SWN Production Company, LLC
P O Box 12359
Spring, Texas 77391-2359
www.swn.com

MICHAEL DUNN PAD

CLASS I ADMINISTRATIVE UPDATE

REV	BY	DATE	DESCRIPTION	FACILITIES REVIEWED	DATE
1	TL	10/19/2016	G70-C219	NA	NA
2	CM	3/29/2017	CLASS I AU: REV: DEHY THROUGHPUT - 20MMSCFD	JPH	3/29/2017

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this G70-D General Permit application for the Michael Dunn Pad, a natural gas production facility in Marshall County. The facility currently operates under Permit No. G70-C219, issued on October 19, 2016. With this application, SWN requests authorization to operate under the General Permit G70-D for Oil and Natural Gas Production Facilities. The changes are summarized below:

- The throughput of the Triethylene Glycol (TEG) Dehydration Unit has been increased from 15.0-MMSCFD to 20.0-MMSCFD
- The safety factor added to the TEG Dehydration Unit criteria and HAP emissions has been decreased from 20% to 15%
- Vapor combustor emissions have been revised based on the change in dehydration unit throughput.

No changes were made to the emission estimates for the existing engines, GPU burners, heater treater, reboiler, tanks, loading, vapor combustor pilots, or fugitive emissions. Note that other small storage tanks may be present on site (i.e., methanol, lube oil) but are considered de minimis sources per Table 45-13B and are listed on the application form.

Proposed Emissions

Emissions calculations for the facility are presented in Attachment T.

TEG dehydration unit emissions were estimated using the Fork Ridge PVT and GRI-GLYCalc™ 4.0 software. Still vent emissions are reduced by an air-cooled condenser and non-condensable gases are routed to the reboiler as fuel with an estimated 50% destruction efficiency. Flash tank off-gases are routed to the produced water storage tanks and then to the combustor for 98% destruction efficiency.

Greenhouse gas emissions were calculated with the latest EPA factors and manufacturer data when available. Documents used as references for the emissions calculations, including AP-42 and EPA emission factor references, gas and liquids analyses, and process simulation results are attached.

Regulatory Discussion

STATE

45 CSR 13 - 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:

The facility requests to operate under the General Permit G70-D. Emissions of carbon monoxide and volatile organic compounds are less than 80 tons per year (TPY). Oxides of nitrogen emissions are less than 50 TPY and particulate matter 10/2.5 and sulfur dioxide emissions are each less than 20 TPY. Also, the facility will have less than 8 TPY for each hazardous air pollutant and less than 20 tons for total hazardous air pollutants. This project qualifies as a Class I Administrative Update since there is a decrease in emissions.

45 CSR 22 - AIR QUALITY MANAGEMENT FEE PROGRAM:

The facility will be required to maintain a valid Certificate to Operate on the premises.

45 CSR 30 - REQUIREMENTS FOR OPERATING PERMITS:

Emissions from the facility do not exceed major source thresholds; therefore, this rule does not apply.

FEDERAL

40 CFR PART 63 SUBPART HH - NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES FROM OIL AND NATURAL GAS PRODUCTION FACILITIES:

The site is a minor (area) source of hazardous air pollutants. This Subpart applies to affected emission points that are located at facilities that are major and area sources of HAP, and either process, upgrade, or store hydrocarbon liquids prior to custody transfer or that process, upgrade, or store natural gas prior to entering the natural gas transmission and storage source category. For purposes of this Subpart natural gas enters the natural gas transmission and storage source category after the natural gas processing plant, if present. Even though the TEG dehydration unit at this facility is considered an affected area source, it is exempt from the requirements of § 63.764(d)(2) since the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 Mg (1.0 TPY), as

determined by the procedures specified in § 63.772(b)(2). However, the facility must maintain records of the de minimis determination as required in § 63.774(d)(1).

APPLICATION FOR GENERAL PERMIT REGISTRATION

west virginia department of environmental protection

Division of Air Quality
601 57th Street SE
Charleston, WV 25 4
Phone (304) 926-0475
Fax (304) 926-0479
www.dep.wv.gov

G70-D GENERAL PERMIT REGISTRATION APPLICATION

PREVENTION AND CONTROL OF AIR POLLUTION IN REGARD TO THE CONSTRUCTION, MODIFICATION, RELOCATION, ADMINISTRATIVE UPDATE AND OPERATION OF NATURAL GAS PRODUCTION FACILITIES LOCATED AT THE WELL SITE

☐CONSTRUCTION
☐MODIFICATION
☐RELOCATION
☒CLASS I ADMINISTRATIVE UPDATE
☐CLASS II ADMINISTRATIVE UPDATE

SECTION 1. GENERAL INFORMATION

Name of Applicant (as registered with the WV Secretary of State's Office): SWN Production Company, LLC

Federal Employer ID No. (FEIN): 26-4388727

Applicant's Mailing Address: 10000 Energy Drive

City: Spring | State: TX | ZIP Code: 77389

Facility Name: Michael Dunn Pad

Operating Site Physical Address: Not applicable. Facility is located at 39.896500, -80.558222
If none available, list road, city or town and zip of facility.

City: Cameron | Zip Code: 26033 | County: Marshall

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Latitude: 39.89650
Longitude: -80.55822

SIC Code: 1311
NAICS Code: 211111

DAQ Facility ID No. (For existing facilities)

CERTIFICATION OF INFORMATION

This G70-D General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of the Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. **Any administratively incomplete or improperly signed or unsigned G70-D Registration Application will be returned to the applicant. Furthermore, if the G70-D forms are not utilized, the application will be returned to the applicant. No substitution of forms is allowed.**

I hereby certify that Carla Suszkowski is an Authorized Representative and in that capacity shall represent the interest of the business (e.g., Corporation, Partnership, Limited Liability Company, Association Joint Venture or Sole Proprietorship) and may obligate and legally bind the business. If the business changes its Authorized Representative, a Responsible Official shall notify the Director of the Division of Air Quality immediately.

I hereby certify that all information contained in this G70-D General Permit Registration Application and any supporting documents appended hereto is, to the best of my knowledge, true, accurate and complete, and that all reasonable efforts have been made to provide the most comprehensive information possible.

Responsible Official Signature: Carla L Suszkowski
Name and Title: Carla Suszkowski, P.E, Regulatory Manager – WV Division Phone: 832-796-1000
Fax:
Email: Carla_Suszkowski@SWN.com Date: 3-29-17

If applicable:
Authorized Representative Signature: _____
Name and Title: Phone: Fax:
Email: Date:

If applicable:
Environmental Contact
Name and Title: Clay Murral Phone: 304-884-1715 Fax:
Email: Clay_Murral@SWN.com Date:

OPERATING SITE INFORMATION	
Briefly describe the proposed new operation and/or any change(s) to the facility: This application proposes to increase TEG dehydration unit throughput, decrease TEG dehydration emissions safety factor, and revise vapor combustor emissions based on the increase in dehydration throughput.	
Directions to the facility: From SR 891 and US 250 junction, travel 0.1 mile and turn right on Poplar Springs Road CR 52. Travel 1.7 miles to fork in road (no signage) and turn right on gravel road up hill. Travel 0.2 mile to well access on right.	
ATTACHMENTS AND SUPPORTING DOCUMENTS	
I have enclosed the following required documents:	
Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22). ☐ Check attached to front of application. ☐ I wish to pay by electronic transfer. Contact for payment (incl. name and email address): ☐ I wish to pay by credit card. Contact for payment (incl. name and email address): ☐$500 (Construction, Modification, and Relocation) ☐$300 (Class II Administrative Update) ☐$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ and/or OOOO [1] ☐$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH [2] [1] Only one NSPS fee will apply. [2] Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ. *NSPS and NESHAP fees apply to new construction or if the source is being modified.*	
☒ Responsible Official or Authorized Representative Signature (if applicable)	
☒ Single Source Determination Form **(must be completed in its entirety)** – Attachment A	
☐ Siting Criteria Waiver (if applicable) – Attachment B	☒ Current Business Certificate – Attachment C
☒ Process Flow Diagram – Attachment D	☒ Process Description – Attachment E
☒ Plot Plan – Attachment F	☒ Area Map – Attachment G
☒ G70-D Section Applicability Form – Attachment H	☒ Emission Units/ERD Table – Attachment I
☐ Fugitive Emissions Summary Sheet – Attachment J	
☐ Gas Well Affected Facility Data Sheet (if applicable) – Attachment K	
☐ Storage Vessel(s) Data Sheet (include gas sample data, USEPA Tanks, simulation software (e.g. ProMax, E&P Tanks, HYSYS, etc.), etc. where applicable) – Attachment L	
☐ Natural Gas Fired Fuel Burning Unit(s) Data Sheet (GPUs, Heater Treaters, In-Line Heaters if applicable) – Attachment M	
☐ Internal Combustion Engine Data Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment N	
☐ Tanker Truck Loading Data Sheet (if applicable) – Attachment O	
☒ Glycol Dehydration Unit Data Sheet(s) (include wet gas analysis, GRI- GLYCalc™ input and output reports and information on reboiler if applicable) – Attachment P	
☐ Pneumatic Controllers Data Sheet – Attachment Q	
☐ Pneumatic Pump Data Sheet – Attachment R	
☒ Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment S	
☒ Emission Calculations (please be specific and include all calculation methodologies used) – Attachment T	
☒ Facility-wide Emission Summary Sheet(s) – Attachment U	
☐ Class I Legal Advertisement – Attachment V	
☒ One (1) paper copy and two (2) copies of CD or DVD with pdf copy of application and attachments	

All attachments must be identified by name, divided into sections, and submitted in order.

ATTACHMENT A: SINGLE SOURCE DETERMINATION

ATTACHMENT A - SINGLE SOURCE DETERMINATION FORM

Classifying multiple facilities as one "stationary source" under 45CSR13, 45CSR14, and 45CSR19 is based on the definition of Building, structure, facility, or installation as given in §45-14-2.13 and §45-19-2.12. The definition states:

"Building, Structure, Facility, or Installation" means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control). Pollutant-emitting activities are a part of the same industrial grouping if they belong to the same "Major Group" (i.e., which have the same two (2)-digit code) as described in the Standard Industrial Classification Manual, 1987 (United States Government Printing Office stock number GPO 1987 0-185-718:QL 3).

The Source Determination Rule for the oil and gas industry was published in the Federal Register on June 3, 2016 and will become effective on August 2, 2016. EPA defined the term "adjacent" and stated that equipment and activities in the oil and gas sector that are under common control will be considered part of the same source if they are located on the same site or on sites that share equipment and are within ¼ mile of each other.

Is there equipment and activities in the same industrial grouping (defined by SIC code)?

Yes ☐ No ☒

Is there equipment and activities under the control of the same person/people?

Yes ☐ No ☒

Is there equipment and activities located on the same site or on sites that share equipment and are within ¼ mile of each other?

Yes ☐ No ☒

ATTACHMENT C: BUSINESS REGISTRATION CERTIFICATE

WEST VIRGINIA
STATE TAX DEPARTMENT
BUSINESS REGISTRATION CERTIFICATE

ISSUED TO:
SWN PRODUCTION COMPANY, LLC
5400D BIG TYLER RD
CHARLESTON, WV 25313-1103

BUSINESS REGISTRATION ACCOUNT NUMBER: **2307-3731**

This certificate is issued on: **12/8/2014**

This certificate is issued by
the West Virginia State Tax Commissioner
in accordance with Chapter 11, Article 12, of the West Virginia Code

The person or organization identified on this certificate is registered to conduct business in the State of West Virginia at the location above.

This certificate is not transferrable and must be displayed at the location for which issued.

This certificate shall be permanent until cessation of the business for which the certificate of registration was granted or until it is suspended, revoked or cancelled by the Tax Commissioner.

Change in name or change of location shall be considered a cessation of the business and a new certificate shall be required.

TRAVELING/STREET VENDORS: Must carry a copy of this certificate in every vehicle operated by them.
CONTRACTORS, DRILLING OPERATORS, TIMBER/LOGGING OPERATIONS: Must have a copy of this certificate displayed at every job site within West Virginia.

