26.20759
Propane	1.79100	12.73128
i-Butane	0.17584	1.00412
n-Butane	0.99114	3.81205
i-Pentane	0.25180	0.52165
n-Pentane	0.51720	0.88532
2,2-Dimethylbutane	0.00151	0.00216
2,3-Dimethylbutane	0.04579	0.04791
2-Methylpentane	0.00000	0.00000
3-Methylpentane	0.02994	0.02715
Hexane	0.10004	0.08850
2,2-Dimethylpentane	0.00000	0.00000
Methylcyclopentane	0.00000	0.00000
Benzene	0.03499	0.00166
3,3-Dimethylpentane	0.00000	0.00000
Cyclohexane	0.05039	0.01452
2-Methylhexane	0.02772	0.01599
2,3-Dimethylpentane	0.00575	0.00260
3-Methylhexane	0.03659	0.01728
Heptane	0.07701	0.03297
Toluene	0.14008	0.00355
Octane	0.02852	0.00720
Ethylbenzene	0.01680	0.00029
o-Xylene	0.02216	0.00027
2-Methylheptane	0.02751	0.00905
1,t-2-Dimethylcyclopentane	0.00000	0.00000

1,t-3Dimethylcyclopentane	0.04887	0.00864
Methylcyclohexane	0.08355	0.01797
2,5-Dimethylhexane	0.00190	0.00091
2,3-Dimethylhexane	0.00000	0.00000
4-Methylheptane	0.00000	0.00000
3-Methylheptane	0.00000	0.00000
1,t-4-Dimethylcyclohexane	0.00000	0.00000
1,t-3-Dimethylcyclohexane	0.00364454	0.00045279
Ethylcyclohexane	0.010896061	0.001723877
Nonane	0.013381796	0.001802523
n-Undecane	0.000307611	1.18981E-05
n-Decane	0.000987688	7.26319E-05
Dodecane	3.64037E-05	7.41E-07
Tridecane	1.91556E-06	2.23E-08
Tetradecane	1.05464E-07	8.29E-10
Pentadecane	1.20519E-08	7.11E-11
Hexadecane	9.56837E-10	4.83E-12
Heptadecane	8.81753E-11	4.02E-13
Octadecane	2.05035E-11	8.00E-14
Nonadecane	3.83331E-12	1.26E-14
m-Xylene	0.08493217	0.001394333
3-Ethylpentane	0.000633194	0.000256126
2,4-Dimethylhexane	0.002924017	0.001221004
trans-1,2-Dimethylcyclohexane	0.005112928	0.000683389
cis-1,2-Dimethylcyclohexane	0.006254963	0.000646351
cis-1,3-Dimethylcyclohexane	0.0019143	0.000283782
Pressure, psig	0.10	57.00
Temperature, °F	207.17	119.00
MW	22.33	27.94
Case 1: Design Flow Rate (lb/h)	146.50	32.00
Case 2: Winter High P Flow Rate (lb/h)	82.36	31.00
Case 3: Winter Low P Flow Rate (lb/h)	98.38	29.00
Case 4: Summer High P Flow Rate (lb/h)	208.33	35.00
Case 5: Summer Low P Flow Rate (lb/h)	254.49	32.00
Case 6: Updated Still Vent Only Flow Rate (lb/h)	296.94	0.00
Case 7: Updated Flash Gas Only Flow Rate (lb/h)	0.00	109.00
Case 8: Updated Design Flow Rate (lb/h)	188.47	102.00
Case 9: Updated Winter High P Flow Rate (lb/h)	128.80	101.00
Case 10: Updated Winter Low P Flow Rate (lb/h)	149.06	94.00
Case 11: Updated Summer High P Flow Rate (lb/h)	246.51	109.00
Case 12: Updated Summer Low P Flow Rate (lb/h)	296.94	99.00

Please note that the design of the Thermal Oxidizer assumes that all Waste Gas constituents are in the vapor phase only. If liquids or solids are present, they will be removed prior to the waste gas entering the Thermal Oxidizer.

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4.3 Fuel Gas Summary

Composition	Units	Value
Water	mol %	0.0053708
TEG	mol %	0.0000477
Nitrogen	mol %	0.2571619
CO2	mol %	0.1243241
Methane	mol %	81.6811822
Ethane	mol %	12.5932194
Propane	mol %	3.4521581
i-Butane	mol %	0.4828718
n-Butane	mol %	0.7570188
i-Pentane	mol %	0.2142871
n-Pentane	mol %	0.1646706
Neopentane	mol %	0.0099856
2,2-Dimethylbutane	mol %	0.0119321
2,3-Dimethylbutane	mol %	0.0534826
3-Methylpentane	mol %	0.0317120
Hexane	mol %	0.0502353
2,2-Dimethylpentane	mol %	0.0060154
Methylcyclopentane	mol %	0.0130547
Benzene	mol %	0.0010142
3,3-Dimethylpentane	mol %	0.0017660
Cyclohexane	mol %	0.0050990
2-Methylhexane	mol %	0.0156586
2,3-Dimethylpentane	mol %	0.0049848
3-Methylhexane	mol %	0.0168784
2,2,4-Trimethylpentane	mol %	0.0008747
Heptane	mol %	0.0171566
cis-1,2-Dimethylcyclopentane	mol %	0.0008634
2,5-Dimethylhexane	mol %	0.0022959
Toluene	mol %	0.0025218
2-Methylheptane	mol %	0.0072161
3-Ethylhexane	mol %	0.0046792
trans-1,2-Dimethylcyclohexane	mol %	0.0004670
1,1-Dimethylcyclohexane	mol %	0.0003772
Octane	mol %	0.0053790
1,t-3-Dimethylcyclohexane	mol %	0.0004640
o-Xylene	mol %	0.0000756
Nonane	mol %	0.0014424
m-Ethyltoluene	mol %	0.0002151
p-Ethyltoluene	mol %	0.0003362
2-Methylnonane	mol %	0.0002247
n-Decane	mol %	0.0002574
2,2,4-Trimethylhexane	mol %	0.0001892
3-Methyloctane	mol %	0.0002483
Isopropylcyclohexane	mol %	0.0001561
n-Propylcyclohexane	mol %	0.0000767
Butylbenzene	mol %	0.0000915
1-Methyl-2-Propylbenzene	mol %	0.0000473
1,2-Dimethyl-4-Ethylbenzene	mol %	0.0000396
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	mol %	0.0001739
TOTAL	**mol %**	**100.000**
Specific Gravity	-	0.681
Temperature	°F	40 - 70

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4.4 Utility Summary

Utility	Units	Required Amount
Electrical Power	V / Phase / Hz	460 / 3 / 60
Instrument Air Flowrate	SCFH	2000 - 3000
Fuel Gas Flowrate	lb/hr	47.8
Fuel Gas Pressure	psig	50.0

4.5 Flue Gas Summary @ 1700°F Operating Temperature

The below table contains a summary of the Flue Gas Compositions, Temperatures, and Flowrates at the outlet of the Thermal Oxidizer Chamber:

Composition	Units	Case 1: Design	Case 2: Winter High P	Case 3: Winter Low P	Case 4: Summer High P
Carbon Dioxide	mol %	4.94%	5.01%	5.02%	4.88%
Water	mol %	19.58%	18.35%	18.83%	20.36%
Nitrogen	mol %	66.66%	67.76%	67.36%	65.94%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	8.82%	8.88%	8.78%	8.83%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.20	27.34	27.28	27.11
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	3,801	3,308	3,331	4,367

Composition	Units	Case 5: Summer Low P	Case 6: Still Vent Only	Case 7: Flash Gas Only	Case 8: Updated Design
Carbon Dioxide	mol %	4.87%	5.17%	4.53%	4.55%
Water	mol %	21.17%	24.80%	14.76%	17.49%
Nitrogen	mol %	65.26%	62.48%	70.30%	68.03%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	8.71%	7.54%	10.41%	9.93%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.02	26.66	27.68	27.39
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	4,556	3,425	6,211	7,216

Composition	Units	Case 9: Updated Winter High P	Case 10: Updated Winter Low P	Case 11: Updated Summer High P	Case 12: Updated Summer Low P
Carbon Dioxide	mol %	4.55%	4.58%	4.53%	4.56%
Water	mol %	16.78%	17.20%	17.96%	18.70%
Nitrogen	mol %	68.63%	68.30%	67.62%	67.02%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	10.04%	9.92%	9.90%	9.73%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.46	27.42	27.34	27.26
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	6,754	6,584	7,934	7,840

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4.6 System Performance

Parameter	Units	Guaranteed Value
VOC Destruction Efficiency	%	$\geq$ 99.9
NO_x @ TO Outlet	ppmvd @ 3% O_2	$\leq$ 200

These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the design summary and for the Waste(s) stipulated in the design basis sections of this proposal. VOC is defined as non-methane and on-ethane hydrocarbons.

5.0 PROCESS DESCRIPTION

The Thermal Oxidizer Package shall be equipped with **One (1) Forced Draft GB-Series Fuel Gas Burner**. The system is purged using the combustion air supplied by the proposed Blower. After the purge cycle is complete, the burner is ignited via electric ignition.

Once the Thermal Oxidizer has achieved the Waste permissive temperature of **1,700°F**, Waste Gas is introduced into the system. The temperature control system and minimum 1 second residence time of the Thermal Oxidizer Chamber further ensures that Waste Gas is combusted and destroyed while minimizing fuel consumption. The Flue Gasses at the outlet of the Thermal Oxidizer Chamber are vented through atmosphere through an integrated and refractory lined Stack.

Due to the quantity of H_2O in the Waste Stream, Zeeco recommends the addition of heat traced and insulated Waste Gas piping as well as a Knock Drum upstream of the Thermal Oxidizer, as needed.

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6.0 EQUIPMENT DESCRIPTION

6.1 Zeeco Standard Skid-Mounted Vertical Thermal Oxidizer Package

One (1) Zeeco Standard Skid-Mounted Vertical Thermal Oxidizer shall be designed and supplied per Zeeco's Standard design, materials of construction, and manufacturers / suppliers. The Thermal Oxidizer has been designed to operate at a temperature of **1700ºF** with excess air, in order to ensure complete combustion of the waste gas combustible components. The Thermal Oxidizer shall be supplied with the following features:

- Nominal 12' (W) x 12' (L) x 8' (H) Thermal Oxidizer skidded unit (*fully assembled*), shipped horizontally
- Nominal 6' O.D. x 38' (L) Vent Stack, shipped horizontally for bolting / assembly to the Thermal Oxidizer skid in the field
- The Thermal Oxidizer and Vent Stack are not considered to be Pressure Vessels, as they are open to the atmosphere.
- External Shell of the Thermal Oxidizer and Vent Stack constructed from SA-36 Carbon Steel
- Combustion Air and Quench Air Ducting constructed from SA-36 Carbon Steel
- Ladders and Platforms constructed from SA-36 Carbon Steel and trial fitted by Zeeco and shipped loose to site for field assembly / installation
- Galvanized Carbon Steel Rainshield and Expanded Metal Personnel Protection Material supplied and installed by Zeeco, as required.
- Shop Installed Refractory Anchors
- Shop Installed Refractory Material (*w/out Dryout*)
- External surfaces of the Thermal Oxidizer sandblasted and painted per Paint Coating System 3d and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)
- The base of the Thermal Oxidizer shall be mounted on a structural steel skid, along with the Waste Gas piping, Fuel Control Rack, and Control Panel. Approximate skid dimensions can be found in Section 3.6 of this proposal.

6.2 Burner

One (1) Forced Draft Zeeco Burner is offered using Zeeco's Standard Design, materials of construction, and suppliers and has the following features:

- 6.0 MMBtu/hr maximum release rating
- 10:1 Fuel Gas Turndown
- High Energy Electric Spark Ignition System
- External Shell constructed from SA-36 Carbon Steel
- Waste Gas nozzle connections sizes, ratings, and materials of construction shall be consistent with Williams PO# 753213 / Zeeco SO# 43653 and will comply with all relevant project specifications noted in Table 3.7.3 of this proposal
- One (1) ¾" 150# (*max*) Drain Nozzle included, and shall be located on the shell of the Burner, in close proximity to the front plate (*size and location to be confirmed after detailed Engineering has been completed*)
- 60% Al_2O_3 Burner Tile Construction
- External surfaces of the Burner sandblasted and painted per Paint Coating System 3d and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)

6.3 Fuel Control Rack

One (1) skid-mounted and pre-assembled Fuel Gas and Instrument Air Control Rack shall be designed and supplied per Zeeco's Standard design, materials of construction, and manufacturers / suppliers, and shall be complete with the following features:

- Instrument Air Lines supplied in compliance with the 3A0 Pipe Class, per specification 40 05 27E Revision 03.23.
- Fuel Gas Lines supplied in compliance with the 3A1 Pipe Class, per specification 40 05 27E Revision 03.23.
- Fuel Gas and Instrument Air piping and nozzle connection sizes, ratings, and materials of construction shall be consistent with Williams PO# 753213 / Zeeco SO# 43653 and will comply with all relevant project specifications noted in Table 3.7.3 of this proposal
- Instrument and Piping connections from Fuel Rack to field instrumentation and other field equipment items shall be by others.
- Waste Gas Piping, Valves, and Instrumentation shall be supplied by others.
- External surfaces of all Fuel Control Rack Piping sandblasted and painted per Paint Coating System 3b and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)

6.4 Refractory

All refractory materials will be designed, supplied, and shop installed by Zeeco. The proposed refractory material shall consist of a hard castable lining throughout the entire Thermal Oxidizer and Vent Stack, and a brick refractory lining on the floor plate of the Thermal Oxidizer. All refractory materials shall be supplied by Zeeco's Standard suppliers / manufacturers.

6.5 Combustion Air Blower & Motor

One (1) Combustion Air Blower and Motor shall be supplied per Zeeco's Standard design and manufacturers / suppliers and shall be supplied with the following features:

- Design Rate: 1,950 ACFM at 105°F
- Discharge Pressure: 5" W.C.
- Motor HP: ≤ 5
- Sound Level ≤ 85 dBA @ 3' from Battery Limit
- Manufacturer's Standard Materials of Construction
- Manufacturer's Standard Paint Coating System

6.6 Controls and Instrumentation

Zeeco's Standard Controls and Instrumentation Package shall be supplied for this Thermal Oxidizer Package. All Controls and Instrumentation items shall be supplied by Zeeco's Standard suppliers / manufacturers, and shall be complete with the following:

- SIL-2 Capable Zeeco Standard Instrumentation and Controls Package, designed per NFPA-86 requirements and complete with the following features:
    a. Temperature rating of -20°F, with exception to the HMI (*guaranteed to 32°F*)
    b. Hazardous Area Classification: Class I, Division II, Groups C, D
    c. Fuel Gas and Pilot Gas Block Valve shall be supplied as FM Listed Assemblies
    d. Pneumatic Actuators supplied with inlet Relief Valves
    e. All Conduit shall be Hot Dip Galvanized (*before threading*)
    f. FCI Thermal Mass Flow Switches Provided for LL Air and Purge Air Flow Interlocks
    g. Transmitters and Pressure Gauges supplied with Manifolds
    h. Pressure Transmitters supplied, as needed (instead of Pressure Switches)
- One (1) Local Control Panel consistent with NFPA-86 requirements and complete with the following features:
    a. One (1) SIL-2 capable Allen Bradley Compact Guardlogix BMS PLC with additional provisions for Waste Gas and Process Control (*by Zeeco*)
    b. Open and Closed Limit Switches for Automated Valves wired to the PLC
    c. One (1) Rain / Sun Shield over the Local Control Panel
- One (1) Rosemount (*or equivalent*) O_2 Analyzer
- One (1) Zeeco Standard VFD housed within the Local Control Panel
- Two (2) Zeeco Standard Flame Scanners
- One (1) ¾" (*max.*) Manual Drain Valve for the Burner (*size to be confirmed after detailed Engineering has been completed*)

7.0 PERFORMANCE WARRANTY

Zeeco warranties the system performance stated in this proposal. These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the **DESIGN SUMMARY** for the waste (s) stipulated in the **DESIGN BASIS** sections of this proposal.

The purchaser, at his option and cost, may conduct a performance test to determine if the performance warranties are being met. The purchaser shall provide sufficient written notice to Zeeco so that a representative of Zeeco can witness the test. Additionally, Zeeco will be given access to all operating data and laboratory analysis that would bear on the final determination of performance. All analysis of operating data will be done in accordance with generally accepted engineering practice and only published physical data will be used.

22151 East 91st Street
Broken Arrow, OK 74014 USA
Phone: 918-258-8551
Fax: 918-251-5519
www.zeeco.com

Duplicate of Blake Ridge Flare
Zeeco Ref: SO 32415

April 24, 2018

Williams
Park Place Corporate Center 2
2000 Commerce Drive
Pittsburgh, PA 15275
Ph: 412-787-3132
fax:

Attention: Austin Day, Sr. Project Engr

Subject:	Williams Ref.:	Ridgeline CF
	Zeeco Reference:	2017-03133FL-01 -- Rev. 0

Thank you for your interest in Zeeco, Inc. We look forward to the opportunity to work with you on this project. In response to your above referenced inquiry, we are pleased to provide you with our proposal for the combustion equipment designed specifically for your needs.

Zeeco's flare systems are designed to handle peak releases immediately, with no adverse effects on the flare itself or on the pilots or ignition system. Zeeco's design also offers exceptional reliability and life expectancy as well as provisions for easy maintenance and repair.

Zeeco appreciates the opportunity to propose our products to Williams.
We are confident that we offer the best flaring equipment in the world at competitive prices. Should you have additional questions or require additional information, please feel free to contact us.

Best Regards,

Nikki Jenlink
Flare Application Engineer
(reach me by email at: nikki_jenlink@zeeco.com)

AVAILABLE ATTACHMENTS

Attachment A	DELETED
Attachment B	Commercial Proposal
Attachment C	Process Conditions
Attachment D	Specification Sheets: • Flare Tip Specification Sheet • Flare Pilot Specification Sheet • Flare Stack Structure Specification Sheet • High Energy Spark Ignition (HEI) Specification Sheet • Utility Piping Scope of Supply Specification Sheet • Typical High-Temp Thermocouple Wiring Spec Sheet
Attachment E	Spare Parts • Spare Parts for Start-up & Commissioning • Spare Parts for Two Years Operation
Attachment F	Clarifications and Exceptions
Attachment G	Start-up & Maintenance Services
Attachment H	Radiation Profile
Attachment I	Typical GA Drawing
Attachment J	ISO &ASME Sec. VIII Code Certificates
Attachment K	Sample Inspection and Test Plan
Attachment L	Zeeco Rental Brochure

ATTACHMENTS

Attachment B

Commercial Proposal

Scope of Supply

Our scope of supply will include:

1) General Arrangement Drawings for customer approval.
2) Operation & Maintenance Manual.
3) The equipment necessary for flaring the waste streams as specified in the inquiry documents, including:

Identical to Final SO 32415

Scope of Supply (Continued)

Our Scope of Supply does NOT include:

Identical to Final SO 32415

COMMERCIAL PROPOSAL

Pricing and Payment Terms

BASE Flare System as Detailed In This Proposal (Sonic Flare Tips):	$	287,700.00

Options

Ex-works:	Shop Door, Zeeco USA Point of Manufacture, North/Central America (Stack, Structural Steel, Piping)
Base Pricing Validity:	30 days from date of quotation
Optional Pricing Validity:	7 days after receipt of an order or LOI, unless specifically defined otherwise
Terms of Payment:	Same as Agreed on Blake Ridge

Delivery:

Foundation Loadings:	2 weeks after receipt of order
GA Drawings / P&ID for Approval:	4 weeks after receipt of order
Panel Drawings / IDS for Review:	6 weeks after receipt of order
Equipment Shipment:	20-22 weeks after drawing approval

Warranty:	18 months from ship date, or 12 months from start-up, whichever condition expires first.

ATTACHMENTS

Attachment C

Process Conditions

Process Conditions -- English Units

Client: Williams		Zeeco Ref.: 2017-03133FL-01		Date:	24-Apr-18
Location: West Virgina		Client Ref.: Ridgeline CF		Rev.	0

	Mol %					
	RL Flare	RL FG				
METHANE	81.67	81.70				
ETHANE	12.60	12.59				
PROPANE	3.46	3.45				
BUTANE	1.24	1.24				
PENTANE	0.38	0.38				
HEXANE	0.26	0.05				
HEPTANE		0.02				
OCTANE		0.00				
NONANE						
DECANE						
DODECANE						
TRIDECANE						
CYCLOPENTANE						
ETHYLENE						
PROPYLENE						
BUTYLENE						
ACETYLENE						
BENZENE						
TOLUENE						
XYLENE						
CARBON MONOXIDE						
CARBON DIOXIDE	0.13	0.12				
HYDROGEN SULFIDE						
SULFUR DIOXIDE						
AMMONIA						
AIR						
HYDROGEN						
OXYGEN						
NITROGEN	0.26	0.26				
WATER		0.01				
BUTADIENE						
METHANOL						
Total	**100**	**100**				
Mol. Wt.	19.77	19.60				
L. H. V. (BTU/SCF):	1,089	1,081				
Temperature (Deg. F):	-15.0					
Avail. Static Pressure (psig):	35.00					
Flow Rate (lbs/hr):	384,399					
Smokeless Rate (lbs/hr):	384,399					

*Smokeless is Ringleman 1.0 or less

ATTACHMENTS

Attachment D

Specification Sheets:

Flare Tip Specification Sheet
• Flare Pilot Specification Sheet
• Flare Stack Structure Specification Sheet
• High Energy Spark Ignition (HEI) Specification Sheet
• Utility Piping Scope of Supply Specification Sheet
• Typical High-Temp Thermocouple Wiring Spec Sheet

Flare Tip Specification Sheet

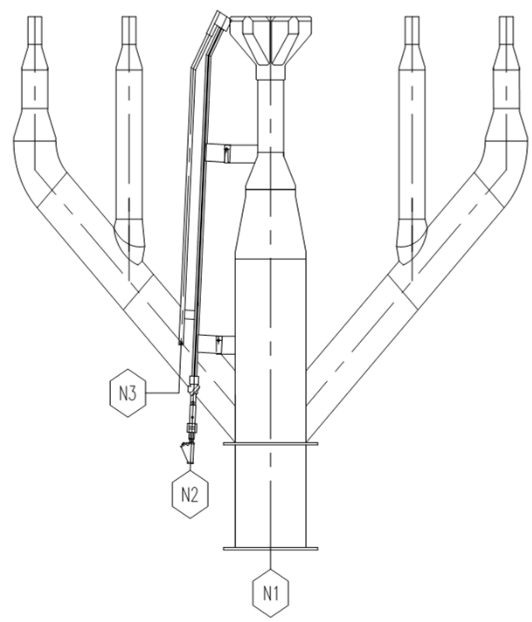
Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

Tag No.:	Ridgeline CF		
Model:	MJ-16	Type:	Sonic
Length:	10'- 0 "		
Weight:	1298	lbs	
No. of Pilots:	2		

Design Case:

Governing Case:	RL Flare
Molecular Weight:	19.8
L. H. V. :	1,089 BTU/SCF
Temperature:	-15 Deg. F
Available Static Pressure:	35 psig
Design Flow Rate:	384,399 lbs/hr
Approximate Exit Velocity:	1211 ft/s
Mach No.:	1.00
Approx. Tip Press. Drop:	24.78 psig



(Typical drawing only)

Construction:

Upper Section:	310 SS	Windshield:	NO
Lower Section:	304 SS	Flame Retention Ring:	n/a
Refractory:	None	Lifting Lugs:	YES - S.S. Type
Refractory Thk:	N/A		

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP6	Primer:	Inorganic Zinc
Paint (c. s. surfaces):	High Heat Aluminum		

Connections:

	Qty.	Size	Type	Material
N1 - Flare Gas Inlet:	1	16 "	150# RFSO	304 SS
N2 - Pilot Gas:	1	1"	150# RFSW	304 SS
N3 - Ignition Line:	0	n/a	n/a	n/a

Miscellaneous Notes:

1. Includes Integral Purge Reducing Velocity Seal.
2. Required Fuel Gas Purge Rate = 760 SCFH.

Pre-Mix Flare Pilot Assembly Specification Sheet

Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

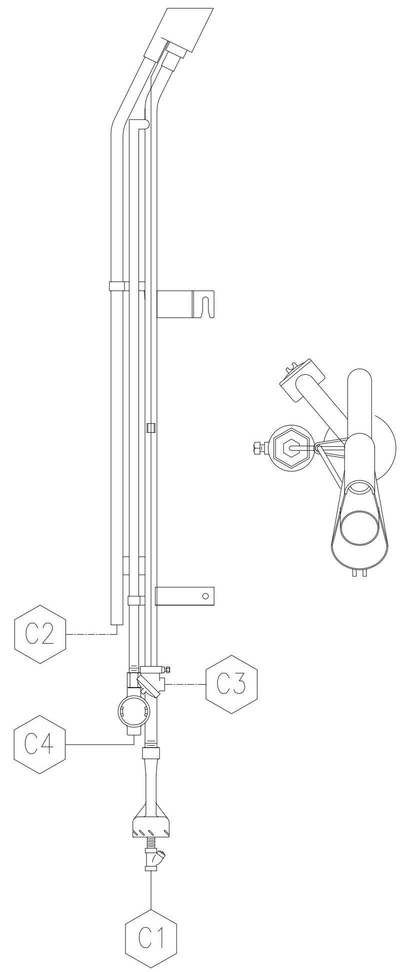
Tag No.:	FP-1	
Model:	HSLF	
Length:	9.135	feet
Weight:	68	lbs.
Pilot Type:	Pre-Mix	High Stability
Ignition Type:	Flame Front Generator	

Process Design Data:

Design Heat Release:	65,000	BTU/hr
Fuel Gas MW:	22.40	
Fuel Gas LHV:	1,342	BTU/SCF
Fuel Gas Temperature:	100	Deg. F
Fuel Gas Inlet Pressure:	15.00	psig
Fuel Gas Flow rate:	48.4	SCFH
Design Wind Velocity:	150	mph
Design Rainfall:	50.00	inches/hr
Mounting Position:	Vertical	
Thermocouple Type:	K	Ungrounded

Construction:

Pilot Firing Tip:	HK
Windshield Assembly:	HK
Integral Thermowell:	HK
FFG Ignition Line:	N/A
Mounting Brackets:	HK
Premix Fuel Line:	310 SS
Thermocouple Sheath:	310 SS
Thermocouple Head:	316 SS
Fuel Mixer / Spud Assembly:	CF-3M / 18-8
Fuel Strainer Assembly:	CF-8M
HEI Probe and Support:	310 SS
HEI Junction Head:	310 SS



Connections:	Qty.	Size	Type	Material
C1 - Fuel Gas Inlet:	1	1/2"	FNPT	CF8M
C2 - FFG Ignition Inlet:	0	n/a	n/a	n/a
C3 - Thermocouple:	1	3/4"	Conduit	CF8M
C4 - HEI Ignition:	1	3/4"	Conduit	CF8M

Misc. Notes: (see ignition system datasheet for type applicable to this quote)

1. Upper mounting bracket is reinforced hook type for pilot removal from platform.
2. Pilot mounting brackets and thermocouple mounting brackets are investment cast assemblies.
3. Pilot mixer assembly is investment cast, high efficiency computer modeled venturi section.
4. ~~Thermocouples are duplex fixed type. Retractable type (replaceable from grade) available upon request.~~

Self-supported Flare Stack Specification Sheet

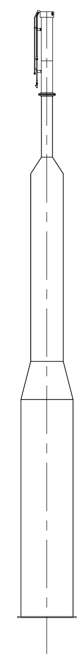
Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.:	0

General Information:

Tag No.:	Ridgeline CF
Overall Height:	130'- 0 "

Design Criteria:

Wind Design Code:	ASCE 7-10
Seismic Design Code:	ASCE 7-10
Importance Factor:	1.25
Structural Design Code:	AISC
Wind Speed (Structural):	120 mph
Seismic Zone:	D
Max. Design Temperature:	150 Deg. F
Min. Design Temperature:	-65 Deg. F
Design Pressure:	50 psig
Riser Corrosion Allow.:	0.000 in.



(Typical drawing only)

Construction:

Inner Gas Riser Material:	304 SS	Ladders & Step-offs:	per OSHA
Inner Gas Riser Diameter:	16"	Platform at Tip:	360 deg
Outer Support Stack Material:	A36CS	Additional Platforms:	None
Outer Support Stack Diameter:	Varies Along Height	ACWL:	None

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	Per Spec	Primer:	Per Spec
Int. Coat:	Per Spec	Finish Paint:	Per Spec

Utility Piping:

Per Attached Utility Piping Scope of Supply

Miscellaneous Notes:

High Energy Electronic Ignition Generator Specification Sheet

Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

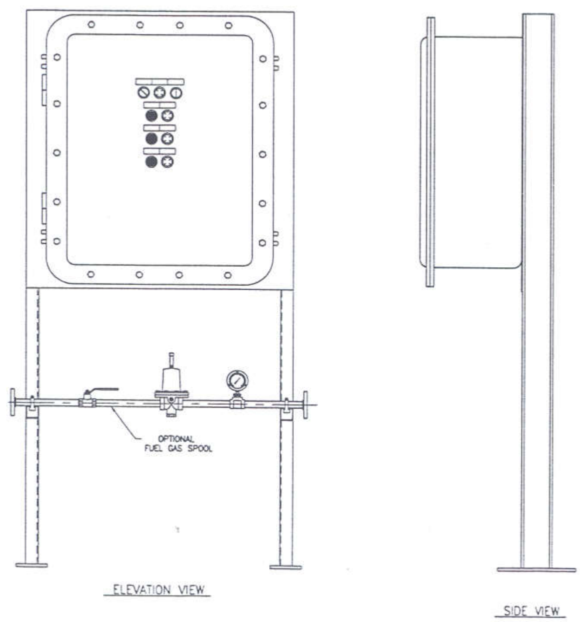
Tag No.:	Ridgeline CF
Model No.:	HEIC-2-DT/S
Operation:	Manual/Automatic
No. of Pilots Ignited:	2
Area Classification:	Class 1, Div 2, Group C&D
Spark Intensity:	Approx. 1,000 Volts

Fuel Gas Data:

Molecular Weight:	19.6
L. H. V.:	1,081 BTU/SCF
Temperature:	100 Deg. F
Pressure:	15 psig

Utility Consumption:

Pilot Gas (Per Pilot):	60 SCFH
Pilot Gas (Total):	120 SCFH
Power Available:	120 Volt, 1 Phase, 60 Hertz



(Typical drawing only)

Construction:

Fuel Gas Piping:	Carbon Steel	Ignition Probe Mat'l:	310 SS
Mounting Rack:	Carbon Steel	No. Thermocouples/Pilot:	1
Enclosure:	NEMA 4X/7	Thermocouple Type:	K
Sun / Rain Shield:	No	Ignition Probes per Pilot:	1

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP6	First Coat:	High Build Epoxy; 1 Coat (4~6 mils)
Second Coat:	Polyurethane; 1 Coat (2~3 mils)	Finish Color:	Grey - RAL7038
		Enclosure:	Manufacturer Std.

Connections:

	Qty.	Size	Type	Material
Pilot Gas Inlet:	1	1/2"	150# RFSW	Carbon Steel
Ignition Probe Inlet (On Pilot):	1	3/4"	FNPT	304SS
Pilot Gas Outlet:	1	1/2"	150# RFSW	Carbon Steel

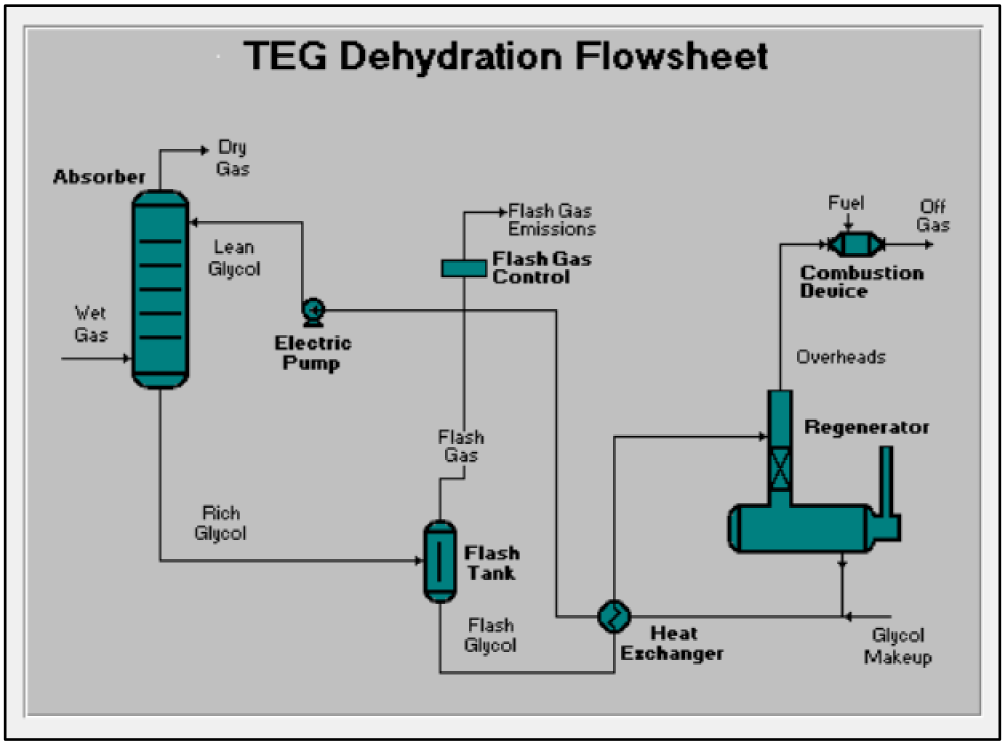
Miscellaneous Notes:

1. Zeeco has considered relay logic. PLC can be considered upon request.
2. Piping/valves/instruments shall be CS w/ SW connections

Supplement S6

Emission Program Data

- **EPA Tanks 4.0.9d – Produced Water (P/W) Storage Tanks (TK-01 (18E)) thru TK-04 (21E))**
- **GRI-GLYCalc 4.0 – 250.0 MMscfd TEG Dehydrator (DFT-01 (12E) and DSV-01 (13E))**
- **GRI-GLYCalc 4.0 – 160.0 MMscfd TEG Dehydrator (DFT-02 (15E) and DSV-02 (16E))**



Produced Water (PW) - Storage Tanks (TK-01 thru TK-04)

Identification

User Identification:	AMS-Ridgeline CS 400 bbl Produced Water
City:	
State:	West Virginia
Company:	Appalachia Midstream Services, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	400 bbl each, 30,000 bbl/year 95% Water 5% Condensate (Gasoline RVP=12)

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	12.00
Liquid Height (ft) :	19.00
Avg. Liquid Height (ft):	10.00
Volume (gallons):	16,800.00
Turnovers:	75.00
Net Throughput(gal/yr):	1,260,000.00
Is Tank Heated (y/n):	Y

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.06

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Produced Water

Tank Dimensions	Per Tank		Four (4) Tanks	
	gal	bbl	gal	bbl
Capacity	16,800	**400**	67,200	1,600
Daily T-Put	3,452	82	13,808	329
Annual T-Put	**1,260,000**	30,000	5,040,000	120,000

VOC Emissions	Per Tank		Four (4) Tanks	
	lb/yr	tpy	lb/yr	tpy
Working	**70.46**	0.04	281.84	0.14
Breathing	**0.00**	0.00	0.00	0.00
Total	**70.46**	0.04	281.84	0.14

Meterological Data used in Emissions Calculations: Pittsburgh, Pennsylvania (Avg Atmospheric Pressure = 14.11 psia)

AMS-Ridgeline CS 400 bbl Produced Water - Vertical Fixed Roof Tank
, West Virginia

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight
Produced Water	All	60.00	60.00	60.00	60.00	0.3174	0.3174	0.3174	27.3860			18.75
Gasoline (RVP 12)						6.3542	6.3542	6.3542	64.0000	0.0500	0.4768	92.00
Water						0.2552	0.2552	0.2552	18.0000	0.9500	0.5232	18.00

Emissions Report for: Annual

AMS-Ridgeline CS 400 bbl Produced Water - Vertical Fixed Roof Tank
, West Virginia

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Produced Water	147.77	0.00	147.77
Water	77.31	0.00	77.31
Gasoline (RVP 12)	70.46	0.00	70.46

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: D-2 - Ridgeline CF - 250 MMscfd w/Electric Pump
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\Ridgeline CF - 250 MMscfd (2MM) w.Electric Pump.ddf
Date: April 25, 2022

DESCRIPTION:

Description: 250 MMscfd (2 MMBtu/hr Regen), 80 oF, 1,000 psig; Ridgeline Extended Gas Analysis;
Elect Pump, 24 gpm Flash Tank, 110 oF, 60 psig;
Stripping gas @ 15 scfm
Emissions Controlled by Thermal Oxidizer

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 1000.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1530
Nitrogen	0.4250
Methane	81.1320
Ethane	12.7450
Propane	3.3880
Isobutane	0.4750
n-Butane	0.7340
Isopentane	0.2190
n-Pentane	0.1750
Cyclopentane	0.0210
n-Hexane	0.1000
Cyclohexane	0.0200
Other Hexanes	0.1840
Heptanes	0.1030
Methylcyclohexane	0.0310
Benzene	0.0030
Toluene	0.0060

```
                   Ethylbenzene      0.0010
                        Xylenes      0.0070
                    C8+ Heavies      0.0788


DRY GAS:
--------------------------------------------------------------------

                    Flow Rate:     250.0 MMSCF/day
                Water Content:       7.0 lbs. H2O/MMSCF


LEAN GLYCOL:
--------------------------------------------------------------------

                  Glycol Type: TEG
                Water Content:       1.5 wt% H2O
                    Flow Rate:      24.0 gpm


PUMP:
--------------------------------------------------------------------

             Glycol Pump Type: Electric/Pneumatic


FLASH TANK:
--------------------------------------------------------------------

                      Flash Control: Combustion device
           Flash Control Efficiency:  99.50 %
                  Temperature:     110.0 deg. F
                     Pressure:      60.0 psig


STRIPPING GAS:
--------------------------------------------------------------------

                Source of Gas: Dry Gas
                Gas Flow Rate:    15.000 scfm


REGENERATOR OVERHEADS CONTROL DEVICE:
--------------------------------------------------------------------
```

Control Device:	Combustion Device
Destruction Efficiency:	99.5 %
Excess Oxygen:	5.0 %
Ambient Air Temperature:	50.0 deg. F

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: D-2 - Ridgeline CF - 250 MMscfd w/Electric Pump
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\Ridgeline CF - 250 MMscfd (2MM) w.Electric Pump.ddf
Date: April 25, 2022

DESCRIPTION:

Description: 250 MMscfd (2 MMBtu/hr Regen), 80 oF, 1,000 psig; Ridgeline Extended Gas Analysis;
Elect Pump, 24 gpm Flash Tank, 110 oF, 60 psig;
Stripping gas @ 15 scfm
Emissions Controlled by Thermal Oxidizer

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1658	3.980	0.7263
Ethane	0.0770	1.848	0.3373
Propane	0.0511	1.227	0.2239
Isobutane	0.0139	0.334	0.0610
n-Butane	0.0302	0.724	0.1321
Isopentane	0.0113	0.271	0.0494
n-Pentane	0.0122	0.294	0.0536
Cyclopentane	0.0078	0.187	0.0341
n-Hexane	0.0146	0.350	0.0638
Cyclohexane	0.0152	0.366	0.0668
Other Hexanes	0.0196	0.471	0.0859
Heptanes	0.0332	0.796	0.1452
Methylcyclohexane	0.0284	0.682	0.1245
Benzene	0.0224	0.537	0.0979
Toluene	0.0722	1.733	0.3162
Ethylbenzene	0.0166	0.400	0.0729
Xylenes	0.1628	3.908	0.7132

C8+ Heavies	0.0709	1.702	0.3106
Total Emissions	0.8253	19.807	3.6147
Total Hydrocarbon Emissions	0.8253	19.807	3.6147
Total VOC Emissions	0.5824	13.979	2.5511
Total HAP Emissions	0.2886	6.926	1.2641
Total BTEX Emissions	0.2740	6.577	1.2002

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	33.1665	795.997	145.2694
Ethane	15.4012	369.629	67.4573
Propane	10.2241	245.379	44.7816
Isobutane	2.7838	66.812	12.1931
n-Butane	6.0302	144.725	26.4124
Isopentane	2.2556	54.135	9.8796
n-Pentane	2.4472	58.732	10.7186
Cyclopentane	1.5582	37.397	6.8249
n-Hexane	2.9147	69.954	12.7665
Cyclohexane	3.0486	73.166	13.3528
Other Hexanes	3.9236	94.167	17.1855
Heptanes	6.6308	159.140	29.0430
Methylcyclohexane	5.6838	136.411	24.8950
Benzene	4.4710	107.303	19.5828
Toluene	14.4396	346.551	63.2456
Ethylbenzene	3.3300	79.919	14.5853
Xylenes	32.5643	781.544	142.6319
C8+ Heavies	14.1830	340.392	62.1216
Total Emissions	165.0564	3961.353	722.9469
Total Hydrocarbon Emissions	165.0564	3961.353	722.9469
Total VOC Emissions	116.4886	2795.727	510.2202
Total HAP Emissions	57.7197	1385.272	252.8121
Total BTEX Emissions	54.8049	1315.318	240.0455

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr

Methane	0.1803	4.328	0.7898
Ethane	0.1339	3.213	0.5863
Propane	0.0622	1.493	0.2725
Isobutane	0.0126	0.303	0.0553
n-Butane	0.0222	0.534	0.0974
Isopentane	0.0070	0.169	0.0308
n-Pentane	0.0063	0.152	0.0277
Cyclopentane	0.0011	0.027	0.0050
n-Hexane	0.0042	0.102	0.0186
Cyclohexane	0.0012	0.028	0.0052
Other Hexanes	0.0074	0.178	0.0326
Heptanes	0.0047	0.112	0.0205
Methylcyclohexane	0.0017	0.040	0.0073
Benzene	0.0002	0.005	0.0010
Toluene	0.0004	0.011	0.0019
Ethylbenzene	0.0001	0.001	0.0002
Xylenes	0.0004	0.009	0.0016
C8+ Heavies	0.0009	0.021	0.0039
Total Emissions	0.4470	10.727	1.9577
Total Hydrocarbon Emissions	0.4470	10.727	1.9577
Total VOC Emissions	0.1328	3.187	0.5816
Total HAP Emissions	0.0053	0.128	0.0234
Total BTEX Emissions	0.0011	0.026	0.0048

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	36.0648	865.554	157.9637
Ethane	26.7720	642.527	117.2612
Propane	12.4446	298.671	54.5075
Isobutane	2.5246	60.591	11.0578
n-Butane	4.4491	106.777	19.4869
Isopentane	1.4070	33.767	6.1626
n-Pentane	1.2659	30.382	5.5447
Cyclopentane	0.2291	5.498	1.0035
n-Hexane	0.8481	20.354	3.7145
Cyclohexane	0.2367	5.681	1.0368
Other Hexanes	1.4873	35.695	6.5143
Heptanes	0.9349	22.438	4.0949
Methylcyclohexane	0.3332	7.996	1.4593

Benzene	0.0445	1.069	0.1950
Toluene	0.0885	2.124	0.3877
Ethylbenzene	0.0113	0.271	0.0495
Xylenes	0.0748	1.795	0.3276
C8+ Heavies	0.1779	4.269	0.7791
Total Emissions	89.3942	2145.460	391.5465
Total Hydrocarbon Emissions	89.3942	2145.460	391.5465
Total VOC Emissions	26.5574	637.379	116.3216
Total HAP Emissions	1.0672	25.613	4.6743
Total BTEX Emissions	0.2191	5.259	0.9598

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.3462	8.308	1.5162
Ethane	0.2109	5.061	0.9236
Propane	0.1133	2.720	0.4964
Isobutane	0.0265	0.637	0.1163
n-Butane	0.0524	1.258	0.2295
Isopentane	0.0183	0.440	0.0802
n-Pentane	0.0186	0.446	0.0813
Cyclopentane	0.0089	0.214	0.0391
n-Hexane	0.0188	0.452	0.0824
Cyclohexane	0.0164	0.394	0.0719
Other Hexanes	0.0271	0.649	0.1185
Heptanes	0.0378	0.908	0.1657
Methylcyclohexane	0.0301	0.722	0.1318
Benzene	0.0226	0.542	0.0989
Toluene	0.0726	1.743	0.3182
Ethylbenzene	0.0167	0.401	0.0732
Xylenes	0.1632	3.917	0.7148
C8+ Heavies	0.0718	1.723	0.3145
Total Emissions	1.2723	30.534	5.5725
Total Hydrocarbon Emissions	1.2723	30.534	5.5725
Total VOC Emissions	0.7152	17.166	3.1327
Total HAP Emissions	0.2939	7.054	1.2874
Total BTEX Emissions	0.2751	6.603	1.2050

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	303.2331	1.5162	99.50
Ethane	184.7185	0.9236	99.50
Propane	99.2892	0.4964	99.50
Isobutane	23.2509	0.1163	99.50
n-Butane	45.8992	0.2295	99.50
Isopentane	16.0422	0.0802	99.50
n-Pentane	16.2632	0.0813	99.50
Cyclopentane	7.8284	0.0391	99.50
n-Hexane	16.4811	0.0824	99.50
Cyclohexane	14.3896	0.0719	99.50
Other Hexanes	23.6999	0.1185	99.50
Heptanes	33.1379	0.1657	99.50
Methylcyclohexane	26.3543	0.1318	99.50
Benzene	19.7778	0.0989	99.50
Toluene	63.6333	0.3182	99.50
Ethylbenzene	14.6348	0.0732	99.50
Xylenes	142.9594	0.7148	99.50
C8+ Heavies	62.9006	0.3145	99.50
Total Emissions	1114.4934	5.5725	99.50
Total Hydrocarbon Emissions	1114.4934	5.5725	99.50
Total VOC Emissions	626.5418	3.1327	99.50
Total HAP Emissions	257.4864	1.2874	99.50
Total BTEX Emissions	241.0053	1.2050	99.50

EQUIPMENT REPORTS:

COMBUSTION DEVICE

Ambient Temperature: 50.00 deg. F
Excess Oxygen: 5.00 %

Combustion Efficiency: 99.50 %
Supplemental Fuel Requirement: 8.24e-001 MM BTU/hr

Component	Emitted	Destroyed
Methane	0.50%	99.50%
Ethane	0.50%	99.50%
Propane	0.50%	99.50%
Isobutane	0.50%	99.50%
n-Butane	0.50%	99.50%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
Cyclopentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	0.50%	99.50%
Other Hexanes	0.50%	99.50%
Heptanes	0.50%	99.50%
Methylcyclohexane	0.50%	99.50%
Benzene	0.50%	99.50%
Toluene	0.50%	99.50%
Ethylbenzene	0.50%	99.50%
Xylenes	0.50%	99.50%
C8+ Heavies	0.50%	99.50%

ABSORBER

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

Calculated Absorber Stages: 1.25
Calculated Dry Gas Dew Point: 1.77 lbs. H2O/MMSCF

Temperature: 80.0 deg. F
Pressure: 1000.0 psig
Dry Gas Flow Rate: 250.0000 MMSCF/day
Glycol Losses with Dry Gas: 2.7171 lb/hr
Wet Gas Water Content: Saturated
Calculated Wet Gas Water Content: 32.37 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio: 4.51 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol

Component		
Water	5.47%	94.53%
Carbon Dioxide	99.84%	0.16%
Nitrogen	99.99%	0.01%
Methane	99.99%	0.01%
Ethane	99.97%	0.03%
Propane	99.95%	0.05%
Isobutane	99.94%	0.06%
n-Butane	99.92%	0.08%
Isopentane	99.92%	0.08%
n-Pentane	99.90%	0.10%
Cyclopentane	99.57%	0.43%
n-Hexane	99.85%	0.15%
Cyclohexane	99.30%	0.70%
Other Hexanes	99.88%	0.12%
Heptanes	99.74%	0.26%
Methylcyclohexane	99.29%	0.71%
Benzene	92.99%	7.01%
Toluene	90.44%	9.56%
Ethylbenzene	88.54%	11.46%
Xylenes	84.01%	15.99%
C8+ Heavies	99.62%	0.38%

FLASH TANK

Flash Control: Combustion device
Flash Control Efficiency: 99.50 %
Flash Temperature: 110.0 deg. F
Flash Pressure: 60.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.98%	0.02%
Carbon Dioxide	46.17%	53.83%
Nitrogen	5.78%	94.22%
Methane	5.99%	94.01%
Ethane	19.08%	80.92%
Propane	34.93%	65.07%
Isobutane	45.75%	54.25%
n-Butane	53.01%	46.99%
Isopentane	57.42%	42.58%

n-Pentane	63.10%	36.90%
Cyclopentane	86.99%	13.01%
n-Hexane	76.29%	23.71%
Cyclohexane	92.94%	7.06%
Other Hexanes	70.76%	29.24%
Heptanes	87.29%	12.71%
Methylcyclohexane	94.62%	5.38%
Benzene	99.06%	0.94%
Toluene	99.44%	0.56%
Ethylbenzene	99.70%	0.30%
Xylenes	99.80%	0.20%
C8+ Heavies	98.89%	1.11%

REGENERATOR

Regenerator Stripping Gas:
Dry Product Gas
Stripping Gas Flow Rate: 15.0000 scfm

Component	Remaining in Glycol	Distilled Overhead
Water	38.84%	61.16%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.87%	99.13%
n-Pentane	0.79%	99.21%
Cyclopentane	0.57%	99.43%
n-Hexane	0.66%	99.34%
Cyclohexane	3.44%	96.56%
Other Hexanes	1.41%	98.59%
Heptanes	0.57%	99.43%
Methylcyclohexane	4.23%	95.77%
Benzene	5.05%	94.95%
Toluene	7.95%	92.05%
Ethylbenzene	10.44%	89.56%

Xylenes	12.96%	87.04%
C8+ Heavies	12.16%	87.84%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.04e+007 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.82e-002	3.37e+002
Carbon Dioxide	1.53e-001	1.85e+003
Nitrogen	4.25e-001	3.27e+003
Methane	8.11e+001	3.57e+005
Ethane	1.27e+001	1.05e+005
Propane	3.39e+000	4.10e+004
Isobutane	4.75e-001	7.58e+003
n-Butane	7.33e-001	1.17e+004
Isopentane	2.19e-001	4.34e+003
n-Pentane	1.75e-001	3.47e+003
Cyclopentane	2.10e-002	4.04e+002
n-Hexane	9.99e-002	2.37e+003
Cyclohexane	2.00e-002	4.62e+002
Other Hexanes	1.84e-001	4.35e+003
Heptanes	1.03e-001	2.83e+003
Methylcyclohexane	3.10e-002	8.36e+002
Benzene	3.00e-003	6.43e+001
Toluene	6.00e-003	1.52e+002
Ethylbenzene	9.99e-004	2.92e+001
Xylenes	7.00e-003	2.04e+002
C8+ Heavies	7.87e-002	3.69e+003
Total Components	100.00	5.52e+005

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.04e+007 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.73e-003	1.84e+001
Carbon Dioxide	1.53e-001	1.85e+003
Nitrogen	4.25e-001	3.27e+003
Methane	8.11e+001	3.57e+005
Ethane	1.27e+001	1.05e+005
Propane	3.39e+000	4.10e+004
Isobutane	4.75e-001	7.58e+003
n-Butane	7.34e-001	1.17e+004
Isopentane	2.19e-001	4.34e+003
n-Pentane	1.75e-001	3.46e+003
Cyclopentane	2.09e-002	4.03e+002
n-Hexane	9.99e-002	2.36e+003
Cyclohexane	1.99e-002	4.59e+002
Other Hexanes	1.84e-001	4.35e+003
Heptanes	1.03e-001	2.83e+003
Methylcyclohexane	3.08e-002	8.30e+002
Benzene	2.79e-003	5.98e+001
Toluene	5.43e-003	1.37e+002
Ethylbenzene	8.86e-004	2.58e+001
Xylenes	5.88e-003	1.71e+002
C8+ Heavies	7.85e-002	3.67e+003
Total Components	100.00	5.51e+005

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 2.40e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.33e+004
Water	1.50e+000	2.03e+002

Carbon Dioxide	2.13e-012	2.87e-010
Nitrogen	3.10e-013	4.18e-011
Methane	9.55e-018	1.29e-015
Ethane	1.16e-007	1.56e-005
Propane	5.77e-009	7.78e-007
Isobutane	1.03e-009	1.40e-007
n-Butane	1.74e-009	2.35e-007
Isopentane	1.22e-004	1.65e-002
n-Pentane	1.27e-004	1.72e-002
Cyclopentane	6.52e-005	8.81e-003
n-Hexane	1.32e-004	1.79e-002
Cyclohexane	7.95e-004	1.07e-001
Other Hexanes	3.77e-004	5.09e-002
Heptanes	2.73e-004	3.68e-002
Methylcyclohexane	1.84e-003	2.48e-001
Benzene	1.76e-003	2.37e-001
Toluene	9.23e-003	1.25e+000
Ethylbenzene	2.88e-003	3.88e-001
Xylenes	3.59e-002	4.85e+000
C8+ Heavies	1.42e-002	1.92e+000
Total Components	100.00	1.35e+004

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 2.51e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.47e+001	1.33e+004
Water	3.72e+000	5.22e+002
Carbon Dioxide	2.05e-002	2.87e+000
Nitrogen	2.98e-003	4.18e-001
Methane	2.74e-001	3.84e+001
Ethane	2.36e-001	3.31e+001
Propane	1.36e-001	1.91e+001
Isobutane	3.32e-002	4.65e+000
n-Butane	6.75e-002	9.47e+000
Isopentane	2.36e-002	3.30e+000

n-Pentane	2.45e-002	3.43e+000
Cyclopentane	1.26e-002	1.76e+000
n-Hexane	2.55e-002	3.58e+000
Cyclohexane	2.39e-002	3.35e+000
Other Hexanes	3.63e-002	5.09e+000
Heptanes	5.25e-002	7.36e+000
Methylcyclohexane	4.42e-002	6.19e+000
Benzene	3.38e-002	4.75e+000
Toluene	1.12e-001	1.58e+001
Ethylbenzene	2.66e-002	3.73e+000
Xylenes	2.67e-001	3.75e+001
C8+ Heavies	1.14e-001	1.60e+001
Total Components	100.00	1.40e+004

FLASH TANK OFF GAS STREAM

Temperature: 110.00 deg. F
Pressure: 74.70 psia
Flow Rate: 1.40e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.52e-001	1.01e-001
Carbon Dioxide	9.55e-001	1.55e+000
Nitrogen	3.82e-001	3.94e-001
Methane	6.11e+001	3.61e+001
Ethane	2.42e+001	2.68e+001
Propane	7.66e+000	1.24e+001
Isobutane	1.18e+000	2.52e+000
n-Butane	2.08e+000	4.45e+000
Isopentane	5.30e-001	1.41e+000
n-Pentane	4.77e-001	1.27e+000
Cyclopentane	8.87e-002	2.29e-001
n-Hexane	2.67e-001	8.48e-001
Cyclohexane	7.64e-002	2.37e-001
Other Hexanes	4.69e-001	1.49e+000
Heptanes	2.53e-001	9.35e-001
Methylcyclohexane	9.22e-002	3.33e-001
Benzene	1.55e-002	4.45e-002
Toluene	2.61e-002	8.85e-002

Ethylbenzene	2.89e-003	1.13e-002
Xylenes	1.91e-002	7.48e-002
C8+ Heavies	2.84e-002	1.78e-001
Total Components	100.00	9.14e+001

FLASH TANK GLYCOL STREAM

Temperature: 110.00 deg. F
Flow Rate: 2.49e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.53e+001	1.33e+004
Water	3.74e+000	5.21e+002
Carbon Dioxide	9.52e-003	1.33e+000
Nitrogen	1.73e-004	2.42e-002
Methane	1.65e-002	2.30e+000
Ethane	4.53e-002	6.31e+000
Propane	4.79e-002	6.68e+000
Isobutane	1.53e-002	2.13e+000
n-Butane	3.60e-002	5.02e+000
Isopentane	1.36e-002	1.90e+000
n-Pentane	1.55e-002	2.17e+000
Cyclopentane	1.10e-002	1.53e+000
n-Hexane	1.96e-002	2.73e+000
Cyclohexane	2.24e-002	3.12e+000
Other Hexanes	2.58e-002	3.60e+000
Heptanes	4.61e-002	6.42e+000
Methylcyclohexane	4.21e-002	5.86e+000
Benzene	3.38e-002	4.70e+000
Toluene	1.12e-001	1.57e+001
Ethylbenzene	2.67e-002	3.72e+000
Xylenes	2.68e-001	3.74e+001
C8+ Heavies	1.13e-001	1.58e+001
Total Components	100.00	1.39e+004

FLASH GAS EMISSIONS

Flow Rate: 5.81e+003 scfh
Control Method: Combustion Device
Control Efficiency: 99.50

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.15e+001	1.70e+002
Carbon Dioxide	3.83e+001	2.58e+002
Nitrogen	9.18e-002	3.94e-001
Methane	7.34e-002	1.80e-001
Ethane	2.91e-002	1.34e-001
Propane	9.21e-003	6.22e-002
Isobutane	1.42e-003	1.26e-002
n-Butane	2.50e-003	2.22e-002
Isopentane	6.37e-004	7.03e-003
n-Pentane	5.73e-004	6.33e-003
Cyclopentane	1.07e-004	1.15e-003
n-Hexane	3.21e-004	4.24e-003
Cyclohexane	9.18e-005	1.18e-003
Other Hexanes	5.63e-004	7.44e-003
Heptanes	3.05e-004	4.67e-003
Methylcyclohexane	1.11e-004	1.67e-003
Benzene	1.86e-005	2.23e-004
Toluene	3.14e-005	4.43e-004
Ethylbenzene	3.48e-006	5.65e-005
Xylenes	2.30e-005	3.74e-004
C8+ Heavies	3.41e-005	8.89e-004
Total Components	100.00	4.28e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 8.23e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.17e+001	3.19e+002
Carbon Dioxide	1.56e-001	1.49e+000
Nitrogen	5.05e-002	3.07e-001
Methane	9.54e+000	3.32e+001

Ethane	2.36e+000	1.54e+001
Propane	1.07e+000	1.02e+001
Isobutane	2.21e-001	2.78e+000
n-Butane	4.79e-001	6.03e+000
Isopentane	1.44e-001	2.26e+000
n-Pentane	1.56e-001	2.45e+000
Cyclopentane	1.02e-001	1.56e+000
n-Hexane	1.56e-001	2.91e+000
Cyclohexane	1.67e-001	3.05e+000
Other Hexanes	2.10e-001	3.92e+000
Heptanes	3.05e-001	6.63e+000
Methylcyclohexane	2.67e-001	5.68e+000
Benzene	2.64e-001	4.47e+000
Toluene	7.23e-001	1.44e+001
Ethylbenzene	1.45e-001	3.33e+000
Xylenes	1.41e+000	3.26e+001
C8+ Heavies	3.84e-001	1.42e+001
Total Components	100.00	4.86e+002

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
Pressure: 14.70 psia
Flow Rate: 7.45e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	5.27e+001	1.66e-001
Ethane	1.30e+001	7.70e-002
Propane	5.91e+000	5.11e-002
Isobutane	1.22e+000	1.39e-002
n-Butane	2.64e+000	3.02e-002
Isopentane	7.96e-001	1.13e-002
n-Pentane	8.64e-001	1.22e-002
Cyclopentane	5.66e-001	7.79e-003
n-Hexane	8.62e-001	1.46e-002
Cyclohexane	9.23e-001	1.52e-002
Other Hexanes	1.16e+000	1.96e-002
Heptanes	1.69e+000	3.32e-002
Methylcyclohexane	1.47e+000	2.84e-002

Benzene	1.46e+000	2.24e-002
Toluene	3.99e+000	7.22e-002
Ethylbenzene	7.99e-001	1.66e-002
Xylenes	7.81e+000	1.63e-001
C8+ Heavies	2.12e+000	7.09e-002
Total Components	100.00	8.25e-001

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: S4 - Ridgeline CS-DFT02-DSV02-042722
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\RLCS-45CSR13 Permit Application-160 MMscfd-GRIGlyCalc-042722.ddf
Date: April 27, 2022

DESCRIPTION:

Description: 80 oF, 1,000 psig;
Ridgeline Extended Gas Analysis;
Elect Pump, 24.6 gpm
Flash Tank, 110 oF, 50 psig;
Emissions Controlled by 99.5% TOx

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 1000.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1530
Nitrogen	0.4250
Methane	81.1320
Ethane	12.7450
Propane	3.3880
Isobutane	0.4750
n-Butane	0.7340
Isopentane	0.2190
n-Pentane	0.1750
Cyclopentane	0.0210
n-Hexane	0.1000
Cyclohexane	0.0200
Other Hexanes	0.1840
Heptanes	0.1030
Methylcyclohexane	0.0310
Benzene	0.0030
Toluene	0.0060
Ethylbenzene	0.0010

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                              Xylenes      0.0070
                          C8+ Heavies      0.0788


DRY GAS:
--------------------------------------------------------------------

                            Flow Rate:     160.0 MMSCF/day
                        Water Content:       7.0 lbs. H2O/MMSCF


LEAN GLYCOL:
--------------------------------------------------------------------

                          Glycol Type: TEG
                        Water Content:       1.5 wt% H2O
                            Flow Rate:      24.6 gpm


PUMP:
--------------------------------------------------------------------

                     Glycol Pump Type: Electric/Pneumatic


FLASH TANK:
--------------------------------------------------------------------

                        Flash Control: Combustion device
             Flash Control Efficiency:  99.50 %
                          Temperature:     110.0 deg. F
                             Pressure:      50.0 psig