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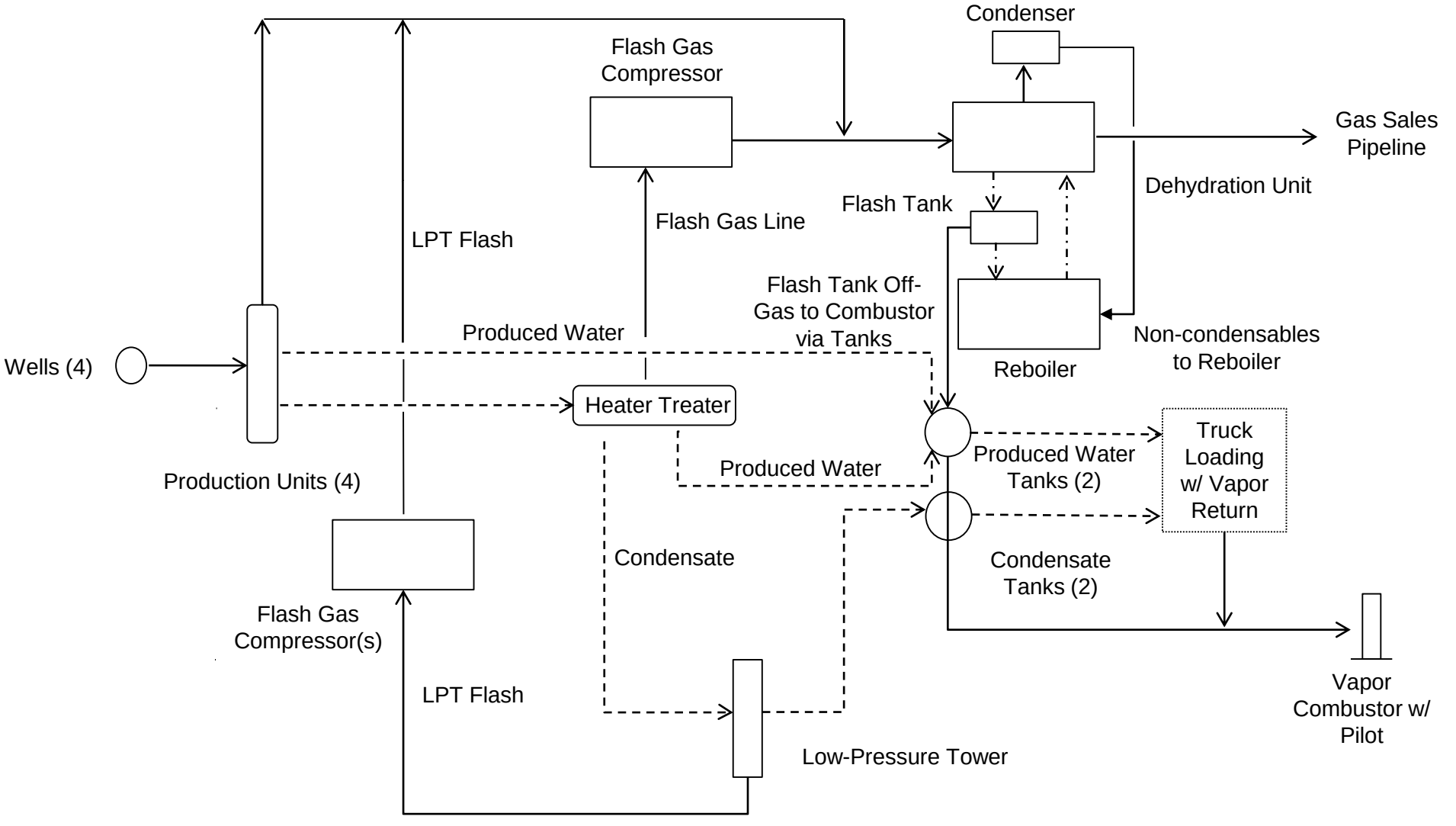
ATTACHMENT D: PROCESS FLOW DIAGRAM



Gas/Vapor

Liquids (Condensate and Produced Water)

Glycol

Note: Drawing is a depiction of general facility process and is not intended to represent facility and/or equipment layout.

SWN Production Company, LLC

Michael Dunn Pad

Attachment D: Process Flow Diagram

March 2017

ATTACHMENT E: PROCESS DESCRIPTION

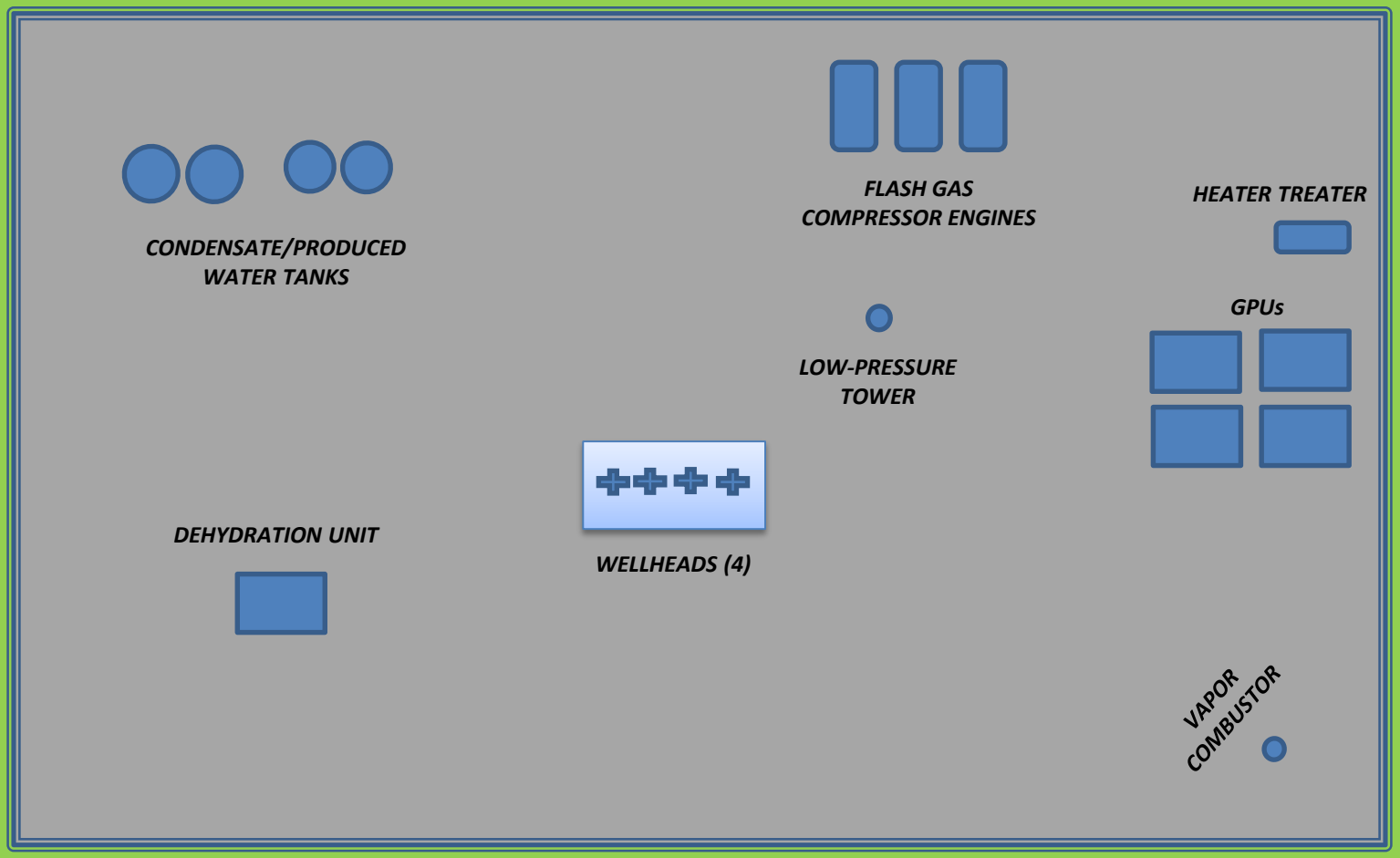
The facility is an oil and natural gas exploration and production facility, responsible for the production of condensate and natural gas. Storage of condensate and produced water also occurs on-site. A description of the facility process is as follows: Condensate, gas and water come from the four (4) wellheads to the production units, where the first stage of separation occurs. Produced water is sent from the production units to the produced water tanks. Condensate and residual water are sent to the heater treater. The flash from the heater treater is captured via natural gas-fired engine-driven flash gas compressors. Condensate flows into the low-pressure tower. Flash gases from the low-pressure tower are routed via hard-piping (with 100% capture efficiency) to the inlet of the flash gas compressors to be compressed.

Working, breathing and flashing vapors from the condensate and produced water storage tanks are routed to the vapor combustor with 100% capture efficiency to be burned with at least 98% combustion efficiency. The vapor combustor has one (1) natural gas-fired pilot to ensure a constant flame for combustion.

The natural gas stream from the gas production units and flash gas compressors is routed to the dehydration unit before exiting the facility. In the dehydration process, gas passes through a contactor vessel where water is absorbed by the glycol. The “rich” glycol-containing water goes to the glycol dehydrator reboiler where heat is used to boil off the water. Still vent vapors from the dehydration unit are controlled by an air-cooled condenser. Non-condensables from the still column overheads are routed to the reboiler for combustion. It was conservatively assumed that the reboiler provides 50% destruction efficiency since the burner on the reboiler is necessary to maintain the temperature and is inherent in the process; therefore, it is appropriate to use 50% efficiency with no monitoring required. The manufacturer guarantees a higher control efficiency. Flash tank off-gases are routed to the vapor combustor via the tanks with 100% capture efficiency to be burned with 98% combustion efficiency.

A process flow diagram reflecting facility operations is shown in Attachment D.

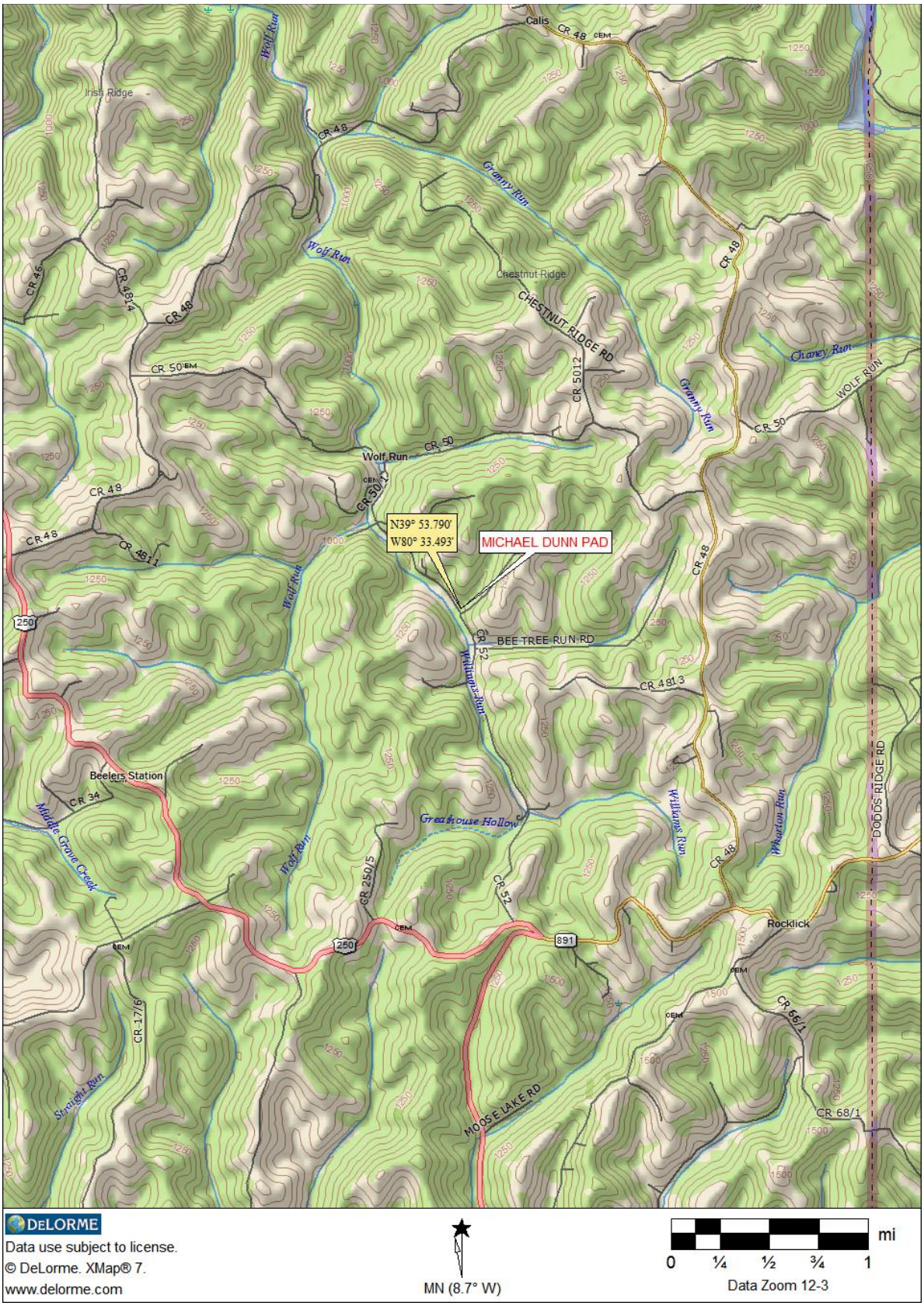
ATTACHMENT F: PLOT PLAN



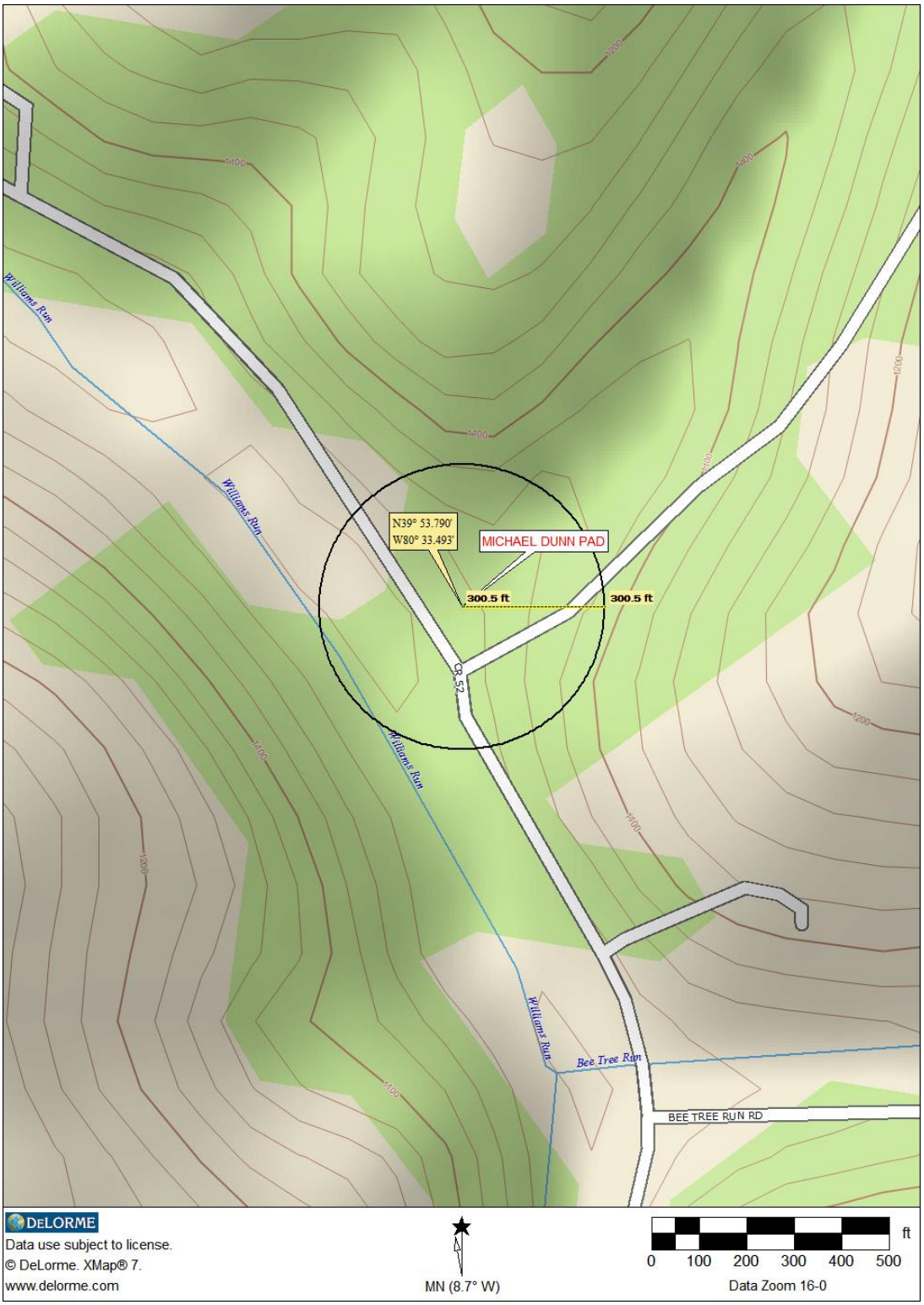
***NOTE**: Image is only a representation of production/emissions equipment. Actual location specifications and equipment placement are not to scale.*

SWN Production Company, LLC
Michael Dunn Pad
Attachment F: Simple Plot Plan
March 2017

ATTACHMENT G: AREA MAPS



SWN Production Company, LLC
Michael Dunn Pad
Attachment G: Area Map
March 2017



SWN Production Company, LLC
Michael Dunn Pad
Attachment G: Area Map with 300' Radius
March 2017

ATTACHMENT H: G70-D SECTION APPLICABILITY FORM

General Permit G70-D Registration
Section Applicability Form

General Permit G70-D was developed to allow qualified applicants to seek registration for a variety of sources. These sources include gas well affected facilities, storage vessels, gas production units, in-line heaters, heater treaters, glycol dehydration units and associated reboilers, pneumatic controllers, pneumatic pumps, reciprocating internal combustion engines (RICEs), tank truck/rail car loading, fugitive emissions, completion combustion devices, flares, enclosed combustion devices, and vapor recovery systems. All registered facilities will be subject to Sections 1.0, 2.0, 3.0, and 4.0.

General Permit G70-D allows the registrant to choose which sections of the permit they are seeking registration under. Therefore, please mark which additional sections that you are applying for registration under. If the applicant is seeking registration under multiple sections, please select all that apply. Please keep in mind, that if this registration is approved, the issued registration will state which sections will apply to your affected facility.

GENERAL PERMIT G70-D APPLICABLE SECTIONS	
☐Section 5.0	Gas and Oil Well Affected Facility (NSPS, Subpart OOOO/OOOOa)
☒Section 6.0	Storage Vessels Containing Condensate and/or Produced Water[1]
☐Section 7.0	Storage Vessel Affected Facility (NSPS, Subpart OOOO/OOOOa)
☒Section 8.0	Control Devices and Emission Reduction Devices not subject to NSPS Subpart OOOO/OOOOa and/or NESHAP Subpart HH
☒Section 9.0	Small Heaters and Reboilers not subject to 40CFR60 Subpart Dc
☐Section 10.0	Pneumatic Controllers Affected Facility (NSPS, Subpart OOOO/OOOOa)
☐Section 11.0	Pneumatic Pump Affected Facility (NSPS, Subpart OOOOa)
☐Section 12.0	Fugitive Emissions GHG and VOC Standards (NSPS, Subpart OOOOa)
☒Section 13.0	Reciprocating Internal Combustion Engines, Generator Engines
☒Section 14.0	Tanker Truck/Rail Car Loading[2]
☒Section 15.0	Glycol Dehydration Units[3]

1 Applicants that are subject to Section 6 may also be subject to Section 7 if the applicant is subject to the NSPS, Subparts OOOO or OOOOa control requirements or the applicable control device requirements of Section 8.

2 Applicants that are subject to Section 14 may also be subject to control device and emission reduction device requirements of Section 8.

3 Applicants that are subject to Section 15 may also be subject to the requirements of Section 9 (reboilers). Applicants that are subject to Section 15 may also be subject to control device and emission reduction device requirements of Section 8.

ATTACHMENT I: EMISSIONS UNITS/ERD TABLE

ATTACHMENT I - EMISSION UNITS/EMISSION REDUCTION DEVICES (ERD) TABLE

Include ALL emission units and air pollution control devices/ERDs that will be part of this permit application review. Do not include fugitive emission sources in this table. Deminimis storage tanks shall be listed in the Attachment L table. This information is required for all sources regardless of whether it is a construction, modification, or administrative update.

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed	Manufac. Date[3]	Design Capacity	Type[4] and Date of Change	Control Device(s)[5]	ERD(s)[6]
EU-C1	EP-C1	145-hp Caterpillar G3306 NA Engine	TBD	11/20/2013	145-hp	Existing	NSCR	NSCR
EU-C2	EP-C2	145-hp Caterpillar G3306 NA Engine	TBD	11/21/2013	145-hp	Existing	NSCR	NSCR
EU-C3	EP-C3	23.6-hp Kubota DG972-E2 Engine	TBD	TBD	23.6-hp	Existing	None	None
EU-GPU1	EP-GPU1	1.0-mmBtu/hr GPU Burner	TBD	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU2	EP-GPU2	1.0-mmBtu/hr GPU Burner	TBD	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU3	EP-GPU3	1.0-mmBtu/hr GPU Burner	TBD	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU4	EP-GPU4	1.0-mmBtu/hr GPU Burner	TBD	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-HT1	EP-HT1	0.5-mmBtu/hr Heater Treater	TBD	N/A	0.5-mmBtu/hr	Existing	N/A	N/A
EU-DEHY1	EP-RB1	20.0-MMSCFD TEG Dehydration Unit	TBD	N/A	20.0 MMSCFD	Modification	Condenser and EU-RB1	Condenser and EU-RB1
EU-RB1	EP-RB1	0.75-mmBtu/hr TEG Reboiler	TBD	N/A	0.75-mmBtu/hr	Existing	N/A	N/A
EU-TANKS-COND	APC-COMB-TKLD	Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	TBD	N/A	400-bbl	Existing	APC-COMB-TKLD	APC-COMB-TKLD
EU-TANKS-PW	APC-COMB-TKLD	Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	TBD	N/A	400-bbl	Existing	APC-COMB-TKLD	APC-COMB-TKLD
EU-LOAD-COND	APC-COMB-TKLD	Condensate Truck Loading w/ Vapor Return Routed to Combustor	TBD	N/A	5,518,800 gal/yr	Existing	Vapor Return and APC-COMB-TKLD	Vapor Return and APC-COMB-TKLD
EU-LOAD-PW	APC-COMB-TKLD	Produced Water Truck Loading w/ Vapor Return Routed to Combustor	TBD	N/A	15,330,000 gal/yr	Existing	Vapor Return and APC-COMB-TKLD	Vapor Return and APC-COMB-TKLD
APC-COMB-TKLD	APC-COMB-TKLD	15.0-mmBtu/hr Vapor Combustor	TBD	N/A	15.0-mmBtu/hr	Modification	N/A	N/A
EU-PILOT	APC-COMB-TKLD	Vapor Combustor Pilot	TBD	N/A	50-scfh	Existing	N/A	N/A
EU-FUG	EP-FUG	Fugitive Emissions	TBD	N/A	N/A	Existing	N/A	N/A
EU-HR	EP-HR	Fugitive Haul Road Emissions	TBD	N/A	N/A	Existing	N/A	N/A

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.

[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.

[3] When required by rule

[4] New, modification, removal, existing

[5] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

[6] For ERDs use the following numbering system: 1D, 2D, 3D,... or other appropriate designation.

ATTACHMENT P: GLYCOL DEHYDRATION UNIT DATA SHEET

GRI-GLYCALC REPORTS

EXTENDED ANALYSIS

ATTACHMENT P – GLYCOL DEHYDRATION UNIT DATA SHEET

Complete this data sheet for each Glycol Dehydration Unit, Reboiler, Flash Tank and/or Regenerator at the facility. Include gas sample analysis and GRI- GLYCalc™ input and aggregate report. Use extra pages if necessary.

Manufacturer: N/A	Model: N/A
Max. Dry Gas Flow Rate: 20.0 mmscf/day	Reboiler Design Heat Input: 0.75 MMBTU/hr
Design Type: ☒ TEG ☐ DEG ☐ EG	Source Status[1]: ES
Date Installed/Modified/Removed[2]: TBD	Regenerator Still Vent APCD/ERD[3]: CC
Control Device/ERD ID#[3]: APC-COND/EP-RB1	Fuel HV (BTU/scf): 905
H_2S Content (gr/100 scf): Negligible	Operation (hours/year): 8,760
Pump Rate (gpm): 7.50	
Water Content (wt %) in: Wet Gas: Dry Gas:	

Is the glycol dehydration unit exempt from 40CFR63 Section 764(d)? ☒ Yes ☐ No: If Yes, answer the following:

The actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters per day, as determined by the procedures specified in §63.772(b)(1) of this subpart. ☐ Yes ☒ No

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 ton per year), as determined by the procedures specified in §63.772(b)(2) of this subpart. ☒ Yes ☐ No

Is the glycol dehydration unit located within an Urbanized Area (UA) or Urban Cluster (UC)? ☐ Yes ☒ No

Is a lean glycol pump optimization plan being utilized? ☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler.
☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler and mixed with fuel.
☒ Yes ☐ No

What happens when temperature controller shuts off fuel to the reboiler?
☒ Still vent emissions to the atmosphere.
☐ Still vent emissions stopped with valve.
☐ Still vent emissions to glow plug.

Please indicate if the following equipment is present.
☒ Flash Tank
☐ Burner management system that continuously burns condenser or flash tank vapors

Control Device Technical Data

Pollutants Controlled	Manufacturer's Guaranteed Control Efficiency (%)

Emissions Data

Emission Unit ID / Emission Point ID[4]	Description	Calculation Methodology[5]	PTE[6]	Controlled Maximum Hourly Emissions (lb/hr)	Controlled Maximum Annual Emissions (tpy)
EU-RB1/EP-RB1	Reboiler Vent	AP	NO_x	0.08	0.36
		AP	CO	0.07	0.30
		AP	VOC	<0.01	0.02
		AP	SO_2	<0.01	<0.01
		AP	PM_{10}	<0.01	0.02
		AP	GHG (CO_2e)	87.82	384.67

EU-DEHY1/EP-RB1	Glycol Regenerator Still Vent	GRI-GlyCalc™	VOC	1.80	7.90
		GRI-GlyCalc™	Benzene	0.07	0.31
		GRI-GlyCalc™	Toluene	0.06	0.28
		GRI-GlyCalc™	Ethylbenzene	0.00	0.00
		GRI-GlyCalc™	Xylenes	0.11	0.49
		GRI-GlyCalc™	n-Hexane	0.04	0.18
EU-DEHY1/APC-COMB-TKLD	Glycol Flash Tank	GRI-GlyCalc™	VOC	1.16	5.07
		GRI-GlyCalc™	Benzene	<0.01	0.02
		GRI-GlyCalc™	Toluene	0.01	0.02
		GRI-GlyCalc™	Ethylbenzene	0.00	0.00
		GRI-GlyCalc™	Xylenes	0.01	0.06
		GRI-GlyCalc™	n-Hexane	0.03	0.12

Note: Glycol Regenerator Still Vent and Flash Tank emissions include a 15% safety factor.

1 Enter the Source Status using the following codes:

NS	Construction of New Source	ES	Existing Source
MS	Modification of Existing Source		

2 Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.