REGENERATOR OVERHEADS CONTROL DEVICE:
--------------------------------------------------------------------

                       Control Device: Combustion Device
                Destruction Efficiency:      99.5 %
                        Excess Oxygen:       5.0 %
            Ambient Air Temperature:      50.0 deg. F
```

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: S4 - Ridgeline CS-DFT02-DSV02-042722
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\RLCS-45CSR13 Permit Application-160 MMscfd-GRIGlyCalc-042722.ddf
Date: April 27, 2022

DESCRIPTION:

Description: 80 oF, 1,000 psig;
Ridgeline Extended Gas Analysis;
Elect Pump, 24.6 gpm
Flash Tank, 110 oF, 50 psig;
Emissions Controlled by 99.5% TOx

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0103	0.246	0.0449
Ethane	0.0295	0.708	0.1292
Propane	0.0308	0.740	0.1351
Isobutane	0.0101	0.242	0.0442
n-Butane	0.0241	0.577	0.1054
Isopentane	0.0091	0.219	0.0400
n-Pentane	0.0105	0.253	0.0461
Cyclopentane	0.0079	0.189	0.0345
n-Hexane	0.0136	0.328	0.0598
Cyclohexane	0.0157	0.377	0.0687
Other Hexanes	0.0177	0.425	0.0776
Heptanes	0.0329	0.790	0.1442
Methylcyclohexane	0.0294	0.705	0.1286
Benzene	0.0225	0.539	0.0984
Toluene	0.0720	1.728	0.3154
Ethylbenzene	0.0165	0.396	0.0723
Xylenes	0.1570	3.767	0.6875
C8+ Heavies	0.0733	1.759	0.3210

Total Emissions	0.5828	13.988	2.5528
Total Hydrocarbon Emissions	0.5828	13.988	2.5528
Total VOC Emissions	0.5431	13.034	2.3787
Total HAP Emissions	0.2816	6.758	1.2333
Total BTEX Emissions	0.2679	6.430	1.1736

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	2.0508	49.219	8.9824
Ethane	5.8975	141.541	25.8313
Propane	6.1695	148.069	27.0226
Isobutane	2.0188	48.450	8.8422
n-Butane	4.8117	115.482	21.0754
Isopentane	1.8267	43.842	8.0011
n-Pentane	2.1051	50.521	9.2202
Cyclopentane	1.5767	37.840	6.9059
n-Hexane	2.7293	65.503	11.9544
Cyclohexane	3.1391	75.338	13.7492
Other Hexanes	3.5428	85.027	15.5174
Heptanes	6.5837	158.008	28.8365
Methylcyclohexane	5.8730	140.952	25.7238
Benzene	4.4948	107.876	19.6873
Toluene	14.4003	345.607	63.0733
Ethylbenzene	3.2994	79.185	14.4513
Xylenes	31.3923	753.414	137.4981
C8+ Heavies	14.6553	351.727	64.1903
Total Emissions	116.5668	2797.603	510.5626
Total Hydrocarbon Emissions	116.5668	2797.603	510.5626
Total VOC Emissions	108.6185	2606.843	475.7489
Total HAP Emissions	56.3161	1351.586	246.6644
Total BTEX Emissions	53.5868	1286.082	234.7100

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1894	4.546	0.8296

Ethane	0.1437	3.448	0.6293
Propane	0.0679	1.629	0.2972
Isobutane	0.0140	0.336	0.0613
n-Butane	0.0249	0.599	0.1092
Isopentane	0.0079	0.190	0.0347
n-Pentane	0.0072	0.173	0.0315
Cyclopentane	0.0013	0.032	0.0059
n-Hexane	0.0049	0.117	0.0214
Cyclohexane	0.0014	0.033	0.0061
Other Hexanes	0.0085	0.204	0.0373
Heptanes	0.0054	0.131	0.0238
Methylcyclohexane	0.0019	0.047	0.0085
Benzene	0.0003	0.006	0.0011
Toluene	0.0005	0.012	0.0022
Ethylbenzene	0.0001	0.002	0.0003
Xylenes	0.0004	0.010	0.0018
C8+ Heavies	0.0010	0.024	0.0045
Total Emissions	0.4808	11.539	2.1058
Total Hydrocarbon Emissions	0.4808	11.539	2.1058
Total VOC Emissions	0.1477	3.545	0.6469
Total HAP Emissions	0.0061	0.147	0.0269
Total BTEX Emissions	0.0012	0.030	0.0054

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	37.8823	909.175	165.9244
Ethane	28.7348	689.635	125.8585
Propane	13.5712	325.708	59.4417
Isobutane	2.8001	67.202	12.2643
n-Butane	4.9880	119.713	21.8475
Isopentane	1.5861	38.066	6.9471
n-Pentane	1.4387	34.529	6.3016
Cyclopentane	0.2672	6.413	1.1704
n-Hexane	0.9789	23.493	4.2874
Cyclohexane	0.2764	6.633	1.2106
Other Hexanes	1.7042	40.900	7.4642
Heptanes	1.0883	26.118	4.7665
Methylcyclohexane	0.3884	9.321	1.7011
Benzene	0.0519	1.246	0.2273

Toluene	0.1011	2.428	0.4430
Ethylbenzene	0.0127	0.305	0.0556
Xylenes	0.0824	1.979	0.3611
C8+ Heavies	0.2034	4.881	0.8907
Total Emissions	96.1560	2307.743	421.1632
Total Hydrocarbon Emissions	96.1560	2307.743	421.1632
Total VOC Emissions	29.5389	708.933	129.3803
Total HAP Emissions	1.2270	29.449	5.3744
Total BTEX Emissions	0.2482	5.956	1.0870

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1997	4.792	0.8745
Ethane	0.1732	4.156	0.7584
Propane	0.0987	2.369	0.4323
Isobutane	0.0241	0.578	0.1055
n-Butane	0.0490	1.176	0.2146
Isopentane	0.0171	0.410	0.0747
n-Pentane	0.0177	0.425	0.0776
Cyclopentane	0.0092	0.221	0.0404
n-Hexane	0.0185	0.445	0.0812
Cyclohexane	0.0171	0.410	0.0748
Other Hexanes	0.0262	0.630	0.1149
Heptanes	0.0384	0.921	0.1680
Methylcyclohexane	0.0313	0.751	0.1371
Benzene	0.0227	0.546	0.0996
Toluene	0.0725	1.740	0.3176
Ethylbenzene	0.0166	0.397	0.0725
Xylenes	0.1574	3.777	0.6893
C8+ Heavies	0.0743	1.783	0.3254
Total Emissions	1.0636	25.527	4.6586
Total Hydrocarbon Emissions	1.0636	25.527	4.6586
Total VOC Emissions	0.6908	16.579	3.0256
Total HAP Emissions	0.2877	6.905	1.2602
Total BTEX Emissions	0.2692	6.460	1.1790

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	174.9068	0.8745	99.50
Ethane	151.6897	0.7584	99.50
Propane	86.4643	0.4323	99.50
Isobutane	21.1065	0.1055	99.50
n-Butane	42.9230	0.2146	99.50
Isopentane	14.9482	0.0747	99.50
n-Pentane	15.5218	0.0776	99.50
Cyclopentane	8.0763	0.0404	99.50
n-Hexane	16.2418	0.0812	99.50
Cyclohexane	14.9598	0.0748	99.50
Other Hexanes	22.9817	0.1149	99.50
Heptanes	33.6031	0.1680	99.50
Methylcyclohexane	27.4249	0.1371	99.50
Benzene	19.9146	0.0996	99.50
Toluene	63.5164	0.3176	99.50
Ethylbenzene	14.5069	0.0725	99.50
Xylenes	137.8592	0.6893	99.50
C8+ Heavies	65.0810	0.3254	99.50
Total Emissions	931.7258	4.6586	99.50
Total Hydrocarbon Emissions	931.7258	4.6586	99.50
Total VOC Emissions	605.1292	3.0256	99.50
Total HAP Emissions	252.0389	1.2602	99.50
Total BTEX Emissions	235.7971	1.1790	99.50

EQUIPMENT REPORTS:

COMBUSTION DEVICE

Ambient Temperature:	50.00 deg. F
Excess Oxygen:	5.00 %
Combustion Efficiency:	99.50 %

Supplemental Fuel Requirement: 5.52e-001 MM BTU/hr

Component	Emitted	Destroyed
Methane	0.50%	99.50%
Ethane	0.50%	99.50%
Propane	0.50%	99.50%
Isobutane	0.50%	99.50%
n-Butane	0.50%	99.50%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
Cyclopentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	0.50%	99.50%
Other Hexanes	0.50%	99.50%
Heptanes	0.50%	99.50%
Methylcyclohexane	0.50%	99.50%
Benzene	0.50%	99.50%
Toluene	0.50%	99.50%
Ethylbenzene	0.50%	99.50%
Xylenes	0.50%	99.50%
C8+ Heavies	0.50%	99.50%

ABSORBER

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

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	1.44 lbs. H2O/MMSCF
Temperature:	80.0 deg. F
Pressure:	1000.0 psig
Dry Gas Flow Rate:	160.0000 MMSCF/day
Glycol Losses with Dry Gas:	1.7380 lb/hr
Wet Gas Water Content:	Saturated
Calculated Wet Gas Water Content:	32.37 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	7.15 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol

Water	4.44%	95.56%
Carbon Dioxide	99.75%	0.25%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.95%	0.05%
Propane	99.92%	0.08%
Isobutane	99.90%	0.10%
n-Butane	99.87%	0.13%
Isopentane	99.88%	0.12%
n-Pentane	99.84%	0.16%
Cyclopentane	99.29%	0.71%
n-Hexane	99.76%	0.24%
Cyclohexane	98.85%	1.15%
Other Hexanes	99.81%	0.19%
Heptanes	99.58%	0.42%
Methylcyclohexane	98.83%	1.17%
Benzene	88.96%	11.04%
Toluene	85.07%	14.93%
Ethylbenzene	82.25%	17.75%
Xylenes	75.90%	24.10%
C8+ Heavies	99.37%	0.63%

FLASH TANK

Flash Control: Combustion device
Flash Control Efficiency: 99.50 %
Flash Temperature: 110.0 deg. F
Flash Pressure: 50.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.98%	0.02%
Carbon Dioxide	42.02%	57.98%
Nitrogen	4.99%	95.01%
Methane	5.14%	94.86%
Ethane	17.03%	82.97%
Propane	31.25%	68.75%
Isobutane	41.89%	58.11%
n-Butane	49.10%	50.90%
Isopentane	53.76%	46.24%
n-Pentane	59.60%	40.40%

Cyclopentane	85.58%	14.42%
n-Hexane	73.73%	26.27%
Cyclohexane	92.17%	7.83%
Other Hexanes	67.85%	32.15%
Heptanes	85.89%	14.11%
Methylcyclohexane	94.05%	5.95%
Benzene	98.92%	1.08%
Toluene	99.36%	0.64%
Ethylbenzene	99.66%	0.34%
Xylenes	99.77%	0.23%
C8+ Heavies	98.80%	1.20%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	50.16%	49.84%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.93%	99.07%
n-Pentane	0.84%	99.16%
Cyclopentane	0.58%	99.42%
n-Hexane	0.68%	99.32%
Cyclohexane	3.47%	96.53%
Other Hexanes	1.47%	98.53%
Heptanes	0.58%	99.42%
Methylcyclohexane	4.25%	95.75%
Benzene	5.05%	94.95%
Toluene	7.95%	92.05%
Ethylbenzene	10.44%	89.56%
Xylenes	12.95%	87.05%
C8+ Heavies	12.16%	87.84%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 6.67e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.82e-002	2.16e+002
Carbon Dioxide	1.53e-001	1.18e+003
Nitrogen	4.25e-001	2.09e+003
Methane	8.11e+001	2.29e+005
Ethane	1.27e+001	6.74e+004
Propane	3.39e+000	2.63e+004
Isobutane	4.75e-001	4.85e+003
n-Butane	7.33e-001	7.50e+003
Isopentane	2.19e-001	2.78e+003
n-Pentane	1.75e-001	2.22e+003
Cyclopentane	2.10e-002	2.59e+002
n-Hexane	9.99e-002	1.51e+003
Cyclohexane	2.00e-002	2.96e+002
Other Hexanes	1.84e-001	2.79e+003
Heptanes	1.03e-001	1.81e+003
Methylcyclohexane	3.10e-002	5.35e+002
Benzene	3.00e-003	4.12e+001
Toluene	6.00e-003	9.72e+001
Ethylbenzene	9.99e-004	1.87e+001
Xylenes	7.00e-003	1.31e+002
C8+ Heavies	7.87e-002	2.36e+003
Total Components	100.00	3.53e+005

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 6.67e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.03e-003	9.60e+000
Carbon Dioxide	1.53e-001	1.18e+003
Nitrogen	4.25e-001	2.09e+003
Methane	8.11e+001	2.29e+005
Ethane	1.27e+001	6.73e+004
Propane	3.39e+000	2.62e+004
Isobutane	4.75e-001	4.85e+003
n-Butane	7.33e-001	7.49e+003
Isopentane	2.19e-001	2.77e+003
n-Pentane	1.75e-001	2.22e+003
Cyclopentane	2.09e-002	2.57e+002
n-Hexane	9.98e-002	1.51e+003
Cyclohexane	1.98e-002	2.92e+002
Other Hexanes	1.84e-001	2.78e+003
Heptanes	1.03e-001	1.81e+003
Methylcyclohexane	3.06e-002	5.29e+002
Benzene	2.67e-003	3.66e+001
Toluene	5.11e-003	8.27e+001
Ethylbenzene	8.23e-004	1.53e+001
Xylenes	5.31e-003	9.91e+001
C8+ Heavies	7.83e-002	2.34e+003
Total Components	100.00	3.53e+005

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 2.46e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.36e+004
Water	1.50e+000	2.08e+002
Carbon Dioxide	2.14e-012	2.96e-010
Nitrogen	3.15e-013	4.36e-011
Methane	9.70e-018	1.34e-015

Ethane	1.18e-007	1.63e-005
Propane	5.81e-009	8.03e-007
Isobutane	1.04e-009	1.45e-007
n-Butane	1.76e-009	2.43e-007
Isopentane	1.24e-004	1.71e-002
n-Pentane	1.29e-004	1.78e-002
Cyclopentane	6.70e-005	9.26e-003
n-Hexane	1.35e-004	1.86e-002
Cyclohexane	8.16e-004	1.13e-001
Other Hexanes	3.83e-004	5.30e-002
Heptanes	2.79e-004	3.85e-002
Methylcyclohexane	1.89e-003	2.61e-001
Benzene	1.73e-003	2.39e-001
Toluene	8.99e-003	1.24e+000
Ethylbenzene	2.78e-003	3.85e-001
Xylenes	3.38e-002	4.67e+000
C8+ Heavies	1.47e-002	2.03e+000
Total Components	100.00	1.38e+004

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 2.55e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.55e+001	1.36e+004
Water	2.90e+000	4.14e+002
Carbon Dioxide	2.08e-002	2.96e+000
Nitrogen	3.06e-003	4.37e-001
Methane	2.80e-001	3.99e+001
Ethane	2.43e-001	3.46e+001
Propane	1.38e-001	1.97e+001
Isobutane	3.38e-002	4.82e+000
n-Butane	6.87e-002	9.80e+000
Isopentane	2.41e-002	3.43e+000
n-Pentane	2.50e-002	3.56e+000
Cyclopentane	1.30e-002	1.85e+000

n-Hexane	2.61e-002	3.73e+000
Cyclohexane	2.47e-002	3.53e+000
Other Hexanes	3.72e-002	5.30e+000
Heptanes	5.41e-002	7.71e+000
Methylcyclohexane	4.57e-002	6.52e+000
Benzene	3.36e-002	4.79e+000
Toluene	1.10e-001	1.57e+001
Ethylbenzene	2.59e-002	3.70e+000
Xylenes	2.54e-001	3.61e+001
C8+ Heavies	1.18e-001	1.69e+001
Total Components	100.00	1.43e+004

FLASH TANK OFF GAS STREAM

Temperature: 110.00 deg. F
Pressure: 64.70 psia
Flow Rate: 1.49e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.35e-001	9.53e-002
Carbon Dioxide	9.96e-001	1.72e+000
Nitrogen	3.78e-001	4.15e-001
Methane	6.03e+001	3.79e+001
Ethane	2.44e+001	2.87e+001
Propane	7.86e+000	1.36e+001
Isobutane	1.23e+000	2.80e+000
n-Butane	2.19e+000	4.99e+000
Isopentane	5.61e-001	1.59e+000
n-Pentane	5.09e-001	1.44e+000
Cyclopentane	9.73e-002	2.67e-001
n-Hexane	2.90e-001	9.79e-001
Cyclohexane	8.38e-002	2.76e-001
Other Hexanes	5.05e-001	1.70e+000
Heptanes	2.77e-001	1.09e+000
Methylcyclohexane	1.01e-001	3.88e-001
Benzene	1.70e-002	5.19e-002
Toluene	2.80e-002	1.01e-001
Ethylbenzene	3.05e-003	1.27e-002
Xylenes	1.98e-002	8.24e-002

C8+ Heavies	3.05e-002	2.03e-001
Total Components	100.00	9.84e+001

FLASH TANK GLYCOL STREAM

Temperature: 110.00 deg. F
Flow Rate: 2.52e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.62e+001	1.36e+004
Water	2.92e+000	4.14e+002
Carbon Dioxide	8.79e-003	1.24e+000
Nitrogen	1.54e-004	2.18e-002
Methane	1.45e-002	2.05e+000
Ethane	4.17e-002	5.90e+000
Propane	4.36e-002	6.17e+000
Isobutane	1.43e-002	2.02e+000
n-Butane	3.40e-002	4.81e+000
Isopentane	1.30e-002	1.84e+000
n-Pentane	1.50e-002	2.12e+000
Cyclopentane	1.12e-002	1.59e+000
n-Hexane	1.94e-002	2.75e+000
Cyclohexane	2.30e-002	3.25e+000
Other Hexanes	2.54e-002	3.60e+000
Heptanes	4.68e-002	6.62e+000
Methylcyclohexane	4.33e-002	6.13e+000
Benzene	3.34e-002	4.73e+000
Toluene	1.10e-001	1.56e+001
Ethylbenzene	2.60e-002	3.68e+000
Xylenes	2.55e-001	3.61e+001
C8+ Heavies	1.18e-001	1.67e+001
Total Components	100.00	1.42e+004

FLASH GAS EMISSIONS

Flow Rate: 6.24e+003 scfh
Control Method: Combustion Device
Control Efficiency: 99.50

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.14e+001	1.82e+002
Carbon Dioxide	3.84e+001	2.78e+002
Nitrogen	9.01e-002	4.15e-001
Methane	7.18e-002	1.89e-001
Ethane	2.91e-002	1.44e-001
Propane	9.36e-003	6.79e-002
Isobutane	1.47e-003	1.40e-002
n-Butane	2.61e-003	2.49e-002
Isopentane	6.69e-004	7.93e-003
n-Pentane	6.06e-004	7.19e-003
Cyclopentane	1.16e-004	1.34e-003
n-Hexane	3.45e-004	4.89e-003
Cyclohexane	9.99e-005	1.38e-003
Other Hexanes	6.01e-004	8.52e-003
Heptanes	3.30e-004	5.44e-003
Methylcyclohexane	1.20e-004	1.94e-003
Benzene	2.02e-005	2.60e-004
Toluene	3.34e-005	5.06e-004
Ethylbenzene	3.63e-006	6.34e-005
Xylenes	2.36e-005	4.12e-004
C8+ Heavies	3.63e-005	1.02e-003
Total Components	100.00	4.60e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 4.93e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.81e+001	2.06e+002
Carbon Dioxide	2.18e-001	1.24e+000
Nitrogen	5.99e-003	2.18e-002
Methane	9.83e-001	2.05e+000
Ethane	1.51e+000	5.90e+000
Propane	1.08e+000	6.17e+000

Isobutane	2.67e-001	2.02e+000
n-Butane	6.37e-001	4.81e+000
Isopentane	1.95e-001	1.83e+000
n-Pentane	2.24e-001	2.11e+000
Cyclopentane	1.73e-001	1.58e+000
n-Hexane	2.44e-001	2.73e+000
Cyclohexane	2.87e-001	3.14e+000
Other Hexanes	3.16e-001	3.54e+000
Heptanes	5.05e-001	6.58e+000
Methylcyclohexane	4.60e-001	5.87e+000
Benzene	4.42e-001	4.49e+000
Toluene	1.20e+000	1.44e+001
Ethylbenzene	2.39e-001	3.30e+000
Xylenes	2.27e+000	3.14e+001
C8+ Heavies	6.62e-001	1.47e+001
Total Components	100.00	3.24e+002

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
Pressure: 14.70 psia
Flow Rate: 2.88e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	8.41e+000	1.03e-002
Ethane	1.29e+001	2.95e-002
Propane	9.20e+000	3.08e-002
Isobutane	2.28e+000	1.01e-002
n-Butane	5.44e+000	2.41e-002
Isopentane	1.67e+000	9.13e-003
n-Pentane	1.92e+000	1.05e-002
Cyclopentane	1.48e+000	7.88e-003
n-Hexane	2.08e+000	1.36e-002
Cyclohexane	2.45e+000	1.57e-002
Other Hexanes	2.70e+000	1.77e-002
Heptanes	4.32e+000	3.29e-002
Methylcyclohexane	3.93e+000	2.94e-002
Benzene	3.78e+000	2.25e-002
Toluene	1.03e+001	7.20e-002

Ethylbenzene	2.04e+000	1.65e-002
Xylenes	1.94e+001	1.57e-001
C8+ Heavies	5.66e+000	7.33e-002
Total Components	100.00	5.83e-001

****** End of Application for 45CSR30 Title V Operating Permit ******

Barron, Sarah K <sarah.k.barron@wv.gov>

Ridgeline Compressor Station; Application No. R30-05100261-2024

Barron, Sarah K <sarah.k.barron@wv.gov> Mon, Feb 5, 2024 at 11:24 AM
To: "Steeber, Jeff" <Jeff.Steeber@williams.com>

Hello, Jeff.

While reviewing the initial permit application for the Ridgeline Compressor Station, I noticed that the page with Item 13. Contact Information was missing from the General Information section of the application. Could you send me this form?

Thanks,
- Sarah

--
Sarah Barron
Technical Analyst Trainee
West Virginia Department of Environmental Protection
Division of Air Quality
(304) 926-0499 ext. 41915
sarah.k.barron@wv.gov

Received
February 2, 2024
WV DEP/Div of Air Quality

Division of Air Quality Permit Application Submittal

Please find attached a permit application for:

Appalachia Midstream Services, LLC; Ridgeline Compressor Station
[Company Name; Facility Location]

- DAQ Facility ID (for existing facilities only): **051-00261**
- Current 45CSR13 and 45CSR30 (Title V) permits associated with this process (for existing facilities only): **NSR: R13-3561**

- Type of NSR Application (check all that apply):
  - ☐ Construction
  - ☐ Modification
  - ☐ Class I Administrative Update
  - ☐ Class II Administrative Update
  - ☐ Relocation
  - ☐ Temporary
  - ☐ Permit Determination

- Type of 45CSR30 (TITLE V) Application:
  - ☒ **Title V Initial**
  - ☐ Title V Renewal
  - ☐ Administrative Amendment**
  - ☐ Minor Modification**
  - ☐ Significant Modification**
  - ☐ Off Permit Change

**If the box above is checked, include the Title V revision information as ATTACHMENT S to the combined NSR/Title V application.

- Payment Type:
  - ☐ Credit Card (Instructions to pay by credit card will be sent in the Application Status email.)
  - ☐ Check (Make checks payable to: WVDEP – Division of Air Quality)
    Mail checks to:
    WVDEP – DAQ – Permitting
    Attn: NSR Permitting Secretary
    601 57th Street, SE Charleston, WV 25304

Please wait until DAQ emails you the Facility ID Number and Permit Application Number. Please add these identifiers to your check or cover letter with your check.

- If the permit writer has any questions, please contact (all that apply):
  - ☐ Responsible Official/Authorized Representative
    - Name:
    - Email:
    - Phone Number:
  - ☒ **Company Contact**
    - Name: **Jeff Steeber, Environmental Specialist**
    - Email: **Jeff.Steeber@Williams.com**
    - Phone Number: **(304) 843-3125**
  - ☐ Consultant
    - Name:
    - Email:
    - Phone Number:

Appalachia Midstream Services
Appalachia Midstream Services, LLC
100 Teletech Drive, Suite 2
Moundsville, WV 26041-2352

February 2, 2024

Via e-mail to: DEPAirQualityPermitting@wv.gov
Appalachia Midstream Services, LLC; Ridgeline Compressor Station

Carrie McCumbers
Title V Permits Program Manager
West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street SE
Charleston, WV 25304-2345

Subject: **Application for 45CSR30 Title V Operating Permit**
Appalachia Midstream Services, LLC – Ridgeline Compressor Station
Plant ID No. 051-00261
Marshall County, West Virginia

Dear Ms. McCumbers:

Appalachia Midstream Services, LLC is submitting an Application for a 45CSR30 Title V Operating Permit for the existing Ridgeline Compressor Station located at 249 US-250, Cameron, in Marshall County, West Virginia.

If you have any questions concerning this submittal, or need additional information, please contact me by telephone at (304) 650-4741 or by e-mail at Jeff.Steeber@Williams.com.

Sincerely,

Jeff Steeber

Jeff Steeber
Environmental Specialist

Attachments:
- Facility-Wide Potential to Emit (PTE)
- Title V Operating Permit Application – Checklist

Enclosures:
- Application for Title V Operating Permit
- Attachments A thru H
- Supplements S1 thru S6

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Facility-Wide Potential to Emit (PTE) [Tons per Year]

Unit ID	Point ID	Control ID	Description	NOX	CO	VOC (w/HCHO)	SO2	PM10/2.5	TOTAL HAPs
Ridgeline Compressor Station - Point Sources									
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	19.31	13.17	13.92	0.10	1.63	3.30
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	0.22	1.39	0.46	1E-03	0.02	0.15
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	---	---	9.22	---	---	0.70
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	---	---	2.42	---	---	0.18
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	7.09	3.54	4.78	0.03	0.50	1.47
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	20.36	20.65	2.37	1.16	3.40	0.36
TSS	10E	---	Compressor Turbine Start/Stop	0.10	3.80	1.04	---	---	0.08
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	---	---	3.71	---	---	0.28
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	---	---	0.70	---	---	0.03
DSV-01	13E		Dehydrator 01 - Still Vent	---	---	3.14	---	---	1.59
RBV-01	14E	---	Dehydrator 01 - Reboiler	0.86	0.72	0.05	0.01	0.07	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	---	---	0.78	---	---	0.03
DSV-02	16E		Dehydrator 02 - Still Vent	---	---	2.94	---	---	1.55
RBV-02	17E	---	Dehydrator 02 - Reboiler	0.86	0.72	0.05	0.01	0.07	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	---	---	0.04	---	---	0.01
TK-02	19E	---	Storage Tank 02 - Produced Water	---	---	0.04	---	---	0.01
TK-03	20E	---	Storage Tank 03 - Produced Water	---	---	0.04	---	---	0.01
TK-04	21E	---	Storage Tank 04 - Produced Water	---	---	0.04	---	---	0.01
TLO	22E	---	Truck Load-Out - Produced Water	---	---	1.66	---	---	0.24
PIG	23E	FLR-01 (26E)	Pigging Operations	---	---	0.52	---	---	0.04
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	3.27	10.33	0.18	0.02	0.25	0.06
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	2.88	9.10	0.16	0.02	0.22	0.05
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	2.95	9.34	0.16	0.02	0.22	0.06
			Total Point Sources:	**115.84**	**112.26**	**90.15**	**1.64**	**11.27**	**20.10**
Total Fugitive Sources:									
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	---	---	3.15	---	---	0.24
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	---	---	8.94	---	---	1.29
			Total Facility-Wide:	**---**	**---**	**12.08**	**---**	**---**	**1.53**
Ridgeline Compressor Station - Total PTE									
			Total Facility-Wide:	**115.84**	**112.26**	**102.23**	**1.64**	**11.27**	**21.63**

Important Notes: Title V Operating Permit (TVOP) Applicability:

* Criteria pollutant fugitives are **not included** in TVOP major source determinations because the facility is not a listed source category.
* Hazardous air pollutant (HAP) fugitives are **always included** in TVOP major source determinations.
* Greenhouse gases (GHG) are **not included** in TVOP major source determinations.

1 - Emissions based on 100% of rated load for 8,760 hr/yr, including Compressor Blowdown (CBD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01), each with intermittent operations.
2 - VOC is volatile organic compounds, as defined by EPA, includes HCHO (formaldehyde).
3 - HCHO is formaldehyde and is the individual HAP with the highest PTE.
4 - Total HAP is total hazardous air pollutants, including, but not limited to: acetaldehyde, acrolein, benzene, ethylbenzene, formaldehyde (HCHO), n-hexane, methanol (MeOH), toluene, 2,2,4-trimethylpentane (2,2,4-TMP or i-octane), and xylenes.
5 - CO2e is aggregated Greenhouse Gas (GHG) emissions, comprised of: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), as adjusted for Global Warming Potential (GWP).

TITLE V PERMIT APPLICATION CHECKLIST
FOR ADMINISTRATIVE COMPLETENESS

A complete application is demonstrated when all of the information required below is properly prepared, completed and attached. The items listed below are required information which must be submitted with a Title V permit application. Any submittal will be considered incomplete if the required information is not included.*	
☑	A signed copy of the application ("Certification" page must be signed and dated by a Responsible Official as defined in 45CSR30)
☑	*Table of Contents (needs to be included but not for administrative completeness)
☑	Facility information
☑	Description of process and products, including NAICS and SIC codes, and including alternative operating scenarios
☑	Area map showing plant location
☑	Plot plan showing buildings and process areas
☑	Process flow diagram(s), showing all emission units, control equipment, emission points, and their relationships
☑	Identification of all applicable requirements with a description of the compliance status, the methods used for demonstrating compliance, and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the source is not in compliance
☑	Listing of all active permits and consent orders (if applicable)
☑	Facility-wide emissions summary
☑	Identification of Insignificant Activities
☑	ATTACHMENT D – Title V Equipment Table completed for all emission units at the facility except those designated as insignificant activities
☑	ATTACHMENT E – Emission Unit Form completed for each emission unit listed in the Title V Equipment Table (ATTACHMENT D) and a Schedule of Compliance Form (ATTACHMENT F) for all requirements for which the emission unit is not in compliance
☑	ATTACHMENT G – Air Pollution Control Device Form completed for each control device listed in the Title V Equipment Table (ATTACHMENT D)
☑	ATTACHMENT H – Compliance Assurance Monitoring (CAM) Plan Form completed for each control device for which the "Is the device subject to CAM?" question is answered "Yes" on the Air Pollution Control Device Form (ATTACHMENT G)
☑	General Application Forms signed by a Responsible Official
☐	Confidential Information submitted in accordance with 45CSR31

Application for
45CSR30 Title V Operating Permit

For the:

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Plant ID No. 051-00261

Marshall County, West Virginia

Submitted to:

West Virginia
Department of Environmental Protection
Division of Air Quality

Submitted by:

Appalachia Midstream Services, LLC
100 Teletech Drive, Suite 2
Moundsville, WV 26041-2352

Prepared by:

EcoLogic Environmental Consultants, LLC
864 Windsor Court
Santa Barbara, CA 93111-1037

December 2023

Application for
45CSR30 Title V Operating Permit

Appalachia Midstream Services, LLC
Ridgeline Compressor Station
Plant ID No. 051-00261
Marshall County, West Virginia

Table of Contents

Application for
45CSR30 Title V Operating Permit

- **Section 1. General Information**
- **Section 2. Applicable Requirements**
- **Section 3. Facility-Wide Emissions**
- **Section 4. Insignificant Activities**
- **Section 5. Emission Units, Control Devices, and Emission Points**
- **Section 6. Certification of Information**

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY

601 57th Street SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

INITIAL/RENEWAL TITLE V PERMIT APPLICATION - GENERAL FORMS

Section 1: General Information

1. Name of Applicant (As registered with the WV Secretary of State's Office):

Appalachia Midstream Services, LLC

2. Facility Name or Location:

Ridgeline Compressor Station

3. DAQ Plant ID No.:

0 5 1 - 0 0 2 6 1

4. Federal Employer ID No. (FEIN):

2 6 - 3 6 7 8 9 7 2

5. Permit Application Type:

- ☑ **Initial Permit**
- ☐ Permit Renewal
- ☐ Update to Initial/Renewal Permit Application

When did operations commence? **2021**

What is the expiration date of the existing permit? **na**

6. Type of Business Entity:

☐ Corporation ☐ Government Agency ☑ **LLC**
☐ Partnership ☐ Limited Partnership

7. Is the Applicant the:

☐ Owner ☐ Operator ☑ **Both**

If the Applicant is not both the owner and operator, please provide the name and address of the other party.

na

8. Number of On-site Employees:

Less than ten (10)

9. Governmental Code:

- ☑ **Privately owned and operated; 0**
- ☐ Federally owned and operated; 1
- ☐ State government owned and operated; 2
- ☐ County government owned and operated; 3
- ☐ Municipality government owned and operated; 4
- ☐ District government owned and operated; 5

10. Business Confidentiality Claims

Does this application include confidential information (per 45CSR31)? ☐ Yes ☑ **No**

If yes, identify each segment of information on each page that is submitted as confidential, and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's "*PRECAUTIONARY NOTICE-CLAIMS OF CONFIDENTIALITY*" guidance.

11. Mailing Address		
Street or P.O. Box:		
Appalachia Midstream Services, LLC **100 Teletech Drive, Suite 2**		
City:	**State:**	**Zip:**
Moundsville	**WV**	**26041**
Telephone Number:	**Fax Number:**	
(304) 843-3125	**na**	

12. Facility Location					
Street:		**City:**		**County:**	
249 US-250		**Cameron**		**Marshall**	
UTM Easting:	**537.78 km E**	**UTM Northing:**	**4,403.01 km N**	**Zone:**	☑ **17** ☐ 18

Directions:

From Cameron:

1) Head Southeast on US-250/Maple Ave ~5.1 mi;

2) Destination is on the Left.

Portable Source?	☐ Yes ☑ **No**		
Is facility located w/in a nonattainment area?	☐ Yes ☑ **No**	**If yes, for what air pollutants?**	**na**
Is facility located w/in 50 miles of another state?	☑ **Yes** ☐ No	**If yes, name the affected state(s).**	**Ohio and Pennsylvania**
Is facility located w/in 100 km of a Class I Area[1]?	☐ Yes ☑ **No**	**If yes, name the area(s).**	**na**
If no, do emissions impact a Class I Area[1]?	☐ Yes ☑ **No**		

[1] *Class I areas include Dolly Sods and Otter Creek Wilderness Areas in West Virginia, and Shenandoah National Park James River Face Wilderness Area in Virginia.*

Section 6: Certification of Information

28. Certification of Truth, Accuracy and Completeness and Certification of Compliance

Note: This Certification must be signed by a responsible official as defined in 45CSR§30-2.38.

a. Certification of Truth, Accuracy and Completeness

I certify that I am a responsible official (as defined at 45CSR§30-2.38) and am accordingly authorized to make this submission on behalf of the owners or operators of the source described in this document and its attachments. I certify under penalty of law that I have personally examined and am familiar with the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine and/or imprisonment.

b. Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

Responsible official (type or print)

Name:	**Title:**
T. J. Rinke	**Vice President**

Responsible official's signature:

Signature: DocuSigned by: TJ Rinke DE800755CD4A4F0... Signature Date: 1/25/2024 | 9:36 AM PST

(Must be signed and dated in blue ink or have a valid electronic signature)

Note: Please check all applicable attachments included with this permit application:	
☑	**ATTACHMENT A: Area Map**
☑	**ATTACHMENT B: Plot Plan(s)**
☑	**ATTACHMENT C: Process Flow Diagram(s)**
☑	**ATTACHMENT D: Equipment Table**
☑	**ATTACHMENT E: Emission Unit Form(s)**
☐	ATTACHMENT F: Schedule of Compliance Form(s) **(Not Applicable)**
☑	**ATTACHMENT G: Air Pollution Control Device Form(s)**
☑	**ATTACHMENT H: Compliance Assurance Monitoring (CAM) Form(s)**

All of the required forms and additional information can be found and downloaded from, the DEP website at www.dep.wv.gov/daq, requested by phone (304) 926-0475, and/or obtained through the mail.

14. Facility Description

List all processes, products, NAICS and SIC codes for normal operation, in order of priority. Also list any process, products, NAICS and SIC codes associated with any alternative operating scenarios if different from those listed for normal operation.

Process	Products	NAICS	SIC
Natural Gas Compression	**Compressed and Dehydrated Natural Gas**	**213112***	**1389****
Natural Gas Dehydration			

*** NAICS 213112: Support Activities for Oil and Gas Operations**

**** SIC 1389: Oil and Gas Field Services, Not Elsewhere Classified**

Provide a general description of operations

Appalachia Midstream Services, LLC owns and operates the Ridgeline Compressor Station located at 249 US 250, approximately 3.5 miles South of Cameron in Marshall County, West Virginia.

The facility receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site. There is no on-site storage of condensate liquids.

Please reference SUPPLEMENT 1 – Process Description

15. Provide an **Area Map** showing plant location as **ATTACHMENT A**.

16. Provide a **Plot Plan(s)**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is located as **ATTACHMENT B**. For instructions, refer to "Plot Plan - Guidelines."

17. Provide a detailed **Process Flow Diagram(s)** showing each process or emissions unit as **ATTACHMENT C**. Process Flow Diagrams should show all emission units, control equipment, emission points, and their relationships.

18. Applicable Requirements Summary	
Instructions: Mark all applicable requirements.	
☐ SIP	☐ FIP
☑ **Minor Source NSR (45CSR13)**	☐ PSD (45CSR14)
☐ NESHAP (45CSR34)	☐ Nonattainment NSR (45CSR19)
☑ **Section 111 NSPS (JJJJ, KKKK and OOOOa)**	☑ **Section 112(d) MACT Standard (HH and ZZZZ)**
☐ Section 112(g) Case-by-case MACT	☐ 112(r) RMP
☐ Section 112(i) Early Reduction of HAP	☐ Consumer/Commercial Prod. Reqts., Sect 183(e)
☐ Section 129 Standards/Reqts.	☐ Stratospheric Ozone (Title VI)
☐ Tank Vessel Reqt., Section 183(f)	☐ Emissions Cap 45CSR§30-2.6.2
☐ NAAQS, Increments or Visibility (temp. sources)	☐ 45CSR27 State Enforceable Only Rule (CPU)
☑ **45CSR4 State Enforceable Only Rule (Odors)**	☐ Acid Rain (Title IV, 45CSR33)
☐ Emissions Trading and Banking (45CSR28)	☑ **Compliance Assurance Monitoring (40CFR64)**
☐ CAIR NOx Annual Trading Program (45CSR39)	☐ CAIR NOx Ozone Trading Program (45CSR40)
☐ CAIR SO2 Trading Program (45CSR41)	
<u>Please reference Supplement S2 - Regulatory Discussion</u>	

19. Non Applicability Determinations

List all requirements which the source has determined <u>not applicable</u> and for which a permit shield is requested. The listing shall also include the rule citation and the reason why the shield applies.

<u>Please reference Supplement S2 - Regulatory Discussion</u>

☑ **Permit Shield**

20. Facility-Wide Applicable Requirements

List all <u>facility-wide</u> applicable requirements. For each applicable requirement, include the underlying rule/regulation citation and/or <u>construction permit</u> with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements) .

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

☑ **Permit Shield**

For all <u>facility-wide</u> applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number and/or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

Are you in compliance with all facility-wide applicable requirements? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

21. Active Permits/Consent Orders		
Permit or Consent Order Number	Date of Issuance MM/DD/YYYY	List any Permit Determinations that Affect the Permit (if any)
R13-3561	07/29/2022	na

22. Inactive Permits/Obsolete Permit Conditions		
Permit Number	Date of Issuance	Permit Condition Number
G35-D137A	06/29/2021	na

23. Facility-Wide Emissions Summary [Tons per Year] - Reference SUPPLEMENT 03 – Emission Calculations

Criteria Pollutants	Potential Emissions
Carbon Monoxide (CO)	112.26
Nitrogen Oxides (NOx)	115.84
Lead (Pb)	---
Particulate Matter (PM2.5)[1]	11.27
Particulate Matter (PM10)[1]	11.27
Total Particulate Matter (TSP)	11.27
Sulfur Dioxide (SO2)	1.64
Volatile Organic Compounds (VOC)	102.23
Hazardous Air Pollutants[2]	**Potential Emissions**
Acetaldehyde	2.54
Acrolein	1.56
Benzene	0.43
Butadiene, 1,3-	0.08
Ethylbenzene	0.47
Fornaldehyde (HCHO	9.19
Hexane, n-	2.61
Methanol (MeOH)	0.95
Polycyclic Organic Matter (POM/PAH)	0.12
Toluene	1.17
TMP, 2,2,4- (i-Octane)	0.21
Xylenes	2.18
Other/Trace HAP*	0.11
TOTAL HAPs	21.63
Regulated Pollutants other than Criteria and HAP	**Potential Emissions**
Carbon Dioxide (CO_2)	142,078
Nitrous Oxide (N_2O)	1.23
Methane (CH_4)	574.72
CO_2 equivalent (CO_2e)	156,814

[1] *PM2.5 and PM10 are components of TSP.*

[2] *For HAPs that are also considered PM or VOCs, emissions should be included in both the HAPs section and the Criteria Pollutants section.*

* Other/Trace HAPs include: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

24. Insignificant Activities (Check all that apply)		
☑	1	Air compressors and pneumatically operated equipment, including hand tools.
☑	2	Air contaminant detectors or recorders, combustion controllers or shutoffs.
☑	3	Any consumer product used in the same manner as in normal consumer use, provided the use results in a duration and frequency of exposure which are not greater than those experienced by consumer, and which may include, but not be limited to, personal use items; janitorial cleaning supplies, office supplies and supplies to maintain copying equipment.
☑	4	Bathroom/toilet vent emissions.
☑	5	Batteries and battery charging stations, except at battery manufacturing plants.
☑	6	Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents. Many lab fume hoods or vents might qualify for treatment as insignificant (depending on the applicable SIP) or be grouped together for purposes of description.
☐	7	Blacksmith forges.
☐	8	Boiler water treatment operations, not including cooling towers.
☑	9	Brazing, soldering or welding equipment used as an auxiliary to the principal equipment at the source.
☐	10	CO2 lasers, used only on metals and other materials which do not emit HAP in the process.
☑	11	Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources.
☑	12	Combustion units designed and used exclusively for comfort heating that use liquid petroleum gas or natural gas as fuel.
☑	13	Comfort air conditioning or ventilation systems not used to remove air contaminants generated by or released from specific units of equipment.
☐	14	Demineralized water tanks and demineralizer vents.
☐	15	Drop hammers or hydraulic presses for forging or metalworking.
☐	16	Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substances being processed in the ovens or autoclaves or the boilers delivering the steam.
☐	17	Emergency (backup) electrical generators at residential locations.
☐	18	Emergency road flares.
☑	19	Emission units which do not have any applicable requirements and which emit criteria pollutants (CO, NOx, SO2, VOC and PM) into the atmosphere at a rate of less than 1 pound per hour and less than 10,000 pounds per year aggregate total for each criteria pollutant from all emission units. Please specify all emission units for which this exemption applies along with the quantity of criteria pollutants emitted on an hourly and annual basis **- See next page - Misc Storage Tanks.**
☑	20	Emission units which do not have any applicable requirements and which emit hazardous air pollutants into the atmosphere at a rate of less than 0.1 pounds per hour and less than 1,000 pounds per year aggregate total for all HAPs from all emission sources. This limitation cannot be used for any source which emits dioxin/furans nor for toxic air pollutants as per 45CSR27. Please specify all emission units for which this exemption applies along with the quantity of hazardous air pollutants emitted on an hourly and annual basis **-- See next page - Misc Storage Tanks**

24. Insignificant Activities (Check all that apply) (Continued)						
Emission Unit ID	Misc. Storage Tanks Emission Unit Description	Design Capacity	VOC		HAP	
			lb/hr	lb/yr	lb/hr	lb/yr
TK-05	Storage Tank - Lube Oil	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-06	Storage Tank - Used Oil	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-07	Storage Tank - Coolant	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-08	Storage Tank - Used Coolant	4,200 gal	Negligible	Negligible	Negligible	Negligible
TK-09	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-10	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-11	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-12	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-13	Storage Tank - Methanol Blend	500 gal	Negligible	Negligible	Negligible	Negligible
TK-14	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-15	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-16	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-17	Storage Tank - Engine Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-18	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-19	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-20	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-21	Storage Tank - Compressor Oil	520 gal	Negligible	Negligible	Negligible	Negligible
TK-22	Storage Tank - Triethylene Glycol	1,000 gal	Negligible	Negligible	Negligible	Negligible
TK-23	Storage Tank - Triethylene Glycol	300 gal	Negligible	Negligible	Negligible	Negligible
TK-24	Storage Tank - Defoamer	500 gal	Negligible	Negligible	Negligible	Negligible

☑	21	Environmental chambers not using hazardous air pollutant (HAP) gases.
☑	22	Equipment on the premises of industrial and manufacturing operations used solely for the purpose of preparing food for human consumption.
☐	23	Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment.
☑	24	Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis.
☑	25	Equipment used for surface coating, painting, dipping or spray operations, except those that will emit VOC or HAP.
☑	26	Fire suppression systems.
☐	27	Firefighting equipment and the equipment used to train firefighters.
☐	28	Flares used solely to indicate danger to the public.
☑	29	Fugitive emission related to movement of passenger vehicle provided the emissions are not counted for applicability purposes and any required fugitive dust control plan or its equivalent is submitted.
☐	30	Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation.
☑	31	Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic.
☐	32	Humidity chambers.

24. Insignificant Activities (Check all that apply) (Continued)		
☑	33	Hydraulic and hydrostatic testing equipment.
☑	34	Indoor or outdoor kerosene heaters.
☑	35	Internal combustion engines used for landscaping purposes.
☐	36	Laser trimmers using dust collection to prevent fugitive emissions.
☐	37	Laundry activities, except for dry-cleaning and steam boilers.
☑	38	Natural gas pressure regulator vents, excluding venting at oil and gas production facilities.
☐	39	Oxygen scavenging (de-aeration) of water.
☐	40	Ozone generators.
☑	41	Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification. (Cleaning and painting activities qualify if they are not subject to VOC or HAP control requirements. Asphalt batch plant owners/operators must still get a permit if otherwise requested.)
☑	42	Portable electrical generators that can be moved by hand from one location to another. "Moved by Hand" means that it can be moved without the assistance of any motorized or non-motorized vehicle, conveyance, or device.
☐	43	Process water filtration systems and demineralizers.
☑	44	Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification.
☑	45	Repairs or maintenance where no structural repairs are made and where no new air pollutant emitting facilities are installed or modified.
☑	46	Routing calibration and maintenance of laboratory equipment or other analytical instruments.
☐	47	Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants. Shock chambers.
☐	48	Shock chambers.
☐	49	Solar simulators.
☑	50	Space heaters operating by direct heat transfer.
☑	51	Steam cleaning operations.
☐	52	Steam leaks.
☐	53	Steam sterilizers.
☐	54	Steam vents and safety relief valves.
☑	55	Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized.
☑	56	Storage tanks, vessels, and containers holding or storing liquid substances that will not emit any VOC or HAP. Exemptions for storage tanks containing petroleum liquids or other volatile organic liquids should be based on size limits such as storage tank capacity and vapor pressure of liquids stored and are not appropriate for this list.
☐	57	Such other sources or activities as the Director may determine.
☑	58	Tobacco smoking rooms and areas.
☑	59	Vents from continuous emissions monitors and other analyzers.

25. Equipment Table

Fill out the **Title V Equipment Table** and provide it as **ATTACHMENT D**.

26. Emission Units

For each emission unit listed in the Title V Equipment Table, fill out and provide an **Emission Unit Form** as **ATTACHMENT E**.

For each emission unit not in compliance with an applicable requirement, fill out a **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

27. Control Devices

For each control device listed in the **Title V Equipment Table**, fill out and provide an **Air Pollution Control Device Form** as **ATTACHMENT G**.

For any control device that is required on an emission unit in order to meet a standard or limitation for which the potential pre-control device emissions of an applicable regulated air pollutant is greater than or equal to the Title V Major Source Threshold Level, refer to the **Compliance Assurance Monitoring (CAM) Form(s)** for CAM applicability. Fill out and provide these forms, if applicable, for each Pollutant Specific Emission Unit (PSEU) as **ATTACHMENT H**.

Section 6: Certification of Information

28. Certification of Truth, Accuracy and Completeness and Certification of Compliance
Note: This Certification must be signed by a responsible official as defined in 45CSR§30-2.38.

a. Certification of Truth, Accuracy and Completeness

I certify that I am a responsible official (as defined at 45CSR§30-2.38) and am accordingly authorized to make this submission on behalf of the owners or operators of the source described in this document and its attachments. I certify under penalty of law that I have personally examined and am familiar with the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine and/or imprisonment.

b. Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

Responsible official (type or print)	
Name: T. J. Rinke	**Title:** Vice President

Responsible official's signature:

Signature: ______________________ Signature Date: ______________

(Must be signed and dated in blue ink or have a valid electronic signature)

Note: Please check all applicable attachments included with this permit application:	
☑	**ATTACHMENT A: Area Map**
☑	**ATTACHMENT B: Plot Plan(s)**
☑	**ATTACHMENT C: Process Flow Diagram(s)**
☑	**ATTACHMENT D: Equipment Table**
☑	**ATTACHMENT E: Emission Unit Form(s)**
☐	ATTACHMENT F: Schedule of Compliance Form(s) **(Not Applicable)**
☑	**ATTACHMENT G: Air Pollution Control Device Form(s)**
☑	**ATTACHMENT H: Compliance Assurance Monitoring (CAM) Form(s)**

All of the required forms and additional information can be found and downloaded from, the DEP website at www.dep.wv.gov/daq, requested by phone (304) 926-0475, and/or obtained through the mail.

Attachment A

Area Map

(2016 USGS 7.5 Minute Topo)

“15. Provide an Area Map showing plant location as ATTACHMENT A.”

- **Location:**
  Appalachia Midstream Services, LLC
  Ridgeline Compressor Station
  249 US-250 (~3.5 mi South of Cameron)
  Marshall County, WV 26033

- **Latitude and Longitude:**
  Lat: 39.776224°N x -80.558790°W

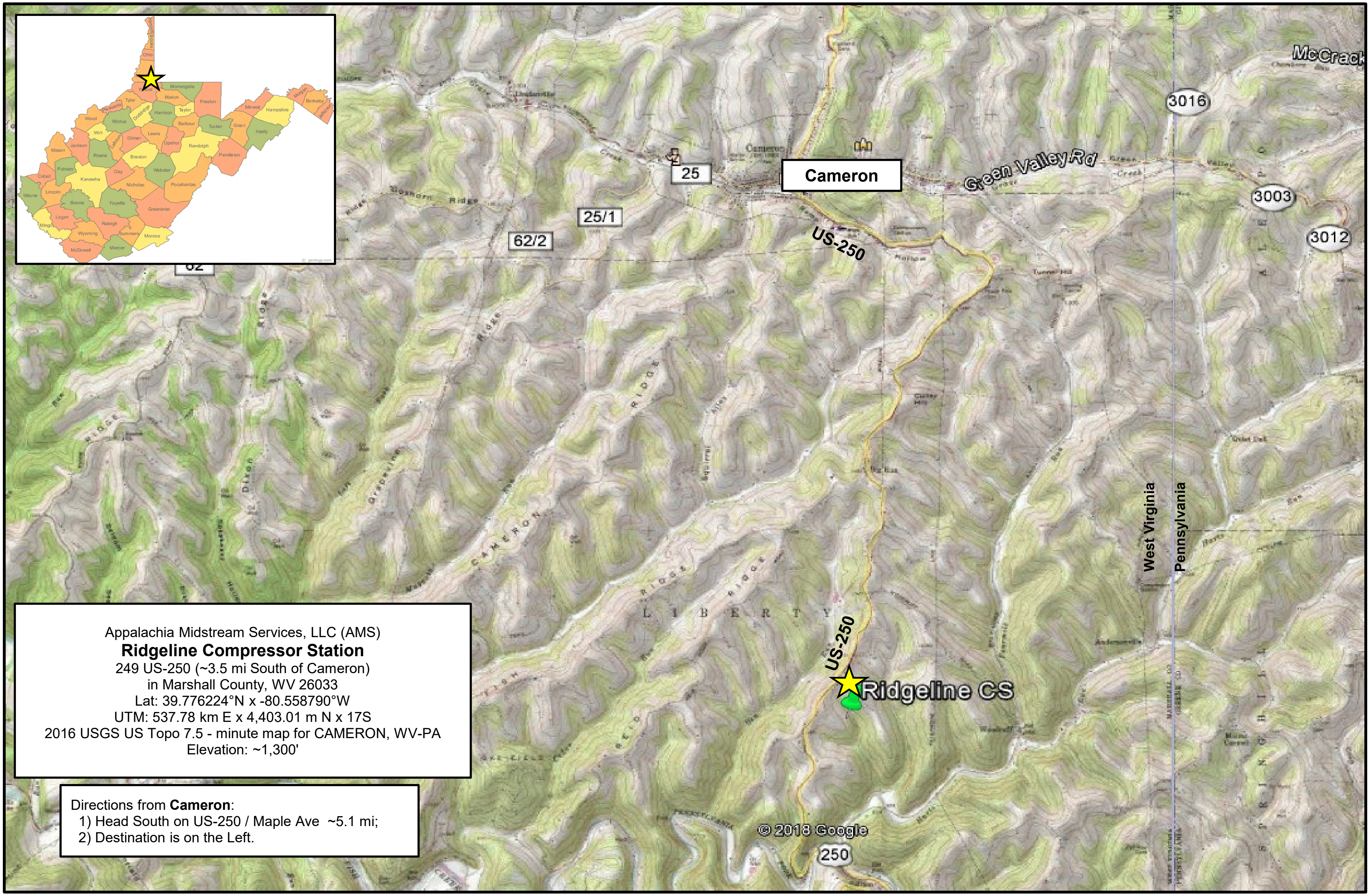
- **UTM:**
  537.78 km E x 4,403.01 m N x 17S

- **Elevation:**
  ~1,300 ft

- **USGS:**
  CAMERON, WV-PA Quadrangle
  7.5" Topographic – 2016

- **Directions:**
  From **Cameron**, West Virginia -
  1) Head South on US-250 / Maple Ave ~5.1 mi;
  2) Destination is on the Left.

Attachment A - Location Map



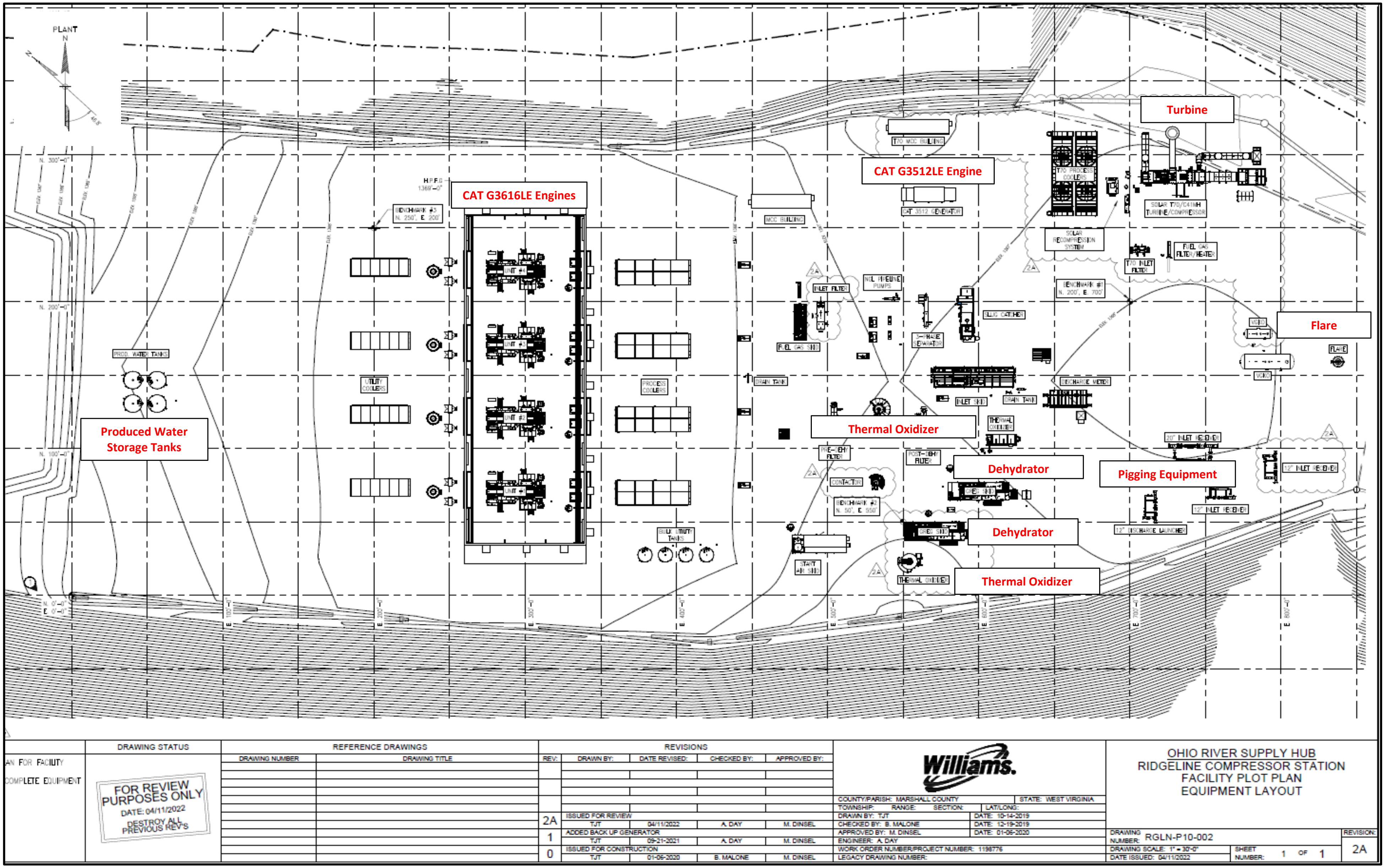
Attachment B

Plot Plan(s)

"16. Provide a Plot Plan(s), e.g., scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is located as ATTACHMENT B. For instructions, refer to Plot Plan - Guidelines."

- **Plot Plan – Ridgeline Compressor Station**

Attachment B - Plot Plan



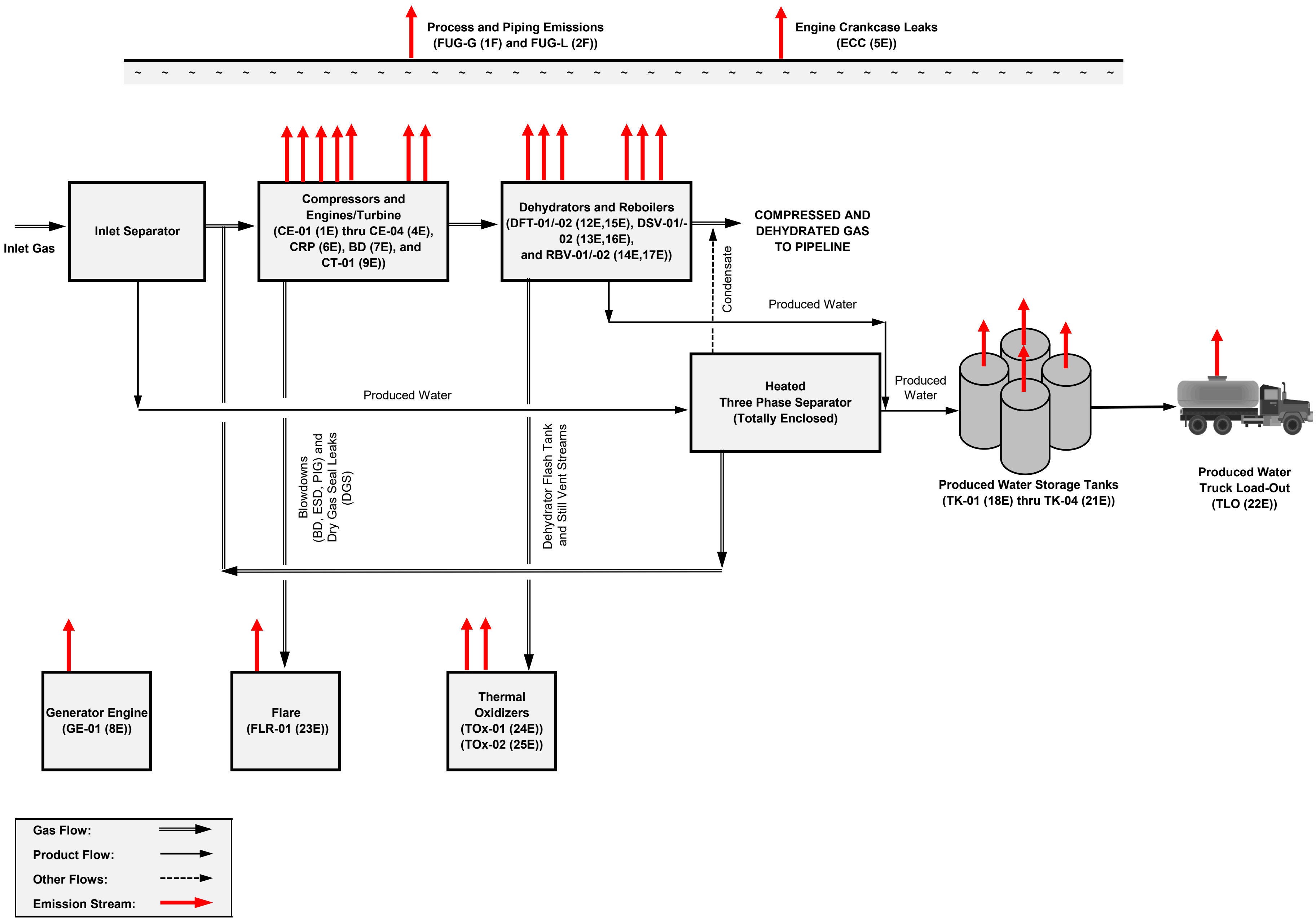
Attachment C

Process Flow Diagram(s) (PFD)

"17. Provide a detailed Process Flow Diagram(s) showing each process or emissions unit as ATTACHMENT C. Process Flow Diagrams should show all emission units, control equipment, emission points, and their relationships."

- **Process Flow Diagram (PFD) – Ridgeline Compressor Station**

Attachment F - Process Flow Diagram (PFD)



Attachment D
Equipment Table

"25. Fill out the Title V Equipment Table and provide it as ATTACHMENT D."

- **Title V Equipment Table – Ridgeline Compressor Station**

Attachment D - Title V Equipment Table

(includes all emission units at the facility except those designated as insignificant activities in Section 4, Item 24 of the General Forms)

Emission Unit ID[1]	Emission Point ID[1]	Emission Unit Description	Year Installed	Design Capacity		Control Device[1]
CE-01	1E	Compressor Engine 01 - CAT G3616LE A4	2021	5,000	bhp	OxCat-01
CE-02	2E	Compressor Engine 02 - CAT G3616LE A4	2021	5,000	bhp	OxCat-02
CE-03	3E	Compressor Engine 03 - CAT G3616LE A4	2021	5,000	bhp	OxCat-03
CE-04	4E	Compressor Engine 04 - CAT G3616LE A4	2021	5,000	bhp	OxCat-04
ECC	5E	Engine Crankcase (CE-01 thru -04, GE-01)	2021	5	Engines	---
CRP	6E	Compressor Rod Packing (Comp-01 thru -04)	2021	4	Compr's	---
BD	7E	Blowdown (CBD and ESD)	2021	6	Compr's	FLR-01 (26E)
GE-01	8E	Generator Engine 01 - CAT G3512LE	2021	1,468	bhp	OxCat-05
CT-01	9E	Compressor Turbine 01 - Solar Taurus 70-10802S	2022	11,252	bhp	---
TSS	10E	Compressor Turbine Start/Stop	2022	104	Events/yr	---
DGS	11E	Centrifugal Compressor Dry Gas Seal Leaks	2022	11,252	bhp	---
DFT-01	12E	Dehydrator 01 - Flash Tank	2021	250	MMscfd	TOx-01 (24E)
DSV-01	13E	Dehydrator 01 - Still Vent	2021	250	MMscfd	
RBV-01	14E	Dehydrator 01 - Reboiler	2021	2.0	MMBtu/hr	---
DFT-02	15E	Dehydrator 02 - Flash Tank	2022	160	MMscfd	TOx-02 (25E)
DSV-02	16E	Dehydrator 02 - Still Vent	2022	160	MMscfd	
RBV-02	17E	Dehydrator 02 - Reboiler	2022	2.0	MMBtu/hr	---
TK-01	18E	Storage Tank 01 - Produced Water	2021	400	bbl	---
TK-02	19E	Storage Tank 02 - Produced Water	2021	400	bbl	---
TK-03	20E	Storage Tank 03 - Produced Water	2021	400	bbl	---
TK-04	21E	Storage Tank 04 - Produced Water	2021	400	bbl	---
TLO	22E	Truck Load-Out - Produced Water	2021	120,000	bbl/yr	---
PIG	23E	Pigging Operations	2021	4	Units	FLR-01 (26E)
TOx-01	24E	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	2021	7.61	MMBtu/hr	---
TOx-02	25E	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	2021	6.70	MMBtu/hr	---
FLR-01	26E	CBD/PIG Elevated Flare - Zeeco MJ-16	2021	7.00	MMBtu/hr	---
FUG-G	1F	Process Piping and Equipment Leaks - Gas	2021	4,981	Fittings	LDAR
FUG-L	2F	Process Piping and Equipment Leaks - Light Oil	2021	2,271	Fittings	

[1]For 45CSR13 permitted sources, the numbering system used for the emission points, control devices, and emission units should be consistent with the numbering system used in the 45CSR13 permit. For grandfathered sources, the numbering system should be consistent with registrations or emissions inventory previously submitted to DAQ. For emission points, control devices, and emissions units which have not been previously labeled, use the following 45CSR13 numbering system: 1S, 2S, 3S,... or other appropriate description for emission units; 1C, 2C, 3C,... or other appropriate designation for control devices; 1E, 2E, 3E, ... or other appropriate designation for emission points.

Attachment E

Emissions Unit Form(s)

"26a. For each emission unit listed in the Title V Equipment Table, fill out and provide an Emission Unit Form as ATTACHMENT E."

- Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions
- Engine Crankcase (ECC (5E)) Emissions
- Compressor Rod Packing (CRP (6E)) Emissions
- Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions
- Generator Engine (GE-01 (8E)) Emissions
- Compressor Turbine (CT-01 (9E)) Emissions
- Compressor Turbine Start/Stop (TSS (10E)) Emissions
- Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E)) Emissions
- Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions
- Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions
- Reboiler 01 and 02 (RBV-01 (14E and 17E)) Emissions
- Produced Water - Storage Tank (TK-01 (18E) thru TK-04 (21E)) Emissions
- Produced Water - Truck Load-Out (TLO (22E)) Emissions
- Pigging Operation (PIG (23E)) Emissions
- DFT-01/DSV-01 Thermal Oxidizer 01 (TOx-01 (24E)) Emissions
- DFT-02/DSV-02 Thermal Oxidizer 02 (TOx-02 (25E)) Emissions
- BD/PIG Elevated Flare (FLR-01 (26E)) Emissions
- Process Piping and Equipment Leak (FUG-G (1F)) Emissions – Gas
- Process Piping and Equipment Leak (FUG-L (2F)) Emissions – Liquid

Attachment E - Emission Unit Form

Emission Unit Description		**CE-01 thru CE-04 (each)**
Emission unit ID number: CE-01 thru CE-04 (each)	**Emission unit name:** Compressor Engine	**List any control devices associated with this emission unit:** OxCat-01 thru OxCat-04
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Natural gas-fueled, 4-stroke, lean-burn, reciprocating internal combustion engine (4SLB-RICE); drives a natural gas reciprocating compressor. Exhaust from combustion of the natural gas fuel in the engine is controlled by an oxidation catalyst.		
Manufacturer: Caterpillar	**Model number:** G3616LE	**Serial number(s):** ZZY0855, ZZY0860, ZZY0862, ZZY0940
Construction date: After 07/01/10	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 5,000 bhp		
Maximum Hourly Throughput: 37.33 MMBtu/hr (fuel)	**Maximum Annual Throughput:** 327,011 MMBtu/yr (fuel)	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___No Natural Gas		**If yes, is it?** ___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating: 5,000 bhp		**Type and Btu/hr rating of burners:** 37.33 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 36,598 scf/hr 320.60 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		CE-01 thru CE-04 (each)
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**3.01**	**13.17**
Nitrogen Oxides (NOX)	**4.41**	**19.31**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.02**	**0.10**
Particulate Matter (PM10)	**0.02**	**0.10**
Total Particulate Matter (TSP)	**0.02**	**0.10**
Sulfur Dioxide (SO2)	**0.37**	**1.63**
Volatile Organic Compounds (VOC)	**3.18**	**13.92**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**0.12**	**0.55**
Acrolein	**0.08**	**0.34**
Benzene	**0.01**	**0.03**
Butadiene, 1,3-	**4E-03**	**0.02**
Ethylbenzene	**6E-04**	**3E-03**
Formaldehyde	**0.46**	**2.03**
Hexane, n-	**0.02**	**0.07**
Methanol	**0.04**	**0.16**
POM/PAH	**0.01**	**0.02**
Toluene	**0.01**	**0.03**
TMP, 2,2,4-	**4E-03**	**0.02**
Xylenes	**3E-03**	**0.01**
Other/Trace HAP	**5E-03**	**0.02**
Total HAP	**0.75**	**3.30**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**4,817**	**21,099**
Methane (CH4) (GWP=25)	**24.91**	**109.12**
Nitrous Oxide (N2O) (GWP=298)	**0.01**	**0.04**
CO2 Equivalent (CO2e)	**5,442**	**23,838**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**CE-01 thru CE-04 (each)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

5.0. Source-Specific Requirements (Compressor Engines, CE-01 to CE-04, Generator Engine (GE-01))

5.1. Limitations and Standards

5.1.1. Maximum emissions from each of the 5,000 bhp natural gas fired reciprocating engines equipped with oxidation catalysts, Caterpillar G3616LE A4 (CE-01 – CE-04) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	4.41	19.31
Carbon Monoxide	3.01	13.17
Volatile Organic Compounds (includes formaldehyde)	3.18	13.92
Formaldehyde	0.46	2.03

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		ECC
Emission unit ID number: ECC	**Emission unit name:** Engine Crankcase (Sum of Five (5) Units)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Internal combustion results in a small but continual amount of blow-by, which occurs when some of the gases from combustion leak past the piston rings to end up inside the crankcase, causing pressure to build up in the crank case. These engine crankcase blow-by gases are vented to the atmosphere.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr (each)
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		ECC
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.32**	**1.39**
Nitrogen Oxides (NOX)	**0.05**	**0.22**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**3E-04**	**1E-03**
Volatile Organic Compounds (VOC)	**0.11**	**0.46**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**4E-03**	**0.02**
Acrolein	**2E-03**	**0.01**
Benzene	**2E-04**	**8E-04**
Butadiene, 1,3-	**1E-04**	**5E-04**
Ethylbenzene	**2E-05**	**8E-05**
Formaldehyde	**0.03**	**0.12**
Hexane, n-	**5E-04**	**2E-03**
Methanol	**1E-03**	**5E-03**
POM/PAH	**2E-04**	**7E-04**
Toluene	**2E-04**	**8E-04**
TMP, 2,2,4-	**1E-04**	**5E-04**
Xylenes	**8E-05**	**3E-04**
Other/Trace HAP	**1E-04**	**6E-04**
Total HAP	**0.04**	**0.15**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**55.88**	**244.77**
Methane (CH4) (GWP=25)	**0.29**	**1.27**
Nitrous Oxide (N2O) (GWP=298)	**1E-04**	**4E-04**
CO2 Equivalent (CO2e)	**63.14**	**276.54**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**ECC**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

There are no applicable requirements specified for this emissions unit.

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**CRP**
Emission unit ID number: CRP	**Emission unit name:** Compressor Rod Packing (Sum of Four (4) Units)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The reciprocating compressor operations result in emissions from the wear of mechanical seals around the piston rods over time. These emissions are generated from the compressors associated with the gas-fired compressor engines (CE-01 through CE-04).		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		CRP
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**2.11**	**9.22**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.01**	**0.02**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.01**	**0.02**
Formaldehyde	---	---
Hexane, n-	**0.11**	**0.48**
Methanol	**0.01**	**0.02**
POM/PAH	---	---
Toluene	**0.01**	**0.06**
TMP, 2,2,4-	**0.01**	**0.02**
Xylenes	**0.01**	**0.06**
Other/Trace HAP	---	---
Total HAP	**0.16**	**0.70**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.05**	**0.21**
Methane (CH4) (GWP=25)	**9.09**	**39.80**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**227.24**	**995**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**CRP**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**BD**
Emission unit ID number: **BD**	**Emission unit name:** **Compressor Blowdown and Emergency Shutdown Testing**	**List any control devices associated with this emission unit:** **na**
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): **When an engine or turbine is shutdown, the natural gas contained within the compressor and associated piping may be evacuated (compressor blowdown, BD). Additionally, there will be other infrequent emissions such as emergency shutdown (ESD) testing.**		
Manufacturer: **na**	**Model number:** **na**	**Serial number(s):** **na**
Construction date: **na**	**Installation date:** **2021-2022**	**Modification date(s):** **na**
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): **na**		
Maximum Hourly Throughput: **na**	**Maximum Annual Throughput:** **na**	**Maximum Operating Schedule:** **8,760 hr/yr**
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ **Yes** _X_**No**		**If yes, is it?** ___ **Indirect** ___ **Direct**
Maximum design heat input and/or maximum horsepower rating: **na**		**Type and Btu/hr rating of burners:** **na**
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. **na**		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**BD**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.55**	**2.42**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**1E-03**	**0.01**
Butadiene, 1,3-	---	---
Ethylbenzene	**1E-03**	**0.01**
Formaldehyde	---	---
Hexane, n-	**0.03**	**0.13**
Methanol	**1E-03**	**0.01**
POM/PAH	---	---
Toluene	**3E-03**	**0.02**
TMP, 2,2,4-	**1E-03**	**0.01**
Xylenes	**3E-03**	**0.02**
Other/Trace HAP	---	---
Total HAP	**0.04**	**0.18**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.62**	**2.70**
Methane (CH4) (GWP=25)	**2.39**	**10.45**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**60.29**	**264**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Mass balance and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**BD**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

11.0. Source-Specific Hazardous Air Pollutant Requirements (CBD, PIG controlled by Elevated Flare, FLR-01)

11.1 Limitations and Standards

11.1.1 The maximum number of compressor blowdown (CBD) events per year shall not exceed 458 events, with an estimated 24,398,000 scf per year. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the compressor blowdown events at any given time during the previous twelve consecutive calendar months.

11.1.3 The maximum number of plant shutdown events per year shall not exceed 1 event, with an estimated 1,002,000 scf per event. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the plant shut downs at any given time during the previous twelve consecutive calendar months. Unscheduled emergency shutdowns shall not be counted as plant shutdown events.

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		GE-01
Emission unit ID number: GE-01	**Emission unit name:** Generator Engine	**List any control devices associated with this emission unit:** OxCat-05
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Natural gas-fueled, 4-stroke, lean-burn, reciprocating internal combustion engine (4SLB-RICE); drives a natural gas reciprocating compressor. Exhaust from combustion of the natural gas fuel in the engine is controlled by an oxidation catalyst.		
Manufacturer: Caterpillar	**Model number:** G3512LE	**Serial number(s):** E2T00222
Construction date: After 07/01/10	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 1,468 bhp		
Maximum Hourly Throughput: 11.38 MMBtu/hr (fuel)	**Maximum Annual Throughput:** 99,677 MMBtu/yr (fuel)	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___No Natural Gas		**If yes, is it?** ___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating: 1,468 bhp		**Type and Btu/hr rating of burners:** 11.38 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 11,156 scf/hr 97.72 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		GE-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.81**	**3.54**
Nitrogen Oxides (NOX)	**1.62**	**7.09**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.01**	**0.03**
Particulate Matter (PM10)	**0.01**	**0.03**
Total Particulate Matter (TSP)	**0.01**	**0.03**
Sulfur Dioxide (SO2)	**0.11**	**0.50**
Volatile Organic Compounds (VOC)	**1.09**	**4.78**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**0.07**	**0.33**
Acrolein	**0.05**	**0.20**
Benzene	**4E-03**	**0.02**
Butadiene, 1,3-	**2E-03**	**0.01**
Ethylbenzene	**4E-04**	**2E-03**
Formaldehyde	**0.16**	**0.71**
Hexane, n-	**0.01**	**0.04**
Methanol	**0.02**	**0.10**
POM/PAH	**3E-03**	**0.01**
Toluene	**4E-03**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**2E-03**	**0.01**
Other/Trace HAP	**3E-03**	**0.01**
Total HAP	**0.33**	**1.47**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**1,589**	**6,960**
Methane (CH4) (GWP=25)	**7.90**	**34.59**
Nitrous Oxide (N2O) (GWP=298)	**3E-03**	**0.01**
CO2 Equivalent (CO2e)	**1,787**	**7,828**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**GE-01**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

5.1.2. Maximum emissions from each of the 1,468 bhp natural gas fired emergency generator equipped with oxidation catalyst, Caterpillar G3512LE (GE-01) shall not exceed the following limits:

Pollutant	**Maximum Hourly Emissions (lb/hr)**	**Maximum Annual Emissions (ton/year)**
Nitrogen Oxides	1.62	7.09
Carbon Monoxide	0.81	3.54
Volatile Organic Compounds (includes formaldehyde)	1.09	4.78

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description **CT-01**

Emission unit ID number:	Emission unit name:	List any control devices associated with this emission unit:
CT-01	Compressor Turbine	na

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

Natural gas-fueled, SoLoNOx turbine drives a natural gas centrifugal compressor. Exhaust from combustion of the natural gas fuel in the turbine is vented to the atmosphere.

Manufacturer:	Model number:	Serial number(s):
Solar Turbines, Inc.	Taurus 70-10802S	0850B
Construction date:	**Installation date:**	**Modification date(s):**
After 07/01/10	2022	na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

11,252 bhp

Maximum Hourly Throughput:	Maximum Annual Throughput:	Maximum Operating Schedule:
83.87 MMBtu/hr (fuel)	734,701 MMBtu/yr (fuel)	8,760 hr/yr

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? _X_ Yes ___No	If yes, is it?
Natural Gas	___ Indirect _X_Direct
Maximum design heat input and/or maximum horsepower rating:	**Type and Btu/hr rating of burners:**
11,252 bhp	83.87 MMBtu/hr

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

Natural gas 82,225 scf/hr 720.30 MMscf/yr

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		CT-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**5.11**	**20.65**
Nitrogen Oxides (NOX)	**5.04**	**20.36**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**0.84**	**3.40**
Particulate Matter (PM10)	**0.84**	**3.40**
Total Particulate Matter (TSP)	**0.84**	**3.40**
Sulfur Dioxide (SO2)	**0.29**	**1.16**
Volatile Organic Compounds (VOC)	**0.59**	**2.37**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**3E-03**	**0.01**
Acrolein	**5E-04**	**2E-03**
Benzene	**8E-05**	**3E-04**
Butadiene, 1,3-	**4E-05**	**1E-04**
Ethylbenzene	**3E-03**	**0.01**
Formaldehyde	**0.06**	**0.24**
Hexane, n-	**---**	**---**
Methanol	**---**	**---**
POM/PAH	**3E-03**	**0.01**
Toluene	**0.01**	**0.04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**5E-03**	**0.02**
Other/Trace HAP	**2E-03**	**0.01**
Total HAP	**0.09**	**0.36**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**9,226**	**37,436**
Methane (CH4) (GWP=25)	**2.94**	**11.91**
Nitrous Oxide (N2O) (GWP=298)	**0.25**	**1.02**
CO2 Equivalent (CO2e)	**9,374**	**38,038**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