3 Enter the Air Pollution Control Device (APCD)/Emission Reduction Device (ERD) type designation using the following codes and the device ID number:

NA	None	CD	Condenser	FL	Flare	
CC	Condenser/Combustion Combination	TO	Thermal Oxidizer	O	Other	(please list)

4 Enter the appropriate Emission Unit ID Numbers and Emission Point ID Numbers for the glycol dehydration unit reboiler vent and glycol regenerator still vent. The glycol dehydration unit reboiler vent and glycol regenerator still vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a Glycol Dehydration Emission Unit Data Sheet shall be completed for each, using Source Identification RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

5 Enter the Potential Emissions Data Reference designation using the following codes:

MD	Manufacturer's Data	AP	AP-42	
GR	GRI-GLYCalc™	OT	Other	(please list)

6 Enter the Reboiler Vent and Glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The Glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalc™ (Radian International LLC & Gas Research Institute). **Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc™ Aggregate Calculations Report (shall include emissions reports, equipment reports, and stream reports) to this Glycol Dehydration Emission Unit Data Sheet(s). Backup pumps do not have to be considered as operating for purposes of PTE.** This PTE data shall be incorporated in the Emissions Summary Sheet.

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Michael Dunn 20 MMSCFD TEG Dehydration Unit
File Name: C:\Users\hmoseley\Dropbox\Flatrock OKC - Hillary\Southwestern\Michael Dunn\2017March G70-D\Michael Dunn_GLYCalc.ddf
Date: March 29, 2017

DESCRIPTION:

Description: Fork Ridge PVT analysis temp = 70F, pressure = 900 psig. Kimray 45015 PV (7.5 gpm) glycol pump. Flash tank off gas to combustor via tanks. Still vent emissions to BTEX Skid w/ overheads to reboiler.

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 70.00 deg. F
Pressure: 900.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1590
Nitrogen	0.3640
Methane	77.1830
Ethane	14.7160
Propane	4.7820
Isobutane	0.6470
n-Butane	1.2100
Isopentane	0.3270
n-Pentane	0.2710
Cyclopentane	0.0070
n-Hexane	0.0790
Cyclohexane	0.0080
Other Hexanes	0.1420
Heptanes	0.0840
Methylcyclohexane	0.0120
Benzene	0.0020
Toluene	0.0030
Xylenes	0.0100
C8+ Heavies	0.0270

DRY GAS:

Flow Rate: 20.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

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

PUMP:

Glycol Pump Type: Gas Injection
Gas Injection Pump Volume Ratio: 0.080 acfm gas/gpm glycol

FLASH TANK:

Flash Control: Combustion device
Flash Control Efficiency: 98.00 %
Temperature: 150.0 deg. F
Pressure: 50.0 psig

REGENERATOR OVERHEADS CONTROL DEVICE:

Control Device: Condenser
Temperature: 100.0 deg. F
Pressure: 14.0 psia

Control Device: Combustion Device
Destruction Efficiency: 50.0 %
Excess Oxygen: 5.0 %
Ambient Air Temperature: 50.0 deg. F

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Michael Dunn 20 MMSCFD TEG Dehydration Unit
File Name: C:\Users\hmoseley\Dropbox\Flatrock OKC - Hillary\Southwestern\Michael Dunn\2017March G70-D\Michael Dunn_GLYCalc.ddf
Date: March 29, 2017

DESCRIPTION:

Description: Fork Ridge PVT analysis temp = 70F, pressure = 900 psig. Kimray 45015 PV (7.5 gpm) glycol pump. Flash tank off gas to combustor via tanks. Still vent emissions to BTEX Skid w/ overheads to reboiler.

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.3721	8.931	1.6300
Ethane	0.5342	12.820	2.3396
Propane	0.5085	12.205	2.2274
Isobutane	0.1320	3.168	0.5782
n-Butane	0.3321	7.970	1.4545
Isopentane	0.0891	2.139	0.3903
n-Pentane	0.0873	2.096	0.3824
Cyclopentane	0.0161	0.386	0.0705
n-Hexane	0.0356	0.853	0.1557
Cyclohexane	0.0257	0.616	0.1125
Other Hexanes	0.0547	1.314	0.2397
Heptanes	0.0471	1.129	0.2061
Methylcyclohexane	0.0264	0.633	0.1156
Benzene	0.0612	1.468	0.2678
Toluene	0.0557	1.338	0.2442
Xylenes	0.0975	2.340	0.4271
C8+ Heavies	0.0002	0.006	0.0011
Total Emissions	2.4755	59.412	10.8426
Total Hydrocarbon Emissions	2.4755	59.412	10.8426
Total VOC Emissions	1.5692	37.660	6.8730
Total HAP Emissions	0.2500	5.999	1.0948
Total BTEX Emissions	0.2144	5.146	0.9391

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.7472	17.932	3.2725
Ethane	1.0879	26.110	4.7650
Propane	1.1253	27.006	4.9287
Isobutane	0.3227	7.746	1.4136
n-Butane	0.8663	20.792	3.7945
Isopentane	0.3114	7.474	1.3640
n-Pentane	0.3584	8.603	1.5700

Cyclopentane	0.0823	1.974	0.3603
n-Hexane	0.2660	6.384	1.1650
Cyclohexane	0.2427	5.824	1.0629
Other Hexanes	0.3196	7.671	1.4000
Heptanes	0.8486	20.367	3.7170
Methylcyclohexane	0.4909	11.782	2.1502
Benzene	0.8089	19.414	3.5430
Toluene	1.9500	46.800	8.5410
Xylenes	11.5897	278.153	50.7629
C8+ Heavies	1.3133	31.518	5.7521
Total Emissions	22.7312	545.549	99.5627
Total Hydrocarbon Emissions	22.7312	545.549	99.5627
Total VOC Emissions	20.8962	501.508	91.5252
Total HAP Emissions	14.6146	350.750	64.0119
Total BTEX Emissions	14.3486	344.367	62.8469

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	2.0283	48.680	8.8842
Ethane	0.8685	20.845	3.8042
Propane	0.4588	11.012	2.0097
Isobutane	0.0903	2.167	0.3955
n-Butane	0.1894	4.544	0.8294
Isopentane	0.0618	1.484	0.2709
n-Pentane	0.0579	1.389	0.2534
Cyclopentane	0.0032	0.077	0.0140
n-Hexane	0.0245	0.589	0.1074
Cyclohexane	0.0055	0.132	0.0241
Other Hexanes	0.0387	0.930	0.1697
Heptanes	0.0393	0.943	0.1722
Methylcyclohexane	0.0090	0.216	0.0393
Benzene	0.0030	0.072	0.0131
Toluene	0.0048	0.115	0.0211
Xylenes	0.0122	0.293	0.0535
C8+ Heavies	0.0085	0.205	0.0374
Total Emissions	3.9039	93.693	17.0989
Total Hydrocarbon Emissions	3.9039	93.693	17.0989
Total VOC Emissions	1.0070	24.168	4.4106
Total HAP Emissions	0.0445	1.069	0.1951
Total BTEX Emissions	0.0200	0.480	0.0877

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	101.4173	2434.014	444.2076
Ethane	43.4267	1042.240	190.2088
Propane	22.9414	550.594	100.4834
Isobutane	4.5144	108.345	19.7730
n-Butane	9.4677	227.224	41.4685
Isopentane	3.0924	74.218	13.5447
n-Pentane	2.8931	69.436	12.6720
Cyclopentane	0.1595	3.828	0.6987
n-Hexane	1.2265	29.436	5.3720

Cyclohexane	0.2754	6.608	1.2060
Other Hexanes	1.9368	46.484	8.4833
Heptanes	1.9656	47.175	8.6094
Methylcyclohexane	0.4490	10.775	1.9665
Benzene	0.1499	3.597	0.6565
Toluene	0.2403	5.768	1.0526
Xylenes	0.6105	14.651	2.6738
C8+ Heavies	0.4265	10.236	1.8681
Total Emissions	195.1929	4684.630	854.9450
Total Hydrocarbon Emissions	195.1929	4684.630	854.9450
Total VOC Emissions	50.3490	1208.376	220.5286
Total HAP Emissions	2.2272	53.452	9.7550
Total BTEX Emissions	1.0007	24.016	4.3829

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	2.4005	57.612	10.5141
Ethane	1.4027	33.665	6.1438
Propane	0.9674	23.217	4.2371
Isobutane	0.2223	5.335	0.9736
n-Butane	0.5214	12.514	2.2838
Isopentane	0.1510	3.623	0.6612
n-Pentane	0.1452	3.484	0.6359
Cyclopentane	0.0193	0.463	0.0844
n-Hexane	0.0601	1.442	0.2632
Cyclohexane	0.0312	0.749	0.1366
Other Hexanes	0.0935	2.243	0.4094
Heptanes	0.0864	2.073	0.3783
Methylcyclohexane	0.0354	0.849	0.1549
Benzene	0.0641	1.540	0.2810
Toluene	0.0606	1.453	0.2652
Xylenes	0.1097	2.633	0.4806
C8+ Heavies	0.0088	0.211	0.0384
Total Emissions	6.3793	153.104	27.9415
Total Hydrocarbon Emissions	6.3793	153.104	27.9415
Total VOC Emissions	2.5762	61.828	11.2836
Total HAP Emissions	0.2945	7.068	1.2899
Total BTEX Emissions	0.2344	5.626	1.0268

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	447.4802	10.5141	97.65
Ethane	194.9738	6.1438	96.85
Propane	105.4120	4.2371	95.98
Isobutane	21.1866	0.9736	95.40
n-Butane	45.2629	2.2838	94.95
Isopentane	14.9087	0.6612	95.57
n-Pentane	14.2420	0.6359	95.54
Cyclopentane	1.0590	0.0844	92.03

n-Hexane	6.5371	0.2632	95.97
Cyclohexane	2.2690	0.1366	93.98
Other Hexanes	9.8833	0.4094	95.86
Heptanes	12.3264	0.3783	96.93
Methylcyclohexane	4.1166	0.1549	96.24
Benzene	4.1994	0.2810	93.31
Toluene	9.5936	0.2652	97.24
Xylenes	53.4368	0.4806	99.10
C8+ Heavies	7.6203	0.0384	99.50
Total Emissions	954.5077	27.9415	97.07
Total Hydrocarbon Emissions	954.5077	27.9415	97.07
Total VOC Emissions	312.0537	11.2836	96.38
Total HAP Emissions	73.7669	1.2899	98.25
Total BTEX Emissions	67.2298	1.0268	98.47

EQUIPMENT REPORTS:

CONDENSER AND COMBUSTION DEVICE

Condenser Outlet Temperature:	100.00 deg. F
Condenser Pressure:	14.00 psia
Condenser Duty:	1.27e-002 MM BTU/hr
Hydrocarbon Recovery:	1.43 bbls/day
Produced Water:	1.36 bbls/day
Ambient Temperature:	50.00 deg. F
Excess Oxygen:	5.00 %
Combustion Efficiency:	50.00 %
Supplemental Fuel Requirement:	1.27e-002 MM BTU/hr

Component	Emitted	Destroyed
Methane	49.81%	50.19%
Ethane	49.10%	50.90%
Propane	45.19%	54.81%
Isobutane	40.90%	59.10%
n-Butane	38.33%	61.67%
Isopentane	28.61%	71.39%
n-Pentane	24.36%	75.64%
Cyclopentane	19.55%	80.45%
n-Hexane	13.37%	86.63%
Cyclohexane	10.58%	89.42%
Other Hexanes	17.12%	82.88%
Heptanes	5.55%	94.45%
Methylcyclohexane	5.38%	94.62%
Benzene	7.56%	92.44%
Toluene	2.86%	97.14%
Xylenes	0.84%	99.16%
C8+ Heavies	0.02%	99.98%

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:	0.85	lbs. H2O/MMSCF
Temperature:	70.0	deg. F
Pressure:	900.0	psig
Dry Gas Flow Rate:	20.0000	MMSCF/day
Glycol Losses with Dry Gas:	0.1269	lb/hr
Wet Gas Water Content:	Saturated	
Calculated Wet Gas Water Content:	25.32	lbs. H2O/MMSCF
Calculated Lean Glycol Recirc. Ratio:	22.05	gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.36%	96.64%
Carbon Dioxide	99.38%	0.62%
Nitrogen	99.95%	0.05%
Methane	99.96%	0.04%
Ethane	99.88%	0.12%
Propane	99.82%	0.18%
Isobutane	99.75%	0.25%
n-Butane	99.67%	0.33%
Isopentane	99.68%	0.32%
n-Pentane	99.58%	0.42%
Cyclopentane	98.09%	1.91%
n-Hexane	99.34%	0.66%
Cyclohexane	96.83%	3.17%
Other Hexanes	99.50%	0.50%
Heptanes	98.81%	1.19%
Methylcyclohexane	96.71%	3.29%
Benzene	72.40%	27.60%
Toluene	64.27%	35.73%
Xylenes	48.03%	51.97%
C8+ Heavies	98.61%	1.39%

FLASH TANK

Flash Control:	Combustion device	
Flash Control Efficiency:	98.00	%
Flash Temperature:	150.0	deg. F
Flash Pressure:	50.0	psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.48%	0.52%
Carbon Dioxide	6.84%	93.16%
Nitrogen	0.72%	99.28%
Methane	0.73%	99.27%
Ethane	2.44%	97.56%
Propane	4.68%	95.32%
Isobutane	6.67%	93.33%
n-Butane	8.38%	91.62%
Isopentane	9.37%	90.63%
n-Pentane	11.27%	88.73%
Cyclopentane	34.31%	65.69%
n-Hexane	18.10%	81.90%
Cyclohexane	48.39%	51.61%
Other Hexanes	14.68%	85.32%

Heptanes	30.43%	69.57%
Methylcyclohexane	53.97%	46.03%
Benzene	85.14%	14.86%
Toluene	89.89%	10.11%
Xylenes	95.64%	4.36%
C8+ Heavies	77.91%	22.09%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	75.94%	24.06%
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	2.61%	97.39%
n-Pentane	2.47%	97.53%
Cyclopentane	1.24%	98.76%
n-Hexane	1.84%	98.16%
Cyclohexane	6.00%	94.00%
Other Hexanes	4.10%	95.90%
Heptanes	1.28%	98.72%
Methylcyclohexane	6.75%	93.25%
Benzene	5.81%	94.19%
Toluene	8.71%	91.29%
Xylenes	13.42%	86.58%
C8+ Heavies	12.70%	87.30%

STREAM REPORTS:

WET GAS STREAM

Temperature: 70.00 deg. F
Pressure: 914.70 psia
Flow Rate: 8.34e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.33e-002	2.11e+001
Carbon Dioxide	1.59e-001	1.54e+002
Nitrogen	3.64e-001	2.24e+002
Methane	7.71e+001	2.72e+004
Ethane	1.47e+001	9.72e+003
Propane	4.78e+000	4.63e+003
Isobutane	6.46e-001	8.26e+002
n-Butane	1.21e+000	1.55e+003
Isopentane	3.27e-001	5.18e+002
n-Pentane	2.71e-001	4.30e+002

Cyclopentane	6.99e-003	1.08e+001
n-Hexane	7.89e-002	1.50e+002
Cyclohexane	7.99e-003	1.48e+001
Other Hexanes	1.42e-001	2.69e+002
Heptanes	8.39e-002	1.85e+002
Methylcyclohexane	1.20e-002	2.59e+001
Benzene	2.00e-003	3.43e+000
Toluene	3.00e-003	6.07e+000
Xylenes	9.99e-003	2.33e+001
C8+ Heavies	2.70e-002	1.01e+002
Total Components	100.00	4.61e+004

DRY GAS STREAM

Temperature: 70.00 deg. F
Pressure: 914.70 psia
Flow Rate: 8.33e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.79e-003	7.09e-001
Carbon Dioxide	1.58e-001	1.53e+002
Nitrogen	3.64e-001	2.24e+002
Methane	7.72e+001	2.72e+004
Ethane	1.47e+001	9.71e+003
Propane	4.78e+000	4.63e+003
Isobutane	6.46e-001	8.24e+002
n-Butane	1.21e+000	1.54e+003
Isopentane	3.26e-001	5.17e+002
n-Pentane	2.70e-001	4.28e+002
Cyclopentane	6.87e-003	1.06e+001
n-Hexane	7.85e-002	1.49e+002
Cyclohexane	7.75e-003	1.43e+001
Other Hexanes	1.41e-001	2.68e+002
Heptanes	8.30e-002	1.83e+002
Methylcyclohexane	1.16e-002	2.50e+001
Benzene	1.45e-003	2.49e+000
Toluene	1.93e-003	3.90e+000
Xylenes	4.81e-003	1.12e+001
C8+ Heavies	2.66e-002	9.97e+001
Total Components	100.00	4.60e+004

LEAN GLYCOL STREAM

Temperature: 70.00 deg. F
Flow Rate: 7.49e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	4.15e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	2.24e-012	9.46e-011
Nitrogen	2.54e-013	1.07e-011
Methane	8.65e-018	3.65e-016
Ethane	1.33e-007	5.61e-006
Propane	8.21e-009	3.46e-007

Isobutane	1.47e-009	6.19e-008
n-Butane	3.02e-009	1.28e-007
Isopentane	1.98e-004	8.36e-003
n-Pentane	2.15e-004	9.09e-003
Cyclopentane	2.45e-005	1.03e-003
n-Hexane	1.18e-004	4.98e-003
Cyclohexane	3.67e-004	1.55e-002
Other Hexanes	3.24e-004	1.37e-002
Heptanes	2.61e-004	1.10e-002
Methylcyclohexane	8.42e-004	3.55e-002
Benzene	1.18e-003	4.99e-002
Toluene	4.41e-003	1.86e-001
Xylenes	4.26e-002	1.80e+000
C8+ Heavies	4.53e-003	1.91e-001
Total Components	100.00	4.22e+003

RICH GLYCOL AND PUMP GAS STREAM

Temperature: 70.00 deg. F
Pressure: 914.70 psia
Flow Rate: 8.02e+000 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.31e+001	4.15e+003
Water	1.88e+000	8.38e+001
Carbon Dioxide	3.28e-002	1.46e+000
Nitrogen	1.93e-002	8.59e-001
Methane	2.29e+000	1.02e+002
Ethane	9.98e-001	4.45e+001
Propane	5.40e-001	2.41e+001
Isobutane	1.08e-001	4.84e+000
n-Butane	2.32e-001	1.03e+001
Isopentane	7.65e-002	3.41e+000
n-Pentane	7.31e-002	3.26e+000
Cyclopentane	5.44e-003	2.43e-001
n-Hexane	3.36e-002	1.50e+000
Cyclohexane	1.20e-002	5.34e-001
Other Hexanes	5.09e-002	2.27e+000
Heptanes	6.34e-002	2.83e+000
Methylcyclohexane	2.19e-002	9.75e-001
Benzene	2.26e-002	1.01e+000
Toluene	5.33e-002	2.38e+000
Xylenes	3.14e-001	1.40e+001
C8+ Heavies	4.33e-002	1.93e+000
Total Components	100.00	4.46e+003

FLASH TANK OFF GAS STREAM

Temperature: 150.00 deg. F
Pressure: 64.70 psia
Flow Rate: 3.33e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)

Water	2.76e-001	4.36e-001
Carbon Dioxide	3.53e-001	1.36e+000
Nitrogen	3.47e-001	8.53e-001
Methane	7.20e+001	1.01e+002
Ethane	1.65e+001	4.34e+001
Propane	5.93e+000	2.29e+001
Isobutane	8.85e-001	4.51e+000
n-Butane	1.86e+000	9.47e+000
Isopentane	4.88e-001	3.09e+000
n-Pentane	4.57e-001	2.89e+000
Cyclopentane	2.59e-002	1.60e-001
n-Hexane	1.62e-001	1.23e+000
Cyclohexane	3.73e-002	2.75e-001
Other Hexanes	2.56e-001	1.94e+000
Heptanes	2.24e-001	1.97e+000
Methylcyclohexane	5.21e-002	4.49e-001
Benzene	2.19e-002	1.50e-001
Toluene	2.97e-002	2.40e-001
Xylenes	6.55e-002	6.10e-001
C8+ Heavies	2.85e-002	4.27e-001
Total Components	100.00	1.98e+002

FLASH TANK GLYCOL STREAM

Temperature: 150.00 deg. F
Flow Rate: 7.58e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.75e+001	4.15e+003
Water	1.96e+000	8.34e+001
Carbon Dioxide	2.35e-003	1.00e-001
Nitrogen	1.46e-004	6.21e-003
Methane	1.75e-002	7.47e-001
Ethane	2.55e-002	1.09e+000
Propane	2.64e-002	1.13e+000
Isobutane	7.57e-003	3.23e-001
n-Butane	2.03e-002	8.66e-001
Isopentane	7.50e-003	3.20e-001
n-Pentane	8.62e-003	3.68e-001
Cyclopentane	1.95e-003	8.33e-002
n-Hexane	6.36e-003	2.71e-001
Cyclohexane	6.06e-003	2.58e-001
Other Hexanes	7.82e-003	3.33e-001
Heptanes	2.02e-002	8.60e-001
Methylcyclohexane	1.24e-002	5.26e-001
Benzene	2.02e-002	8.59e-001
Toluene	5.01e-002	2.14e+000
Xylenes	3.14e-001	1.34e+001
C8+ Heavies	3.53e-002	1.50e+000
Total Components	100.00	4.26e+003

FLASH GAS EMISSIONS

Flow Rate: 1.27e+004 scfh

Control Method: Combustion Device
Control Efficiency: 98.00

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.23e+001	3.77e+002
Carbon Dioxide	3.71e+001	5.48e+002
Nitrogen	9.07e-002	8.53e-001
Methane	3.77e-001	2.03e+000
Ethane	8.60e-002	8.69e-001
Propane	3.10e-002	4.59e-001
Isobutane	4.63e-003	9.03e-002
n-Butane	9.71e-003	1.89e-001
Isopentane	2.55e-003	6.18e-002
n-Pentane	2.39e-003	5.79e-002
Cyclopentane	1.36e-004	3.19e-003
n-Hexane	8.48e-004	2.45e-002
Cyclohexane	1.95e-004	5.51e-003
Other Hexanes	1.34e-003	3.87e-002
Heptanes	1.17e-003	3.93e-002
Methylcyclohexane	2.72e-004	8.98e-003
Benzene	1.14e-004	3.00e-003
Toluene	1.55e-004	4.81e-003
Xylenes	3.43e-004	1.22e-002
C8+ Heavies	1.49e-004	8.53e-003
Total Components	100.00	9.29e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 5.41e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.80e+001	2.01e+001
Carbon Dioxide	1.59e-001	1.00e-001
Nitrogen	1.56e-002	6.21e-003
Methane	3.27e+000	7.47e-001
Ethane	2.54e+000	1.09e+000
Propane	1.79e+000	1.13e+000
Isobutane	3.89e-001	3.23e-001
n-Butane	1.04e+000	8.66e-001
Isopentane	3.03e-001	3.11e-001
n-Pentane	3.48e-001	3.58e-001
Cyclopentane	8.22e-002	8.23e-002
n-Hexane	2.16e-001	2.66e-001
Cyclohexane	2.02e-001	2.43e-001
Other Hexanes	2.60e-001	3.20e-001
Heptanes	5.94e-001	8.49e-001
Methylcyclohexane	3.50e-001	4.91e-001
Benzene	7.26e-001	8.09e-001
Toluene	1.48e+000	1.95e+000
Xylenes	7.65e+000	1.16e+001
C8+ Heavies	5.40e-001	1.31e+000
Total Components	100.00	4.29e+001

CONDENSER PRODUCED WATER STREAM

Temperature: 100.00 deg. F
Flow Rate: 3.97e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)
Water	1.00e+002	1.99e+001	999647.
Carbon Dioxide	1.58e-003	3.14e-004	16.
Nitrogen	2.25e-006	4.46e-007	0.
Methane	5.48e-004	1.09e-004	5.
Ethane	9.47e-004	1.88e-004	9.
Propane	7.84e-004	1.56e-004	8.
Isobutane	1.14e-004	2.26e-005	1.
n-Butane	3.88e-004	7.71e-005	4.
Isopentane	7.56e-005	1.50e-005	1.
n-Pentane	8.08e-005	1.61e-005	1.
Cyclopentane	1.12e-004	2.23e-005	1.
n-Hexane	2.84e-005	5.64e-006	0.
Cyclohexane	1.24e-004	2.47e-005	1.
Other Hexanes	3.47e-005	6.89e-006	0.
Heptanes	2.14e-005	4.25e-006	0.
Methylcyclohexane	6.19e-005	1.23e-005	1.
Benzene	9.27e-003	1.84e-003	93.
Toluene	7.20e-003	1.43e-003	72.
Xylenes	1.39e-002	2.77e-003	139.
C8+ Heavies	6.19e-008	1.23e-008	0.
Total Components	100.00	1.99e+001	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 100.00 deg. F
Flow Rate: 4.18e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)
Water	3.83e-002	6.81e-003
Carbon Dioxide	5.78e-003	1.03e-003
Nitrogen	2.40e-004	4.27e-005
Methane	1.55e-002	2.76e-003
Ethane	1.09e-001	1.94e-002
Propane	6.08e-001	1.08e-001
Isobutane	3.30e-001	5.87e-002
n-Butane	1.14e+000	2.02e-001
Isopentane	7.49e-001	1.33e-001
n-Pentane	1.03e+000	1.84e-001
Cyclopentane	2.82e-001	5.01e-002
n-Hexane	1.10e+000	1.95e-001
Cyclohexane	1.08e+000	1.91e-001
Other Hexanes	1.18e+000	2.10e-001
Heptanes	4.24e+000	7.55e-001
Methylcyclohexane	2.46e+000	4.38e-001
Benzene	3.85e+000	6.85e-001
Toluene	1.03e+001	1.84e+000
Xylenes	6.41e+001	1.14e+001
C8+ Heavies	7.38e+000	1.31e+000
Total Components	100.00	1.78e+001

CONDENSER VENT STREAM

Temperature: 100.00 deg. F
Pressure: 14.00 psia
Flow Rate: 5.60e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.85e+000	1.82e-001
Carbon Dioxide	1.52e+000	9.86e-002
Nitrogen	1.49e-001	6.17e-003
Methane	3.14e+001	7.44e-001
Ethane	2.41e+001	1.07e+000
Propane	1.56e+001	1.02e+000
Isobutane	3.08e+000	2.64e-001
n-Butane	7.74e+000	6.64e-001
Isopentane	1.67e+000	1.78e-001
n-Pentane	1.64e+000	1.75e-001
Cyclopentane	3.11e-001	3.22e-002
n-Hexane	5.59e-001	7.11e-002
Cyclohexane	4.13e-001	5.14e-002
Other Hexanes	8.60e-001	1.09e-001
Heptanes	6.36e-001	9.41e-002
Methylcyclohexane	3.64e-001	5.28e-002
Benzene	1.06e+000	1.22e-001
Toluene	8.19e-001	1.11e-001
Xylenes	1.24e+000	1.95e-001
C8+ Heavies	1.93e-003	4.87e-004
Total Components	100.00	5.24e+000

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
Pressure: 14.70 psia
Flow Rate: 2.56e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	3.43e+001	3.72e-001
Ethane	2.63e+001	5.34e-001
Propane	1.71e+001	5.09e-001
Isobutane	3.36e+000	1.32e-001
n-Butane	8.46e+000	3.32e-001
Isopentane	1.83e+000	8.91e-002
n-Pentane	1.79e+000	8.73e-002
Cyclopentane	3.40e-001	1.61e-002
n-Hexane	6.11e-001	3.56e-002
Cyclohexane	4.52e-001	2.57e-002
Other Hexanes	9.40e-001	5.47e-002
Heptanes	6.95e-001	4.71e-002
Methylcyclohexane	3.98e-001	2.64e-002
Benzene	1.16e+000	6.12e-002
Toluene	8.96e-001	5.57e-002
Xylenes	1.36e+000	9.75e-002
C8+ Heavies	2.12e-003	2.43e-004

Total Components 100.00 2.48e+000

CONDENSER CONTROL CURVE DATA REPORT:

CONDENSER CONTROL EFFICIENCY CURVES

Note: Condenser curves computed for the range 40.0 F <= T <= 170.0 F. DO NOT EXTRAPOLATE BEYOND THIS RANGE!