NOx, CO, NMNEHC, VOC, and HCHO: Vendor data.
N2O and CO2e: 40CFR98-Subpart C
All other: AP-42

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**CT-01**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

6.0. Source-Specific Requirements (Turbine (CT-01))

6.1. Limitations and Standards

6.1.1. The Solar Taurus 70 Combustion Turbine (CT-01) shall be operated and maintained in accordance with the manufacturer's recommendations and specifications and in a manner consistent with good operating practices and shall only burn natural gas.

6.1.2. The following conditions and requirements are specific to the Solar Taurus 70 Combustion Turbine (CT-01):

Emissions from the combustion turbine (CT-01) shall not exceed the following:

i. Emissions of nitrogen oxides (NO_x) shall be controlled with the combustion controls when ambient temperatures are above 0°F and the load is at or above 50%. The turbine shall not discharge nitrogen oxides (NO_x) emissions in excess of 15 ppm at 15 percent O_2 when operating at load conditions at or above 75 percent of peak load and/or when operating temperatures are at or above 0^0F. When the operating loads of the turbine are less than 75% of peak load and/or operating temperatures are less than 0^0F, NO_x emissions rate from the turbine shall not exceed 150 ppm at 15 percent O_2. Annual NO_x emissions from the turbine shall not exceed 20.46 tpy on a 12-month rolling total. This limit applies at all times, including periods of startup, shutdown, or malfunction.
[40CFR§§60.4320(a), Table 1 to Subpart KKKK of Part 60 – Nitrogen Oxides Emission Limits for New Stationary Combustion Turbines]

ii. Emissions of CO from the combustion turbine shall not exceed 24.45 tons per year on a rolling 12 month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction.

iii. Emissions of SO_2 shall not exceed 0.003 lb of SO_2/MMBtu heat input. For purposes of demonstrating compliance with this limit, the permittee shall maintain the Federal Energy Regulatory Commission (FERC) tariff limit on total sulfur content of 20 grains of sulfur or less per 100 standard cubic feet of natural gas combusted in the turbines.
[40 CFR §§60.4330(a)(2) & 60.4365(a) and 40 CSR §10-]

iv. Emissions of VOC shall not exceed 3.41 tons per year on a rolling 12 month total basis. This limit applies at all times, including periods of startup, shutdown, or malfunction. This limit does not apply to the fugitives from the compressor.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		TSS
Emission unit ID number: TSS	**Emission unit name:** Turbine Startup and Shutdown	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The reciprocating compressor operations result in emissions from the wear of mechanical seals around the piston rods over time. These emissions are generated from the compressors associated with the gas-fired compressor engines (CE-01 through CE-04).		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		TSS
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**0.87**	**3.80**
Nitrogen Oxides (NOX)	**0.02**	**0.10**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.24**	**1.04**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**6E-04**	**3E-03**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**6E-04**	**3E-03**
Formaldehyde	**---**	**---**
Hexane, n-	**0.01**	**0.05**
Methanol	**6E-04**	**3E-03**
POM/PAH	**---**	**---**
Toluene	**1E-03**	**0.01**
TMP, 2,2,4-	**6E-04**	**3E-03**
Xylenes	**1E-03**	**0.01**
Other/Trace HAP	**---**	**---**
Total HAP	**0.02**	**0.08**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**8.03**	**35.15**
Methane (CH4) (GWP=25)	**1.21**	**5.30**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**38.30**	**168**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**TSS**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**DGS**
Emission unit ID number: **DGS**	**Emission unit name:** **Centrifugal Compressor Dry Gas Seal Leaks**	**List any control devices associated with this emission unit:** **na**

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

The centrifugal compressor uses tandem dry seals which vent a small amount of seal gas by design. A vent gas recompression system recovers this gas; however, there will be periods when the recompression system is down for maintenance and other reasons, and the dry gas seal leaks will vent to atmosphere for up to three months per year.

Manufacturer:	**Model number:**	**Serial number(s):**
na	**na**	**na**
Construction date:	**Installation date:**	**Modification date(s):**
na	**2022**	**na**

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

na

Maximum Hourly Throughput:	**Maximum Annual Throughput:**	**Maximum Operating Schedule:**
na	**na**	**8,760 hr/yr**

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? ___ **Yes** _X_**No**	**If yes, is it?** ___ **Indirect** ___ **Direct**
Maximum design heat input and/or maximum horsepower rating: **na**	**Type and Btu/hr rating of burners:** **na**

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

na

Describe each fuel expected to be used during the term of the permit.

Fuel Type	**Max Sulfur Content**	**Max Ash Content**	**BTU Value**
na			

Emission Unit Description		DGS
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.85**	**3.71**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	---	---
Ethylbenzene	**2E-03**	**0.01**
Formaldehyde	---	---
Hexane, n-	**0.04**	**0.19**
Methanol	**2E-03**	**0.01**
POM/PAH	---	---
Toluene	**0.01**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**0.01**	**0.02**
Other/Trace HAP	---	---
Total HAP	**0.06**	**0.28**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.02**	**0.08**
Methane (CH4) (GWP=25)	**3.65**	**16.00**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**91.35**	**400**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Vendor data and engineering judgment

Please reference Supplement S3 - Emission Calculations
Also Supplement S5 - Vendor Data

Emission Unit Description	**DGS**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit?	☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	**(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description			**DEHY-01 (DFT-01 and DSV-01)**
Emission unit ID number: DEHY-01 (DFT-01 and DSV-01)	**Emission unit name:** One 250 MMscfd TEG Dehydrator (DHY-01)		**List any control devices associated with this emission unit:** TOx-01
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): The dehydrator is comprised of a Contactor/Absorber Tower (DSV-01) and a Flash Tank (DFT-01) with emissions controlled 99.5% by a Thermal Oxidizer (TOx-01).			
Manufacturer: na	**Model number:** na		**Serial number(s):** ---
Construction date: na	**Installation date:** 2021		**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 250.0 MMscfd			
Maximum Hourly Throughput: 10.42 MMscf/hr	**Maximum Annual Throughput:** 91,250 MMscf/yr		**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)			
Does this emission unit combust fuel? ___ Yes _X_No			**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na			**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na			
Describe each fuel expected to be used during the term of the permit.			
Fuel Type	**Max Sulfur Content**	**Max Ash Content**	**BTU Value**
na			

Emission Unit Description	DEHY-01 (DFT-01 and DSV-01)	
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.88**	**3.84**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.03**	**0.12**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.02**	**0.09**
Formaldehyde	---	---
Hexane, n-	**0.02**	**0.10**
Methanol	**0.02**	**0.07**
POM/PAH	---	---
Toluene	**0.09**	**0.38**
TMP, 2,2,4-	---	---
Xylenes	**0.20**	**0.86**
Other/Trace HAP	---	---
Total HAP	**0.37**	**1.61**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**3.65**	**15.98**
Methane (CH4) (GWP=25)	**0.42**	**1.82**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**14.03**	**61.46**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

GRI-GLYCalc, Extended Gas Analysis, and Operation Records

Please reference Supplement S3 - Emission Calculations

Also Supplement S6 - Emission Programs

Emission Unit Description	**DEHY-01 (DFT-01 and DSV-01)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.0. Source-Specific Hazardous Air Pollutant Requirements (Natural Gas Dehydration Units DFT-01/DSV01 and DFT02/DSV02 controlled by Thermal Oxidizers TOx-01 – TOx-02)

7.1. Limitations and Standards

7.1.1. Maximum Throughput Limitation. The maximum dry natural gas throughput to each of the glycol dehydration units/still columns shall not exceed the following:

Emission Unit ID#	Emission Point ID#	Emission Unit	Design Capacity
DFT-01/ DSV-01	24E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	250 MMscfd
DFT-02/ DSV-02	25E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	160 MMscfd

Compliance with the Maximum Throughput Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

7.1.2. The permittee shall install the following air pollution control devices to control emissions from the glycol dehydration units:

a. A 7.61 MMBTU/hr thermal oxidizer (TOx-01) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-01) and dehydrator flash tank (DFT-01). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

b. A 6.70 MMBTU/hr thermal oxidizer (TOx-02) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-02) and dehydrator flash tank (DFT-02). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

Emission Unit Description	**DEHY-01 (DFT-01 and DSV-01)**
_X_ Permit Shield	
For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation. (Note: Each requirement listed above must have an associated method of demonstrating compliance. If there is not already a required method in place, then a method must be proposed.)	
Please Reference WVDEP-DAQ Permit R13-3561 (Also SUPPLEMENT S2 – Regulatory Discussion) There are no requested changes	
Are you in compliance with all applicable requirements for this emissions unit? If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	☑ **Yes** ☐ No **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		DEHY-02 (DFT-02 and DSV-02)
Emission unit ID number: DEHY-02 (DFT-02 and DSV-02)	**Emission unit name:** One 160 MMscfd TEG Dehydrator (DHY-02)	**List any control devices associated with this emission unit:** TOx-02

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

The dehydrator is comprised of a Contactor/Absorber Tower (DSV-01) and a Flash Tank (DFT-01) with emissions controlled 99.5% by a Thermal Oxidizer (TOx-01).

Manufacturer:	**Model number:**	**Serial number(s):**
na	na	---
Construction date:	**Installation date:**	**Modification date(s):**
na	2022	na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

160.0 MMscfd

Maximum Hourly Throughput:	**Maximum Annual Throughput:**	**Maximum Operating Schedule:**
6.67 MMscf/hr	58,400 MMscf/yr	8,760 hr/yr

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? ___ Yes _X_No	**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na	**Type and Btu/hr rating of burners:** na

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

na

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**DEHY-02 (DFT-02 and DSV-02)**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.85**	**3.71**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**0.03**	**0.12**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.02**	**0.09**
Formaldehyde	---	---
Hexane, n-	**0.02**	**0.10**
Methanol	**0.02**	**0.07**
POM/PAH	---	---
Toluene	**0.09**	**0.38**
TMP, 2,2,4-	---	---
Xylenes	**0.19**	**0.83**
Other/Trace HAP	---	---
Total HAP	**0.36**	**1.58**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**2.80**	**12.25**
Methane (CH4) (GWP=25)	**0.24**	**1.05**
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	**8.79**	**38.48**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

GRI-GLYCalc, Extended Gas Analysis, and Operation Records

Please reference Supplement S3 - Emission Calculations
Also Supplement S6 - Emission Programs

Emission Unit Description	**DEHY-02 (DFT-02 and DSV-02)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.0. Source-Specific Hazardous Air Pollutant Requirements (Natural Gas Dehydration Units DFT-01/DSV01 and DFT02/DSV02 controlled by Thermal Oxidizers TOx-01 – TOx-02)

7.1. Limitations and Standards

7.1.1. Maximum Throughput Limitation. The maximum dry natural gas throughput to each of the glycol dehydration units/still columns shall not exceed the following:

Emission Unit ID#	Emission Point ID#	Emission Unit	Design Capacity
DFT-01/ DSV-01	24E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	250 MMscfd
DFT-02/ DSV-02	25E	Dehy Still Vent/Flash Tank Controlled by Thermal Oxidizer	160 MMscfd

Compliance with the Maximum Throughput Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the monthly throughput at any given time during the previous twelve consecutive calendar months.

7.1.2. The permittee shall install the following air pollution control devices to control emissions from the glycol dehydration units:

a. A 7.61 MMBTU/hr thermal oxidizer (TOx-01) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-01) and dehydrator flash tank (DFT-01). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

b. A 6.70 MMBTU/hr thermal oxidizer (TOx-02) to control VOC and HAP emissions from the glycol dehydration unit/still vent (DSV-02) and dehydrator flash tank (DFT-02). This thermal oxidizer shall be designed to achieve a minimum guaranteed control efficiency of 99.5% for volatile organic compounds (VOC) and hazardous air pollutants (HAP) emissions.

Emission Unit Description	**DEHY-02 (DFT-02 and DSV-02)**
_X_ Permit Shield	
For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation. **(Note: Each requirement listed above must have an associated method of demonstrating compliance.** **If there is not already a required method in place, then a method must be proposed.)**	
Please Reference WVDEP-DAQ Permit R13-3561 **(Also SUPPLEMENT S2 – Regulatory Discussion)** **There are no requested changes**	
Are you in compliance with all applicable requirements for this emissions unit? If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**.	☑ **Yes** ☐ No **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**RBV-01 and RBV-02**
Emission unit ID number: RBV-01 and RBV-02	**Emission unit name:** Dehydration Unit Reboilers	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): One (1) gas-fueled reboiler is utilized to supply heat to each Dehydrator's Regenerator/Still.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021 & 2022	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 2.00 MMBtu/hr (each)		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr (each)
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 2.00 MMBtu/hr (each)		**Type and Btu/hr rating of burners:** 2.00 MMBtu/hr (each)
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 1,961 scf/hr (each) 17.18 MMscf/yr (each)		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		**RBV-01 and RBV-02**
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**0.16**	**0.72**
Nitrogen Oxides (NOX)	**0.20**	**0.86**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**1E-03**	**0.01**
Particulate Matter (PM10)	**1E-03**	**0.01**
Total Particulate Matter (TSP)	**1E-03**	**0.01**
Sulfur Dioxide (SO2)	**0.01**	**0.07**
Volatile Organic Compounds (VOC)	**0.01**	**0.05**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**4E-06**	**2E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**1E-04**	**6E-04**
Hexane, n-	**4E-03**	**0.02**
Methanol	**---**	**---**
POM/PAH	**1E-06**	**6E-06**
Toluene	**7E-06**	**3E-05**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**2E-06**	**1E-05**
Total HAP	**4E-03**	**0.02**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**235.29**	**1,031**
Methane (CH4) (GWP=25)	**5E-03**	**0.02**
Nitrous Oxide (N2O) (GWP=298)	**4E-03**	**0.02**
CO2 Equivalent (CO2e)	**236.69**	**1,037**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

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Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**RBV-01 and RBV-02**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

10.0. Source-Specific Requirements (Reboilers, Heater Treaters)

10.1. Limitations and Standards

10.1.1. Maximum Design Heat Input. The maximum design heat input (MDHI) shall not exceed the following:

Emission Unit ID#	Emission Unit Description	MDHI (MMBTU/hr)
EURBL-1	Glycol Dehydration Reboiler	1.0
EURBL-2	Glycol Dehydration Reboiler	1.0
EURBL-3	Glycol Dehydration Reboiler	1.0
EUHT-1	Heater Treater	1.0
EUHT-2	Heater Treater	1.0

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**TK-01 thru TK-04 (total)**
Emission unit ID number: **TK-01 thru TK-04 (total)**	**Emission unit name:** **Four (4) Produced Water Storage Tanks**	**List any control devices associated with this emission unit:** **na**
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): **Four (4) 400 bbl storage tanks are used to hold produced water. Gas vapors from these tanks are vented to atmosphere.**		
Manufacturer: **na**	**Model number:** **na**	**Serial number(s):** **na**
Construction date: **na**	**Installation date:** **2021**	**Modification date(s):** **na**
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): **1,600 bbl (Total)**		
Maximum Hourly Throughput: **13.70 bbl/hr (Total)**	**Maximum Annual Throughput:** **120,000 bbl/yr (Total)**	**Maximum Operating Schedule:** **8,760 hr/yr (each)**
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** **___ Indirect ___ Direct**
Maximum design heat input and/or maximum horsepower rating: **na**		**Type and Btu/hr rating of burners:** **na**
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. **na**		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		**TK-01 thru TK-04 (total)**
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.03**	**0.14**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**3E-05**	**1E-04**
Butadiene, 1,3-	---	---
Ethylbenzene	**7E-04**	**3E-03**
Formaldehyde	---	---
Hexane, n-	**2E-03**	**0.01**
Methanol	**2E-05**	**9E-05**
POM/PAH	---	---
Toluene	**3E-04**	**1E-03**
TMP, 2,2,4-	**2E-04**	**1E-03**
Xylenes	**9E-04**	**4E-03**
Other/Trace HAP	---	---
Total HAP	**5E-03**	**0.02**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	---	---
Methane (CH4) (GWP=25)	---	---
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	---	---

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA TANKS 4.0.9(d)

Please reference Supplement S3 - Emission Calculations
also Supplement S6 - Emission Programs

Emission Unit Description	**TK-01 thru TK-04 (total)**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

9.0. Source-Specific Requirements (Produced Water Storage Tanks (TK-01 – TK-04))

9.1. Limitations and Standards

9.1.1. The maximum combined annual throughput of produced water to the storage tanks shall not exceed 5,040,000 gallons per year.

9.1.2. Maximum emissions from the storage tank battery (TK-01 – TK-04) shall not exceed the following limits:

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Volatile Organic Compounds	0.04	0.16

9.1.3. Each Storage Tank (TK-01 – TK-04) thief hatch shall be weighted and properly seated. You must select gasket material for the hatch based on composition of the fluid in the storage vessel and weather conditions.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		TLO
Emission unit ID number: TLO	**Emission unit name:** Produced Water Truck Load-Out	**List any control devices associated with this emission unit:** na

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

Loading of Produced Water into tanker trucks occurs at the facility. Gas vapors from these operations are vented to atmosphere.

Manufacturer:	**Model number:**	**Serial number(s):**
na	na	na
Construction date:	**Installation date:**	**Modification date(s):**
na	2021	na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

na

Maximum Hourly Throughput:	**Maximum Annual Throughput:**	**Maximum Operating Schedule:**
13.70 bbl/hr (Ave)	120,000 bbl/yr	8,760 hr/yr

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? ___ Yes _X_No	**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na	**Type and Btu/hr rating of burners:** na

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

na

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		TLO
Criteria Pollutants	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**0.38**	**1.66**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**3E-04**	**1E-03**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.01**	**0.03**
Formaldehyde	---	---
Hexane, n-	**0.03**	**0.13**
Methanol	**2E-04**	**1E-03**
POM/PAH	---	---
Toluene	**4E-03**	**0.02**
TMP, 2,2,4-	**3E-03**	**0.01**
Xylenes	**0.01**	**0.05**
Other/Trace HAP	---	---
Total HAP	**0.05**	**0.24**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (ave)	**TPY**
Carbon Dioxide (CO2)	---	---
Methane (CH4) (GWP=25)	---	---
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	---	---

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	TLO

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

10.0. Source-Specific Requirements (Truck Loading, TLO)

10.1. Limitations and Standards

10.1.1. The permittee shall install, maintain, and operate all above-ground piping, valves, pumps, etc. that service lines in the transport of potential sources of regulated air pollutants to prevent any substantive fugitive escape of regulated air pollutants. Any above-ground piping, valves, pumps, etc. that shows signs of excess wear and that have a reasonable potential for substantive fugitive emissions of regulated air pollutants shall be replaced.

10.1.2. The maximum quantity of produced water from truck loading (TLO) that shall be loaded shall not exceed 5,040,000 gallons per year. Compliance with the Maximum Yearly Operation Limitation shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the throughput at any given time during the previous twelve consecutive calendar months.

10.1.3. Maximum emissions from the product loadout rack (22E) shall not exceed the following limits:

Pollutant	**Maximum Annual Emissions (ton/year)**
Volatile Organic Compounds	1.66
Total Hazardous Air Pollutants	0.24

10.1.4. The Produced Water Truck Loading shall be operated in accordance with the plans and specifications filed in Permit Application R13-3561.

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)
There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**PIG**
Emission unit ID number: PIG	**Emission unit name:** Pigging Operations Four (4) Pig Traps	**List any control devices associated with this emission unit:** FLR-01
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Emissions from pigging operations result from releases of gas vapor in the pig launcher/receiver for removal of the pig. Gas vapors from the pigging operations are vented to the atmosphere		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** na
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		PIG
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**---**	**---**
Nitrogen Oxides (NOX)	**---**	**---**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.12**	**0.52**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**3E-04**	**1E-03**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**3E-04**	**1E-03**
Formaldehyde	**---**	**---**
Hexane, n-	**0.01**	**0.03**
Methanol	**3E-04**	**1E-03**
POM/PAH	**---**	**---**
Toluene	**7E-04**	**3E-03**
TMP, 2,2,4-	**3E-04**	**1E-03**
Xylenes	**7E-04**	**3E-03**
Other/Trace HAP	**---**	**---**
Total HAP	**0.01**	**0.04**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.13**	**0.58**
Methane (CH4) (GWP=25)	**0.51**	**2.23**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**12.88**	**56.39**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

Mass balance and engineering judgment

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**PIG**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

11.1.2. The maximum number of pigging (PIG) events per year shall not exceed 1,460 events, with an estimated 5,425,000 scf per year. Compliance shall be determined using a twelve month rolling total. A twelve month rolling total shall mean the sum of the pigging events at any given time during the previous twelve consecutive calendar months.

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**TOx-01**
Emission unit ID number: TOx-01	**Emission unit name:** Thermal Oxidizer 01	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Thermal oxidizer used to control emissions from Dehydrator 01		
Manufacturer: Zeeco	**Model number:** Z-HTO	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 7.61 MMBtu/hr		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 7.61 MMBtu/hr		**Type and Btu/hr rating of burners:** 7.61 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 12,576 scf/hr 110.17 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Emission Unit Description		TOx-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.36**	**10.33**
Nitrogen Oxides (NOX)	**0.75**	**3.27**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.06**	**0.25**
Volatile Organic Compounds (VOC)	**0.04**	**0.18**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**2E-05**	**7E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**6E-04**	**2E-03**
Hexane, n-	**0.01**	**0.06**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**3E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**9E-06**	**4E-05**
Total HAP	**0.01**	**0.06**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**894.73**	**3,919**
Methane (CH4) (GWP=25)	**0.02**	**0.08**
Nitrous Oxide (N2O) (GWP=298)	**2E-03**	**0.01**
CO2 Equivalent (CO2e)	**895.66**	**3,923**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	TOx-01

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

7.1.4. Emissions from the thermal oxidizers shall not exceed the following maximum hourly and annual emission limits:

a. Thermal Oxidizer (TOx-01)

Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (ton/year)
Nitrogen Oxides	0.75	3.27
Carbon Monoxide	2.36	10.33
Volatile Organic Compounds	0.92	4.02
Total HAPs	0.38	1.68

7.1.3. The Thermal Oxidizers (TOx-01, TOx-02) shall be designed and operated in accordance with the following:

a. The vapors/overheads from the still vents (DSV-01, DSV-02) and gas from flash tanks in excess of that used for fuel (DFT-01, DFT-02) shall be routed to the thermal oxidizers at all times;

b. The thermal oxidizers shall be operated, with a flame present at all times as determined by the methods specified in permit condition 6.2.1;

c. The thermal oxidizers shall be operated according to the manufacturer's specifications for residence time and minimum combustion chamber temperature;

d. The thermal oxidizers shall be operated at all times when emissions/overheads from the glycol dehydration unit still vents and flash tanks may be vented to it;

e. The thermal oxidizers shall be designed for and operated with no visible emissions as determined by the methods specified in permit condition 6.3.1, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours;

f. The thermal oxidizers are subject to the applicable requirements of 45CSR6.
[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description				TOx-02
Emission unit ID number: TOx-02	**Emission unit name:** Thermal Oxidizer 02		**List any control devices associated with this emission unit:** na	
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Thermal oxidizer used to control emissions from Dehydrator 02				
Manufacturer: Zeeco	**Model number:** Z-VTO		**Serial number(s):** na	
Construction date: na	**Installation date:** 2022		**Modification date(s):** na	
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 6.70 MMBtu/hr				
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na		**Maximum Operating Schedule:** 8,760 hr/yr	
Fuel Usage Data (fill out all applicable fields)				
Does this emission unit combust fuel? _X_ Yes ___ No			**If yes, is it?** ___ Indirect _X_ Direct	
Maximum design heat input and/or maximum horsepower rating: 6.70 MMBtu/hr			**Type and Btu/hr rating of burners:** 6.70 MMBtu/hr	
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 8,904 scf/hr 78.00 MMscf/yr				
Describe each fuel expected to be used during the term of the permit.				
Fuel Type	**Max Sulfur Content**	**Max Ash Content**	**BTU Value**	
Natural gas	<0.01%	negligible	1,020 Btu/scf	

Emission Unit Description		TOx-02
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.08**	**9.10**
Nitrogen Oxides (NOX)	**0.66**	**2.88**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.05**	**0.22**
Volatile Organic Compounds (VOC)	**0.04**	**0.16**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**1E-05**	**6E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**5E-04**	**2E-03**
Hexane, n-	**0.01**	**0.05**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**2E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**8E-06**	**3E-05**
Total HAP	**0.01**	**0.05**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**788.09**	**3,452**
Methane (CH4) (GWP=25)	**0.02**	**0.07**
Nitrous Oxide (N2O) (GWP=298)	**1E-03**	**0.01**
CO2 Equivalent (CO2e)	**788.91**	**3,455**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	**TOx-02**

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

b. Thermal Oxidizer (TOx-02)

Pollutant	**Maximum Hourly Emissions (lb/hr)**	**Maximum Annual Emissions (ton/year)**
Nitrogen Oxides	0.66	2.88
Carbon Monoxide	2.08	9.10
Volatile Organic Compounds	0.89	3.88
Total HAPs	0.37	1.63

7.1.3. The Thermal Oxidizers (TOx-01, TOx-02) shall be designed and operated in accordance with the following:

a. The vapors/overheads from the still vents (DSV-01, DSV-02) and gas from flash tanks in excess of that used for fuel (DFT-01, DFT-02) shall be routed to the thermal oxidizers at all times;

b. The thermal oxidizers shall be operated, with a flame present at all times as determined by the methods specified in permit condition 6.2.1;

c. The thermal oxidizers shall be operated according to the manufacturer's specifications for residence time and minimum combustion chamber temperature;

d. The thermal oxidizers shall be operated at all times when emissions/overheads from the glycol dehydration unit still vents and flash tanks may be vented to it;

e. The thermal oxidizers shall be designed for and operated with no visible emissions as determined by the methods specified in permit condition 6.3.1, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours;

f. The thermal oxidizers are subject to the applicable requirements of 45CSR6.

[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		**FLR-01**
Emission unit ID number: FLR-01	**Emission unit name:** Flare 01	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Flare used to control emissions from blowdowns and pigging operations.		
Manufacturer: Zeeco	**Model number:** MJ-16	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): 7.00 MMBtu/hr		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? _X_ Yes ___ No		**If yes, is it?** ___ Indirect _X_ Direct
Maximum design heat input and/or maximum horsepower rating: 7.00 MMBtu/hr		**Type and Btu/hr rating of burners:** 7.00 MMBtu/hr
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. Natural gas 5,663 scf/hr 49.60 MMscf/yr		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
Natural gas	<0.01%	negligible	1,020 Btu/scf

Attachment E - Emission Unit Form (Continued)

Emission Unit Description		FLR-01
Criteria Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Monoxide (CO)	**2.13**	**9.34**
Nitrogen Oxides (NOX)	**0.67**	**2.95**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**4E-03**	**0.02**
Particulate Matter (PM10)	**4E-03**	**0.02**
Total Particulate Matter (TSP)	**4E-03**	**0.02**
Sulfur Dioxide (SO2)	**0.05**	**0.22**
Volatile Organic Compounds (VOC)	**0.04**	**0.16**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**1E-05**	**6E-05**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**---**	**---**
Formaldehyde	**5E-04**	**2E-03**
Hexane, n-	**0.01**	**0.05**
Methanol	**---**	**---**
POM/PAH	**5E-06**	**2E-05**
Toluene	**2E-05**	**1E-04**
TMP, 2,2,4-	**---**	**---**
Xylenes	**---**	**---**
Other/Trace HAP	**8E-06**	**4E-05**
Total HAP	**0.01**	**0.06**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH (each)	**TPY (each)**
Carbon Dioxide (CO2)	**808.87**	**3,543**
Methane (CH4) (GWP=25)	**0.02**	**0.07**
Nitrous Oxide (N2O) (GWP=298)	**2E-03**	**0.01**
CO2 Equivalent (CO2e)	**809.71**	**3,547**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

AP-42

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	FLR-01

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

11.1.4. The waste gas from the compressor blowdowns, CBD, and pigging, PIG, shall be controlled at all times by the elevated flare, FLR-01. The flare shall have a design capacity of 7.0 MMBtu/hr. This flare shall be designed to achieve a minimum guaranteed control efficiency of 98% for volatile organic compound (VOC) and hazardous air pollutants (HAP) emissions

11.1.5. Maximum emissions from the elevated flare (FLR-01) shall not exceed the following limits:

Pollutant	**Maximum Annual Emissions (ton/year)**
Nitrogen Oxides	2.95
Carbon Monoxide	9.34
Volatile Organic Compounds	3.10

11.1.6. *Operation and Maintenance of Flare (FLR-01).* The permittee shall, to the extent practicable, install, maintain, and operate the flare and associated monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions, or comply with any more stringent limits set forth in this permit or as set forth by any State rule, Federal regulation, or alternative control plan approved by the Secretary.
[45CSR§13-5.10.]

11.1.7 The quantity of waste gas that shall be consumed in the flare shall not exceed 49.60 MMscf per year. Compliance with the gas throughput limit shall be demonstrated using a rolling 12-month total.
[45CSR§13-5.10.]

11.1.8. The flare (FLR-01) is subject to the opacity requirements in 45CSR6.

11.1.9. The flare (FLR-01) shall be operated with a pilot flame present at all times whenever emissions may be vented.
[45CSR§13-5.10.]

11.1.10. The flare (FLR-01) installed shall be operated and designed in accordance with the information filed in permit application R13-3561.
[45CSR§13-5.10.]

11.1.11. The permittee shall comply with the requirements of Section 2.12 of this permit during emergency operation of the flare (FLR-01).
[45CSR§13-5.10.]

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		FUG-G
Emission unit ID number: FUG-G	**Emission unit name:** Process Piping and Equipment Leaks – Gas (FUG-G)	**List any control devices associated with this emission unit:** na
Provide a description of the emissions unit (type. Method of operation, design parameters, etc.): Process Piping and Equipment leaks includes each pump, pressure relief device, open-ended valve or line, valve, and flange or other connector that is in VOC service or in wet gas service.		
Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na
Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp): na		
Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr
Fuel Usage Data (fill out all applicable fields)		
Does this emission unit combust fuel? ___ Yes _X_No		**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na		**Type and Btu/hr rating of burners:** na
List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each. na		
Describe each fuel expected to be used during the term of the permit.		

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		FUG-G
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	**---**	**---**
Nitrogen Oxides (NOX)	**---**	**---**
Lead (Pb)	**---**	**---**
Particulate Matter (PM2.5)	**---**	**---**
Particulate Matter (PM10)	**---**	**---**
Total Particulate Matter (TSP)	**---**	**---**
Sulfur Dioxide (SO2)	**---**	**---**
Volatile Organic Compounds (VOC)	**0.72**	**3.15**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	**---**	**---**
Acrolein	**---**	**---**
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	**---**	**---**
Ethylbenzene	**2E-03**	**0.01**
Formaldehyde	**---**	**---**
Hexane, n-	**0.04**	**0.16**
Methanol	**---**	**0.01**
POM/PAH	**---**	**---**
Toluene	**5E-03**	**0.02**
TMP, 2,2,4-	**2E-03**	**0.01**
Xylenes	**5E-03**	**0.02**
Other/Trace HAP	**---**	**---**
Total HAP	**0.05**	**0.24**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	**0.02**	**0.07**
Methane (CH4) (GWP=25)	**3.10**	**13.58**
Nitrous Oxide (N2O) (GWP=298)	**---**	**---**
CO2 Equivalent (CO2e)	**77.50**	**339.46**

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA Emission Factors

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	FUG-G

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

14.0 Source-Specific Requirements (40CFR60 Subpart OOOOa Requirements Fugitive Emissions)

14.1 Limitations and Standards

14.1.1. The permittee shall comply with the applicable fugitive emission requirements specified in 40 CFR Part 60, Subpart OOOOa.

_X_ Permit Shield

For all applicable requirements listed above, provide <u>monitoring/testing/recordkeeping/reporting</u> which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No

If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment E - Emission Unit Form

Emission Unit Description		FUG-L
Emission unit ID number: FUG-L	**Emission unit name:** Process Piping and Equipment Leaks – Liquid (FUG-L)	**List any control devices associated with this emission unit:** na

Provide a description of the emissions unit (type. Method of operation, design parameters, etc.):

Process Piping and Equipment leaks includes each pump, pressure relief device, open-ended valve or line, valve, and flange or other connector that is in VOC service or in wet gas service.

Manufacturer: na	**Model number:** na	**Serial number(s):** na
Construction date: na	**Installation date:** 2021	**Modification date(s):** na

Design Capacity (examples: furnaces - tons/hr, tanks – gallons, boilers – MMBtu/hr, engines - hp):

na

Maximum Hourly Throughput: na	**Maximum Annual Throughput:** na	**Maximum Operating Schedule:** 8,760 hr/yr

Fuel Usage Data (fill out all applicable fields)

Does this emission unit combust fuel? ___ Yes _X_No	**If yes, is it?** ___ Indirect ___ Direct
Maximum design heat input and/or maximum horsepower rating: na	**Type and Btu/hr rating of burners:** na

List the primary fuel type(s) and if applicable, the secondary fuel type(s). For each fuel type listed, provide the maximum hourly and annual fuel usage for each.

na

Describe each fuel expected to be used during the term of the permit.

Fuel Type	Max Sulfur Content	Max Ash Content	BTU Value
na			

Emission Unit Description		FUG-L
Criteria Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Monoxide (CO)	---	---
Nitrogen Oxides (NOX)	---	---
Lead (Pb)	---	---
Particulate Matter (PM2.5)	---	---
Particulate Matter (PM10)	---	---
Total Particulate Matter (TSP)	---	---
Sulfur Dioxide (SO2)	---	---
Volatile Organic Compounds (VOC)	**2.04**	**8.94**
Hazardous Air Pollutants	**Pollutant Emissions**	
	PPH	**TPY**
Acetaldehyde	---	---
Acrolein	---	---
Benzene	**2E-03**	**0.01**
Butadiene, 1,3-	---	---
Ethylbenzene	**0.04**	**0.19**
Formaldehyde	---	---
Hexane, n-	**0.16**	**0.69**
Methanol	**1E-03**	**0.01**
POM/PAH	---	---
Toluene	**0.02**	**0.09**
TMP, 2,2,4-	**0.01**	**0.06**
Xylenes	**0.06**	**0.24**
Other/Trace HAP	---	---
Total HAP	**0.29**	**1.29**
Regulated Pollutants other than Criteria and HAP	**Pollutant Emissions**	
	PPH	**TPY**
Carbon Dioxide (CO2)	---	---
Methane (CH4) (GWP=25)	---	---
Nitrous Oxide (N2O) (GWP=298)	---	---
CO2 Equivalent (CO2e)	---	---

List the method(s) used to calculate the potential emissions (include dates of any stack tests conducted, versions of software used, source and dates of emission factors, etc.).

EPA Emission Factors

Please reference Supplement S3 - Emission Calculations

Emission Unit Description	FUG-L

List all applicable requirements for this emission unit. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number.
(Note: Title V permit condition numbers alone are not the underlying applicable requirements).
If an emission limit is calculated based on the type of source and design capacity or if a standard is based on a design parameter, this information should also be included.

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

14.0. Source-Specific Requirements (40CFR60 Subpart OOOOa Requirements, Fugitive Emission Components)

14.1. Limitations and Standards

14.1.1. For each affected facility under §60.5365a(j), you must reduce GHG (in the form of a limitation on emissions of methane) and VOC emissions by complying with the requirements of paragraphs (a) through (j) of this section. These requirements are independent of the closed vent system and cover requirements in §60.5411a.

_X_ Permit Shield

For all applicable requirements listed above, provide monitoring/testing/recordkeeping/reporting which shall be used to demonstrate compliance. If the method is based on a permit or rule, include the condition number or citation.
(Note: Each requirement listed above must have an associated method of demonstrating compliance.
If there is not already a required method in place, then a method must be proposed.)

Please Reference WVDEP-DAQ Permit R13-3561
(Also SUPPLEMENT S2 – Regulatory Discussion)

There are no requested changes

Are you in compliance with all applicable requirements for this emissions unit? ☑ **Yes** ☐ No
If no, complete the **Schedule of Compliance Form** as **ATTACHMENT F**. **(Not Applicable)**

Attachment F
Schedule of Compliance
(Not Applicable)

"26b. For each emission unit not in compliance with an applicable requirement, fill out a Schedule of Compliance Form as ATTACHMENT F."

- **Schedule of Compliance Form – Not Applicable**

Attachment F

NOT APPLICABLE

Schedule of Compliance Form

ATTACHMENT F - Schedule of Compliance Form	
Complete this section if you indicated noncompliance with any of the applicable requirements identified in the permit application. For each emission unit which is not in compliance, identify the applicable requirement, the reason(s) for noncompliance, a description of how the source will achieve compliance, and a detailed schedule of compliance. If there is a consent order that applies to this requirement, attach a copy to this form.	
1. Applicable Requirement	
Unit(s):	**Applicable Requirement:**
2. Reason for Noncompliance:	
3. How will Compliance be Achieved?	
4. Consent Order Number (if applicable):	
5. **Schedule of Compliance.** Provide a schedule of remedial measures, including an enforceable sequence of actions with milestones, leading to compliance, including a date for final compliance.	
Remedial Measure or Action	Date to be Achieved
6. Submittal of Progress Reports.	
Content of Progress Report:	**Report starting date:** ______ MM/DD/YYYY **Submittal frequency:**

Attachment G

Air Pollution Control Device Forms

"27a. For each control device listed in the Title V Equipment Table, fill out and provide an Air Pollution Control Device Form as ATTACHMENT G."

- **Oxidation Catalyst (OxCat-01 thru OxCat-04) (Serves CE-01 thru CE-04)**
- **Oxidation Catalyst (OxCat-05) (Serves GE-01)**
- **Dehydrator Thermal Oxidizer 01 (TOx-01) (Serves DHY-01)**
- **Dehydrator Thermal Oxidizer 02 (TOx-02) (Serves DHY-02)**
- **Flare 01 (FLR-01) (Serves BD and PIG)**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Oxidation Catalyst**
Control device ID number:	**List all emission units associated with this control device.**	
OxCat-01 thru OxCat-04	**CE-01 thru CE-04**	
Manufacturer:	**Model Number:**	**Installation Date:**
Catalytic Combustion	**REMB-3615F-D-15HF-HFX4**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	___ Flare	_X_ **Other: Oxidation Catalyst**
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutant	Capture Efficiency	Control Efficiency
NOx	100%	---
CO	100%	89.0%
VOC	100%	65.1%
HCHO	100%	80.0%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Design Flow Rate: **30,842 acf/min** **823 ^{o}F**

Is this device subject to the CAM requirements of 40 C.F.R. 64? ___ **Yes** _X_ **No**

If Yes, Complete Attachment H

If No, Provide justification: **Subject to NSPS JJJJ**

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

Supplement S3 - Emission Calculations and Supplement S5 Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Oxidation Catalyst**
Control device ID number:	**List all emission units associated with this control device.**	
OxCat-05	**GE-01**	
Manufacturer:	**Model Number:**	**Installation Date:**
Miratech	**SP-ZCSS-30-TBD-HSG-0**	**2022**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	___ Flare	_X_ **Other: Oxidation Catalyst**
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutant	Capture Efficiency	Control Efficiency
NOx	100%	---
CO	100%	87.0%
VOC	100%	49.5%
HCHO	100%	83.3%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Design Flow Rate: **9,156 acf/min** **959 ^{o}F**

Is this device subject to the CAM requirements of 40 C.F.R. 64? ___ **Yes** _X_ **No**

If Yes, Complete Attachment H

If No, Provide justification: Pre-control emissions less than 100 TPY

Supplement S3 - Emission Calculations
and Supplement S5 Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

Supplement S3 - Emission Calculations
and Supplement S5 Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Thermal Oxidizer**
Control device ID number:	**List all emission units associated with this control device.**	
TOx-01	**DHY-01 (DFT-01 and DSV-01)**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**Z-HTO**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
_X_ **Thermal Incinerator**	___ Flare	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	Capture Efficiency	Control Efficiency
Volatile Organic Compounds	100%	99.5%
V-HAP	100%	99.5%
Methane	100%	99.5%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: **Emission source does not utilize a control device**

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Thermal Oxidizer**
Control device ID number:	**List all emission units associated with this control device.**	
TOx-02	**DHY-02 (DFT-02 and DSV-02)**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**Z-VTO**	**2022**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
_X_ Thermal Incinerator	___ Flare	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	**Capture Efficiency**	**Control Efficiency**
Volatile Organic Compounds	**100%**	**99.5%**
V-HAP	**100%**	**99.5%**
Methane	**100%**	**99.5%**

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: Emission source does not utilize a control device

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Describe the parameters monitored and/or methods used to indicate performance of this control device.

See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.

Attachment G

Air Pollution Control Device Form

Emission Unit Description		**Flare**
Control device ID number:	**List all emission units associated with this control device.**	
FLR-01	**BD and PIG**	
Manufacturer:	**Model Number:**	**Installation Date:**
Zeeco	**MJ-16**	**2021**

Type of Air Pollution Control Device:

___ Baghouse/Fabric Filter	___ Venturi Scrubber	___ Multicyclone
___ Carbon Bed Adsorber	___ Packed Tower Scrubber	___ Single Cyclone
___ Carbon Drum(s)	___ Other Wet Scrubber	___ Cyclone Bank
___ Catalytic Incinerator	___ Condenser	___ Settling Chamber
___ Thermal Incinerator	_X_ **Flare**	___ Other:
___ Wet Plate Electrostatic Precipitator	___ Dry Plate Electrostatic Precipitator	

List the pollutants for which this device is intended to control and the capture and control efficiencies.

Pollutants	Capture Efficiency	Control Efficiency
Volatile Organic Compounds	100%	98.0%
V-HAP	100%	98.0%
Methane	100%	98.0%

Explain the characteristic design parameters of this control device (flow rates, pressure drops, number of bags, size, temperatures, etc.).

Is this device subject to the CAM requirements of 40 C.F.R. 64? __ Yes _X_ No

If Yes, Complete Attachment H

If No, Provide justification: **Emission source does not utilize a control device**

**See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.**

Describe the parameters monitored and/or methods used to indicate performance of this control device.

**See Attachment H - Compliance Assurance Monitoring (CAM),
Supplement S3 - Emission Calculations, and
Supplement S5 - Vendor Data.**

Attachment H

Compliance Assurance Monitoring (CAM) Forms

“27b. For any control device that is required on an emission unit in order to meet a standard or limitation for which the potential pre-control device emissions of an applicable regulated air pollutant is greater than or equal to the Title V Major Source Threshold Level, refer to the Compliance Assurance Monitoring (CAM) Form(s) for CAM applicability. Fill out and provide these forms, if applicable, for each Pollutant Specific Emission Unit (PSEU) as ATTACHMENT H.”

Attachment H

ATTACHMENT H - Compliance Assurance Monitoring (CAM) Plan Form

For definitions and information about the CAM rule, please refer to 40 CFR Part 64. Additional information (including guidance documents) may also be found at http://www.epa.gov/ttn/emc/cam.html

CAM APPLICABILITY DETERMINATION
1) Does the facility have a PSEU (Pollutant-Specific Emissions Unit considered separately with respect to **EACH** regulated air pollutant) that is subject to CAM (40 CFR Part 64), which must be addressed in this CAM plan submittal? To determine applicability, a PSEU must meet **all** of the following criteria (*If No, then the remainder of this form need not be completed*): ☐ YES ☒ NO Per § 64.5(b), CAM plan is due with renewal application. a. The PSEU is located at a major source that is required to obtain a Title V permit; b. The PSEU is subject to an emission limitation or standard for the applicable regulated air pollutant that is NOT exempt; LIST OF EXEMPT EMISSION LIMITATIONS OR STANDARDS: • NSPS (40 CFR Part 60) or NESHAP (40 CFR Parts 61 and 63) proposed after 11/15/1990. • Stratospheric Ozone Protection Requirements. • Acid Rain Program Requirements. • Emission Limitations or Standards for which a WVDEP Division of Air Quality Title V permit specifies a continuous compliance determination method, as defined in 40 CFR §64.1. • An emission cap that meets the requirements specified in 40 CFR §70.4(b)(12). c. The PSEU uses an add-on control device (as defined in 40 CFR §64.1) to achieve compliance with an emission limitation or standard; d. The PSEU has potential pre-control device emissions of the applicable regulated air pollutant that are equal to or greater than the Title V Major Source Threshold Levels; AND e. The PSEU is NOT an exempt backup utility power emissions unit that is municipally-owned.

BASIS OF CAM SUBMITTAL
2) Mark the appropriate box below as to why this CAM plan is being submitted as part of an application for a Title V permit:
☐ RENEWAL APPLICATION. **ALL** PSEUs for which a CAM plan has NOT yet been approved need to be addressed in this CAM plan submittal.
☐ INITIAL APPLICATION (submitted after 4/20/98). **ONLY** large PSEUs (i. e., PSEUs with potential post-control device emissions of an applicable regulated air pollutant that are equal to or greater than Major Source Threshold Levels) need to be addressed in this CAM plan submittal.
☐ SIGNIFICANT MODIFICATION TO LARGE PSEUs. **ONLY** large PSEUs being modified after 4/20/98 need to be addressed in this cam plan submittal. For large PSEUs with an approved CAM plan, Only address the appropriate monitoring requirements affected by the significant modification.

Supplement S1
Process Description

"14. Provide a general description of operations."

- **Process Description**

Appalachia Midstream Services, LLC
Ridgeline Compressor Station
Application for Title V Operating Permit

Supplement S1

Process Description

<u>Project Overview</u>

Appalachia Midstream Services, LLC (AMS) is submitting an application for 45CSR30 Title V Operating Permit for the existing Ridgeline Compressor Station located at 249 US 250, approximately 3.5 miles South of Cameron in Marshall County, West Virginia. (See Attachment B – Area Map). The facility receives natural gas from local production wells then compresses and dehydrates the gas for delivery to a gathering pipeline. Condensate is removed from the gas and pumped off-site. There is no on-site storage of condensate liquids.

<u>Compressor Engines (CE-01 (1E) thru CE-04 (4E))</u>

Four (4) natural gas-fueled reciprocating engines are utilized at the facility. These engines drive a natural gas compressor to increase the pressure of the natural gas. Emissions result from the combustion of natural gas fuel.

<u>Engine Crankcase Emissions (ECC (5E))</u>

Internal combustion results in a small but continual amount of blow-by, which occurs when some of the gases from combustion leak past the piston rings (that is, blow-by them) to end up inside the crankcase, causing pressure to build up in the crank case. These blow-by gases are vented to the atmosphere.

<u>Compressor Rod Packing Leaks (CRP (6E))</u>

The reciprocating compressors driven by the Caterpillar G3616LE engines result in emissions from the wear of mechanical seals around the piston rods over time. The reciprocating compressor associated with Solar’s vent recompression system has its rod packing leaks circulated to the suction inlet through an integral line resulting in no leaks to the atmosphere.

<u>Blowdown (BD (7E))</u>

As part of facility operation, the compressor engines undergo periods of startup and shutdown. When an engine is shutdown, the natural gas contained within the compressor and associated piping must be evacuated (compressor blowdown (CBD). Additionally, there are other infrequent emissions from various maintenance activities at the facility that are not associated with compressor blowdowns, such as emergency shutdown (ESD) testing. Gas vapor from these blowdown operations are routed to a Flare (FLR-01) for 98% CH_4, VOC, and HAP destruction.

<u>Generator Engine (GE-01 (8E))</u>

One (1) natural gas-fueled generator engine is utilized to provide electrical power to the facility.

Compressor Turbine (CT-01 (9E))

One (1) natural gas-fueled stationary combustion turbine is utilized at the facility. The turbine drives a natural gas compressor to increase the pressure of the natural gas. Emissions result from the combustion of natural gas fuel.

Compressor Turbine Start/Stop (TSS (10E))

During startup and shutdown of the stationary combustion turbine, there are short periods of time when the turbine operates in non-SoLoNOx mode. Operation during non-SoLoNOx mode results in elevated emissions.

Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E))

The centrifugal compressor uses tandem dry seals which vent a small amount of seal gas by design. A vent gas recompression system recovers this gas with 100% collection efficiency. There are periods when the recompression system is down for maintenance and other reasons, and it is assumed the dry gas seal leaks vent to atmosphere for up to three months per year.

Tri-Ethylene Glycol (TEG) Dehydrators (DFT-01/-02 (12E,15E) and DSV-01/-02 (13E,16E)

Two (2) Triethylene Glycol (TEG) Dehydrators are utilized at the facility. Each dehydrator is comprised of a Contactor/Absorber Tower (no vented emissions), a Flash Tank (DFT-01 and DFT-02), and a Regenerator/Still Vent (DSV-01 and DSV-02).

The TEG Dehydrators are used to remove water vapor from the inlet wet gas stream to meet pipeline specifications. In the dehydration process, the wet inlet gas stream flows through a contactor tower where the gas is contacted with lean glycol. The lean glycol absorbs the water in the gas stream and becomes rich glycol laden with water and trace amounts of hydrocarbons.

The rich glycol is then routed to a flash tank where the glycol pressure is reduced to liberate the lighter end hydrocarbons (especially methane). The lighter end hydrocarbons are routed from the flash tank to the reboiler for use as fuel with the excess hydrocarbons vented to a thermal oxidizer with minimum VOC/HAP destruction efficiency of 99.5 percent.

The rich glycol is sent from the flash tank to the regenerator/still where the TEG is heated to drive off the water vapor and any remaining hydrocarbons. The off-gases from the regenerator/still are vented to a thermal oxidizer with minimum VOC/HAP destruction efficiency of 99.5 percent.

After regeneration, the glycol is returned to a lean state and used again in the process.

Reboilers (RBV-01 and RBV-02 (14E and 17E))

Two (2) gas-fueled reboilers are utilized to supply heat to the Dehydrators Regenerator/Still.

Storage Tanks (TK-01 (18E) thru TK-04 (21E) and Misc. Tanks)

Four (4) 400 bbl storage tanks are used to hold produced water from the inlet separator and the dehydrators.

There are also tanks at the facility used to store various materials, including fresh and used lube oil, fresh and spent TEG, hydrate inhibitor (methanol blend), etc. Each of these miscellaneous storage tanks generate de-minimis (negligible) emissions.

Truck Load-Out (TLO (22E))

Loading of produced water into tanker trucks occurs at the facility. The liquid loading produces small quantities of VOC emissions.

Thermal Oxidizers (TOx-01 and TOx-02 (24E and 25E))

Two (2) Thermal Oxidizers (TOx-01 and TOx-02), each with 99.5% CH4/VOC/HAPs destruction efficiency are used to control the Dehydrators Flash Tank (DFT-01 and DFT-02) and Still Vent (DSV-01 and DSV-02) streams.

Flare (FLR-01 (2C))

One (1) Flare with 98% CH4/VOC/HAPs destruction efficiency is used to control emissions from Blowdown (BD) and Pigging Operations (PIG).

Process Piping and Equipment Leak Emissions (FUG-G (1F) and FUG-L (2F))

Piping and process equipment generate leaks from different component types (connectors, valves, pumps, etc.) in gas-vapor service and light-oil (condensate) service.

Supplement S2

Regulatory Discussion

"19. **Non-Applicability Determinations**. List all requirements which the source has determined not applicable and for which a permit shield is requested. The listing shall also include the rule citation and the reason the shield applies."

"20. **Facility-Wide Applicable Requirements**. List all facility-wide applicable requirements. For each applicable requirement, include the underlying rule/regulation citation and/or construction permit with the condition number."

- **Regulatory Discussion**
  - A. Potential to Emit (PTE)
  - B. Applicability of New Source Performance Standards (NSPS)
  - C. Applicability of National Emission Standards for Hazardous Air Pollutants (NESHAP)
  - D. Compliance Assurance Monitoring (CAM)
  - E. Chemical Accident Prevention Provisions (Risk Management Plan (RMP))
  - F. Mandatory Greenhouse Gas Reporting (GHGRP)
  - G. Applicability of State Regulations

Supplement S2

Regulatory Discussion

A. Potential-to-Emit (PTE) (Major Source Classification)
40CFR§50.1-§50.19

1. Non-Attainment New Source Review (NNSR)
40CFR§51.165 [Not Applicable]

This rule does not apply. The facility is in Marshall County, WV, which is currently classified as Attainment, Unclassified, or Maintenance for all national ambient air quality standards (https://www3.epa.gov/airquality/greenbook/anayo_wv.html).

2. Title V Operating Permit (TVOP) [Applicable]

This rule does apply. The AMS-Ridgeline Compressor Station is a Major Source of Criteria Pollutants (i.e., NOx and CO); and therefore, subject to the Title V Operating Permit (TVOP) regulations (45CSR30); as follows:

- **NOx: Title V Major Source with Controlled PTE greater than 100 tpy**
- **CO: Title V Major Source with Controlled PTE greater than 100 tpy**
- VOC: Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- PM10/2.5 Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- SO2: Title V Natural Minor Source with Pre-Controlled PTE less than 100 tpy
- Each HAP: Title V Synthetic Minor (Area) Source with Controlled PTE less than 10 tpy
- Total HAPs: Title V Synthetic Minor (Area) Source with Controlled PTE less than 25 tpy
- GHG: Not Applicable for TVOP Major Source determination

Important Notes:

* Criteria pollutant fugitive emissions **are not included** in TVOP major source determinations because the facility is not a listed source category.

* Hazardous air pollutant (HAP) fugitive emissions **are included** in TVOP major source determinations regardless of whether the facility is a listed source category.

* Greenhouse gases (GHG) **are not included** in TVOP major source determinations.

3. Major Source of Hazardous Air Pollutants (HAPs)
40CFR§63.1-§63.16 [Not Applicable]

This rule does not apply because the subject facility qualifies as a "HAP Area Source" as follows:

- Each HAP: HAP Area Source with Controlled PTE < 10 tpy
- Total HAPs: HAP Area Source with Controlled PTE < 25 tpy

Important Note:

* Hazardous air pollutant (HAP) fugitive emissions are included in HAP Major Source determinations (§63.2).

4. Prevention of Significant Deterioration (PSD) [Not Applicable]

This rule does not apply because the facility is a "PSD Minor Source" for each regulated pollutant, as follows:

- NOx: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- CO: PSD Synthetic Minor Source with Controlled PTE less than 250 tpy
- VOC: PSD Synthetic Minor Source with Controlled PTE less than 250 tpy
- PM10/2.5: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- SO2: PSD Natural Minor Source with Pre-Controlled PTE less than 250 tpy
- CO2e: Not Applicable for PSD Major Source determination

Important Notes:

* Criteria pollutant fugitive emissions are not included in PSD Major Source determinations because the subject facility is not a "listed source" category (§52.21(b)(1)(iii)).

* Greenhouse gases (GHG/CO2e) are not treated as air pollutants for PSD Major Source determinations; however, GHG/CO2e must be included in the permit if potential emissions exceed 100,000 tpy and the facility is "otherwise" subject to PSD requirements (US Supreme Court, No. 12-1146, June 23, 2014).

* The designation of PSD Major Source status is determined on a pollutant specific basis; however, if a facility exceeds a PSD Major Source threshold for a single NSR regulated pollutant, it becomes PSD Major Source for any other regulated NSR pollutant emitted at or above its significant level, regardless of whether that pollutant exceeds the major stationary source threshold.

* A PSD Major Modification is a change at an existing PSD Major Source which would result in both a significant emission increase and a significant net emission increase of any regulated pollutant.

B. Applicability of New Source Performance Standards (NSPS)

The following federal regulations are potentially applicable to natural gas compressor stations. Applicability to the subject facility has been determined as follows:

1. NSPS A, General Provisions
40CFR§60.1-§60.19 [Applicable]

This rule does apply to all sources subject to an NSPS (unless a specific provision is excluded within the source NSPS). Requirements include notification (§60.7); recordkeeping and reporting (§60.7); source testing (§60.8, §60.11); and control device requirements (§60.18).

2. NSPS A, Control Devices - Flares
40CFR§60.18(b) [Not Applicable]

This rule does not apply to the Elevated Flare (FLR-01) or to the Thermal Oxidizers (TOx-01 and TOx-02) because none are subject to any New Source Performance Standard (NSPS).

3. NSPS D (also Da, Db, and Dc), Steam Generating Units
40CFR§60.40-§60.48 [Not Applicable]

These rules do not apply because there are no steam generating units (including line heaters) at the facility with a maximum design heat input capacity equal to or greater than 10 MMBtu/hr (§60.40c(a)).

4. NSPS K (also Ka and Kb), Volatile Organic Liquid Storage Vessels
40CFR§60.40-§60.48 [Not Applicable]

This rule does not apply because there is no Storage Vessel/Tank with capacity equal to or greater than 75 m3 (471.7 bbl or 19,813 gal) that is used to store volatile organic liquids (VOL) at the facility (§60.110(a)).

5. NSPS GG, Stationary Gas Turbines
40CFR§60.330-§60.335 [Not Applicable]

This rule does not apply because the stationary gas turbine at the facility (CT-01) is subject to NSPS KKKK; see below. Stationary combustion turbines regulated under NSPS KKKK are exempt from the requirements of NSPS GG (§60.4305(b)).

6. NSPS KKK, Leaks from Natural Gas Processing Plants
40CFR§60.630-§60.636 [Not Applicable]

This rule does not apply because the facility is not a natural gas processing plant (§60.630(a)).

7. NSPS LLL, Onshore Natural Gas Processing: SO2 Emissions
40CFR§60.640-§60.648 [Not Applicable]

This rule does not apply because there is no gas sweetening operation at the facility (§60.640(a)).

8. NSPS IIII, Compression Ignition Reciprocating Internal Combustion Engines
40CFR§60.4200-§60.4219 [Not Applicable]

This rule does not apply because there is no stationary compression ignition reciprocating internal combustion engine (RICE) at the facility that was manufactured on or after April 1, 2006 (§60.4200(a)).