Temp(F)	BTEX	Total HAP	VOC
40.0	99.64	99.56	92.07
45.0	99.57	99.47	91.61
50.0	99.48	99.36	91.14
55.0	99.37	99.23	90.65
60.0	99.24	99.08	90.14
65.0	99.09	98.91	89.61
70.0	98.92	98.71	89.06
75.0	98.71	98.47	88.49
80.0	98.47	98.20	87.88
85.0	98.20	97.89	87.24
90.0	97.87	97.53	86.56
95.0	97.49	97.11	85.84
100.0	97.05	96.62	85.05
105.0	96.53	96.05	84.20
110.0	95.92	95.40	83.28
115.0	95.21	94.63	82.26
120.0	94.37	93.74	81.14
125.0	93.38	92.70	79.89
130.0	92.20	91.47	78.49
135.0	90.80	90.01	76.91
140.0	89.10	88.27	75.10
145.0	87.05	86.17	73.01
150.0	84.34	83.41	70.38
155.0	81.10	80.15	67.39
160.0	76.97	76.00	63.74
165.0	71.56	70.61	59.15
170.0	64.56	63.65	53.42

ANNUAL AIR-COOLED CONDENSER PERFORMANCE:

ANNUAL AIR-COOLED CONDENSER PERFORMANCE

Nearest Site for Air Temperature Data: Pittsburgh, PA

Ambient Air Dry Bulb Temperature (deg. F)	Frequency (%)	Condenser Outlet Temperature (deg. F)
<=50	47.54	<=70
51-55	7.60	71-75
56-60	8.16	76-80
61-65	9.24	81-85
66-70	9.63	86-90
71-75	7.80	91-95
76-80	5.39	96-100
81-85	3.24	101-105
86-90	1.11	106-110
91-95	0.27	111-115
96-100	0.03	116-120

>100	0.00	>120

Condenser outlet temperature approach to ambient: 20.00 deg. F

Annual air-cooled condenser emissions and control efficiency:

	Uncontrolled emissions tons/year	Controlled emissions tons/year	% Control
Benzene	3.543	0.319	91.01
BTEX	62.847	1.028	98.36
Total HAP	64.012	1.225	98.09
VOC	91.525	11.162	87.80

TABLE 1-B

COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C_{11+}

SEPARATOR GOR.....: 55817 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 267 psig
SEPARATOR TEMPERATURE.....: 73 °F

	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
Component	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.364	0.000	0.026	0.007	0.358	0.000
Carbon Dioxide	0.159	0.000	0.018	0.008	0.156	0.000
Methane	77.183	0.000	7.419	3.193	75.866	0.000
Ethane	14.716	3.968	8.764	5.953	14.604	3.938
Propane	4.782	1.327	9.825	6.866	4.877	1.353
Iso-butane	0.647	0.213	3.048	2.531	0.692	0.228
N-butane	1.210	0.384	8.045	6.438	1.339	0.425
2-2 Dimethylpropane	0.014	0.005	0.162	0.158	0.017	0.006
Iso-pentane	0.306	0.113	5.021	4.666	0.395	0.146
N-pentane	0.271	0.099	5.869	5.399	0.377	0.138
2-2 Dimethylbutane	0.011	0.005	0.363	0.385	0.018	0.007
Cyclopentane	0.007	0.002	0.000	0.000	0.007	0.002
2-3 Dimethylbutane	0.009	0.004	0.555	0.577	0.019	0.008
2 Methylpentane	0.069	0.029	3.334	3.514	0.131	0.055
3 Methylpentane	0.042	0.017	2.220	2.301	0.083	0.034
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.079	0.033	5.090	5.315	0.174	0.072
Methylcyclopentane	0.006	0.002	0.458	0.411	0.015	0.005
Benzene	0.002	0.001	0.103	0.073	0.004	0.001
Cyclohexane	0.008	0.003	0.716	0.619	0.021	0.007
2-Methylhexane	0.017	0.008	2.801	3.307	0.070	0.033
3-Methylhexane	0.016	0.007	2.320	2.705	0.059	0.028
2,2,4 Trimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000
Other Heptanes	0.019	0.008	1.444	1.597	0.046	0.020
n-Heptane	0.020	0.009	3.645	4.271	0.088	0.041
Methylcyclohexane	0.012	0.005	2.249	2.296	0.054	0.022
Toluene	0.003	0.001	0.568	0.483	0.014	0.005
Other C-8's	0.017	0.008	6.298	7.496	0.136	0.064
n-Octane	0.005	0.003	2.264	2.944	0.048	0.025
Ethylbenzene	0.000	0.000	0.508	0.498	0.010	0.004
M&P-Xylene	0.001	0.000	0.541	0.533	0.011	0.004
O-Xylene	0.000	0.000	0.785	0.758	0.015	0.006
Other C-9's	0.004	0.002	2.891	3.844	0.058	0.031
n-Nonane	0.001	0.001	1.315	1.880	0.026	0.015
Other C10's	0.000	0.000	2.858	4.175	0.054	0.031
n-Decane	0.000	0.000	0.814	1.270	0.015	0.010
Undecanes Plus	0.000	0.000	7.660	13.529	0.145	0.101
TOTAL	100.000	6.257	100.000	100.000	100.000	6.864

TABLE 1-B

COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C_{11+}

SEPARATOR GOR.....: 55817 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 267 psig
SEPARATOR TEMPERATURE.....: 73 °F

UNDECANES PLUS (C_{11+}) FRACTION CHARACTERISTICS

COMPONENT	Specific Gravity °API	Specific Gravity **	Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value ***
Gas	N/A	0.8250	156.000	16.558	8,400
Oil	53.492	0.7649	167.900	14.264	128,476
Wellstream	N/A	0.7649	167.900	14.264	N/A

TOTAL SAMPLE CHARACTERISTICS

COMPONENT	Specific Gravity °API	Specific Gravity **	Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value Dry ***	Gross Heating Value Saturated ***
Gas	N/A	0.7247	20.912	159.829	1,280	1,259
Oil	84.429	0.6553	81.446	25.191	N/A	112,760
Wellstream	N/A	0.7615	22.054	50.270	N/A	N/A

* GPM (gallons per Mscf) determined at 14.85 psia and 60 °F

** Gas specific gravity and wellstream specific gravity determined relative to air (SG=1.000).
Oil specific gravity determined relative to water (SG=1.000).

*** Gross Heating Value units for gas (real basis) and oil are BTU/Scf and BTU/Gal, respectively.

ATTACHMENT S: AIR POLLUTION CONTROL DEVICE/EMISSION REDUCTION DEVICES SHEETS

VAPOR COMBUSTION

AP-42 EMISSION FACTORS

ATTACHMENT S – AIR POLLUTION CONTROL DEVICE / EMISSION REDUCTION DEVICE SHEETS

Complete the applicable air pollution control device sheets for each flare, vapor combustor, thermal oxidizer, condenser, adsorption system, vapor recovery unit, BTEX Eliminator, Reboiler with and without Glow Plug, etc. at the facility. Use extra pages if necessary.

Emissions calculations must be performed using the most conservative control device efficiency.

The following five (5) rows are only to be completed if registering an alternative air pollution control device.

Emission Unit ID:	Make/Model:
Primary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: ☐ Yes ☐ No
Secondary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: ☐ Yes ☐ No

VAPOR COMBUSTION
(Including Enclosed Combustors)

General Information

Control Device ID#: APC-COMB-TKLD	Installation Date: TBD ☐ New ☒ Modified ☐ Relocated	
Maximum Rated Total Flow Capacity 6,125 scfh 147,000 scfd	Maximum Design Heat Input (from mfg. spec sheet) 15.0 MMBTU/hr	Design Heat Content 2,450 BTU/scf

Control Device Information

Type of Vapor Combustion Control?

☒ Enclosed Combustion Device ☐ Elevated Flare ☐ Ground Flare
☐ Thermal Oxidizer

Manufacturer: MRW Technologies Model: TBF-5.5-30-147000	Hours of operation per year? 8,760

List the emission units whose emissions are controlled by this vapor control device (Emission Point ID# APC-COMB-TKLD)

Emission Unit ID#	Emission Source Description	Emission Unit ID#	Emission Source Description
EU-DEHY1	TEG Dehydration Unit Flash Tank ONLY	EU-LOAD-COND	Condensate Truck Loading
EU-TANKS-COND	Condensate Tanks	EU-LOAD-PW	Produced Water Truck Loading
EU-TANKS-PW	Produced Water Tanks		

If this vapor combustor controls emissions from more than six (6) emission units, please attach additional pages.

Assist Type (Flares only)	Flare Height	Tip Diameter	Was the design per §60.18?
☐ Steam ☐ Air ☐ Pressure ☒ Non	30 feet	N/A feet	☐ Yes ☒ No Provide determination.

Waste Gas Information

Maximum Waste Gas Flow Rate	Heat Value of Waste Gas Stream	Exit Velocity of the Emissions Stream
102.08 (scfm)	2,450BTU/ft^3	(ft/s)

Provide an attachment with the characteristics of the waste gas stream to be burned.

Pilot Gas Information

Number of Pilot Lights	Fuel Flow Rate to Pilot Flame per Pilot	Heat Input per Pilot	Will automatic re-ignition be used?
1	50 scfh	45,250 BTU/hr	☒ Yes ☐ No

If automatic re-ignition is used, please describe the method. **If the pilot flame is lost, the control system will automatically attempt to relight the pilot. If the re-ignition attempt fails, the pilot solenoid valve will automatically close and a local and remote alarm signal will be generated to indicate loss of pilot flame.**

Is pilot flame equipped with a monitor to detect the presence of the flame? ☒ Yes ☐ No	If Yes, what type? ☐ Thermocouple ☐ Infrared ☐ Ultraviolet ☐ Camera ☒ Other: flame rod

Describe all operating ranges and maintenance procedures required by the manufacturer to maintain the warranty. *(If unavailable, please indicate).*

Additional information attached? ☒ Yes ☐ No
Please attach copies of manufacturer's data sheets, drawings, flame demonstration per §60.18 or §63.11(b) and performance testing.

CONDENSER		
General Information		
Control Device ID#: APC-COND	Installation Date: TBD ☒ New ☐ Modified ☐ Relocated	
Manufacturer: Jatco	Model:	Control Device Name: Still Column Condenser
Control Efficiency (%): Varies by pollutant		
Manufacturer's required temperature range for control efficiency. ºF		
Describe the warning and/or alarm system that protects against operation when unit is not meeting the design requirements:		
Describe all operating ranges and maintenance procedures required by the manufacturer to maintain the warranty.		
Additional information attached? ☐ Yes ☒ No Please attach copies of manufacturer's data sheets.		
Is condenser routed to a secondary APCD or ERD? ☒ Yes ☐ No		

Tank Battery Combustor Specification Sheet
MRW Technologies, Inc.
Combustor Model Number: TBF-5.5-30-147000

Expected Destruction Removal Efficiency (DRE):	98% or Greater of Non-Methane Hydrocarbons
Unit Size:	5.5-foot Diameter 30-Foot Overall Height
Design Heat Input:	15 MMBTU/HR
Design Flow Rates:	147,000 SCFD
Design Heat Content:	2450 BTU/SCF
Waste Gas Flame Arrestor:	2" Enardo
Pilot Type:	MRW Electric Ignition
Pilot Operation (Continuous/Intermittent):	Continuous
Pilot Fuel Consumption:	50 SCFH or Less
Pilot Monitoring Device:	Flame Rod
Automatic Re-Ignition:	Included
Remote Alarm Indication:	Included

Description of Control Scheme:

The Combustor pilot is monitored via flame rod. If the pilot flame is lost, the control system will automatically attempt to relight the pilot. If the re-ignition attempt fails, the pilot solenoid valve will automatically close and a local & remote alarm signal will be generated to indicate loss of pilot flame.

Since flares do not lend themselves to conventional emission testing techniques, only a few attempts have been made to characterize flare emissions. Recent EPA tests using propylene as flare gas indicated that efficiencies of 98 percent can be achieved when burning an offgas with at least 11,200 kJ/m^3 (300 Btu/ft^3). The tests conducted on steam-assisted flares at velocities as low as 39.6 meters per minute (m/min) (130 ft/min) to 1140 m/min (3750 ft/min), and on air-assisted flares at velocities of 180 m/min (617 ft/min) to 3960 m/min (13,087 ft/min) indicated that variations in incoming gas flow rates have no effect on the combustion efficiency. Flare gases with less than 16,770 kJ/m^3 (450 Btu/ft^3) do not smoke.

Table 13.5-1 presents flare emission factors, and Table 13.5-2 presents emission composition data obtained from the EPA tests.[1] Crude propylene was used as flare gas during the tests. Methane was a major fraction of hydrocarbons in the flare emissions, and acetylene was the dominant intermediate hydrocarbon species. Many other reports on flares indicate that acetylene is always formed as a stable intermediate product. The acetylene formed in the combustion reactions may react further with hydrocarbon radicals to form polyacetylenes followed by polycyclic hydrocarbons.[2]

In flaring waste gases containing no nitrogen compounds, NO is formed either by the fixation of atmospheric nitrogen (N) with oxygen (O) or by the reaction between the hydrocarbon radicals present in the combustion products and atmospheric nitrogen, by way of the intermediate stages, HCN, CN, and OCN.[2] Sulfur compounds contained in a flare gas stream are converted to SO_2 when burned. The amount of SO_2 emitted depends directly on the quantity of sulfur in the flared gases.

Table 13.5-1 (English Units). EMISSION FACTORS FOR FLARE OPERATIONS[a]

EMISSION FACTOR RATING: B

Component	Emission Factor (lb/10^6 Btu)
Total hydrocarbons[b]	0.14
Carbon monoxide	0.37
Nitrogen oxides	0.068
Soot[c]	0 - 274

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

ATTACHMENT T: EMISSIONS CALCULATIONS

SWN Production Company, LLC
Michael Dunn Pad
Summary of Criteria Air Pollutant Emissions

Equipment	Unit ID	Emission Point ID	NOx		CO		Total VOC[1]		SO_2		PM Total	
			lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
145-hp Caterpillar G3306 NA Engine	EU-C1	EP-C1	0.32	1.40	0.64	2.80	0.24	1.07	<0.01	<0.01	0.02	0.11
145-hp Caterpillar G3306 NA Engine	EU-C2	EP-C2	0.32	1.40	0.64	2.80	0.24	1.07	<0.01	<0.01	0.02	0.11
23.6-hp Kubota DG972-E2 Engine	EU-C3	EP-C3	0.31	1.36	5.55	24.30	0.31	1.36	<0.01	<0.01	<0.01	0.02
1.0-mmBtu/hr GPU Burner	EU-GPU1	EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU2	EP-GPU2	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU3	EP-GPU3	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU4	EP-GPU4	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
0.5-mmBtu/hr Heater Treater	EU-HT1	EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02
20.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	EP-RB1	-	-	-	-	1.80	7.90	-	-	-	-
0.75-mmBtu/hr TEG Reboiler	EU-RB1	EP-RB1	0.08	0.36	0.07	0.30	<0.01	0.02	<0.01	<0.01	0.01	0.03
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	APC-COMB-TKLD	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	APC-COMB-TKLD	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	APC-COMB-TKLD	-	-	-	-	1.28	5.59	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	APC-COMB-TKLD	-	-	-	-	0.04	0.17	-	-	-	-
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	APC-COMB-TKLD	2.07	9.07	4.13	18.10	4.52	19.78	-	-	0.05	0.20
Vapor Combustor Pilot	EU-PILOT	APC-COMB-TKLD	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	EP-FUG	-	-	-	-	0.88	3.83	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	EP-HR	-	-	-	-	-	-	-	-	1.42	4.65
Total =			**3.60**	**15.79**	**11.45**	**50.16**	**9.34**	**40.93**	**0.01**	**0.02**	**1.56**	**5.28**
Current Permit Allowable Emissions =			**3.60**	**15.79**	**11.45**	**50.16**	**9.48**	**41.50**	**0.01**	**0.02**	**1.56**	**5.28**
Net Allowable Emissions =			**-**	**-**	**-**	**-**	**(0.13)**	**(0.58)**	**-**	**-**	**-**	**-**

Notes:
[1] Total VOC includes all constituents heavier than Propane (C3+), including hazardous air pollutants (HAP). Speciated HAP presented in following table.

SWN Production Company, LLC
Michael Dunn Pad
Summary of Hazardous Air Pollutants

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-C1	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
145-hp Caterpillar G3306 NA Engine	EU-C2	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
23.6-hp Kubota DG972-E2 Engine	EU-C3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU3	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU4	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
20.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.07	0.00	-	-	0.04	0.06	0.11	0.29
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	<0.01	0.01	-	-	0.07	0.01	0.02	0.11
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	-	-	0.01	0.02	-	-	0.21	0.03	0.07	0.34
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.03	<0.01	0.01	0.05
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		**0.01**	**0.01**	**0.08**	**0.03**	**0.04**	**0.01**	**0.37**	**0.11**	**0.22**	**0.88**
Current Permit Allowable Emissions =		**0.01**	**0.01**	**0.09**	**0.03**	**0.04**	**0.01**	**0.38**	**0.11**	**0.22**	**0.89**
Net Allowable Emissions =		**-**	**-**	**(0.01)**	**-**	**-**	**-**	**(0.01)**	**(0.00)**	**(0.00)**	**(0.02)**

Continued on Next Page

SWN Production Company, LLC
Michael Dunn Pad
Summary of Hazardous Air Pollutants (Continued)

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-C1	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
145-hp Caterpillar G3306 NA Engine	EU-C2	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
23.6-hp Kubota DG972-E2 Engine	EU-C3	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	-	<0.01	<0.01	0.02
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU2	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU3	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU4	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
20.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.31	0.00	-	-	0.18	0.28	0.49	1.26
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	0.01	0.04	-	-	0.31	0.04	0.10	0.49
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	0.01	<0.01	<0.01	0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	-	-	0.03	0.10	-	-	0.92	0.12	0.32	1.49
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.01	-	-	0.15	0.02	0.04	0.22
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		**0.04**	**0.02**	**0.37**	**0.15**	**0.19**	**0.04**	**1.62**	**0.46**	**0.95**	**3.86**
Current Permit Allowable Emissions =		**0.04**	**0.02**	**0.39**	**0.15**	**0.19**	**0.04**	**1.65**	**0.48**	**0.96**	**3.93**
Net Allowable Emissions =		**-**	**-**	**(0.02)**	**-**	**-**	**-**	**(0.02)**	**(0.02)**	**(0.00)**	**(0.07)**

SWN Production Company, LLC
Michael Dunn Pad
Summary of Greenhouse Gas Emissions - Metric Tons per Year (Tonnes)

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\ Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\ Eq.}$		Total CO_2 + $CO_{2\ Eq.}$ [1]	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
145-hp Caterpillar G3306 NA Engine	EU-C1	155.04	616.04	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.64
145-hp Caterpillar G3306 NA Engine	EU-C2	155.04	616.04	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.64
23.6-hp Kubota DG972-E2 Engine	EU-C3	18.82	74.77	0.08	0.33	2.09	8.29	<0.01	<0.01	0.01	0.05	20.92	83.12
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU2	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU3	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU4	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	232.40	<0.01	<0.01	0.03	0.11	<0.01	<0.01	0.03	0.13	58.55	232.64
20.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	<0.01	0.45	1.77	11.16	44.36	-	-	-	-	11.17	44.36
0.75-mmBtu/hr TEG Reboiler	EU-RB1	87.73	348.60	<0.01	0.01	0.04	0.16	<0.01	<0.01	0.05	0.20	87.82	348.96
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor[2]	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor[2]	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.01	0.22	0.89	5.61	22.30	-	-	-	-	5.61	22.31
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	0.01	0.62	2.48	15.59	61.96	-	-	-	-	15.60	61.97
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	1,754.66	6,972.07	0.03	0.13	0.83	3.28	<0.01	0.01	0.99	3.92	1,756.47	6,979.27
Vapor Combustor Pilot	EU-PILOT	5.29	21.03	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	21.05
Fugitive Emissions	EU-FUG	0.01	0.03	1.27	5.05	31.77	126.24	-	-	-	-	31.78	126.27
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		**2,761.48**	**10,972.62**	**2.70**	**10.73**	**67.51**	**268.25**	**0.01**	**0.02**	**1.54**	**6.14**	**2,830.53**	**11,247.01**
Current Permit Allowable Emissions =		**2,761.48**	**10,972.62**	**2.70**	**10.73**	**67.53**	**268.34**	**0.01**	**0.02**	**1.54**	**6.14**	**2,830.55**	**11,247.10**
Net Allowable Emissions =		**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.02)**	**(0.10)**	**-**	**-**	**-**	**-**	**(0.02)**	**(0.10)**

Notes:
[1] CO_2 Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO_2 = 1, CH_4 = 25, N_2O = 298
[2] Per API Compendium (2009) Chapter 5: Because most of the CH_4 and CO_2 emissions from storage tanks occur as a result of flashing (which is controlled by the vapor combustor in this case), working and breathing loss emissions of these gases are very small in production and virtually non-existent in the downstream segments. Vapors from the tanks are routed to the vapor combustor at this site. Therefore, GHG emissions from the condensate and produced water tanks are assumed to be negligible.

SWN Production Company, LLC
Michael Dunn Pad
Summary of Greenhouse Gas Emissions - Short Tons per Year (Tons)

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\ Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\ Eq.}$		Total CO_2 + $CO_{2\ Eq.}$[1]	
		lb/hr	tons/yr[2]	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr
145-hp Caterpillar G3306 NA Engine	EU-C1	155.04	679.06	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.73
145-hp Caterpillar G3306 NA Engine	EU-C2	155.04	679.06	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.73
23.6-hp Kubota DG972-E2 Engine	EU-C3	18.82	82.42	0.08	0.37	2.09	9.14	<0.01	<0.01	0.01	0.06	20.92	91.63
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU2	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU3	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU4	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	256.18	<0.01	<0.01	0.03	0.12	<0.01	<0.01	0.03	0.14	58.55	256.44
20.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	0.01	0.45	1.96	11.16	48.89	-	-	-	-	11.17	48.91
0.75-mmBtu/hr TEG Reboiler	EU-RB1	87.73	384.27	<0.01	0.01	0.04	0.18	<0.01	<0.01	0.05	0.22	87.82	384.67
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor[3]	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor[3]	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.01	0.22	0.98	5.61	24.59	-	-	-	-	5.61	24.59
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	0.02	0.62	2.73	15.59	68.29	-	-	-	-	15.60	68.31
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	1,754.66	7,685.39	0.03	0.14	0.83	3.62	<0.01	0.01	0.99	4.32	1,756.47	7,693.33
Vapor Combustor Pilot	EU-PILOT	5.29	23.18	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	23.21
Fugitive Emissions	EU-FUG	0.01	0.03	1.27	5.57	31.77	139.15	-	-	-	-	31.78	139.18
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		**2,761.48**	**12,095.25**	**2.70**	**11.83**	**67.51**	**295.69**	**0.01**	**0.02**	**1.54**	**6.76**	**2,830.53**	**12,397.71**
Current Permit Allowable Emissions =		**2,761.48**	**12,095.25**	**2.70**	**11.83**	**67.53**	**295.80**	**0.01**	**0.02**	**1.54**	**6.76**	**2,830.55**	**12,397.81**
Net Allowable Emissions =		**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.02)**	**(0.11)**	**-**	**-**	**-**	**-**	**(0.02)**	**(0.11)**

Notes:
[1] CO_2 Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO_2 = 1, CH_4 = 25, N_2O = 298
[2] EPA and API GHG calculation methodologies calculate emissions in metric tons (tonnes). These values have been converted to short tons for consistency with permitting threshold units.
[3] Per API Compendium (2009) Chapter 5: Because most of the CH_4 and CO_2 emissions from storage tanks occur as a result of flashing (which is controlled by the vapor combustor in this case), working and breathing loss emissions of these gases are very small in production and virtually non-existent in the downstream segments. Vapors from the tanks are routed to the vapor combustor at this site. Therefore, GHG emissions from the condensate and produced water tanks are assumed to be negligible.

SWN Production Company, LLC
Michael Dunn Pad
Glycol Dehydration Unit Emissions - Criteria and Hazardous Air Pollutants

Equipment Information

Parameter	Units	Value
Unit ID	-	EU-DEHY1
Emission Point ID:	-	EP-RB1
Maximum Throughput	MMSCFD	20.0
Operating Hours	Hours/Year	8,760
Wet Gas Temperature	°F	70
Wet Gas Pressure	psig	900
Pump Make	-	Kimray
Pump Model	-	45015 PV
Pump Type	Electric/Gas	Gas
Lean Glycol Flow Rate[1]	gpm	7.50
Flash Tank Temperature	°F	150
Flash Tank Pressure	psig	50
Flash Tank Controls[2]	-	Combustion
Regenerator Still Vent Controls[3]	-	Condenser/ Combustion
Flash Tank Control Efficiency	%	98%
Condenser Temperature	°F	100
Condenser Pressure	psia	14.00

Proposed Emissions[4]

Unit ID: **EU-DEHY1**

Pollutant	lb/hr	TPY
n-Hexane	0.04	0.18
Benzene	0.07	0.31
Toluene	0.06	0.28
Ethylbenzene	0.00	0.00
Xylenes	0.11	0.49
Total HAPs =	**0.29**	**1.26**
Total VOCs =	**1.80**	**7.90**

SWN Production Company, LLC
Michael Dunn Pad
Glycol Dehydration Unit Emissions - Criteria and Hazardous Air Pollutants (Continued)

GRI-GLYCalc Results - Controlled (For Reference Only)[5]

	STILL VENT		FLASH TANK		TOTAL (EU-DEHY1)	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	0.0356	0.1557	0.0245	0.1074	0.0601	0.2631
Benzene	0.0612	0.2678	0.0030	0.0131	0.0642	0.2809
Toluene	0.0557	0.2442	0.0048	0.0211	0.0605	0.2653
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes	0.0975	0.4271	0.0122	0.0535	0.1097	0.4806
Total HAP =	**0.2500**	**1.0948**	**0.0445**	**0.1951**	**0.2945**	**1.2899**
Total VOCs =	**1.5692**	**6.8731**	**1.0070**	**4.4106**	**2.5762**	**11.2837**

GRI-GLYCalc Results - Uncontrolled (For Reference Only)[5]

	STILL VENT		FLASH TANK		TOTAL (EU-DEHY1)	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	0.2660	1.1650	1.2265	5.3720	1.4925	6.5370
Benzene	0.8089	3.5430	0.1499	0.6565	0.9588	4.1995
Toluene	1.9500	8.5410	0.2403	1.0526	2.1903	9.5936
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes	11.5897	50.7629	0.6105	2.6738	12.2002	53.4367
Total HAP =	**14.6146**	**64.0119**	**2.2272**	**9.7549**	**16.8418**	**73.7668**
Total VOCs =	**20.8962**	**91.5252**	**50.3490**	**220.5286**	**71.2452**	**312.0538**

Notes:

[1] Dehydration unit is equipped with two (2) 7.5 gpm Kimray 45015 gas injection pumps. One is a backup; only one pump will be in use at one time.