9. NSPS JJJJ, Stationary Spark Ignition (SI) Internal Combustion Engines (ICE)
40CFR§60.4230-§60.4248 [Applicable]

This rule does apply to the four (4) 5,000 bhp CAT G3616LE A4 lean burn compressor engines (CE-01 thru CE-04) because the maximum engine power of each engine is greater than 1,340 bhp and each engine was manufactured or reconstructed on or after 07/01/07 (§60.4230(a)(4)(i)).

This rule does apply to the 1,468 bhp CAT G3512LE lean burn generator engine (GE-01) because the maximum engine power is greater than 1,340 bhp and the engine was manufactured or reconstructed on or after 07/01/07 (§60.4230(a)(4)(i)).

Requirements include NOx, CO and VOC emission limits (§60.4233(e-f)); operating limits (§60.4243); performance testing (§60.4244); maintenance plan, and notification and recordkeeping (§60.4245).

10. NSPS KKKK, Stationary Combustion Turbines
40CFR§60.4300-§60.4420 [Applicable]

This rule does apply because the 11,252 bhp Solar Taurus 70-10802S Compressor Turbine (CT-01) has a heat input at peak load ≥ 10 MMBtu/hr and construction, modification, or reconstruction commenced after 02/18/05 (§60.4305(a)).

Requirements include NOx emission limits (§60.4320); SO2 emission limits (§60.4330); and initial and subsequent performance testing (§60.4400).

11. NSPS OOOO, Crude Oil and Natural Gas Production
40CFR§60.5360-§60.5430 [Not Applicable]

This rule does not apply because the facility was constructed after September 18, 2015 (§60.5360).

12. NSPS OOOOa, Crude Oil and Natural Gas Production
40CFR§60.5360a-§60.5430a [Applicable]

This rule does apply to the reciprocating compressors driven by the CAT G3616LE A4 Engines (CE-01 thru CE-04) because the facility is identified within the natural gas production segment and each compressor commenced construction after 09/18/15 (§60.5360 and §60.5365(c)).

This rule does apply to the new electrically driven reciprocating compressor (associated with Solar Turbines' dry gas seal recompression system) because it was constructed after 09/18/15 (§60.5360 and §60.5365(c)).

Requirements include replacing rod packing systems on a specified schedule (CE-01 thru CE-04) and collecting the VOC emissions from the rod packing using a rod packing emissions collection system that operates under negative pressure and route the rod packing emissions to a process through a closed vent system (electric compressor) ((§60.5385(a)), notification, monitoring, recordkeeping and reporting (§60.5410(c), §60.5415(c), §60.5420(b)(1) and §60.5420(b)(4)).

This rule does apply to the fugitive emission components at a compressor station.

Requirements include reducing GHG and VOC emissions by developing a fugitive emission monitoring plan, monitoring all fugitive emission components, repairing all sources of fugitive emissions, and recordkeeping and reporting. For the purposes of this section, fugitive emissions are defined as: Any visible emission from a fugitive emissions component observed using optical gas imaging or an instrument reading of 500 ppm or greater using Method 21.

This rule does not apply to the produced water storage tanks (TK-01 thru TK-04) (nor any other tank) at the facility because each tank does not have the potential to emit more than 6 tpy of VOCs. Note, however, there is a requirement to document that the VOC PTE is less than 6 tpy per tank (§60.5420).

This rule <u>does not apply</u> to the pneumatic controllers because they are compressed air driven, otherwise they have a bleed rate ≤ 6 scfh, are located between the wellhead and point of custody transfer, and they are not located at a natural gas processing plant (§60.5365(d)(1)).

Other requirements of this rule <u>do not apply</u> because the facility is a) not a well, b) does not have a centrifugal compressor using wet seals, and c) does not have a process unit associated with the processing of natural gas.

13. NESHAP Part 61 - Designated Source Standards
40CFR§61.01-§61.359 [Not Applicable]

This rule <u>does not apply</u> because the facility is not a NESHAP Designated Facility (or Source).

Specifically, NESHAP J - Equipment Leaks (Fugitive Emission Sources) of Benzene and NESHAP V - Equipment Leaks (Fugitive Emission Sources) do not apply because all the fluids (liquid or gas) at the facility are less than 10 wt% volatile hazardous air pollutant (VHAP) ((§61.111 and §61.241).

14. NESHAP Part 63 (aka: MACT) - General Provisions
40CFR§63.1-§63.16 <u>[Applicable/Exempt]</u>

This rule <u>does apply</u> to the Compressor Engines (CE-01 thru CE-04); however, they are each subject to, but exempted from, the requirements of NESHAP ZZZZ. This rule <u>does apply</u> to the dehydrators (DFT-01/DFT-02 and DSV-01/DSV-02); however, they are each subject to, but exempted from, the requirements of NESHAP HH.

This rule <u>does not apply</u> to storage tanks, compressors, or ancillary equipment because the facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.

15. NESHAP HH, Oil and Natural Gas Production Facilities
40CFR§63.760-§63.779 <u>[Applicable/Exempt]</u>

This rule <u>does apply</u> to the dehydrators (DFT-01/DFT-02 and DSV-01/DSV-02). However, because the facility is an area source of HAP emissions, and the actual average emissions of benzene from each glycol dehydration unit process vent to the atmosphere is less than 0.90 megagram per year (1.0 tpy), the dehydration units are exempt. The only requirement is to maintain records of the actual average benzene emissions per year (§63.774(d)(1)(i)).

This rule <u>does not apply</u> to storage vessels (tanks), compressors, or ancillary equipment because the facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.

16. NESHAP HHH, Natural Gas Transmission and Storage Facilities
40CFR§63.1270-§63.1289 [Not Applicable]

This rule <u>does not apply</u> because the facility is not a natural gas transmission or storage facility transporting or storing natural gas prior to local distribution (§63.1270(a)).

17. NESHAP YYYY, Stationary Combustion Turbines

40CFR§63.6080-§63.6175 [Not Applicable]

This rule does not apply because the facility is not a major source of HAP emissions (§63.6080).

18. NESHAP ZZZZ, Stationary Reciprocating Internal Combustion Engines (RICE)

40CFR§63.6580-§63.6675 [Applicable/Exempt]

This rule does apply to the 5,000 bhp CAT G3616LE A4 compressor engines (CE-01 thru CE-04) and 1,468 bhp CAT 3512LE generator engine (GE-01). However, because each engine is "new" (i.e., commenced construction or reconstruction on or after 06/12/06) (§63.6590(a)(2)(iii)); the only requirement is compliance with §60.4230-§60.4248 (NSPS JJJJ) for Spark Ignition Internal Combustion Engines.

19. NESHAP DDDDD, Industrial, Commercial, and Institutional Boilers and Process Heaters – Major Sources

40CFR§63.7480 – §63.7575 [Not Applicable]

This rule does not apply because the facility is not a major source of HAP emissions (§63.7485).

20. NESHAP JJJJJJ, Industrial, Commercial, and Institutional Boilers and Process Heaters – Area Sources

40CFR§63.11193 – §63.11237 [Not Applicable]

This rule does not apply because the gas-fired reboilers (RBV-01 and RBV-02) do not meet the definition of "boiler" in §63.11237. Specifically, "boiler" is defined as an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the form of steam and/or hot water. Furthermore, waste heat boilers, process heaters, and autoclaves are excluded from the definition of "boiler".

21. Compliance Assurance Monitoring (CAM)

40CFR§64.1-§64.10 [Applicable]

This rule does apply because the facility is a major source required to obtain a Title V Operating Permit (§64.2(a)). A CAM plan will be developed for the Title V Operating Permit renewal application (§64.5(b)).

22. Chemical Accident Prevention Provisions (Risk Management Plan (RMP))

40CFR§68.1-§68.220 [Not Applicable]

This rule does not apply because the facility does not store more than a threshold quantity of a regulated substance in a process. Specifically, "Prior to entry into a natural gas processing plant or a petroleum refining process unit, regulated substances in naturally occurring hydrocarbon mixtures need not be considered when determining whether more than a threshold quantity is present at a stationary source" (§68.115(b)(2)(iii)).

23. Mandatory Greenhouse Gases (GHG) Reporting
40CFR§98.1-§98.9 [Applicable]

This rule does apply because the CO2e emissions from all stationary sources combined within the hydrocarbon basin as defined in 40 CFR Part 98 is ≥ 25,000 metric ton/yr (§98.2(a)(3)).

Requirements include monitoring, recordkeeping, and annual reporting of GHG from stationary fuel combustion sources (§98.2(a)(3)).

C. Applicability of Source Aggregation

The operations of the facility have not been aggregated with any other gas production, midstream service facilities, or transportation operations because there are no other oil and gas facilities or operations that are both a) "contiguous and adjacent" and b) "under common control" to the facility.

D. Applicability of State Regulations

The following state regulations are potentially applicable to natural gas compressor stations. Applicability to the facility has been determined as follows:

1. Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers
§45CSR2 [Applicable]

This rule does apply; however, because the reboilers (RBV-01 and RBV-02) each have a maximum design heat input (MDHI) rating less than 10 MMBtu/hr, the only requirement is to limit visible emissions to less than 10% opacity during normal operations (§45-02-3.1). The reboiler combusts only natural gas which inherently conforms to the visible emission standards.

2. Prevent and Control the Discharge of Air Pollutants into the Open Air Which Causes or Contributes to an Objectionable Odor or Odors
§45CSR4 [Applicable]

This rule does apply and states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable.

3. Control of Air Pollution from Combustion of Refuse
§45CSR6 [Applicable]

This rule does apply to the Elevated Flare (FLR-01) and to the Thermal Oxidizers (TOx-01 and TOx-02); however, these units combust waste from natural gas operations which inherently conforms to the particulate emission and opacity standards.

4. **Prevent and Control Air Pollution from the Emission of Sulfur Oxides**
§45CSR10 [Not Applicable]

This rule does not apply to the Compressor Engines (CE-01 thru CE-04), Generator Engine (GE-01), Elevated Flare (FLR-01), Reboilers (RBV-01 and RBV-02), Thermal Oxidizers (TOx-01 and TOx-02) or any other fuel burning units, manufacturing process sources, or combustion sources because each combust only natural gas (§45-10A-3.1.b).

5. **Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation**
§45CSR13 [Applicable]

This rule does apply. The facility is currently operating under 45CSR13 Modification Permit R13-3561, issued July 29, 2022.

6. **Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants for Prevention of Significant Deterioration**
45CSR14 [Not Applicable]

The rule does not apply because the facility is neither a new PSD major source of pollutants nor is the proposed facility a modification to an existing PSD major source.

7. **Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60**
45CSR16 [Applicable]

The rule does apply to this source by reference to §40CFR60 Subparts JJJJ, KKKK and OOOOa. The facility is subject to the notification, testing, monitoring, recordkeeping and reporting requirements of these Subparts.

8. **Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution Which Cause or Contribute to Nonattainment**
45CSR19 [Not Applicable]

This rule does not apply because the facility is a minor (or “deferred”) source of all regulated pollutants.

9. **Regulation of Volatile Organic Compounds (VOC)**
45CSR21 [Not Applicable]

This rule does not apply because the facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

10. **Air Quality Management Fees Program**
45CSR22 [Applicable]

This rule does apply. It establishes a program to collect fees for certificates to operate and for permits to construct, modify, or relocate sources of air pollution.

11. Prevent and Control Emissions of Toxic Air Pollutants (Best Available Control Technology (BAT))
45CSR27 [Not Applicable]

This rule does not apply because the equipment used in the production and distribution of petroleum products is exempt, provided the product contains no more than 5% benzene by weight (§45-27-2.4).

12. Air Pollution Emissions Banking and Trading
45CSR28 [Not Applicable]

This rule does not apply because the facility does not choose to participate in the voluntarily statewide air pollutant emissions trading program.

13. Emission Statements for VOC and NOx
45CSR29 [Not Applicable]

This rule does not apply because the facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

14. Requirements for Operating Permits
45CSR30 [Applicable]

This rule does apply because the facility qualifies as a "Title V Major Source" (See section A.2 above.)

15. Emission Standards for Hazardous Air Pollutants (HAP)
45CSR34 [Not Applicable]

This rule does not apply because the facility is an area source of HAP emissions. Note: The provisions under Subparts HH and ZZZZ of 40 CFR Part 63 which apply to non-major area sources of hazardous air pollutants are excluded.

Supplement S3

Emission Calculations

- **Emission Summary Spreadsheets**
  - Potential to Emit (PTE) – Criteria Pollutants – Controlled
  - Potential to Emit (PTE) – Hazardous Air Pollutants (HAP) – Controlled – 1 of 2
  - Potential to Emit (PTE) – Hazardous Air Pollutants (HAP) – Controlled – 2 of 2
  - Potential to Emit (PTE) – Greenhouse Gases (GHG) – Controlled
  - Potential to Emit (PTE) – Regulated Pollutants – PRE-Controlled
- **Unit-Specific Emission Spreadsheets**
  - Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions
  - Engine Crankcase (ECC (5E)) Emissions
  - Compressor Rod Packing (CRP (6E)) Emissions
  - Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions
  - Generator Engine (GE-01 (8E)) Emissions
  - Compressor Turbine (CT-01 (9E)) Emissions
  - Compressor Turbine Start/Stop (TSS (10E)) Emissions
  - Centrifugal Compressor Dry Gas Seal Leaks (DGS (11E)) Emissions
  - Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions
  - Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions
  - Reboiler 01 and 02 (RBV-01 (14E and 17E)) Emissions
  - Produced Water - Storage Tank (TK-01 (18E) thru TK-04 (21E)) Emissions
  - Produced Water - Truck Load-Out (TLO (22E)) Emissions
  - Pigging Operation (PIG (23E)) Emissions
- **Air Pollution Control Equipment (APCE) Emission Spreadsheets**
  - DFT-01/DSV-01 Thermal Oxidizer 01 (TOx-01 (24E)) Emissions
  - DFT-02/DSV-02 Thermal Oxidizer 02 (TOx-02 (25E)) Emissions
  - BD/PIG Elevated Flare (FLR-01 (26E)) Emissions
- **Fugitive Emissions**
  - Process Piping and Equipment Leak (FUG-G (1F)) Emissions – Gas
- Process Piping and Equipment Leak (FUG-L (2F)) Emissions – Liquid
- Selected AP-42 and GHG Emission Factors

Potential-to-Emit (PTE) - Criteria Pollutants - Controlled

Unit ID	Point ID	Control ID	Description	Site Rating	NOX		CO		VOC (w/HCHO)		SO2		PM10/2.5	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources														
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	4.41	19.31	3.01	13.17	3.18	13.92	0.02	0.10	0.37	1.63
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	0.05	0.22	0.32	1.39	0.11	0.46	3E-04	1E-03	4E-03	0.02
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	---	---	---	2.11	9.22	---	---	---	---
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	---	---	---	0.55	2.42	---	---	---	---
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	1.62	7.09	0.81	3.54	1.09	4.78	0.01	0.03	0.11	0.50
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	5.04	20.36	5.11	20.65	0.59	2.37	0.29	1.16	0.84	3.40
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	0.02	0.10	0.87	3.80	0.24	1.04	---	---	---	---
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	---	---	---	0.85	3.71	---	---	---	---
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	0.16	0.70	---	---	---	---
DSV-01	13E		Dehydrator 01 - Still Vent		---	---	---	---	0.72	3.14	---	---	---	---
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-03	0.01	0.01	0.07
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	0.18	0.78	---	---	---	---
DSV-02	16E		Dehydrator 02 - Still Vent		---	---	---	---	0.67	2.94	---	---	---	---
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-03	0.01	0.01	0.07
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	---	---
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	---	---
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	---	---	---	0.38	1.66	---	---	---	---
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	---	---	---	0.12	0.52	---	---	---	---
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	0.75	3.27	2.36	10.33	0.04	0.18	4E-03	0.02	0.06	0.25
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	0.66	2.88	2.08	9.10	0.04	0.16	4E-03	0.02	0.05	0.22
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	0.67	2.95	2.13	9.34	0.04	0.16	4E-03	0.02	0.05	0.22
				Total Point Sources:	**26.84**	**115.84**	**26.03**	**112.26**	**20.63**	**90.15**	**0.39**	**1.64**	**2.64**	**11.27**
				TVOP Threshold:**	**---**	**100**	**---**	**100**	**---**	**100**	**---**	**100**	**---**	**100**
Ridgeline Compressor Station - Fugitive Sources														
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	4,981 Fittings	---	---	---	---	0.72	3.15	---	---	---	---
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271 Fittings	---	---	---	---	2.04	8.94	---	---	---	---
				Total Fugitive Sources:	**---**	**---**	**---**	**---**	**2.76**	**12.08**	**---**	**---**	**---**	**---**
Ridgeline Compressor Station - Total PTE														
				Total Facility-Wide:	**26.84**	**115.84**	**26.03**	**112.26**	**23.39**	**102.23**	**0.39**	**1.64**	**2.64**	**11.27**
				TVOP Threshold:**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**
					lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
					NOX		**CO**		**VOC (w/HCHO)**		**SO2**		**PM10/2.5**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Hazardous Air Pollutants (HAP) - Controlled - 1 of 2

Unit ID	Point ID	Control ID	Description	Site Rating	Acetaldehyde		Acrolein		Benzene		Butadiene, 1,3-		Ethylbenzene		HCHO		n-Hexane	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources																		
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	0.12	0.55	0.08	0.34	0.01	0.03	4E-03	0.02	6E-04	3E-03	0.46	2.03	0.02	0.07
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	4E-03	0.02	2E-03	0.01	2E-04	8E-04	1E-04	5E-04	2E-05	8E-05	0.03	0.12	5E-04	2E-03
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	---	---	---	0.01	0.02	---	---	0.01	0.02	---	---	0.11	0.48
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	---	---	---	1E-03	6E-03	---	---	1E-03	6E-03	---	---	0.03	0.13
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	0.07	0.33	0.05	0.20	4E-03	0.02	0.00	0.01	4E-04	2E-03	0.16	0.71	0.01	0.04
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	3E-03	0.01	5E-04	2E-03	8E-05	3E-04	4E-05	1E-04	3E-03	1E-02	0.06	0.24	---	---
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	---	---	---	---	6E-04	3E-03	---	---	6E-04	3E-03	---	---	0.01	0.05
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	---	---	---	2E-03	1E-02	---	---	2E-03	1E-02	---	---	0.04	0.19
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	3E-04	1E-03	---	---	7E-05	3E-04	---	---	0.01	0.02
DSV-01	13E		Dehydrator 01 - Still Vent		---	---	---	---	0.03	0.12	---	---	0.02	0.09	---	---	0.02	0.08
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	---	---	---	---	4E-06	2E-05	---	---	---	---	1E-04	6E-04	4E-03	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	3E-04	1E-03	---	---	8E-05	3E-04	---	---	0.01	0.03
DSV-02	16E		Dehydrator 02 - Still Vent		---	---	---	---	0.03	0.12	---	---	0.02	0.09	---	---	0.02	0.07
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	---	---	---	---	4E-06	2E-05	---	---	---	---	1E-04	6E-04	4E-03	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	---	---	---	6E-06	3E-05	---	---	2E-04	7E-04	---	---	6E-04	3E-03
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	---	---	---	3E-04	1E-03	---	---	8E-03	3E-02	---	---	0.03	0.13
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	---	---	---	3E-04	1E-03	---	---	3E-04	1E-03	---	---	6E-03	0.03
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	---	---	---	---	2E-05	7E-05	---	---	---	---	6E-04	2E-03	0.01	0.06
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	---	---	---	---	1E-05	6E-05	---	---	---	---	5E-04	2E-03	0.01	0.05
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	---	---	---	---	1E-05	6E-05	---	---	---	---	5E-04	2E-03	0.01	0.05
				Total Point Sources:	**0.58**	**2.54**	**0.36**	**1.56**	**0.10**	**0.42**	**0.02**	**0.08**	**0.06**	**0.28**	**2.10**	**9.19**	**0.40**	**1.75**
				TVOP Threshold:**	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Ridgeline Compressor Station - Fugitive Sources																		
FUG-G	1F	LDAR	Process Piping Fugitives - Gas	4,981 Fittings	---	---	---	---	2E-03	0.01	---	---	2E-03	0.01	---	---	0.04	0.16
FUG-L	2F		Process Piping Fugitives - Light Oil	2,271 Fittings	---	---	---	---	2E-03	0.01	---	---	0.04	0.19	---	---	0.16	0.69
				Total Fugitive Sources:	---	---	---	---	**3E-03**	**0.02**	---	---	**0.04**	**0.19**	---	---	**0.20**	**0.85**
Ridgeline Compressor Station - Total PTE																		
				Total Facility-Wide:	**0.58**	**2.54**	**0.36**	**1.56**	**0.10**	**0.43**	**0.02**	**0.08**	**0.11**	**0.47**	**2.10**	**9.19**	**0.60**	**2.61**
				TVOP Threshold:**	---	**10**	---	**10**	---	**10**	---	**10**	---	**10**	---	**10**	---	**10**
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
					Acetaldehyde		Acrolein		Benzene		Butadiene, 1,3-		Ethylbenzene		HCHO		n-Hexane	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Hazardous Air Pollutants (HAP) - Controlled - 2 of 2

Unit ID	Point ID	Control ID	Description	Site Rating	Methanol		POM/PAH		Toluene		TMP, 2,2,4-		Xylenes		Other HAP		TOTAL HAPs	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources																		
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	0.04	0.16	0.01	0.02	0.01	0.03	4E-03	0.02	3E-03	0.01	0.00	0.02	**0.75**	**3.30**
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	1E-03	5E-03	2E-04	7E-04	2E-04	8E-04	1E-04	5E-04	8E-05	3E-04	1E-04	6E-04	**0.04**	**0.15**
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	0.01	0.02	---	---	0.01	0.06	0.01	0.02	0.01	0.06	---	---	**0.16**	**0.70**
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	1E-03	6E-03	---	---	3E-03	2E-02	1E-03	6E-03	3E-03	2E-02	---	---	**0.04**	**0.18**
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	0.02	0.10	3E-03	0.01	4E-03	0.02	2E-03	0.01	2E-03	0.01	3E-03	0.01	**0.33**	**1.47**
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	---	---	3E-03	0.01	1E-02	0.04	---	---	5E-03	0.02	2E-03	0.01	**0.09**	**0.36**
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	6E-04	3E-03	---	---	1E-03	0.01	6E-04	0.00	1E-03	0.01	---	---	**0.02**	**0.08**
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	2E-03	1E-02	---	---	5E-03	0.02	2E-03	0.01	5E-03	0.02	---	---	**0.06**	**0.28**
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	5E-04	2E-03	---	---	4E-04	2E-03	---	---	**0.01**	**0.03**
DSV-01	13E		Dehydrator 01 - Still Vent		0.02	0.07	---	---	0.09	0.38	---	---	0.20	0.86	---	---	**0.36**	**1.59**
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	---	---	1E-06	6E-06	7E-06	3E-05	---	---	---	---	2E-06	1E-05	**4E-03**	**0.02**
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	6E-04	3E-03	---	---	5E-04	2E-03	---	---	**0.01**	**0.03**
DSV-02	16E		Dehydrator 02 - Still Vent		0.02	0.07	---	---	0.09	0.38	---	---	0.19	0.83	---	---	**0.35**	**1.55**
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	---	---	1E-06	6E-06	7E-06	3E-05	---	---	---	---	2E-06	1E-05	**4E-03**	**0.02**
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	5E-06	2E-05	---	---	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	---	---	**1E-03**	**5E-03**
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	2E-04	1E-03	---	---	4E-03	0.02	3E-03	0.01	0.01	0.05	---	---	**0.05**	**0.24**
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	3E-04	1E-03	---	---	7E-04	3E-03	3E-04	1E-03	7E-04	3E-03	---	---	**9E-03**	**0.04**
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	---	---	5E-06	2E-05	3E-05	1E-04	---	---	---	---	9E-06	4E-05	**0.01**	**0.06**
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	---	---	5E-06	2E-05	2E-05	1E-04	---	---	---	---	8E-06	3E-05	**0.01**	**0.05**
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	---	---	5E-06	2E-05	2E-05	1E-04	---	---	---	---	8E-06	4E-05	**0.01**	**0.06**
				Total Point Sources:	**0.21**	**0.94**	**0.03**	**0.12**	**0.24**	**1.06**	**0.03**	**0.14**	**0.44**	**1.92**	**0.02**	**0.11**	**4.60**	**20.10**
				TVOP Threshold:**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**
Ridgeline Compressor Station - Fugitive Sources																		
FUG-G	1F	LDAR	Process Piping Fugitives - Gas	4,981 Fittings	2E-03	0.01	---	---	5E-03	0.02	2E-03	0.01	5E-03	0.02	---	---	**0.05**	**0.24**
FUG-L	2F		Process Piping Fugitives - Light Oil	2,271 Fittings	1E-03	0.01	---	---	0.02	0.09	0.01	0.06	0.06	0.24	---	---	**0.29**	**1.29**
				Total Fugitive Sources:	**3E-03**	**0.01**	**---**	**---**	**0.03**	**0.11**	**0.02**	**0.07**	**0.06**	**0.26**	**---**	**---**	**0.35**	**1.53**
Ridgeline Compressor Station - Total PTE																		
				Total Facility-Wide:	**0.22**	**0.95**	**0.03**	**0.12**	**0.27**	**1.17**	**0.05**	**0.21**	**0.50**	**2.18**	**0.02**	**0.11**	**4.95**	**21.63**
				TVOP Threshold:**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**10**	**---**	**25**
					lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
					Methanol		**POM/PAH**		**Toluene**		**TMP, 2,2,4-**		**Xylenes**		**Other HAP**		**TOTAL HAPs**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) - Greenhouse Gas (GHG) Pollutants - Controlled

Unit ID	Point ID	Control ID	Description	Site Rating	Heat Input MMBtu/hr (HHV)	Hours of Operation	CO2	CO2e	CH4	CO2e	N2O	CO2e	TOTAL CO2e	
							GWP:	1.00	GWP:	25.00	GWP:	298.00		
						hr/yr*	tpy	tpy	tpy	tpy	tpy	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources														
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	37.33	8,760	21,099	21,099	109.12	2,728	0.04	10.74	**5,442**	**23,838**
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	---	8,760	244.77	244.77	1.27	31.65	4E-04	0.12	**63.14**	**277**
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	8,760	0.21	0.21	39.80	995	---	---	**227.24**	**995**
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	8,760	2.70	2.70	10.45	261	---	---	**60.29**	**264**
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	11.38	8,760	6,960	6,960	34.59	864.70	0.01	3.27	**1,787**	**7,828**
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	83.87	8,760	37,436	37,436	11.91	297.79	1.02	304.25	**8,684**	**38,038**
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	---	8,760	35	35	5.30	132.60	---	---	**38**	**168**
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	2,160	0.08	0.08	16.00	400.05	---	---	**370**	**400**
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	8,760	8.15	8.15	0.95	23.69	---	---	**7.27**	**32**
DSV-01	13E		Dehydrator 01 - Still Vent		---	8,760	7.83	7.83	0.87	21.79	---	---	**6.76**	**30**
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	2.00	8,760	1,031	1,031	0.02	0.49	2E-02	5.63	**236.69**	**1,037**
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	8,760	6.57	6.57	1.00	24.89	---	---	**7.18**	**31**
DSV-02	16E		Dehydrator 02 - Still Vent		---	8,760	5.68	5.68	0.05	1.35	---	---	**1.60**	**7**
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	2.00	8,760	1,031	1,031	0.02	0.49	2E-02	5.63	**236.69**	**1,037**
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	8,760	---	---	---	---	---	---	**---**	**---**
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	8,760	---	---	---	---	---	---	**---**	**---**
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	8,760	0.58	0.58	2.23	55.82	---	---	**---**	**56**
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	7.61	8,760	3,919	3,919	0.08	1.88	0.01	2.19	**895.66**	**3,923**
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	6.70	8,760	3,452	3,452	0.07	1.65	0.01	1.93	**788.91**	**3,455**
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	7.00	8,760	3,543	3,543	0.07	1.70	0.01	1.98	**809.71**	**3,547**
						Total Point Sources:	**142,078**	**142,078**	**561.14**	**14,029**	**1.23**	**367.97**	**35,991**	**156,475**
						TVOP Threshold:**	na	na	na	na	na	na	na	na
Ridgeline Compressor Station - Fugitive Sources														
FUG-G	1F	LDAR	Process Piping and Equipment Leaks - Gas	4,981 Fittings	---	8,760	0.07	0.07	13.58	339	---	---	**77.50**	**339**
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271 Fittings	---	8,760	---	---	---	---	---	---	**---**	**---**
						Total Fugitive Sources:	**0.07**	**0.07**	**13.58**	**339.39**	**---**	**---**	**77.50**	**339**
Ridgeline Compressor Station - Total PTE														
						Total Facility-Wide:	**142,078**	**142,078**	**574.72**	**14,368**	**1.23**	**367.97**	**36,069**	**156,814**
						TVOP Threshold:**	na	na	na	na	na	na	na	na
							tpy	**tpy**	**tpy**	**tpy**	**tpy**	**tpy**	**lb/hr***	**tpy**
							CO2	**CO2e**	**CH4**	**CO2e**	**N2O**	**CO2e**	**TOTAL CO2e**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Potential-to-Emit (PTE) – Regulated Pollutants - PRE-Controlled

Unit ID	Point ID	Control ID	Description	Site Rating	NOX		CO		VOC (w/HCHO)		HCHO		Total HAP	
					lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
Ridgeline Compressor Station - Point Sources														
CE-01	1E	OxCat-01	Compressor Engine 01 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-02	2E	OxCat-02	Compressor Engine 02 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-03	3E	OxCat-03	Compressor Engine 03 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
CE-04	4E	OxCat-04	Compressor Engine 04 - CAT G3616LE A4	5,000 bhp	4.41	19.31	27.34	119.74	6.28	27.52	2.31	10.14	3.04	13.31
ECC	5E	---	Engine Crankcase (CE-01 thru -04, GE-01)	5 Engines	0.05	0.22	0.32	1.39	0.11	0.46	0.03	0.12	0.04	0.15
CRP	6E	---	Compressor Rod Packing (Comp-01 thru -04)	4 Compr's	---	---	---	---	2.11	9.22	---	---	0.16	0.70
BD	7E	FLR-01 (26E)	Blowdown (CBD and ESD)	6 Compr's	---	---	---	---	27.65	121.12	---	---	2.09	9.14
GE-01	8E	OxCat-05	Generator Engine 01 - CAT G3512LE	1,468 bhp	1.62	7.09	6.21	27.22	3E-03	4.54	0.97	4.25	1.19	5.22
CT-01	9E	---	Compressor Turbine 01 - Solar Taurus 70-10802S	11,252 bhp	5.04	20.36	5.11	20.65	0.59	2.37	0.06	0.24	0.09	0.36
TSS	10E	---	Compressor Turbine Start/Stop	104 Events/yr	0.02	0.10	0.87	3.80	0.24	1.04	---	---	0.02	0.08
DGS	11E	---	Centrifugal Compressor Dry Gas Seal Leaks	11,252 bhp	---	---	---	---	0.85	3.71	---	---	0.06	0.28
DFT-01	12E	TOx-01 (24E)	Dehydrator 01 - Flash Tank	250.0 MMscfd	---	---	---	---	31.87	139.59	---	---	1.28	5.61
DSV-01	13E		Dehydrator 01 - Still Vent		---	---	---	---	143.55	628.74	---	---	72.40	317.10
RBV-01	14E	---	Dehydrator 01 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-04	6E-04	4E-03	0.02
DFT-02	15E	TOx-02 (25E)	Dehydrator 02 - Flash Tank	160.0 MMscfd	---	---	---	---	35.45	155.26	---	---	1.47	6.45
DSV-02	16E		Dehydrator 02 - Still Vent		---	---	---	---	134.11	587.38	---	---	70.71	309.73
RBV-02	17E	---	Dehydrator 02 - Reboiler	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1E-04	6E-04	4E-03	0.02
TK-01	18E	---	Storage Tank 01 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-02	19E	---	Storage Tank 02 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-03	20E	---	Storage Tank 03 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TK-04	21E	---	Storage Tank 04 - Produced Water	400 bbl	---	---	---	---	0.01	0.04	---	---	0.00	0.01
TLO	22E	---	Truck Load-Out - Produced Water	120,000 bbl/yr	---	---	---	---	0.38	1.66	---	---	0.05	0.24
PIG	23E	FLR-01 (26E)	Pigging Operations	4 Units	---	---	---	---	5.91	25.87	---	---	0.45	4.71
TOx-01	24E	---	DFT-01/DSV-01 Thermal Oxidizer - Zeeco Z-HTO	7.61 MMBtu/hr	No Pre-Controlled Emissions from the Thermal Oxider (TOx-01)									
TOx-02	25E	---	DFT-02/DSV-02 Thermal Oxidizer - Zeeco Z-VTO	6.70 MMBtu/hr	No Pre-Controlled Emissions from the Thermal Oxider (TOx-02)									
FLR-01	26E	---	CBD/PIG Elevated Flare - Zeeco MJ-16	7.00 MMBtu/hr	No Pre-Controlled Emissions from the Flare 01 (FLR-01)									
				Total Point Sources:	**24.76**	**106.74**	**122.19**	**533.44**	**407.98**	**1,791**	**10.32**	**45.17**	**162.18**	**713.07**
				TVOP Threshold:**	**---**	**100**	**---**	**100**	**---**	**100**	**---**	**10**	**---**	**25**
Ridgeline Compressor Station - Fugitive Sources														
FUG-G	1F	---	Process Piping and Equipment Leaks - Gas	4,981 Fittings	---	---	---	---	3.06	13.41	---	---	0.23	1.01
FUG-L	2F		Process Piping and Equipment Leaks - Light Oil	2,271 Fittings	---	---	---	---	7.45	32.65	---	---	1.08	4.71
				Total Fugitive Sources:	**---**	**---**	**---**	**---**	**10.52**	**46.06**	**---**	**---**	**1.31**	**5.72**
Ridgeline Compressor Station - Total PTE														
				Total Facility-Wide:	**24.76**	**106.74**	**122.19**	**533.44**	**418.50**	**1,837**	**10.32**	**45.17**	**163.49**	**718.80**
				TVOP Threshold:**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**	**---**	**na**
					lb/hr*	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**	**lb/hr***	**tpy**
					NOX		**CO**		**VOC (w/HCHO)**		**HCHO**		**Total HAP**	

* = lb/hr is based on 8,760 hr/yr, including Blowdown (BD), Truck Load-Out (TLO), Pigging Operations (PIG), and Flare-01 (FLR-01) operate less frequent.

** = Fugitive emissions of criteria pollutants are not included in major source determination because the facility is not a listed source category.

Compressor Engine (CE-01 (1E) thru CE-04 (4E)) Emissions

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions		
				g/bhp-hr	lb/MMBtu	lb/hr	tpy		g/bhp-hr	lb/hr	tpy
	Compressor Engines	Vendor Data	NOX	0.40	0.12	4.41	19.31	---	**0.40**	**4.41**	**19.31**
	01 thru 04 (Each)	Vendor Data	CO	2.48	0.73	27.34	119.74	89.0%	**0.27**	**3.01**	**13.17**
	(OxCat-01 thru OxCat-04)	Vendor Data	NMNEHC	0.57	0.17	6.28	27.52	60.0%	**0.23**	**2.51**	**11.01**
	Caterpillar (CAT)	Sum	VOC (w/Aldehydes)*	0.83	0.24	9.10	39.87	65.1%	**0.29**	**3.18**	**13.92**
	G3616LE A4 (4SLB)	AP-42 Table 3.2-2	SO2	1.99E-03	5.88E-04	0.02	0.10	---	**2E-03**	**0.02**	**0.10**
		AP-42 Table 3.2-2	PM10/2.5	3.38E-02	9.99E-03	0.37	1.63	---	**0.03**	**0.37**	**1.63**
	5,000 bhp (Each)	AP-42 Table 3.2-2	*Acetaldehyde	2.83E-02	8.36E-03	0.31	1.37	60.0%	**0.01**	**0.12**	**0.55**
	8,760 hr/yr (Each)	AP-42 Table 3.2-2	*Acrolein	1.74E-02	5.14E-03	0.19	0.84	60.0%	**7E-03**	**0.08**	**0.34**
	1,000 rpm, 16 cyl	AP-42 Table 3.2-2	Benzene	1.49E-03	4.40E-04	0.02	0.07	60.0%	**6E-04**	**0.01**	**0.03**
	20,698 in3 Displacement	AP-42 Table 3.2-2	Butadiene, 1,3-	9.04E-04	2.67E-04	0.01	0.04	60.0%	**4E-04**	**4E-03**	**0.02**
CE-01 (1E) CE-02 (2E) CE-03 (3E) CE-04 (4E) (Each)	1,294 in3/cyl	AP-42 Table 3.2-2	Ethylbenzene	1.34E-04	3.97E-05	1E-03	6E-03	60.0%	**5E-05**	**6E-04**	**3E-03**
		Vendor Data	*Formaldehyde	0.21	0.06	2.31	10.14	80.0%	**0.04**	**0.46**	**2.03**
	823 Exhaust Temp (oF)	AP-42 Table 3.2-2	n-Hexane	3.76E-03	1.11E-03	0.04	0.18	60.0%	**2E-03**	**0.02**	**0.07**
	30,842 Exhaust Flow (acfm)	AP-42 Table 3.2-2	Methanol	8.47E-03	2.50E-03	0.09	0.41	60.0%	**3E-03**	**0.04**	**0.16**
		AP-42 Table 3.2-2	POM/PAH	1.26E-03	3.74E-04	0.01	0.06	60.0%	**5E-04**	**0.01**	**0.02**
	MFD: > 08/23/11	AP-42 Table 3.2-2	Toluene	1.38E-03	4.08E-04	0.02	0.07	60.0%	**6E-04**	**0.01**	**0.03**
	NSPS JJJJ Affected	AP-42 Table 3.2-2	TMP, 2,2,4-	9.04E-04	2.67E-04	0.01	0.04	60.0%	**4E-04**	**4E-03**	**0.02**
		AP-42 Table 3.2-2	Xylenes	6.23E-04	1.84E-04	0.01	0.03	60.0%	**2E-04**	**3E-03**	**0.01**
	7,466 Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	Other/Trace HAP	1.09E-03	3.21E-04	0.01	0.05	60.0%	**4E-04**	**0.00**	**0.02**
	37.33 MMBtu/hr (HHV) (Each)	AP-42 Table 3.2-2	Total HAP	0.28	0.08	3.04	13.31	75.2%	**0.07**	**0.75**	**3.30**
	36,598 scf/hr (Each)	Vendor Data	CO2 (GWP=1)	437	129.04	4,817	21,099	---	**437.00**	**4,817**	**21,099**
	320.60 MMscf/yr (Each)	Vendor Data	CH4 (GWP=25)	2.26	0.67	24.91	109.12	---	**2.26**	**24.91**	**109.12**
	1,020 Btu/scf (HHV)	40CFR98 - Table C2	N2O (GWP=298)	7.47E-04	2.20E-04	0.01	0.04	---	**7E-04**	**0.01**	**0.04**
		Weighted Sum	CO2e	493.72	145.79	5,442	23,838	---	**493.72**	**5,442**	**23,838**

* = As per vendor data, the VOC Emission Factor is the sum of NMNEHC plus Aldehydes.

Notes:

1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - As per vendor data, emission values are based on adjustment to specified NOX level, all other emission values are "Not to Exceed" (i.e., Vendor Guarantee).

3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

4 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

5 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.

6 - Total NMNEHC, VOC, HCHO, HAP and CO2e emissions include Compressor Rod Packing (CRP), Compressor Blowdown (CBD), Engine Start-up (ESU), and Engine Crankcase (ECC) Emissions:

Description (Each Engine w/ Compressor)	NMNEHC	VOC	HCHO	Tot HAP	CO2e
Engine Operations (See Above)	11.01 tpy	13.92 tpy	2.03 tpy	3.30 tpy	23,838 tpy
Compressor Rod Packing (CRP)	2.31 tpy	2.31 tpy	---	0.17 tpy	249 tpy
Compressor Blowdown (CBD)	0.54 tpy	0.54 tpy	---	0.04 tpy	59 tpy
Engine Start-up (ESU)	Electric or Pneumatic Starters are Utilized				
Engine Crankcase (ECC)	0.08 tpy	0.11 tpy	0.03 tpy	0.04 tpy	64.41 tpy
TOTAL:	**13.94 tpy**	**16.88 tpy**	**2.06 tpy**	**3.55 tpy**	**24,210 tpy**

Engine Crankcase (ECC (5E)) Emissions

Unit ID	Source ID	Site Rating	Operations	CAT G3616 A4 Emission Rates		NOx		CO		VOC		SO2		PM			CO2		CH4		N2O		CO2e	
						4.41 lb/hr		27.34 lb/hr		9.10 lb/hr		0.02 lb/hr		0.37 lb/hr			4,817 lb/hr		24.91 lb/hr		0.01 lb/hr		5,442 lb/hr	
				0.41 scf/bhp-hr		5.79 lb/MMscf		35.91 lb/MMscf		11.96 lb/MMscf		0.03 lb/MMscf		0.49 lb/MMscf			6,328 lb/MMscf		32.72 lb/MMscf		0.01 lb/MMscf		7,149 lb/MMscf	
				MMscf/yr		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	CE-01	5,000 bhp	8,760 hr/yr	18.02		0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03		13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-02	5,000 bhp	8,760 hr/yr	18.02		0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03		13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-03	5,000 bhp	8,760 hr/yr	18.02		0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03		13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	CE-04	5,000 bhp	8,760 hr/yr	18.02		0.01	0.05	0.07	0.32	0.02	0.11	6E-05	3E-04	1E-03	4E-03		13.02	57.01	0.07	0.29	2E-05	1E-04	14.70	64.41
	GE-01	1,468 bhp	8,760 hr/yr	5.29		3E-03	0.02	0.02	0.09	0.01	0.03	2E-05	8E-05	3E-04	1E-03		3.82	16.74	0.02	0.09	7E-06	3E-05	4.32	18.91
	TOTAL:	**21,468 bhp**	**43,800 hr/yr**	**77.36**	**Total:**	**0.05**	**0.22**	**0.32**	**1.39**	**0.11**	**0.46**	**3E-04**	**1E-03**	**4E-03**	**0.02**	**Total:**	**55.88**	**244.77**	**0.29**	**1.27**	**1E-04**	**4E-04**	**63.14**	**276.54**
					Pre-Control:	0.05	0.22	0.32	1.39	0.11	0.46	3E-04	1E-03	4E-03	0.02	Pre-:	55.88	244.77	0.29	1.27	1E-04	4E-04	63.14	276.54

Unit ID	Acetaldehyde		Acrolein		Benzene		Butadiene		Ethylbenzene		HCHO		n-Hexane		Methanol		POM/PAH		Toluene		TMP, 2,2,4-		Xylenes		Other/Trace		Total HAPs	
	0.31 lb/hr		0.19 lb/hr		0.02 lb/hr		0.01 lb/hr		1E-03 lb/hr		2.31 lb/hr		0.04 lb/hr		0.09 lb/hr		0.01 lb/hr		0.02 lb/hr		0.01 lb/hr		0.01 lb/hr		0.01 lb/hr		3.04 lb/hr	
	0.41 lb/MMscf		0.25 lb/MMscf		0.02 lb/MMscf		0.01 lb/MMscf		2E-03 lb/MMscf		3.04 lb/MMscf		0.05 lb/MMscf		0.12 lb/MMscf		0.02 lb/MMscf		0.02 lb/MMscf		0.01 lb/MMscf		0.01 lb/MMscf		0.02 lb/MMscf		3.99 lb/MMscf	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
ECC (5E)	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	8E-04	4E-03	5E-04	2E-03	4E-05	2E-04	3E-05	1E-04	4E-06	2E-05	0.01	0.03	1E-04	5E-04	3E-04	1E-03	4E-05	2E-04	4E-05	2E-04	3E-05	1E-04	2E-05	8E-05	3E-05	1E-04	0.01	0.04
	2E-04	1E-03	2E-04	7E-04	1E-05	6E-05	8E-06	3E-05	1E-06	5E-06	0.00	0.01	3E-05	1E-04	7E-05	3E-04	1E-05	5E-05	1E-05	5E-05	8E-06	3E-05	5E-06	2E-05	9E-06	4E-05	0.00	0.01
Total	**4E-03**	**0.02**	**2E-03**	**0.01**	**2E-04**	**8E-04**	**1E-04**	**5E-04**	**2E-05**	**8E-05**	**0.03**	**0.12**	**5E-04**	**2E-03**	**1E-03**	**5E-03**	**2E-04**	**7E-04**	**2E-04**	**8E-04**	**1E-04**	**5E-04**	**8E-05**	**3E-04**	**1E-04**	**6E-04**	**0.04**	**0.15**
Pre-Control:	4E-03	0.02	2E-03	0.01	2E-04	8E-04	1E-04	5E-04	2E-05	8E-05	0.03	0.12	5E-04	2E-03	1E-03	5E-03	2E-04	7E-04	2E-04	8E-04	1E-04	5E-04	8E-05	3E-04	1E-04	6E-04	0.04	0.15

Notes:

1 - As per Caterpillar's Application & Installation Guide - Crankcase Ventilation Systems:
"[B]low-by on a new engine is approx. 0.5 ft3 /bhp-hr
and design for a worn engine should be 1.0 ft3 /bhp-hr."
http://s7d2.scene7.com/is/content/Caterpillar/CM20160713-53120-62603

2 - Blowby emission rates converted from "actual" cubic feet to "standard" cubic feet:

scf = acf * [(P+14.6959)/14.6959] * [527.67/(T+459.67)]

Actual to Standard Conversions (@ 823 oF vs. 68 oF (Ignore Δ psi):	**1.0 acf =**	**0.41 scf**

3 - Engine Exhaust Flow Rates converted from "actual" cubic feet per minute to "standard" cubic feet per minute:

scf = acf * [(P+14.6959)/14.6959] * [527.67/(T+459.67)]

Actual to Standard Conversions (@ 823 oF vs. 68 oF (Ignore Δ psi):	**30,842 acfm =**	**12,688 scfm**

Compressor Rod Packing (CRP (6E)) Emissions

Unit ID	Unit Description (Compressor Rod Packing)	No of Cylinders	scfh per Cylinder	Contin-gency	Total Fugitive Leak Rate		Pre-Control VOC 9,537 lb/MMscf		Control Efficiency	VOC 9,537 lb/MMscf		CO2 (w/o Control) 213 lb/MMscf		CH4 41,158 lb/MMscf		CO2e CH4 GWP = 25	
					scfh	MMscfy	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CRP (6E)	Recip Compressor - 01 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31	na	0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 02 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 03 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
	Recip Compressor - 04 (Gas Engine)	4	12.0	15%	55.20	0.48	0.53	2.31		0.53	2.31	0.01	0.05	2.27	9.95	56.81	248.82
				TOTAL:	**220.80**	**1.93**	**2.11**	**9.22**	**TOTAL:**	**2.11**	**9.22**	**0.05**	**0.21**	**9.09**	**39.80**	**227.24**	**995**
				Pre-Control:	220.80	1.93	2.11	9.22	Pre-Cont:	2.11	9.22	0.05	0.21	9.09	39.80	227.24	995

Unit ID	Unit Description (Compressor Rod Packing)	Benzene 25.00 lb/MMscf		E-Benzene 25.00 lb/MMscf		n-Hexane 500 lb/MMscf		Methanol 25.00 lb/MMscf		Toluene 60.00 lb/MMscf		2,2,4-TMP 25.00 lb/MMscf		Xylene 60.00 lb/MMscf		Tot HAP 720 lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CRP (6E)	Recip Compressor - 01 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 02 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 03 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	Recip Compressor - 04 (Gas Engine)	1E-03	0.01	1E-03	0.01	0.03	0.12	1E-03	0.01	3E-03	0.01	1E-03	0.01	3E-03	0.01	0.04	0.17
	TOTAL:	**0.01**	**0.02**	**0.01**	**0.02**	**0.11**	**0.48**	**0.01**	**0.02**	**0.01**	**0.06**	**0.01**	**0.02**	**0.01**	**0.06**	**0.16**	**0.70**
	Pre-Control:	0.01	0.02	0.01	0.02	0.11	0.48	0.01	0.02	0.01	0.06	0.01	0.02	0.01	0.06	0.16	0.70

Notes:

1 - As per the manufacturer (Ariel): "Packing in new and broken-in condition will leak 5-10 scfh through the vent. This leakage rate will increase over time due to wear of the non-metallic sealing rings." The Williams' engineering department provides a conservative leak rate estimate of 12 scfh/cylinder.

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Min. Contingency: Wet Gas	20% VOC and GHG Worst Case	%Total	%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

3 - Each engine drives a four throw Ariel KBZ/4 reciprocating compressor.

4 - The reciprocating compressor associated with Solar's vent recompression system has its rod packing leaks circulated to the suction inlet through a dedicated line resulting in no leaks to the atmosphere.

Compressor Blowdown / Emergency Shutdown (BD (7E)) Emissions

Unit ID	Unit Description	Site Rating	Emission Factor	Blowdown Gas	Blowdown and ESD	Total Gas Vented	Pre-Control VOC 9,537 Gas lb/MMscf		Flare Control %	VOC 9,537 Gas lb/MMscf		CO2 (w/o Control) 213 Gas lb/MMscf		CH4 41,158 Gas lb/MMscf		CO2e CH4 GWP = 25	
		bhp	scf/bhp	scf/Event	Events/yr	Mscf/yr	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
BD (7E)	Recip Comp - 01 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14	98%	0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 02 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 03 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Recip Comp - 04 (Gas Engine) (CBD)	5,000	10.95	54,732	104	5,692	6.20	27.14		0.12	0.54	0.14	0.61	0.53	2.34	13.51	59.17
	Centrifugal Comp - 01 (Turbine CBD)	11,252	4.76	53,533	30	1,606	1.75	7.66		0.03	0.15	0.04	0.17	0.15	0.66	3.81	16.70
	Recip Comp - 05 (Electric) (CBD)	75	26.67	2,000	12	24	0.03	0.11		5E-04	2E-03	6E-04	3E-03	2E-03	0.01	0.06	0.25
	Emergency Shutdown (ESD) Testing	---	---	1,001,610	1	1,002	1.09	4.78		0.02	0.10	0.02	0.11	0.09	0.41	2.38	10.41
Assumes 1 hr/Event				**TOTAL:**	**459**	**25,400**	**27.65**	**121.12**	**TOTAL:**	**0.55**	**2.42**	**0.62**	**2.70**	**2.39**	**10.45**	**13.51**	**264.06**
							1,383	6,056	Pre-Control:	27.65	121.12	0.62	2.70	119.34	523	2,984	13,070

Unit ID	Unit Description	Benzene 25.00 Gas lb/MMscf		Ethylbenzene 25.00 Gas lb/MMscf		n-Hexane 500.00 Gas lb/MMscf		Methanol 25.00 Gas lb/MMscf		Toluene 60.00 Gas lb/MMscf		2,2,4-TMP 25.00 Gas lb/MMscf		Xylene 60.00 Gas lb/MMscf		Total HAP 720.00 Gas lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
BD (7E)	Recip Comp - 01 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 02 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 03 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Recip Comp - 04 (Gas Engine) (CBD)	3E-04	1E-03	3E-04	1E-03	6E-03	0.03	3E-04	1E-03	8E-04	3E-03	3E-04	1E-03	8E-04	3E-03	9E-03	0.04
	Centrifugal Comp - 01 (Turbine CBD)	9E-05	4E-04	9E-05	4E-04	2E-03	0.01	9E-05	4E-04	2E-04	1E-03	9E-05	4E-04	2E-04	1E-03	3E-03	0.01
	Recip Comp - 05 (Electric) (CBD)	1E-06	6E-06	1E-06	6E-06	3E-05	1E-04	1E-06	6E-06	3E-06	1E-05	1E-06	6E-06	3E-06	1E-05	4E-05	2E-04
	Emergency Shutdown (ESD) Testing	6E-05	3E-04	6E-05	3E-04	1E-03	5E-03	6E-05	3E-04	1E-04	6E-04	6E-05	3E-04	1E-04	6E-04	2E-03	7E-03
Assumes 1 hr/Event	**TOTAL:**	**1E-03**	**0.01**	**1E-03**	**0.01**	**0.03**	**0.13**	**1E-03**	**0.01**	**3E-03**	**0.02**	**1E-03**	**0.01**	**3E-03**	**0.02**	**0.04**	**0.18**
	Pre-Control:	0.07	0.32	0.07	0.32	1.45	6.35	0.07	0.32	0.17	0.76	0.07	0.32	0.17	0.76	2.09	9.14

Notes: 1 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

	Min. Contingency:	20% VOC and GHG		
Pollutant	**Wet Gas**	**Worst Case**	**%Total**	**%VOC**
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

ATTACHMENT S – BLOWDOWN AND PIGGING OPERATIONS

Type	Events	scf/Event	MW Gas	Total tpy	VOC%	VOC-tpy
CBD	416	Varies	20.05	13.96	15.55	2.17
ESD	1	1,001,610	20.05	0.61	15.55	0.10
LO-PIG	1095	2,668	20.05	1.79	15.55	0.28
HI-PIG	365	2,503	20.05	1.53	15.55	0.24

Type	Events	scf/Event	MW Gas	Total tpy	HAP%	HAP-tpy
CBD	416	Varies	20.05	13.96	1.17	0.16
ESD	1	1,001,610	20.05	0.61	1.17	0.007
LO-PIG	1095	2,668	20.05	1.79	1.17	0.02
HI-PIG	365	2,503	20.05	1.53	1.17	0.02

2 - The lb/hr emission estimates are tpy averaged over 8,760 hr/yr.

3 - The electric compressor blowdown volume is conservatively estimated at 2,000 scf.

Generator Engine (GE-01 (8E)) Emissions

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions				Control Efficiency	Controlled Emissions		
				g/bhp-hr	lb/MMBtu	lb/hr	tpy		g/bhp-hr	lb/hr	tpy
	Generator Engine 01 (OxCat-05)	Vendor Data	NOX	0.50	0.14	1.62	7.09	---	**0.50**	**1.62**	**7.09**
		Vendor Data	CO	1.92	0.55	6.21	27.22	87.0%	**0.25**	**0.81**	**3.54**
		Vendor Data	NMNEHC	0.32	0.09	1.04	4.54	21.9%	**0.25**	**0.81**	**3.54**
	Caterpillar (CAT) G3512LE (4SLB)	Sum	VOC (w/Aldehydes)*	0.67	0.19	2.16	9.46	49.5%	**0.34**	**1.09**	**4.78**
		AP-42 Table 3.2-2	SO2	2.07E-03	5.88E-04	0.01	0.03	---	**2E-03**	**0.01**	**0.03**
		AP-42 Table 3.2-2	PM10/2.5	3.51E-02	9.99E-03	0.11	0.50	---	**0.04**	**0.11**	**0.50**
	1,468 bhp	AP-42 Table 3.2-2	*Acetaldehyde	2.94E-02	8.36E-03	0.10	0.42	21.9%	**0.02**	**0.07**	**0.33**
	8,760 hr/yr	AP-42 Table 3.2-2	*Acrolein	1.81E-02	5.14E-03	0.06	0.26	21.9%	**1E-02**	**0.05**	**0.20**
	1,800 rpm, 16 cyl	AP-42 Table 3.2-2	Benzene	1.55E-03	4.40E-04	0.01	0.02	21.9%	**1E-03**	**4E-03**	**0.02**
		AP-42 Table 3.2-2	Butadiene, 1,3-	9.39E-04	2.67E-04	3E-03	0.01	21.9%	**7E-04**	**2E-03**	**0.01**
		AP-42 Table 3.2-2	Ethylbenzene	1.40E-04	3.97E-05	5E-04	2E-03	21.9%	**1E-04**	**4E-04**	**2E-03**
GE-01 (8E)		Vendor Data	*Formaldehyde	0.30	0.09	0.97	4.25	83.3%	**0.05**	**0.16**	**0.71**
	959 Exhaust Temp (oF)	AP-42 Table 3.2-2	n-Hexane	3.90E-03	1.11E-03	0.01	0.06	21.9%	**3E-03**	**0.01**	**0.04**
	9,156 Exhaust Flow (acfm)	AP-42 Table 3.2-2	Methanol	8.79E-03	2.50E-03	0.03	0.12	21.9%	**7E-03**	**0.02**	**0.10**
		AP-42 Table 3.2-2	POM/PAH	1.31E-03	3.74E-04	4E-03	0.02	21.9%	**1E-03**	**3E-03**	**0.01**
	MFD: > 08/23/11	AP-42 Table 3.2-2	Toluene	1.43E-03	4.08E-04	5E-03	0.02	21.9%	**1E-03**	**4E-03**	**0.02**
	NSPS JJJJ Affected	AP-42 Table 3.2-2	TMP, 2,2,4-	9.39E-04	2.67E-04	3E-03	0.01	21.9%	**7E-04**	**2E-03**	**0.01**
		AP-42 Table 3.2-2	Xylenes	6.47E-04	1.84E-04	2E-03	0.01	21.9%	**5E-04**	**2E-03**	**7E-03**
	7,751 Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	Other/Trace HAP	1.13E-03	3.21E-04	4E-03	0.02	21.9%	**9E-04**	**3E-03**	**0.01**
	11.38 MMBtu/hr (HHV)	AP-42 Table 3.2-2	Total HAP	0.37	0.10	1.19	5.22	71.9%	**0.10**	**0.33**	**1.47**
	11,156 scf/hr	Vendor Data	CO2 (GWP=1)	491	139.65	1,589	6,960	---	**491.00**	**1,589**	**6,960**
	97.72 MMscf/yr	Vendor Data	CH4 (GWP=25)	2.44	0.69	7.90	34.59	---	**2.44**	**7.90**	**34.59**
	1,020 Btu/scf (HHV)	40CFR98 - Table C2	N2O (GWP=298)	7.75E-04	2.20E-04	3E-03	0.01	---	**8E-04**	**3E-03**	**0.01**
		Weighted Sum	CO2e	552.23	157.07	1,787	7,828	---	**552.23**	**1,787**	**7,828**

* = As per vendor data, the VOC Emission Factor is the sum of NMNEHC plus Aldehydes.

Notes:

1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - As per vendor data, emission values are based on adjustment to specified NOX level, all other emission values are "Not to Exceed" (i.e., Vendor Guarantee).

3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

4 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

5 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.

6 - Total NMNEHC, VOC, HCHO, HAP and CO2e emissions include Compressor Rod Packing (CRP), Compressor Blowdown (CBD), Engine Start-up (ESU), and Engine Crankcase (ECC) Emissions:

Description (Each Engine w/ Compressor)	NMNEHC	VOC	HCHO	Tot HAP	CO2e
Engine Operations (See Above)	3.54 tpy	4.78 tpy	0.71 tpy	1.47 tpy	7,828 tpy
Compressor Rod Packing (CRP)	2.31 tpy	2.31 tpy	---	0.17 tpy	249 tpy
Compressor Blowdown (CBD)	0.54 tpy	0.54 tpy	---	0.04 tpy	59 tpy
Engine Start-up (ESU)	Electric or Pneumatic Starters are Utilized				
Engine Crankcase (ECC)	0.08 tpy	0.11 tpy	0.03 tpy	0.04 tpy	64.41 tpy
TOTAL:	**6.47 tpy**	**7.73 tpy**	**0.74 tpy**	**1.72 tpy**	**8,200 tpy**

Compressor Turbine (CT-01) Emissions

Unit ID	Description	Reference	Pollutant	Pre-Controlled Emissions lb/MMBtu (0^oF)	lb/MMBtu (50^oF)	lb/hr (0^oF)	tpy (50^oF)	Control Efficiency	Controlled Emissions lb/hr (0^oF)	tpy (50^oF)
CT-01 (9E)	**Compressor Turbine 01**	Vendor Data	NOx (15 ppm)	0.100	0.100	5.04	20.36	---	**5.04**	**20.36**
		Vendor Data	CO (25 ppm)	0.122	0.122	5.11	20.65	---	**5.11**	**20.65**
	Solar Taurus 70-10802S	Vendor Data	UHC (CH4) (25 ppm)	0.035	0.035	2.93	11.83	---	**2.93**	**11.83**
		Vendor Data (PIL 168)	VOC (UHC*20%)	0.007	0.007	0.59	2.37	---	**0.59**	**2.37**
	11,252 bhp (Max @ 0oF)	AP-42 Table 3.2-2	SO2	0.003	0.003	0.29	1.16	---	**0.29**	**1.16**
	10,747 bhp (Avg @ 50oF)	Vendor Data (PIL 171)	PM10/2.5	0.010	0.010	0.84	3.40	---	**0.84**	**3.40**
	8,760 hr/yr	AP-42 Table 3.2-2	Acetaldehyde	4.00E-05	4.00E-05	3E-03	0.01	---	**3E-03**	**0.01**
	12,852 rpm (Max @ 0oF)	AP-42 Table 3.2-2	Acrolein	6.40E-06	6.40E-06	5E-04	2E-03	---	**5E-04**	**2E-03**
	12,852 rpm (Typ @ 50oF)	AP-42 Table 3.2-2	Benzene	9.10E-07	9.10E-07	8E-05	3E-04	---	**8E-05**	**3E-04**
		AP-42 Table 3.2-2	Butadiene, 1,3-	4.30E-07	4.30E-07	4E-05	1E-04	---	**4E-05**	**1E-04**
	Manufactured ≥ 02/18/05	AP-42 Table 3.2-2	Ethylbenzene	3.20E-05	3.20E-05	3E-03	0.01	---	**3E-03**	**0.01**
	NSPS KKKK Affected	Vendor Data (PIL 168)	Formaldehyde	7.10E-04	7.10E-04	0.06	0.24	---	**0.06**	**0.24**
		AP-42 Table 3.2-2	n-Hexane	---	---	---	---	---	**---**	**---**
	932 Exhaust Temp (oF)	AP-42 Table 3.2-2	Methanol	---	---	---	---	---	**---**	**---**
	208,678 Exhaust Flow (lb/hr)	AP-42 Table 3.2-2	POM/PAH	3.47E-05	3.47E-05	3E-03	0.01	---	**3E-03**	**0.01**
		AP-42 Table 3.2-2	Toluene	1.30E-04	1.30E-04	0.01	0.04	---	**0.01**	**0.04**
	7,229 Btu/bhp-hr (HHV)	AP-42 Table 3.2-2	TMP, 2,2,4-	---	---	---	---	---	**---**	**---**
	83.87 MMBtu/hr (Max @ 0oF)	AP-42 Table 3.2-2	Xylenes	6.40E-05	6.40E-05	5E-03	0.02	---	**5E-03**	**0.02**
	77.70 MMBtu/hr (Typ @ 50oF)	AP-42 Table 3.2-2	Other/Trace HAP	2.90E-05	2.90E-05	2E-03	0.01	---	**2E-03**	**0.01**
	82,225 scf/hr (Max @ 0oF)	Sum	Total HAP	1.05E-03	1.05E-03	0.09	0.36	---	**0.09**	**0.36**
	76,176 scf/hr (Typ @ 50oF)	AP-42 Table 3.2-2	CO2 (GWP=1)	110	110.00	9,226	37,436	---	**9,226**	**37,436**
	667 MMscf/yr	Vendor Data	CH4 (GWP=25)	0.035	0.035	2.94	11.91	---	**2.94**	**11.91**
	1,020 Btu/scf (HHV)	AP-42 Table 3.2-2	N2O (GWP=298)	0.003	0.003	0.25	1.02	---	**0.25**	**1.02**
		Weighted Sum	CO2e	112	111.77	9,374	38,038	---	**9,374**	**38,038**

Notes:

1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr.

2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5

3 - "Other/Trace HAPs" includes: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

4 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate. (It does NOT impact the emission estimates.)

5 - Total VOC, HCHO, HAP and CO2e emissions include Compressor Turbine Operations (CT-01), Compressor Turbine Start+Stop (TSS), Dry Gas Seals (DGS), and Compressor Blowdown (CBD) emissions:

Description (Each Engine w/ Compressor)	VOC	HCHO	Tot HAP
Compressor Turbine Operations (See Above)	2.37 tpy	0.24 tpy	0.36 tpy
Compressor Turbine Start-Stop (TSS)	1.04 tpy	---	0.08 tpy
Dry Gas Seals (DGS)	3.71 tpy	---	0.28 tpy
Compressor Blowdown (CBD)	0.15 tpy	---	1E-02 tpy
TOTAL:	**7.27 tpy**	**0.24 tpy**	**0.73 tpy**

Combustion Turbine Start/Stop (TSS) Emissions

Unit ID	Description	Start+Stop per year	NOX		CO		VOC		CO2		CH4 (UHC)		CO2e	
			lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
TSS (10E)	Solar Taurus 70-10802S	104	2 lb/(Start+Stop)		73 lb/(Start+Stop)		20 lb/(Start+Stop)		676 lb/(Start+Stop)		102 lb/(Start+Stop)		3,226 lb/(Start+Stop)	
			0.02	0.10	0.87	3.80	0.24	1.04	8.03	35.15	1.21	5.30	38.30	167.75
	TOTAL:	**104**	**0.02**	**0.10**	**0.87**	**3.80**	**0.24**	**1.04**	**8.03**	**35.15**	**1.21**	**5.30**	**38.30**	**167.75**
		Pre-Control:	0.02	0.10	0.87	3.80	0.24	1.04	8.03	35.15	1.21	5.30	38.30	167.75

* lb/hr is tpy averaged over 8,760 hr/yr

Unit ID	Benzene 0.26% VOC		Ethylbenzene 0.26% VOC		n-Hexane 5.24% VOC		Methanol 0.26% VOC		Toluene 0.63% VOC		2,2,4-TMP 0.26% VOC		Xylene 0.63% VOC		Total HAP 7.55% VOC	
	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
TSS (10E)	6E-04	3E-03	6E-04	3E-03	0.01	0.05	6E-04	3E-03	1E-03	0.01	6E-04	3E-03	1E-03	0.01	0.02	0.08
	6E-04	**3E-03**	**6E-04**	**3E-03**	**0.01**	**0.05**	**6E-04**	**3E-03**	**1E-03**	**0.01**	**6E-04**	**3E-03**	**1E-03**	**0.01**	**0.02**	**0.08**
Pre-Control:	6E-04	3E-03	6E-04	3E-03	0.01	0.05	6E-04	3E-03	1E-03	0.01	6E-04	3E-03	1E-03	0.01	0.02	0.08

Notes: 1 - The emission factors for start-up and shutdown events are provided by the vendor in PIL 170, summarized below: (See Attachment C1 - Vendor Data)

Start/Stop Emissions Rate in lb/Event	Taurus 60-7000S					
	NOX	CO	VOC	CO2	CH4	CO2e
lb/Start	1	37	10	381	52	1,681
lb/Stop	1	36	10	295	50	1,545
Total lb/(Start+Stop)	**2**	**73**	**20**	**676**	**102**	**3,226**

Table 4: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units with Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7802S (Post 9/2020 Orders)	1	5	4	1	247	1	7	6	1	235
Taurus 70 10802S (Post 2/2018 Orders)	1	37	52	10	381	1	36	50	10	295

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

Pollutant	Inlet Gas	Minimum Contingency: Worst Case	20% %Total	%VOC
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.23%
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.55%
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.18%
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.00%
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.26%
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.26%
n-Hexane	227.09 lb/MMscf	500 lb/MMscf	0.815	5.24%
Methanol	--- lb/MMscf	25 lb/MMscf	0.041	0.26%
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.63%
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.26%
Xylenes	19.58 lb/MMscf	60 lb/MMscf	0.098	0.63%
Total HAP	270.21 lb/MMscf	720 lb/MMscf	1.174	7.55%

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Centrifugal Compressor Dry Gas Seal (DGS) Emissions

Unit ID	Unit Description (Compressor Dry Gas Seals)	Operating Time	Leak Rate (Solar PIL 251)		Pre-Control VOC 9,537 lb/MMscf		Control %	VOC 9,537 lb/MMscf		CO2 (w/o Control) 213 lb/MMscf		CH4 41,158 lb/MMscf		CO2e CH4 GWP = 25	
		Hours	scfm	MMscf/yr	lb/hr*	tpy		lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
DGS (11E)	Comp Turbine 01	6,600	6.00	2.38	2.59	11.33	100%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2,160	6.00	0.78	0.85	3.71	0%	0.85	3.71	0.02	0.08	3.65	16.00	91.35	400.13
				TOTAL:	**3.43**	**15.04**	**TOTAL:**	**0.85**	**3.71**	**0.02**	**0.08**	**3.65**	**16.00**	**91.35**	**400**
							Pre-Control:	3.43	15.04	0.08	0.34	14.82	64.90	370	1,623

Source ID	Benzene 25.00 lb/MMscf		Ethylbenzene 25.00 lb/MMscf		n-Hexane 500.00 lb/MMscf		Methanol 25.00 lb/MMscf		Toluene 60.00 lb/MMscf		2,2,4-TMP 25.00 lb/MMscf		Xylene 60.00 lb/MMscf		Total HAP 720.00 lb/MMscf	
	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy	lb/hr*	tpy
DGS (11E)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2E-03	0.01	2E-03	0.01	0.04	0.19	2E-03	0.01	5E-03	0.02	2E-03	0.01	5E-03	0.02	0.06	0.28
	2E-03	**0.01**	**2E-03**	**0.01**	**0.04**	**0.19**	**2E-03**	**0.01**	**5E-03**	**0.02**	**2E-03**	**0.01**	**5E-03**	**0.02**	**0.06**	**0.28**
Pre-Control:	9E-03	0.04	9E-03	0.04	0.18	0.79	0.01	0.04	2E-02	0.09	9E-03	0.04	2E-02	0.09	0.26	1.14

Notes:

1 - The Solar Taurus 70 Compressor Turbines (CT-01) drives one (1) Solar C41MH centrifugal compressor

2 - Dry gas seal leak rate provided by Solar Turbines and based on PIL 251 and historical operating pressure. A conservative contingency has been added to the estimate leak rate.

5.0 scfm * 120% Contingency = 6.00 scfm

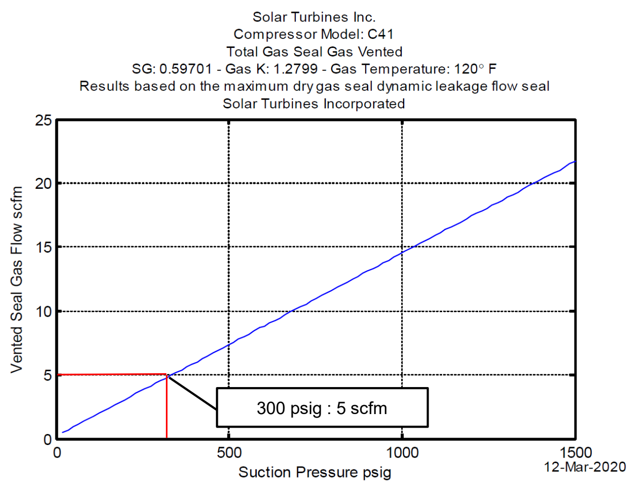

Figure 8: C41

3 - The results of a representative Extended Gas Analysis were used to determine the following worst-case VOC and HAP components (See Attachment C1 - Lab Analysis):

Pollutant	Inlet Gas	Worst-Case	Wgt%	Wt%VOC
		Minimum Contingency:		**20%**
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	20 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270 lb/MMscf	720 lb/MMscf	1.174	7.550

4 - A dry seal recompression system is used to capture the centrifugal compressor dry gas seal leaks for reinjection to the station suction or discharge header. This recompression system achieves 100% capture of the seal leaks. There will be occasional maintenance performed on the recompression system and it is assumed up to 3 months (2,160 hours) of recompression system downtime may occur over the course of a year.

Dehydrator 01 (DFT-01 (12E) and DSV-01 (13E)) Emissions

Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Pre-Control Emissions		Worst-Case Pre-Control VOC/GHG: 20% Margin HAP: 20% Margin		T-Ox Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
			GRI-GLYCalc 4.0 + Proc Sim	VOC	26.56	116.32	31.87	140		**0.16**	**0.70**
			GRI-GLYCalc 4.0	Benzene	0.04	0.19	0.05	0.23		**3E-04**	**1E-03**
		Flow Rate	GRI-GLYCalc 4.0	Ethylbenzene	0.01	0.05	0.01	0.06		**7E-05**	**3E-04**
		250.0	GRI-GLYCalc 4.0	n-Hexane	0.85	3.71	1.02	4.46		**0.01**	**0.02**
	Dehydrator Flash Tank		Process Simulation	Methanol	---	---	---	---	99.5%	**---**	**---**
DFT-01 (12E)	Flash Tank Off-Gas Controlled by 99.5% T-Ox (T-Ox)	MMscfd	GRI-GLYCalc 4.0	Toluene	0.09	0.39	0.11	0.47		**5E-04**	**2E-03**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	0.07	0.33	0.09	0.39		**4E-04**	**2E-03**
		8,760	GRI-GLYCalc 4.0	Tot HAP	1.07	4.67	1.28	5.61		**0.01**	**0.03**
			GRI-GLYCalc 4.0	CO2	1.55	6.79	1.86	8.15	---	**1.86**	**8.15**
		hr/yr	GRI-GLYCalc 4.0	CH4	36.06	158	43.28	190	99.5%	**0.22**	**0.95**
			40CFR98 - Table A-1	CO2e	903.17	3,956	1,084	4,747	99.3%	**7.27**	**31.84**
			GRI-GLYCalc 4.0 + Proc Sim	VOC	119.62	523.95	143.55	628.74		**0.72**	**3.14**
			GRI-GLYCalc 4.0	Benzene	4.47	19.58	5.37	23.50		**0.03**	**0.12**
		Flow Rate	GRI-GLYCalc 4.0	Ethylbenzene	3.33	14.59	4.00	17.50		**0.02**	**0.09**
		250.0	GRI-GLYCalc 4.0	n-Hexane	2.91	12.77	3.50	15.32		**0.02**	**0.08**
	Dehydrator Still Vent		Process Simulation	Methanol	3.13	13.73	3.13	13.73	99.5%	**0.02**	**0.07**
DSV-01 (13E)	Still Vent Off-Gas Controlled by 99.5% T-Ox (T-Ox)	MMscfd	GRI-GLYCalc 4.0	Toluene	14.44	63.25	17.33	75.89		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	32.56	142.63	39.08	171.16		**0.20**	**0.86**
		8,760	GRI-GLYCalc 4.0	Tot HAP	60.85	266.54	72.40	317.10		**0.36**	**1.59**
			GRI-GLYCalc 4.0	CO2	1.49	6.53	1.79	7.83	---	**1.79**	**7.83**
		hr/yr	GRI-GLYCalc 4.0	CH4	33.17	145.27	39.80	174.32	99.5%	**0.20**	**0.87**
			40CFR98 - Table A-1	CO2e	829.16	3,638	996.78	4,366	99.3%	**6.76**	**29.62**
			GRI-GLYCalc 4.0 + Proc Sim	VOC	146.18	640.27	175	768		**0.88**	**3.84**
			GRI-GLYCalc 4.0	Benzene	4.52	19.78	5.42	23.73		**0.03**	**0.12**
		Flow Rate	GRI-GLYCalc 4.0	Ethylbenzene	3.34	14.63	4.01	17.56		**0.02**	**0.09**
		250.0	GRI-GLYCalc 4.0	n-Hexane	3.76	16.48	4.52	19.78		**0.02**	**0.10**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73	99.5%	**0.02**	**0.07**
DHY-01	Dehydrator (Total)	MMscfd	GRI-GLYCalc 4.0	Toluene	14.53	63.63	17.43	76.36		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	32.64	142.96	39.17	171.55		**0.20**	**0.86**
		8,760	GRI-GLYCalc 4.0	Tot HAP	61.92	271.21	73.68	323		**0.37**	**1.61**
			GRI-GLYCalc 4.0	CO2	3.04	13.32	3.65	15.98	---	**3.65**	**15.98**
		hr/yr	GRI-GLYCalc 4.0	CH4	69.23	303	83.08	364	99.5%	**0.42**	**1.82**
			40CFR98 - Table A-1	CO2e	1732	7,594	2,081	9,113	99.3%	**14.03**	**61**

Notes:
1 - Used GRI-GLYCalc V4.0 to calculate Flash Tank and Regenerator/Still Vent emissions (see Supplement S4 - Emission Programs). Process Simulation used to calculate MeOH emissions. Total VOC includes MeOH.
2 - GRI-GLYCalc 4.0 Model Results are based on the following input:

Wet Gas:	80 oF and 1,000 psig, H2O Saturated	Glycol Pump:	Electric Pump
Wet Gas Analysis:	See Supplement S1 - Wet Gas Summary	Flash Tank:	110 oF, 60 psig, 99.5% Combustion
Dry Gas:	250.0 MMscfd, 7.0 lb-H2O/MMscf	Stripping Gas:	Dry Gas @ 15 scfm
Lean Glycol:	1.5 wt% H2O, 24.0 gpm	Regen Control:	99.5% Combustion

3 - A contingency has been added to the GRI-GLYCalc model results to account for potential future changes in gas composition.

Dehydrator 02 (DFT-02 (15E) and DSV-02 (16E)) Emissions

Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Pre-Control Emissions		Worst-Case Pre-Control VOC/GHG: 20% Margin HAP: 20% Margin		T-Ox Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy	%	lb/hr	tpy
DFT-02 (15E)	Dehydrator Flash Tank Flash Tank Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	29.54	129.38	35.45	155	99.5%	**0.18**	**0.78**
			GRI-GLYCalc 4.0	Benzene	0.05	0.23	0.06	0.27		**3E-04**	**1E-03**
			GRI-GLYCalc 4.0	Ethylbenzene	0.01	0.06	0.02	0.07		**8E-05**	**3E-04**
			GRI-GLYCalc 4.0	n-Hexane	0.98	4.29	1.17	5.15		**0.01**	**0.03**
			Process Simulation	Methanol	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Toluene	0.10	0.44	0.12	0.53		**6E-04**	**3E-03**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	0.08	0.36	0.10	0.43		**5E-04**	**2E-03**
			GRI-GLYCalc 4.0	Tot HAP	1.23	5.37	1.47	6.45		**0.01**	**0.03**
			GRI-GLYCalc 4.0	CO2	1.25	5.48	1.50	6.57	---	**1.50**	**6.57**
			GRI-GLYCalc 4.0	CH4	37.88	166	45.46	199	99.5%	**0.23**	**1.00**
			40CFR98 - Table A-1	CO2e	948.33	4,154	1,138	4,984	99.4%	**7.18**	**31.46**
DSV-02 (16E)	Dehydrator Still Vent Still Vent Off-Gas Controlled by 99.5% T-Ox (T-Ox)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	111.75	489.49	134.11	587.38	99.5%	**0.67**	**2.94**
			GRI-GLYCalc 4.0	Benzene	4.49	19.69	5.39	23.63		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.30	14.45	3.96	17.34		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	2.73	11.95	3.28	14.35		**0.02**	**0.07**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.40	63.07	17.28	75.69		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	31.39	137.50	37.67	165.00		**0.19**	**0.83**
			GRI-GLYCalc 4.0	Tot HAP	59.45	260.40	70.71	309.73		**0.35**	**1.55**
			GRI-GLYCalc 4.0	CO2	1.08	4.73	1.30	5.68	---	**1.30**	**5.68**
			GRI-GLYCalc 4.0	CH4	2.05	8.98	2.46	10.78	99.5%	**0.01**	**0.05**
			40CFR98 - Table A-1	CO2e	51.27	229	62.82	275	97.4%	**1.60**	**7.02**
DHY-02	Dehydrator (Total)	Flow Rate 160.0 MMscfd 8,760 hr/yr	GRI-GLYCalc 4.0 + Proc Sim	VOC	141.29	619	170	743	99.5%	**0.85**	**3.71**
			GRI-GLYCalc 4.0	Benzene	4.55	19.91	5.46	23.90		**0.03**	**0.12**
			GRI-GLYCalc 4.0	Ethylbenzene	3.31	14.51	3.97	17.41		**0.02**	**0.09**
			GRI-GLYCalc 4.0	n-Hexane	3.71	16.24	4.45	19.49		**0.02**	**0.10**
			Process Simulation	Methanol	3.13	13.73	3.13	13.73		**0.02**	**0.07**
			GRI-GLYCalc 4.0	Toluene	14.50	63.52	17.40	76.22		**0.09**	**0.38**
			GRI-GLYCalc 4.0	2,2,4-TMP	---	---	---	---		**---**	**---**
			GRI-GLYCalc 4.0	Xylenes	31.48	137.86	37.77	165.43		**0.19**	**0.83**
			GRI-GLYCalc 4.0	Tot HAP	60.68	265.77	72.19	316		**0.36**	**1.58**
			GRI-GLYCalc 4.0	CO2	2.33	10.21	2.80	12.25	---	**2.80**	**12.25**
			GRI-GLYCalc 4.0	CH4	39.93	175	47.92	210	99.5%	**0.24**	**1.05**
			40CFR98 - Table A-1	CO2e	1000	4,383	1,201	5,260	99.3%	**8.79**	**38**

Notes:
1 - Used GRI-GLYCalc V4.0 to calculate Flash Tank and Regenerator/Still Vent emissions (see Supplement S4 - Emission Programs). Process Simulation used to calculate MeOH emissions. Total VOC includes MeOH.
2 - GRI-GLYCalc 4.0 Model Results are based on the following input:

Wet Gas:	80 oF and 1,000 psig, H2O Saturated	Glycol Pump:	Electric Pump
Wet Gas Analysis:	See Supplement S1 - Wet Gas Summary	Flash Tank:	110 oF, 50 psig, 99.5% Combustion
Dry Gas:	160.0 MMscfd, 7.0 lb-H2O/MMscf	Stripping Gas:	na
Lean Glycol:	1.5 wt% H2O, 24.6 gpm	Regen Control:	99.5% Combustion

3 - A contingency has been added to the GRI-GLYCalc model results to account for potential future changes in gas composition.

Reboiler 01 and 02 (RBV-01 (14E) and RBV-02 (17E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor		Emissions	
				lb/MMscf	lb/MMBtu	lb/hr	tpy
RBV-01 (14E) RBV-02 (17E)	Reboiler	EPA AP-42 Table 1.4-1	NOX	100	9.80E-02	**0.20**	**0.86**
		EPA AP-42 Table 1.4-1	CO	84	8.24E-02	**0.16**	**0.72**
		EPA AP-42 Table 1.4-2	NMNEHC	5.4	5.32E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-2	VOC	5.5	5.39E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-2	SO2	0.6	5.88E-04	**1E-03**	**0.01**
		EPA AP-42 Table 1.4-2	PM10/2.5	7.6	7.45E-03	**0.01**	**0.07**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
	2.00 MMBtu/hr (HHV) (ea)	EPA AP-42 Table 1.4-3	Benzene	2.10E-03	2.06E-06	**4E-06**	**2E-05**
		EPA AP-42 Table 1.4-4	Butadiene, 1,3-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Formaldehyde	7.50E-02	7.35E-05	**1E-04**	**6E-04**
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	POM/PAH	6.98E-04	6.85E-07	**1E-06**	**6E-06**
		EPA AP-42 Table 1.4-3	Toluene	3.40E-03	3.33E-06	**7E-06**	**3E-05**
		EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Other/Trace HAP	1.20E-03	1.18E-06	**2E-06**	**1E-05**
		SUM	Total HAP	1.88	1.85E-03	**4E-03**	**0.02**
	1,961 scf/hr	EPA AP-42 Table 1.4-3	CO2 (GWP=1)	118	117.65	**235.29**	**1,031**
	47.06 Mscfd	EPA AP-42 Table 1.4-3	CH4 (GWP=25)	2.30	2.25E-03	**5E-03**	**0.02**
	17.18 MMscf/yr	EPA AP-42 Table 1.4-3	N2O (GWP=298)	2.20	2.16E-03	**4E-03**	**2E-02**
		40CFR98 - Table A-1	CO2e	831	118.35	**236.69**	**1,037**

Notes:
1 - The emissions shown are based on operation at 100% of rated load for 8,760 hr/yr. Actual load and operating hours will be less.
2 - The fuel heating value will vary, 1,020 Btu/scf (HHV) is at the low end of the range and results in a high (conservative) fuel consumption estimate.
3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5
4 - "Other/Trace HAPs" includes: CarbonTetrachloride, Chlorobenzene, Chloroform, Dichloropropene, 1,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Phenol, Propylene Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

Produced Water - Storage Tank TK-01 thru TK-04 (18E-21E) Emissions

Unit ID	Material Stored	Capacity		Thruput	EPA TANKS 4.0.9d				Control Efficiency (FLR)	VOC 100.00 %VOC		CO2 (w/o Control) --- VOC		CH4 --- VOC		CO2e CH4 GWP = 25	
					Working	Breathing	Total										
		bbl	bbl/day	bbl/yr	lb/yr	lb/yr	lb/yr	tpy/yr		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TK-01 (18E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04	na	0.01	0.04	Negligible GHG Emissions from Produced Water (PW)					
TK-02 (19E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
TK-03 (20E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
TK-04 (21E)	Produced Water	400	75.0	30,000	70.46	---	70.46	0.04		0.01	0.04						
	TOTAL:	1,600		120,000					TOTAL:	0.03	0.14	---	---	---	---	---	---
									PRE-Control SC/TK:	0.03	0.14	---	---	---	---	---	---

Unit ID	Benzene 0.08 %VOC		Ethylbenzene 2.09 %VOC		n-Hexane (C6) 7.72 %VOC		Methanol (MeOH) 0.06 %VOC		Toluene (C7) 1.05 %VOC		2,2,4-TMP 0.70 %VOC		Xylenes (C8) 2.73 %VOC		Total HAP 14.43 %VOC	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TK-01 (18E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-02 (19E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-03 (20E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TK-04 (21E)	6E-06	3E-05	2E-04	7E-04	6E-04	3E-03	5E-06	2E-05	8E-05	4E-04	6E-05	2E-04	2E-04	1E-03	1E-03	5E-03
TOTAL:	**3E-05**	**1E-04**	**7E-04**	**3E-03**	**2E-03**	**0.01**	**2E-05**	**9E-05**	**3E-04**	**1E-03**	**2E-04**	**1E-03**	**9E-04**	**4E-03**	**5E-03**	**0.02**
PRE-PW/TK:	3E-05	1E-04	7E-04	3E-03	2E-03	1E-02	2E-05	9E-05	3E-04	1E-03	2E-04	1E-03	9E-04	4E-03	5E-03	0.02

Notes: 1 - Produced water storage tanks are heated to approximately 60 degrees Fahrenheit to prevent freezing. Breathing losses are zero due to constant temperature.

2 - The results of a **Condensate Analysis** were used to determine the following worst-case components (See Supplement S1- Condensate Summary):

Pollutant	Min. Contingency: Condensate	20% VOC 20% HAP Worst Case	%Total	%VOC
CO2	--- lb/MMscf	--- lb/MMscf	---	---
Methane (CH4)	--- lb/MMscf	--- lb/MMscf	---	---
N2/Water/Ethane/Etc	--- lb/MMscf	--- lb/MMscf	---	---
VOC	268,162 lb/MMscf	321,795 lb/MMscf	100	100
TOTAL Gas	268,162 lb/MMscf	321,795 lb/MMscf	100	---
Benzene	127 lb/MMscf	253 lb/MMscf	0.08	0.08
Ethylbenzene	3,357 lb/MMscf	6,714 lb/MMscf	2.09	2.09
n-Hexane	12,422 lb/MMscf	24,843 lb/MMscf	7.72	7.72
Methanol	--- lb/MMscf	200 lb/MMscf	0.06	0.06
Toluene	1,687 lb/MMscf	3,375 lb/MMscf	1.05	1.05
2,2,4-TMP	1,132 lb/MMscf	2,264 lb/MMscf	0.70	0.70
Xylenes	4,395 lb/MMscf	8,790 lb/MMscf	2.73	2.73
Total HAP	23,120 lb/MMscf	46,439 lb/MMscf	14.43	14.43

3 - The TANKS 4.0.9d program was used to determine storage tank emissions (See Supplement S4 - TANKS 4.0.9d Output)

Produced Water - Truck Load-Out (TLO (22E)) Emissions

Unit ID	Description	S	P	M	T	CE (FLR)	L_L	T-Put	VOC 100.00%		CO2 --- VOC		CH4 --- VOC		CO2e CH4 GWP = 25	
		sat. fac.	psia	lb/lb-mol	°R	%	lb/Mgal	Mgal/yr	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TLO (22E)	Produced Water	0.60	1.50	30.00	510	na	0.66	5,040	0.38	1.66	---	---	---	---	---	---
							TOTAL:	**5,040**	**0.38**	**1.66**	**---**	**---**	**---**	**---**	**---**	**---**
							PRE-Control:		0.38	1.66	---	---	---	---	---	---

Unit ID	Benzene 0.08 %VOC		Ethylbenzene 2.09 %VOC		n-Hexane (C6) 7.72 %VOC		Methanol 0.06 %VOC		Toluene (C7) 1.05 %VOC		2,2,4-TMP 0.70 %VOC		Xylenes (C8) 2.73 %VOC		Total HAP 14.43 %VOC	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
TLO (22E)	3E-04	1E-03	0.01	0.03	0.03	0.13	2E-04	1E-03	4E-03	0.02	3E-03	0.01	0.01	0.05	0.05	0.24
TOTAL:	**3E-04**	**1E-03**	**0.01**	**0.03**	**0.03**	**0.13**	**2E-04**	**1E-03**	**4E-03**	**0.02**	**3E-03**	**0.01**	**0.01**	**0.05**	**0.05**	**0.24**
PRE-Control:	3E-04	1E-03	0.01	0.03	0.03	0.13	2E-04	1E-03	4E-03	0.02	3E-03	0.01	0.01	0.05	0.05	0.24

Notes: 1 - Emission factors and formulas are from AP-42 Section 5.2 "Transportation and Marketing of Petroleum Liquids":

L_L = 12.46 x S x P x M / T x (1 - CE)

where:
- L_L = loading loss, lb/1000 gal of liquid loaded
- S = saturation factor, use 0.60 for submerged fill.
- P = true vapor pressure of liquid loaded, psia.
- M = molecular weight of vapors, lb/lb-mol.
- T = temperature of bulk liquid loaded, °R = °F + 460
- CE = overall emission reduction efficiency (70% collection efficiency x 98% FLR).

2 - Vapor pressure (P), molecular weight (M), and temperature (T) derived from EPA TANKS 4.0.9d.
(See Supplement S4 - Emission Program Results.)

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight
Produced Water (95% Water + 5% Condensate)	All	51.94	47.06	56.81	50.33	0.2465	0.2101	0.2893	28.3522			18.75
Gasoline (RVP 12)						5.4430	4.9447	5.9807	64.0000	0.0500	0.5080	92.00
Water						0.1930	0.1614	0.2307	18.0000	0.9500	0.4920	18.00

Pigging Operation (PIG (23E) Emissions

Unit ID	Unit Description	Blowdown Volume	Blowdown and ESD	Total Gas Vented	Pre-Control VOC 9,537 Gas lb/MMscf		FLR Control %	VOC 9,537 Gas lb/MMscf		CO_2 (w/o Control) 213 Gas lb/MMscf		CH_4 41,158 Gas lb/MMscf		CO_2e CH4 GWP = 25	
		scf/Event	Events/yr	Mscf/yr	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PIG (23E)	12" Receiver A (PIG)	1,612	365	588	0.64	2.81	98%	0.01	0.06	0.01	0.06	0.06	0.24	1.40	6.12
	12" Receiver B (PIG)	1,612	365	588	0.64	2.81		0.01	0.06	0.01	0.06	0.06	0.24	1.40	6.12
	20" Receiver B (PIG)	4,781	365	1,745	1.90	8.32		0.04	0.17	0.04	0.19	0.16	0.72	4.14	18.14
	16" Launcher A (PIG)	6,858	365	2,503	2.73	11.94		0.05	0.24	0.06	0.27	0.24	1.03	5.94	26.02
Assumes 1 hr/Event	TOTAL:		**1,460**	**5,425**	**5.91**	**25.87**	**TOTAL:**	**0.12**	**0.52**	**0.13**	**0.58**	**0.51**	**2.23**	**12.88**	**56.39**
							Pre-Control:	5.91	25.87	6.59	28.88	25.49	111.63	644	2,820

Unit ID	Unit Description	Benzene 25.00 Gas lb/MMscf		Ethylbenzene 25.00 Gas lb/MMscf		n-Hexane 500.00 Gas lb/MMscf		Methanol 25.00 Gas lb/MMscf		Toluene 60.00 Gas lb/MMscf		2,2,4-TMP 25.00 Gas lb/MMscf		Xylene 60.00 Gas lb/MMscf		Total HAP 720.00 Gas lb/MMscf	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PIG (23E)	12" Receiver A (PIG)	3E-05	1E-04	3E-05	1E-04	7E-04	3E-03	3E-05	1E-04	8E-05	4E-04	3E-05	1E-04	8E-05	4E-04	1E-03	4E-03
	12" Receiver B (PIG)	3E-05	1E-04	3E-05	1E-04	7E-04	3E-03	3E-05	1E-04	8E-05	4E-04	3E-05	1E-04	8E-05	4E-04	1E-03	4E-03
	20" Receiver B (PIG)	1E-04	4E-04	1E-04	4E-04	2E-03	9E-03	1E-04	4E-04	2E-04	1E-03	1E-04	4E-04	2E-04	1E-03	3E-03	0.01
	16" Launcher A (PIG)	1E-04	6E-04	1E-04	6E-04	3E-03	1E-02	1E-04	6E-04	3E-04	2E-03	1E-04	6E-04	3E-04	2E-03	4E-03	0.02
Assumes 1 hr/Event	TOTAL:	**3E-04**	**1E-03**	**3E-04**	**1E-03**	**0.01**	**0.03**	**3E-04**	**1E-03**	**7E-04**	**3E-03**	**3E-04**	**1E-03**	**7E-04**	**3E-03**	**0.01**	**0.04**
	Pre-Control:	0.02	0.07	0.02	0.07	0.31	1.36	0.02	0.07	0.04	0.16	0.02	0.07	0.04	0.16	0.45	1.95

Notes:

1 - Volume of gas vented during each Pigging Operation was conservatively estimated as follows:
(Lower temperature (T) is more conservative and higher pressure (P) is more conservative.)

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
20" Receiver:	23.0	9.0	26.0	60	720	0.93	1,420
	19.0	24.0	47.3				2,584
	9.3	30.0	14.0				766
	1.6	15.0	0.2				11
		Total Vacf:	87.4			**Total Vscf:**	**4,781**

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
12" Receiver	15.0	7.0	8.6	120	720	0.76	514
	11.0	20.0	13.2				790
	7.4	17.0	5.0				300
	1.6	8.5	0.1				7
		Total Vacf:	26.9			**Total Vscf:**	**1,612**

	ID (in)	L (ft)	V (acf)	T (oF)	P (psig)	Z	V (scf)
16" Launcher	20.0	10.0	21.8	120	1,440	0.76	2,586
	16.0	14.5	20.2				2,400
	12.0	9.0	7.1				838
	8.0	25.0	8.7				1,034
		Total Vacf:	57.9			**Total Vscf:**	**6,858**

2 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

	Min. Contingency:	20% VOC and GHG		
Pollutant	**Wet Gas**	**Worst Case**	**%Total**	**%VOC**
CO_2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH_4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N_2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25 lb/MMscf	0.041	0.262
n-Hexane	227.09 lb/MMscf	500 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25 lb/MMscf	0.041	0.262
Xylenes	19.58 lb/MMscf	60 lb/MMscf	0.098	0.629
Total HAP	270.21 lb/MMscf	720 lb/MMscf	1.174	7.550

Where: Vacf = 3.1416 * (Din/12/2)^2 * Lft
Vscf = Vacf * 528/(ToF+460) * (Ppsig+14.70)/14.70 / Z
Compressibility Factor (Z) from https://checalc.com/solved/naturalgasZ.html

DFT/DSV Thermal Oxidizer (TOx-01 (24E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor		Emissions	
				lb/MMscf	lb/MMBtu	lb/hr	tpy
	Zeeco Z-HTO Thermal Oxidizer (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	59	0.10	**0.75**	**3.27**
		EPA AP-42 Table 13.5-1	CO	187	0.31	**2.36**	**10.33**
		EPA AP-42 Table 1.4-2	NMNEHC	3.22	5.32E-03	**0.04**	**0.18**
	Controls Dehydrator (DHY-01) Flash Tank (DFT-01 (12E) and Still Vent (DSV-01 (13E))	EPA AP-42 Table 1.4-2	VOC	3.26	5.39E-03	**0.04**	**0.18**
		EPA AP-42 Table 1.4-2	SO2	0.36	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	4.51	7.45E-03	**0.06**	**0.25**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	1.25E-03	2.06E-06	**2E-05**	**7E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	Site Rating	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	7.61 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Formaldehyde	0.04	7.35E-05	**6E-04**	**2E-03**
TOx-01 (24E)	99.5% Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	1.07	1.76E-03	**0.01**	**0.06**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	4.1E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	2.0E-03	3.33E-06	**3E-05**	**1E-04**
	605 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Other/Trace HAP	7.1E-04	1.18E-06	**9E-06**	**4E-05**
		SUM	Total HAP	1.12	1.85E-03	**0.01**	**0.06**
	12,576 scf/hr	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	71,146	117.65	**894.73**	**3,919**
	302 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	1.36	2.25E-03	**0.02**	**0.08**
	110.17 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.13	2.20E-04	**2E-03**	**0.01**
		40CFR98 - Table A-1	CO2e	71,220	117.77	**895.66**	**3,923**

Notes:

1 - Dehydrator flash tank off-gases are generally burned as fuel in the reboiler. However, to be conservative, all flash tank off-gases are shown as being routed to the Thermal Oxidizer (TOx-01).

2 - Heat Input to the Thermal Oxidizer was determined as follows:

Waste/Pilot Gas Stream	scf/hr	Btu/scf (HHV)	MMBtu/hr
DFT-01 - Flash Tank Off-Gas	1,400	1,447	2.03
RSV-01 - Regenerator/Still Vent Gas	8,230	399	3.28
Purge, Fuel and Pilot Gas	850	1,214	1.03
20% Contingency	2,096	605	1.27
Total Gas to the Thermal Oxidizer:	**12,576**	**605**	**7.61**

3 - Reference: GRI-GLYCalc Results, Worst-Case Gas Analysis, Vendor Data, and Engineering Judgment.

DFT/DSV Thermal Oxidizer (TOx-02 (25E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor lb/MMscf	Emission Factor lb/MMBtu	Emissions lb/hr	Emissions tpy
TOx-02 (25E)	Zeeco Z-VTO Thermal Oxidizer (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	74	0.10	**0.66**	**2.88**
		EPA AP-42 Table 13.5-1	CO	233	0.31	**2.08**	**9.10**
		EPA AP-42 Table 1.4-2	NMNEHC	4.00	5.32E-03	**0.04**	**0.16**
	Controls Dehydrator (DHY-02) Flash Tank (DFT-02 (15E) and Still Vent (DSV-02 (16E))	EPA AP-42 Table 1.4-2	VOC	4.06	5.39E-03	**0.04**	**0.16**
		EPA AP-42 Table 1.4-2	SO2	0.44	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	5.61	7.45E-03	**0.05**	**0.22**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	1.55E-03	2.06E-06	**1E-05**	**6E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	<u>Site Rating</u>	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	6.70 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Formaldehyde	0.06	7.35E-05	**5E-04**	**2E-03**
	99.5% Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	1.33	1.76E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	5.1E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	2.5E-03	3.33E-06	**2E-05**	**1E-04**
	752 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr	EPA AP-42 Table 1.4-3	Other/Trace HAP	8.9E-04	1.18E-06	**8E-06**	**3E-05**
		SUM	Total HAP	1.39	1.85E-03	**0.01**	**0.05**
	8,904 scf/hr	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	88,510	117.65	**788.09**	**3,452**
	214 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	1.70	2.25E-03	**0.02**	**0.07**
	78.00 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.17	2.20E-04	**1E-03**	**0.01**
		40CFR98 - Table A-1	CO2e	88,602	117.77	**788.91**	**3,455**

Notes:

1 - Dehydrator flash tank off-gases are generally burned as fuel in the reboiler. However, to be conservative, all flash tank off-gases are shown as being routed to the Thermal Oxidizer (TOx-01).

2 - Heat Input to the Thermal Oxidizer was determined as follows:

Waste/Pilot Gas Stream	scf/hr	Btu/scf (HHV)	MMBtu/hr
DFT-02 - Flash Tank Off-Gas	1,490	1,464	2.18
RSV-02 - Regenerator/Still Vent Gas	4,930	444	2.19
Purge, Fuel and Pilot Gas	1,000	1,214	1.21
20% Contingency	1,484	752	1.12
Total Gas to the Thermal Oxidizer:	**8,904**	**752**	**6.70**

3 - Reference: GRI-GLYCalc Results, Worst-Case Gas Analysis, Vendor Data, and Engineering Judgment.

BD/PIG Elevated Flare (FLR-01 (26E)) Emissions

Unit ID	Description	Reference	Pollutant	Emission Factor lb/MMscf	Emission Factor lb/MMBtu	Emissions lb/hr	Emissions tpy
FLR-01 (26E)	Zeeco MJ-16 Elevated Flare (Combustion Only)	EPA AP-42 Table 1.4-1	NOX	119.04	0.10	**0.67**	**2.95**
		EPA AP-42 Table 13.5-1	CO	376.40	0.31	**2.13**	**9.34**
		EPA AP-42 Table 1.4-2	NMNEHC	6.46	5.32E-03	**0.04**	**0.16**
	Controls Compressor Blowdown and Emergency Shutdown (BD (7E), and PIG (23E)	EPA AP-42 Table 1.4-2	VOC	6.55	5.39E-03	**0.04**	**0.16**
		EPA AP-42 Table 1.4-2	SO2	0.71	5.88E-04	**4E-03**	**0.02**
		EPA AP-42 Table 1.4-2	PM10/2.5	9.05	7.45E-03	**0.05**	**0.22**
		EPA AP-42 Table 1.4-3	Acetaldehyde	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Acrolein	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Benzene	2.50E-03	2.06E-06	**1E-05**	**6E-05**
		EPA AP-42 Table 1.4-3	Butadiene, 1,3-	---	---	**---**	**---**
	Site Rating	EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	**---**	**---**
	7.00 MMBtu/hr (HHV) (Ave)	EPA AP-42 Table 1.4-3	Formaldehyde	0.09	7.35E-05	**5E-04**	**2E-03**
	98.0% Net Control Efficiency	EPA AP-42 Table 1.4-3	n-Hexane	2.14	1.76E-03	**0.01**	**0.05**
		EPA AP-42 Table 1.4-3	Methanol	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	POM/PAH	8.3E-04	6.85E-07	**5E-06**	**2E-05**
		EPA AP-42 Table 1.4-3	Toluene	4.0E-03	3.33E-06	**2E-05**	**1E-04**
	1,214 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	TMP, 2,2,4-	---	---	**---**	**---**
		EPA AP-42 Table 1.4-3	Xylenes	---	---	**---**	**---**
	8,760 hr/yr (intermittent)	EPA AP-42 Table 1.4-3	Other/Trace HAP	1.4E-03	1.18E-06	**8E-06**	**4E-05**
		SUM	Total HAP	2.24	1.85E-03	**0.01**	**0.06**
	5,663 scf/hr (Ave)	EPA AP-42 Table 1.4-2	CO2 (GWP=1)	142,845	117.65	**808.87**	**3,543**
	136 Mscf/dy	EPA AP-42 Table 1.4-2	CH4 (GWP=25)	2.74	2.25E-03	**0.02**	**0.07**
	49.60 MMscf/yr	40CFR98 - Table C-2	N2O (GWP=298)	0.27	2.20E-04	**2E-03**	**7E-03**
		40CFR98 - Table A-1	CO2e	142,993	117.77	**809.71**	**3,547**

Notes: 1 - The average Heat Input to FLR-01 (26E) was determined as follows:

Waste/Pilot Gas Stream	scf/hr (ave)	Btu/scf (HHV)	MMBtu/hr (ave)
Recip Comp - 01 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 02 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 03 (Gas Engine) (CBD)	650	1,214	0.79
Recip Comp - 04 (Gas Engine) (CBD)	650	1,214	0.79
Centrifugal Comp - 01 (Turbine CBD)	183	1,214	0.22
Recip Comp - 05 (Electric) (CBD)	3	1,214	3E-03
Emergency Shutdown (ESD) Testing	114	1,214	0.14
Pigging Operations (PIG)	619	1,214	0.75
Purge, Fuel, and Pilot Gas	1,200	1,214	1.46
20% Contingency	944	1,214	1.15
Total Gas to FLR-01 (26E)	**5,663**	**1,214**	**6.88**
		Round-Up:	**7.00**

2 - Reference: Worst-Case Wet Gas Analysis, Vendor Data, and Engineering Judgment.

Process Piping and Equipment Leaks – Gas (FUG-G (1F)) Emissions

Unit ID	Description	Component (Unit) Type	Unit Count	Cons'tive Multiplier	Leak Factor	Pre-Controlled Leaks		LDAR Control Credit	Controlled Leaks		VOC 15.55 Wgt%		CO2 2.23% VOC		CH4 432% VOC		CO2e CH4 GWP = 25	
		(Gas)		150%	lb/hr/Unit	lb/hr	tpy		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
FUG-G (1F)	Process Piping and Equipment Leaks (Gas)	Valves	960	1,440	9.92E-03	14.29	62.57	92%	1.14	5.01	0.18	0.78	4E-03	0.02	0.77	3.36	19.18	84.01
		Pump Seals	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	72	108	1.94E-02	2.10	9.18	---	2.10	9.18	0.33	1.43	7E-03	0.03	1.41	6.16	35.17	154.03
		Connectors	3,132	4,698	4.41E-04	2.07	9.07	93%	0.15	0.64	0.02	0.10	5E-04	2E-03	0.10	0.43	2.43	10.66
		Flanges	783	1,175	8.60E-04	1.01	4.42	---	1.01	4.42	0.16	0.69	4E-03	0.02	0.68	2.97	16.95	74.23
		Open-ended Lines	34	51	4.41E-03	0.22	0.98	---	0.22	0.98	0.03	0.15	8E-04	3E-03	0.15	0.66	3.77	16.53
		TOTAL:	**4,981**	**7,472**						**TOTAL:**	**0.72**	**3.15**	**0.02**	**0.07**	**3.10**	**13.58**	**77.50**	**339.46**
										PRE Control:	3.06	13.41	0.07	0.30	13.21	57.88	330.42	1447.24

Unit ID	Description	Component (Unit) Type	Benzene 0.262% VOC		Ethylbenzene 0.262% VOC		n-Hexane (C6) 5.24% VOC		Methanol 0.26% VOC		Toluene (C7) 0.629% VOC		2,2,4-TMP 0.262% VOC		Xylenes (C8) 0.629% VOC		Total HAP 7.550% VOC	
		(Gas)	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
FUG-G (1F)	Process Piping and Equipment Leaks (Gas)	Valves	5E-04	2E-03	5E-04	2E-03	9E-03	0.04	5E-04	2E-03	1E-03	5E-03	5E-04	2E-03	1E-03	5E-03	0.01	0.06
		Pump Seals	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	9E-04	4E-03	9E-04	4E-03	0.02	0.07	9E-04	4E-03	2E-03	9E-03	9E-04	4E-03	2E-03	9E-03	0.02	0.11
		Connectors	6E-05	3E-04	6E-05	3E-04	1E-03	5E-03	6E-05	3E-04	1E-04	6E-04	6E-05	3E-04	1E-04	6E-04	2E-03	7E-03
		Flanges	4E-04	2E-03	4E-04	2E-03	8E-03	0.04	4E-04	2E-03	1E-03	4E-03	4E-04	2E-03	1E-03	4E-03	0.01	0.05
		Open-ended Lines	9E-05	4E-04	9E-05	4E-04	2E-03	8E-03	9E-05	4E-04	2E-04	1E-03	9E-05	4E-04	2E-04	1E-03	3E-03	1E-02
		TOTAL:	**2E-03**	**0.01**	**2E-03**	**0.01**	**0.04**	**0.16**	**2E-03**	**0.01**	**5E-03**	**0.02**	**2E-03**	**0.01**	**5E-03**	**0.02**	**0.05**	**0.24**
		PRE Control:	5.10	35.80	2.76	12.08	0.16	0.70	0.01	0.04	0.02	0.08	0.01	0.04	0.02	0.08	0.23	1.01

Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.

2 - Gas/Vapor emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995; Table 2-4, Oil and Gas Production Operations:

Equipment Type	Gas		Light Oil		Water/Oil	
	kg/hr	lb/hr/unit	kg/hr	lb/hr/unit	kg/hr	lb/hr/unit
Valves	4.5E-03	9.92E-03	2.5E-03	5.51E-03	9.8E-05	2.16E-04
Pump Seals	---	---	1.3E-02	2.87E-02	2.4E-05	5.29E-05
Others	8.8E-03	1.94E-02	7.5E-03	1.65E-02	1.4E-02	3.09E-02
Connectors	2.0E-04	4.41E-04	2.1E-04	4.63E-04	1.1E-04	2.43E-04
Flanges	3.9E-04	8.60E-04	1.1E-04	2.43E-04	2.9E-06	6.39E-06
Open-Ended Lines	2.0E-03	4.41E-03	1.4E-03	3.09E-03	2.5E-04	5.51E-04

3 - "Other" components include pressure relief devices (PRD), compressors, diaphragms, drains, meters, etc.

4 - The results of a representative **Wet Gas Analysis** were used to determine the following worst-case components (See Supplement S1 - Wet Gas Summary):

	Min. Contingency:	20% VOC		
Pollutant	**Wet Gas**	**Worst Case**	**%Total**	**%VOC**
CO2	177 lb/MMscf	213 lb/MMscf	0.347	2.233
Methane (CH4)	34,298 lb/MMscf	41,158 lb/MMscf	67.119	431.555
N2/Water/Ethane/Etc	10,412 lb/MMscf	10,412 lb/MMscf	16.980	109.179
VOC	7,948 lb/MMscf	9,537 lb/MMscf	15.553	100.000
TOTAL Gas	52,835 lb/MMscf	61,320 lb/MMscf	100.000	---
Benzene	6.18 lb/MMscf	25.00 lb/MMscf	0.041	0.262
Ethylbenzene	2.80 lb/MMscf	25.00 lb/MMscf	0.041	0.262
n-Hexane	227.09 lb/MMscf	500.00 lb/MMscf	0.815	5.243
Methanol (MeOH)	--- lb/MMscf	25.00 lb/MMscf	0.041	0.262
Toluene	14.57 lb/MMscf	60.00 lb/MMscf	0.098	0.629
2,2,4-TMP	--- lb/MMscf	25.00 lb/MMscf	0.041	0.262
Xylenes	19.58 lb/MMscf	60.00 lb/MMscf	0.098	0.629
Total HAP	270.21 lb/MMscf	720.00 lb/MMscf	1.174	7.550

Process Piping and Equipment Leaks – Light Oil (FUG-L (2F)) Emissions

Unit ID	Description	Component (Unit) Type (Light Oil)	Unit Count	Cons'tive Multiplier 150%	Leak Factor lb/hr/Unit	Pre-Controlled Leaks lb/hr	Pre-Controlled Leaks tpy	LDAR Control Credit	Controlled Leaks lb/hr	Controlled Leaks tpy	VOC 100.00 Wgt% lb/hr	VOC tpy	CO2 --- VOC lb/hr	CO2 tpy	CH4 --- VOC lb/hr	CH4 tpy	CO2e CH4 GWP = 25 lb/hr	CO2e tpy
FUG-L (2F)	Process Piping and Equipment Leaks (Light Oil)	Valves	576	864	5.51E-03	4.76	20.86	88%	0.57	2.50	0.57	2.50	---	---	---	---	---	---
		Pump Seals	12	18	2.87E-02	0.52	2.26	75%	0.13	0.56	0.13	0.56	---	---	---	---	---	---
		Other	43	65	1.65E-02	1.07	4.67	---	1.07	4.67	1.07	4.67	---	---	---	---	---	---
		Connectors	1,296	1,944	4.63E-04	0.90	3.94	93%	0.06	0.28	0.06	0.28	---	---	---	---	---	---
		Flanges	324	486	2.43E-04	0.12	0.52	---	0.12	0.52	0.12	0.52	---	---	---	---	---	---
		Open-ended Lines	20	30	3.09E-03	0.09	0.41	---	0.09	0.41	0.09	0.41	---	---	---	---	---	---
		TOTAL:	**2,271**	**3,407**						**TOTAL:**	**2.04**	**8.94**	**---**	**---**	**---**	**---**	**---**	**---**
										PRE Control:	7.45	32.65	---	---	---	---	---	---

Unit ID	Description	Component (Unit) Type (Light Oil)	Benzene 0.079% VOC lb/hr	Benzene tpy	Ethylbenzene 2.09% VOC lb/hr	Ethylbenzene tpy	n-Hexane (C6) 7.72% VOC lb/hr	n-Hexane tpy	Methanol 0.06% VOC lb/hr	Methanol tpy	Toluene (C7) 1.05% VOC lb/hr	Toluene tpy	2,2,4-TMP 0.70% VOC lb/hr	2,2,4-TMP tpy	Xylenes (C8) 2.73% VOC lb/hr	Xylenes tpy	Total HAP 14.43% VOC lb/hr	Total HAP tpy
FUG-L (2F)	Process Piping and Equipment Leaks (Light Oil)	Valves	4E-04	2E-03	0.01	0.05	0.04	0.19	4E-04	2E-03	6E-03	0.03	4E-03	0.02	0.02	0.07	0.08	0.36
		Pump Seals	1E-04	4E-04	3E-03	0.01	0.01	0.04	8E-05	4E-04	1E-03	6E-03	9E-04	4E-03	4E-03	0.02	0.02	0.08
		Other	8E-04	4E-03	0.02	0.10	0.08	0.36	7E-04	3E-03	0.01	0.05	8E-03	0.03	0.03	0.13	0.15	0.67
		Connectors	5E-05	2E-04	1E-03	6E-03	5E-03	0.02	4E-05	2E-04	7E-04	3E-03	4E-04	2E-03	2E-03	0.01	0.01	0.04
		Flanges	9E-05	4E-04	2E-03	0.01	0.01	0.04	7E-05	3E-04	1E-03	5E-03	8E-04	4E-03	3E-03	0.01	0.02	0.07
		Open-ended Lines	7E-05	3E-04	2E-03	0.01	0.01	0.03	6E-05	3E-04	1E-03	4E-03	7E-04	3E-03	3E-03	0.01	0.01	0.06
		TOTAL:	**2E-03**	**0.01**	**0.04**	**0.19**	**0.16**	**0.69**	**1E-03**	**6E-03**	**0.02**	**0.09**	**1E-02**	**6E-02**	**0.06**	**0.24**	**0.29**	**1.29**
		PRE Control:	6E-03	0.03	0.16	0.68	0.58	2.52	5E-03	0.02	0.08	0.34	5E-02	0.23	0.20	0.89	1.08	4.71

Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.

2 - Light Oil emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995; Table 2-4, Oil and Gas Production Operations:

Equipment Type	Gas kg/hr	Gas lb/hr/unit	Light Oil kg/hr	Light Oil lb/hr/unit	Water/Oil kg/hr	Water/Oil lb/hr/unit
Valves	4.5E-03	9.92E-03	2.5E-03	5.51E-03	9.8E-05	2.16E-04
Pump Seals	---	---	1.3E-02	2.87E-02	2.4E-05	5.29E-05
Others	8.8E-03	1.94E-02	7.5E-03	1.65E-02	1.4E-02	3.09E-02
Connectors	2.0E-04	4.41E-04	2.1E-04	4.63E-04	1.1E-04	2.43E-04
Flanges	3.9E-04	8.60E-04	1.1E-04	2.43E-04	2.9E-06	6.39E-06
Open-Ended Lines	2.0E-03	4.41E-03	1.4E-03	3.09E-03	2.5E-04	5.51E-04

3 - "Other" components include pressure relief devices (PRD), diaphragms, drains, meters, etc.

4 - The results of a representative **Condensate Analysis** were used to determine the following worst-case components (See Supplement S1 - Condensate Summary):

	Min. Contingency:	20% VOC 100% HAP		
Pollutant	**Condensate**	**Worst Case**	**%Total**	**%VOC**
CO2	--- lb/MMscf	--- lb/MMscf	---	---
Methane (CH4)	--- lb/MMscf	--- lb/MMscf	---	---
N2/Water/Ethane/Etc	--- lb/MMscf	--- lb/MMscf	---	---
VOC	268,162 lb/MMscf	321,795 lb/MMscf	100.000	100.000
TOTAL Condensate	268,162 lb/MMscf	321,795 lb/MMscf	100.000	---
Benzene	126.59 lb/MMscf	253.18 lb/MMscf	0.079	0.079
Ethylbenzene	3,357.16 lb/MMscf	6,714.31 lb/MMscf	2.087	2.087
n-Hexane	12,421.65 lb/MMscf	24,843.30 lb/MMscf	7.720	7.720
Methanol (MeOH)	--- lb/MMscf	200.00 lb/MMscf	0.062	0.062
Toluene	1,687.46 lb/MMscf	3,374.93 lb/MMscf	1.049	1.049
2,2,4-TMP	1,131.80 lb/MMscf	2,263.61 lb/MMscf	0.703	0.703
Xylenes	4,395.08 lb/MMscf	8,790.15 lb/MMscf	2.732	2.732
Total HAP	23,119.74 lb/MMscf	46,439.48 lb/MMscf	14.431	14.431

Potentially Applicable

AP-42 and GHG EMISSION FACTORS

(Preferentially use test data or vendor data where available)

	Pollutant	Natural Gas-Fired Reciprocating Engines			Stationary Gas-Fired Turbines	
		AP-42 Table 3.2-1; 3.2-2; 3.2-3 07/00			AP-42 Table 3.1-1; 3.1-2a; 3.1-3 04/00	
		2SLB lb/MMBtu	4SLB lb/MMBtu	4SRB lb/MMBtu	Uncontrolled lb/MMBtu	Lean Pre-Mix# lb/MMBtu
CRITERIA	NOx (≥ 90% Load)	3.17E+00	4.08E+00	2.21E+00	3.23E-01	9.91E-02
	CO (≥ 90% Load)	3.86E-01	3.17E-01	3.72E+00	8.23E-02	1.51E-02
	VOC (NMNEHC w/o Aldehydes*)	4.93E-02	5.17E-02	3.68E-03	2.06E-03	2.06E-03
	VOC (NMNEHC w/ Aldehydes*)	1.20E-01	1.18E-01	2.96E-02	2.82E-03	2.13E-03
	SO2 (2,000 gr-S/MMscf ≈ 0.0007 W%)	5.88E-04	5.88E-04	5.88E-04	3.40E-03	3.40E-03
	PM10/2.5 (Condensible and Filterable)	4.83E-02	9.99E-03	1.94E-02	6.63E-03	6.63E-03
HAPs	Acetaldehyde*	7.76E-03	8.36E-03	2.79E-03	4.00E-05	4.00E-05
	Acrolein*	7.78E-03	5.14E-03	2.63E-03	6.40E-06	6.40E-06
	Benzene	1.94E-03	4.40E-04	1.58E-03	1.20E-05	9.10E-07
	Butadiene, 1,3-	8.20E-04	2.67E-04	6.63E-04	4.30E-07	4.30E-07
	Ethylbenzene	1.08E-04	3.97E-05	2.48E-05	3.20E-05	3.20E-05
	Formaldehyde (HCHO)*	5.52E-02	5.28E-02	2.05E-02	7.10E-04	2.00E-05
	n-Hexane	4.45E-04	1.11E-03	---	---	---
	Methanol (MeOH)	2.48E-03	2.50E-03	3.06E-03	---	---
	Polycyclic Organic Matter (POM/PAH)	2.68E-04	3.74E-04	2.38E-04	3.47E-05	3.47E-05
	Toluene	9.63E-04	4.08E-04	5.58E-04	1.30E-04	1.30E-04
	Trimethylpentane, 2,2,4- (i-Octane)	8.46E-04	2.50E-04	---	---	---
	Xylenes	2.68E-04	1.84E-04	1.95E-04	6.40E-05	6.40E-05
	Other/Trace HAP**	6.57E-04	3.21E-04	1.79E-04	2.90E-05	2.90E-05
	TOTAL HAP	7.95E-02	7.22E-02	3.24E-02	1.06E-03	3.57E-04
GHG	CO2 (GWP=1)	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02
	CH4 (GWP=25)	1.45E+00	1.25E+00	2.30E-01	8.64E-03	8.64E-03
	N2O (GWP=298)	Use 40CFR98	Use 40CFR98	Use 40CFR98	3.00E-03	3.00E-03
	CO2e	Use 40CFR98	Use 40CFR98	Use 40CFR98	Use 40CFR98	Use 40CFR98

(#Lean Pre-Mix - aka: Dry Low Emissions (DLE or DLN) or SoLoNOx)

	Pollutant	Natural Gas (External) Combustion			Industrial Flares	Diesel Engines
		AP-42 Table 1.4-1; 1.4-2; 1.4-3 (<100 MMBtu/hr) 07/98			13.5-1 06/17	3.3-1; 3.3-2 10/96
		Uncontrolled lb/MMBtu	LoNOx Burners lb/MMBtu	Flue Gas Recirc lb/MMBtu	Combustion lb/MMBtu	Uncontrolled lb/MMBtu
CRITERIA	NOx (≥ 90% Load)	9.80E-02	4.90E-02	3.14E-02	Use Ext. Comb.	4.41E+00
	CO (≥ 90% Load)	8.24E-02	8.24E-02	8.24E-02	3.10E-01	9.50E-01
	VOC (NMNEHC w/o Aldehydes*)	5.32E-03	5.32E-03	5.32E-03		3.60E-01
	VOC (NMNEHC w/ Aldehydes*)	5.39E-03	5.39E-03	5.39E-03	Use Ext. Comb.	3.62E-01
	SO2 (2,000 gr-S/MMscf ≈ 0.0007 W%)	5.88E-04	5.88E-04	5.88E-04		2.90E-01
	PM10/2.5 (Condensible and Filterable)	7.45E-03	7.45E-03	7.45E-03		3.10E-01
HAPs	Acetaldehyde*	---	---	---		7.67E-04
	Acrolein*	---	---	---		9.25E-05
	Benzene	2.06E-06	2.06E-06	2.06E-06		9.33E-04
	Butadiene, 1,3-	---	---	---		3.91E-05
	Ethylbenzene	---	---	---		---
	Formaldehyde (HCHO)*	7.35E-05	7.35E-05	7.35E-05		1.18E-03
	n-Hexane	1.76E-03	1.76E-03	1.76E-03	Use Ext. Comb.	---
	Methanol (MeOH)	---	---	---		---
	Polycyclic Organic Matter (POM/PAH)	6.85E-07	6.85E-07	6.85E-07		1.68E-04
	Toluene	3.33E-06	3.33E-06	3.33E-06		4.09E-04
	Trimethylpentane, 2,2,4- (i-Octane)	---	---	---		---
	Xylenes	---	---	---		2.85E-04
	Other/Trace HAP**	1.18E-06	1.18E-06	1.18E-06		---
	TOTAL HAP	1.85E-03	1.85E-03	1.85E-03		3.87E-03
GHG	CO2 (GWP=1)	1.18E+02	1.18E+02	1.18E+02		1.64E+02
	CH4 (GWP=25)	2.25E-03	2.25E-03	2.25E-03	Use Ext. Comb.	
	N2O (GWP=298)	2.16E-03	6.27E-04	6.27E-04		Use 40CFR98
	CO2e	Use 40CFR98	Use 40CFR98	Use 40CFR98		

40CFR98 - Default Greenhouse Gas (GHG) Emission Factors					
Fuel Type	Table C-1 to Subpart C of Part 98		Table C-2 to Subpart C of Part 98		Weighted Sum
	Default HHV	Carbon Dioxide lb CO2/MMBtu	Methane lb CH4/MMBtu	Nitrous Oxide lb N2O/MMBtu	CO2e lb CO2e/MMBtu
Fuel Oil No. 2 (Diesel)	138,000 Btu/gal	1.63E+02	6.61E-03	1.32E-03	1.64E+02
Propane	91,000 Btu/gal	1.39E+02	6.61E-03	1.32E-03	1.39E+02
Natural Gas	1,026 Btu/scf	1.17E+02	2.20E-03	2.20E-04	1.17E+02

* Aldehyde (not measured in EPA Test Method 25)

** Other/Trace HAPs include: Carbon Tetrachloride, Chlorobenzene, Chloroform, Dichloropropene, ,3-Dichloropropene, Ethylene Dibromide, Methylene Chloride, Naphthalene, Phenol, Propylene, Oxide, Styrene, 1,1,2,2-Tetrachloroethane, 1,1,2-Trichloroethane, and Vinyl Chloride (as per AP-42).

Global Warming Potential (100 Yr) (GWP)		
Table A-1 to Subpart A of Part 98		
CO2	CH4	N2O
1	25	298

Supplement S4

Lab Analysis

- **Inlet Gas – Summary – Ridgeline Compressor Station**
- **Inlet Gas – Lab Analysis – Ridgeline Compressor Station**
- **Condensate Liquid – Summary – Ridgeline Compressor Station**
- **Condensate Liquid – Lab Analysis – Ridgeline Compressor Station**
- **Btu Loading – Zeeco Z-HTO Thermal Oxidizer (TOx-01)**
- **Btu Loading – Zeeco V-HTO Thermal Oxidizer (TOx-02)**

Appalachia Midstream Services, LLC

Ridgeline Compressor Station

Application for 45CSR30 Title V Operating Permit

Inlet Gas - Summary

Sampled: **01/25/21** **Jamison CRP (Intertek Analysis)** GPSA-Sec 23

Component	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Wgt Sum (MW*Mol Fraction)	lb/MMscf (WS/UGC#)	Weight % Total	Weight % THC	Weight % VOC	Component Btu/scf (HHV)	Btu/scf (HHV)
Water	109-86-4	H2O	18.015	**---**	---	---	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.010	**0.1530**	0.067	177.44	0.3358	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.086	**---**	---	---	---	---	---	637.6	---
Nitrogen	7727-37-9	N2	28.013	**0.4250**	0.119	313.73	0.5938	---	---	---	---
Methane*	75-82-8	CH4	16.042	**81.1320**	13.015	34,297.98	64.9148	65.5239	---	1,010.0	819.433
Ethane*	74-84-0	C2H6	30.069	**12.7450**	3.832	10,098.68	19.1135	19.2928	---	1,769.7	225.548
Propane**	74-98-6	C3H8	44.096	**3.3880**	1.494	3,936.81	7.4511	7.5210	49.5349	2,516.2	85.249
iso-Butane**	75-28-5	i-C4H10	58.122	**0.4750**	0.276	727.51	1.3769	1.3899	9.1539	3,252.0	15.447
n-Butane**	106-97-8	n-C4H10	58.122	**0.7340**	0.427	1,124.20	2.1277	2.1477	14.1453	3,262.4	23.946
iso-Pentane**	78-78-4	i-C5H12	72.149	**0.2190**	0.158	416.37	0.7880	0.7954	5.2390	4,000.9	8.762
n-Pentane**	109-66-0	n-C5H12	72.149	**0.1750**	0.126	332.72	0.6297	0.6356	4.1864	4,008.9	7.016
Cyclopentane**	287-92-3	C5H10	70.100	**0.0210**	0.015	38.79	0.0734	0.0741	0.4881	3,763.6	0.790
Cyclohexane**	110-82-7	C6H12	84.162	**0.0200**	0.017	44.36	0.0840	0.0847	0.5581	4,481.6	0.896
Other Hexanes**	Various	C6H14	86.175	**0.1840**	0.159	417.84	0.7908	0.7982	5.2574	4,750.3	8.741
Heptanes**	142-82-5	C7H16	100.205	**0.1030**	0.103	271.98	0.5148	0.5196	3.4222	5,502.5	5.668
Methylcyclohexane**	108-87-2	C7H14	98.186	**0.0310**	0.030	80.21	0.1518	0.1532	1.0092	5,215.9	1.617
C8+ Heavies**	Various	C8+	138.00 est.	**0.0788**	0.109	286.56	0.5424	0.5474	3.6056	7,000.0	5.516
Benzene***	71-43-2	C6H6	78.112	**0.0030**	0.002	6.18	0.0117	0.0118	0.0777	3,741.9	0.112
Ethylbenzene***	100-41-4	C8H10	106.165	**0.0010**	0.001	2.80	0.0053	0.0053	0.0352	5,222.0	0.052
n-Hexane***	110-54-3	C6H14	86.175	**0.1000**	0.086	227.09	0.4298	0.4338	2.8573	4,756.0	4.756
Methanol (MeOH)	67-56-1	CH4O	32.042	**---**	---	---	---	---	---	866.9	---
Toluene***	108-88-3	C7H8	92.138	**0.0060**	0.006	14.57	0.0276	0.0278	0.1833	4,474.9	0.268
2,2,4-Trimethylpentane***	540-84-1	C8H18	114.229	**---**	---	---	---	---	---	6,213.6	---
Xylenes***	1330-20-7	C8H10	106.165	**0.0070**	0.007	19.58	0.0371	0.0374	0.2464	5,208.7	0.365

#UGC (Universal Gas Constant)
= 379.482 scf/lb-mol @ 60 oF and 14.6959 psia.

lb "X"/scf =
(M% of "X") x (MW of "X") / #UGC

	Molecular Weight (MW)	Mole %	Wgt Sum	lb/MMscf	Weight % Total	Weight % THC	Weight % VOC
Totals:	**20.05**	**100.00**	**20.05**	**52,835**	**100.00**	**---**	**---**
THC:	**19.98**	**99.42**	**19.86**	**52,344**	**99.07**	**100.00**	**---**
Total VOC:	**54.38**	**5.55**	**3.02**	**7,948**	**15.04**	**15.18**	**100.00**
Total HAP:	**87.64**	**0.12**	**0.10**	**270**	**0.51**	**0.52**	**3.40**

Calculated Btu/scf (HHV): **1,214**

Worst-Case Btu/scf (HHV): **1,020**

Component	Representative Wet Gas Analysis			Assumed "Worst-Case" 120% VOC and GHG		Margin for Changes in Future Gas Composition
	Mole %	Wgt %	lb/MMscf	Wgt %	lb/MMscf	
CO2	0.15	0.34	177	0.35	213	**20% Margin**
Methane*	81.13	64.91	34,298	67.12	41,158	**20% Margin**
Other (N2, C2, O2, CO, H2O)	13.17	19.71	10,412	16.98	10,412	**0% Margin**
VOC**	5.55	15.04	7,948	15.55	9,537	**20% Margin**
TOTAL GAS	**100.00**	**100.00**	**52,835**	**100.00**	**61,320**	
Benzene***	0.003	0.012	6.18	0.02	25	**305% Margin**
Ethylbenzene***	0.001	0.005	2.80	0.04	25	**794% Margin**
n-Hexane***	0.100	0.430	227	0.82	500	**120% Margin**
Methanol (MeOH)	---	---	---	0.04	25	**--- Margin**
Toluene***	0.006	0.028	14.57	0.10	60	**312% Margin**
2,2,4-Trimethylpentane***	---	---	---	0.04	25	**--- Margin**
Xylenes***	0.007	0.037	19.58	0.10	60	**206% Margin**
Total HAP***	**0.12**	**0.51**	**270**	**1.17**	**720**	

* = Hydrocarbon (HC)
** = also Volatile Organic Compound (VOC)
*** = also Hazardous Air Pollutant (HAP)

Inlet Gas - Summary

Inlet Gas - Lab Analysis

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

Williams Energy

ID:	**Jamison Sample 1 of 2**	LINE PRESSURE:	**927 PSI**
AREA:		LINE TEMPERATURE:	**85.9 F**
METER:	**25976A**	CYLINDER NUMBER:	**4099**
LEASE:		EFFECTIVE DATE:	
OPERATOR:		SAMPLED BY:	**Client**
STATION:		ANALYZED BY:	**Intertek**
SAMPLE DATE:	**1/25/2021**	ANALYZED DATE:	**1/28/2021**
SAMPLE OF:	**Gas**	SAMPLE TYPE:	**Natural Gas**

For: Williams Energy
Attn: Callie Emmerling
37905 Crimm Rd
Scio, OH 43988

Physical Properties per GPA 2145-09 — Calculations per GPA 2286-03

Note: Zero = Less than detection limit

	MOL%	WEIGHT%	GPM @ 14.696
NITROGEN	0.425	0.594	
CARBON DIOXIDE	0.153	0.336	
METHANE	81.132	64.951	
ETHANE	12.745	19.124	3.411
PROPANE	3.388	7.456	0.934
ISOBUTANE	0.475	1.378	0.156
N-BUTANE	0.734	2.129	0.232
2,2-Dimethylpropane	0.012	0.043	0.005
ISOPENTANE	0.219	0.789	0.080
N-PENTANE	0.163	0.587	0.059
HEXANES PLUS	0.554	2.613	0.234
	100.000	100.000	5.111

BTU	Vol. Ideal Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.696 PSIA (DRY)	1213.9	1217.8
BTU @ 14.696 PSIA (SAT.)	1192.3	1196.5
Specific Gravity	0.6919	0.6938
Compressibility (Z)	0.9968	

Gasoline Content (Gallons Per Thousand - GPM)	
Ethane & Heavier	5.111
Propane & Heavier	1.700
Butane & Heavier	0.766
Pentane & Heavier	0.373
Total 26 psi Reid V.P. Gasoline GPM	0.590

Secondary BTU Psia Base	Vol. IDEAL Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.696 PSIA (DRY)	1213.9	1217.8
BTU @ 14.696 PSIA (SAT.)	1192.3	1196.5

Compressibility (Z) at 14.696 = 0.9968

Remarks: US360-0021499
Remarks:

Wet Gas - Lab Analysis - Continued

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

COMPANY: Williams Energy **SAMPLE DATE:** 1/25/2021
AREA / FIELD:
LEASE:

	MOL%	WEIGHT%	GPM @ 14.696
NITROGEN	0.425	0.594	0.047
CARBON DIOXIDE	0.153	0.336	0.026
METHANE	81.132	64.951	13.763
ETHANE	12.745	19.124	3.411
PROPANE	3.388	7.456	0.934
ISOBUTANE	0.475	1.378	0.156
N-BUTANE	0.734	2.129	0.232
2,2-Dimethylpropane	0.012	0.043	0.005
ISOPENTANE	0.219	0.789	0.080
N-PENTANE	0.163	0.587	0.059
2,2-Dimethylbutane	0.019	0.082	0.008
2,3-Dimethylbutane & Cyclopentane	0.021	0.090	0.009
2-Methylpentane	0.100	0.430	0.041
3-Methylpentane	0.065	0.280	0.027
n-Hexane	0.100	0.430	0.041
2,2-Dimethylpentane	0.004	0.020	0.002
Methylcyclopentane	0.008	0.034	0.003
2,4-Dimethylpentane	0.004	0.020	0.002
2,2,3- Trimethylbutane	0.001	0.005	0.000
Benzene	0.003	0.012	0.001
3,3-Dimethylpentane	0.003	0.015	0.001
Cyclohexane	0.012	0.050	0.004
2-Methylhexane	0.025	0.125	0.012
2,3-Dimethylpentane	0.008	0.040	0.004
1,1-Dimethylcyclopentane	0.000	0.000	0.000
3-Methylhexane	0.025	0.125	0.011
l,t-3-Dimethylcyclopentane	0.000	0.000	0.000
1,c-3-Dimethylcyclopentane & 3-Ethylpentane	0.004	0.020	0.002
l,t-2-Dimethylcyclopentane & 2,2,4- Trimethylpentane	0.001	0.005	0.000
n-Heptane	0.033	0.165	0.015
Methylcyclohexane	0.025	0.123	0.010
1,1,3- Trimethylcyclopentane & 2,2-Dimethylhexane	0.000	0.000	0.000
2,5-Dimethylhexane & 2,4-Dimethylhexane	0.006	0.034	0.003
Ethylcyclopentane	0.001	0.005	0.000
2,2,3- Trimethylpentane & 1,t-2,c-4- Trimethylcyclopentane	0.000	0.000	0.000
3,3-Dimethylhexane & 1,t-2,c-3- Trimethylcyclopentane	0.000	0.000	0.000
2,3,4- Trimethylpentane & 2,3.Dimethylhexane	0.000	0.000	0.000
Toluene	0.006	0.028	0.002
1,1,2- Trimethylcyclopentane	0.000	0.000	0.000
3,4-Dimethylhexane	0.000	0.000	0.000
2-Methylheptane	0.010	0.057	0.005
4-Methylheptane	0.004	0.023	0.002
1,c-2,t-4- Trimethylcyclopentane	0.000	0.000	0.000
3-Methylheptane & 3,4-Dimethylhexane	0.008	0.046	0.004

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Wet Gas - Lab Analysis - Continued

Intertek

LABORATORY REFERENCE NUMBER : **2021-PITT-000122-001**

COMPANY: **Williams Energy** **SAMPLE DATE:** **1/25/2021**
AREA / FIELD:
LEASE:

	MOL%	WEIGHT%	GPM @ 14.696
1,c-3-Dimethylcyclohexane & 3-Ethylhexane	0.003	0.017	0.001
l,t-4-Dimethylcyclohexane & 1,c2,t3- Trimethylcyclopentane	0.000	0.000	0.000
2,2,5-Trimethylhexane & 1,1-Dimethylcyclohexane	0.000	0.000	0.000
Methyl-Ethylcyclopentane's & 2,2,4- Trimethylhexane	0.000	0.000	0.000
n-Octane	0.013	0.074	0.007
1,t2 Dimethylcyclohexane & 2,2,4,4- Tetramethylpentane	0.001	0.006	0.000
1,t-3-Dimethylcyclohexane & 1,c-4-Dimethylcyclohexane	0.001	0.006	0.000
Dimethylheptanes & 1 ,c-2,c-3- Trimethylcyclopentane	0.000	0.000	0.000
Isopropylcyclopentane	0.000	0.000	0.000
Dimethylheptanes & Trimethylhexanes	0.000	0.000	0.000
1,c-2-Dimethylcyclohexane	0.002	0.011	0.001
Dimethylheptanes	0.000	0.000	0.000
Ethylcyclohexane	0.002	0.011	0.001
n-Propylcyclopentane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
Ethylbenzene	0.001	0.005	0.000
Dimethylheptanes & Trimethylhexanes	0.000	0.000	0.000
m-Xylene & p-Xylene	0.006	0.032	0.002
2 & 4 Methyloctane & 3,4-Dimethylheptane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
3-Methyloctane	0.000	0.000	0.000
Trimethylcyclohexanes	0.000	0.000	0.000
o-Xylene	0.001	0.005	0.000
Trimethylcyclohexanes & Isobutylcyclopentane	0.000	0.000	0.000
n-Nonane	0.011	0.070	0.006
C9 Naphthenes & C10 Paraffins & Trimethylcyclohexanes	0.000	0.000	0.000
Isopropylbenzene & Trimethylcyclohexanes	0.001	0.006	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
Isopropylcyclohexane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins & Cyclooctane	0.003	0.018	0.001
N-Propylcyclohexane	0.002	0.013	0.001
C9 Naphthenes & C10 Paraffins & n-Butylcyclopentane	0.000	0.000	0.000
n-Propylbenzene	0.001	0.006	0.000
C9 Naphthenes & C10 Paraffins & EthylBenzenes	0.000	0.000	0.000
m-Ethyltoluene	0.000	0.000	0.000
p-Ethyltoluene	0.000	0.000	0.000
1,3,5- Trimethylbenzene & 4 & 5 Methylnonane	0.001	0.007	0.001
2-Methylnonane & 3-Ethyloctane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
O-Ethyltoluene & 3-Methylnonane	0.000	0.000	0.000
C9 Naphthenes & C10 Paraffins	0.000	0.000	0.000
tert-Butylbenzene	0.000	0.000	0.000
1,2,4 Trimethylbenzene & Methylcyclooctane	0.002	0.012	0.001
Isobutylcyclohexane & tert- Butylcyclohexane	0.000	0.000	0.000
n-Decane Plus	0.007	0.050	0.003
	100.000	100.000	18.947

Stabilized Condensate - Summary

Sampled: **From Pioneer CF Process Simulation** GPSA-Sec 23

Component	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Mole Fraction (MF)	lb/MMscf (WS/UGC#)	Weight % Total	Weight % THC	Weight % VOC	Component Btu/scf (HHV)	Btu/scf (HHV)
Water	109-86-4	H2O	18.015	**---**	---	---	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.010	**---**	---	---	---	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.086	**---**	---	---	---	---	---	637.6	---
Nitrogen	7727-37-9	N2	28.013	**---**	---	---	---	---	---	---	---
Methane*	75-82-8	CH4	16.042	**---**	---	---	---	---	---	1,010.0	---
Ethane*	74-84-0	C2H6	30.069	**0.0001**	0.00002	0.05	**0.00002**	0.00002	---	1,769.7	0.001
Propane**	74-98-6	C3H8	44.096	**1.1300**	0.498	1,313.05	**0.4896**	0.4896	0.4896	2,516.2	28.433
iso-Butane**	75-28-5	i-C4H10	58.122	**1.7000**	0.988	2,603.75	**0.9710**	0.9710	0.9710	3,252.0	55.284
n-Butane**	106-97-8	n-C4H10	58.122	**9.2900**	5.400	14,228.74	**5.3060**	5.3060	5.3060	3,262.4	303.077
iso-Pentane**	78-78-4	i-C5H12	72.149	**4.3300**	3.124	8,232.39	**3.0699**	3.0699	3.0699	4,000.9	173.239
n-Pentane**	109-66-0	n-C5H12	72.149	**9.4400**	6.811	17,947.74	**6.6929**	6.6929	6.6929	4,008.9	378.440
Cyclopentane**	287-92-3	C5H10	70.100	**---**	---	---	**---**	---	---	3,763.6	---
Cyclohexane**	110-82-7	C6H12	84.162	**1.2750**	1.073	2,827.71	**1.0545**	1.0545	1.0545	4,481.6	57.140
Other Hexanes**	Various	C6H14	86.175	**8.6600**	7.463	19,665.72	**7.3335**	7.3335	7.3335	4,750.3	411.376
C8+ Heavies**	Various	C8+	138.00 est.	**33.8747**	46.747	123,186.69	**45.9374**	45.9374	45.9374	7,000.0	2371.231
Benzene***	71-43-2	C6H6	78.112	**0.0615**	0.048	126.59	**0.0472**	0.0472	0.0472	3,741.9	2.301
Ethylbenzene***	100-41-4	C8H10	106.165	**1.2000**	1.274	3,357.16	**1.2519**	1.2519	1.2519	5,222.0	62.664
n-Hexane***	110-54-3	C6H14	86.175	**5.4700**	4.714	12,421.65	**4.6321**	4.6321	4.6321	4,756.0	260.153
Methanol (MeOH)	67-56-1	CH4O	32.042	**---**	---	---	**---**	---	---	866.9	---
Toluene***	108-88-3	C7H8	92.138	**0.6950**	0.640	1,687.46	**0.6293**	0.6293	0.6293	4,474.9	31.101
2,2,4-Trimethylpentane***	540-84-1	C8H18	114.229	**0.3760**	0.429	1,131.80	**0.4221**	0.4221	0.4221	6,213.6	23.363
Xylenes***	1330-20-7	C8H10	106.165	**1.5710**	1.668	4,395.08	**1.6390**	1.6390	1.6390	5,208.7	81.828
Totals:				**100.00**	**101.76**	**268,162**	**100.00**	**---**	**---**	**Calculated Btu/scf (HHV):**	**5,379**
THC:				**100.00**	**101.76**	**268,162**	**100.00**	**100.00**	**---**		
Total VOC:				**100.00**	**101.76**	**268,162**	**100.00**	**100.00**	**100.00**		
Total HAP:				**9.37**	**8.77**	**23,120**	**8.62**	**8.62**	**8.62**		

#UGC (Universal Gas Constant)
= 379.482 scf/lb-mol @ 60 oF and 14.6959 psia.

lb "X"/scf =
(M% of "X") x (MW of "X") / #UGC

Component	Representative Condensate Analysis			Assumed "Worst-Case" 120% VOC and GHG		Margin for Changes in Future Condensate Composition
	Mole %	Wgt %	lb/MMscf	Wgt %	lb/MMscf	
CO2	---	---	---	---	---	**--- Margin**
Methane*	---	---	---	---	---	**--- Margin**
Other (N2, C2, O2, CO, H2O)	---	---	---	---	---	**--- Margin**
VOC**	100.00	100.00	268,162	100.00	321,795	**20% Margin**
TOTAL CONDENSATE	**100.00**	**100.00**	**268,162**	**100.00**	**321,795**	
Benzene***	0.06	0.05	126.59	0.08	253	**100% Margin**
Ethylbenzene***	1.20	1.25	3,357.16	2.09	6,714	**100% Margin**
n-Hexane***	5.47	4.63	12,422	7.72	24,843	**100% Margin**
Methanol (MeOH)	---	---	---	0.06	200	**--- Margin**
Toluene***	0.70	0.63	1,687.46	1.05	3,375	**100% Margin**
2,2,4-Trimethylpentane***	0.38	0.42	1,131.80	0.70	2,264	**--- Margin**
Xylenes***	1.57	1.64	4,395.08	2.73	8,790	**100% Margin**
Total HAP***	**9.37**	**8.62**	**23,120**	**14.43**	**46,439**	

* = Hydrocarbon (HC)
** = also Volatile Organic Compound (VOC)
*** = also Hazardous Air Pollutant (HAP)

Stabilized Condensate - Lab Analysis

Appalachia Midstream Services, LLC
PIONEER COMPRESSION FACILITY
Application for G35-D General Permit Class I Administrative Update
Attachment U - Gas Analysis

Stabilized Condensate Composition

Constituent	Mol%
Water	2.70E-09
Methane	1.57E-11
CO2	1.91E-10
Ethane	6.66E-05
Propane	1.13E+00
i-Butane	1.70E+00
n-Butane	9.29E+00
i-Pentane	4.33E+00
n-Pentane	9.44E+00
2,3-Dimethylbutane	4.83E+00
3-Methylpentane	3.83E+00
Hexane	5.47E+00
2,2-Dimethylpentane	6.94E-02
Methylcyclopentane	4.42E-01
Benzene	6.15E-02
3,3-Dimethylpentane	7.28E-02
Cyclohexane	8.33E-01
2-Methylhexane	3.54E+00
2,3-Dimethylpentane	1.10E-01
3-Methylhexane	3.37E+00
Heptane	9.07E+00
Toluene	6.95E-01
Octane	7.55E+00
Ethylbenzene	1.20E+00
o-Xylene	2.54E-01
2-Methylheptane	4.62E+00
Methylcyclohexane	4.17E+00
2,5-Dimethylhexane	6.79E-01
1,t-3-Dimethylcyclohexane	3.34E-01
Nonane	6.00E+00
n-Undecane	9.70E-01
n-Decane	3.64E+00
Dodecane	3.23E-01
Tridecane	1.05E-01
Tetradecane	3.65E-02
Pentadecane	3.00E-02
Hexadecane	8.63E-02
Heptadecane	6.20E-02
Octadecane	7.37E-02
Nonadecane	6.68E-02
Eicosane	8.65E-02
C21	2.46E-01
C22	6.64E-01
C23	1.38E+00
C24	1.65E-01
m-Xylene	6.65E-01
p-Xylene	6.52E-01
2,2,4-Trimethylpentane	3.76E-01
2,4-Dimethylpentane	2.75E-02
3-Ethylpentane	4.97E-01
2,4-Dimethylhexane	6.62E-01
trans-1,2-Dimethylcyclohexane	3.69E+00
cis-1,2-Dimethylcyclohexane	1.91E+00
cis-1,3-Dimethylcyclohexane	4.91E-01

Btu Loading – Zeeco Z-HTO Thermal Oxidizer (TOx-01)

Component	Component Btu/scf (HHV)	DFT-01 - Flash Gas Ave Flowrate: 1,400 scf/hr		DSV-01 - Still Vent Ave Flowrate: 8,230 scf/hr		--- Ave Flowrate: ---		--- Ave Flowrate: ---		--- Ave Flowrate: ---		TOTAL Ave Flowrate: 9,630
		Vol%	MMBtu/hr	Vol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	MMBtu/Hr
Water	---	0.1520	---	81.7000	---	---	---	---	---	---	---	---
Carbon Monoxide	---	---	---	---	---	---	---	---	---	---	---	---
Nitrogen	---	0.3820	---	0.0505	---	---	---	---	---	---	---	---
Oxygen	---	---	---	---	---	---	---	---	---	---	---	---
Hydrogen Sulfide	637.64	---	---	---	---	---	---	---	---	---	---	---
Carbon Dioxide	---	0.9550	---	0.1560	---	---	---	---	---	---	---	---
Methane	1,010.00	61.1000	0.8640	9.5400	0.7930	---	---	---	---	---	---	1.6569
Ethane	1,769.70	24.2000	0.5996	2.3600	0.3437	---	---	---	---	---	---	0.9433
Propane	2,516.20	7.6600	0.2698	1.0700	0.2216	---	---	---	---	---	---	0.4914
i-Butane	3,252.00	1.1800	0.0537	0.2210	0.0591	---	---	---	---	---	---	0.1129
n-Butane	3,262.40	2.0800	0.0950	0.4790	0.1286	---	---	---	---	---	---	0.2236
Cyclopentane	3,763.60	---	---	---	---	---	---	---	---	---	---	0.0000
i-Pentane	4,000.90	0.5300	0.0297	0.1440	0.0474	---	---	---	---	---	---	0.0771
n-Pentane	4,008.90	0.4770	0.0268	0.1560	0.0515	---	---	---	---	---	---	0.0782
Cyclohexane	4,481.60	0.0764	0.0048	0.1670	0.0616	---	---	---	---	---	---	0.0664
Other Hexanes	4,750.30	0.4690	0.0312	0.2100	0.0821	---	---	---	---	---	---	0.1133
Methylcyclohexane	5,215.90	0.0922	0.0067	0.2670	0.1146	---	---	---	---	---	---	0.1213
Heptanes	5,502.50	0.2530	0.0195	0.3050	0.1381	---	---	---	---	---	---	0.1576
C8+ Heavies	7,150.00 est	0.0284	0.0028	0.3840	0.2260	---	---	---	---	---	---	0.2288
Benzene	3,741.90	0.0155	0.0008	0.2640	0.0813	---	---	---	---	---	---	0.0821
Ethylbenzene	5,222.00	0.0029	---	---	---	---	---	---	---	---	---	0.0000
n-Hexane	4,756.00	0.2670	0.0178	0.1560	0.0611	---	---	---	---	---	---	0.0788
Toluene	4,474.90	0.0261	0.0016	0.7230	0.2663	---	---	---	---	---	---	0.2679
2,2,4-TMP (i-Octane)	6,213.60	---	---	---	---	---	---	---	---	---	---	0.0000
Xylenes	5,208.67	0.0191	0.0014	1.4100	0.6044	---	---	---	---	---	---	0.6058
		99.97		99.76								
	Average MMBtu/hr:		2.03		3.28		---		---		---	5.31
	Average scf/hr:		1,400		8,230		---		---		---	9,630
	Average Btu/scf:		1,447		399		---		---		---	551

Mol%=Vol% Values from GRI-GLYCalc Model Results

Btu Loading – Zeeco Z-VTO Thermal Oxidizer (TOx-02)

Component	Component Btu/scf (HHV)	DFT-02 - Flash Gas Ave Flowrate: 1,490 scf/hr		DSV-02 - Still Vent Ave Flowrate: 4,930 scf/hr		--- Ave Flowrate: ---		--- Ave Flowrate: ---		--- Ave Flowrate: ---		TOTAL Ave Flowrate: 6,420
		Vol%	MMBtu/hr	Vol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	Mol%	MMBtu/hr	MMBtu/Hr
Water	---	0.1350	---	88.1000	---	---	---	---	---	---	---	---
Carbon Monoxide	---	---	---	---	---	---	---	---	---	---	---	---
Nitrogen	---	0.3780	---	0.0060	---	---	---	---	---	---	---	---
Oxygen	---	---	---	---	---	---	---	---	---	---	---	---
Hydrogen Sulfide	637.64	---	---	---	---	---	---	---	---	---	---	---
Carbon Dioxide	---	0.9960	---	0.2180	---	---	---	---	---	---	---	---
Methane	1,010.00	60.3000	0.9075	0.9830	0.0489	---	---	---	---	---	---	0.9564
Ethane	1,769.70	24.4000	0.6434	1.5100	0.1317	---	---	---	---	---	---	0.7751
Propane	2,516.20	7.8600	0.2947	1.0800	0.1340	---	---	---	---	---	---	0.4287
i-Butane	3,252.00	1.2300	0.0596	0.2670	0.0428	---	---	---	---	---	---	0.1024
n-Butane	3,262.40	2.1900	0.1065	0.6370	0.1025	---	---	---	---	---	---	0.2089
Cyclopentane	3,763.60	0.0973	0.0055	0.1730	0.0321	---	---	---	---	---	---	0.0376
i-Pentane	4,000.90	0.5610	0.0334	0.1950	0.0385	---	---	---	---	---	---	0.0719
n-Pentane	4,008.90	0.5090	0.0304	0.2240	0.0443	---	---	---	---	---	---	0.0747
Cyclohexane	4,481.60	0.0838	0.0056	0.2870	0.0634	---	---	---	---	---	---	0.0690
Other Hexanes	4,750.30	0.5050	0.0357	0.3160	0.0740	---	---	---	---	---	---	0.1097
Methylcyclohexane	5,215.90	0.1010	0.0078	0.4600	0.1183	---	---	---	---	---	---	0.1261
Heptanes	5,502.50	0.2770	0.0227	0.5050	0.1370	---	---	---	---	---	---	0.1597
C8+ Heavies	7,150.00 est	0.0305	0.0032	0.6620	0.2334	---	---	---	---	---	---	0.2366
Benzene	3,741.90	0.0170	0.0009	0.4420	0.0815	---	---	---	---	---	---	0.0825
Ethylbenzene	5,222.00	0.0031	---	0.2390	---	---	---	---	---	---	---	0.0000
n-Hexane	4,756.00	0.2900	0.0206	0.2440	0.0572	---	---	---	---	---	---	0.0778
Toluene	4,474.90	0.0280	0.0019	1.2000	0.2647	---	---	---	---	---	---	0.2666
2,2,4-TMP (i-Octane)	6,213.60	---	---	---	---	---	---	---	---	---	---	0.0000
Xylenes	5,208.67	0.0198	0.0015	2.2700	0.5829	---	---	---	---	---	---	0.5844
		100.01		100.02								
		Average MMBtu/hr:	2.18		2.19		---		---		---	4.37
		Average scf/hr:	1,490		4,930		---		---		---	6,420
		Average Btu/scf:	1,464		444		---		---		---	680

Mol%=Vol% Values from GRI-GLYCalc Model Results

Supplement S5

Vendor Data

- **5,000 bhp Caterpillar G3616LE A4 Compressor Engine w/ OxCat (CE-01 (1E) thru CE-04 (4E))**
- **1,468 bhp Caterpilar G3512LE Generator Engine (GE-01 (8E))**
- **11,252 bhp Solar Taurus 70-10802S Compressor Turbine (CT-01 (9E))**
    - PIL 168 – VOC, SO2, and HCHO Emission Estimates
    - PIL 170 – Emission Estimates at Start-up, Shutdown, and Commissioning
    - PIL 171 – Particulate Matter Emission Estimates
    - PIL 251 – Emissions from Gas Seal Systems
    - PIL 279 – Primary Vent Dry Gas Seal Recompression
    - PIL 280 – Process Gas Vent Recompression
- **Zeeco Z-HTO Thermal Oxidizer 01 (DHY-01 (DFT-01/DSV-01) TOx-01 (24E))**
- **Zeeco V-HTO Thermal Oxidizer 02 (DHY-02 (DFT-02/DSV-02) TOx-02 (25E))**
- **Zeeco Elevated Flare (BD (CBD/ESD) and PIG) FLR-01 (26E))**

G3616

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Ridgeline Compressor Station

CATERPILLAR®

GAS COMPRESSION APPLICATION

ENGINE SPEED (rpm):	1000
COMPRESSION RATIO:	7.6
AFTERCOOLER TYPE:	SCAC
AFTERCOOLER - STAGE 2 INLET (°F):	130
AFTERCOOLER - STAGE 1 INLET (°F):	174
JACKET WATER OUTLET (°F):	190
ASPIRATION:	TA
COOLING SYSTEM:	JW+1AC, OC+2AC
CONTROL SYSTEM:	ADEM4
EXHAUST MANIFOLD:	DRY
COMBUSTION:	LOW EMISSION
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5
SET POINT TIMING:	17

RATING STRATEGY:	STANDARD
FUEL SYSTEM:	GAV WITH AIR FUEL RATIO CONTROL
SITE CONDITIONS:	
FUEL:	Gas Analysis
FUEL PRESSURE RANGE(psig): (See note 1)	58.0-70.3
FUEL METHANE NUMBER:	57.7
FUEL LHV (Btu/scf):	1104
ALTITUDE(ft):	1365
INLET AIR TEMPERATURE(°F):	77
STANDARD RATED POWER:	5000 bhp@1000rpm

RATING		NOTES	LOAD	MAXIMUM RATING 100%	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE 100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(2)	bhp	5000	5000	3750	2500
INLET AIR TEMPERATURE			°F	77	77	77	77
ENGINE DATA							
FUEL CONSUMPTION (LHV)		(3)	Btu/bhp-hr	6689	6689	6876	7346
FUEL CONSUMPTION (HHV)		(3)	Btu/bhp-hr	7382	7382	7588	8108
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(4)(5)	ft3/min	12065	12065	9096	6224
AIR FLOW	(WET)	(4)(5)	lb/hr	53495	53495	40334	27597
FUEL FLOW (60ºF, 14.7 psia)			scfm	505	505	389	277
INLET MANIFOLD PRESSURE		(6)	in Hg(abs)	101.5	101.5	76.2	53.6
EXHAUST TEMPERATURE - ENGINE OUTLET		(7)	°F	830	830	889	956
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(8)(5)	ft3/min	30831	30831	24339	17515
EXHAUST GAS MASS FLOW	(WET)	(8)(5)	lb/hr	55091	55091	41565	28473
EMISSIONS DATA - ENGINE OUT				Use NOX @ 0.40 g/bhp-hr			
NOx (as NO2)		(9)(10)	g/bhp-hr	0.50	0.50	0.50	0.50
CO		(9)(10)	g/bhp-hr	2.48	2.48	2.48	2.48
THC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	3.54	3.54	3.84	4.02
NMHC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	1.28	1.28	1.39	1.46
NMNEHC (VOCs) (mol. wt. of 15.84)		(9)(10)(11)	g/bhp-hr	0.57	0.57	0.62	0.65
HCHO (Formaldehyde)		(9)(10)	g/bhp-hr	0.21	0.21	0.22	0.24
CO_2		(9)(10)	g/bhp-hr	437	437	450	479
EXHAUST OXYGEN		(9)(12)	% DRY	11.0	11.0	10.7	10.3
HEAT REJECTION							
HEAT REJ. TO JACKET WATER (JW)		(13)	Btu/min	53106	53106	42952	36275
HEAT REJ. TO ATMOSPHERE		(13)	Btu/min	17723	17723	16216	14746
HEAT REJ. TO LUBE OIL (OC)		(13)	Btu/min	30615	30615	27037	23538
HEAT REJ. TO A/C - STAGE 1 (1AC)		(13)(14)	Btu/min	43321	43321	21417	4805
HEAT REJ. TO A/C - STAGE 2 (2AC)		(13)(14)	Btu/min	11190	11190	7712	4742

COOLING SYSTEM SIZING CRITERIA	NOTES	LOAD	MAXIMUM RATING 100%
TOTAL JACKET WATER CIRCUIT (JW+1AC)	(14)(15)	Btu/min	103904
TOTAL STAGE 2 AFTERCOOLER CIRCUIT (OC+2AC)	(14)(15)	Btu/min	48488

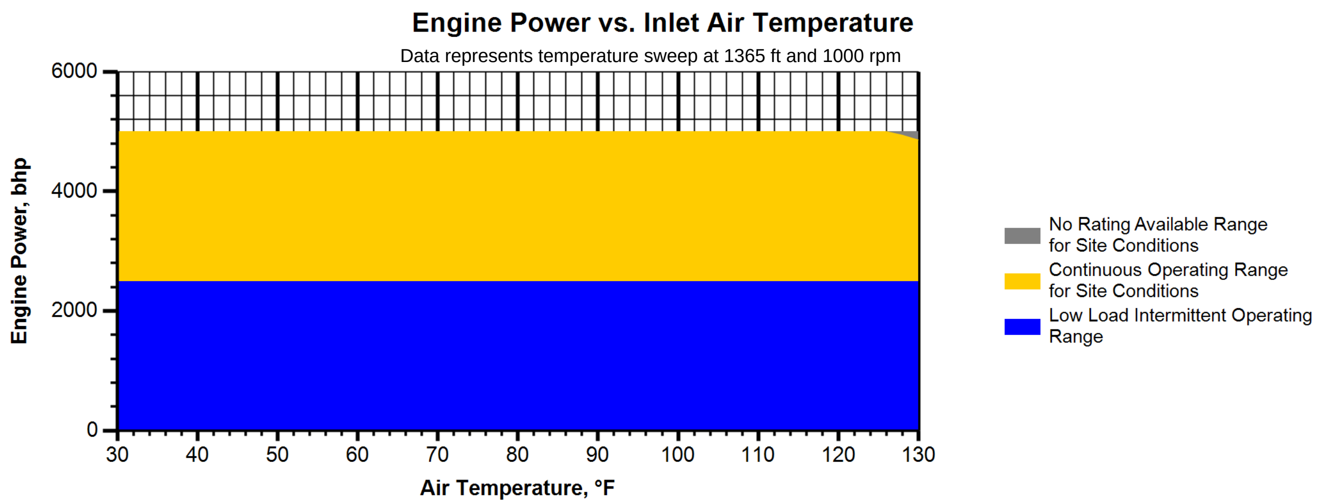
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.

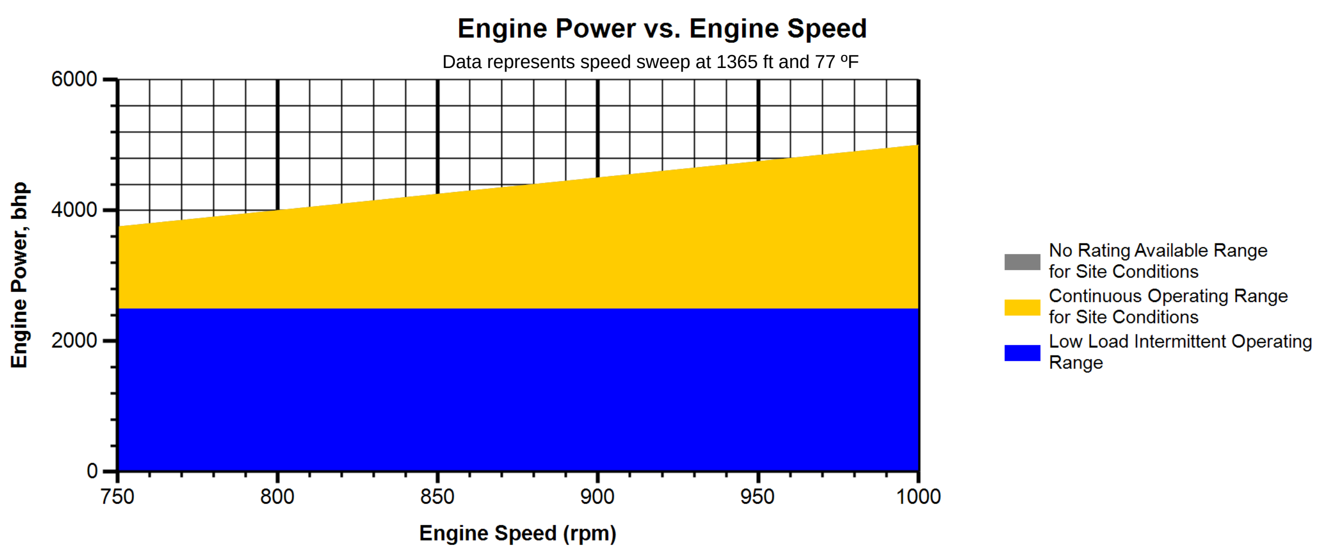
CONDITIONS AND DEFINITIONS

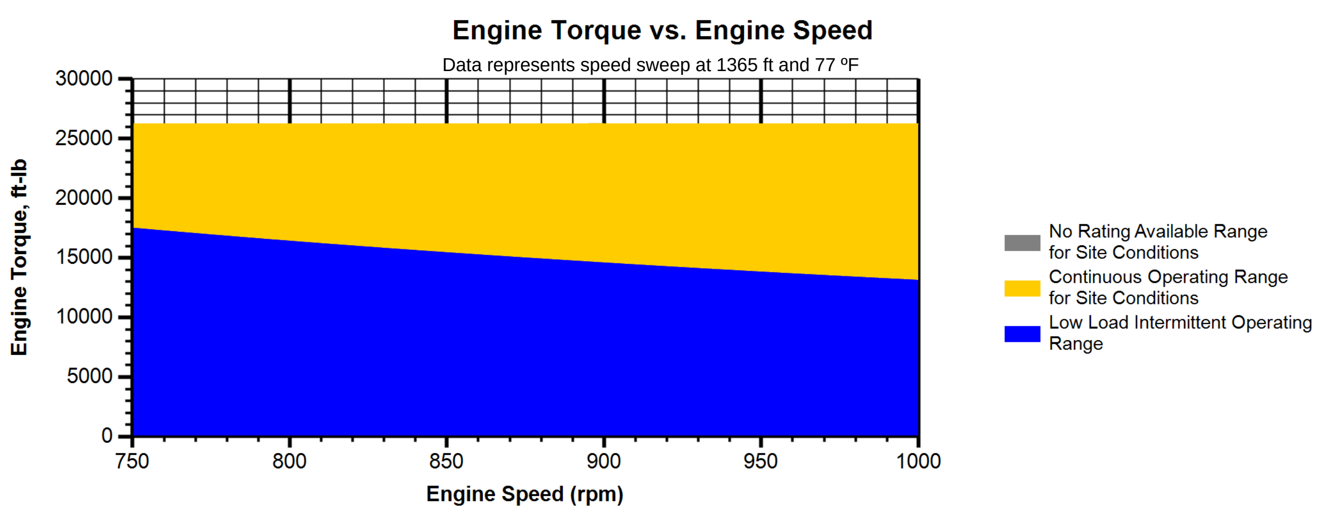
Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Maximum rating is the maximum capability at the specified aftercooler inlet temperature for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY: ,
Data generated by GERP Web Version 1.5.1
Ref. Data Set EM0455-08-001, Printed 16Mar2021







Note:
At site conditions of 1365 ft and 77°F inlet air temp., constant torque can be maintained down to 750 rpm.The minimum speed for loading at these conditions is 750 rpm.

NOTES:

1. Fuel pressure range specified is to the engine gas shutoff valve (GSOV). Additional fuel train components should be considered in pressure and flow calculations.

2. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.

3. Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site ambient temperature.

4. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

5. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.

6. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

7. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

8. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

9. Emissions data is at engine exhaust flange prior to any after treatment.

10. Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate the maximum values expected under steady state conditions. Fuel methane number cannot vary more than ± 3. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.

11. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

12. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

13. Heat rejection values are nominal. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for radiation, ± 20% for lube oil circuit, and ± 5% for aftercooler circuit.

14. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.

15. Cooling system sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

GAS ENGINE SITE SPECIFIC TECHNICAL DATA
Ridgeline Compressor Station

CATERPILLAR®

GAS COMPRESSION APPLICATION

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	81.1320	81.1314
Ethane	C2H6	12.7450	12.7449
Propane	C3H8	3.3880	3.3880
Isobutane	iso-C4H10	0.4750	0.4750
Norbutane	nor-C4H10	0.7340	0.7340
Isopentane	iso-C5H12	0.2190	0.2190
Norpentane	nor-C5H12	0.1960	0.1960
Hexane	C6H14	0.3070	0.3070
Heptane	C7H16	0.1400	0.1400
Nitrogen	N2	0.4250	0.4250
Carbon Dioxide	CO2	0.1530	0.1530
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0868	0.0868
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0008	100.0001

Fuel Makeup:	Gas Analysis
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	57.7
Lower Heating Value (Btu/scf):	1104
Higher Heating Value (Btu/scf):	1218
WOBBE Index (Btu/scf):	1327
THC: Free Inert Ratio:	172.01
Total % Inerts (% N2, CO2, He):	0.578%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.997
Stoich A/F Ratio (Vol/Vol):	11.46
Stoich A/F Ratio (Mass/Mass):	16.57
Specific Gravity (Relative to Air):	0.692
Fuel Specific Heat Ratio (K):	1.287

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

PREPARED BY: ,
Data generated by GERP Web Version 1.5.1
Ref. Data Set EM0455-08-001, Printed 16Mar2021

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311 Riggs Street, Bloomer, WI 54724
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Email bweninger@catalyticcombustion.com

CATALYTIC COMBUSTION
EMISSION TECHNOLOGIES

To Williams	Our Ref. 001-00-263673.03
Attn	Date: 16 February, 2021
Via E-mail	Page: 1 of 6

QUOTATION

For : Project/Location : Ridgeline

Engine Parameters

				Raw Exhaust		
Engine Manufacturer	Caterpillar					
Engine Model	G3616 - 0.5/5000		NOx	0.50	g/bhp-hr	Use NOX @ 0.40 g/bhp-hr
Horsepower	5000	bhp	CO	2.48	g/bhp-hr	
Speed	1000	rpm	NMHC	1.28	g/bhp-hr	
Exhaust Flowrate	30831	acfm	NMNEHC (VOC)	0.57	g/bhp-hr	
Exhaust Temperature	830	° F	HCHO	0.21	g/bhp-hr	
Fuel	Natural Gas		Oxygen	11.00	%	

Catalyst Description and Performance Expectations

Catalyst Model	REMB-3615F-D-15HF-HFX4	Overall Dimensions	35.88 x 14.88 x 3.7
Cell Pattern, Substrate	15HF	Catalyst Qty Required	8 per Unit
Formulation	HFX4	Pressure Drop	2.3 inches of H2O
Warranty Period [hrs]	12000		

	Required		Required		Expected Fresh Performance	
NOx			Use CO @ 89% Reduction			
CO	0.31	g/bhp-hr	88	% Conversion	100	% Conversion
NMHC			Use NMNEHC @ 60% Reduction			
NMNEHC (VOC)	0.16	g/bhp-hr	72	% Conversion	83	% Conversion
HCHO	-	g/bhp-hr	-	% Conversion	94	% Conversion
			Use HCHO @ 80% Reduction			

General Terms and Conditions of Sale and Manufacturers Warranty documents are available upon request.

Thank you for the opportunity to quote these products for you. Please contact us if you have any questions regarding this quotation or to let us know how we can be of further help.

Best regards,

Brian Weninger

Brian Weninger
Product and Application Engineer, Catalytic Combustion Corporation

G3512

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1800	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	9.7	PACKAGE TYPE:	WITH RADIATOR
AFTERCOOLER TYPE:	SCAC	RATING LEVEL:	STANDBY
AFTERCOOLER - STAGE 2 INLET (°F):	130	FUEL:	NAT GAS
AFTERCOOLER - STAGE 1 INLET (°F):	198	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
JACKET WATER OUTLET (°F):	210		
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	0.5-5.0
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL METHANE NUMBER:	85
CONTROL SYSTEM:	ADEM4 W/ IM	FUEL LHV (Btu/scf):	905
EXHAUST MANIFOLD:	DRY	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	5069
COMBUSTION:	LOW EMISSION	POWER FACTOR:	0.8
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5	VOLTAGE(V):	440-4160
FAN POWER (bhp):	50		

RATING		NOTES	LOAD	100%	75%	50%
PACKAGE POWER	(WITH FAN)	(2)(3)	ekW	1000	750	500
PACKAGE POWER	(WITH FAN)	(2)(3)	kVA	1250	938	625
ENGINE POWER	(WITHOUT FAN)	(3)	bhp	1468	1113	763
GENERATOR EFFICIENCY		(2)	%	94.5	94.6	94.0
PACKAGE EFFICIENCY(@ 1.0 Power Factor)	(ISO 3046/1)	(4)	%	34.5	33.2	30.4
THERMAL EFFICIENCY		(5)	%	49.6	50.4	51.6
TOTAL EFFICIENCY (@ 1.0 Power Factor)		(6)	%	84.1	83.6	82.0

ENGINE DATA						
PACKAGE FUEL CONSUMPTION	(ISO 3046/1)	(7)	Btu/ekW-hr	10089	10460	11432
PACKAGE FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/ekW-hr	10285	10663	11654
ENGINE FUEL CONSUMPTION	(NOMINAL)	(7)	Btu/bhp-hr	7004	7187	7637
AIR FLOW (77°F, 14.7 psia)	(WET)	(8)	ft3/min	3257	2543	1830
AIR FLOW	(WET)	(8)	lb/hr	14441	11277	8114
FUEL FLOW (60ºF, 14.7 psia)			scfm	189	147	107
COMPRESSOR OUT PRESSURE			in Hg(abs)	92.3	75.1	56.5
COMPRESSOR OUT TEMPERATURE			°F	335	293	225
AFTERCOOLER AIR OUT TEMPERATURE			°F	136	135	133
INLET MAN. PRESSURE		(9)	in Hg(abs)	84.9	67.2	48.6
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(10)	°F	136	135	133
TIMING		(11)	°BTDC	32	32	32
EXHAUST TEMPERATURE - ENGINE OUTLET		(12)	°F	961	955	966
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(13)	ft3/min	9280	7217	5235
EXHAUST GAS MASS FLOW	(WET)	(13)	lb/hr	14958	11679	8407
MAX INLET RESTRICTION		(14)	in H2O	10.04	10.04	10.04
MAX EXHAUST RESTRICTION		(14)	in H2O	20.07	20.07	20.07

EMISSIONS DATA - ENGINE OUT					
NOx (as NO2)	(15)(16)	g/bhp-hr	0.50	0.50	0.50
CO	(15)(17)	g/bhp-hr	1.92	1.94	1.96
THC (mol. wt. of 15.84)	(15)(17)	g/bhp-hr	2.91	3.25	3.74
NMHC (mol. wt. of 15.84)	(15)(17)	g/bhp-hr	0.47	0.52	0.60
NMNEHC (VOCs) (mol. wt. of 15.84)	(15)(17)(18)	g/bhp-hr	0.32	0.36	0.41
HCHO (Formaldehyde)	(15)(17)	g/bhp-hr	0.30	0.30	0.32
CO2	(15)(17)	g/bhp-hr	491	513	542
EXHAUST OXYGEN	(15)(19)	% DRY	9.6	9.5	9.4
LAMBDA	(15)(19)		1.74	1.75	1.73

ENERGY BALANCE DATA						
LHV INPUT		(20)	Btu/min	171417	133293	97113
HEAT REJECTION TO JACKET WATER (JW)		(21)(29)	Btu/min	24308	20989	17610
HEAT REJECTION TO ATMOSPHERE	(INCLUDES GENERATOR)	(22)	Btu/min	8839	7118	6377
HEAT REJECTION TO LUBE OIL (OC)		(23)(29)	Btu/min	4650	4156	3562
HEAT REJECTION TO EXHAUST (LHV TO 77°F)		(24)(25)	Btu/min	61072	47528	34807
HEAT REJECTION TO EXHAUST (LHV TO 248°F)		(24)	Btu/min	47835	37030	27102
HEAT REJECTION TO A/C - STAGE 1 (1AC)		(26)(29)	Btu/min	6798	3665	757
HEAT REJECTION TO A/C - STAGE 2 (2AC)		(27)(30)	Btu/min	5806	4110	2490
PUMP POWER		(28)	Btu/min	971	971	971

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure.) No overload permitted at rating shown. Consult the altitude deration factor chart for applications that exceed the rated altitude or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	40	45	50	55	60	65	70	75	80	85	100
SET POINT TIMING	-	26	29	32	32	32	32	32	32	32	32
DERATION FACTOR	0	1	1	1	1	1	1	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
120	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
110	0.84	0.79	0.74	0.70	0.66	0.63	0.59	0.55	0.51	No Rating	No Rating	No Rating	No Rating
100	1	1	1	0.98	0.92	0.87	0.81	0.75	0.70	0.64	0.58	0.52	No Rating
90	1	1	1	1	1	0.95	0.89	0.83	0.77	0.71	0.65	0.58	0.52
80	1	1	1	1	1	1	0.94	0.89	0.84	0.78	0.72	0.65	0.58
70	1	1	1	1	1	1	0.96	0.91	0.86	0.81	0.77	0.70	0.63
60	1	1	1	1	1	1	0.97	0.92	0.87	0.82	0.78	0.72	0.66
50	1	1	1	1	1	1	0.98	0.93	0.88	0.83	0.78	0.73	0.67

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
120	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating	No Rating
110	1.22	1.27	1.32	1.38	1.43	1.49	1.49	1.49	1.49	No Rating	No Rating	No Rating	No Rating
100	1.15	1.20	1.25	1.30	1.35	1.41	1.41	1.41	1.41	1.41	1.41	1.41	No Rating
90	1.07	1.12	1.17	1.22	1.28	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
80	1	1.05	1.10	1.15	1.20	1.25	1.26	1.26	1.26	1.26	1.26	1.26	1.26
70	1	1	1.02	1.07	1.12	1.17	1.18	1.18	1.18	1.18	1.18	1.18	1.18
60	1	1	1	1	1.04	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
50	1	1	1	1	1	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:

This table shows the derate factor and full load set point timing required for a given fuel. Note that deration and set point timing adjustment may be required as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar methane number calculation.

ALTITUDE DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site. The derate factors shown assume a specific air-to-core temperature rise and zero additional air flow restriction on the standard packaged radiator. Refer to TMI Systems Data for fan air flow and air-to-core temperature rise values. Increased fan airflow restriction or a different air-to-core rise value requires a Special Rating Request to determine actual engine power at your site. Additional rating may be available with a larger, custom radiator.

ACTUAL ENGINE RATING:

To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).
1) Fuel Usage Guide Deration
2) 1-((1-Altitude/Temperature Deration) + (1-RPC))

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):

To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See notes 29 and 30 for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

INLET AND EXHAUST RESTRICTIONS FOR ALTITUDE CAPABILITY:

The altitude derate chart is based on the maximum inlet and exhaust restrictions provided on page 1. Contact factory for restrictions over the specified values. Heavy Derates for higher restrictions will apply.

NOTES:

1. Fuel pressure range specified is to the engine fuel control valve. Additional fuel train components should be considered in pressure and flow calculations.
2. Generator efficiencies, power factor, and voltage are based on standard generator. [Package Power (ekW) is calculated as: (Engine Power (bkW) - Fan Power (bkW)) x Generator Efficiency], [Package Power (kVA) is calculated as: (Engine Power (bkW) - Fan Power (bkw)) x Generator Efficiency / Power Factor]
3. Rating is with two engine driven water pumps. Tolerance is (+)3, (-)0% of full load.
4. Package Efficiency published in accordance with ISO 3046/1, based on a 1.0 power factor.
5. Thermal Efficiency is calculated based on energy recovery from the jacket water, lube oil, 1st stage aftercooler, and exhaust to 248ºF with engine operation at ISO 3046/1 Package Efficiency, and assumes unburned fuel is converted in an oxidation catalyst.
6. Total efficiency is calculated as: Package Efficiency + Thermal Efficiency. Tolerance is ±10% of full load data.
7. ISO 3046/1 Package fuel consumption tolerance is (+)5, (-)0% at the specified power factor. Nominal package and engine fuel consumption tolerance is ± 3.0% of full load data at the specified power factor.
8. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.
9. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
10. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
11. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
12. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
13. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
14. Inlet and Exhaust Restrictions are maximum allowed values at the corresponding loads. Increasing restrictions beyond what is specified will result in a significant engine derate.
15. Emissions data is at engine exhaust flange prior to any after treatment.
16. NOx tolerances are ± 18% of specified value.
17. CO, CO2, THC, NMHC, NMNEHC, and HCHO are the maximum values expected under steady state conditions. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
18. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
19. Exhaust Oxygen tolerance is ± 0.5; Lambda tolerance is ± 0.05. Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
20. LHV rate tolerance is ± 3.0%.
21. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
22. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
23. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
24. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
25. Heat rejection to exhaust (LHV to 77°F) value shown includes unburned fuel and is not intended to be used for sizing or recovery calculations.
26. Heat rejection to A/C - Stage 1 based on treated water. Tolerance is ±5% of full load data.
27. Heat rejection to A/C - Stage 2 based on treated water. Tolerance is ±5% of full load data.
28. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
29. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2) + (1AC x 1.05) + [0.78 x (1AC + 2AC) x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
30. Total Second Stage Aftercooler Circuit heat rejection is calculated as: (2AC x 1.05) + [(1AC + 2AC) x 0.22 x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

FREE FIELD MECHANICAL & EXHAUST NOISE

MECHANICAL: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	125.5	108.0	109.6	114.9	111.5	108.8	113.4	112.6	112.7	111.8	110.2
750	75	1113	122.9	107.6	109.4	113.8	110.7	108.2	113.1	111.5	112.0	111.4	109.6
500	50	763	121.9	106.9	108.1	113.4	109.1	107.9	112.9	111.8	111.0	110.5	109.3

MECHANICAL: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	110.5	109.7	109.7	108.2	109.5	107.7	106.3	105.5	118.4	119.0	106.1
750	75	1113	109.8	108.9	108.5	106.8	107.5	106.4	104.8	106.5	111.8	103.5	100.8
500	50	763	109.5	108.4	107.6	105.8	106.0	104.6	105.4	106.6	100.9	98.7	97.7

EXHAUST: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	Overall	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	129.7	115.0	123.2	117.2	119.3	119.7	123.3	121.5	113.6	114.3	115.0
750	75	1113	128.5	113.8	121.6	115.1	117.8	120.1	121.9	120.1	113.0	113.7	114.1
500	50	763	126.7	113.4	120.7	113.5	114.5	117.4	119.5	118.9	112.4	112.1	111.8

EXHAUST: Sound Power (1/3 Octave Frequencies)

Gen Power With Fan	Percent Load	Engine Power	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
ekW	%	bhp	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)
1000	100	1468	111.2	106.4	106.1	102.8	101.6	102.0	98.3	94.4	100.2	102.0	88.9
750	75	1113	110.5	105.9	104.5	99.9	99.0	99.2	96.2	93.1	96.7	88.2	83.5
500	50	763	108.7	104.7	102.7	96.6	95.9	95.9	94.1	92.4	88.2	85.0	80.4

SOUND PARAMETER DEFINITION:
Sound Power Level Data - DM8702-03

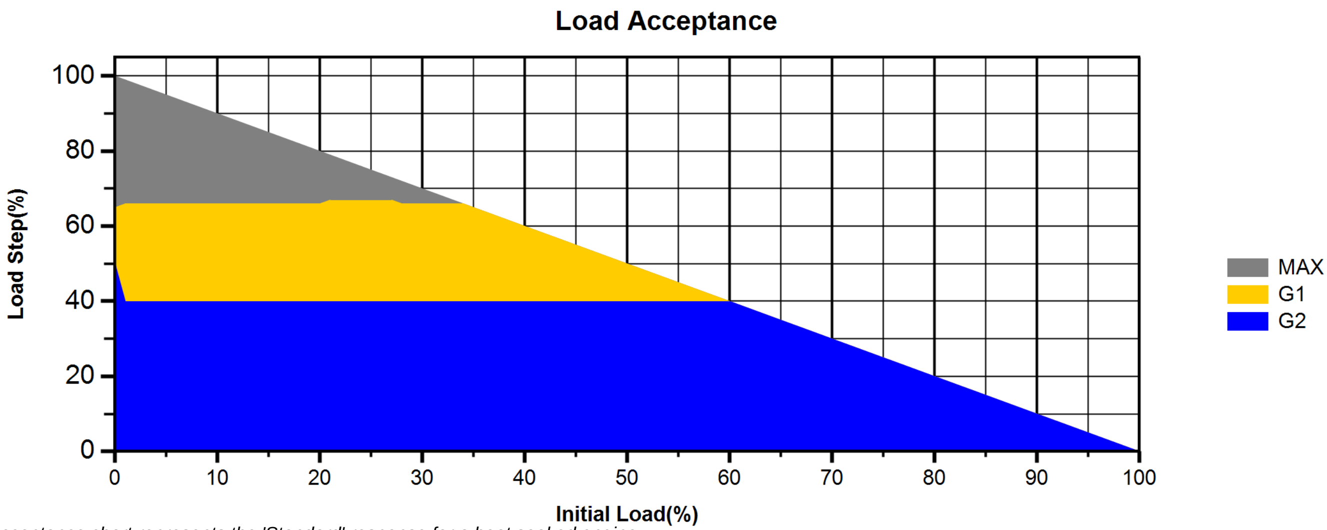
Sound power is defined as the total sound energy emanating from a source irrespective of direction or distance. Sound power level data is presented under two index headings:
Sound power level -- Mechanical
Sound power level -- Exhaust

Mechanical: Sound power level data is calculated in accordance with ISO 3747. The data is recorded with the exhaust sound source isolated.

Exhaust: Sound power level data is calculated in accordance with ISO 6798 Annex A. Exhaust data is post-catalyst on gas engine ratings labeled as "Integrated Catalyst".

Measurements made in accordance with ISO 3747 and ISO 6798 for mechanical and exhaust sound level only. Frequency bands outside the displayed ranges are not measured, due to physical test, and environmental conditions that affect the accuracy of the measurement. No cooling system noise is included unless specifically indicated. Sound level data is indicative of noise levels recorded on one engine sample in a survey grade 3 environment.

How an engine is packaged, installed and the site acoustical environment will affect the site specific sound levels. For site specific sound level guarantees, sound data collection needs to be done on-site or under similar conditions.



Load Acceptance chart represents the 'Standard' response for a heat soaked engine

Transient Load Acceptance

Load Step	Frequency Deviation +/- (%)	Voltage Deviation +/- (%)	Recovery Time (sec)	Classification as Defined by ISO 8528 - 5	Notes
100	+2/-22	+1/-53	6/12.5		(4)
75	+1/-21	+1/-43	7.7/7.1		(4)
50	+2/-12	+4/-21	3.7/5.4	G1	(2)(4)
40	+2/-10	+1/-20	3.5	G2	(3)
30	+2/-8	+3/-15	4.5	G2	(3)
25	+2/-7	+3/-12	4	G2	(3)
20	+2/-6	+2/-10	3.5	G2	(3)
15	+3/-5	+2/-7	3	G2	(3)
10	+3/-4	+1/-5	3	G2	(3)
-10	+3/-3	+2/-4	4.5		
-50	+6/-4	+10/-3	3.7		
-75	+8/-3	+16/-3	4.3		
Breaker Open	+11/-1	+26/-2	3		(1)
Recovery Specification	+1.75/-1.75	+5/-5			
Steady State Specification	+0.5/-0.5	+0.25/-0.25			(5)

Transient Information

The transient load steps listed above are stated as a percentage of the engine’s full rated load as indicated in the appropriate performance technical data sheet. Site ambient conditions, fuel quality, inlet/exhaust restriction and emissions settings will all affect engine response to load change. Engines that are not operating at the standard conditions stated in the Technical data sheet should be set up according to the guidelines included in the technical data; applying timing changes and/or engine derates as needed. Adherence to the engine settings guidelines will allow the engines to retain the transient performance stated in the tables above as a percentage of the site derated power (where appropriate).Fuel supply pressure and stability is critical to transient performance. Proper installation requires that all fuel train components (including filters, shut off valves, and regulators) be sized to ensure adequate fuel be delivered to the engine. The following are fuel pressure requirements to be measured at the engine mounted fuel control valve.

a. Steady State Fuel Pressure Stability +/- .15 psi/sec
b. Transient fuel Pressure Stability +/- .15 psi/sec

Inlet water temperature to the SCAC must be maintained at specified value for all engines. It is important that the external cooling system design is able to maintain the Inlet water temp to the SCAC to within +/- 1 °C during all engine-operating cycles. The SCAC inlet temperature stability criterion is to maintain stable inlet manifold air temperature. The Air Fuel Ratio control system requires up to 180 seconds to converge after a load step has been performed for NOx to return to nominal setting. If the stabilization time is not met between load steps the transient performance listed in the document may not be met. Differences in generator inertia may change the transient response of engine. Engine Governor gains and Voltage regulator settings may need to be tuned for site conditions. Engines must be maintained in accordance to guidelines specified in the Caterpillar Service Manuals applicable to each engine. Wear of components outside of the specified tolerances will affect the transient capability of the engine.

NOTES:

1. For unloading the engine to 0% load from a loaded condition no external input is needed. The engine control algorithm employs a load sensing strategy to determine a load drop. In the event that the local generator breaker opens the strategy provides control to the engine that resets all control inputs to the rated idle condition. This prevents engine over speeding and will allow the engine to remain running unloaded at the rated synchronous speed.
2. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G1 transient performance as defined by ISO 8528 - 5 with exceptions.
3. The engines specified above have been tested against the voltage deviation, frequency deviation, and recovery time requirements defined in ISO 8528 - 5. At this time the engines stated above will meet class G2 transient performance as defined by ISO 8528 - 5 with exceptions.
4. Air flow is critical for turbocharged engines during transients. As the exhaust temperature increases, the air flow or turbo response increases to enhance the genset transient response. Therefore, the recovery time for an engine's "First" load step after start up may differ from the "Standard" response for a heat soaked engine. If different, the load step recovery times are illustrated as Standard/First .
5. Steady state voltage and frequency stability specified at +/-2 sigma or better.

Application & Performance Warranty Data

Project Information

Site Location:	PA
Project Name:	Williams Ridgeline - G3512 1000kW
Application:	Prime Power
Number Of Engines:	1
Operating Hours per Year:	8760

Engine Specifications

Engine Manufacturer:	CAT
Model Number:	G3512
Rated Speed:	1800 RPM
Generator Power:	1019 ekW
Type of Fuel:	Natural Gas
Type of Lube Oil:	0.6 wt% sulfated ash or less
Lube Oil Consumption:	0.1 % Fuel Consumption
Number of Exhaust Manifolds:	1

Engine Cycle Data

Load	Speed	Power	Exhaust Flow	Exhaust Temp.	Fuel Cons.	CO	NMNEHC	CH_2O	O_2	H_2O
%		*bhp*	*acfm (cfm)*	*F*		*g/bhp-hr*	*g/bhp-hr*	*g/bhp-hr*	*%*	*%*
100	Rated	1,468	9,280	961		1.92	0.32	0.3	9.6	12

Emission Data (100% Load)

Emission	Raw Engine Emissions						Target Outlet Emissions						Calculated Reduction
	g/bhp-hr	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	*g/bhp-hr*	*tons/yr*	*ppmvd @ 15% O_2*	*ppmvd*	*g/kW-hr*	*lb/MW-hr*	
CO	1.92	27.22	245	469	2.575	5.68	0.25	3.54	32	61	0.335	0.74	87%
NMNEHC*	0.32	4.54	71	137	0.429	0.95	0.25	3.54	56	107	0.335	0.74	21.9%
CH_2O	0.3	4.25	36	68	0.402	0.89	0.05	0.71	6	11	0.067	0.15	83.3%

System Specifications

Oxidation System Specifications (SP-ZCSS-30-TBD)

Design Exhaust Flow Rate:	9,280 acfm (cfm)
Design Exhaust Temperature[1]:	961°F
Housing Model Number:	SP-ZCSS-30-TBD-HSG-0
Element Model Number:	MECB-OX-SB2969-1550-2475-350
Number of Catalyst Elements:	2
Number of Spare Catalyst Tracks:	1
System Pressure Loss:	5.0 inches of WC (Clean) (12.5 mBar)
Sound Attenuation:	22-29 dBA insertion loss
Exhaust Temperature Limits**:	550 – 1250°F (catalyst inlet); 1350°F (catalyst outlet) 288 – 677°C (catalyst inlet); 732°C (catalyst outlet)

* MW referenced as CH_4. Propane in the exhaust shall not exceed 15% by volume of the NMNEHC compounds in the exhaust, excluding aldehydes. The 15% (vol.) shall be established on a wet basis, reported on a methane molecular weight basis. The measurement of exhaust NMNEHC composition shall be based upon EPA method 320 (FTIR), and shall exclude formaldehyde.

** General catalyst temperature operating range. Performance is based on the Design Exhaust Temperature.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	Engine Model **TAURUS 70-10802S** **CS/MD STANDARD**
Job ID	
Inquiry Number	Fuel Type: **CHOICE GAS** — Water Injection: **NO**
Run By: **David Anthony Pocengal** — Date Run: **3-Feb-22**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 11252 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	22.06	22.39	12.82
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.60	0.61	0.35
lbm/hr	5.04	5.11	2.93
2 — 11206 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.46	21.77	12.47
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.59	0.59	0.34
lbm/hr	4.90	4.97	2.85
3 — 11111 HP, 100.0% Load, Elev. 1300 ft, Rel. Humidity 60.0%, Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.90	21.21	12.15
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.58	0.58	0.33
lbm/hr	4.77	4.84	2.77

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	
Job ID	
Inquiry Number	
Run By: **David Anthony Pocengal**	Date Run: **3-Feb-22**

Engine Model	**TAURUS 70-10802S CS/MD STANDARD**
Fuel Type: **CHOICE GAS**	Water Injection: **NO**
Engine Emissions Data	**REV. 0.1**

4	10235 HP 100.0% Load	Elev. 1300 ft	Rel. Humidity 60.0%	Temperature 60.0 Deg. F
		NOx EMISSIONS	**CO EMISSIONS**	**UHC EMISSIONS**
	PPMvd at 15% O2	15.00	25.00	25.00
	ton/yr	19.61	19.90	11.40
	lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
	lbm/(MW-hr) (gas turbine shaft pwr)	0.59	0.60	0.34
	lbm/hr	4.48	4.54	2.60

5	9278 HP 100.0% Load	Elev. 1300 ft	Rel. Humidity 60.0%	Temperature 80.0 Deg. F
		NOx EMISSIONS	**CO EMISSIONS**	**UHC EMISSIONS**
	PPMvd at 15% O2	15.00	25.00	25.00
	ton/yr	18.22	18.49	10.59
	lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
	lbm/(MW-hr) (gas turbine shaft pwr)	0.60	0.61	0.35
	lbm/hr	4.16	4.22	2.42

6	8198 HP 100.0% Load	Elev. 1300 ft	Rel. Humidity 60.0%	Temperature 100.0 Deg. F
		NOx EMISSIONS	**CO EMISSIONS**	**UHC EMISSIONS**
	PPMvd at 15% O2	15.00	25.00	25.00
	ton/yr	16.65	16.89	9.67
	lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
	lbm/(MW-hr) (gas turbine shaft pwr)	0.62	0.63	0.36
	lbm/hr	3.80	3.86	2.21

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer	Model **TAURUS 70-10802S**
	Package Type **CS/MD**
Job ID	Match **STANDARD**
Run By **David Anthony Pocengal**	Date Run **3-Feb-22**
Engine Performance Code **REV. 4.20.2.27.13**	Engine Performance Data **REV. 1.0**
Fuel System **GAS**	Fuel Type **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	1300
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	23.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	0	20.0	40.0	60.0	80.0	100.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	11971	11895	11773	11486	11177	10781
Specified Load	HP	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	HP	11252	11206	11111	10235	9278	8198
Fuel Flow	mmBtu/hr	83.87	81.64	79.66	75.02	70.17	64.89
Heat Rate	Btu/HP-hr	7453	7286	7170	7330	7563	7915
Therm Eff	%	34.139	34.922	35.488	34.715	33.645	32.148
Engine Exhaust Flow	lbm/hr	226503	220160	213754	202216	189602	174495
PT Exit Temperature	deg F	910	912	921	943	968	1001
Exhaust Temperature	deg F	901	909	921	943	968	1001

Fuel Gas Composition (Volume Percent)

Methane (CH4)	81.65
Ethane (C2H6)	12.60
Propane (C3H8)	3.46
I-Butane (C4H10)	0.48
N-Butane (C4H10)	0.76
I-Pentane (C5H12)	0.21
N-Pentane (C5H12)	0.17
Hexane (C6H14)	0.15
Heptane (C7H16)	0.07
Octane (C8H18)	0.04
Carbon Dioxide (CO2)	0.13
Water Vapor (H2O)	0.02
Nitrogen (N2)	0.26
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	1090.3	Specific Gravity	0.6831	Wobbe Index at 60F	1319.2

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer	
Job ID	
Inquiry Number	
Run By: **David Anthony Pocengal**	Date Run: **3-Feb-22**

Engine Model: **TAURUS 70-10802S CS/MD STANDARD**	
Fuel Type: **CHOICE GAS**	Water Injection: **NO**
Engine Emissions Data: **REV. 0.1**	

1	10747 HP	100.0% Load	Elev. 1300 ft	Rel. Humidity 60.0%	Temperature 50.0 Deg. F

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.36	20.65	11.83
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr) (gas turbine shaft pwr)	0.58	0.59	0.34
lbm/hr	4.65	4.72	2.70

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar’s typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg F, and between 50% and 100% load for gas fuel, and between 65% and 100% load for liquid fuel (except for the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg F and between 80% and 100% load.
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer	Model **TAURUS 70-10802S**
	Package Type **CS/MD**
Job ID	Match **STANDARD**
Run By **David Anthony Pocengal** / Date Run **3-Feb-22**	Fuel System **GAS**
Engine Performance Code **REV. 4.20.2.27.13** / Engine Performance Data **REV. 1.0**	Fuel Type **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	1300
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	4.0
Accessory on GP Shaft	HP	23.8
Engine Inlet Temperature	deg F	50.0
Relative Humidity	%	60.0
Driven Equipment Speed	RPM	11645
Specified Load	HP	FULL
Net Output Power	HP	10747
Fuel Flow	mmBtu/hr	77.70
Heat Rate	Btu/HP-hr	7229
Therm Eff	%	35.195
Engine Exhaust Flow	lbm/hr	208678
PT Exit Temperature	deg F	932
Exhaust Temperature	deg F	932

Fuel Gas Composition (Volume Percent)

Methane (CH4)	81.65
Ethane (C2H6)	12.60
Propane (C3H8)	3.46
I-Butane (C4H10)	0.48
N-Butane (C4H10)	0.76
I-Pentane (C5H12)	0.21
N-Pentane (C5H12)	0.17
Hexane (C6H14)	0.15
Heptane (C7H16)	0.07
Octane (C8H18)	0.04
Carbon Dioxide (CO2)	0.13
Water Vapor (H2O)	0.02
Nitrogen (N2)	0.26
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	1090.3	Specific Gravity	0.6831	Wobbe Index at 60F	1319.2

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar® Turbines
A Caterpillar Company

PIL 168
Product Information Letter

Volatile Organic Compound, Sulfur Dioxide, and Formaldehyde Emission Estimates

Leslie Witherspoon

PURPOSE

This Product Information Letter (PIL) summarizes emission factors commonly utilized to estimate emissions of volatile organic compounds (VOC), sulfur dioxide (SO_2), and formaldehyde from gas turbines.

Volatile Organic Compounds

Many permitting agencies require gas turbine users to include emissions of VOC, a subpart of the unburned hydrocarbon (UHC) emissions, during the air permitting process. Volatile organic compounds, non-methane hydrocarbons (NMHC), and reactive organic gases (ROG) are different ways of referring to the non-methane (and non-ethane) portion of an "unburned hydrocarbon" emission estimate.

For natural gas fuel, Solar's customers often use 10-20% of the UHC emission rate to conservatively estimate VOC emissions. Solar can offer a 5 ppm VOC warranty level upon request. For liquid fuel, it is appropriate to estimate that 100% of the UHC estimate is VOC. The emissions estimates are assumed valid at ambient temperatures >0 °F (-17.8 °C) and for natural gas from 50-100% load (40-100% for the Titan™ 250 and 80-100% load for the Saturn® 20) or for liquid fuel from 65-100% load (80-100% for the Saturn 20 and Centaur® 40).

Environmental Protection Agency (EPA's) AP-42[1] document and WebFIRE[2] database also contain VOC emission estimates for gas turbines. These sources are not commonly used by Solar's customers.

Sulfur Dioxide

Sulfur dioxide emissions are produced by conversion of any sulfur in the fuel to SO_2. Solar customers usually either use a mass balance calculation or reference AP-42 to estimate SO_2 emissions. Because Solar does not control the amount of sulfur in the fuel, no SO_2 emissions warranty is available.

The mass balance method assumes that any sulfur in the fuel converts to SO_2. For reference, the typical mass balance equation is shown below.

$$\frac{\text{lb SO2}}{\text{hr}} = \left(\frac{\text{wt\% Sulfur}}{100}\right)\left(\frac{\text{lb fuel}}{\text{Btu}}\right)\left(\frac{10^6\ \text{Btu}}{\text{MMBtu}}\right)\left(\frac{\text{MMBtu fuel}}{\text{hr}}\right)\left(\frac{\text{MW SO2}}{\text{MW Sulfur}}\right)$$

Variables: wt% of sulfur in fuel
Btu/lb fuel (LHV)
MMBtu/hr fuel flow (LHV)

As an alternative to the mass balance calculation, EPA's AP-42 document can be used. AP-42 (Table 3.1-2a, April 2000) suggests emission factors of 0.94S lb/MMBtu (HHV) (where S=Sulfur % in fuel) or 0.0034 lb/MMBtu (HHV) for gas fuel and 1.01S lb/MMBtu (HHV) (where S=Sulfur% in fuel) or 0.33 lb/MMBtu (HHV) for liquid fuel.

[1] AP-42 is an EPA document containing a compilation of air pollutant emission factors by source category.
[2] WebFIRE is an EPA electronic based repository and retrieval tool for emission factors.

Formaldehyde

For gas turbines, formaldehyde emissions are a result of incomplete combustion and are unstable in the exhaust stream. In this section, regulatory background, recommended emission factors, and testing considerations are discussed.

Regulatory Background and Emissions Factors – U.S. and EU

In 2004 the U.S. EPA published a Maximum Achievable Control Technology (MACT) standard (40 CFR 63 Subpart YYYY) for natural gas fired combustion turbines with a formaldehyde limit of 91 ppb (15% O2). The standard was stayed a few months later for the natural gas subcategories essentially rendering the regulation "on hold". The stay was lifted on March 9, 2022. After ~18 years of not having to comply with the MACT standard, natural gas fired combustion turbines located **at major sources of hazardous air pollutants** need to comply with the standard. The initial compliance date is September 4, 2022. With the lifting of the stay, four of the eight subcategories outlined in the Subpart YYYY must comply with the MACT standard. They are:

- stationary lean premix combustion turbines when firing gas and when firing oil at sites where all turbines fire oil no more than an aggregate total of 1,000 hours annually
- stationary lean premix combustion turbines when firing oil at sites where all turbines fire oil more than an aggregate total of 1,000 hours annually
- stationary diffusion flame combustion turbines when firing gas and when firing oil at sites where all turbines fire oil no more than an aggregate total of 1,000 hours annually
- stationary diffusion flame combustion turbines when firing oil at sites where all turbines fire oil more than an aggregate total of 1,000 hours annually

For U.S. customers with a combustion turbine that must comply with Subpart YYYY, an emission factor of 91 ppb @ 15% O2 (~0.00021 lb/MMBtu HHV) is recommended.

The formaldehyde emissions estimate of 91 ppb @15%O2 (~0.00021 lb/MMbtu HHV) can be used for all new, current production, SoLoNOx models and ratings when firing pipeline quality natural gas or ultra-low sulfur (ULSD) diesel fuel. The emissions estimate is valid for natural gas from 50-100% load (40-100% load for Titan 250) or for liquid fuel from 65-100% load (80-100% load for the Centaur 40) and at ambient temperatures >0 °F (> -20 °F for Titan 250).

Alternative emission factors for combustion turbines **not** affected by Subpart YYYY (or non-U.S. based combustion turbines) are from U.S. EPA's AP-42 document and are 0.00071 lb/MMBtu (HHV) for natural gas and 0.00028 lb/MMBtu (HHV) for distillate oil[3]. Note that both of the aforementioned formaldehyde emission factors are higher than the MACT standard. Since ~2003 many gas turbine users have used the emission factors found in an EPA memo Revised HAP Emission Factors for Stationary Combustion Turbines[4] for estimating hazardous air pollutant emissions. The memo presents hazardous air pollutant emission factor data in several categories. While the memo presents several formaldehyde emissions factors, the most common formaldehyde emission factor used to estimate emissions from gas turbines from this document is 0.00288 lb/MMBtu HHV (Table 16). Note that this emission factor is an order of magnitude higher than the MACT standard.

In the EU, Germany has established a formaldehyde limit of 5 mg/Nm3 for combustion turbines (13.BImSchV Section 33). This limit applies for operation at 70-100% load and it is anticipated that something similar will be adopted in other EU member states. The 5 mg/Nm3 limit is equivalent to ~0.0038 kg/GJ or ~3.7 ppm.

Formaldehyde Emissions Testing Considerations

Actual emissions of formaldehyde from Solar's gas turbines, in the SoLoNOx operating range, are predicted to be less than 91 ppb @15%O2. However, **the 91 ppb level can only be verified if the proper testing equipment is utilized.** To properly measure formaldehyde emissions, Fourier Transform Infrared (FTIR) instrumentation with limits of detection well below the standard must be utilized. Most "traditional" FTIR systems have formaldehyde

[3] AP-42, Table 3.1-3 for Natural Gas and Table 3.1-4 for Distillate Oil, 4/00.

[4] Revised HAP Emission Factors for Stationary Combustion Turbines, OAR-2002-0060, IV-B-09,8/22/03.

limits of detection in the 120-150 ppb range and are not suitable to measure formaldehyde from combustion turbines.

Solar recommends the MKS Multi Gas 2030 FTIR with StarBoost™ System, the Spectrum WaveRunIR-EXT or an equivalent system with similar path lengths and detection levels.

EPA Method 320 (or equivalent method for non-U.S. testing) should be used to measure formaldehyde. Testing should include three – 120-minute test runs. To ensure accurate formaldehyde measurements, the testing company, in addition to following the requirements of Method 320 (or equivalent method), should take necessary steps to optimize signal-to-noise, verify the FTIR is fully temperature stabilized and purged, ensure the FTIR signal is optimized before testing by maximizing alignment and cleanliness of optics, minimize sampling line bias by using clean sample lines at 250°F to prevent off-gassing and minimize contamination with other compounds, verify absence of sampling system bias via system zero measurements, measure a source specific moisture spectrum while at the test site using a water/N2 delivery systems at +/-10% of turbine moisture content, and use the source specific water spectrum as an interferent in the analysis.

Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNOx™ Combustion Products

Leslie Witherspoon

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide emission estimates for start-up and shutdown events for Solar® gas turbines with SoLoNOx™ dry low emissions combustion systems.[1] For start-up and shutdown emissions estimates for conventional combustion turbines, landfill gas, digester gas, or other alternative fuel applications, contact Solar's Environmental Programs team.

INTRODUCTION

The information presented in this document is representative for both generator set (GS) and compressor set/mechanical drive (CS/MD) SoLoNOx combustion turbine applications. Operation of duct burners and/or any add-on control equipment is not accounted for in the emissions estimates. Emissions estimates related to the start-up, shutdown, and commissioning of combustion turbines will not be warranted. The estimates in this document are based on limited engine testing and analysis. The engine testing was conducted at idle and other non-SoLoNOx mode load points. An actual start-up/shutdown event was not measured.

The start-up and shutdown estimates are most commonly used for potential to emit calculations to determine air permitting status. **Solar discourages customers from accepting the estimates in this document as permit limits, with or without source testing requirements.** Accurately measuring emissions during a – non-steady state – start-up or shutdown event with steady state source test methods may prove to be very challenging. In the event customers take permit limits and accept compliance testing permit conditions, Solar recommends adding significant margin to the estimates in this document.

START-UP PROCESS

The duration of a nominal start-up is the same for a cold start, warm start, or hot start (e.g., a Solar Turbine is programmed to start-up in "x" minutes whether it's a cold, warm, or hot start).

The start-up and shutdown time for a Solar turbine in a simple-cycle or combine heat and power application is the same. Heat recovery steam generator (HRSG) steam pressure is usually 250 psig or less. At 250 psig or less, thermal stress within the HRSG is minimized and, therefore, firing ramp-up/ramp-down is not limited. However, some combined heat and power plant applications will desire or dictate longer start-up/shutdown times due to external requirements.

The start-up sequence and attaining SoLoNOx combustion mode takes three steps:

1. Purge-crank
2. Ignition and acceleration to idle
3. Loading/thermal stabilization

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[1]Start-up and shutdown emissions for the Mercury™50 engine are found in PIL 205

During the "purge-crank" step, rotation of the turbine shaft is accomplished with a starter motor to remove any residual fuel gas in the engine flow path and exhaust. During "ignition and acceleration to idle," fuel is introduced into the combustor and ignited in a diffusion flame mode and the engine rotor is accelerated to idle speed.

The third step consists of applying up to 50% load[2] while allowing the combustion flame to transition and stabilize. Once 50% load is achieved, the turbine transitions to SoLoNOx combustion mode and the engine control system begins to maintain the combustion primary zone temperature and limit pilot fuel to achieve the targeted nitrogen oxides (NOx), carbon monoxide (CO), and unburned hydrocarbons (UHC) emission levels.

SHUTDOWN PROCESS

Normal, planned cool down/shutdown duration varies by engine model. Once the shutdown process starts the engine unloads and moves into a cooldown mode.

START-UP AND SHUTDOWN EMISSIONS ESTIMATES

Tables 1 through 5 summarize the estimated pounds of emissions per start-up and shutdown event for SoLoNOx products. The mass emissions estimates are calculated using exhaust characteristics at ISO conditions in conjunction with ppm emissions estimates at various load points. The estimates in Tables 1 and 2 are representative of new production units ordered from 2006 up until the implementation of Enhanced Emissions Control (EEC). Tables 3 and 4 summarize emissions estimates for turbine models and ratings equipped with EEC. Enhanced Emission Control (EEC) is a new control regime that will result in lower CO and UHC values at lower loads thus reducing the estimated emissions per start-up and shutdown sequence. The Titan™ 250 and the Titan 130 23001/23502 (and 22401/22402) ratings have always been equipped with EEC. As testing is completed and other models/ratings are qualified and able to be equipped with the updated controls PIL170 will be updated. Reference PIL 220, specifically pages 7 and 8, for additional information about Enhanced Emission Control. Table 5 summarizes start-up and shutdown emissions estimates for liquid fuel applications.

Please contact Solar Environmental Programs, Leslie Witherspoon (858.694.6609) or Anthony Pocengal (858.505.8554) for support.

COMMISSIONING EMISSIONS

Commissioning generally takes place over a two-week period. Static testing, where no combustion occurs, usually requires one week and no emissions are expected. Dynamic testing, where combustion will occur, typically includes a number of engine start and shutdown cycles and a variety of loads will be placed on the system. It is impossible to predict how long the turbine will run and in what combustion/emissions mode it will be running. The dynamic testing period is generally followed by one to two days of final commissioning during which the turbine is running at various loads.

[2] 40% load for the Titan 250 Engine on natural gas. 65% load for all engines on liquid fuel (except 80% load for the Centaur™ 40).

Table 1: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units from 2006 and without Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4701S	1	66	62	12	247	1	67	67	13	228
Centaur 50 6201S	1	67	84	17	333	1	67	88	18	316
Taurus™ 60 7901S	1	86	110	22	338	1	89	119	24	311
Taurus 65 8701S	1	74	67	13	376	1	75	74	15	347
Taurus 70 10801S	1	78	67	13	544	1	58	52	10	411
Mars™ 90 13000S GSC	1	84	41	8	640	1	80	44	9	605
Mars 100 15000S/16000S GSC	1	81	39	8	669	1	76	42	8	616
Titan 130 20501S	3	172	138	28	832	3	174	151	30	768

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 2: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications

Nominal Start-up and Shutdown, Natural Gas Fuel

Production Units from 2006 and without Enhanced Emissions Control

Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4702S	1	21	17	3	188	1	19	18	4	194
Centaur 50 6102S	1	21	17	3	184	1	20	19	4	169
Taurus 60 7802S	1	22	17	3	180	1	20	18	4	161
Taurus 70 10802S	1	88	88	18	381	1	78	83	17	295
Mars 90 13000S CS/MD	1	45	20	4	437	1	56	28	6	590
Mars 100 15000S/16000S CS/MD	1	46	20	4	385	1	58	28	6	490
Titan 130 20502S	1	55	37	7	662	1	61	43	9	751

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 3: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
Nominal Start-up and Shutdown, Natural Gas Fuel
Production Units with Enhanced Emissions Control
Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7901S GSC (Post 9/2020 Orders)	1	114	65	13	368	1	140	80	16	345
Taurus 70 10801S GSC (Post 2/2018 Orders)	1	34	45	9	552	1	28	36	7	419
Taurus 70 11101S GSC (Post 2/2018 Orders)	1	35	45	9	563	1	28	37	7	427
Mars 90 13000S GSC (Post 9/2020 Orders)	1	33	25	5	727	1	37	27	5	682
Mars 90 15000S GSC (Post 9/2020 Orders)	1	40	33	7	760	1	44	35	7	710
Mars 100 16000S GSC (Post 8/2017 Orders)	1	32	24	5	789	1	35	25	5	733
Titan 130 19501S (Post 9/2020 Orders)	1	31	35	7	842	1	35	40	8	795
Titan 130 20501S (Post 2/2018 Orders)	2	70	80	16	839	2	83	95	19	782
Titan 130 23001S (All Units)	1	20	23	5	943	1	21	24	5	885
Titan 250 30000S GSC (All Units)	2	38	15	3	1502	2	30	12	2	1159
Titan 250 31900S GSC (All Units)	2	41	16	3	1280	2	33	13	3	975

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.
Assumes unit is operating at >50% load prior to shutdown.
Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 4: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications

Nominal Start-up and Shutdown, Natural Gas Fuel

Production Units with Enhanced Emissions Control

Emissions estimates will NOT be warranted.

Engine	Total Emissions Per Start (lbs)					Total Emissions Per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Taurus 60 7802S (Post 9/2020 Orders)	1	5	4	1	247	1	7	6	1	235
Taurus 70 10802S (Post 2/2018 Orders)	1	37	52	10	381	1	36	50	10	295
Mars 100 13000S CS/MD (Post 9/2020 Orders)	1	16	12	2	437	1	23	17	3	564
Mars 100 15000S CS/MD (Post 9/2020 Orders)	1	21	13	3	474	1	31	19	4	612
Mars 100 16000S CS/MD (Post 8/2017 Orders)	1	18	12	2	496	1	25	17	3	642
Titan 130 20502S (Post 9/2020 Orders)	1	11	6	1	682	1	13	7	1	762
Titan 130 22402S (All Units)	1	13	15	3	690	1	15	17	3	775
Titan 130 23502S (All Units)	1	16	18	4	767	1	19	22	4	869
Titan 250 30000S CS/MD (All Units)	2	32	12	2	1172	2	28	11	2	1036
Titan 250 31900S CS/MD (All Units)	1	24	9	2	987	1	21	8	2	880

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Table 5: Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications

Nominal Start-up and Shutdown, Liquid Fuel (Diesel #2)

Emissions estimates will NOT be warranted.

Engine	Total Emissions per Start (lbs)					Total Emissions per Shutdown (lbs)				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Centaur 40 4701S	4	140	23	23	419	4	153	26	26	386
Centaur 50 6201S	3	130	22	22	472	3	143	24	24	440
Taurus 60 7901S	4	147	25	25	483	4	163	28	28	435
Taurus 70 10801S	6	251	42	42	754	5	201	34	34	568
Mars 100 16000S GSC	4	119	20	20	854	4	150	25	25	857
Titan 130 20501S	8	336	57	57	1164	8	371	63	63	1058
Titan 130 23001S	4	138	23	23	1206	4	133	22	22	1086
Titan 250 30000S GSC	8	280	47	47	2189	6	220	37	37	1656
Titan 250 31900S GSC	8	292	49	49	2112	6	230	39	39	1588

Assumes ISO conditions: 59°F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 (Fuel Air and Water or Steam for Solar Gas Turbine Engines) compliant.

Particulate Matter Emission Estimates

Leslie Witherspoon

PURPOSE

This Product Information Letter (PIL) summarizes Solar's recommended $PM_{10/2.5}$ emission levels for our combustion turbines. The recommended levels are based on an analysis of emissions tests collected from customer sites.

PARTICULTE MATTER DEFINITION

National Ambient Air Quality Standards (NAAQS) for particulate matter were first set in 1971. Total suspended particulate (TSP) was the first indicator used to represent suspended particles in the ambient air. Since July 1, 1987, the Environmental Protection Agency (EPA) has used the indicator PM_{10}, which includes only the particles with aerodynamic diameter smaller than 10 micrometers (μm). PM_{10} (coarse particles) come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic.

The EPA added a $PM_{2.5}$ ambient air standard in 1997. $PM_{2.5}$ includes particles with an aerodynamic diameter less than 2.5 μm. $PM_{2.5}$ (fine particles) are generally emitted from industrial and residential combustion and from vehicle exhaust. Fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxide, and volatile organic compounds, emitted by combustion activities, are transformed by chemical reactions.

Nearly all particulate matter from gas turbines exhaust is less than one micrometer (micron) in diameter. Thus the emission rates of TSP, PM_{10}, and $PM_{2.5}$ from gas turbines are theoretically equivalent although source testing will show variation due to test method detection levels and processes.

TESTING FOR PARTICULATE MATTER

The turbine combustion process has little effect on the particulate matter generated and measured. The largest contributor to particulate matter emissions for gas and liquid fired combustion turbines is measurement technique and error. Other, minor contributing, sources of particulate matter emissions include carbon, ash, fuel-bonded sulfur, artifact sulfate formation, compressor/lubricating oils, and inlet air.

Historical customer particulate matter source test data show that there is significant variability from test to test. The source test results support the common industry argument that particulate matter from natural gas fired combustion sources is difficult to measure accurately. The reference test methods for particulate matter were developed primarily for measuring emissions from coal-fired power plants and other major emitters of particulates. Particulate concentrations from gas turbine can be 100 10,000 times lower than the "traditional" particulate sources. The test methods were not developed or verified for low emission levels. There are interferences, insignificant at higher exhaust particulate matter concentrations that result in emissions greater than the actual emissions from gas turbines. New methods are being developed to address this problem.

Due to measurement and procedural errors, the measured results may not be representative of actual particulate matter emitted. There are many potential error sources in measuring particulate matter. Most of these have to do with contamination of the samples, material from the sampling apparatus getting into the samples, and human error in samples and analysis. Over the past few years, source test firms are gaining experience in measuring particulate matter and the historical variability from test to test and the emissions levels measured have decreased.

RECOMMENDED PARTICULATE MATTER EMISSION FACTORS

When necessary to support the air permitting process Solar recommends the following $PM_{10/2.5}$ emission factors for all models and ratings except for the Mercury™ 50. Please refer to PIL 205 for the Mercury 50. The emission factors below are intended to include both the front half (filterable) and the back half (condensable).

- Pipeline Natural Gas*: 0.01 lb/MMBtu fuel input (HHV)
- Landfill/Digester Gas+: 0.03 lb/MMBtu fuel input (HHV)
- Liquid Fuel#: 0.02 lb/MMBtu fuel input (HHV)

  *Pipeline natural gas emissions factor assumes <1 grains of Sulfur per 100 standard cubic feet.
  +Landfill/digester gas emissions factor assumes <.15lb SO2/MMBtu heat input
  #Liquid fuel emission factor assumes fuel Sulfur content is <500 ppm and ash content is <0.005% by wt.

Contact Solar's Environmental Programs group for particulate matter emissions estimates for fuels not listed above.

The conversion of particulate matter emissions request from mg/Nm^3 to lb/MMBtu (HHV) units involves several specific turbine parameters. Please contact Solar if you need the calculation performed.

Recent customer source testing has shown that AP-42 (EPA AP-42 "Compilation of Air Pollutant Emission Factors") emission factors for natural gas are achievable in the field, when the test method recommendations shown below are followed. Customers generally choose a particulate matter emissions factor at or above the AP-42 level that works for their site permitting recognizing that the lower the emissions factor the higher the risk for source testing.

TEST METHOD RECOMMENDATION

Solar recommends that EPA Methods 201/201A[1] be used to measure the "front half." "Front half" represents filterable particulate matter.

EPA Method 202[2] (with Nitrogen purge and field blanks) should be used to measure the "back half." "Back half" measurements represent the condensable portion of particulate matter.

EPA Method 5[3], which measures the front and back halves may be substituted (e.g. where exhaust temperatures do not allow the use of Method 202).

The turbine should have a minimum of 300 operating ours prior to conducting particulate matter source testing. The turbine should be running for 3-4 hours prior to conducting a particulate matter source test so that the turbine and auxiliary equipment is in a sustained "typical" operating mode prior to gathering samples.

Testing should include three 4-hour test runs.

Solar recommends using the aforementioned test methods until more representative test methods are developed and widely commercially available

REFERENCES

[1]EPA Method 201, Determination of PM10 Emissions, Exhaust Gas Recycle Procedure. EPA Method 201A. Determination of PM10 Emissions, Constant Sampling Rate Procedure, 40 CFR 60, Part 60, Appendix A.
[2]EPA Method 202, Determination of Condensable Particulate Emissions from Station Sources, 40 CFR 60, Part 60. Appendix A.
[3]EPA Method 5, Determination of Particulate Emissions from Station Sources, 40 CFR 60, Part 60, Appendix A.

Emissions from Centrifugal Compressor Dry Gas Seal System

Anthony Pocengal and Sean Garceau

PURPOSE

This product information letter (PIL) provides estimates of methane emitted from the dry gas seal systems installed in Solar® centrifugal gas compressors.

INTRODUCTION

The standard design of dry seal systems includes characteristic 'seal leakage' which in most configurations results in methane emissions to the atmosphere from the primary seal vent. Figure 1 below shows a cutaway diagram of a typical compressor shaft and dry seal system showing some of the basic components. The primary seal uses a high-pressure seal gas to maintain the process gas within the gas compressor body. The seal gas is typically pressurized process gas, i.e. methane for a typical natural gas compression station, and since the seal gas pressure is slightly higher than the suction and discharge pressures, most of the seal gas is returned to the compression process thru the labyrinth seal passage. A portion of the seal gas leaks across the primary seal face per design and is emitted through the primary vent to atmosphere. The volume of methane emitted from the seal vent is directly proportional to the operating suction pressure of the gas compressor.

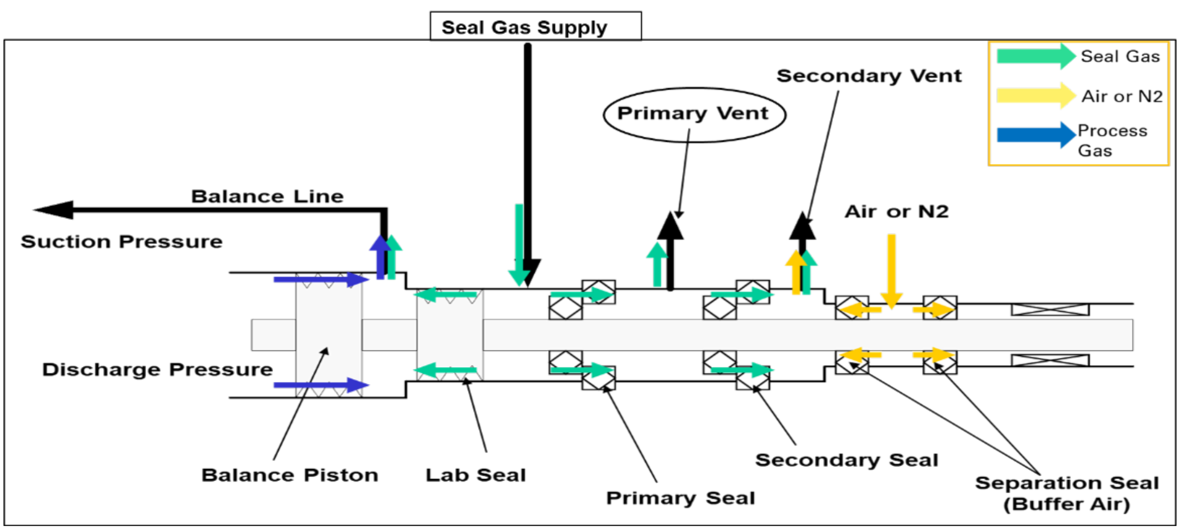

Figure 1: Centrifugal Compressor Dry Gas Seal System – Basic Components

Solar offers a dry seal emissions recompression system which captures the emissions from the primary vent and allows routing of these emissions back into the compression process or for another beneficial use onsite. Solar PIL 279 has further information on this application which virtually eliminates methane emissions from the dry seal system.

DRY GAS SEAL EMISSIONS DATA

The figures below may be used to estimate dry gas seal emissions ('seal leakage') emitted through the primary vent based on the compressor suction pressure (P1). The charts show the maximum expected leakage rates per each compressor. Actual emissions are expected to be lower.

For further technical information on Dry Gas Seal systems refer to PIL 140 Dry Gas Face Seals for Solar Gas Compressors.

Note regarding PIL 140: The maximum dynamic leakage rates from PIL 140 Table 1a are the highest possible guaranteed flow rates and are based on maximum allowable speed and pressure and should not be utilized for emission inventories or expected emissions from Solar compressors.

TABLE OF FIGURES

Centrifugal compressor dry gas seal leakage estimates

The charts shown below provide estimates for the seal leakage from the two primary dry gas seals on Solar gas compressors. The dry gas seal leakage flow is a function of the compressor suction pressure. The charts show seal gas vented flow (scfm) vs compressor suction pressure (psig)

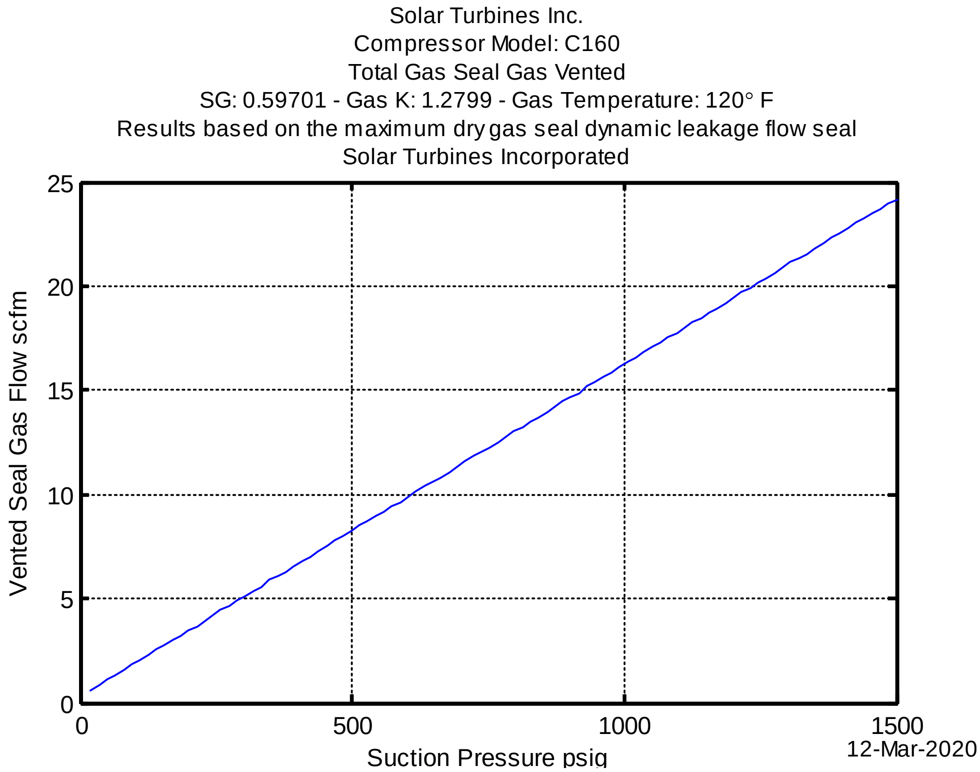

Figure 2: C16, C28

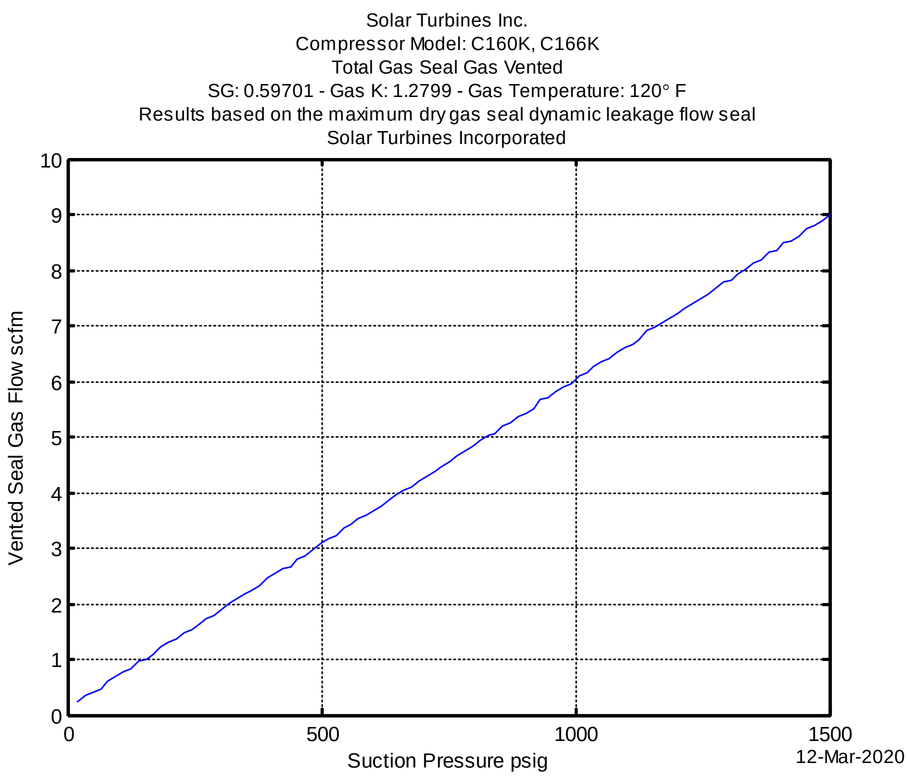

Figure 3: C160K, C166K

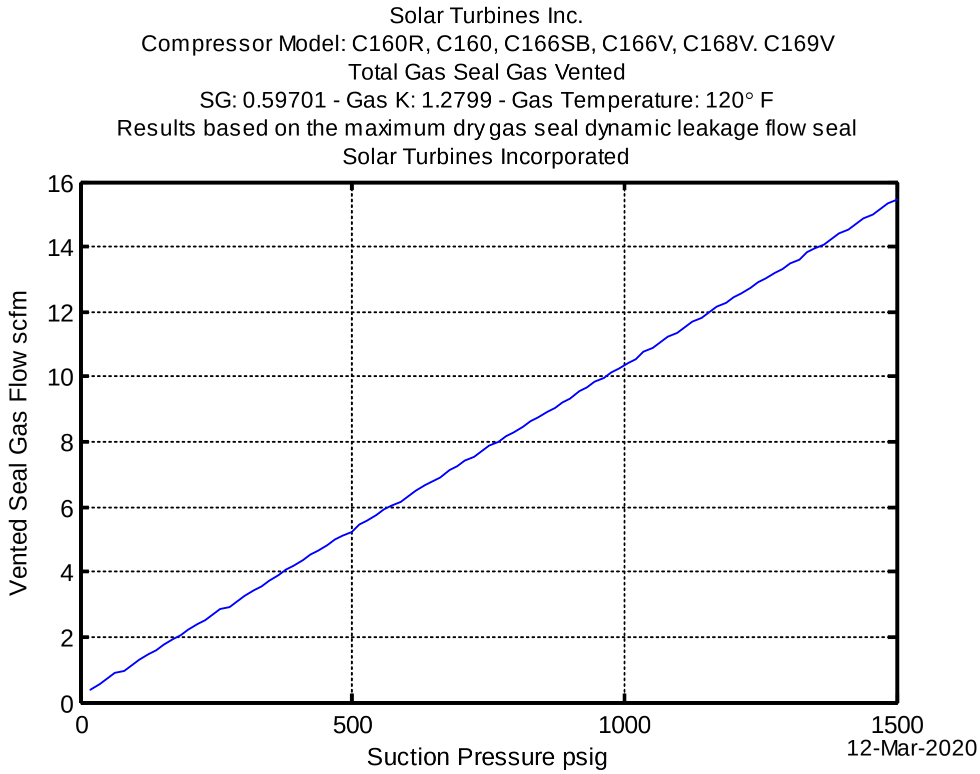

Figure 4: C160R, C160, C166SB, C166V, C168V, C169V

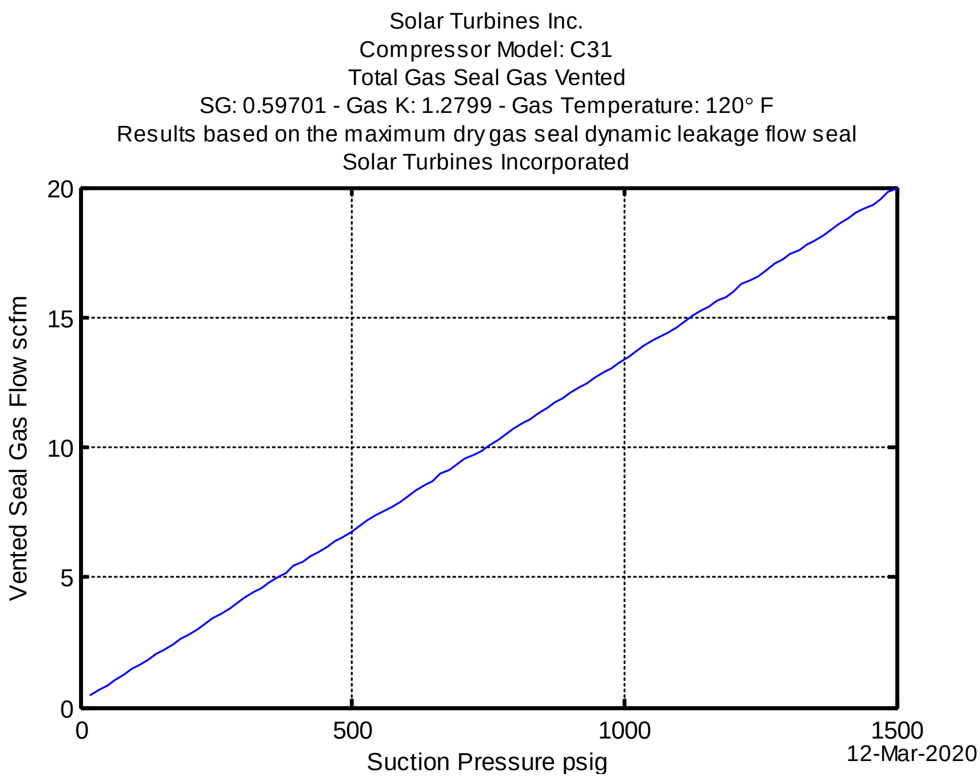

Figure 5: C31

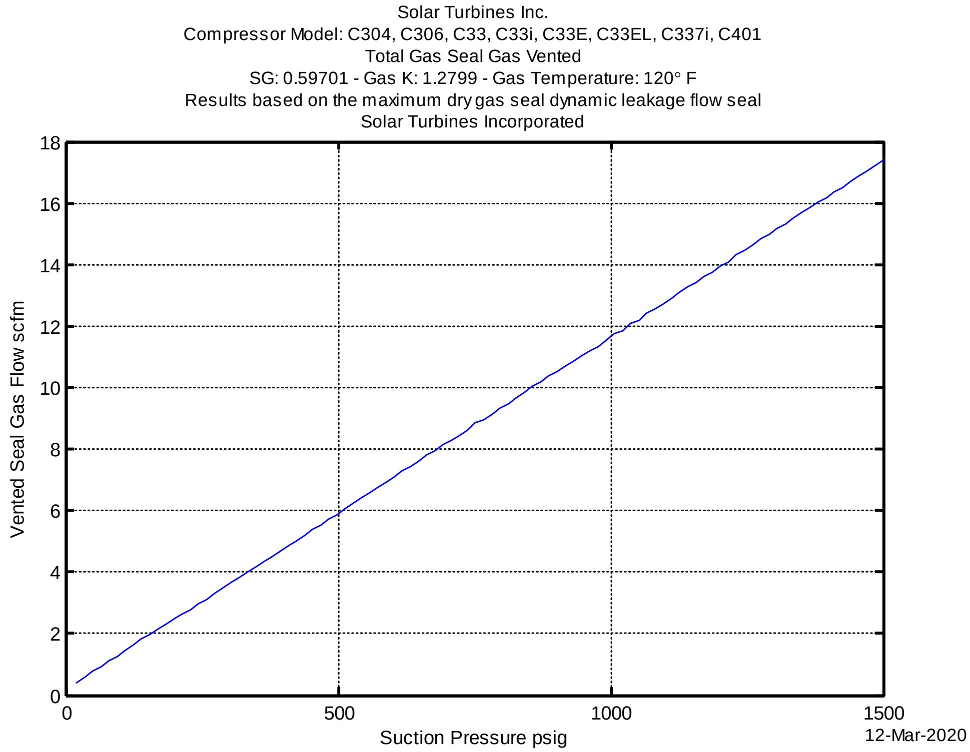

Figure 6: C304. C306, C33, C33i, C33E, C33EL, C337i, C401

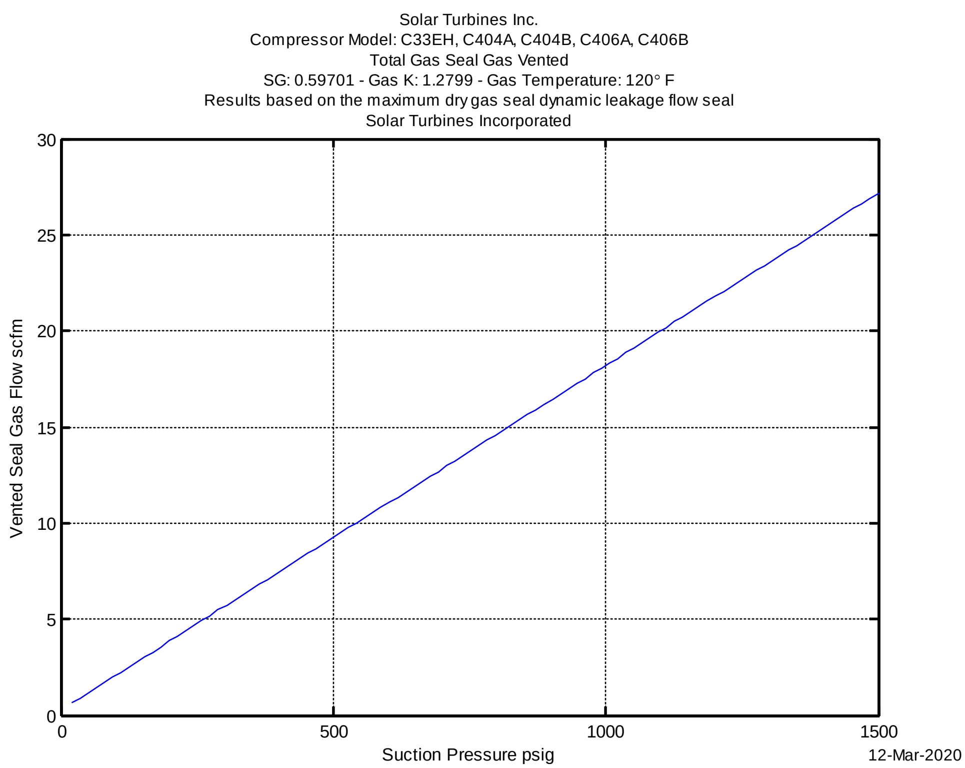

Figure 7: C33EH, C404A, A404B, C406A, C406B

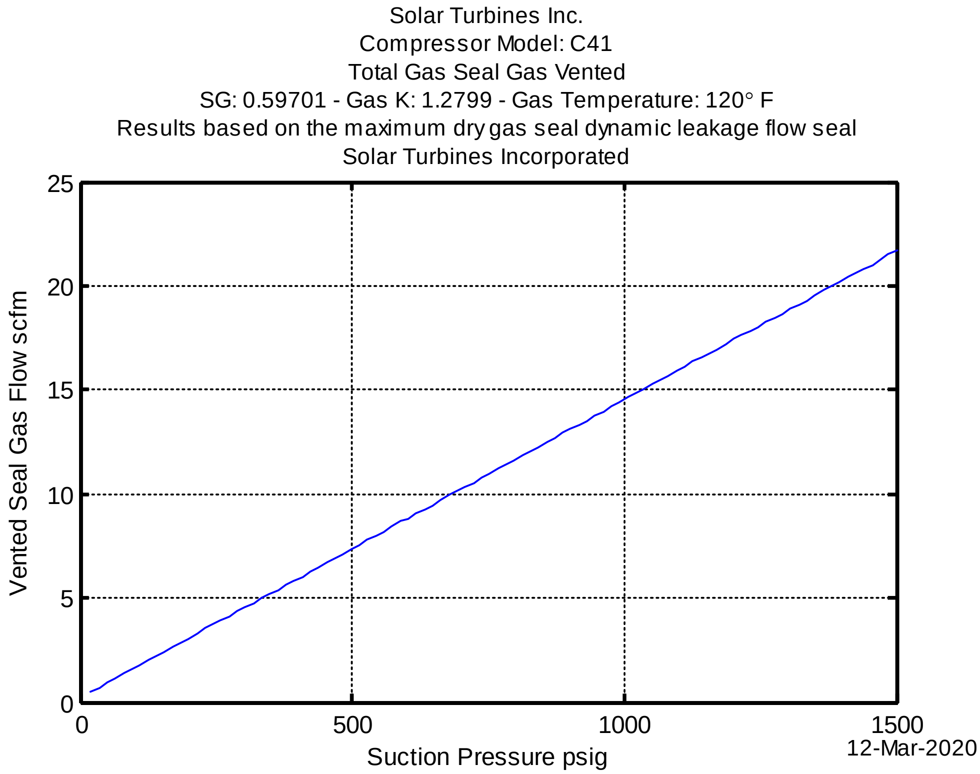

Figure 8: C41

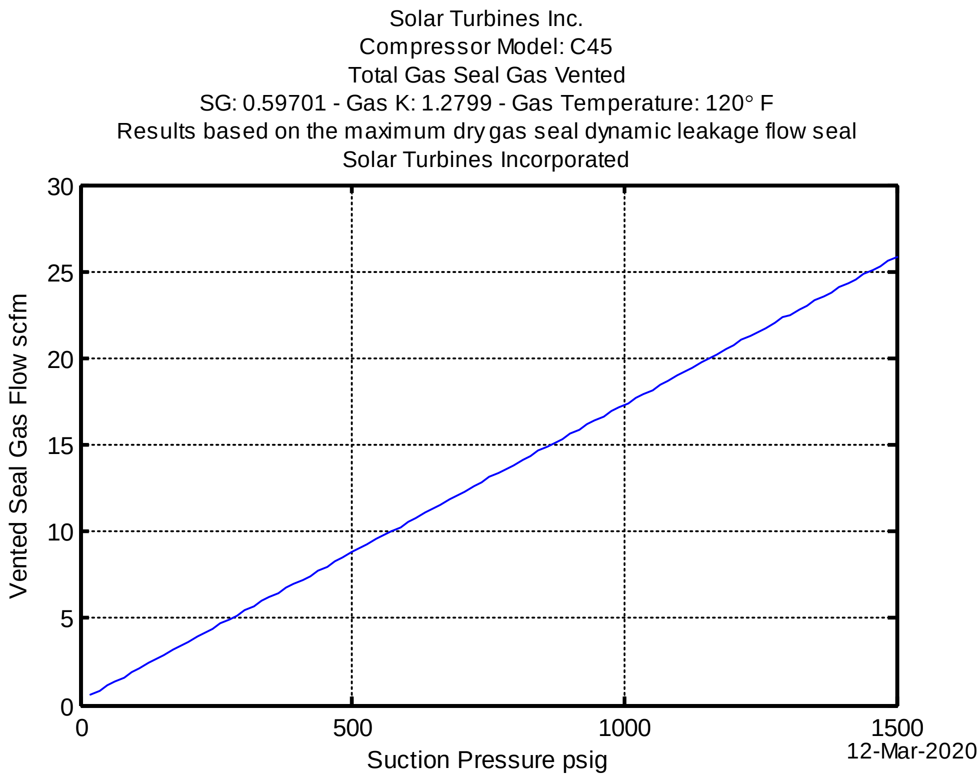

Figure 9: C45

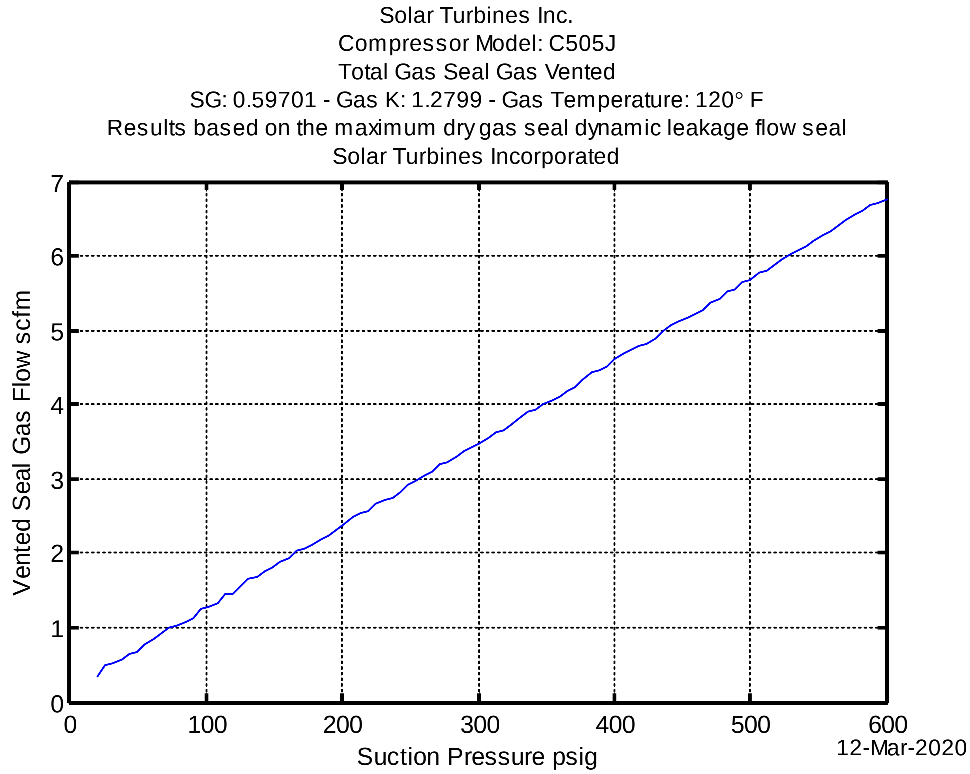

Figure 10: C505J

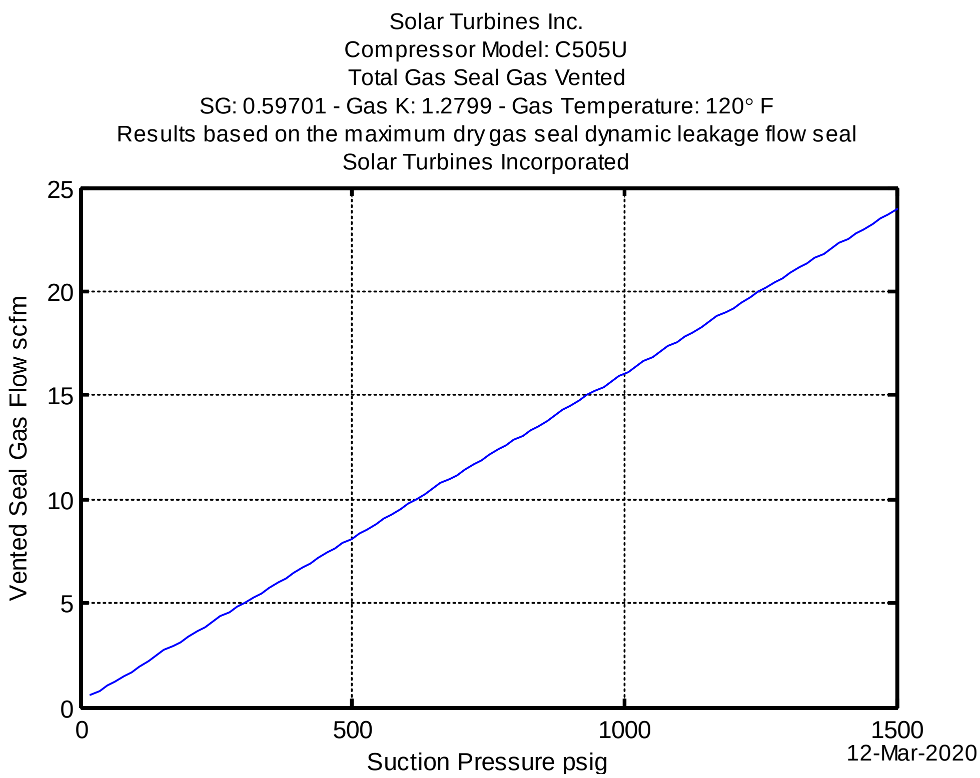

Figure 11: C505 U

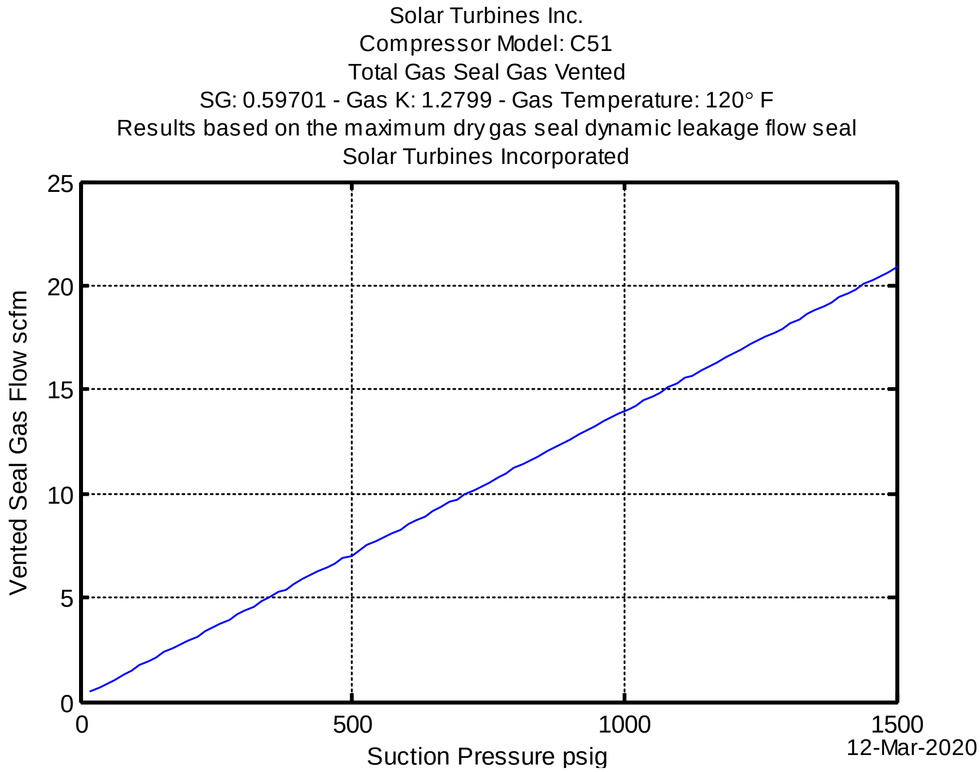

Figure 12: C51

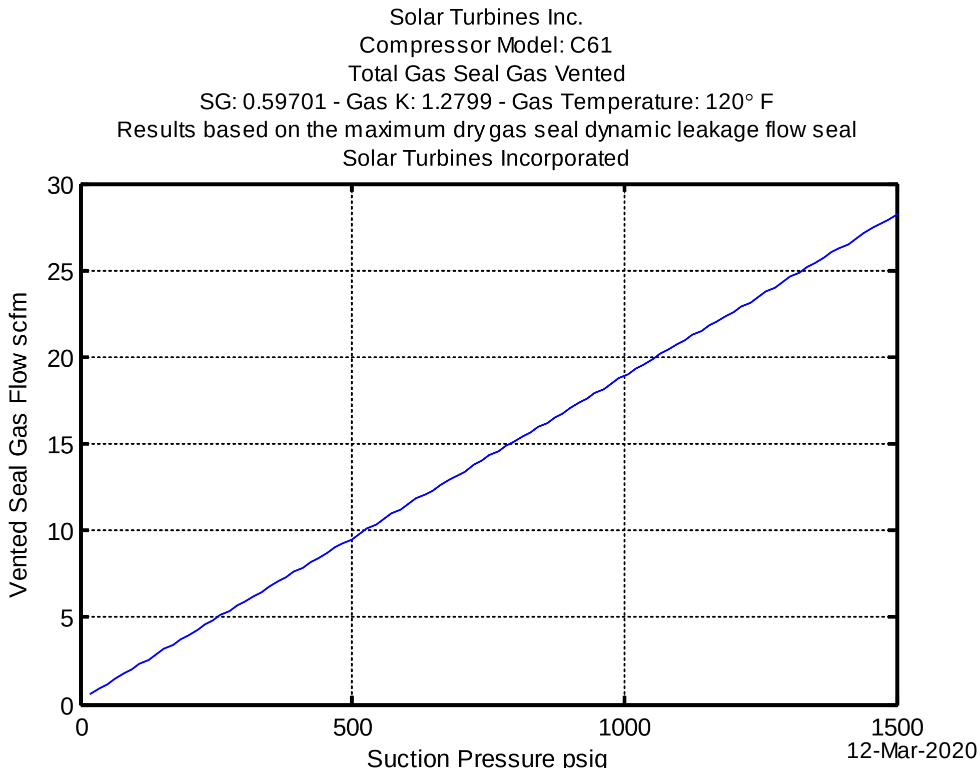

Figure 13: C61

Solar Turbines Inc.
Compressor Model: C65
Total Gas Seal Gas Vented
SG: 0.59701 - Gas K: 1.2799 - Gas Temperature: 120° F
Results based on the maximum dry gas seal dynamic leakage flow seal
Solar Turbines Incorporated

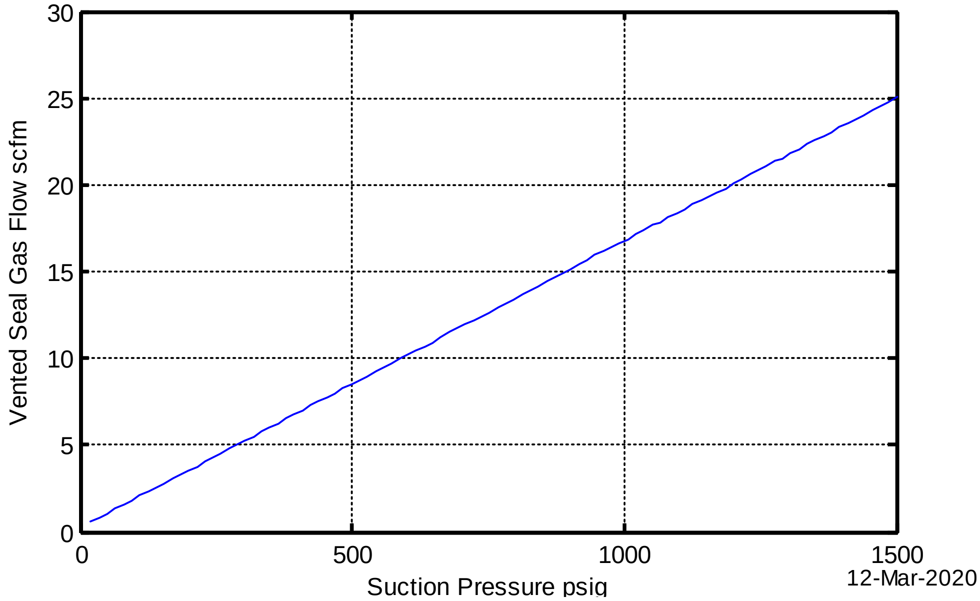

Figure 14: C65

Solar Turbines Inc.
Compressor Model: C75
Total Gas Seal Gas Vented
SG: 0.59701 - Gas K: 1.2799 - Gas Temperature: 120° F
Results based on the maximum dry gas seal dynamic leakage flow seal
Solar Turbines Incorporated

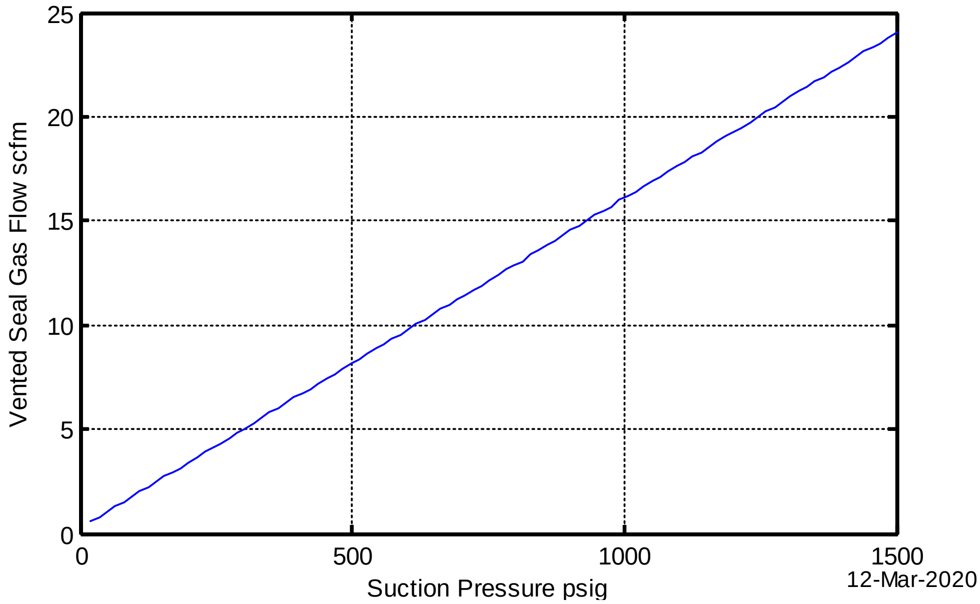

Figure 15: C75

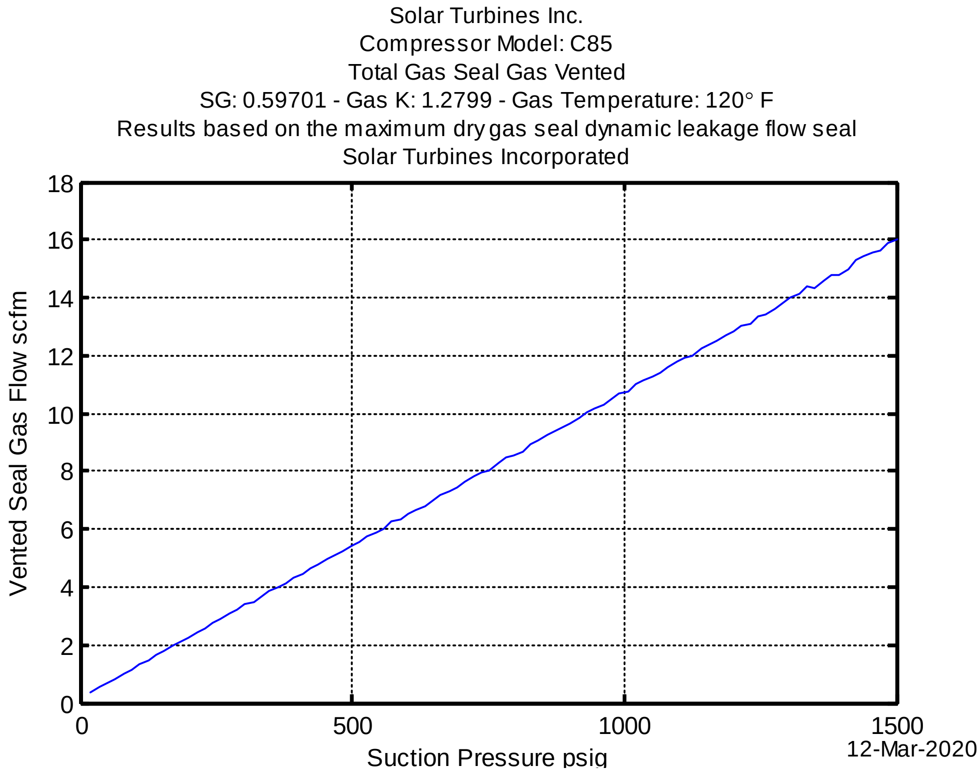

Figure 16: C85

SUMMARY

The figures provided in this PIL may be used to estimate dry gas seal emissions ('seal leakage') emitted through the primary vent based on the compressor suction pressure (P1). The charts show the maximum expected leakage rates per each compressor. Actual emissions are expected to be lower. For further technical information on Dry Gas Seal systems refer to PIL 140 Dry Gas Face Seals for Solar Gas Compressors.

Solar Turbines
A Caterpillar Company

PIL 279
Product Information Letter

Emissions Management Methane Reduction Solutions Primary Vent Dry Gas Seal Recompression

Sean Garceau

PURPOSE

The purpose of this Product Information Letter is to provide an overview of Solar Turbines' primary vent dry gas seal recompression system which has been developed to help customers achieve near-zero methane emissions targets and to reduce the environmental impact of greenhouse gas (GHG) emissions.

A comprehensive study by the EPA[1] found that emissions from compressor stations, blow down and purge accounted for 97.7 Bscf or just over 31% of the total methane emissions attributed to the natural gas industry. The oil & gas industry and environmental agencies around the world are working to find solutions to reduce greenhouse gas emissions. With methane (CH_4) having 25 times the impact on global warming compared to carbon dioxide (CO_2), developing solutions to further mitigate methane emissions from centrifugal gas compressors and from process gas vents becomes necessary as the industry moves towards near-zero targets.

Solar's primary vent dry gas seal recompression system is designed to meet customers' needs in compressor pipeline applications, gas transmissions, gas gathering and production applications. It is compatible with all gas turbine and electric motor drive applications.

For information on Solar's process gas vent recompression system, designed to address methane emissions from the process vent, refer to PIL 280.

KEY BENEFITS

For centrifugal compressors with tandem dry seals, each primary seal leaks on average, 4 to 10 scfm (6.4 to 16 Nm3/hr) depending upon the product configuration; refer to PIL 140 and PIL 251 for additional information. For example, a Solar C41 gas compressor operating at 750 psig and operating 4,400 hours per year leaks an average 2.6 M cubic feet of fugitive methane annually. This is a CO_2 equivalent of 1,000 tons which is the same as CO_2 emissions from 112,524 gallons of gasoline consumed or GHG emissions from 216 passenger vehicles driven for one year.[1] The key benefits of implementing Solar's primary vent dry gas seal recompression system are reduction of fugitive methane emissions to the atmosphere, potential cost savings, and the ability to reach near-zero emissions targets.

GENERAL DESCRIPTION

The primary vent dry gas seal recompression system is a solution designed to capture and reuse the fugitive methane from the Solar compressor's primary seal vent while the compressor is in operation.

The design is a three-module system consisting of the following:

- Backpressure module
- Accumulation module
- Recompression module

[1] epa.gov/energy/greenhouse-gas-equivalencies-calculator

The backpressure module is used to increase the primary seal vent pressure to above atmospheric pressure. The accumulation module is used as a reservoir for the captured methane until it reaches a specific pressure. The recompression module increases the pressure of the gas so it can be reinjected into the process system without any impact to the operation of the process compressor package/equipment.

The backpressure module is located within or adjacent to the main compressor package. The accumulation and recompression modules can be installed inside or outside of the gas compressor building.

The size of the dry gas seal recompression system is based on the flow of the gas compressor's primary vent guaranteed flow rate (per PIL 140). The size selection is dictated by the process gas compressor model and suction pressures.

The three-module dry gas seal recompression system is designed per compressor package. For stations with multiple compressor packages, additional information such as station operating conditions and compressor suction pressures are required to optimize the number of compressor packages per dry gas seal recompression system.

Solar's dry gas seal recompression system is designed to integrate Solar Turbines' process compressors with a suction pressure equal to or less than 1500 psig, including settle out pressure. Upon recompression, the system has customer interface provisions for use of the gas into applications with a pressure equal to or less than 1500 psig. It is the customer's responsibility to integrate the dry seal recompression solution into their application. The customer must provide over-pressure protection for their systems including tubing, piping, and other equipment. Solar Turbines can provide dry gas seal recompression system integration services upon request.

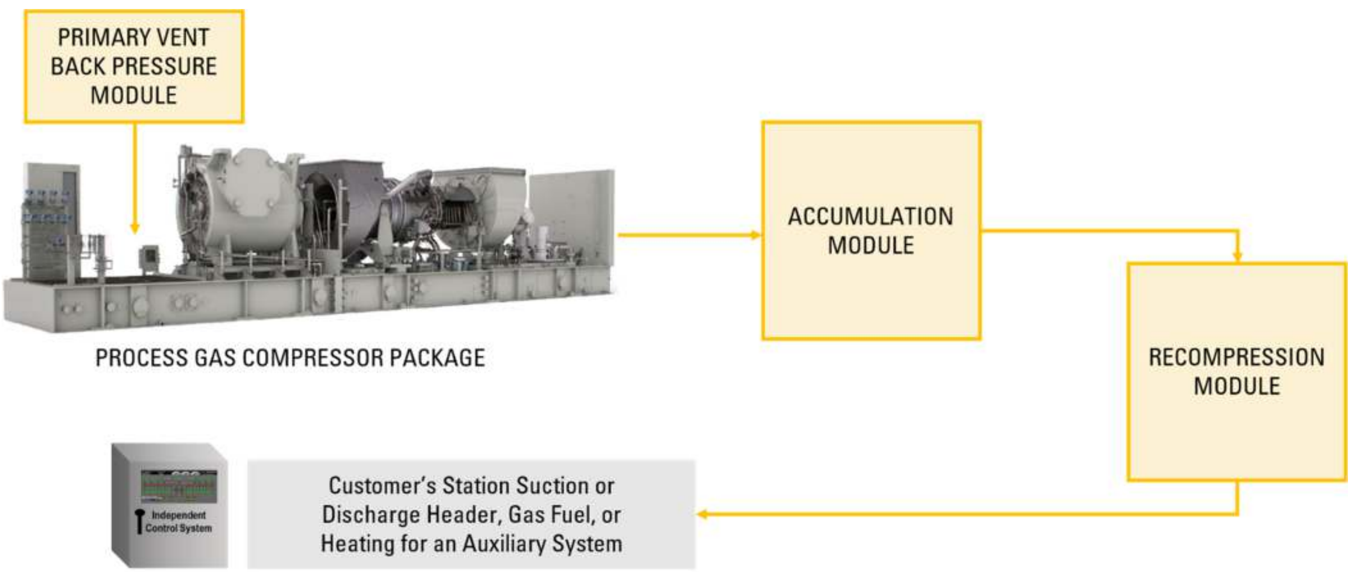

Figure 1: Primary Vent Dry Seal Recompression System (DSR)

BACKPRESSURE MODULE

Solar Turbines gas compressors use tandem dry seals, termed primary and secondary seals. The primary seal is supplied with clean dry seal gas which acts as a medium to ensure process gas does not contaminate the dry seals. Most of the seal gas is fed back into the compressor case, however, a small amount (by design) is leaked across the primary seal rings and eventually out the primary vent.

For the backpressure module to effectively use the dry gas seals' vent gas, the primary vent pressure needs to be increased above atmospheric pressure. This involves adding several new components to the primary vent. The increase in primary vent pressure does not compromise or affect the safe operation of the tandem dry seal. The backpressure module can be located on-skid or near skid and is provisioned with overhead lift points. The estimated weight and dimensions are shown in Table 3.

ACCUMULATION MODULE

From the backpressure module, gas is gathered into a vessel until it reaches a specified pressure. On the main compressor package, a second skid edge primary vent line connection must be added to route the methane from the primary vent backpressure module to the accumulation module. The customer must provide a connection from the new skid edge connection to the accumulation system inlet connection.

The estimated accumulation module weight and dimensions are shown in Table 3. The module is provisioned with overhead lift points. All electrical connections are instrumentation signals using nominal 24VDC. Air is supplied from the recompression module, which regulates the pressure to 90 psig (6.2 bar).

RECOMPRESSION MODULE

The main component of the recompression module is an electric motor-driven reciprocating compressor. The recompression module increases the pressure from 3 psi (0.2 bar) to 2000 psi (138 bar) for reinjection into the station suction or discharge headers, the gas fuel supply, or for heating auxiliary systems.

The recompression module includes a control box for enablement, local shutdown, and to indicate operation status. The recompression module and the control box are fixed on a skid that includes provisions for lifting with a forklift or a crane via straps. The estimated weights and dimensions are shown in Table 3.

Table 1: Electrical Specifications for the Recompression Module

Description	
Compressor AC Motor[1]	25 or 40 HP, 380-480VAC, 50/60 4Hz
Compressor Motor Heater	38 W, 120/220/240 VAC, 50/60 Hz
Compressor Thermal Switch	Discrete
Lube Oil Heater[2]	0.5 kW

Notes:
[1] Shielded cable shall be used.
[2] Heater voltage is either 120VAC, 190-220VAC, or 230-240 VAC 50/60HZ. All single-phase heaters.

All systems are offered with an option of a 575/600 VAC, 50/60HZ motor for NEC and CEC applications. The motors are controlled using a Variable Frequency Drive (VFD). PIL 231 shall be used for line harmonics, wire type, and wire sizing. The recompression module has a local user interface box, which is NEC, CEC, and ATEX certified and include the following switches and lights:

- Emergency Stop Switch
- Stop Switch
- Enable / Disable Switch
- Running Light
- Disabled Light
- Stop Light

Air supply for actuation of automatic valves shall be supplied by the customer. The air pressure is regulated to 90 psig (6.2 bar) on the recompression module and distributed to the accumulation module.

PRODUCT OPTIONS

Solar's primary vent dry gas seal recompression system is designed to meet customers' needs with a variety of available options to choose from as described below.

- Weatherproof enclosure for the recompression module
- Integration of system logic into unit control panel with Turbotronic™ 4 or newer
- Auxiliary recapture tank for reduced emissions
    - Allows for a recapture rate of methane >99%
    - Eliminates the need for dedicated liquid/gas drain connection
- 100% x-ray of pipe assemblies
    - Required for all Pressure Equipment Directive (PED) and Canadian applications

CONTROL SYSTEM

A standard dedicated control system is supplied to control the dry gas seal recompression system. The control system is equipped with a Human Machine Interface (HMI) and appropriate lights and buttons for the operator to control the system. The programmable logic controller and I/O modules are compliant for the application.

For applications where there is a single dry gas seal recompression system per turbomachinery package and the unit control system is Turbotronic 4 or newer, the dry gas seal recompression system may be controlled by the unit control system.

AMBIENT DESIGN CONDITIONS

Ambient, Operating (Standard): -4°F to +104°F (-20°C to 40°C) for NEC and CEC applications
Ambient, Operating (High Temp): -4°F to +140°F (-20°C to 60°C) for ATEX applications

For operation in ambient temperatures below 32°F (0°C), the recompression module requires a weatherproof enclosure. For operation below -4°F (-20°C), contact Solar Turbines for available enclosure options. Enclosed system can be installed in ambient conditions up to 110°F (43°C).

NOISE

Noise level is 87 dB(A) at 1m for an unenclosed recompression module operating at full speed. Solar Turbines' option for weatherproof enclosure is designed to meet 85 dB(A) at 1m, if required.

DOCUMENTATION

Solar will provide the following documents for the dry gas seal recompression system:

- Electrical Loop Schematic
- Process and Instrumentation Diagram
- Mechanical Interface Drawing
- Utility List
- Operation, Maintenance, and Inspection (OMI) Manual
- Illustrated Parts List

SYSTEM UTILITY REQUIREMENTS

The customer shall provide the following utilities:

Instrument air:

- 100 psig (6.9 bar) to 200 psig (13.8 bar) per Solar Turbines Engineering Specification ES 9-98 Fuel, Air, Water for Solar Gas Turbine Engines

Electrical:

- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/50Hz) to support a 25/40 HP motor
- 120VAC/1/60Hz (208-240VAC/1/50-60Hz) to support motor space heaters
- Motor control center space for a VFD

TRANSPORTATION

Contact Solar Turbines for specific transportation options and procedure associated with the product.

Special Handling Notes:

- Solar recommends using air-ride trucks
- Solar provides courtesy loading at Solar's Mabank, Texas and Kearny Mesa, California facilities
- Cargo must be picked up on flatbed or step deck type trucks; trucks will be turned away if this requirement is not followed
- Items not connected with the main systems will be packed per PIL 097 and PIL 254

CODES AND STANDARDS

The primary vent dry gas seal recompression system complies with the following codes and standards:

Pressure Vessels:	ASME BPVC Section VIII, Division 1; Pressure Equipment Directive 2014/68/EU; Canadian Registration Number per CSA B51
Heater Terminal Box (Type/IP):	NEMA 4X (NEC/CSA) or IP 65 Exe (IEC Certified)
Control Panel (Type):	UL Type 4/7, NEC, UL(C) 508 Listed or Exd IP 66, IEC Certified
System Certification:	Solar Turbines uses a Zone classification process based on IEC 60079. The standard products are certified to meet the following requirements: NEC Class 1, Division 2 and CEC Class 1, Division 2, Gas Group D ATEX Zone 2, Gas Group IIA Based on the selection of the devices on the package, the system can be electrically certified for use in: NEC Class 1, Division 1 and CEC Class 1, Division 1, Gas Group D ATEX Zone 1, Gas Group IIA

	Modules are shipped from Solar Turbines as pre-wired assemblies. In NEC and CEC applications, the assemblies are not pre-certified assemblies. ATEX modules are shipped by Solar Turbines as certified ATEX and PED assemblies. ATEX modules can also be shipped by Solar Turbines as CE marked assemblies
Tubing and Piping:	ASME B31.3, ASME B16.5
NACE:	On request

CONCLUSION

The modular design of the primary vent dry gas seal recompression system allows for simple integration into turbine and electric motor drive compressor packages with dry gas seal-equipped centrifugal compressors. Solar works directly with customers to select the appropriate model based on package configuration, flow, and operating conditions. Solar can also assist in identifying the best location to reinject the captured fugitive methane to help customers achieve near-zero methane emissions targets and to reduce the environmental impact of greenhouse gas (GHG) emissions. The dry gas seal recompression system is supported by Solar's global customer services team. Please contact your local district office for additional information on system maintenance or service parts support.

REFERENCES

Table 2: Supporting Solar Product Information Letters

DOCUMENT	PRODUCT INFORMATION LETTER
PIL 097	Package Preservation and Preparation for Shipment
PIL 140	Dry Gas Face Seals for Solar Gas Compressors
PIL 231	Variable Frequency Drives
PIL 251	Emissions from Centrifugal Compressor Gas Seal Systems
PIL 254	Service Parts Packaging and Procedures
PIL 280	Methane Emissions Reduction Solutions: Process Gas Vent Recompression

Table 3: Estimated Weights and Dimensions (Unenclosed)

Module	Length	Width	Height	Estimated Weight
Backpressure Module	1.9 ft (0.58 m)	1.7 ft (0.52 m)	1.5 ft (0.46 m)	150 lbs (68 kg)
Accumulation Module	3.8 ft (1.2 m)	4.6 ft (1.4 m)	7.8 ft (2.4 m)	1000 lbs (454 kg)
Recompression Module	10.9 ft (3.3 m)	7.5 in (2.3 m)	4.7 ft (1.4 m)	4695 lbs (2129 kg)

Solar Turbines
A Caterpillar Company

PIL 280
Product Information Letter

Emissions Management Methane Reduction Solutions

Process Gas Vent Recompression

Sean Garceau, Michella Thomas

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide an overview of Solar Turbines' process vent recompression system which has been developed to help customers achieve near-zero methane emissions targets, and to reduce the environmental impact of greenhouse gas (GHG) emissions.

A comprehensive study by the EPA[1] found that emissions from compressor stations, blow down and purge accounted for 97.7 Bscf or just over 31% of the total methane emissions attributed to the natural gas industry. The oil & gas industry and environmental agencies around the world are working to find solutions to reduce greenhouse gas emissions. With methane (CH_4) having 25 times the impact on global warming compared to carbon dioxide (CO_2), developing solutions to further mitigate methane emissions from centrifugal gas compressors and from process gas vents becomes necessary as the industry moves towards near-zero targets.

Solar's process vent recompression product is designed to meet customers' needs in compressor pipeline applications, gas transmissions, gas gathering and production applications. It is compatible with all gas turbine and electric motor drive applications, and all centrifugal and reciprocating compressors.

For information on Solar's dry seal recompression system, designed to address methane emissions from the primary vent of Solar compressors, refer to PIL 279.

KEY BENEFITS

For compressor stations having to perform non-emergency shutdown events due to planed or scheduled maintenance, compressors will either be put into a pressurized hold or operations will require unit or station blow down. The amount of methane emitted into the atmosphere during a blow down event is significant, with a typical volume upwards of 52,000 cubic feet per event. The CO_2 equivalent is 29.1 tons which equates to CO_2 emissions from 2,966 gallons of gasoline consumed or GHG emissions from 64,446 miles driven by an average passenger vehicle.[1] Recompression of gas emitted from the process vent offers an alternative to pressurized hold or unit blow down with key benefits of reducing large amounts of methane emissions to the atmosphere, potential cost savings, and the ability to reach near-zero emission targets.

GENERAL DESCRIPTION

The process vent recompression system is a solution designed to capture gas between the compressor suction and discharge valves using a recovery and conditioning system. During operation of the process vent recompression system, the compressor dry seal supply gas shall be sourced internal to the compressor suction and discharge valve to eliminate the addition of gas into the system.

The gas process includes the components, piping, and equipment containing gas between the unit suction and discharge valves. The gas process vent is the atmospheric vent of that contained volume. The venting of this

[1] epa.gov/energy/greenhouse-gas-equivalencies-calculator

volume is the largest contributor of methane emissions and the greatest opportunity to reduce large periodic equipment emissions.

The process vent recompression system is connected to the gas process piping between the process compressor suction and discharge valves. When the process compressor is in pressurized hold and the user decides to depressurize the compressor, the process gas conditioning skid opens its shutoff valve. Gas is filtered, heated, and regulated for supply to the recompression module. The gas is fed into a recompression module to boost the pressure for reinjection into a location upstream or downstream of the process suction and discharge valves.

The 2-module recompression system consists of a gas conditioning system module and a recompression system module. The recompression system is sized per compressors package process vent. For stations with multiple compressor packages that accommodate separate and independent depressurization times, a single process vent recompression system to support each compressor package process vent is an option. System isolation and check valves are available upon request.

The standard process vent recompression system is designed to integrate with all compressor station process vent systems with a suction pressure equal to or less than 1500 psig, including settle out pressure. Higher pressure can be accommodated when requested. It is the customer's responsibility to integrate the process vent recompression solution into their application. Seal gas must be an internal source. The customer must provide over-pressure protection for their systems including tubing, piping, and other equipment. Solar Turbines can provide process vent recompression system integration services upon request.

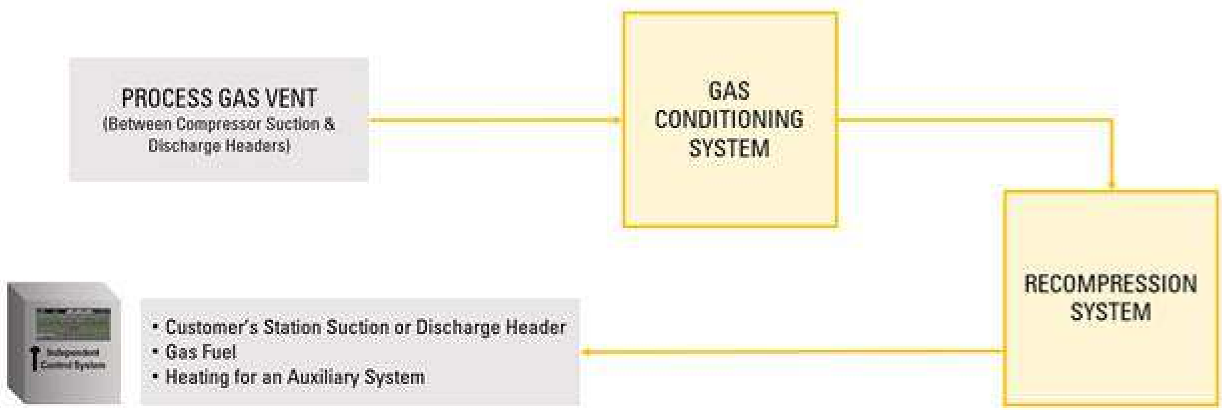

Figure 1: Process Vent Recompression (PVR) System

CONDITIONING MODULE

The process gas capture and conditioning module is connected to the compressor suction or discharge process piping. The process gas conditioning module is designed to clean, heat, and regulate the process gas, which feeds the recompression module. The conditioning module is located off-skid. Estimated weights and dimensions are shown in Table 4 of this document. The module is provisioned with overhead lift points.

A simplified seal gas conditioning module is offered, which excludes the coarse filter and heater. In application where the percent of methane is above 90% and the process gas supplied to the module is below 800 psig, the simplified version could be used. A dew point analysis and temperature expansion study are recommended prior to selection of the simplified module.

RECOMPRESSION MODULE

The main component of the recompression module is an electric motor-driven reciprocating compressor. The standard recompression module increases the pressure from 3 psi (0.2 bar) to 2000 psi (138 bar) for reinjection into the station suction or discharge headers; the gas fuel supply; or for heating auxiliary systems. The package compressor will be depressurized to at least 30 psig (2.07 bar) before the unit process vent is opened.

The recompression module includes a control box for enablement, local shutdown, and to indicate operation status. The recompression module and the control box are fixed on the skid. The estimated weights and dimensions are shown in Table 4 of this document. The skid has provisions for lifting with a forklift or a crane via straps.

Table 1: Electrical Specifications for the Recompression Module

Description	
Compressor AC Motor[1]	75 HP, 380-480VAC 50/60 Hz
Compressor Motor Heater	55 W, 120/220/240 VAC, 50/60 Hz
Compressor Thermal Switch	Discrete
Lube Oil Heater[2]	0.5 kW

Notes:

[1] Variable frequency drives, shielded cable shall be used.

[2] Heater voltage is either 120VAC, 190-220VAC, or 230-240VAC 50/60Hz. All single-phase heaters.

All systems are offered with an option of 575/600VAC, 50/60Hz – motor for NEC and CEC applications. The recompression module has a local user interface box, which is NEC, CEC, and ATEX certified. The interface box includes the following switches and lights.

- Emergency stop switch
- Stop switch
- Enable/disable switch
- Running light
- Disabled light
- Stop light

Air supply for actuation of automatic valves shall be supplied by the customer at 100-200 psig (6.9-13.8 bar). The air pressure is regulated to 90 psig (6.2 bar) on the recompression module and distributed to the process gas conditioning modules.

Product options

The process vent recompression system is designed to meet customers' needs with a variety of available options to choose from as described below.

- Enclosure for the recompression system modules
- Integration of system logic into unit control panel with Turbotronic™ 4 or newer
- Auxiliary recapture tank for reduced emissions
    - Allow for a recapture rate of methane >99%
    - Eliminates the need for dedicated liquid/gas drain connection
- 100% x-ray of pipe assemblies
    - Required for all Pressure Equipment Directive (PED) and Canadian applications

CONTROL SYSTEM

A standard dedicated control system is supplied to control the process vent recompression system. The control system is equipped with a Human Machine Interface (HMI) and appropriate lights and buttons for the operator to control the system. The programmable logic controller and I/O modules are compliant for the application.

For applications where there is a single recompression system per turbomachinery package and the gas compressor package control system is Turbotronic™ 4 or newer, the process vent recompression system may be controlled by the unit control system.

PROCESS VENT SYSTEM APPLICATIONS

The time to capture and recompress the process gas will be determined during the execution of the project.

AMBIENT DESIGN CONDITIONS

Ambient, operating (standard): -4°F to +104°F (-20°C to 40°C) for NEC and CEC applications and ATEX PVR100
Ambient, operating (high temp): -4°F to +140°F (-20°C to 60°C) for ATEX applications except the PVR100

For operation in ambient temperatures below 32°F (0°C), the recompression module requires a weatherproof enclosure. Enclosed system can be installed in ambient conditions up to 110°F (43°C). For operation below -4°F (-20°C) or above 110°F (43°C), contact Solar Turbines for available enclosure options.

NOISE

Noise level at 1 m [dB(A)]: PVR100 is 91 for an unenclosed recompression module operating at full speed. Solar Turbines' option for weatherproof enclosure is designed to meet 85 dB(A) at 1m, if required. Lower noise levels can be review when requested.

DOCUMENTATION

Solar will provide the following documents for the process vent recompression system.

- Electrical schematic
- Process and instrumentation diagram
- Mechanical interface drawing
- Utility list
- Operation, maintenance, and inspection (OMI) manual
- Illustrated part list

SYSTEM UTILITY REQUIREMENTS

The customer shall provide the following utilities:

Instrument air:

- 100 psig (6.9 bar) to 200 psig (13.8 bar) per Solar Turbines Engineering Specification ES 9-98 Fuel, Air, Water for Solar Gas Turbine Engines

Electrical:

- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/60HZ) to support a 75 HP motor
- 120VAC/1/60Hz (208-240VAC/1/50Hz) to support motor space heaters
- 460VAC/3/60Hz (380VAC/3/50Hz or 575VAC/3/60HZ) support 10kW heater
- Motor Control Space for a Variable Frequency Drive

TRANSPORTATION

Contact Solar Turbines for specific transportation options and procedure associated with the product.

SPECIAL HANDLING NOTES

- Solar recommends using air-ride trucks
- Solar provides courtesy loading at Solar's Mabank, Texas and Kearny Mesa, California facilities
- Cargo must be picked up on flatbed or step deck type trucks; trucks will be turned away if this requirement is not followed
- Items not connected with the main systems will be packed per PIL097 and PIL254

CODES AND STANDARDS

The process vent recompression system complies with the following codes and standards:

Pressure Vessels:	ASME BPVC Section VIII, Division 1; Pressure Equipment Directive 2014/68/EU; Canadian Registration Number per CSA B51
Heater Terminal Box (Type/IP):	NEMA 4X (NEC/CSA) or IP 65 Exe (IEC Certified)
Control Panel (Type):	UL Type 4/7, NEC, UL(C) 508 Listed or Exd IP 66, IEC Certified
System Certification:	Solar Turbines uses a Zone classification process based on IEC 60079. The standard products are certified to meet the following requirements: NEC Class 1, Division 2 and CEC Class 1, Division 2, Gas Group D ATEX Zone 2, Gas Group IIA Based on the selection of the devices on the package, the system can be electrically certified for use in: NEC Class 1, Division 1 and CEC Class 1, Division 1, Gas Group D ATEX Zone 1, Gas Group IIA Modules are shipped from Solar Turbines as pre-wired assemblies. In NEC and CEC applications, the assemblies are not pre-certified assemblies. ATEX modules are shipped by Solar Turbines as certified ATEX and PED assemblies. ATEX modules can also be shipped by Solar Turbines as CE marked assemblies
Tubing and Piping:	ASME B31.3, ASME B16.5
NACE:	On request

CONCLUSION

The modular design of the process vent recompression system allows for simple integration into gas compression stations. Solar works directly with customers to select the appropriate process vent recompression model per package configuration, flow, and operating conditions. Solar can also assist in identifying the best location to reinject the captured fugitive methane to help customers achieve near-zero methane emissions targets, and to reduce the environmental impact of greenhouse gas (GHG) emissions. The process vent recompression system is supported by Solar's global customer services team. Please contact your local district office for additional information on system maintenance or service parts support.

REFERENCES

Table 3: Supporting Solar Product Information Letters

DOCUMENT	PRODUCT INFORMATION LETTER
PIL 097	Package Preservation and Preparation for Shipment
PIL 140	Dry Gas Face Seals for Solar Gas Compressors
PIL 231	Variable Frequency Drives
PIL 251	Emissions from Centrifugal Compressor Gas Seal Systems
PIL 254	Service Parts Packaging and Procedures
PIL 280	Methane Emissions Reduction Solutions: Process Gas Vent Recompression

Table 4: Estimated Weights and Dimensions (Unenclosed)

Module	Model No.	Length	Width	Height	Estimated Weight
Conditioning System	Simple	5.2 ft (1.6 m)	3.2 ft (1.0 m)	3.2 ft (1.0 m)	942 lbs. (427 kg)
	Full	13 ft (4.0 m)	2.5 ft (0.8 m)	4.8 ft (1.5 m)	2927 lbs. (1328 kg)
Recompression System	PVR-100	10.9 ft (3.3 m)	7.5 in (2.3 m)	4.7 ft (1.4 m)	5600 lbs. (2540 kg)

• Burners
• Flares
• Incinerators
• Combustion Systems

22151 East 91st Street
Broken Arrow, OK 74014 USA
Phone: 918-258-8551
Fax: 918-251-5519
www.zeeco.com
sales@zeeco.com

April 23, 2018

Williams - NE G&P
2000 Commerce Drive
Pittsburgh, PA 15275

Attention: Austin Day
Austin.Day@williams.com

Reference: Ridgeline Thermal Oxidizer
Zeeco Proposal No. 2018-02569IN-01 Rev 0

Dear Mr. Day:

Thank you for your inquiry. We appreciate this opportunity to provide our proposal to provide the following equipment:

- ~~One (1) Zeeco Standard, Direct Fired Horizontal Thermal Oxidizer Package- Two Dehy Design~~
- One (1) Zeeco Standard, Direct Fired Horizontal Thermal Oxidizer Package- Single Dehy Design

The attached proposal describes specific features and performance of Zeeco's standard thermal oxidizer system. Our design incorporates a proven thermal process to effectively treat the waste gas stream from your process. The design and materials of construction have been chosen to maximize on-line time and operational life.

Please note that the base of the thermal oxidizer is mounted on a pre-wired and pre-piped rectangular structural steel skid that will also house the fuel rack and control panel. This is intended to reduce installation time associated with interconnecting piping and wiring between the fuel rack/control panel and the thermal oxidizer.

Furthermore, the unit is ***NFPA 86 compliant*** to ensure personnel and equipment safety.

Again, we appreciate the opportunity to quote on your combustion equipment requirements. After you have had an opportunity to review our proposal, should you have any questions or require additional information, please contact me at (918)893-8416 or email me at sydney_levine@zeeco.com.

Best regards,

Sydney Levine

Sydney Levine
Applications Engineer

Cc: Ryan B. Tate, Zeeco- Broken Arrow

TABLE OF CONTENTS

1.0 INTRODUCTION

Zeeco has been designing and manufacturing burners, flares, incinerators, air pre-heaters, and combustion systems for world wide use since 1980.

Zeeco's Engineering Staff offers over 1,000 years of experience in the development, design, and testing of Combustion Systems. Zeeco has the proven skills and innovative abilities to design a practical and environmentally friendly combustion system to thermally treat virtually any industrial waste. This learned "art" gained by research and design efforts which are refined by testing and field experience has been implemented in the process plants of numerous industries throughout the world.

From project planning through design, procurement, manufacturing, installation, and even start-up, Zeeco will provide project management and support as deemed necessary. It is our world class HANDS ON type design skills, quality products, experienced staff, and especially our responsiveness to our customers needs that truly set Zeeco apart from our competition.

Quality: Our customers expect it. We demand it!

4.0 DESIGN BASIS

4.1 Site Conditions

Elevation, feet	1,250
Barometric Pressure, psia	13.9
Temperature, °F (Min/Max)	-20* / 100
Design Relative Humidity	90% (assumed)
Wind Design	ASCE 7-10, 120MPH

*Note: The Thermal Oxidizer package is acceptable to -20°F with the exception of the HMI, which is guaranteed to 32°F.

4.2 Waste Stream Summary

RIDGELINE (Two Dehy Case)				
Components	Waste Gas 1 Mol %	Waste Gas 2 Mol %	Waste Gas 3 Mol %	Waste Gas 4 Mol %
Water	0.142373717	86.21186646	0.142373717	86.21186646
TEG	0.000130897	6.84E-05	0.000130897	6.84E-05
Nitrogen	0.05601957	0.000421556	0.05601957	0.000421556
CO2	0.599489677	0.226822026	0.599489677	0.226822026
Methane	62.88109505	2.113740939	62.88109505	2.113740939
Ethane	23.14590683	3.048986051	23.14590683	3.048986051
Propane	8.405789072	2.32283657	8.405789072	2.32283657
i-Butane	1.068157584	0.37047711	1.068157584	0.37047711
n-Butane	2.015033149	1.049989348	2.015033149	1.049989348
i-Pentane	0.551954871	0.548688563	0.551954871	0.548688563
n-Pentane	0.463895654	0.567115895	0.463895654	0.567115895
Neopentane	0.022464835	0.01117731	0.022464835	0.01117731
2,2-Dimethylbutane	0.032125073	0.047370468	0.032125073	0.047370468
2,3-Dimethylbutane	0.148625999	0.302190842	0.148625999	0.302190842
3-Methylpentane	0.087076479	0.20375093	0.087076479	0.20375093
Hexane	0.128435584	0.315479281	0.128435584	0.315479281
2,2-Dimethylpentane	0.013916747	0.038571139	0.013916747	0.038571139
Methylcyclopentane	0.044555216	0.370953246	0.044555216	0.370953246
Benzene	0.004232043	0.212335939	0.004232043	0.212335939
3,3-Dimethylpentane	0.004275088	0.01883755	0.004275088	0.01883755
Cyclohexane	0.015864116	0.12044048	0.015864116	0.12044048
2-Methylhexane	0.034458362	0.131713244	0.034458362	0.131713244
2,3-Dimethylpentane	0.011761746	0.057628052	0.011761746	0.057628052
3-Methylhexane	0.037990982	0.179641089	0.037990982	0.179641089
2,2,4-Trimethylpentane	0.001809807	0.009070139	0.001809807	0.009070139

Heptane	0.035123576	0.184493202	0.035123576	0.184493202
cis-1,2-Dimethylcyclopentane	0.002214401	0.038198546	0.002214401	0.038198546
2,5-Dimethylhexane	0.003975826	0.018795111	0.003975826	0.018795111
Toluene	0.008011101	0.77537816	0.008011101	0.77537816
2-Methylheptane	0.01193309	0.082243148	0.01193309	0.082243148
3-Ethylhexane	0.007903255	0.069464299	0.007903255	0.069464299
trans-1,2-Dimethylcyclohexane	0.000789823	0.013718834	0.000789823	0.013718834
1,1-Dimethylcyclohexane	0.00066575	0.009872933	0.00066575	0.009872933
Octane	0.007847464	0.071765179	0.007847464	0.071765179
1,t-3-Dimethylcyclohexane	0.000768767	0.014533001	0.000768767	0.014533001
m-Xylene	2.85E-09	4.31E-07	2.85E-09	4.31E-07
o-Xylene	0.00014847	0.029939815	0.00014847	0.029939815
Nonane	0.001192295	0.021136926	0.001192295	0.021136926
m-Ethyltoluene	0.000265614	0.043561941	0.000265614	0.043561941
p-Ethyltoluene	0.000410201	0.084055794	0.000410201	0.084055794
2-Methylnonane	0.000104122	0.003015635	0.000104122	0.003015635
n-Decane	0.000106215	0.003556708	0.000106215	0.003556708
2,2,4-Trimethylhexane	0.000265482	0.00118502	0.000265482	0.00118502
3-Methyloctane	0.000248647	0.00348681	0.000248647	0.00348681
Isopropylcyclohexane	0.000163713	0.006771658	0.000163713	0.006771658
n-Propylcyclohexane	7.43E-05	2.71E-03	7.43E-05	2.71E-03
Butylbenzene	6.37E-05	2.03E-02	6.37E-05	2.03E-02
1-Methyl-2-Propylbenzene	3.33E-05	9.16E-03	3.33E-05	9.16E-03
1,2-Dimethyl-4-Ethylbenzene	2.38E-05	7.48E-03	2.38E-05	7.48E-03
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	0.000229023	0.00496988	0.000229023	0.00496988
PRESSURE (psig)	57	0.1	57	0.1
TEMPERATURE (F)	106.8	205	106.8	205
MW	24.2	22.87	24.2	22.87
FLOW RATE (lb/hr)	102.333	177.375	102.333	177.375

Waste streams are assumed to be in vapor phase, no liquid has been considered within this design. It has been assumed that Waste Streams 1 & 3 are in one pipe coming to the thermal oxidizer, and Waste Streams 2 & 4 are in one pipe coming to the thermal oxidizer. The continuous waste streams are assumed to be running simultaneously to the thermal oxidizer.

RIDGELINE (Single Dehy Case)		
Components	**Waste Gas 1 Mol %**	**Waste Gas 2 Mol %**
Water	0.212110491	92.57222234

TEG	0.000131107	6.93E-05
Nitrogen	0.056587763	0.000238192
CO2	0.60289967	0.12480453
Methane	62.98098525	1.168332526
Ethane	23.04102455	1.652829998
Propane	8.348543894	1.243047131
i-Butane	1.06053381	0.197347732
n-Butane	2.006377838	0.560151156
i-Pentane	0.551463114	0.290852674
n-Pentane	0.463185551	0.297794264
Neopentane	0.022311696	0.005926674
2,2-Dimethylbutane	0.032152632	0.024860966
2,3-Dimethylbutane	0.149513476	0.159963702
3-Methylpentane	0.08772097	0.108389747
Hexane	0.129207154	0.165143786
2,2-Dimethylpentane	0.014031235	0.020326532
Methylcyclopentane	0.045290713	0.195752311
Benzene	0.004357429	0.114913228
3,3-Dimethylpentane	0.004326211	0.009915344
Cyclohexane	0.01609812	0.064062671
2-Methylhexane	0.034849263	0.069139229
2,3-Dimethylpentane	0.011921192	0.030342687
3-Methylhexane	0.038507372	0.094244109
2,2,4-Trimethylpentane	0.001837374	0.004751308
Heptane	0.035598806	0.096278714
cis-1,2-Dimethylcyclopentane	0.002262287	0.020294309
2,5-Dimethylhexane	0.004017117	0.009650835
Toluene	0.008313742	0.422433006
2-Methylheptane	0.012122808	0.042953672
3-Ethylhexane	0.008038114	0.036334185
trans-1,2-Dimethylcyclohexane	0.000805756	0.007149828
1,1-Dimethylcyclohexane	0.000678244	0.005105629
Octane	0.007984875	0.037224678
1,t-3-Dimethylcyclohexane	0.000784947	0.007545462
m-Xylene	4.27E-10	3.42E-08
o-Xylene	0.000156867	0.017205918
Nonane	0.001220327	0.010931621
m-Ethyltoluene	0.000275898	0.024419444
p-Ethyltoluene	0.000429672	0.048755563
2-Methylnonane	0.000107003	0.001543912
n-Decane	0.00010907	0.001819762

2,2,4-Trimethylhexane	0.000267037	0.000600294
3-Methyloctane	0.000253849	0.001804282
Isopropylcyclohexane	0.000167681	0.003617079
n-Propylcyclohexane	7.61E-05	0.001441825
Butylbenzene	6.82E-05	0.013554302
1-Methyl-2-Propylbenzene	3.53E-05	0.006256256
1,2-Dimethyl-4-Ethylbenzene	2.54E-05	0.005153657
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	0.000233099	0.002503613
PRESSURE (psig)	57	0.1
TEMPERATURE (F)	108.1	208.5
MW	24.15723074	20.61041879
FLOW RATE (lb/hr)	104.6771627	297.2279686

Waste streams are assumed to be in vapor phase, no liquid has been considered within this design. It has been assumed that Waste Stream 1 and 2 will be continuously flowing to the thermal oxidizer in separate pipes. It is assumed waste stream 1 will not be sent to the thermal oxidizer without waste gas 2, they will be entering the system simultaneously.

4.3 Utilities

Electrical Power	460V / 3 Phase / 60 Hz
Instrument Air, SCFH	2000
Fuel Gas Required During Normal Operation	1 MMBtu/Hr

4.4 Flue Gas Summary

Ridgeline (Two Dehy Case) at 1800°F	
Components	**Waste Gas 1, 2, 3 & 4 Mol%**
Carbon Dioxide	4.69
Water	16.14
Nitrogen	69.11
Oxygen	10.06
Total, mol/hr	511.60
Mol. Wt.	27.55

Ridgeline (Single Dehy Case) at 1700°F	
Components	**Waste Gas 1 & 2 Mol%**
Carbon Dioxide	4.37
Water	17.45

Nitrogen	67.97
Oxygen	10.21
Total, mol/hr	310.65
Mol. Wt.	27.38

4.5 System Performance

Stack Parameter	Guaranteed Values
VOC Destruction Efficiency	**99.5 %**

These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the design summary and for the waste(s) stipulated in the design basis sections of this proposal. VOC is defined as non-methane and on-ethane hydrocarbons.

5.0 PROCESS DESCRIPTION

The Horizontal Forced Draft Thermal Oxidizer is equipped with one (1) GB-Series Fuel Gas Burner. The system is purged using the combustion blower provided. When the purge cycle is complete, the burner pilot is ignited via electric ignition. Once the burner pilot flame is proven, the main burner flame is ignited.

The thermal oxidizer is then allowed to achieve a waste permissive temperature of 1800°F for the two dehy design and 1700F for the single dehy design. Waste gas can then be introduced into the thermal oxidizer. The thermal oxidizer controlled temperature and residence time ensures that the waste gasses are destroyed using a minimum fuel quantity. The flue gases from the thermal oxidizer exit to atmosphere via the refractory lined vent stack.

6.0 EQUIPMENT DESCRIPTION

6.1 Standard Horizontal Thermal Oxidizer- Two Dehy Design

One (1) standard horizontal thermal oxidizer is offered. It is designed to operate at 1800°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 5’-0” O.D. x 20’-0” overall skid length
- Includes 2’-6” O.D. Stack
- Discharge height of 20’-0” above grade
- Thermal oxidizer and Stack Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
    - Blast clean: SP5
    - Coat 1 & Coat 2: 228HS- Grey
- The base portion of the thermal oxidizer shall be mounted on a structural steel skid, along with the waste gas piping, fuel metering rack, and control panel. Skid dimensions will be approximately 8’ W x 20 L x 8’ H.
- The stack portion of the thermal oxidizer shall be shipped loose for bolting to the base portion in the field.

6.2 Standard Horizontal Thermal Oxidizer- Single Dehy Design

One (1) standard horizontal thermal oxidizer is offered. It is designed to operate at 1800°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 5’-0” O.D. x 20’-0” overall skid length
- Includes 2’-0” O.D. Stack
- Discharge height of 20’-0” above grade
- Thermal oxidizer and Stack Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
    - Blast clean: SP5
    - Coat 1 & Coat 2: 228HS- Grey
- The base portion of the thermal oxidizer shall be mounted on a structural steel skid, along with the waste gas piping, fuel metering rack, and control panel. Skid dimensions will be approximately 8’ W x 20 L x 8’ H.
  The stack portion of the thermal oxidizer shall be shipped loose for bolting to the base portion in the field.

6.3 Burner- Two Dehy Design

One (1) Forced Draft Burner Assembly is offered and will consist of One (1) Zeeco GB-Series Burner. The Burner is specially designed for forced draft operation and has the following features:

- Maximum Fuel Gas release is 6 MMBTU/hr
- High Energy Electric Spark Ignition System
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
  - Blast clean: SP5
  - Coat 1 & Coat 2: 228HS- Grey
- 10:1 Fuel Gas Turndown
- Waste gas nozzle connections to be SS material

6.4 Burner- Single Dehy Design

One (1) Forced Draft Burner Assembly is offered and will consist of One (1) Zeeco GB-Series Burner. The Burner is specially designed for forced draft operation and has the following features:

- Maximum Fuel Gas release is 6 MMBTU/hr
- High Energy Electric Spark Ignition System
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- All Carbon Steel External Surfaces Sandblasted and Painted per the final paint solution on Blake Ridge and Pioneer Thermal Oxidizers, shown below:
  - Blast clean: SP5
  - Coat 1 & Coat 2: 228HS- Grey
- 10:1 Fuel Gas Turndown
- Waste gas nozzle connections to be SS material

6.5 ~~Combustion Air Blower- Two Dehy Design~~

- ~~3456 ACFM at 100°F~~
- ~~5” H_2O static pressure~~
- ~~< 5 HP Motor~~
- ~~Manufacturer’s standard construction~~
- ~~Manufacturer’s standard paint system~~

6.6 Combustion Air Blower- Single Dehy Design

- 2076 ACFM at 100°F
- 5” H_2O static pressure
- < 5 HP Motor
- Manufacturer’s standard construction
- Manufacturer’s standard paint system

6.7 Refractory- Two Dehy and Single Dehy Designs

The refractory will be supplied and shop installed by Zeeco. Refractory material proposed within the thermal oxidizer chamber and stack is a hard castable lining supplied by Zeeco standard suppliers.

6.8 Instrumentation and Controls- Two Dehy and Single Dehy Designs

Zeeco's Standard Burner Management System Instrumentation and Controls scope is offered by Zeeco Standard Suppliers:

1. Pre-assembled fuel gas and instrument air control rack, skid mounted.
2. Instrument and piping connections from rack to field instruments and other field equipment by others.
3. Rack mounted local control panel with BMS and Process Control.
4. The BMS complies with NFPA 86; this proposal offers an Allen Bradley Compact Guard Logix with a Zeeco Standard VFD included in the Panel.
5. Zeeco has considered the control of waste gas valves as detailed in Section 3.1, above.
6. Zeeco has included an oxygen analyzer within the base scope of supply.

Zeeco has not included waste gas piping and instrumentation, these items are to be provided by others.

7.0 PERFORMANCE WARRANTY

Zeeco warranties the system performance stated in this proposal. These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the **DESIGN SUMMARY** for the waste (s) stipulated in the **DESIGN BASIS** sections of this proposal.

The purchaser, at his option and cost, may conduct a performance test to determine if the performance warranties are being met. The purchaser shall provide sufficient written notice to Zeeco so that a representative of Zeeco can witness the test. Additionally, Zeeco will be given access to all operating data and laboratory analysis that would bear on the final determination of performance. All analysis of operating data will be done in accordance with generally accepted engineering practice and only published physical data will be used.

ZEECO QUOTATION

CLIENT: WILLIAMS

END USER: WILLIAMS

ZEECO QUOTE #: 2021-17325IN-01

QUOTE REV #: 4

DATE OF ISSUE: 01/07/2022

APPLICATION ENGINEER: SREE KRISHNAN

ZEECO®

BURNERS | FLARES | THERMAL OXIDIZERS
VAPOR CONTROL | RENTALS | AFTERMARKET

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Date: January 7th, 2022

Customer: Williams
2000 Commerce Drive
Pittsburgh, PA 15275

Attention: Mr. Austin Day
Project Engineer
Email: Austin.Day@Williams.com
Cell: +1 (412) 759-4873

Reference: Thermal Oxidizer Proposal for the Williams Ridgeline CF Expansion Project
Zeeco Proposal No. 2021-17325IN-01-R3

Dear Austin,

Thank you for your inquiry. We appreciate this opportunity to provide you with our proposal for the following equipment:

- One (1) Zeeco Standard, Direct Fired Vertical Thermal Oxidizer Package

The attached proposal describes specific features and performance of Zeeco's Standard Thermal Oxidizer System. Our design incorporates a proven thermal process to effectively treat the waste gas stream from your process. The design and materials of construction have been chosen to maximize on-line time and operational life.

Please note that the base of the Thermal Oxidizer is mounted on a pre-wired and pre-piped rectangular structural steel skid that will also house the Fuel Rack and Control Panel. This is intended to reduce installation time associated with interconnecting piping and wiring between the Fuel Rack/Control Panel and the Thermal Oxidizer. Furthermore, the unit is NFPA 86 compliant to ensure personnel and equipment safety.

Again, we appreciate the opportunity to quote on your combustion equipment requirements. After you have had an opportunity to review our proposal, should you have any questions or require additional information, please contact me at (918) 893-8606 or by email at sree_krishnan@zeeco.com.

Best Regards,

Sreeram "Sree" Krishnan
Applications Engineer - Thermal Oxidizers & Combustion Systems
Zeeco World Headquarters

CC: Sydney Levine, *Midstream & End User Business Manager - Thermal Oxidizers & Combustion Systems*

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1.0 INTRODUCTION

Zeeco has designed and manufactured burners, flares, incinerators, air pre-heaters, and combustion systems for worldwide use since 1980.

Zeeco's Incineration Division offers over 1,000 years of experience in the development, design, and testing of combustion systems. Zeeco has the proven skills and innovative abilities to design a practical and environmentally friendly combustion system to thermally treat virtually any industrial waste. This learned "art", gained by research and design efforts which are refined by testing and field experience, has been implemented in the process plants of numerous industries throughout the world.

From project planning through design, procurement, manufacturing, installation, and even start-up, Zeeco will provide project management and support to ensure the success of the project. It is our world-class, HANDS ON type design skills, quality products, experienced staff, and especially our responsiveness to our customers' needs that truly set Zeeco apart from our competition.

Quality: Our customers expect it. We demand it!

3.3 General Terms and Conditions

Please refer to Attachment B for Zeeco's General Terms and Conditions associated with this proposal.

3.4 Invoices

Please refer to Attachment D for Zeeco's Standard Payment Terms associated with this proposal.

3.5 Shipment & Delivery Basis

4.4.1 The proposed Zeeco Standard, skid-mounted Vertical Thermal Oxidizer Package shall be ready for shipment **20-24 weeks** from the date of firm order commitment and approval / release to proceed with procurement of raw materials.

4.4.2 Please note that the above pricing is based on current material availability and the use of the Zeeco's existing Standard Design. This offer also considers the current Engineering, Drafting, and Manufacturing Schedules required to supply the equipment and materials detailed within this proposal.

4.4.3 Expedited delivery is available, if required. Please contact Zeeco for an updated proposal.

3.6 Preliminary Equipment Weights & Dimensions

The preliminary weights and dimensions for the *major* equipment items within Zeeco's Base Scope of Supply have been noted in Table 3.6.1 below.

TABLE 3.6.1: PRELIMINARY EQUIPMENT WEIGHTS & DIMENSIONS

Item	**Qty**	**Approximate Weight (lbs)**	**Approximate Dimensions**
Vertical Thermal Oxidizer Skid	1	30,000	12' (L) x 12' (W) x 8' (H)
Thermal Oxidizer Vent Stack	1	20,000	6' O.D. x 38' (L)

3.6.1 The preliminary weights and dimensions noted in the above table reflect the fully assembled and skidded equipment, including all relevant refractory material and external attachments, as described in Section 6.0 of this proposal.

3.6.2 Please note that all equipment described within this proposal shall be shop assembled by Zeeco to the maximum extent possible, given the local, state, and federal shipping / transit limitations. The extent of shop assembly for external attachments and equipment has been detailed in Section 6.0 of this proposal.

3.7 Drawing and Documentation

3.7.1 Key submission drawings associated with Invoicing Milestone 2 of Zeeco's Standard Payment Terms (Attachment D) have been defined as the P&ID and Thermal Oxidizer General Arrangement and Foundation Drawings.

3.7.2 The delivery schedule noted in Section 3.5 of this proposal includes two (2) review / approval cycles for all submitted Documents and Drawings, as noted below:

3.7.2.1 Customer / Buyer review cycle within fourteen (14) calendar days from the date of document and drawing submission by Zeeco

3.7.2.2 Document and Drawing revision and resubmission by Zeeco within fourteen (14) calendar days from the return date from the Customer / Buyer

3.7.3 Zeeco shall comply with all relevant requirements listed in the following Williams Specifications, as shown in Table 3.7.3 below:

TABLE 3.7.3: WILLIAMS SPECIFICATIONS

SPEC. NO.	REVISION	DESCRIPTION
09 96 10C	04.00	Above-Ground Protective Coatings
26 00 11D	02.02	Electrical Area Classification Design Manual
26 05 00C	01.04	Electrical Installation
33 08 61F1	01.02	ASME B31.3 Pre-Approval & Pressure Test Record
33 52 30C	01.01	Onshore Nondestructive Examination (NDE) of Steel Pipe System Welds
40 05 08E	04.02	Pipe Supports & Spans
40 05 27E	03.23	Piping Specification
40 05 41C	04.02	Bolt Tensioning and Alignment for Standard Flange Connections
40 05 48E	02.01	Pipe Nipple Design Manual
40 15 20P	01	Exhaust Gas Sample Port Configuration
40 61 10C	01.03	Instrumentation and Controls
40 61 10E	01.01	Instrumentation and Controls
40 63 44E	01.01	Alley Bradley Programmable Logic Controller Engineering Specification
40 67 17P	01.01	Onshore Control Panel Procurement Specification
43 42 01P	02.01	Unfired ASME Section VIII Pressure Vessels

3.8 Start-Up, Commissioning, and Installation

3.8.1 Start-up and Commissioning services have not been included in this proposal but can be purchased separately as per Zeeco's Standard Rates noted in Attachment C.

3.8.2 Installation, Erection, and Construction services have not been included in this proposal, however, Zeeco can provide a separate price for these services upon request.

3.9 Limited Liability

Seller shall not be liable for any loss of profit, special, indirect, incidental or consequential damages whether arising under warranty, contract, strict liability, indemnification, or any other cause or combination of causes whatsoever. This limitation shall apply notwithstanding any failure of essential purpose of any limited remedy.

Seller's cumulative liability, inclusive of insurance proceeds paid to Agent under Seller's insurance policies and liquidated damages paid to Agent, shall in no event be in excess of the value of the purchase price, whether arising under warranty, contract, strict liability, indemnification, or any other cause or combination of causes whatsoever. These limitations shall prevail over any conflicting or inconsistent provisions stated elsewhere.

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4.0 DESIGN BASIS

Zeeco has designed all equipment within this proposal based on the following parameters and assumptions, as per your inquiry and Zeeco's Standard Design:

4.1 Site Conditions

Elevation (ft)	~1255
Barometric Pressure (psia)	13.8
Ambient Temperature, Min / Max (°F)	-20 / 105
Relative Design Humidity (%)	95% (*assumed*)
Wind Design	ASCE 7-10, 120 MPH
Snow Design	30 lb/ft^2

4.2 Waste Stream Summary

Constituent	Still Vent Gas *Mol %*	Flash Gas *Mol %*
Water	92.46183	0.30333
TEG	0.00022	0.00023
Oxygen	0.00000	0.00000
Nitrogen	0.00057	0.13017
Methane	0.99780	53.65338
CO2	0.08474	0.44373
Ethane	1.81764	26.20759
Propane	1.79100	12.73128
i-Butane	0.17584	1.00412
n-Butane	0.99114	3.81205
i-Pentane	0.25180	0.52165
n-Pentane	0.51720	0.88532
2,2-Dimethylbutane	0.00151	0.00216
2,3-Dimethylbutane	0.04579	0.04791
2-Methylpentane	0.00000	0.00000
3-Methylpentane	0.02994	0.02715
Hexane	0.10004	0.08850
2,2-Dimethylpentane	0.00000	0.00000
Methylcyclopentane	0.00000	0.00000
Benzene	0.03499	0.00166
3,3-Dimethylpentane	0.00000	0.00000
Cyclohexane	0.05039	0.01452
2-Methylhexane	0.02772	0.01599
2,3-Dimethylpentane	0.00575	0.00260
3-Methylhexane	0.03659	0.01728
Heptane	0.07701	0.03297
Toluene	0.14008	0.00355
Octane	0.02852	0.00720
Ethylbenzene	0.01680	0.00029
o-Xylene	0.02216	0.00027
2-Methylheptane	0.02751	0.00905
1,t-2-Dimethylcyclopentane	0.00000	0.00000

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1,t-3Dimethylcyclopentane	0.04887	0.00864
Methylcyclohexane	0.08355	0.01797
2,5-Dimethylhexane	0.00190	0.00091
2,3-Dimethylhexane	0.00000	0.00000
4-Methylheptane	0.00000	0.00000
3-Methylheptane	0.00000	0.00000
1,t-4-Dimethylcyclohexane	0.00000	0.00000
1,t-3-Dimethylcyclohexane	0.00364454	0.00045279
Ethylcyclohexane	0.010896061	0.001723877
Nonane	0.013381796	0.001802523
n-Undecane	0.000307611	1.18981E-05
n-Decane	0.000987688	7.26319E-05
Dodecane	3.64037E-05	7.41E-07
Tridecane	1.91556E-06	2.23E-08
Tetradecane	1.05464E-07	8.29E-10
Pentadecane	1.20519E-08	7.11E-11
Hexadecane	9.56837E-10	4.83E-12
Heptadecane	8.81753E-11	4.02E-13
Octadecane	2.05035E-11	8.00E-14
Nonadecane	3.83331E-12	1.26E-14
m-Xylene	0.08493217	0.001394333
3-Ethylpentane	0.000633194	0.000256126
2,4-Dimethylhexane	0.002924017	0.001221004
trans-1,2-Dimethylcyclohexane	0.005112928	0.000683389
cis-1,2-Dimethylcyclohexane	0.006254963	0.000646351
cis-1,3-Dimethylcyclohexane	0.0019143	0.000283782
Pressure, psig	0.10	57.00
Temperature, °F	207.17	119.00
MW	22.33	27.94
Case 1: Design Flow Rate (lb/h)	146.50	32.00
Case 2: Winter High P Flow Rate (lb/h)	82.36	31.00
Case 3: Winter Low P Flow Rate (lb/h)	98.38	29.00
Case 4: Summer High P Flow Rate (lb/h)	208.33	35.00
Case 5: Summer Low P Flow Rate (lb/h)	254.49	32.00
Case 6: Updated Still Vent Only Flow Rate (lb/h)	296.94	0.00
Case 7: Updated Flash Gas Only Flow Rate (lb/h)	0.00	109.00
Case 8: Updated Design Flow Rate (lb/h)	188.47	102.00
Case 9: Updated Winter High P Flow Rate (lb/h)	128.80	101.00
Case 10: Updated Winter Low P Flow Rate (lb/h)	149.06	94.00
Case 11: Updated Summer High P Flow Rate (lb/h)	246.51	109.00
Case 12: Updated Summer Low P Flow Rate (lb/h)	296.94	99.00

Please note that the design of the Thermal Oxidizer assumes that all Waste Gas constituents are in the vapor phase only. If liquids or solids are present, they will be removed prior to the waste gas entering the Thermal Oxidizer.

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4.3 Fuel Gas Summary

Composition	Units	Value
Water	mol %	0.0053708
TEG	mol %	0.0000477
Nitrogen	mol %	0.2571619
CO2	mol %	0.1243241
Methane	mol %	81.6811822
Ethane	mol %	12.5932194
Propane	mol %	3.4521581
i-Butane	mol %	0.4828718
n-Butane	mol %	0.7570188
i-Pentane	mol %	0.2142871
n-Pentane	mol %	0.1646706
Neopentane	mol %	0.0099856
2,2-Dimethylbutane	mol %	0.0119321
2,3-Dimethylbutane	mol %	0.0534826
3-Methylpentane	mol %	0.0317120
Hexane	mol %	0.0502353
2,2-Dimethylpentane	mol %	0.0060154
Methylcyclopentane	mol %	0.0130547
Benzene	mol %	0.0010142
3,3-Dimethylpentane	mol %	0.0017660
Cyclohexane	mol %	0.0050990
2-Methylhexane	mol %	0.0156586
2,3-Dimethylpentane	mol %	0.0049848
3-Methylhexane	mol %	0.0168784
2,2,4-Trimethylpentane	mol %	0.0008747
Heptane	mol %	0.0171566
cis-1,2-Dimethylcyclopentane	mol %	0.0008634
2,5-Dimethylhexane	mol %	0.0022959
Toluene	mol %	0.0025218
2-Methylheptane	mol %	0.0072161
3-Ethylhexane	mol %	0.0046792
trans-1,2-Dimethylcyclohexane	mol %	0.0004670
1,1-Dimethylcyclohexane	mol %	0.0003772
Octane	mol %	0.0053790
1,t-3-Dimethylcyclohexane	mol %	0.0004640
o-Xylene	mol %	0.0000756
Nonane	mol %	0.0014424
m-Ethyltoluene	mol %	0.0002151
p-Ethyltoluene	mol %	0.0003362
2-Methylnonane	mol %	0.0002247
n-Decane	mol %	0.0002574
2,2,4-Trimethylhexane	mol %	0.0001892
3-Methyloctane	mol %	0.0002483
Isopropylcyclohexane	mol %	0.0001561
n-Propylcyclohexane	mol %	0.0000767
Butylbenzene	mol %	0.0000915
1-Methyl-2-Propylbenzene	mol %	0.0000473
1,2-Dimethyl-4-Ethylbenzene	mol %	0.0000396
cis-1,2,trans-1,4-1,2,4-Trimethylcyclohexane	mol %	0.0001739
TOTAL	**mol %**	**100.000**
Specific Gravity	-	0.681
Temperature	°F	40 - 70

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4.4 Utility Summary

Utility	Units	Required Amount
Electrical Power	V / Phase / Hz	460 / 3 / 60
Instrument Air Flowrate	SCFH	2000 - 3000
Fuel Gas Flowrate	lb/hr	47.8
Fuel Gas Pressure	psig	50.0

4.5 Flue Gas Summary @ 1700°F Operating Temperature

The below table contains a summary of the Flue Gas Compositions, Temperatures, and Flowrates at the outlet of the Thermal Oxidizer Chamber:

Composition	Units	Case 1: Design	Case 2: Winter High P	Case 3: Winter Low P	Case 4: Summer High P
Carbon Dioxide	mol %	4.94%	5.01%	5.02%	4.88%
Water	mol %	19.58%	18.35%	18.83%	20.36%
Nitrogen	mol %	66.66%	67.76%	67.36%	65.94%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	8.82%	8.88%	8.78%	8.83%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.20	27.34	27.28	27.11
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	3,801	3,308	3,331	4,367

Composition	Units	Case 5: Summer Low P	Case 6: Still Vent Only	Case 7: Flash Gas Only	Case 8: Updated Design
Carbon Dioxide	mol %	4.87%	5.17%	4.53%	4.55%
Water	mol %	21.17%	24.80%	14.76%	17.49%
Nitrogen	mol %	65.26%	62.48%	70.30%	68.03%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	8.71%	7.54%	10.41%	9.93%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.02	26.66	27.68	27.39
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	4,556	3,425	6,211	7,216

Composition	Units	Case 9: Updated Winter High P	Case 10: Updated Winter Low P	Case 11: Updated Summer High P	Case 12: Updated Summer Low P
Carbon Dioxide	mol %	4.55%	4.58%	4.53%	4.56%
Water	mol %	16.78%	17.20%	17.96%	18.70%
Nitrogen	mol %	68.63%	68.30%	67.62%	67.02%
HCl	mol %	0.00%	0.00%	0.00%	0.00%
SO_2	mol %	0.00%	0.00%	0.00%	0.00%
Oxygen	mol %	10.04%	9.92%	9.90%	9.73%
TOTAL	**mol %**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
MW	amu	27.46	27.42	27.34	27.26
Temperature	°F	1700	1700	1700	1700
Flowrate	lb/hr	6,754	6,584	7,934	7,840

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4.6 System Performance

Parameter	Units	Guaranteed Value
VOC Destruction Efficiency	%	$\geq$ 99.9
NO_x @ TO Outlet	ppmvd @ 3% O_2	$\leq$ 200

These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the design summary and for the Waste(s) stipulated in the design basis sections of this proposal. VOC is defined as non-methane and on-ethane hydrocarbons.

5.0 PROCESS DESCRIPTION

The Thermal Oxidizer Package shall be equipped with **One (1) Forced Draft GB-Series Fuel Gas Burner**. The system is purged using the combustion air supplied by the proposed Blower. After the purge cycle is complete, the burner is ignited via electric ignition.

Once the Thermal Oxidizer has achieved the Waste permissive temperature of **1,700°F**, Waste Gas is introduced into the system. The temperature control system and minimum 1 second residence time of the Thermal Oxidizer Chamber further ensures that Waste Gas is combusted and destroyed while minimizing fuel consumption. The Flue Gasses at the outlet of the Thermal Oxidizer Chamber are vented through atmosphere through an integrated and refractory lined Stack.

Due to the quantity of H_2O in the Waste Stream, Zeeco recommends the addition of heat traced and insulated Waste Gas piping as well as a Knock Drum upstream of the Thermal Oxidizer, as needed.

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6.0 EQUIPMENT DESCRIPTION

6.1 Zeeco Standard Skid-Mounted Vertical Thermal Oxidizer Package

One (1) Zeeco Standard Skid-Mounted Vertical Thermal Oxidizer shall be designed and supplied per Zeeco's Standard design, materials of construction, and manufacturers / suppliers. The Thermal Oxidizer has been designed to operate at a temperature of **1700ºF** with excess air, in order to ensure complete combustion of the waste gas combustible components. The Thermal Oxidizer shall be supplied with the following features:

- Nominal 12' (W) x 12' (L) x 8' (H) Thermal Oxidizer skidded unit (*fully assembled*), shipped horizontally
- Nominal 6' O.D. x 38' (L) Vent Stack, shipped horizontally for bolting / assembly to the Thermal Oxidizer skid in the field
- The Thermal Oxidizer and Vent Stack are not considered to be Pressure Vessels, as they are open to the atmosphere.
- External Shell of the Thermal Oxidizer and Vent Stack constructed from SA-36 Carbon Steel
- Combustion Air and Quench Air Ducting constructed from SA-36 Carbon Steel
- Ladders and Platforms constructed from SA-36 Carbon Steel and trial fitted by Zeeco and shipped loose to site for field assembly / installation
- Galvanized Carbon Steel Rainshield and Expanded Metal Personnel Protection Material supplied and installed by Zeeco, as required.
- Shop Installed Refractory Anchors
- Shop Installed Refractory Material (*w/out Dryout*)
- External surfaces of the Thermal Oxidizer sandblasted and painted per Paint Coating System 3d and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)
- The base of the Thermal Oxidizer shall be mounted on a structural steel skid, along with the Waste Gas piping, Fuel Control Rack, and Control Panel. Approximate skid dimensions can be found in Section 3.6 of this proposal.

6.2 Burner

One (1) Forced Draft Zeeco Burner is offered using Zeeco's Standard Design, materials of construction, and suppliers and has the following features:

- 6.0 MMBtu/hr maximum release rating
- 10:1 Fuel Gas Turndown
- High Energy Electric Spark Ignition System
- External Shell constructed from SA-36 Carbon Steel
- Waste Gas nozzle connections sizes, ratings, and materials of construction shall be consistent with Williams PO# 753213 / Zeeco SO# 43653 and will comply with all relevant project specifications noted in Table 3.7.3 of this proposal
- One (1) ¾" 150# (*max*) Drain Nozzle included, and shall be located on the shell of the Burner, in close proximity to the front plate (*size and location to be confirmed after detailed Engineering has been completed*)
- 60% Al_2O_3 Burner Tile Construction
- External surfaces of the Burner sandblasted and painted per Paint Coating System 3d and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)

6.3 Fuel Control Rack

One (1) skid-mounted and pre-assembled Fuel Gas and Instrument Air Control Rack shall be designed and supplied per Zeeco's Standard design, materials of construction, and manufacturers / suppliers, and shall be complete with the following features:

- Instrument Air Lines supplied in compliance with the 3A0 Pipe Class, per specification 40 05 27E Revision 03.23.
- Fuel Gas Lines supplied in compliance with the 3A1 Pipe Class, per specification 40 05 27E Revision 03.23.
- Fuel Gas and Instrument Air piping and nozzle connection sizes, ratings, and materials of construction shall be consistent with Williams PO# 753213 / Zeeco SO# 43653 and will comply with all relevant project specifications noted in Table 3.7.3 of this proposal
- Instrument and Piping connections from Fuel Rack to field instrumentation and other field equipment items shall be by others.
- Waste Gas Piping, Valves, and Instrumentation shall be supplied by others.
- External surfaces of all Fuel Control Rack Piping sandblasted and painted per Paint Coating System 3b and Color FSC 16187 (*Gray*), as noted in specification 09 96 10C (*Revision 04.00*)

6.4 Refractory

All refractory materials will be designed, supplied, and shop installed by Zeeco. The proposed refractory material shall consist of a hard castable lining throughout the entire Thermal Oxidizer and Vent Stack, and a brick refractory lining on the floor plate of the Thermal Oxidizer. All refractory materials shall be supplied by Zeeco's Standard suppliers / manufacturers.

6.5 Combustion Air Blower & Motor

One (1) Combustion Air Blower and Motor shall be supplied per Zeeco's Standard design and manufacturers / suppliers and shall be supplied with the following features:

- Design Rate: 1,950 ACFM at 105°F
- Discharge Pressure: 5" W.C.
- Motor HP: ≤ 5
- Sound Level ≤ 85 dBA @ 3' from Battery Limit
- Manufacturer's Standard Materials of Construction
- Manufacturer's Standard Paint Coating System

6.6 Controls and Instrumentation

Zeeco's Standard Controls and Instrumentation Package shall be supplied for this Thermal Oxidizer Package. All Controls and Instrumentation items shall be supplied by Zeeco's Standard suppliers / manufacturers, and shall be complete with the following:

- SIL-2 Capable Zeeco Standard Instrumentation and Controls Package, designed per NFPA-86 requirements and complete with the following features:
    a. Temperature rating of -20°F, with exception to the HMI (*guaranteed to 32°F*)
    b. Hazardous Area Classification: Class I, Division II, Groups C, D
    c. Fuel Gas and Pilot Gas Block Valve shall be supplied as FM Listed Assemblies
    d. Pneumatic Actuators supplied with inlet Relief Valves
    e. All Conduit shall be Hot Dip Galvanized (*before threading*)
    f. FCI Thermal Mass Flow Switches Provided for LL Air and Purge Air Flow Interlocks
    g. Transmitters and Pressure Gauges supplied with Manifolds
    h. Pressure Transmitters supplied, as needed (instead of Pressure Switches)
- One (1) Local Control Panel consistent with NFPA-86 requirements and complete with the following features:
    a. One (1) SIL-2 capable Allen Bradley Compact Guardlogix BMS PLC with additional provisions for Waste Gas and Process Control (*by Zeeco*)
    b. Open and Closed Limit Switches for Automated Valves wired to the PLC
    c. One (1) Rain / Sun Shield over the Local Control Panel
- One (1) Rosemount (*or equivalent*) O_2 Analyzer
- One (1) Zeeco Standard VFD housed within the Local Control Panel
- Two (2) Zeeco Standard Flame Scanners
- One (1) ¾" (*max.*) Manual Drain Valve for the Burner (*size to be confirmed after detailed Engineering has been completed*)

7.0 PERFORMANCE WARRANTY

Zeeco warranties the system performance stated in this proposal. These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the **DESIGN SUMMARY** for the waste (s) stipulated in the **DESIGN BASIS** sections of this proposal.

The purchaser, at his option and cost, may conduct a performance test to determine if the performance warranties are being met. The purchaser shall provide sufficient written notice to Zeeco so that a representative of Zeeco can witness the test. Additionally, Zeeco will be given access to all operating data and laboratory analysis that would bear on the final determination of performance. All analysis of operating data will be done in accordance with generally accepted engineering practice and only published physical data will be used.

-Burners
-Flares
-Incinerators

22151 East 91st Street
Broken Arrow, OK 74014 USA
Phone: 918-258-8551
Fax: 918-251-5519
www.zeeco.com

Duplicate of Blake Ridge Flare
Zeeco Ref: SO 32415

April 24, 2018

Williams
Park Place Corporate Center 2
2000 Commerce Drive
Pittsburgh, PA 15275
Ph: 412-787-3132
fax:

Attention: Austin Day, Sr. Project Engr

Subject:	Williams Ref.:	Ridgeline CF
	Zeeco Reference:	2017-03133FL-01 -- Rev. 0

Thank you for your interest in Zeeco, Inc. We look forward to the opportunity to work with you on this project. In response to your above referenced inquiry, we are pleased to provide you with our proposal for the combustion equipment designed specifically for your needs.

Zeeco's flare systems are designed to handle peak releases immediately, with no adverse effects on the flare itself or on the pilots or ignition system. Zeeco's design also offers exceptional reliability and life expectancy as well as provisions for easy maintenance and repair.

Zeeco appreciates the opportunity to propose our products to Williams.
We are confident that we offer the best flaring equipment in the world at competitive prices. Should you have additional questions or require additional information, please feel free to contact us.

Best Regards,

Nikki Jenlink
Flare Application Engineer
(reach me by email at: nikki_jenlink@zeeco.com)

AVAILABLE ATTACHMENTS

Attachment A DELETED

Attachment B Commercial Proposal

Attachment C Process Conditions

Attachment D Specification Sheets:
- Flare Tip Specification Sheet
- Flare Pilot Specification Sheet
- Flare Stack Structure Specification Sheet
- High Energy Spark Ignition (HEI) Specification Sheet
- Utility Piping Scope of Supply Specification Sheet
- Typical High-Temp Thermocouple Wiring Spec Sheet

Attachment E Spare Parts
- Spare Parts for Start-up & Commissioning
- Spare Parts for Two Years Operation

Attachment F Clarifications and Exceptions

Attachment G Start-up & Maintenance Services

Attachment H Radiation Profile

Attachment I Typical GA Drawing

Attachment J ISO &ASME Sec. VIII Code Certificates

Attachment K Sample Inspection and Test Plan

Attachment L Zeeco Rental Brochure

ATTACHMENTS

Attachment B

Commercial Proposal

Scope of Supply

Our scope of supply will include:

1) General Arrangement Drawings for customer approval.
2) Operation & Maintenance Manual.
3) The equipment necessary for flaring the waste streams as specified in the inquiry documents, including:

Identical to Final SO 32415

Scope of Supply (Continued)

Our Scope of Supply does NOT include:

Identical to Final SO 32415

COMMERCIAL PROPOSAL

Pricing and Payment Terms

BASE Flare System as Detailed In This Proposal (Sonic Flare Tips):	$	287,700.00

Options

Ex-works:	Shop Door, Zeeco USA Point of Manufacture, North/Central America (Stack, Structural Steel, Piping)
Base Pricing Validity:	30 days from date of quotation
Optional Pricing Validity:	7 days after receipt of an order or LOI, unless specifically defined otherwise
Terms of Payment:	Same as Agreed on Blake Ridge

Delivery:

Foundation Loadings:	2 weeks after receipt of order
GA Drawings / P&ID for Approval:	4 weeks after receipt of order
Panel Drawings / IDS for Review:	6 weeks after receipt of order
Equipment Shipment:	20-22 weeks after drawing approval

Warranty:	18 months from ship date, or 12 months from start-up, whichever condition expires first.

Attachment C

Process Conditions

Process Conditions -- English Units

Client: Williams	Zeeco Ref.: 2017-03133FL-01	Date: 24-Apr-18
Location: West Virgina	Client Ref.: Ridgeline CF	Rev. 0

	Mol %					
	RL Flare	RL FG				
METHANE	81.67	81.70				
ETHANE	12.60	12.59				
PROPANE	3.46	3.45				
BUTANE	1.24	1.24				
PENTANE	0.38	0.38				
HEXANE	0.26	0.05				
HEPTANE		0.02				
OCTANE		0.00				
NONANE						
DECANE						
DODECANE						
TRIDECANE						
CYCLOPENTANE						
ETHYLENE						
PROPYLENE						
BUTYLENE						
ACETYLENE						
BENZENE						
TOLUENE						
XYLENE						
CARBON MONOXIDE						
CARBON DIOXIDE	0.13	0.12				
HYDROGEN SULFIDE						
SULFUR DIOXIDE						
AMMONIA						
AIR						
HYDROGEN						
OXYGEN						
NITROGEN	0.26	0.26				
WATER		0.01				
BUTADIENE						
METHANOL						
Total	**100**	**100**				
Mol. Wt.	19.77	19.60				
L. H. V. (BTU/SCF):	1,089	1,081				
Temperature (Deg. F):	-15.0					
Avail. Static Pressure (psig):	35.00					
Flow Rate (lbs/hr):	384,399					
Smokeless Rate (lbs/hr):	384,399					

*Smokeless is Ringleman 1.0 or less

ATTACHMENTS

Attachment D

Specification Sheets:

Flare Tip Specification Sheet
• Flare Pilot Specification Sheet
• Flare Stack Structure Specification Sheet
• High Energy Spark Ignition (HEI) Specification Sheet
• Utility Piping Scope of Supply Specification Sheet
• Typical High-Temp Thermocouple Wiring Spec Sheet

Flare Tip Specification Sheet

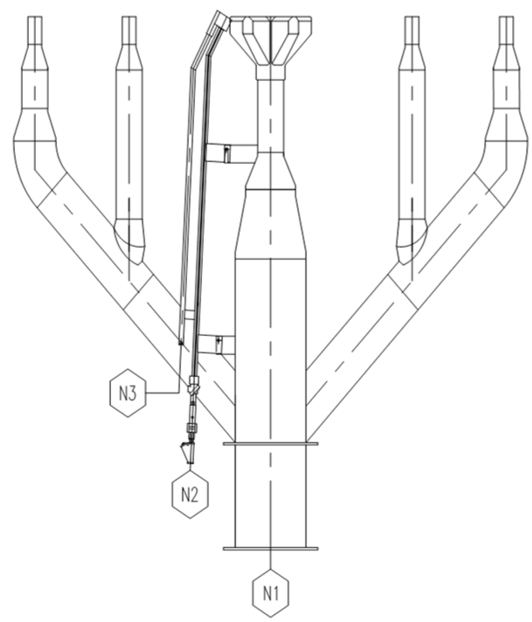
Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

Tag No.:	Ridgeline CF		
Model:	MJ-16		Type: Sonic
Length:	10'- 0 "		
Weight:	1298	lbs	
No. of Pilots:	2		

Design Case:

Governing Case:	RL Flare
Molecular Weight:	19.8
L. H. V. :	1,089 BTU/SCF
Temperature:	-15 Deg. F
Available Static Pressure:	35 psig
Design Flow Rate:	384,399 lbs/hr
Approximate Exit Velocity:	1211 ft/s
Mach No.:	1.00
Approx. Tip Press. Drop:	24.78 psig



(Typical drawing only)

Construction:

Upper Section:	310 SS	Windshield:	NO
Lower Section:	304 SS	Flame Retention Ring:	n/a
Refractory:	None	Lifting Lugs:	YES - S.S. Type
Refractory Thk:	N/A		

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP6	Primer:	Inorganic Zinc
Paint (c. s. surfaces):	High Heat Aluminum		

Connections:

	Qty.	Size	Type	Material
N1 - Flare Gas Inlet:	1	16 "	150# RFSO	304 SS
N2 - Pilot Gas:	1	1"	150# RFSW	304 SS
N3 - Ignition Line:	0	n/a	n/a	n/a

Miscellaneous Notes:

1. Includes Integral Purge Reducing Velocity Seal.
2. Required Fuel Gas Purge Rate = 760 SCFH.

Pre-Mix Flare Pilot Assembly Specification Sheet

Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

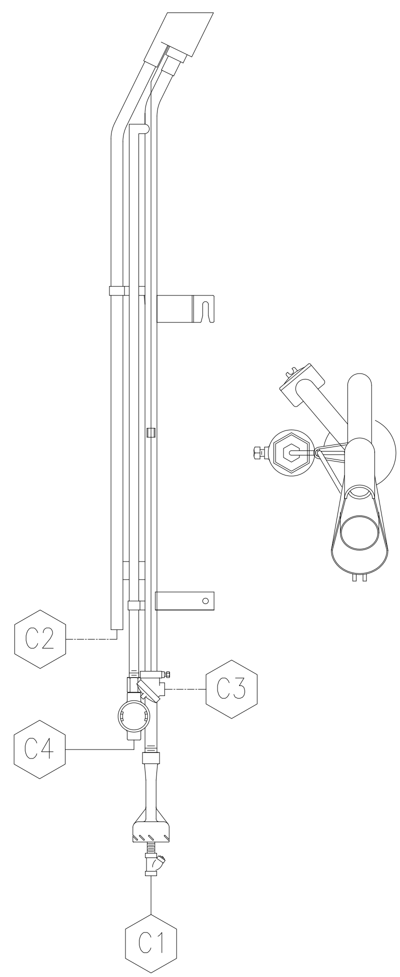
Tag No.:	FP-1	
Model:	HSLF	
Length:	9.135	feet
Weight:	68	lbs.
Pilot Type:	Pre-Mix	High Stability
Ignition Type:	Flame Front Generator	

Process Design Data:

Design Heat Release:	65,000	BTU/hr
Fuel Gas MW:	22.40	
Fuel Gas LHV:	1,342	BTU/SCF
Fuel Gas Temperature:	100	Deg. F
Fuel Gas Inlet Pressure:	15.00	psig
Fuel Gas Flow rate:	48.4	SCFH
Design Wind Velocity:	150	mph
Design Rainfall:	50.00	inches/hr
Mounting Position:	Vertical	
Thermocouple Type:	K	Ungrounded

Construction:

Pilot Firing Tip:	HK
Windshield Assembly:	HK
Integral Thermowell:	HK
FFG Ignition Line:	N/A
Mounting Brackets:	HK
Premix Fuel Line:	310 SS
Thermocouple Sheath:	310 SS
Thermocouple Head:	316 SS
Fuel Mixer / Spud Assembly:	CF-3M / 18-8
Fuel Strainer Assembly:	CF-8M
HEI Probe and Support:	310 SS
HEI Junction Head:	310 SS



Connections:	Qty.	Size	Type	Material
C1 - Fuel Gas Inlet:	1	1/2"	FNPT	CF8M
C2 - FFG Ignition Inlet:	0	n/a	n/a	n/a
C3 - Thermocouple:	1	3/4"	Conduit	CF8M
C4 - HEI Ignition:	1	3/4"	Conduit	CF8M

Misc. Notes: (see ignition system datasheet for type applicable to this quote)

1. Upper mounting bracket is reinforced hook type for pilot removal from platform.
2. Pilot mounting brackets and thermocouple mounting brackets are investment cast assemblies.
3. Pilot mixer assembly is investment cast, high efficiency computer modeled venturi section.
4. ~~Thermocouples are duplex fixed type. Retractable type (replaceable from grade) available upon request.~~

Self-supported Flare Stack Specification Sheet

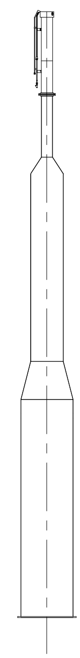
Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.:	0

General Information:

Tag No.:	Ridgeline CF
Overall Height:	130'- 0 "

Design Criteria:

Wind Design Code:	ASCE 7-10
Seismic Design Code:	ASCE 7-10
Importance Factor:	1.25
Structural Design Code:	AISC
Wind Speed (Structural):	120 mph
Seismic Zone:	D
Max. Design Temperature:	150 Deg. F
Min. Design Temperature:	-65 Deg. F
Design Pressure:	50 psig
Riser Corrosion Allow.:	0.000 in.



(Typical drawing only)

Construction:

Inner Gas Riser Material:	304 SS	Ladders & Step-offs:	per OSHA
Inner Gas Riser Diameter:	16"	Platform at Tip:	360 deg
Outer Support Stack Material:	A36CS	Additional Platforms:	None
Outer Support Stack Diameter:	Varies Along Height	ACWL:	None

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	Per Spec	Primer:	Per Spec
Int. Coat:	Per Spec	Finish Paint:	Per Spec

Utility Piping:

Per Attached Utility Piping Scope of Supply

Miscellaneous Notes:

High Energy Electronic Ignition Generator Specification Sheet

Client:	Williams	Zeeco Ref.:	2017-03133FL-01	Date:	24-Apr-18
Location:	West Virgina	Client Ref.:	Ridgeline CF	Rev.	0

General Information:

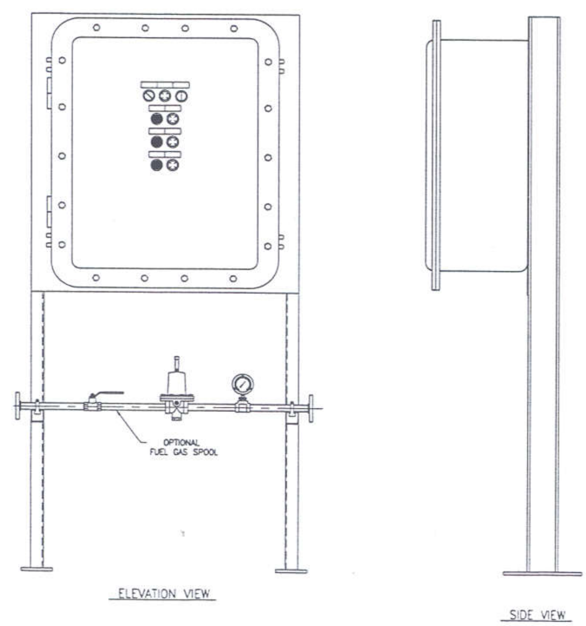
Tag No.:	Ridgeline CF
Model No.:	HEIC-2-DT/S
Operation:	Manual/Automatic
No. of Pilots Ignited:	2
Area Classification:	Class 1, Div 2, Group C&D
Spark Intensity:	Approx. 1,000 Volts

Fuel Gas Data:

Molecular Weight:	19.6
L. H. V.:	1,081 BTU/SCF
Temperature:	100 Deg. F
Pressure:	15 psig

Utility Consumption:

Pilot Gas (Per Pilot):	60 SCFH
Pilot Gas (Total):	120 SCFH
Power Available:	120 Volt, 1 Phase, 60 Hertz



(Typical drawing only)

Construction:

Fuel Gas Piping:	Carbon Steel	Ignition Probe Mat'l:	310 SS
Mounting Rack:	Carbon Steel	No. Thermocouples/Pilot:	1
Enclosure:	NEMA 4X/7	Thermocouple Type:	K
Sun / Rain Shield:	No	Ignition Probes per Pilot:	1

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP6	First Coat:	High Build Epoxy; 1 Coat (4~6 mils)
Second Coat:	Polyurethane; 1 Coat (2~3 mils)	Finish Color:	Grey - RAL7038
		Enclosure:	Manufacturer Std.

Connections:

	Qty.	Size	Type	Material
Pilot Gas Inlet:	1	1/2"	150# RFSW	Carbon Steel
Ignition Probe Inlet (On Pilot):	1	3/4"	FNPT	304SS
Pilot Gas Outlet:	1	1/2"	150# RFSW	Carbon Steel

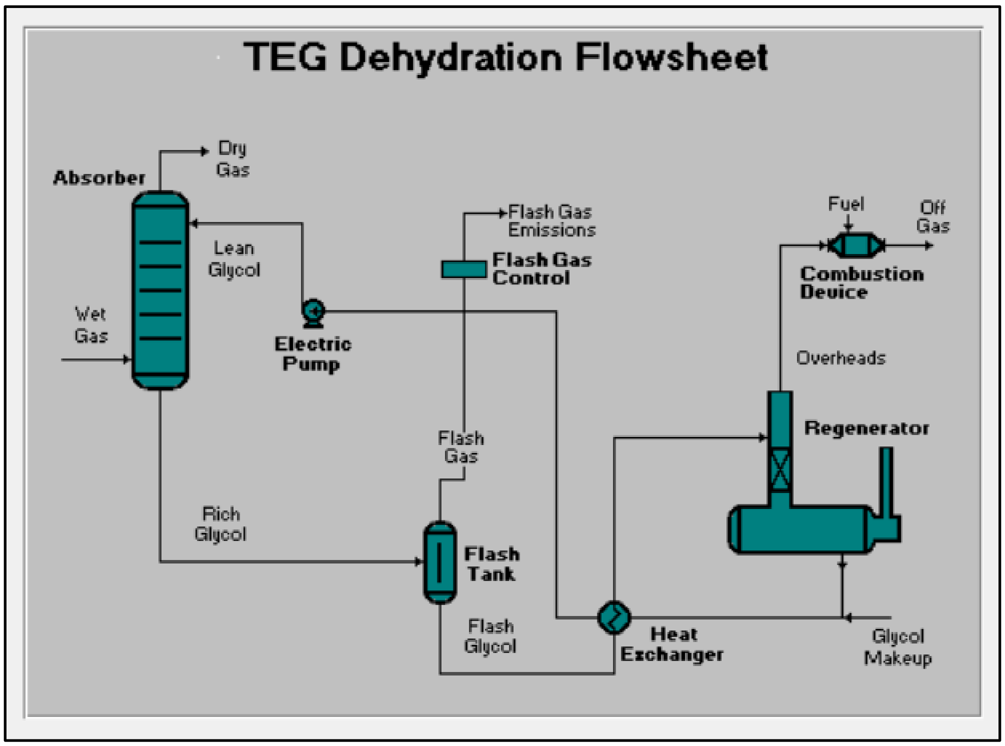
Miscellaneous Notes:

1. Zeeco has considered relay logic. PLC can be considered upon request.
2. Piping/valves/instruments shall be CS w/ SW connections

Supplement S6

Emission Program Data

- **EPA Tanks 4.0.9d – Produced Water (P/W) Storage Tanks (TK-01 (18E)) thru TK-04 (21E))**
- **GRI-GLYCalc 4.0 – 250.0 MMscfd TEG Dehydrator (DFT-01 (12E) and DSV-01 (13E))**
- **GRI-GLYCalc 4.0 – 160.0 MMscfd TEG Dehydrator (DFT-02 (15E) and DSV-02 (16E))**



Produced Water (PW) - Storage Tanks (TK-01 thru TK-04)

Identification

User Identification:	AMS-Ridgeline CS 400 bbl Produced Water
City:	
State:	West Virginia
Company:	Appalachia Midstream Services, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	400 bbl each, 30,000 bbl/year 95% Water 5% Condensate (Gasoline RVP=12)

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	12.00
Liquid Height (ft) :	19.00
Avg. Liquid Height (ft):	10.00
Volume (gallons):	16,800.00
Turnovers:	75.00
Net Throughput(gal/yr):	1,260,000.00
Is Tank Heated (y/n):	Y

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.06

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Produced Water

Tank Dimensions	Per Tank		Four (4) Tanks	
	gal	bbl	gal	bbl
Capacity	16,800	**400**	67,200	1,600
Daily T-Put	3,452	82	13,808	329
Annual T-Put	**1,260,000**	30,000	5,040,000	120,000

VOC Emissions	Per Tank		Four (4) Tanks	
	lb/yr	tpy	lb/yr	tpy
Working	**70.46**	0.04	281.84	0.14
Breathing	**0.00**	0.00	0.00	0.00
Total	**70.46**	0.04	281.84	0.14

Meterological Data used in Emissions Calculations: Pittsburgh, Pennsylvania (Avg Atmospheric Pressure = 14.11 psia)

AMS-Ridgeline CS 400 bbl Produced Water - Vertical Fixed Roof Tank , West Virginia

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight
Produced Water	All	60.00	60.00	60.00	60.00	0.3174	0.3174	0.3174	27.3860			18.75
Gasoline (RVP 12)						6.3542	6.3542	6.3542	64.0000	0.0500	0.4768	92.00
Water						0.2552	0.2552	0.2552	18.0000	0.9500	0.5232	18.00

Emissions Report for: Annual

AMS-Ridgeline CS 400 bbl Produced Water - Vertical Fixed Roof Tank , West Virginia

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Produced Water	147.77	0.00	147.77
Water	77.31	0.00	77.31
Gasoline (RVP 12)	70.46	0.00	70.46

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: D-2 - Ridgeline CF - 250 MMscfd w/Electric Pump
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\Ridgeline CF - 250 MMscfd (2MM) w.Electric Pump.ddf
Date: April 25, 2022

DESCRIPTION:

Description: 250 MMscfd (2 MMBtu/hr Regen), 80 oF, 1,000 psig; Ridgeline Extended Gas Analysis;
Elect Pump, 24 gpm Flash Tank, 110 oF, 60 psig;
Stripping gas @ 15 scfm
Emissions Controlled by Thermal Oxidizer

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 1000.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1530
Nitrogen	0.4250
Methane	81.1320
Ethane	12.7450
Propane	3.3880
Isobutane	0.4750
n-Butane	0.7340
Isopentane	0.2190
n-Pentane	0.1750
Cyclopentane	0.0210
n-Hexane	0.1000
Cyclohexane	0.0200
Other Hexanes	0.1840
Heptanes	0.1030
Methylcyclohexane	0.0310
Benzene	0.0030
Toluene	0.0060

```
                  Ethylbenzene      0.0010
                       Xylenes      0.0070
                   C8+ Heavies      0.0788


DRY GAS:
-------------------------------------------------------------------

                     Flow Rate:     250.0 MMSCF/day
                 Water Content:       7.0 lbs. H2O/MMSCF


LEAN GLYCOL:
-------------------------------------------------------------------

                   Glycol Type: TEG
                 Water Content:       1.5 wt% H2O
                     Flow Rate:      24.0 gpm


PUMP:
-------------------------------------------------------------------

              Glycol Pump Type: Electric/Pneumatic


FLASH TANK:
-------------------------------------------------------------------

                       Flash Control: Combustion device
            Flash Control Efficiency:  99.50 %
                   Temperature:     110.0 deg. F
                      Pressure:      60.0 psig


STRIPPING GAS:
-------------------------------------------------------------------

                 Source of Gas: Dry Gas
                 Gas Flow Rate:    15.000 scfm


REGENERATOR OVERHEADS CONTROL DEVICE:
-------------------------------------------------------------------
```

Control Device:	Combustion Device
Destruction Efficiency:	99.5 %
Excess Oxygen:	5.0 %
Ambient Air Temperature:	50.0 deg. F

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: D-2 - Ridgeline CF - 250 MMscfd w/Electric Pump
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\Ridgeline CF - 250 MMscfd (2MM) w.Electric Pump.ddf
Date: April 25, 2022

DESCRIPTION:

Description: 250 MMscfd (2 MMBtu/hr Regen), 80 oF, 1,000 psig; Ridgeline Extended Gas Analysis;
Elect Pump, 24 gpm Flash Tank, 110 oF, 60 psig;
Stripping gas @ 15 scfm
Emissions Controlled by Thermal Oxidizer

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1658	3.980	0.7263
Ethane	0.0770	1.848	0.3373
Propane	0.0511	1.227	0.2239
Isobutane	0.0139	0.334	0.0610
n-Butane	0.0302	0.724	0.1321
Isopentane	0.0113	0.271	0.0494
n-Pentane	0.0122	0.294	0.0536
Cyclopentane	0.0078	0.187	0.0341
n-Hexane	0.0146	0.350	0.0638
Cyclohexane	0.0152	0.366	0.0668
Other Hexanes	0.0196	0.471	0.0859
Heptanes	0.0332	0.796	0.1452
Methylcyclohexane	0.0284	0.682	0.1245
Benzene	0.0224	0.537	0.0979
Toluene	0.0722	1.733	0.3162
Ethylbenzene	0.0166	0.400	0.0729
Xylenes	0.1628	3.908	0.7132

Component	lbs/hr	lbs/day	tons/yr
C8+ Heavies	0.0709	1.702	0.3106
Total Emissions	0.8253	19.807	3.6147
Total Hydrocarbon Emissions	0.8253	19.807	3.6147
Total VOC Emissions	0.5824	13.979	2.5511
Total HAP Emissions	0.2886	6.926	1.2641
Total BTEX Emissions	0.2740	6.577	1.2002

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	33.1665	795.997	145.2694
Ethane	15.4012	369.629	67.4573
Propane	10.2241	245.379	44.7816
Isobutane	2.7838	66.812	12.1931
n-Butane	6.0302	144.725	26.4124
Isopentane	2.2556	54.135	9.8796
n-Pentane	2.4472	58.732	10.7186
Cyclopentane	1.5582	37.397	6.8249
n-Hexane	2.9147	69.954	12.7665
Cyclohexane	3.0486	73.166	13.3528
Other Hexanes	3.9236	94.167	17.1855
Heptanes	6.6308	159.140	29.0430
Methylcyclohexane	5.6838	136.411	24.8950
Benzene	4.4710	107.303	19.5828
Toluene	14.4396	346.551	63.2456
Ethylbenzene	3.3300	79.919	14.5853
Xylenes	32.5643	781.544	142.6319
C8+ Heavies	14.1830	340.392	62.1216
Total Emissions	165.0564	3961.353	722.9469
Total Hydrocarbon Emissions	165.0564	3961.353	722.9469
Total VOC Emissions	116.4886	2795.727	510.2202
Total HAP Emissions	57.7197	1385.272	252.8121
Total BTEX Emissions	54.8049	1315.318	240.0455

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr

Methane	0.1803	4.328	0.7898
Ethane	0.1339	3.213	0.5863
Propane	0.0622	1.493	0.2725
Isobutane	0.0126	0.303	0.0553
n-Butane	0.0222	0.534	0.0974
Isopentane	0.0070	0.169	0.0308
n-Pentane	0.0063	0.152	0.0277
Cyclopentane	0.0011	0.027	0.0050
n-Hexane	0.0042	0.102	0.0186
Cyclohexane	0.0012	0.028	0.0052
Other Hexanes	0.0074	0.178	0.0326
Heptanes	0.0047	0.112	0.0205
Methylcyclohexane	0.0017	0.040	0.0073
Benzene	0.0002	0.005	0.0010
Toluene	0.0004	0.011	0.0019
Ethylbenzene	0.0001	0.001	0.0002
Xylenes	0.0004	0.009	0.0016
C8+ Heavies	0.0009	0.021	0.0039
Total Emissions	0.4470	10.727	1.9577
Total Hydrocarbon Emissions	0.4470	10.727	1.9577
Total VOC Emissions	0.1328	3.187	0.5816
Total HAP Emissions	0.0053	0.128	0.0234
Total BTEX Emissions	0.0011	0.026	0.0048

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	36.0648	865.554	157.9637
Ethane	26.7720	642.527	117.2612
Propane	12.4446	298.671	54.5075
Isobutane	2.5246	60.591	11.0578
n-Butane	4.4491	106.777	19.4869
Isopentane	1.4070	33.767	6.1626
n-Pentane	1.2659	30.382	5.5447
Cyclopentane	0.2291	5.498	1.0035
n-Hexane	0.8481	20.354	3.7145
Cyclohexane	0.2367	5.681	1.0368
Other Hexanes	1.4873	35.695	6.5143
Heptanes	0.9349	22.438	4.0949
Methylcyclohexane	0.3332	7.996	1.4593

Benzene	0.0445	1.069	0.1950
Toluene	0.0885	2.124	0.3877
Ethylbenzene	0.0113	0.271	0.0495
Xylenes	0.0748	1.795	0.3276
C8+ Heavies	0.1779	4.269	0.7791
Total Emissions	89.3942	2145.460	391.5465
Total Hydrocarbon Emissions	89.3942	2145.460	391.5465
Total VOC Emissions	26.5574	637.379	116.3216
Total HAP Emissions	1.0672	25.613	4.6743
Total BTEX Emissions	0.2191	5.259	0.9598

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.3462	8.308	1.5162
Ethane	0.2109	5.061	0.9236
Propane	0.1133	2.720	0.4964
Isobutane	0.0265	0.637	0.1163
n-Butane	0.0524	1.258	0.2295
Isopentane	0.0183	0.440	0.0802
n-Pentane	0.0186	0.446	0.0813
Cyclopentane	0.0089	0.214	0.0391
n-Hexane	0.0188	0.452	0.0824
Cyclohexane	0.0164	0.394	0.0719
Other Hexanes	0.0271	0.649	0.1185
Heptanes	0.0378	0.908	0.1657
Methylcyclohexane	0.0301	0.722	0.1318
Benzene	0.0226	0.542	0.0989
Toluene	0.0726	1.743	0.3182
Ethylbenzene	0.0167	0.401	0.0732
Xylenes	0.1632	3.917	0.7148
C8+ Heavies	0.0718	1.723	0.3145
Total Emissions	1.2723	30.534	5.5725
Total Hydrocarbon Emissions	1.2723	30.534	5.5725
Total VOC Emissions	0.7152	17.166	3.1327
Total HAP Emissions	0.2939	7.054	1.2874
Total BTEX Emissions	0.2751	6.603	1.2050

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	303.2331	1.5162	99.50
Ethane	184.7185	0.9236	99.50
Propane	99.2892	0.4964	99.50
Isobutane	23.2509	0.1163	99.50
n-Butane	45.8992	0.2295	99.50
Isopentane	16.0422	0.0802	99.50
n-Pentane	16.2632	0.0813	99.50
Cyclopentane	7.8284	0.0391	99.50
n-Hexane	16.4811	0.0824	99.50
Cyclohexane	14.3896	0.0719	99.50
Other Hexanes	23.6999	0.1185	99.50
Heptanes	33.1379	0.1657	99.50
Methylcyclohexane	26.3543	0.1318	99.50
Benzene	19.7778	0.0989	99.50
Toluene	63.6333	0.3182	99.50
Ethylbenzene	14.6348	0.0732	99.50
Xylenes	142.9594	0.7148	99.50
C8+ Heavies	62.9006	0.3145	99.50
Total Emissions	1114.4934	5.5725	99.50
Total Hydrocarbon Emissions	1114.4934	5.5725	99.50
Total VOC Emissions	626.5418	3.1327	99.50
Total HAP Emissions	257.4864	1.2874	99.50
Total BTEX Emissions	241.0053	1.2050	99.50

EQUIPMENT REPORTS:

COMBUSTION DEVICE

Ambient Temperature: 50.00 deg. F
Excess Oxygen: 5.00 %

Combustion Efficiency: 99.50 %
Supplemental Fuel Requirement: 8.24e-001 MM BTU/hr

Component	Emitted	Destroyed
Methane	0.50%	99.50%
Ethane	0.50%	99.50%
Propane	0.50%	99.50%
Isobutane	0.50%	99.50%
n-Butane	0.50%	99.50%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
Cyclopentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	0.50%	99.50%
Other Hexanes	0.50%	99.50%
Heptanes	0.50%	99.50%
Methylcyclohexane	0.50%	99.50%
Benzene	0.50%	99.50%
Toluene	0.50%	99.50%
Ethylbenzene	0.50%	99.50%
Xylenes	0.50%	99.50%
C8+ Heavies	0.50%	99.50%

ABSORBER

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

Calculated Absorber Stages: 1.25
Calculated Dry Gas Dew Point: 1.77 lbs. H2O/MMSCF

Temperature: 80.0 deg. F
Pressure: 1000.0 psig
Dry Gas Flow Rate: 250.0000 MMSCF/day
Glycol Losses with Dry Gas: 2.7171 lb/hr
Wet Gas Water Content: Saturated
Calculated Wet Gas Water Content: 32.37 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio: 4.51 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol

Water	5.47%	94.53%
Carbon Dioxide	99.84%	0.16%
Nitrogen	99.99%	0.01%
Methane	99.99%	0.01%
Ethane	99.97%	0.03%
Propane	99.95%	0.05%
Isobutane	99.94%	0.06%
n-Butane	99.92%	0.08%
Isopentane	99.92%	0.08%
n-Pentane	99.90%	0.10%
Cyclopentane	99.57%	0.43%
n-Hexane	99.85%	0.15%
Cyclohexane	99.30%	0.70%
Other Hexanes	99.88%	0.12%
Heptanes	99.74%	0.26%
Methylcyclohexane	99.29%	0.71%
Benzene	92.99%	7.01%
Toluene	90.44%	9.56%
Ethylbenzene	88.54%	11.46%
Xylenes	84.01%	15.99%
C8+ Heavies	99.62%	0.38%

FLASH TANK

Flash Control: Combustion device
Flash Control Efficiency: 99.50 %
Flash Temperature: 110.0 deg. F
Flash Pressure: 60.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.98%	0.02%
Carbon Dioxide	46.17%	53.83%
Nitrogen	5.78%	94.22%
Methane	5.99%	94.01%
Ethane	19.08%	80.92%
Propane	34.93%	65.07%
Isobutane	45.75%	54.25%
n-Butane	53.01%	46.99%
Isopentane	57.42%	42.58%

n-Pentane	63.10%	36.90%
Cyclopentane	86.99%	13.01%
n-Hexane	76.29%	23.71%
Cyclohexane	92.94%	7.06%
Other Hexanes	70.76%	29.24%
Heptanes	87.29%	12.71%
Methylcyclohexane	94.62%	5.38%
Benzene	99.06%	0.94%
Toluene	99.44%	0.56%
Ethylbenzene	99.70%	0.30%
Xylenes	99.80%	0.20%
C8+ Heavies	98.89%	1.11%

REGENERATOR

Regenerator Stripping Gas:
Dry Product Gas
Stripping Gas Flow Rate: 15.0000 scfm

Component	Remaining in Glycol	Distilled Overhead
Water	38.84%	61.16%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.87%	99.13%
n-Pentane	0.79%	99.21%
Cyclopentane	0.57%	99.43%
n-Hexane	0.66%	99.34%
Cyclohexane	3.44%	96.56%
Other Hexanes	1.41%	98.59%
Heptanes	0.57%	99.43%
Methylcyclohexane	4.23%	95.77%
Benzene	5.05%	94.95%
Toluene	7.95%	92.05%
Ethylbenzene	10.44%	89.56%

Xylenes	12.96%	87.04%
C8+ Heavies	12.16%	87.84%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.04e+007 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.82e-002	3.37e+002
Carbon Dioxide	1.53e-001	1.85e+003
Nitrogen	4.25e-001	3.27e+003
Methane	8.11e+001	3.57e+005
Ethane	1.27e+001	1.05e+005
Propane	3.39e+000	4.10e+004
Isobutane	4.75e-001	7.58e+003
n-Butane	7.33e-001	1.17e+004
Isopentane	2.19e-001	4.34e+003
n-Pentane	1.75e-001	3.47e+003
Cyclopentane	2.10e-002	4.04e+002
n-Hexane	9.99e-002	2.37e+003
Cyclohexane	2.00e-002	4.62e+002
Other Hexanes	1.84e-001	4.35e+003
Heptanes	1.03e-001	2.83e+003
Methylcyclohexane	3.10e-002	8.36e+002
Benzene	3.00e-003	6.43e+001
Toluene	6.00e-003	1.52e+002
Ethylbenzene	9.99e-004	2.92e+001
Xylenes	7.00e-003	2.04e+002
C8+ Heavies	7.87e-002	3.69e+003
Total Components	100.00	5.52e+005

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 1.04e+007 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.73e-003	1.84e+001
Carbon Dioxide	1.53e-001	1.85e+003
Nitrogen	4.25e-001	3.27e+003
Methane	8.11e+001	3.57e+005
Ethane	1.27e+001	1.05e+005
Propane	3.39e+000	4.10e+004
Isobutane	4.75e-001	7.58e+003
n-Butane	7.34e-001	1.17e+004
Isopentane	2.19e-001	4.34e+003
n-Pentane	1.75e-001	3.46e+003
Cyclopentane	2.09e-002	4.03e+002
n-Hexane	9.99e-002	2.36e+003
Cyclohexane	1.99e-002	4.59e+002
Other Hexanes	1.84e-001	4.35e+003
Heptanes	1.03e-001	2.83e+003
Methylcyclohexane	3.08e-002	8.30e+002
Benzene	2.79e-003	5.98e+001
Toluene	5.43e-003	1.37e+002
Ethylbenzene	8.86e-004	2.58e+001
Xylenes	5.88e-003	1.71e+002
C8+ Heavies	7.85e-002	3.67e+003
Total Components	100.00	5.51e+005

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 2.40e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.33e+004
Water	1.50e+000	2.03e+002

Carbon Dioxide	2.13e-012	2.87e-010
Nitrogen	3.10e-013	4.18e-011
Methane	9.55e-018	1.29e-015
Ethane	1.16e-007	1.56e-005
Propane	5.77e-009	7.78e-007
Isobutane	1.03e-009	1.40e-007
n-Butane	1.74e-009	2.35e-007
Isopentane	1.22e-004	1.65e-002
n-Pentane	1.27e-004	1.72e-002
Cyclopentane	6.52e-005	8.81e-003
n-Hexane	1.32e-004	1.79e-002
Cyclohexane	7.95e-004	1.07e-001
Other Hexanes	3.77e-004	5.09e-002
Heptanes	2.73e-004	3.68e-002
Methylcyclohexane	1.84e-003	2.48e-001
Benzene	1.76e-003	2.37e-001
Toluene	9.23e-003	1.25e+000
Ethylbenzene	2.88e-003	3.88e-001
Xylenes	3.59e-002	4.85e+000
C8+ Heavies	1.42e-002	1.92e+000
Total Components	100.00	1.35e+004

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 2.51e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.47e+001	1.33e+004
Water	3.72e+000	5.22e+002
Carbon Dioxide	2.05e-002	2.87e+000
Nitrogen	2.98e-003	4.18e-001
Methane	2.74e-001	3.84e+001
Ethane	2.36e-001	3.31e+001
Propane	1.36e-001	1.91e+001
Isobutane	3.32e-002	4.65e+000
n-Butane	6.75e-002	9.47e+000
Isopentane	2.36e-002	3.30e+000

n-Pentane	2.45e-002	3.43e+000
Cyclopentane	1.26e-002	1.76e+000
n-Hexane	2.55e-002	3.58e+000
Cyclohexane	2.39e-002	3.35e+000
Other Hexanes	3.63e-002	5.09e+000
Heptanes	5.25e-002	7.36e+000
Methylcyclohexane	4.42e-002	6.19e+000
Benzene	3.38e-002	4.75e+000
Toluene	1.12e-001	1.58e+001
Ethylbenzene	2.66e-002	3.73e+000
Xylenes	2.67e-001	3.75e+001
C8+ Heavies	1.14e-001	1.60e+001
Total Components	100.00	1.40e+004

FLASH TANK OFF GAS STREAM

Temperature: 110.00 deg. F
Pressure: 74.70 psia
Flow Rate: 1.40e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.52e-001	1.01e-001
Carbon Dioxide	9.55e-001	1.55e+000
Nitrogen	3.82e-001	3.94e-001
Methane	6.11e+001	3.61e+001
Ethane	2.42e+001	2.68e+001
Propane	7.66e+000	1.24e+001
Isobutane	1.18e+000	2.52e+000
n-Butane	2.08e+000	4.45e+000
Isopentane	5.30e-001	1.41e+000
n-Pentane	4.77e-001	1.27e+000
Cyclopentane	8.87e-002	2.29e-001
n-Hexane	2.67e-001	8.48e-001
Cyclohexane	7.64e-002	2.37e-001
Other Hexanes	4.69e-001	1.49e+000
Heptanes	2.53e-001	9.35e-001
Methylcyclohexane	9.22e-002	3.33e-001
Benzene	1.55e-002	4.45e-002
Toluene	2.61e-002	8.85e-002

Ethylbenzene	2.89e-003	1.13e-002
Xylenes	1.91e-002	7.48e-002
C8+ Heavies	2.84e-002	1.78e-001
Total Components	100.00	9.14e+001

FLASH TANK GLYCOL STREAM

Temperature: 110.00 deg. F
Flow Rate: 2.49e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.53e+001	1.33e+004
Water	3.74e+000	5.21e+002
Carbon Dioxide	9.52e-003	1.33e+000
Nitrogen	1.73e-004	2.42e-002
Methane	1.65e-002	2.30e+000
Ethane	4.53e-002	6.31e+000
Propane	4.79e-002	6.68e+000
Isobutane	1.53e-002	2.13e+000
n-Butane	3.60e-002	5.02e+000
Isopentane	1.36e-002	1.90e+000
n-Pentane	1.55e-002	2.17e+000
Cyclopentane	1.10e-002	1.53e+000
n-Hexane	1.96e-002	2.73e+000
Cyclohexane	2.24e-002	3.12e+000
Other Hexanes	2.58e-002	3.60e+000
Heptanes	4.61e-002	6.42e+000
Methylcyclohexane	4.21e-002	5.86e+000
Benzene	3.38e-002	4.70e+000
Toluene	1.12e-001	1.57e+001
Ethylbenzene	2.67e-002	3.72e+000
Xylenes	2.68e-001	3.74e+001
C8+ Heavies	1.13e-001	1.58e+001
Total Components	100.00	1.39e+004

FLASH GAS EMISSIONS

Flow Rate: 5.81e+003 scfh
Control Method: Combustion Device
Control Efficiency: 99.50

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.15e+001	1.70e+002
Carbon Dioxide	3.83e+001	2.58e+002
Nitrogen	9.18e-002	3.94e-001
Methane	7.34e-002	1.80e-001
Ethane	2.91e-002	1.34e-001
Propane	9.21e-003	6.22e-002
Isobutane	1.42e-003	1.26e-002
n-Butane	2.50e-003	2.22e-002
Isopentane	6.37e-004	7.03e-003
n-Pentane	5.73e-004	6.33e-003
Cyclopentane	1.07e-004	1.15e-003
n-Hexane	3.21e-004	4.24e-003
Cyclohexane	9.18e-005	1.18e-003
Other Hexanes	5.63e-004	7.44e-003
Heptanes	3.05e-004	4.67e-003
Methylcyclohexane	1.11e-004	1.67e-003
Benzene	1.86e-005	2.23e-004
Toluene	3.14e-005	4.43e-004
Ethylbenzene	3.48e-006	5.65e-005
Xylenes	2.30e-005	3.74e-004
C8+ Heavies	3.41e-005	8.89e-004
Total Components	100.00	4.28e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 8.23e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.17e+001	3.19e+002
Carbon Dioxide	1.56e-001	1.49e+000
Nitrogen	5.05e-002	3.07e-001
Methane	9.54e+000	3.32e+001

Ethane	2.36e+000	1.54e+001
Propane	1.07e+000	1.02e+001
Isobutane	2.21e-001	2.78e+000
n-Butane	4.79e-001	6.03e+000
Isopentane	1.44e-001	2.26e+000
n-Pentane	1.56e-001	2.45e+000
Cyclopentane	1.02e-001	1.56e+000
n-Hexane	1.56e-001	2.91e+000
Cyclohexane	1.67e-001	3.05e+000
Other Hexanes	2.10e-001	3.92e+000
Heptanes	3.05e-001	6.63e+000
Methylcyclohexane	2.67e-001	5.68e+000
Benzene	2.64e-001	4.47e+000
Toluene	7.23e-001	1.44e+001
Ethylbenzene	1.45e-001	3.33e+000
Xylenes	1.41e+000	3.26e+001
C8+ Heavies	3.84e-001	1.42e+001
Total Components	100.00	4.86e+002

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
Pressure: 14.70 psia
Flow Rate: 7.45e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	5.27e+001	1.66e-001
Ethane	1.30e+001	7.70e-002
Propane	5.91e+000	5.11e-002
Isobutane	1.22e+000	1.39e-002
n-Butane	2.64e+000	3.02e-002
Isopentane	7.96e-001	1.13e-002
n-Pentane	8.64e-001	1.22e-002
Cyclopentane	5.66e-001	7.79e-003
n-Hexane	8.62e-001	1.46e-002
Cyclohexane	9.23e-001	1.52e-002
Other Hexanes	1.16e+000	1.96e-002
Heptanes	1.69e+000	3.32e-002
Methylcyclohexane	1.47e+000	2.84e-002

Benzene	1.46e+000	2.24e-002
Toluene	3.99e+000	7.22e-002
Ethylbenzene	7.99e-001	1.66e-002
Xylenes	7.81e+000	1.63e-001
C8+ Heavies	2.12e+000	7.09e-002
Total Components	100.00	8.25e-001

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: S4 - Ridgeline CS-DFT02-DSV02-042722
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\RLCS-45CSR13 Permit Application-160 MMscfd-GRIGlyCalc-042722.ddf
Date: April 27, 2022

DESCRIPTION:

Description: 80 oF, 1,000 psig;
Ridgeline Extended Gas Analysis;
Elect Pump, 24.6 gpm
Flash Tank, 110 oF, 50 psig;
Emissions Controlled by 99.5% TOx

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 1000.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1530
Nitrogen	0.4250
Methane	81.1320
Ethane	12.7450
Propane	3.3880
Isobutane	0.4750
n-Butane	0.7340
Isopentane	0.2190
n-Pentane	0.1750
Cyclopentane	0.0210
n-Hexane	0.1000
Cyclohexane	0.0200
Other Hexanes	0.1840
Heptanes	0.1030
Methylcyclohexane	0.0310
Benzene	0.0030
Toluene	0.0060
Ethylbenzene	0.0010

Xylenes 0.0070
C8+ Heavies 0.0788

DRY GAS:

Flow Rate: 160.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Flow Rate: 24.6 gpm

PUMP:

Glycol Pump Type: Electric/Pneumatic

FLASH TANK:

Flash Control: Combustion device
Flash Control Efficiency: 99.50 %
Temperature: 110.0 deg. F
Pressure: 50.0 psig

REGENERATOR OVERHEADS CONTROL DEVICE:

Control Device: Combustion Device
Destruction Efficiency: 99.5 %
Excess Oxygen: 5.0 %
Ambient Air Temperature: 50.0 deg. F

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: S4 - Ridgeline CS-DFT02-DSV02-042722
File Name: D:\Projects2\wfs\AMS\Ridgeline\R13 Application #2\RLCS-45CSR13 Permit Application-160 MMscfd-GRIGlyCalc-042722.ddf
Date: April 27, 2022

DESCRIPTION:

Description: 80 oF, 1,000 psig;
Ridgeline Extended Gas Analysis;
Elect Pump, 24.6 gpm
Flash Tank, 110 oF, 50 psig;
Emissions Controlled by 99.5% TOx

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0103	0.246	0.0449
Ethane	0.0295	0.708	0.1292
Propane	0.0308	0.740	0.1351
Isobutane	0.0101	0.242	0.0442
n-Butane	0.0241	0.577	0.1054
Isopentane	0.0091	0.219	0.0400
n-Pentane	0.0105	0.253	0.0461
Cyclopentane	0.0079	0.189	0.0345
n-Hexane	0.0136	0.328	0.0598
Cyclohexane	0.0157	0.377	0.0687
Other Hexanes	0.0177	0.425	0.0776
Heptanes	0.0329	0.790	0.1442
Methylcyclohexane	0.0294	0.705	0.1286
Benzene	0.0225	0.539	0.0984
Toluene	0.0720	1.728	0.3154
Ethylbenzene	0.0165	0.396	0.0723
Xylenes	0.1570	3.767	0.6875
C8+ Heavies	0.0733	1.759	0.3210

Total Emissions	0.5828	13.988	2.5528
Total Hydrocarbon Emissions	0.5828	13.988	2.5528
Total VOC Emissions	0.5431	13.034	2.3787
Total HAP Emissions	0.2816	6.758	1.2333
Total BTEX Emissions	0.2679	6.430	1.1736

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	2.0508	49.219	8.9824
Ethane	5.8975	141.541	25.8313
Propane	6.1695	148.069	27.0226
Isobutane	2.0188	48.450	8.8422
n-Butane	4.8117	115.482	21.0754
Isopentane	1.8267	43.842	8.0011
n-Pentane	2.1051	50.521	9.2202
Cyclopentane	1.5767	37.840	6.9059
n-Hexane	2.7293	65.503	11.9544
Cyclohexane	3.1391	75.338	13.7492
Other Hexanes	3.5428	85.027	15.5174
Heptanes	6.5837	158.008	28.8365
Methylcyclohexane	5.8730	140.952	25.7238
Benzene	4.4948	107.876	19.6873
Toluene	14.4003	345.607	63.0733
Ethylbenzene	3.2994	79.185	14.4513
Xylenes	31.3923	753.414	137.4981
C8+ Heavies	14.6553	351.727	64.1903
Total Emissions	116.5668	2797.603	510.5626
Total Hydrocarbon Emissions	116.5668	2797.603	510.5626
Total VOC Emissions	108.6185	2606.843	475.7489
Total HAP Emissions	56.3161	1351.586	246.6644
Total BTEX Emissions	53.5868	1286.082	234.7100

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1894	4.546	0.8296

Ethane	0.1437	3.448	0.6293
Propane	0.0679	1.629	0.2972
Isobutane	0.0140	0.336	0.0613
n-Butane	0.0249	0.599	0.1092
Isopentane	0.0079	0.190	0.0347
n-Pentane	0.0072	0.173	0.0315
Cyclopentane	0.0013	0.032	0.0059
n-Hexane	0.0049	0.117	0.0214
Cyclohexane	0.0014	0.033	0.0061
Other Hexanes	0.0085	0.204	0.0373
Heptanes	0.0054	0.131	0.0238
Methylcyclohexane	0.0019	0.047	0.0085
Benzene	0.0003	0.006	0.0011
Toluene	0.0005	0.012	0.0022
Ethylbenzene	0.0001	0.002	0.0003
Xylenes	0.0004	0.010	0.0018
C8+ Heavies	0.0010	0.024	0.0045
Total Emissions	0.4808	11.539	2.1058
Total Hydrocarbon Emissions	0.4808	11.539	2.1058
Total VOC Emissions	0.1477	3.545	0.6469
Total HAP Emissions	0.0061	0.147	0.0269
Total BTEX Emissions	0.0012	0.030	0.0054

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	37.8823	909.175	165.9244
Ethane	28.7348	689.635	125.8585
Propane	13.5712	325.708	59.4417
Isobutane	2.8001	67.202	12.2643
n-Butane	4.9880	119.713	21.8475
Isopentane	1.5861	38.066	6.9471
n-Pentane	1.4387	34.529	6.3016
Cyclopentane	0.2672	6.413	1.1704
n-Hexane	0.9789	23.493	4.2874
Cyclohexane	0.2764	6.633	1.2106
Other Hexanes	1.7042	40.900	7.4642
Heptanes	1.0883	26.118	4.7665
Methylcyclohexane	0.3884	9.321	1.7011
Benzene	0.0519	1.246	0.2273

Toluene	0.1011	2.428	0.4430
Ethylbenzene	0.0127	0.305	0.0556
Xylenes	0.0824	1.979	0.3611
C8+ Heavies	0.2034	4.881	0.8907
Total Emissions	96.1560	2307.743	421.1632
Total Hydrocarbon Emissions	96.1560	2307.743	421.1632
Total VOC Emissions	29.5389	708.933	129.3803
Total HAP Emissions	1.2270	29.449	5.3744
Total BTEX Emissions	0.2482	5.956	1.0870

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.1997	4.792	0.8745
Ethane	0.1732	4.156	0.7584
Propane	0.0987	2.369	0.4323
Isobutane	0.0241	0.578	0.1055
n-Butane	0.0490	1.176	0.2146
Isopentane	0.0171	0.410	0.0747
n-Pentane	0.0177	0.425	0.0776
Cyclopentane	0.0092	0.221	0.0404
n-Hexane	0.0185	0.445	0.0812
Cyclohexane	0.0171	0.410	0.0748
Other Hexanes	0.0262	0.630	0.1149
Heptanes	0.0384	0.921	0.1680
Methylcyclohexane	0.0313	0.751	0.1371
Benzene	0.0227	0.546	0.0996
Toluene	0.0725	1.740	0.3176
Ethylbenzene	0.0166	0.397	0.0725
Xylenes	0.1574	3.777	0.6893
C8+ Heavies	0.0743	1.783	0.3254
Total Emissions	1.0636	25.527	4.6586
Total Hydrocarbon Emissions	1.0636	25.527	4.6586
Total VOC Emissions	0.6908	16.579	3.0256
Total HAP Emissions	0.2877	6.905	1.2602
Total BTEX Emissions	0.2692	6.460	1.1790

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	174.9068	0.8745	99.50
Ethane	151.6897	0.7584	99.50
Propane	86.4643	0.4323	99.50
Isobutane	21.1065	0.1055	99.50
n-Butane	42.9230	0.2146	99.50
Isopentane	14.9482	0.0747	99.50
n-Pentane	15.5218	0.0776	99.50
Cyclopentane	8.0763	0.0404	99.50
n-Hexane	16.2418	0.0812	99.50
Cyclohexane	14.9598	0.0748	99.50
Other Hexanes	22.9817	0.1149	99.50
Heptanes	33.6031	0.1680	99.50
Methylcyclohexane	27.4249	0.1371	99.50
Benzene	19.9146	0.0996	99.50
Toluene	63.5164	0.3176	99.50
Ethylbenzene	14.5069	0.0725	99.50
Xylenes	137.8592	0.6893	99.50
C8+ Heavies	65.0810	0.3254	99.50
Total Emissions	931.7258	4.6586	99.50
Total Hydrocarbon Emissions	931.7258	4.6586	99.50
Total VOC Emissions	605.1292	3.0256	99.50
Total HAP Emissions	252.0389	1.2602	99.50
Total BTEX Emissions	235.7971	1.1790	99.50

EQUIPMENT REPORTS:

COMBUSTION DEVICE

Ambient Temperature:	50.00 deg. F
Excess Oxygen:	5.00 %
Combustion Efficiency:	99.50 %

Supplemental Fuel Requirement: 5.52e-001 MM BTU/hr

Component	Emitted	Destroyed
Methane	0.50%	99.50%
Ethane	0.50%	99.50%
Propane	0.50%	99.50%
Isobutane	0.50%	99.50%
n-Butane	0.50%	99.50%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
Cyclopentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	0.50%	99.50%
Other Hexanes	0.50%	99.50%
Heptanes	0.50%	99.50%
Methylcyclohexane	0.50%	99.50%
Benzene	0.50%	99.50%
Toluene	0.50%	99.50%
Ethylbenzene	0.50%	99.50%
Xylenes	0.50%	99.50%
C8+ Heavies	0.50%	99.50%

ABSORBER

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

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	1.44 lbs. H2O/MMSCF
Temperature:	80.0 deg. F
Pressure:	1000.0 psig
Dry Gas Flow Rate:	160.0000 MMSCF/day
Glycol Losses with Dry Gas:	1.7380 lb/hr
Wet Gas Water Content:	Saturated
Calculated Wet Gas Water Content:	32.37 lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	7.15 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol

Water	4.44%	95.56%
Carbon Dioxide	99.75%	0.25%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.95%	0.05%
Propane	99.92%	0.08%
Isobutane	99.90%	0.10%
n-Butane	99.87%	0.13%
Isopentane	99.88%	0.12%
n-Pentane	99.84%	0.16%
Cyclopentane	99.29%	0.71%
n-Hexane	99.76%	0.24%
Cyclohexane	98.85%	1.15%
Other Hexanes	99.81%	0.19%
Heptanes	99.58%	0.42%
Methylcyclohexane	98.83%	1.17%
Benzene	88.96%	11.04%
Toluene	85.07%	14.93%
Ethylbenzene	82.25%	17.75%
Xylenes	75.90%	24.10%
C8+ Heavies	99.37%	0.63%

FLASH TANK

Flash Control: Combustion device
Flash Control Efficiency: 99.50 %
Flash Temperature: 110.0 deg. F
Flash Pressure: 50.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.98%	0.02%
Carbon Dioxide	42.02%	57.98%
Nitrogen	4.99%	95.01%
Methane	5.14%	94.86%
Ethane	17.03%	82.97%
Propane	31.25%	68.75%
Isobutane	41.89%	58.11%
n-Butane	49.10%	50.90%
Isopentane	53.76%	46.24%
n-Pentane	59.60%	40.40%

Cyclopentane	85.58%	14.42%
n-Hexane	73.73%	26.27%
Cyclohexane	92.17%	7.83%
Other Hexanes	67.85%	32.15%
Heptanes	85.89%	14.11%
Methylcyclohexane	94.05%	5.95%
Benzene	98.92%	1.08%
Toluene	99.36%	0.64%
Ethylbenzene	99.66%	0.34%
Xylenes	99.77%	0.23%
C8+ Heavies	98.80%	1.20%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	50.16%	49.84%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.93%	99.07%
n-Pentane	0.84%	99.16%
Cyclopentane	0.58%	99.42%
n-Hexane	0.68%	99.32%
Cyclohexane	3.47%	96.53%
Other Hexanes	1.47%	98.53%
Heptanes	0.58%	99.42%
Methylcyclohexane	4.25%	95.75%
Benzene	5.05%	94.95%
Toluene	7.95%	92.05%
Ethylbenzene	10.44%	89.56%
Xylenes	12.95%	87.05%
C8+ Heavies	12.16%	87.84%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 6.67e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.82e-002	2.16e+002
Carbon Dioxide	1.53e-001	1.18e+003
Nitrogen	4.25e-001	2.09e+003
Methane	8.11e+001	2.29e+005
Ethane	1.27e+001	6.74e+004
Propane	3.39e+000	2.63e+004
Isobutane	4.75e-001	4.85e+003
n-Butane	7.33e-001	7.50e+003
Isopentane	2.19e-001	2.78e+003
n-Pentane	1.75e-001	2.22e+003
Cyclopentane	2.10e-002	2.59e+002
n-Hexane	9.99e-002	1.51e+003
Cyclohexane	2.00e-002	2.96e+002
Other Hexanes	1.84e-001	2.79e+003
Heptanes	1.03e-001	1.81e+003
Methylcyclohexane	3.10e-002	5.35e+002
Benzene	3.00e-003	4.12e+001
Toluene	6.00e-003	9.72e+001
Ethylbenzene	9.99e-004	1.87e+001
Xylenes	7.00e-003	1.31e+002
C8+ Heavies	7.87e-002	2.36e+003
Total Components	100.00	3.53e+005

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 6.67e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	3.03e-003	9.60e+000
Carbon Dioxide	1.53e-001	1.18e+003
Nitrogen	4.25e-001	2.09e+003
Methane	8.11e+001	2.29e+005
Ethane	1.27e+001	6.73e+004
Propane	3.39e+000	2.62e+004
Isobutane	4.75e-001	4.85e+003
n-Butane	7.33e-001	7.49e+003
Isopentane	2.19e-001	2.77e+003
n-Pentane	1.75e-001	2.22e+003
Cyclopentane	2.09e-002	2.57e+002
n-Hexane	9.98e-002	1.51e+003
Cyclohexane	1.98e-002	2.92e+002
Other Hexanes	1.84e-001	2.78e+003
Heptanes	1.03e-001	1.81e+003
Methylcyclohexane	3.06e-002	5.29e+002
Benzene	2.67e-003	3.66e+001
Toluene	5.11e-003	8.27e+001
Ethylbenzene	8.23e-004	1.53e+001
Xylenes	5.31e-003	9.91e+001
C8+ Heavies	7.83e-002	2.34e+003
Total Components	100.00	3.53e+005

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 2.46e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.36e+004
Water	1.50e+000	2.08e+002
Carbon Dioxide	2.14e-012	2.96e-010
Nitrogen	3.15e-013	4.36e-011
Methane	9.70e-018	1.34e-015

Ethane	1.18e-007	1.63e-005
Propane	5.81e-009	8.03e-007
Isobutane	1.04e-009	1.45e-007
n-Butane	1.76e-009	2.43e-007
Isopentane	1.24e-004	1.71e-002
n-Pentane	1.29e-004	1.78e-002
Cyclopentane	6.70e-005	9.26e-003
n-Hexane	1.35e-004	1.86e-002
Cyclohexane	8.16e-004	1.13e-001
Other Hexanes	3.83e-004	5.30e-002
Heptanes	2.79e-004	3.85e-002
Methylcyclohexane	1.89e-003	2.61e-001
Benzene	1.73e-003	2.39e-001
Toluene	8.99e-003	1.24e+000
Ethylbenzene	2.78e-003	3.85e-001
Xylenes	3.38e-002	4.67e+000
C8+ Heavies	1.47e-002	2.03e+000
Total Components	100.00	1.38e+004

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 1014.70 psia
Flow Rate: 2.55e+001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.55e+001	1.36e+004
Water	2.90e+000	4.14e+002
Carbon Dioxide	2.08e-002	2.96e+000
Nitrogen	3.06e-003	4.37e-001
Methane	2.80e-001	3.99e+001
Ethane	2.43e-001	3.46e+001
Propane	1.38e-001	1.97e+001
Isobutane	3.38e-002	4.82e+000
n-Butane	6.87e-002	9.80e+000
Isopentane	2.41e-002	3.43e+000
n-Pentane	2.50e-002	3.56e+000
Cyclopentane	1.30e-002	1.85e+000

n-Hexane	2.61e-002	3.73e+000
Cyclohexane	2.47e-002	3.53e+000
Other Hexanes	3.72e-002	5.30e+000
Heptanes	5.41e-002	7.71e+000
Methylcyclohexane	4.57e-002	6.52e+000
Benzene	3.36e-002	4.79e+000
Toluene	1.10e-001	1.57e+001
Ethylbenzene	2.59e-002	3.70e+000
Xylenes	2.54e-001	3.61e+001
C8+ Heavies	1.18e-001	1.69e+001
Total Components	100.00	1.43e+004

FLASH TANK OFF GAS STREAM

Temperature: 110.00 deg. F
Pressure: 64.70 psia
Flow Rate: 1.49e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.35e-001	9.53e-002
Carbon Dioxide	9.96e-001	1.72e+000
Nitrogen	3.78e-001	4.15e-001
Methane	6.03e+001	3.79e+001
Ethane	2.44e+001	2.87e+001
Propane	7.86e+000	1.36e+001
Isobutane	1.23e+000	2.80e+000
n-Butane	2.19e+000	4.99e+000
Isopentane	5.61e-001	1.59e+000
n-Pentane	5.09e-001	1.44e+000
Cyclopentane	9.73e-002	2.67e-001
n-Hexane	2.90e-001	9.79e-001
Cyclohexane	8.38e-002	2.76e-001
Other Hexanes	5.05e-001	1.70e+000
Heptanes	2.77e-001	1.09e+000
Methylcyclohexane	1.01e-001	3.88e-001
Benzene	1.70e-002	5.19e-002
Toluene	2.80e-002	1.01e-001
Ethylbenzene	3.05e-003	1.27e-002
Xylenes	1.98e-002	8.24e-002

C8+ Heavies	3.05e-002	2.03e-001
Total Components	100.00	9.84e+001

FLASH TANK GLYCOL STREAM

Temperature: 110.00 deg. F
Flow Rate: 2.52e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.62e+001	1.36e+004
Water	2.92e+000	4.14e+002
Carbon Dioxide	8.79e-003	1.24e+000
Nitrogen	1.54e-004	2.18e-002
Methane	1.45e-002	2.05e+000
Ethane	4.17e-002	5.90e+000
Propane	4.36e-002	6.17e+000
Isobutane	1.43e-002	2.02e+000
n-Butane	3.40e-002	4.81e+000
Isopentane	1.30e-002	1.84e+000
n-Pentane	1.50e-002	2.12e+000
Cyclopentane	1.12e-002	1.59e+000
n-Hexane	1.94e-002	2.75e+000
Cyclohexane	2.30e-002	3.25e+000
Other Hexanes	2.54e-002	3.60e+000
Heptanes	4.68e-002	6.62e+000
Methylcyclohexane	4.33e-002	6.13e+000
Benzene	3.34e-002	4.73e+000
Toluene	1.10e-001	1.56e+001
Ethylbenzene	2.60e-002	3.68e+000
Xylenes	2.55e-001	3.61e+001
C8+ Heavies	1.18e-001	1.67e+001
Total Components	100.00	1.42e+004

FLASH GAS EMISSIONS

Flow Rate: 6.24e+003 scfh
Control Method: Combustion Device
Control Efficiency: 99.50

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.14e+001	1.82e+002
Carbon Dioxide	3.84e+001	2.78e+002
Nitrogen	9.01e-002	4.15e-001
Methane	7.18e-002	1.89e-001
Ethane	2.91e-002	1.44e-001
Propane	9.36e-003	6.79e-002
Isobutane	1.47e-003	1.40e-002
n-Butane	2.61e-003	2.49e-002
Isopentane	6.69e-004	7.93e-003
n-Pentane	6.06e-004	7.19e-003
Cyclopentane	1.16e-004	1.34e-003
n-Hexane	3.45e-004	4.89e-003
Cyclohexane	9.99e-005	1.38e-003
Other Hexanes	6.01e-004	8.52e-003
Heptanes	3.30e-004	5.44e-003
Methylcyclohexane	1.20e-004	1.94e-003
Benzene	2.02e-005	2.60e-004
Toluene	3.34e-005	5.06e-004
Ethylbenzene	3.63e-006	6.34e-005
Xylenes	2.36e-005	4.12e-004
C8+ Heavies	3.63e-005	1.02e-003
Total Components	100.00	4.60e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 4.93e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.81e+001	2.06e+002
Carbon Dioxide	2.18e-001	1.24e+000
Nitrogen	5.99e-003	2.18e-002
Methane	9.83e-001	2.05e+000
Ethane	1.51e+000	5.90e+000
Propane	1.08e+000	6.17e+000

Isobutane	2.67e-001	2.02e+000
n-Butane	6.37e-001	4.81e+000
Isopentane	1.95e-001	1.83e+000
n-Pentane	2.24e-001	2.11e+000
Cyclopentane	1.73e-001	1.58e+000
n-Hexane	2.44e-001	2.73e+000
Cyclohexane	2.87e-001	3.14e+000
Other Hexanes	3.16e-001	3.54e+000
Heptanes	5.05e-001	6.58e+000
Methylcyclohexane	4.60e-001	5.87e+000
Benzene	4.42e-001	4.49e+000
Toluene	1.20e+000	1.44e+001
Ethylbenzene	2.39e-001	3.30e+000
Xylenes	2.27e+000	3.14e+001
C8+ Heavies	6.62e-001	1.47e+001
Total Components	100.00	3.24e+002

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
Pressure: 14.70 psia
Flow Rate: 2.88e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	8.41e+000	1.03e-002
Ethane	1.29e+001	2.95e-002
Propane	9.20e+000	3.08e-002
Isobutane	2.28e+000	1.01e-002
n-Butane	5.44e+000	2.41e-002
Isopentane	1.67e+000	9.13e-003
n-Pentane	1.92e+000	1.05e-002
Cyclopentane	1.48e+000	7.88e-003
n-Hexane	2.08e+000	1.36e-002
Cyclohexane	2.45e+000	1.57e-002
Other Hexanes	2.70e+000	1.77e-002
Heptanes	4.32e+000	3.29e-002
Methylcyclohexane	3.93e+000	2.94e-002
Benzene	3.78e+000	2.25e-002
Toluene	1.03e+001	7.20e-002

Ethylbenzene	2.04e+000	1.65e-002
Xylenes	1.94e+001	1.57e-001
C8+ Heavies	5.66e+000	7.33e-002
Total Components	100.00	5.83e-001

****** End of Application for 45CSR30 Title V Operating Permit ******