[2] Flash tank off gas is routed to the combustor via the tanks. 100% capture efficiency and 98% control efficiency assumed; therefore, 98% control efficiency was taken in GRI-GLYCalc™.

[3] Regenerator still vent emissions are controlled by condenser, with non-condensables routed to the reboiler for destruction. 50% combustion control efficiency taken in GRI-GLYCalc™.

[4] 15% safety factor added to controlled GRI-GLYCalc™ results to account for potential fluctuations in gas composition. Note that proposed emissions include still vent emissions only. Flash tank emissions are routed to the combustor via the produced water tanks. Uncombusted emissions are reported at the combustor.

[5] GRI-GLYCalc™ report attached.

SWN Production Company, LLC
Michael Dunn Pad
Glycol Dehydration Unit Emissions - Greenhouse Gas Emissions

CH_4 mol% from gas analysis =	77.183%
CO_2 mol% from gas analysis =	0.159%

Proposed Emissions [1]

Unit ID: **EU-DEHY1**

Pollutant	lb/hr	tons/yr
CO_2 =	<0.01	0.01
CH_4 =	0.45	1.96
CH_4 as CO_2e =	11.16	48.89
Total CO_2 + CO_2e =	**11.17**	**48.91**

GRI-GLYCalc Results - Controlled (For Reference Only) [2]

Unit ID:	STILL VENT		FLASH TANK		TOTAL (EU-DEHY1)	
Pollutant	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**
CO_2 =	0.0021	0.0092	0.0115	0.0503	0.0136	0.0596
CH_4 from GLYCalc =	0.3721	1.6300	2.0283	8.8842	2.4004	10.5142
CH_4 as CO_2e =	9.3025	40.7500	50.7075	222.1050	60.0100	262.8550
Total CO_2 + CO_2e =	**9.3046**	**40.7592**	**50.7190**	**222.1553**	**60.0236**	**262.9146**

GRI-GLYCalc Results - Uncontrolled (For Reference Only) [2]

Unit ID:	STILL VENT		FLASH TANK		TOTAL (EU-DEHY1)	
Pollutant	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**
CO_2 =	0.0042	0.0185	0.5745	2.5165	0.5788	2.5350
CH_4 from GLYCalc =	0.7472	3.2725	101.4173	444.2076	102.1645	447.4801
CH_4 as CO_2e =	18.6800	81.8125	2,535.4325	11,105.1900	2,554.1125	11,187.0025
Total CO_2 + CO_2e =	**18.6842**	**81.8310**	**2,536.0070**	**11,107.7065**	**2,554.6913**	**11,189.5375**

Notes:

[1] Proposed CH_4 emissions based on GRI-GLYCalc™ results with 20% safety factor added for potential fluctuations in gas composition. Proposed CO_2 emissions calculated using mass balance based on CH_4 and CO_2 mol% in the gas sample. Note that proposed emissions include still vent emissions only. Flash tank emissions are controlled by the combustor and are represented there.

[2] Example CO_2 Calculation (Exhibit 5.1: API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, August 2009):
CO_2 = tonnes CH_4 * tonne mole CH_4/16 tonne CH_4 * tonne mole gas/tonne mole CH_4 * tonne mole CO_2/tonne mole gas * 44 tonne CO_2/tonne mole CO_2

SWN Production Company, LLC
Michael Dunn Pad
Vapor Combustor Emissions Calculations - Criteria and Hazardous Air Pollutants

Criteria and Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors[1]	Total Captured Emissions[2]		Combustor Destruction Efficiency	Total Controlled Emissions (Post-Capture and Combustion)	
			lb/hr	TPY	%	lb/hr	TPY
APC-COMB-TKLD	NOx	0.138	-	-	-	2.07	9.07
	CO	0.2755	-		-	4.13	18.10
	PM	7.6	-		-	0.05	0.20
	VOC	Mass Balance	225.84	989.16	98.00%	4.52	19.78
	n-Hexane	Mass Balance	10.55	46.23	98.00%	0.21	0.92
	Benzene	Mass Balance	0.35	1.52	98.00%	0.01	0.03
	Toluene	Mass Balance	1.37	6.01	98.00%	0.03	0.12
	Ethylbenzene	Mass Balance	1.12	4.89	98.00%	0.02	0.10
	Xylenes	Mass Balance	3.65	15.98	98.00%	0.07	0.32

Notes:

[1] Although a vapor combustor is not considered a flare by design, the function is consistent in that it combusts a waste stream for the purpose of reducing emissions; therefore, flare emission factors for NOx and CO were used to provide the most accurate emissions estimates. Although the combustor is designed to be smokeless, PM emissions have been estimated using AP-42 Table 1.4-1 factor (lb/mmscf) for a conservative estimate.

	Hours per Year:	8,760
	Number of Combustors:	1
NOx and CO emission factors (lb/mmBtu): *TCEQ Air Permit Technical Guidance for Chemical Sources: Flares and Vapor Oxidizers:* High Btu waste streams (>1,000 Btu/scf) based on heat input to each combustor =	15.0	mmBtu/hr per Combustor
	15.0	mmBtu/hr Total Heat Input

[2] Total captured emissions are based on 100% capture efficiency from storage tanks and dehydration unit flash tank and 70% capture efficiency from truck loading with 98% destruction efficiency from the vapor combustor based on 8,760 hours of operation per year. Note that 15% safety factor has been added to flash tank captured vapors to account for potential fluctuations in gas composition. Captured emissions from sources controlled by VOC combustor shown in following tables.

SWN Production Company, LLC
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Vapor Combustor Emissions Calculations - Criteria and Hazardous Air Pollutants (Continued)

Source	Captured VOC Emissions	
	lb/hr	TPY
Dehydration Unit Flash Tank Vapors	60.42	264.63
Condensate Storage Tanks	135.26	592.43
Produced Water Storage Tanks	27.09	118.65
Condensate Truck Loading	2.98	13.05
Produced Water Truck Loading	0.09	0.40
Total VOC =	**225.84**	**989.16**

Source	Captured HAP Emissions (lb/hr)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Dehydration Unit Flash Tank Vapors	1.47	0.18	0.29	0.00	0.73
Condensate Storage Tanks	7.43	0.14	0.89	0.91	2.38
Produced Water Storage Tanks	1.49	0.03	0.18	0.18	0.48
Condensate Truck Loading	0.16	<0.01	0.02	0.02	0.05
Produced Water Truck Loading	<0.01	<0.01	<0.01	<0.01	<0.01
Total HAP =	**10.55**	**0.35**	**1.37**	**1.12**	**3.65**

Source	Captured HAP Emissions (TPY)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Dehydration Unit Flash Tank Vapors	6.45	0.79	1.26	0.00	3.21
Condensate Storage Tanks	32.53	0.60	3.88	4.00	10.44
Produced Water Storage Tanks	6.51	0.12	0.78	0.80	2.09
Condensate Truck Loading	0.72	0.01	0.09	0.09	0.23
Produced Water Truck Loading	0.02	<0.01	<0.01	<0.01	0.01
Total HAP =	**46.23**	**1.52**	**6.01**	**4.89**	**15.98**

SWN Production Company, LLC
Michael Dunn Pad
Vapor Combustor Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**APC-COMB-TKLD**
Description:	Vapor Combustor
Number of Combustors:	1
Burner Design Capacity (mmBtu/hr):	15.0
Stream HHV (Btu/scf):	2,450
Annual Throughput (mmscf):	53.63
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions

Pollutant	lb/hr	tonnes/yr	tons/yr
CO_2	1,754.66	6,972.07	7,685.39
CH_4	0.03	0.13	0.14
N_2O	<0.01	0.01	0.01
CH_4 as CO_2e	0.83	3.28	3.62
N_2O as CO_2e	0.99	3.92	4.32
Total CO_2 + CO_2e =	**1,756.47**	**6,979.27**	**7,693.33**

40 CFR 98 Tables C-1 and C-2 Emission Factors (kg/mmBtu)[1]

Carbon Dioxide (CO_2)	53.06
Methane (CH_4)	1.00E-03
Nitrous Oxide (N_2O)	1.00E-04

Notes:
[1] CO_2e = CO_2 equivalent (Pollutant times GWP multiplier):
40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO_2 = 1, CH_4 = 25, N_2O = 298

ATTACHMENT U: FACILITY-WIDE EMISSION SUMMARY SHEETS

ATTACHMENT U – FACILITY-WIDE CONTROLLED EMISSIONS SUMMARY SHEET

List all sources of emissions in this table. Use extra pages if necessary.

Emission Point ID #	NO_X		CO		VOC		SO_2		PM_{10}		$PM_{2.5}$		CH4		GHG (CO_2e)	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-C1	0.32	1.40	0.64	2.80	0.24	1.07	<0.01	<0.01	0.02	0.11	0.02	0.11	<0.01	0.01	155.19	679.73
EP-C2	0.32	1.40	0.64	2.80	0.24	1.07	<0.01	<0.01	0.02	0.11	0.02	0.11	<0.01	0.01	155.19	679.73
EP-C3	0.31	1.36	5.55	24.30	0.31	1.36	<0.01	<0.01	<0.01	0.02	<0.01	0.02	0.08	0.37	20.92	91.63
EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	<0.01	0.01	117.10	512.89
EP-GPU2	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	<0.01	0.01	117.10	512.89
EP-GPU3	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	<0.01	0.01	117.10	512.89
EP-GPU4	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	<0.01	0.01	117.10	512.89
EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	58.55	256.44
EP-RB1	-	-	-	-	1.80	7.90	-	-	-	-	-	-	0.45	1.96	11.17	48.91
EP-RB1	0.08	0.36	0.07	0.30	<0.01	0.02	<0.01	<0.01	0.01	0.03	0.01	0.03	<0.01	0.01	87.82	384.67
EP-LOAD-COND	-	-	-	-	1.28	5.59	-	-	-	-	-	-	0.22	0.98	5.61	24.59
EP-LOAD-PW	-	-	-	-	0.04	0.17	-	-	-	-	-	-	0.62	2.73	15.60	68.31
APC-COMB-TKLD	2.08	9.09	4.14	18.12	4.52	19.78	<0.01	<0.01	0.05	0.21	0.05	0.21	0.03	0.15	1,761.77	7,716.54
TOTAL	3.60	15.79	11.45	50.16	8.47	37.09	0.01	0.02	0.14	0.63	0.14	0.63	1.43	6.26	2,798.75	12,258.53

Annual emissions shall be based on 8,760 hours per year of operation for all emission units except emergency generators.

According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, fugitive emissions shall not be included in the PTE above.

Note that the emissions from the APC-COMB-TKLD includes uncombusted emissions from the glycol dehydrator flash tank, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions.

ATTACHMENT U – FACILITY-WIDE HAP CONTROLLED EMISSIONS SUMMARY SHEET														
List all sources of emissions in this table. Use extra pages if necessary.														
Emission Point ID #	Formaldehyde		Benzene		Toluene		Ethylbenzene		Xylenes		Hexane		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-C1	0.02	0.09	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.03	0.15
EP-C2	0.02	0.09	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.03	0.15
EP-C3	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	<0.01	0.02
EP-GPU1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-HT1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-RB1	-	-	0.07	0.31	0.06	0.28	0.00	0.00	0.11	0.49	0.04	0.18	0.29	1.26
EP-RB1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-LOAD-COND	-	-	<0.01	0.01	0.01	0.04	0.01	0.04	0.02	0.10	0.07	0.31	0.11	0.49
EP-LOAD-PW	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01
APC-COMB-TKLD	<0.01	<0.01	0.01	0.04	0.04	0.16	0.03	0.14	0.10	0.42	0.28	1.24	0.46	1.99
TOTAL	0.04	0.19	0.08	0.37	0.10	0.45	0.03	0.14	0.21	0.91	0.34	1.47	0.83	3.63

Annual emissions shall be based on 8,760 hours per year of operation for all emission units except emergency generators.
According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, fugitive emissions shall not be included in the PTE above.

Note that the emissions from the APC-COMB-TKLD includes uncombusted emissions from the glycol dehydrator flash tank, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions.