SWN Production Company, LLC
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Spring, Texas 77391-2359
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FORK RIDGE PAD

G70-D PERMIT MODIFICATION

REV	BY	DATE	DESCRIPTION	PERMIT	FACILITIES REVIEWED	DATE
1	SWN	01/2016	-	G70-A081A		
2	SWN	08/2016	-	G70-C091B		
3	CMM	03/2017	AOS	G70-B091B		
4	CMM	08/2017	G70-D Modification: ADD 3516 ENG		AL	8/14/2017

SWN PRODUCTION COMPANY, LLC

FORK RIDGE PAD

GENERAL PERMIT G70-D MODIFICATION APPLICATION

SUBMITTED TO WVDEP DIVISION OF AIR QUALITY
AUGUST 2017

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this G70-D General Permit modification application for the Fork Ridge Pad, a natural gas production facility in Marshall County. The facility currently operates under Permit No. G70-C091B. With this application, SWN requests authorization to operate under the General Permit G70-D for Oil and Natural Gas Production Facilities. The purpose of this modification application is to add one (1) 1,380-hp Caterpillar G3516B engine. Please note that one (1) 23.6-hp Kubota engine was previously added under the Alternative Operating Scenario. Equipment to be authorized includes the following:

- One (1) Caterpillar G3406 NA Compressor Engine
- One (1) Kubota DG972-E2 Compressor Engine
- One (1) Caterpillar G3516B Compressor Engine
- One (1) 15-MMSCFD TEG Dehydration Unit
- One (1) 0.75-mmBtu/hr TEG Reboiler
- Eight (8) 1.0-mmBtu/hr Gas Production Units
- Two (2) 0.5-mmBtu/hr Heater Treaters
- One (1) 1.5-mmBtu/hr Line Heater
- Five (5) 400-bbl Condensate Tanks
- Five (5) 400-bbl Produced Water Tanks
- Condensate Truck Loading
- Produced Water Truck Loading
- One (1) 30.0-mmBtu/hr Vapor Combustor with Pilots
- Fugitive Emissions
- Fugitive Haul Road 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 current project are presented in Attachment S. All other equipment emissions remain as currently permitted and have not been addressed further. A fuel heating value of 905 Btu/scf was used to calculate emissions from natural gas-fired equipment. Actual heating value may vary (generally 905 - 1,300) but using a lower heating value in the emissions calculations provides a more conservative (higher) estimate of fuel use.

Emissions from the Caterpillar engine were calculated with manufacturer data when available and AP-42/EPA emissions factors for the remaining pollutants.

Fugitive emissions were calculated with a component count by equipment type from a similar facility, and representative extended gas and liquids analyses.

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, and an engine manufacturer specification sheet 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 application includes the addition of a non-certified engine and is classified as a modification.

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 60 SUBPART JJJJ - STANDARDS OF PERFORMANCE FOR STATIONARY SPARK IGNITION INTERNAL COMBUSTION ENGINES:

EU-ENG3 has a horsepower rating of 1,380-hp (≥ 1,350-hp) and was manufactured on March 20, 2014 (after July 1, 2010); therefore it is subject to the Stage 2 emission limitations under this Subpart. SWN will comply with all applicable requirements.

40 CFR PART 60 SUBPART OOOO - STANDARDS OF PERFORMANCE FOR CRUDE OIL AND NATURAL GAS PRODUCTION, TRANSMISSION, AND DISTRIBUTION:

The emission sources affected by this Subpart include well completions, pneumatic controllers, equipment leaks from natural gas processing plants, sweetening units at natural gas processing plants, reciprocating compressors, centrifugal compressors and storage vessels which are constructed, modified or reconstructed after August 23, 2011 and before September 18, 2015.

The existing wells at this location were completed during the effective date of this Subpart and are subject to the compliance requirements. Reciprocating compressors at well sites are not subject to this Subpart.

40 CFR 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:

The emission sources affected by this Subpart include well completions, centrifugal compressors, reciprocating compressors, pneumatic controllers, storage vessels, fugitive sources at well sites, fugitive sources at compressor stations, pneumatic pumps, equipment leaks from natural gas processing plants and sweetening units at natural gas processing plants which are constructed, modified or reconstructed after September 18, 2015.

Reciprocating compressors at well sites are not subject to this Subpart.

40 CFR PART 63 SUBPART ZZZZ - NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES FROM STATIONARY RECIPROCATING INTERNAL COMBUSTION ENGINES - AREA SOURCE:

The original rule, published on February 26, 2004, initially affected new (constructed or reconstructed after December 19, 2002) reciprocating internal combustion engines (RICE) with a site-rating greater than 500 brake horsepower (HP) located at a major source of HAP emissions. On January 18, 2008, EPA published an amendment that promulgated standards for RICE constructed or reconstructed after June 12, 2006 with a site rating less than or equal to 500 HP located at major sources, and for engines constructed and reconstructed after June 12, 2006 located at area sources. On August 10, 2010, EPA published another amendment that promulgated standards for existing (constructed or reconstructed before June 12, 2006) RICE at

area sources and existing RICE (constructed or reconstructed before June 12, 2006) with a site rating of less than or equal to 500 HP at major sources.

Owners and operators of new or reconstructed engines at area sources must meet the requirements of Subpart ZZZZ by complying with either 40 CFR Part 60 Subpart IIII (for CI engines) or 40 CFR Part 60 Subpart JJJJ (for SI engines). Based on emission calculations, this facility is a minor source of HAP. The 1,380-hp, four-stroke, lean-burn natural gas-fired flash gas compressor engine is considered a new engine manufactured after July 1, 2010 and will meet the requirements of this Subpart by complying with requirements under NSPS Subpart JJJJ.

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: Fork Ridge Pad

Operating Site Physical Address: 8836 Fork Ridge Rd.
If none available, list road, city or town and zip of facility.

City: Glen Easton	Zip Code: 26039	County: Marshall

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Latitude: 39.87078
Longitude: -80.63898

SIC Code: 1311 NAICS Code: 211111	DAQ Facility ID No. (For existing facilities) 051-00205

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 Phone: 832-796-1000 Fax: 405-849-3102
Email: Carla_Suszkowski@SWN.com Date: 8-17-17

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 is for the addition of one (1) Caterpillar G3516B engine (EU-ENG3) to a facility which currently includes one (1) Caterpillar G3406 NA engine (EU-ENG1), one (1) Kubota DG972-E2 engine (EU-ENG2), one (1) 15-MMSCFD TEG dehydration unit (EU-DEHY1), one (1) 0.75-mmBtu/hr TEG reboiler (EU-RB1), eight (8) 1.0-mmBtu/hr natural gas-fired gas production units (GPU) burner (EU-GPU1 – EU-GPU8), two (2) 0.5-mmBtu/hr natural gas-fired heater treaters (EU-HT1 – EU-HT2), one (1) 1.5-mmBtu/hr natural gas-fired line heater (EU-LH1), five (5) 400-bbl condensate tanks (EU-TANKS-COND), five (5) 400-bbl produced water tanks (EU-TANKS-PW), condensate and produced water truck loading (EU-LOAD-COND and EU-LOAD-PW), one (1) 30.0-mmBtu/hr vapor combustor (APC-COMB) with three (3) 50-SCFH pilots (EU-PILOTS), fugitive emissions (EU-FUG), and fugitive haul road emissions (EU-HR).
Directions to the facility: From the intersection of SR 250 and CR 2 in Moundsville, WV, travel south on SR 250 14.17 miles to intersection of SR 250 and CR 17(Fork Ridge Road). Turn right onto CR 17 and travel 3.64 miles to well pad entrance on the 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, OOOO and/or OOOOa [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)** – 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/Rail Car 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.

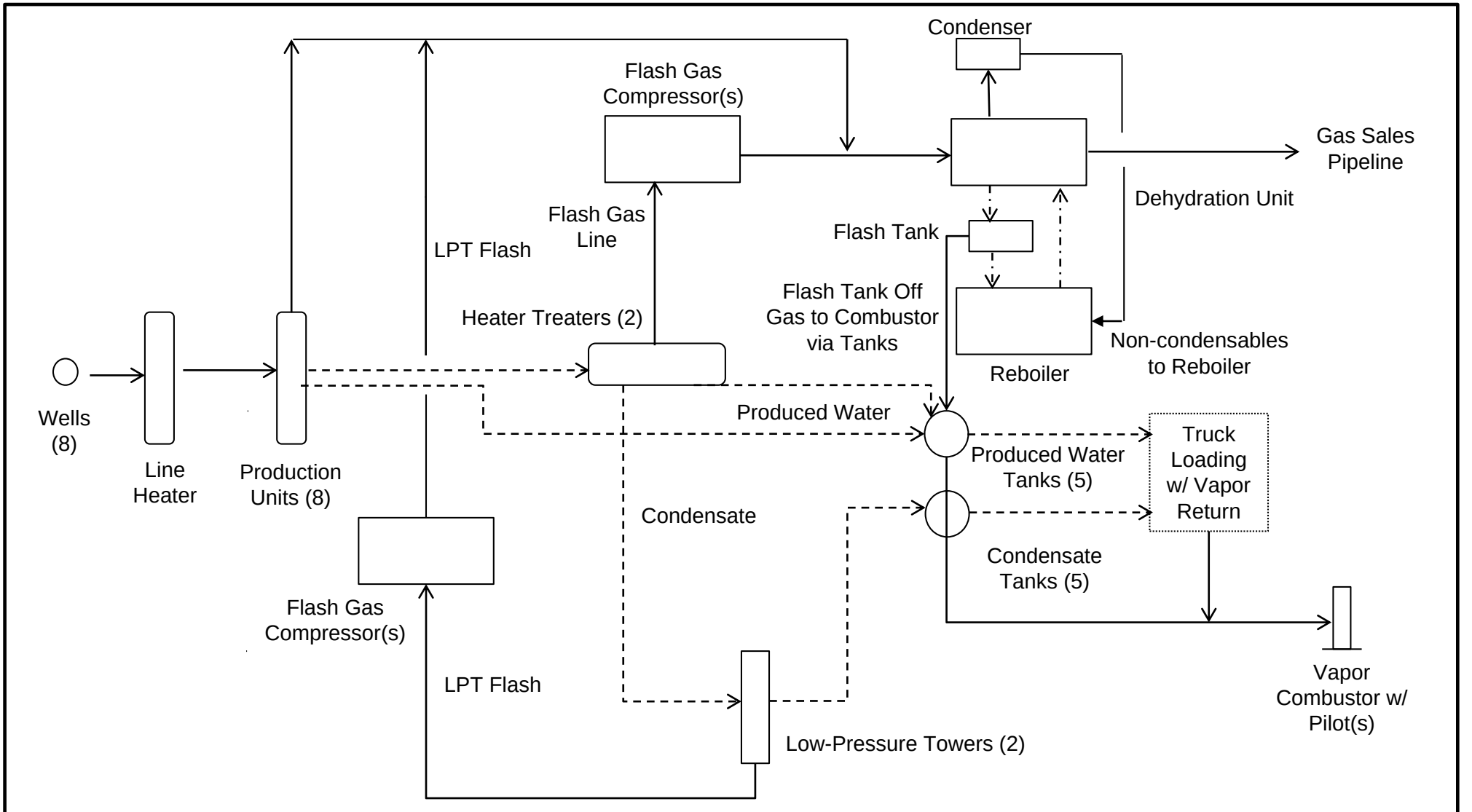
This certificate shall be permanent until cessation of the business for which the certificate of registration was granted or until it is suspended, revoked or cancelled by the Tax Commissioner.

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.

atL006 v.4
L1160094016

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

Fork Ridge Pad

Attachment D: Process Flow Diagram

August 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 wellheads, through the line heater, then 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 treaters. The flash from the heater treaters is captured via natural gas-fired engine-driven flash gas compressors. Condensate flows into the low-pressure towers. Flash gases from the low-pressure towers are routed via hard-piping (with 100% capture efficiency) to the inlet of the flash gas compressors to be compressed.

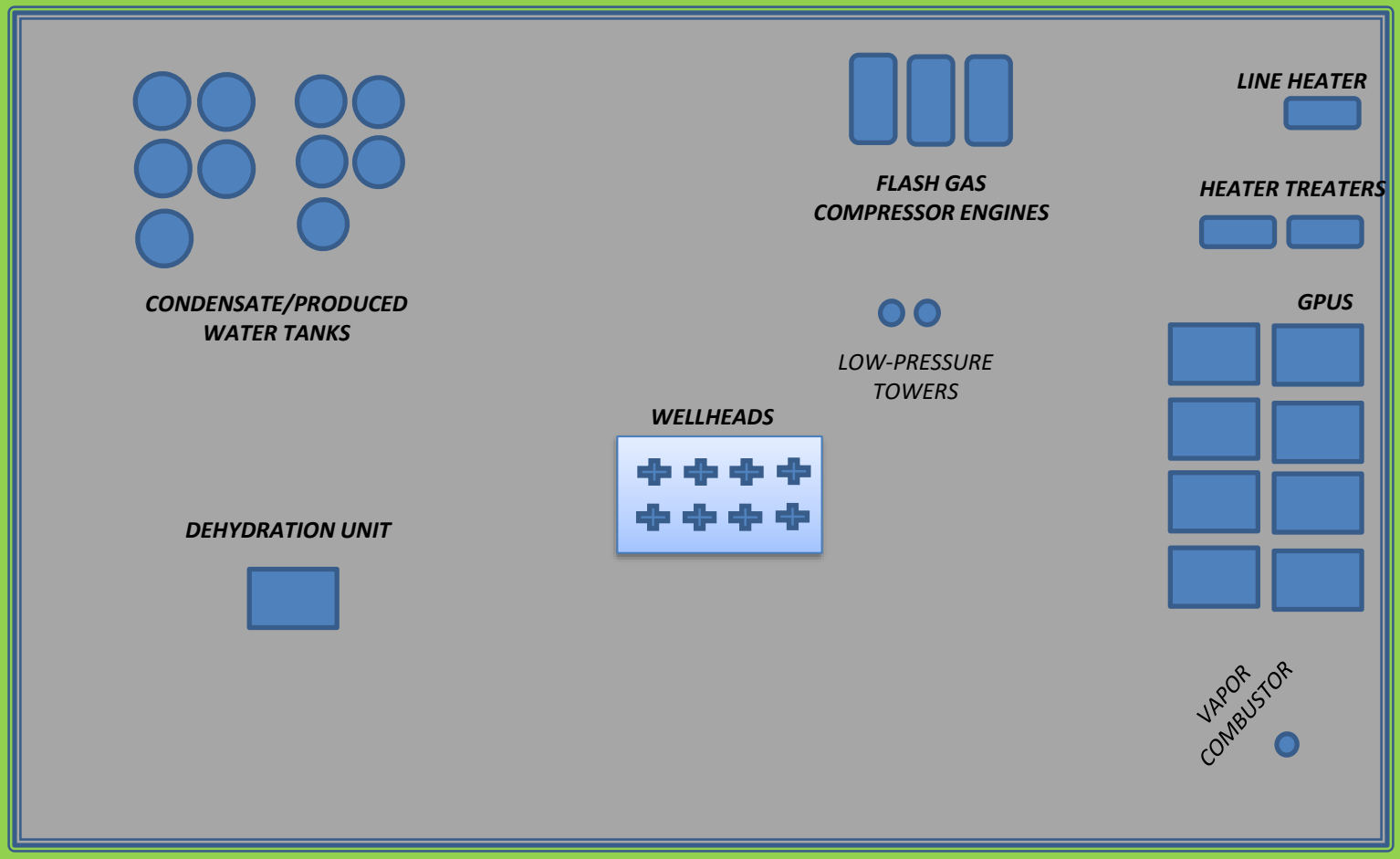
Working, breathing and flashing vapors from the condensate and produced water storage tanks are routed to the vapor combustor with 100% capture efficiency to be burned with at least 98% combustion efficiency. The vapor combustor has three (3) natural gas-fired pilots to ensure a constant flame for combustion.

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 gas are routed to the vapor combustor with a 100% capture efficiency to be burned with a 98% combustion efficiency.

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

ATTACHMENT F: PLOT PLAN

Please note that the simple plot plan provided is only a representation of production/emissions equipment to be installed. Actual location specifications and equipment placement are not to scale.



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

SWN Production Company, LLC
Fork Ridge Pad
Simple Plot Plan
August 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-ENG1	EP-ENG1	215-hp Caterpillar G3406 NA Engine	2014	2014	215-hp	Existing	NSCR	NSCR
EU-ENG2	EP-ENG2	23.6-hp Kubota DG972-E2 Engine	TBD	TBD	23.6-hp	Existing	None	None
EU-ENG3	EP-ENG3	1,380-hp Caterpillar G3516B Engine	TBD	3/20/2014	1,380-hp	New	Oxid. Cat.	Oxid. Cat.
EU-DEHY1	EP-RB1	15.0-MMSCFD TEG Dehydration Unit	2014	N/A	15-MMSCFD	Existing	Reboiler/ Combustion	Condenser
EU-RB1	EP-RB1	0.75-mmBtu/hr TEG Reboiler	2014	N/A	0.75-mmBtu/hr	Existing	N/A	N/A
EU-GPU1 - EU-GPU8	EP-GPU1 - EP-GPU8	Eight (8) 1.0-mmBtu/hr GPU Burners	2014	N/A	1-mmBtu/hr	Existing	N/A	N/A
EU-HT1 - EU-HT2	EP-HT1 - EP-HT2	Two (2) 0.5-mmBtu/hr Heater Treaters	2014	N/A	0.5-mmBtu/hr	Existing	N/A	N/A
EU-LH1	EP-LH1	One (1) 1.5-mmBtu/hr Line Heater	2016	N/A	1.5-mmBtu/hr	Existing	N/A	N/A
EU-TANKS-COND	APC-COMB	Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	2014	2014	400-bbl	Existing	APC-COMB	APC-COMB
EU-TANKS-PW	APC-COMB	Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor	2014	2014	400-bbl	Existing	APC-COMB	APC-COMB
EU-LOAD-COND	APC-COMB	Condensate Truck Loading w/ Vapor Return Routed to Combustor	2014	N/A	3,832,500 gal/yr	Existing	Vapor Return and APC-COMB	Vapor Return and APC-COMB
EU-LOAD-PW	APC-COMB	Produced Water Truck Loading w/ Vapor Return Routed to Combustor	2014	N/A	4,599,000 gal/yr	Existing	Vapor Return and APC-COMB	Vapor Return and APC-COMB
APC-COMB	APC-COMB	One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	2014	N/A	30-mmBtu/hr	Existing	N/A	N/A
EU-PILOT	APC-COMB	Vapor Combustor Pilots	2014	N/A	150-scfh	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 J: FUGITIVE EMISSIONS SUMMARY SHEET

Fugitive emissions at this site consist of haul road emissions, condensate and produced water loading operations, and equipment leaks.

ATTACHMENT J – FUGITIVE EMISSIONS SUMMARY SHEET

Sources of fugitive emissions may include loading operations, equipment leaks, blowdown emissions, etc.
Use extra pages for each associated source or equipment if necessary.

Source/Equipment: EU-FUG

Leak Detection Method Used	☐ Audible, visual, and olfactory (AVO) inspections	☐ Infrared (FLIR) cameras	☐ Other (please describe)	☒ None required

Component Type	Closed Vent System	Count	Source of Leak Factors (EPA, other (specify))	Stream type (gas, liquid, etc.)	Estimated Emissions (tpy)		
					VOC	HAP	GHG (methane, CO_2e)
Pumps	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Valves	☐ Yes ☒ No	173 – gas 124 – LL	EPA	☐ Gas ☐ Liquid ☒ Both	1.42 – gas 2.85 – LL	0.03 – gas 0.26 – LL	112.23 – gas 1.12 – LL
Safety Relief Valves	☐ Yes ☒ No	47	EPA	☒ Gas ☐ Liquid ☐ Both	0.76	0.01	59.63
Open Ended Lines	☐ Yes ☒ No	2	EPA	☒ Gas ☐ Liquid ☐ Both	0.01	<0.01	0.58
Sampling Connections	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Connections (Not sampling)	☐ Yes ☒ No	490	EPA	☐ Gas ☒ Liquid ☐ Both	0.95	0.09	0.37
Compressors	☐ Yes ☒ No	9	EPA	☒ Gas ☐ Liquid ☐ Both	0.14	<0.01	11.42
Flanges	☐ Yes ☒ No	688	EPA	☒ Gas ☐ Liquid ☐ Both	0.49	0.01	38.68
Other[1]	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			

[1] Other equipment types may include compressor seals, relief valves, diaphragms, drains, meters, etc.

Please provide an explanation of the sources of fugitive emissions (e.g. pigging operations, equipment blowdowns, pneumatic controllers, etc.):
Equipment leaks

Please indicate if there are any closed vent bypasses (include component): N/A
Specify all equipment used in the closed vent system (e.g. VRU, ERD, thief hatches, tanker truck/rail car loading, etc.) N/A

TABLE 2-4. OIL AND GAS PRODUCTION OPERATIONS AVERAGE EMISSION FACTORS (kg/hr/source)

Equipment Type	Service[a]	Emission Factor (kg/hr/source)[b]
Valves	Gas	4.5E-03
	Heavy Oil	8.4E-06
	Light Oil	2.5E-03
	Water/Oil	9.8E-05
Pump seals	Gas	2.4E-03
	Heavy Oil	NA
	Light Oil	1.3E-02
	Water/Oil	2.4E-05
Others[c]	Gas	8.8E-03
	Heavy Oil	3.2E-05
	Light Oil	7.5E-03
	Water/Oil	1.4E-02
Connectors	Gas	2.0E-04
	Heavy Oil	7.5E-06
	Light Oil	2.1E-04
	Water/Oil	1.1E-04
Flanges	Gas	3.9E-04
	Heavy Oil	3.9E-07
	Light Oil	1.1E-04
	Water/Oil	2.9E-06
Open-ended lines	Gas	2.0E-03
	Heavy Oil	1.4E-04
	Light Oil	1.4E-03
	Water/Oil	2.5E-04

[a]Water/Oil emission factors apply to water streams in oil service with a water content greater than 50%, from the point of origin to the point where the water content reaches 99%. For water streams with a water content greater than 99%, the emission rate is considered negligible.

[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities. "NA" indicates that not enough data were available to develop the indicated emission factor.

[c]The "other" equipment type was derived from compressors, diaphrams, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps, or valves.

ATTACHMENT N: INTERNAL COMBUSTION ENGINE DATA SHEETS

ENGINE SPECIFICATION SHEET

AP-42 AND EPA EMISSION FACTORS

ATTACHMENT N – INTERNAL COMBUSTION ENGINE DATA SHEET

Complete this data sheet for each internal combustion engine at the facility. Include manufacturer performance data sheet(s) or any other supporting document if applicable. Use extra pages if necessary. *Generator(s) and microturbine generator(s) shall also use this form.*

Emission Unit ID#[1]	EU-ENG1	EU-ENG2	EU-ENG3
Engine Manufacturer/Model	Caterpillar G3406 NA	Kubota DG972-E2	Caterpillar G3516B
Manufacturers Rated bhp/rpm	215-hp/1,800-rpm	23.6-hp/3,600-rpm	1,380-hp/1,400-rpm
Source Status[2]	ES	ES	NS
Date Installed/ Modified/Removed/Relocated[3]	2014	TBD	TBD
Engine Manufactured /Reconstruction Date[4]	2014	After 1/1/2011	3/20/2014
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable)[5]	☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☒40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	☒40CFR60 Subpart JJJJ ☒JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☒40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☒40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources
Engine Type[6]	4SRB	4SRB	4SLB
APCD Type[7]	NSCR	N/A	OxCat
Fuel Type[8]	PQ	PQ	PQ
H_2S (gr/100 scf)	Negligible	Negligible	Negligible
Operating bhp/rpm	215-hp/1,800-rpm	23.6-hp/3,600-rpm	1,380-hp/1,400-rpm
BSFC (BTU/bhp-hr)	8,756	11,771 BTU/kW-hr	7,421
Hourly Fuel Throughput	2,080 ft^3/hr gal/hr	229 ft^3/hr gal/hr	11,316 ft^3/hr gal/hr
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)	18.22 $MMft^3$/yr gal/yr	2.01 $MMft^3$/yr gal/yr	99.13 $MMft^3$/yr gal/yr
Fuel Usage or Hours of Operation Metered	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

Calculation Methodology[9]	**Pollutant[10]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**
MD	NO_x	0.47	2.08	0.31	1.36	1.52	6.66
MD	CO	0.95	4.15	5.55	24.30	0.61	2.68
MD	VOC	0.36	1.59	0.31	1.36	0.88	3.87
AP	SO_2	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
AP	PM_{10}	0.02	0.08	<0.01	0.01	<0.01	<0.01
MD	Formaldehyde	0.03	0.13	<0.01	0.02	0.27	1.20
AP	Total HAPs	0.05	0.22	0.01	0.03	0.45	1.97
MD and EPA	GHG (CO_2e)	283.67	1,242.48	28.69	125.65	1,537.61	6,734.74

1 Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion engine/generator engine located at the well site. Multiple engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. Microturbine generator engines should be designated MT-1, MT-2, MT-3 etc. If more than three (3) engines exist, please use additional sheets.

2 Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Relocated Source
REM	Removal of Source		

3 Enter the date (or anticipated date) of the engine's installation (construction of source), modification, relocation or removal.

4 Enter the date that the engine was manufactured, modified or reconstructed.

5 Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart IIII/JJJJ? If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance as appropriate.

Provide a manufacturer's data sheet for all engines being registered.

6 Enter the Engine Type designation(s) using the following codes:

2SLB	Two Stroke Lean Burn	4SRB	Four Stroke Rich Burn
4SLB	Four Stroke Lean Burn		

7 Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	OxCat	Oxidation Catalyst
SCR	Lean Burn & Selective Catalytic Reduction		

8 Enter the Fuel Type using the following codes:

PQ	Pipeline Quality Natural Gas	RG	Raw Natural Gas /Production Gas	D	Diesel

9 Enter the Potential Emissions Data Reference designation using the following codes. Attach all reference data used.

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

10 Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.

11 PTE for engines shall be calculated from manufacturer's data unless unavailable.

Engine Air Pollution Control Device
(Emission Unit ID# APC-NSCR-ENG-3 use extra pages as necessary)

Air Pollution Control Device Manufacturer's Data Sheet included?
Yes ☒ No ☐

☐ NSCR ☐ SCR ☒ Oxidation Catalyst

Provide details of process control used for proper mixing/control of reducing agent with gas stream:

Manufacturer: N/A	Model #: N/A
Design Operating Temperature: 796ºF	Design gas volume: 189,171 scfh
Service life of catalyst: 3 year warranty	Provide manufacturer data? ☒Yes ☐ No
Volume of gas handled: acfm at ºF	Operating temperature range for NSCR/Ox Cat: From ºF to ºF
Reducing agent used, if any:	Ammonia slip (ppm):

Pressure drop against catalyst bed (delta P): 12 inches of H_2O

Provide description of warning/alarm system that protects unit when operation is not meeting design conditions:

Is temperature and pressure drop of catalyst required to be monitored per 40CFR63 Subpart ZZZZ?
☐ Yes ☒ No

How often is catalyst recommended or required to be replaced (hours of operation)?
3 year warranty

How often is performance test required?
☒ Initial
☐ Annual
☒ Every 8,760 hours of operation
☐ Field Testing Required
☐ No performance test required. If so, why (please list any maintenance required and the applicable sections in NSPS/GACT,

CDM Resource Management LLC

Date: 07-26-2017

Re: Engine Pedigree

Unit # 3819

In order to better assist your company with any of its state and federal permitting needs, CDM Resource Management LLC submits the following information in regards to the engine of the above referenced compressor package. This letter should provide the information necessary to answer any questions pertaining to, but not limited to, the NSPS for SI-RICE, Subpart JJJJ. This information is current as of above date.

Engine Make:	**Caterpillar**
Engine Model:	**3516B**
Engine Serial Number:	**JEF02677**
Engine Type:	4LB
Engine Category:	**NEW**
Engine Subcategory:	Non Certified
Engine NSPS Status:	QUAD-JJJJ
Engine Speed:	**1400**
Rated HP:	**1380**
Engine Manufacture Date:	**03-20-2014**

Silencer Emit ELX 4200Z-1616F-40CEE

1

G3516J

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1400	RATING STRATEGY:	STANDARD
COMPRESSION RATIO:	8	RATING LEVEL:	CONTINUOUS
AFTERCOOLER TYPE:	SCAC	FUEL SYSTEM:	CAT WIDE RANGE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 2 INLET (°F):	130		
AFTERCOOLER - STAGE 1 INLET (°F):	201	SITE CONDITIONS:	
JACKET WATER OUTLET (°F):	210	FUEL:	Gas Analysis
ASPIRATION:	TA	FUEL PRESSURE RANGE(psig): (See note 1)	7.0-40.0
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL METHANE NUMBER:	54.6
CONTROL SYSTEM:	ADEM3	FUEL LHV (Btu/scf):	1161
EXHAUST MANIFOLD:	ASWC	ALTITUDE(ft):	1200
COMBUSTION:	LOW EMISSION	MAXIMUM INLET AIR TEMPERATURE(°F):	100
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5	STANDARD RATED POWER:	1380 bhp@1400rpm
SET POINT TIMING:	28		

RATING		NOTES	LOAD	MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
				100%	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(2)	bhp	1380	1380	1035	690
INLET AIR TEMPERATURE			°F	100	100	100	100
ENGINE DATA							
FUEL CONSUMPTION (LHV)		(3)	Btu/bhp-hr	7421	7421	7948	8537
FUEL CONSUMPTION (HHV)		(3)	Btu/bhp-hr	8176	8176	8757	9405
AIR FLOW (@inlet air temp, 14.7 psia)	(WET)	(4)(5)	ft3/min	3266	3266	2496	1714
AIR FLOW	(WET)	(4)(5)	lb/hr	13886	13886	10612	7286
FUEL FLOW (60°F, 14.7 psia)			scfm	147	147	118	85
INLET MANIFOLD PRESSURE		(6)	in Hg(abs)	88.3	88.3	70.3	48.4
EXHAUST TEMPERATURE - ENGINE OUTLET		(7)	°F	846	846	864	921
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia)	(WET)	(8)(5)	ft3/min	8167	8167	6342	4554
EXHAUST GAS MASS FLOW	(WET)	(8)(5)	lb/hr	14375	14375	11004	7567
EMISSIONS DATA - ENGINE OUT							
NOx (as NO2)		(9)(10)	g/bhp-hr	0.50	0.50	0.50	0.50
CO		(9)(10)	g/bhp-hr	2.96	2.96	3.18	3.12
THC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	4.44	4.44	4.76	4.83
NMHC (mol. wt. of 15.84)		(9)(10)	g/bhp-hr	1.92	1.92	2.06	2.09
NMNEHC (VOCs) (mol. wt. of 15.84)		(9)(10)(11)	g/bhp-hr	0.93	0.93	1.00	1.01
HCHO (Formaldehyde)		(9)(10)	g/bhp-hr	0.39	0.39	0.37	0.36
CO2		(9)(10)	g/bhp-hr	505	505	524	559
EXHAUST OXYGEN		(9)(12)	% DRY	9.1	9.1	8.8	8.4
HEAT REJECTION							
HEAT REJ. TO JACKET WATER (JW)		(13)	Btu/min	36599	36599	32770	27021
HEAT REJ. TO ATMOSPHERE		(13)	Btu/min	5313	5313	4428	3543
HEAT REJ. TO LUBE OIL (OC)		(13)	Btu/min	4359	4359	3903	3218
HEAT REJ. TO A/C - STAGE 1 (1AC)		(13)(14)	Btu/min	9956	9956	7510	1851
HEAT REJ. TO A/C - STAGE 2 (2AC)		(13)(14)	Btu/min	5300	5300	4589	2841

COOLING SYSTEM SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(14)(15)	Btu/min	55943
TOTAL AFTERCOOLER CIRCUIT (2AC)	(14)(15)	Btu/min	5565
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.

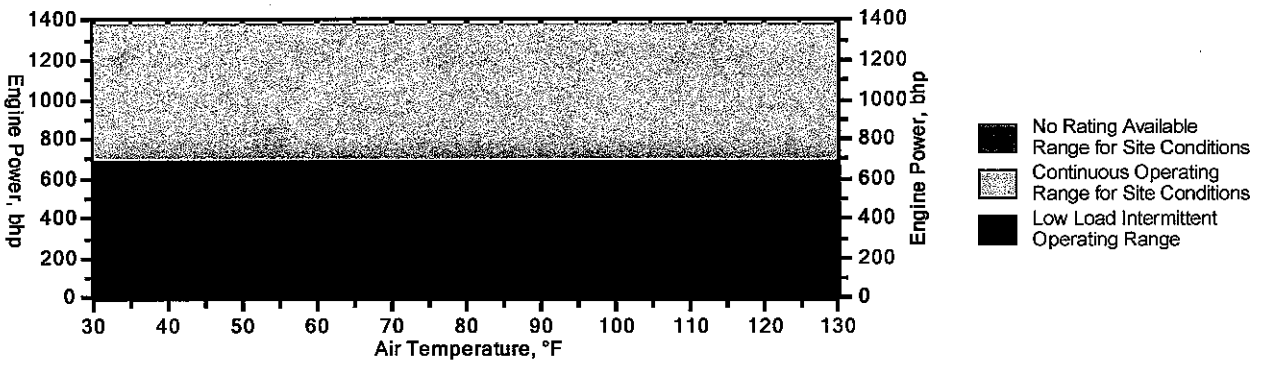
For notes information consult page three.

ELX 4200 Z-16167-90CEE
24 X 15 X 3.5 X (3)

PREPARED BY:
Data generated by Gas Engine Rating Pro Version 6.05.00
Ref. Data Set EM1495-02-001, Printed 20Jul2017

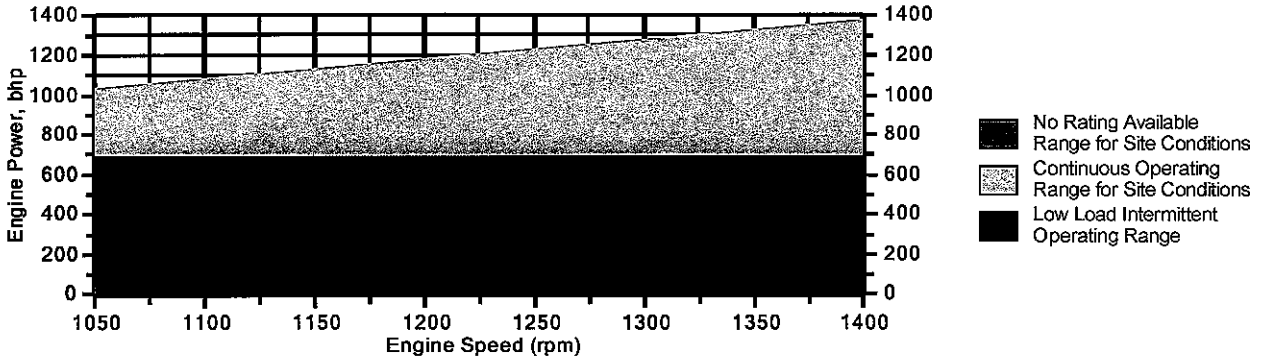
Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 1200 ft and 1400 rpm



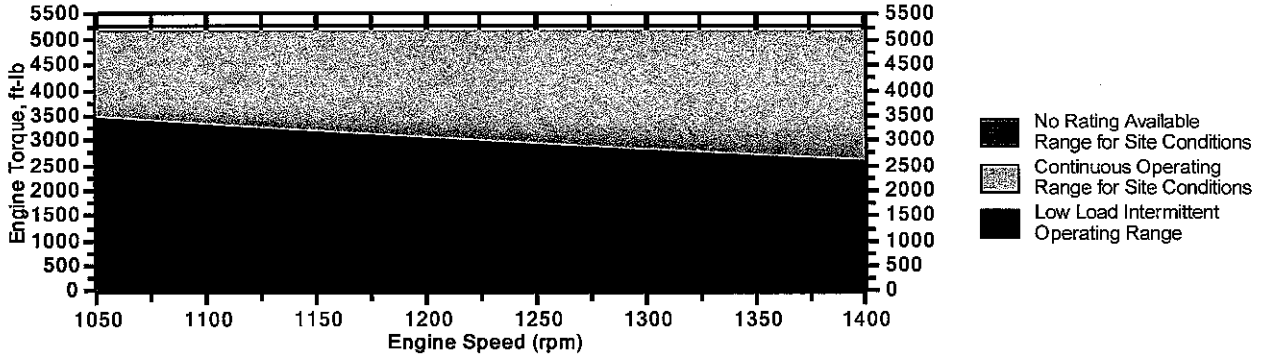
Engine Power vs. Engine Speed

Data represents speed sweep at 1200 ft and 100 °F



Engine Torque vs. Engine Speed

Data represents speed sweep at 1200 ft and 100 °F



Note: At site conditions of 1200 ft and 100°F inlet air temp., constant torque can be maintained down to 1050 rpm. The minimum speed for loading at these conditions is 1050 rpm.

NOTES

1. Fuel pressure range specified is to the engine fuel pressure regulator. 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. Fuel consumption tolerance is ± 3.0% of full load data.

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.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	76.7137	76.7137
Ethane	C2H6	15.0924	15.0924
Propane	C3H8	4.6271	4.6271
Isobutane	iso-C4H1O	0.6476	0.6476
Norbutane	nor-C4H1O	1.2268	1.2268
Isopentane	iso-C5H12	0.3364	0.3364
Norpentane	nor-C5H12	0.2977	0.2977
Hexane	C6H14	0.6272	0.6272
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	0.3137	0.3137
Carbon Dioxide	CO2	0.1174	0.1174
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	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup:	Gas Analysis
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	54.6
Lower Heating Value (Btu/scf):	1161
Higher Heating Value (Btu/scf):	1279
WOBBE Index (Btu/scf):	1360
THC: Free Inert Ratio:	230.96
Total % Inerts (% N2, CO2, He):	0.43%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.996
Stoich A/F Ratio (Vol/Vol):	12.03
Stoich A/F Ratio (Mass/Mass):	16.51
Specific Gravity (Relative to Air):	0.729
Fuel Specific Heat Ratio (K):	1.279

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.

GAS ANALYTICAL SERVICES

C6+ Gas Analysis Report

Gas Analytical

Report Date: Aug 27, 2015 9:14a

Client:	Southwestern Energy	Date Sampled:	May 20, 2015
Site:	Fork Ridge 206H	Analysis Date:	May 26, 2015 3:23p
Field No:	9998	Collected By:	Gary Barnard
Meter:	WHGM55746	Date Effective:	May 20, 2015 10:00a
Source Laboratory	Clarksburg (Bridgeport), WV	Sample Pressure (PSI):	891.0
Lab File No:	**X_CH1-3580.CHR**	Sample Temp (°F):	86
Sample Type:	Spot	Field H2O (lb/MMSCFD):	No Test
Reviewed By:		Field H2S (PPM):	.2

Component	Mol %	Gal/MSCF
Methane	76.7137	
Ethane	15.0924	4.01
Propane	4.6271	1.27
I-Butane	0.6476	0.21
N-Butane	1.2268	0.39
I-Pentane	0.3364	0.12
N-Pentane	0.2977	0.11
Nitrogen	0.3137	
Oxygen	<MDL	
Carbon Dioxide	0.1174	
Hexanes+	0.6272	0.26
TOTAL	100.0000	6.37

Analytical Results at Base Conditions (Real)	
BTU/SCF (Dry):	1,284.2416 BTU/ft³
BTU/SCF (Saturated):	1,262.7679 BTU/ft³
PSIA:	14.730 PSI
Temperature (°F):	60.00 °F
Z Factor (Dry):	0.99630
Z Factor (Saturated):	0.99589

Analytical Results at Contract Conditions (Real)	
BTU/SCF (Dry):	1,284.2416 BTU/ft³
BTU/SCF (Saturated):	1,262.7679 BTU/ft³
PSIA:	14.730 PSI
Temperature (°F):	60.00 °F
Z Factor (Dry):	0.99630
Z Factor (Saturated):	0.99589

Calculated Specific Gravities			
Ideal Gravity:	0.7305	Real Gravity:	0.7329
Molecular Wt:	21.1562 lb/lbmol		

Gross Heating Values are Based on:
GPA 2145-09, 2186
Compressibility is Calculated using AGA-8.

Source	Date	Notes
Gas Analytical	May 26, 2015	results to Roy Smith

<MDL = Less than Method Detection Limits, NG = Not Given, NT = Not Tested

EmeraChem IC Engine Catalyst Sizing

Quote Reference Number: 170726-CDM-G3516J unit 3819

Customer & Project Information

Date:	7/26/2017
Customer Name:	CDM
Project Name:	Unit # 3819
Application Engineer:	Kevan Riebschlaeger

Engine Operating Data

Engine Make	Caterpillar	
Engine Model	G3516J	
Fuel Type	High Propane Fuel	
Engine Horsepower	1380	bhp
Engine Speed	1,400	rpm
Operating Hours	8760	hr/year
Combustion Cycle - 2 vs 4 cycle	4	
Lean Burn / Rich Burn	lean	

Engine Exhaust Flow Rate

Engine Exhaust Temperature	846	F
Catalyst Operating Temperature	796	F
Exhaust Gas Flow Rate	189,171	scfh
Exhaust Gas Flow Rate	7,919	acfm
Exhaust Gas Flow Rate	14,375	lb/hr
Exhaust Gas Oxygen Concentration	9.1%	
Exhaust Gas Water Concentration	12.0%	

Engine Uncontrolled Emissions

Engine NMNEHC measured as Propane.

	NOx	CO	NMNEHC	CH2O
g/bhp-hr		2.96	1.32	0.39
g/MW-hr		3,969	1,770	
g/hr		4,085	1,822	538
lb/hr		9.01	4.02	1.19
tons/year		39.44	17.59	5.20
MW		28.00	44.09	30.00
scfh		122	35	15
mg/m3		762	340	100
ppmv (wet; actual O2)		644	182	79
ppmv (dry; actual O2)		732	207	90
ppmv (dry; 15% O2)		366	104	45

Note:
1) NMNEHC values referenced here include formaldehyde. If the engine emissions data sheet used as a source for this quote excludes formaldehyde in the NMNEHC calculation, the two values must be combined before entry into the performance requirements definition in this tool.

2) The propane concentration is assumed to be less than 15% of the total volume of NMNEHC (including aldehydes) in the exhaust gas. If the concentration of propane is expected to be higher than this value, a

Emissions Requirement

Stack NMNEHC measured as Propane.

	NOx	CO	NMNEHC	CH2O
g/bhp-hr		0.2	0.2	0.09
g/MW-hr				
g/hr		276	276	124
lb/hr		0.61	0.61	0.27
tons/year		2.67	2.67	1.20
MW		28.00	44.07	30.00
scfh		8	5	3
mg/m3		52	52	23
ppmv (wet; actual O2)		44	28	18
ppmv (dry; actual O2)		49	31	21
ppmv (dry; 15% O2)		25	16	10

Catalyst DRE (%)

	NOx	CO	NMNEHC	CH2O	
DRE Required to Meet Emissions Limit		93.2	84.8	76.9	
DRE Guarantee		93.2	84.8	76.9	96,684
DRE Expected - Uncontaminated, Optimal Tuning		99.5	89.6	95.4	
g/bhp-hr Expected - Uncontaminated, Optimal Tuning		0.0	0.1	0.0	

Catalyst Information

Catalyst Part Number:	EC-OX-PX-SQ-1500-2400-3500	
Catalyst Type:	Performax Oxidation	
Warranty (years)	3	
Catalyst Formulation	Performax	
New Install or Replacement	Replacement	
Catalyst Shape	Rectangle	
Number of Catalyst Elements	3	
Modifications	Without Bonnet	
CPSI	300	
Foil Depth	3.5	inches
Width	15.000	inches
Length	24.000	inches
Catalyst Volume	2.19	ft3 (total)
Space Velocity	96,684	1/hr
Catalyst Weight	149.7	lb
Maximum Catalyst Pressure Drop	12.0	in. H2O
Catalyst Design Pressure Drop	2.4	in. H2O

Housing and Silencer Information

Housing Supplier:	Other
Housing Part Number	
Inlet Flange Size	
Outlet Flange Size	
Material	
Housing Orientation	
Inlet/Outlet Orientation	0.0
Side Inlet Clocking Position	
Catalyst Clocking Position	
Side Outlet Clocking Position	
Maximum System Pressure Drop	12.0
Total System Pressure Drop	0.0
Housing Modifications	

Comments:

Ask us how EmeraChem can save you 30% in oil change costs.

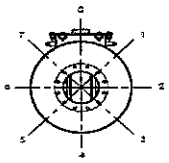
EmeraChem IC Engine Catalyst Quote

Quote Reference Number: 170726-CDM-G3516J unit 3819

Customer & Project Information	
Date:	7/26/2017
Customer Name:	CDM
Project Name:	Unit # 3819
Application Engineer:	Kevan Riebschlaeger

Part Number	Description	Lead Time	Price Each	Quantity	Total Price
Catalyst Modules:					
EC-OX-PX-SQ-1500-2400-3500	Catalyst Module, Performax Oxidation, Rectangle, 15 x 24 x 3.5, Overall Depth 3.7125, 300 CPSIWithout Bonnet	7 days ARO	Per standard price list	3	Per standard price list
Modifications:					
Blank Modules and Guard Bed:					
Catalyst Housing and Silencer:					
Modifications:					
Gasket:					

Clocking Position



Housing viewed from inlet side, looking downstream.

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-54)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	4.08 E+00	B
NO_x[c] <90% Load	8.47 E-01	B
CO[c] 90 - 105% Load	3.17 E-01	C
CO[c] <90% Load	5.57 E-01	B
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	1.47 E+00	A
Methane[g]	1.25 E+00	C
VOC[h]	1.18 E-01	C
PM10 (filterable)[i]	7.71 E-05	D
PM2.5 (filterable)[i]	7.71 E-05	D
PM Condensable[j]	9.91 E-03	D
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[k]	<4.00 E-05	E
1,1,2-Trichloroethane[k]	<3.18 E-05	E
1,1-Dichloroethane	<2.36 E-05	E
1,2,3-Trimethylbenzene	2.30 E-05	D
1,2,4-Trimethylbenzene	1.43 E-05	C
1,2-Dichloroethane	<2.36 E-05	E
1,2-Dichloropropane	<2.69 E-05	E
1,3,5-Trimethylbenzene	3.38 E-05	D
1,3-Butadiene[k]	2.67E-04	D
1,3-Dichloropropene[k]	<2.64 E-05	E
2-Methylnaphthalene[k]	3.32 E-05	C
2,2,4-Trimethylpentane[k]	2.50 E-04	C
Acenaphthene[k]	1.25 E-06	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES (Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Acenaphthylene[k]	5.53 E-06	C
Acetaldehyde[k,l]	8.36 E-03	A
Acrolein[k,l]	5.14 E-03	A
Benzene[k]	4.40 E-04	A
Benzo(b)fluoranthene[k]	1.66 E-07	D
Benzo(e)pyrene[k]	4.15 E-07	D
Benzo(g,h,i)perylene[k]	4.14 E-07	D
Biphenyl[k]	2.12 E-04	D
Butane	5.41 E-04	D
Butyr/Isobutyraldehyde	1.01 E-04	C
Carbon Tetrachloride[k]	<3.67 E-05	E
Chlorobenzene[k]	<3.04 E-05	E
Chloroethane	1.87 E-06	D
Chloroform[k]	<2.85 E-05	E
Chrysene[k]	6.93 E-07	C
Cyclopentane	2.27 E-04	C
Ethane	1.05 E-01	C
Ethylbenzene[k]	3.97 E-05	B
Ethylene Dibromide[k]	<4.43 E-05	E
Fluoranthene[k]	1.11 E-06	C
Fluorene[k]	5.67 E-06	C
Formaldehyde[k,l]	5.28 E-02	A
Methanol[k]	2.50 E-03	B
Methylcyclohexane	1.23 E-03	C
Methylene Chloride[k]	2.00 E-05	C
n-Hexane[k]	1.11 E-03	C
n-Nonane	1.10 E-04	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES
(Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
n-Octane	3.51 E-04	C
n-Pentane	2.60 E-03	C
Naphthalene[k]	7.44 E-05	C
PAH[k]	2.69 E-05	D
Phenanthrene[k]	1.04 E-05	D
Phenol[k]	2.40 E-05	D
Propane	4.19 E-02	C
Pyrene[k]	1.36 E-06	C
Styrene[k]	<2.36 E-05	E
Tetrachloroethane[k]	2.48 E-06	D
Toluene[k]	4.08 E-04	B
Vinyl Chloride[k]	1.49 E-05	C
Xylene[k]	1.84 E-04	B

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\ (\text{heat input, MMBtu/hr})\ (\text{1/operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and

h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

[k] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[l] For lean burn engines, aldehyde emissions quantification using CARB 430 may reflect interference with the sampling compounds due to the nitrogen concentration in the stack. The presented emission factor is based on FTIR measurements. Emissions data based on CARB 430 are available in the background report.

ATTACHMENT S: EMISSIONS CALCULATIONS

SWN Production Company, LLC
Fork Ridge 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
215-hp Caterpillar G3406 NA Engine	EU-ENG1	EP-ENG1	0.47	2.08	0.95	4.15	0.36	1.59	<0.01	<0.01	0.04	0.16
23.6-hp Kubota DG972-E2 Engine	EU-ENG2	EP-ENG2	0.31	1.36	5.55	24.30	0.31	1.36	<0.01	<0.01	<0.01	0.02
1,380-hp Caterpillar G3516B Engine	EU-ENG3	EP-ENG3	1.52	6.66	0.61	2.68	0.88	3.87	0.01	0.03	0.10	0.45
15.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	EP-RB1	-	-	-	-	2.20	9.64	-	-	-	-
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
Eight (8) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU8	EP-GPU1 - EP-GPU8	0.88	3.87	0.74	3.25	0.05	0.21	0.01	0.02	0.07	0.29
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	EP-HT1 - EP-HT2	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
One (1) 1.5-mmBtu/hr Line Heater	EU-LH1	EP-LH1	0.17	0.73	0.14	0.61	0.01	0.04	<0.01	<0.01	0.01	0.06
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	APC-COMB	-	-	-	-	-	-	-	-	-	-
Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	APC-COMB	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	APC-COMB	-	-	-	-	1.16	5.09	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	APC-COMB	-	-	-	-	0.01	0.05	-	-	-	-
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB	APC-COMB	4.14	18.13	8.27	36.20	2.89	12.67	-	-	0.09	0.37
Vapor Combustor Pilots	EU-PILOT	APC-COMB	0.02	0.07	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	EP-FUG	-	-	-	-	1.51	6.62	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	EP-HR	-	-	-	-	-	-	-	-	0.17	0.57
		Total =	**7.70**	**33.74**	**16.43**	**71.97**	**9.40**	**41.19**	**0.01**	**0.06**	**0.50**	**1.99**

Notes:

[1] Total VOC includes all constituents heavier than Propane (C3+), including hazardous air pollutants (HAP). Speciated HAP presented in following table. Also note that Caterpillar engine manufacturer data for VOC does not include formaldehyde; therefore, total VOC emissions presented here are different than VOC emissions as defined and calculated in the engine calculations.

SWN Production Company, LLC
Fork Ridge 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
215-hp Caterpillar G3406 NA Engine	EU-ENG1	0.01	<0.01	<0.01	<0.01	0.03	0.01	-	<0.01	<0.01	0.05
23.6-hp Kubota DG972-E2 Engine	EU-ENG2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	0.01
1,380-hp Caterpillar G3516B Engine	EU-ENG3	0.09	0.05	<0.01	<0.01	0.27	0.03	-	<0.01	<0.01	0.45
15.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.11	0.02	-	-	0.06	0.12	0.06	0.37
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Eight (8) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU8	-	-	<0.01	-	<0.01	-	0.02	<0.01	-	0.02
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
One (1) 1.5-mmBtu/hr Line Heater	EU-LH1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Five (5) 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	-	-	0.06	0.01	0.02	0.10
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
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB	-	-	<0.01	0.01	-	-	0.12	0.02	0.03	0.19
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.01	-	-	0.06	0.01	0.02	0.09
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		**0.09**	**0.06**	**0.12**	**0.05**	**0.31**	**0.03**	**0.33**	**0.15**	**0.13**	**1.28**

Continued on Next Page

SWN Production Company, LLC
Fork Ridge 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
215-hp Caterpillar G3406 NA Engine	EU-ENG1	0.02	0.02	0.01	<0.01	0.13	0.03	-	<0.01	<0.01	0.22
23.6-hp Kubota DG972-E2 Engine	EU-ENG2	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
1,380-hp Caterpillar G3516B Engine	EU-ENG3	0.37	0.23	0.02	<0.01	1.20	0.11	-	0.02	0.01	1.97
15.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.47	0.11	-	-	0.28	0.52	0.25	1.61
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Eight (8) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU8	-	-	<0.01	-	<0.01	-	0.07	<0.01	-	0.07
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
One (1) 1.5-mmBtu/hr Line Heater	EU-LH1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Five (5) 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	0.03	-	-	0.28	0.03	0.09	0.44
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
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB	-	-	0.02	0.06	-	-	0.53	0.07	0.15	0.83
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	0.01	0.03	-	-	0.27	0.03	0.07	0.40
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		**0.40**	**0.25**	**0.53**	**0.23**	**1.36**	**0.14**	**1.46**	**0.67**	**0.57**	**5.61**

SWN Production Company, LLC
Fork Ridge 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
215-hp Caterpillar G3406 NA Engine	EU-ENG1	283.44	1,126.25	<0.01	0.02	0.10	0.41	<0.01	<0.01	0.12	0.49	283.67	1,127.16
23.6-hp Kubota DG972-E2 Engine	EU-ENG2	26.59	105.63	0.08	0.33	2.09	8.29	<0.01	<0.01	0.01	0.05	28.69	113.98
1,380-hp Caterpillar G3516B Engine	EU-ENG3	1,536.38	6,104.74	0.02	0.09	0.56	2.24	<0.01	0.01	0.67	2.67	1,537.61	6,109.65
15.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	0.01	0.44	1.76	11.10	44.11	-	-	-	-	11.10	44.12
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
Eight (8) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU8	935.82	3,718.44	0.02	0.07	0.44	1.75	<0.01	0.01	0.53	2.09	936.78	3,722.28
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
One (1) 1.5-mmBtu/hr Line Heater	EU-LH1	175.47	697.21	<0.01	0.01	0.08	0.33	<0.01	<0.01	0.10	0.39	175.65	697.93
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 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	0.20	0.80	5.06	20.09	-	-	-	-	5.06	20.09
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	<0.01	0.24	0.96	6.07	24.11	-	-	-	-	6.07	24.11
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB	3,509.31	13,944.14	0.07	0.26	1.65	6.57	0.01	0.03	1.97	7.83	3,512.94	13,958.54
Vapor Combustor Pilots	EU-PILOT	15.88	63.10	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.01	0.04	15.90	63.16
Fugitive Emissions	EU-FUG	0.01	0.05	2.05	8.13	51.13	203.18	-	-	-	-	51.15	203.23
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		**6,687.61**	**26,572.97**	**3.14**	**12.46**	**78.40**	**311.50**	**0.01**	**0.05**	**3.53**	**14.02**	**6,769.53**	**26,898.50**

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
Fork Ridge 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
215-hp Caterpillar G3406 NA Engine	EU-ENG1	283.44	1,241.48	<0.01	0.02	0.10	0.45	<0.01	<0.01	0.12	0.54	283.67	1,242.48
23.6-hp Kubota DG972-E2 Engine	EU-ENG2	26.59	116.44	0.08	0.37	2.09	9.14	<0.01	<0.01	0.01	0.06	28.69	125.65
1,380-hp Caterpillar G3516B Engine	EU-ENG3	1,536.38	6,729.32	0.02	0.10	0.56	2.47	<0.01	0.01	0.67	2.95	1,537.61	6,734.74
15.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	0.01	0.44	1.94	11.10	48.62	-	-	-	-	11.10	48.63
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
Eight (8) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU8	935.82	4,098.88	0.02	0.08	0.44	1.93	<0.01	0.01	0.53	2.30	936.78	4,103.11
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
One (1) 1.5-mmBtu/hr Line Heater	EU-LH1	175.47	768.54	<0.01	0.01	0.08	0.36	<0.01	<0.01	0.10	0.43	175.65	769.33
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 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	0.20	0.89	5.06	22.15	-	-	-	-	5.06	22.15
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	<0.01	0.24	1.06	6.07	26.58	-	-	-	-	6.07	26.58
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB	3,509.31	15,370.78	0.07	0.29	1.65	7.24	0.01	0.03	1.97	8.63	3,512.94	15,386.66
Vapor Combustor Pilots	EU-PILOT	15.88	69.55	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.01	0.04	15.90	69.62
Fugitive Emissions	EU-FUG	0.01	0.05	2.05	8.96	51.13	223.97	-	-	-	-	51.15	224.02
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		**6,687.61**	**29,291.69**	**3.14**	**13.73**	**78.40**	**343.37**	**0.01**	**0.05**	**3.53**	**15.46**	**6,769.53**	**29,650.52**

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
Fork Ridge Pad
Engine Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	EU-ENG1	EU-ENG2	EU-ENG3
Emission Point ID:	EP-ENG1	EP-ENG2	EP-ENG3
Make:	Caterpillar	Kubota	Caterpillar
Model:	G3406 NA	DG972-E2	G3516B
Design Class:	4S-RB	4S-RB	4S-LB
Controls:	NSCR	None	Oxid. Cat.
Horsepower (hp):	215	23.6	1,380
Capacity (kW):	NA	17.6	NA
Fuel Use (Btu/hp-hr):	8,756	NA	7,421
Fuel Use (Btu/kW-hr)	NA	11,771	NA
Fuel Use (scfh):	2,080	229	11,316
Annual Fuel Use (mmscf):	18.22	2.01	99.13
Fuel Use (mmBtu/hr):	1.88	0.21	10.24
Exhaust Flow (acfm):	1,040	NA	7,919
Exhaust Temp (°F):	1,168	NA	846
Operating Hours:	8,760	8,760	8,760
Fuel Heating Value (Btu/scf):	905	905	905
Uncontrolled Manufacturer Emission Factors [1]			
NOx (g/hp-hr):	15.91	NA	0.50
CO (g/hp-hr):	15.91	NA	2.96
NMNEHC/VOC (g/hp-hr):	0.41	NA	1.32
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.68	NA	1.71
NMHC + NOx as NOx (g/kW-hr):	NA	8.00	NA
CO (g/kW-hr):	NA	143.00	NA
NMHC + NOx as VOC (g/kW-hr):	NA	8.00	NA
Post-Catalyst Emission Factors			
NOx Control Eff. %	93.71%	NA	0.00%
CO Control Eff. %	87.43%	NA	93.20%
VOC Control Eff. %	0.00%	NA	84.80%
NOx (g/hp-hr):	1.00	NA	0.50
CO (g/hp-hr):	2.00	NA	0.20
NMNEHC/VOC (g/hp-hr):	0.70	NA	0.20
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.76	NA	0.29

SWN Production Company, LLC
Fork Ridge Pad

Uncontrolled Criteria Air Pollutant Emissions

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	7.54	33.03	NA	NA	1.52	6.66
NMHC + NOx as NOx	NA	NA	0.31	1.36	NA	NA
CO	7.54	33.03	5.55	24.30	9.01	39.44
NMNEHC/VOC (does not include HCHO)	0.19	0.85	NA	NA	4.02	17.59
Total VOC (includes HCHO)	0.32	1.41	NA	NA	5.20	22.79
NMHC + NOx as VOC	NA	NA	0.31	1.36	NA	NA
SO_2	<0.01	<0.01	<0.01	<0.01	0.01	0.03
$PM_{10/2.5}$	0.02	0.08	<0.01	0.01	<0.01	<0.01
PM_{COND}	0.02	0.08	<0.01	0.01	0.10	0.44
PM_{TOT}	0.04	0.16	<0.01	0.02	0.10	0.45

Proposed Criteria Air Pollutant Emissions[2, 3]

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.47	2.08	NA	NA	1.52	6.66
NMHC + NOx as NOx	NA	NA	0.31	1.36	NA	NA
CO	0.95	4.15	5.55	24.30	0.61	2.68
NMNEHC/VOC (does not include HCHO)	0.33	1.45	NA	NA	0.61	2.67
Total VOC (includes HCHO)	0.36	1.59	NA	NA	0.88	3.87
NMHC + NOx as VOC	NA	NA	0.31	1.36	NA	NA
SO_2	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
$PM_{10/2.5}$	0.02	0.08	<0.01	0.01	<0.01	<0.01
PM_{COND}	0.02	0.08	<0.01	0.01	0.10	0.44
PM_{TOT}	0.04	0.16	<0.01	0.02	0.10	0.45

SWN Production Company, LLC
Fork Ridge Pad

AP-42 Emission Factors (lb/mmBtu)[4]

	4S-RB	4S-LB
Pollutant	**3.2-3 (7/00)**	**3.2-2 (7/00)**
NOx	2.21E+00	4.08E+00
CO	3.72E+00	3.17E-01
VOC	2.96E-02	1.18E-01
SO_2	5.88E-04	5.88E-04
$PM_{10/2.5}$	9.50E-03	7.71E-05
PM_{COND}	9.91E-03	9.91E-03
PM_{TOT}	1.94E-02	9.99E-03

Notes:

[1] Uncontrolled emission factors based on engine manufacturer data. Per Caterpillar, NMNEHC emission factor does not include formaldehyde (HCHO); therefore, NMNEHC and HCHO factors have been added to demonstrate total uncontrolled VOC.

[2] Post-catalyst emission factors based on catalyst manufacturer data and/or NSPS Subpart JJJJ limits, if applicable. Per NSPS Subpart JJJJ, VOC limit does not include HCHO; therefore, HCHO emissions have been added to the NSPS JJJJ VOC emission rates for demonstration purposes only.

[3] Kubota engine is certified to meet EPA emissions standards of 8 g/kW-hr NMHC+NOx and 610 g/kW-hr CO. Total NMHC+NOx factor used to conservatively estimate emissions of NOx and VOC, respectively. CO certification factor of 143 g/kW-hr used to estimate CO emissions. All other pollutants calculated using AP-42.

[3] Per AP-42, all particulate matter (PM) from combustion of natural gas (total, condensable and filterable PM) is presumed <1 micrometer in diameter.

SWN Production Company, LLC
Fork Ridge Pad
Engine Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-ENG1**	**EU-ENG2**	**EU-ENG3**
Emission Point ID:	EP-ENG1	EP-ENG2	EP-ENG3
Make:	Caterpillar	Kubota	Caterpillar
Model:	G3406 NA	DG972-E2	G3516B
Design Class:	4S-RB	4S-RB	4S-LB
Controls:	NSCR	None	Oxid. Cat.
Horsepower (hp):	215	23.6	1,380
Capacity (kW):	NA	17.6	
Fuel Use (Btu/hp-hr):	8,756	NA	7,421
Fuel Use (Btu/kW-hr)	NA	11,771	
Fuel Use (scfh):	2,080	229	11,316
Annual Fuel Use (mmscf):	18.22	2.01	99.13
Fuel Use (mmBtu/hr):	1.88	0.21	10.24
Exhaust Flow (acfm):	1,040	NA	7,919
Exhaust Temp (°F):	1,168	NA	846
Operating Hours:	8,760	8,760	8,760

Manufacturer Formaldehyde Factor

Pre-Control (g/hp-hr):	0.27	NA	0.39
Control Efficiency[1]:	76.00%	0.00%	76.90%
Post-Control (g/hp-hr):	0.06	NA	0.09

Uncontrolled HAP Emissions

Unit ID: **EU-ENG1** **EU-ENG2** **EU-ENG3**

Pollutant	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Acetaldehyde	0.01	0.02	<0.01	<0.01	0.09	0.37
Acrolein	<0.01	0.02	<0.01	<0.01	0.05	0.23
Benzene	<0.01	0.01	<0.01	<0.01	<0.01	0.02
Ethylbenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.13	0.56	<0.01	0.02	1.19	5.20
Methanol	0.01	0.03	<0.01	<0.01	0.03	0.11
Toluene	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Xylenes	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Total HAPs =	**0.15**	**0.65**	**0.01**	**0.03**	**1.36**	**5.96**

SWN Production Company, LLC
Fork Ridge Pad
Engine Emissions Calculations - Hazardous Air Pollutants

Proposed HAP Emissions

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Acetaldehyde	0.01	0.02	<0.01	<0.01	0.09	0.37
Acrolein	<0.01	0.02	<0.01	<0.01	0.05	0.23
Benzene	<0.01	0.01	<0.01	<0.01	<0.01	0.02
Ethylbenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.03	0.13	<0.01	0.02	0.27	1.20
Methanol	0.01	0.03	<0.01	<0.01	0.03	0.11
Toluene	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Xylenes	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Total HAPs =	**0.05**	**0.22**	**0.01**	**0.03**	**0.45**	**1.97**

AP-42 Emission Factors (lb/mmBtu)

	4S-RB	4S-LB
Pollutant	**3.2-3 (7/00)**	**3.2-2 (7/00)**
Acetaldehyde	2.79E-03	8.36E-03
Acrolein	2.63E-03	5.14E-03
Benzene	1.58E-03	4.40E-04
Ethylbenzene	2.18E-05	3.97E-05
Formaldehyde	2.05E-02	5.28E-02
Methanol	3.06E-03	2.50E-03
Toluene	5.58E-04	4.08E-04
Xylenes	1.95E-04	1.84E-04

Notes:
[1] For conservative estimate, no reduction taken for any HAP other than formaldehyde.

SWN Production Company, LLC
Fork Ridge Pad
Engine Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	EU-ENG1	EU-ENG2	EU-ENG3
Emission Point ID:	EP-ENG1	EP-ENG2	EP-ENG3
Make:	Caterpillar	Kubota	Caterpillar
Model:	G3406 NA	DG972-E2	G3516B
Design Class:	4S-RB	4S-RB	4S-LB
Controls:	NSCR	None	Oxid. Cat.
Horsepower (hp):	215	23.6	1,380
Capacity (kW):	NA	17.6	
Fuel Use (Btu/hp-hr):	8,756	NA	7,421
Fuel Use (Btu/kW-hr)	NA	11,771	
Fuel Use (scfh):	2,080	229	11,316
Fuel Use (mmBtu/hr):	1.88	0.21	10.24
Exhaust Flow (acfm):	1,040	NA	7,919
Exhaust Temp (°F):	1,168	NA	846
Operating Hours:	8,760	8,760	8,760

Manufacturer data (g/hp-hr):

CO_2 =	598	685	505
CH_4=	NA	2	NA

Greenhouse Gas (GHG) Emissions[1]

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**tonnes/yr**	**lb/hr**	**tonnes/yr**	**lb/hr**	**tonnes/yr**
CO_2	283.44	1,126.25	26.59	105.63	1,536.38	6,104.74
CH_4	<0.01	0.02	0.08	0.33	0.02	0.09
N_2O	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
CH_4 as CO_2e	0.10	0.41	2.09	8.29	0.56	2.24
N_2O as CO_2e	0.12	0.49	0.01	0.05	0.67	2.67
Total CO_2 + CO_2e =	**283.67**	**1,127.16**	**28.69**	**113.98**	**1,537.61**	**6,109.65**

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

Methane (CH_4)	1.00E-03
Nitrous Oxide (N_2O)	1.00E-04

Notes:

[1] Certification test data used to estimate CO_2 and CH_4 emissions for the Kubota engine. N_2O emissions estimated using EPA data. Conversion to short tons (tons) found in site-wide Summary of Greenhouse Gases - Short Tons per Year (tons) table.

[2] 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

SWN Production Company, LLC
Fork Ridge Pad
Fugitive Emissions Calculations - Criteria and Hazardous Air Pollutants and Greenhouse Gases

Equipment Information

Source Type/Service	Number of Sources[1]	Em. Factor (lb/hr/source)[2]	Control Efficiency	TOC lb/hr	TOC TPY	VOC Wt %
Valves - Gas	173	9.92E-03	0.00%	1.72	7.52	18.96%
Flanges - Gas	688	8.60E-04	0.00%	0.59	2.59	18.96%
Compressor Seals - Gas	9	1.94E-02	0.00%	0.17	0.76	18.96%
Relief Valves - Gas	47	1.94E-02	0.00%	0.91	3.99	18.96%
Open-Ended Lines - Gas	2	4.41E-03	0.00%	0.01	0.04	18.96%
Total TOC (Gas Components) =				**3.40**	**14.91**	-
Valves - Light Oil	124	5.51E-03	0.00%	0.68	2.99	95.21%
Connectors - Light Oil	490	4.63E-04	0.00%	0.23	0.99	95.21%
Total TOC (Liquid Components) =				**0.91**	**3.99**	-

VOC and Greenhouse Gas Emissions

Source Type/Service	VOC			CH_4		CO_2	
	lb/hr	TPY	lb/yr	lb/hr	TPY	lb/hr	TPY
Valves - Gas	0.33	1.42	2,849.92	1.02	4.49	0.01	0.03
Flanges - Gas	0.11	0.49	982.26	0.35	1.55	<0.01	0.01
Compressor Seals - Gas	0.03	0.14	289.93	0.10	0.46	<0.01	<0.01
Relief Valves - Gas	0.17	0.76	1,514.10	0.54	2.38	<0.01	0.01
Open-Ended Lines - Gas	<0.01	0.01	14.64	0.01	0.02	<0.01	<0.01
Components in Gas Service =	**0.65**	**2.83**	**5,650.86**	**2.03**	**8.90**	**0.01**	**0.05**
Valves - Light Oil	0.65	2.85	5,700.10	0.01	0.04	<0.01	<0.01
Connectors - Light Oil	0.22	0.95	1,892.07	<0.01	0.01	<0.01	<0.01
Components in Liquid Service =	**0.87**	**3.80**	**7,592.16**	**0.01**	**0.06**	**<0.01**	**<0.01**
Total (Gas + Liquid Components) =	**1.51**	**6.62**	**13,243.02**	**2.05**	**8.96**	**0.01**	**0.05**

SWN Production Company, LLC
Fork Ridge Pad
Fugitive Emissions Calculations (Continued)

Hazardous Air Pollutant (HAP) Emissions (lb/hr)

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	0.01	<0.01	<0.01	0.00	<0.01	0.00	0.01
Flanges - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Components in Gas Service =	**0.01**	**<0.01**	**<0.01**	**0.00**	**<0.01**	**0.00**	**0.01**
Valves - Light Oil	0.04	<0.01	<0.01	<0.01	0.01	0.00	0.06
Connectors - Light Oil	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.02
Components in Liquid Service =	**0.05**	**<0.01**	**0.01**	**0.01**	**0.02**	**0.00**	**0.08**
Total (Gas + Liquid Components) =	**0.06**	**<0.01**	**0.01**	**0.01**	**0.02**	**0.00**	**0.09**

Hazardous Air Pollutant (HAP) Emissions (TPY)

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	0.02	<0.01	<0.01	0.00	<0.01	0.00	0.03
Flanges - Gas	0.01	<0.01	<0.01	0.00	<0.01	0.00	0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Relief Valves - Gas	0.01	<0.01	<0.01	0.00	<0.01	0.00	0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Components in Gas Service =	**0.05**	**<0.01**	**<0.01**	**0.00**	**<0.01**	**0.00**	**0.05**
Valves - Light Oil	0.16	<0.01	0.02	0.02	0.05	0.00	0.26
Connectors - Light Oil	0.05	<0.01	0.01	0.01	0.02	0.00	0.09
Components in Liquid Service =	**0.22**	**<0.01**	**0.03**	**0.03**	**0.07**	**0.00**	**0.35**
Total (Gas + Liquid Components) =	**0.27**	**0.01**	**0.03**	**0.03**	**0.07**	**0.00**	**0.40**

SWN Production Company, LLC
Fork Ridge Pad
Fugitive Emissions Calculations (Continued)

Typical Component Count per Equipment Type based on Representative Facility[3]

Source Type/Service	WH	GPU	HT	LPT	FGC	OT	TT-O	DEHY
Valves - Gas	12	3	2	5	5	0	0	24
Flanges - Gas	37	15	9	24	33	3	2	90
Compressor Seals - Gas	0	0	0	0	3	0	0	0
Relief Valves - Gas	1	3	1	1	1	1	1	2
Open-Ended Lines - Gas	0	0	0	0	0	0	0	2
Valves - Light Oil	0	5	6	12	3	6	9	0
Connectors - Light Oil	0	20	24	48	12	24	30	0
Pump Seals - Light Oil	0	0	0	0	0	0	0	0
Other - Light Oil	0	0	0	0	0	0	0	0

Equipment Type	WH	GPU	HT	LPT	FGC	OT	TT-O	DEHY
Number of Each Type On Pad =	8	8	2	2	3	5	1	1

SWN Production Company, LLC
Fork Ridge Pad
Fugitive Emissions Calculations (Continued)

Speciated Gas Analysis[4]

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.159%	0.070	0.335%	-	0.01	0.05
Nitrogen	28.013	0.364%	0.102	0.488%	-	0.02	0.07
Methane	16.042	77.183%	12.382	59.215%	59.706%	2.03	8.90
Ethane	30.069	14.716%	4.425	21.162%	21.338%	0.73	3.18
Propane	44.096	4.782%	2.109	10.085%	10.168%	0.35	1.52
i-Butane	58.122	0.647%	0.376	1.798%	1.813%	0.06	0.27
n-Butane	58.122	1.210%	0.703	3.363%	3.391%	0.12	0.51
i-Pentane	72.149	0.327%	0.236	1.128%	1.138%	0.04	0.17
n-Pentane	72.149	0.271%	0.196	0.935%	0.943%	0.03	0.14
n-Hexane	86.175	0.079%	0.068	0.326%	0.328%	0.01	0.05
Other Hexanes	86.175	0.142%	0.122	0.585%	0.590%	0.02	0.09
Heptanes (as n-Heptane)	100.202	0.084%	0.084	0.403%	0.406%	0.01	0.06
Benzene	78.114	0.002%	0.002	0.007%	0.008%	<0.01	<0.01
Toluene	92.141	0.003%	0.003	0.013%	0.013%	<0.01	<0.01
Ethylbenzene	106.167	0.000%	0.000	0.000%	0.000%	0.00	0.00
Xylenes	106.167	0.001%	0.001	0.005%	0.005%	<0.01	<0.01
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	0.022%	0.025	0.120%	0.121%	<0.01	0.02
Nonanes (as n-Nonane)	128.255	0.005%	0.006	0.031%	0.031%	<0.01	<0.01
Decanes (as n-Decane)	142.282	0.000%	0.000	0.000%	0.000%	0.00	0.00
TOTAL =		**100.00%**	**20.91**	**100.00%**	**100.00%**	**3.43**	**15.03**
		TOTAL HC =	**20.74**	**TOTAL VOC =**	**18.96%**	**0.65**	**2.83**
				TOTAL HAP =	**0.35%**	**0.01**	**0.05**

SWN Production Company, LLC
Fork Ridge Pad
Fugitive Emissions Calculations (Continued)

Speciated Liquids Analysis[4]

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.018%	0.008	0.010%	-	<0.01	<0.01
Nitrogen	28.013	0.026%	0.007	0.009%	-	<0.01	<0.01
Methane	16.042	7.419%	1.190	1.489%	1.490%	0.01	0.06
Ethane	30.069	8.764%	2.635	3.298%	3.299%	0.03	0.13
Propane	44.096	9.825%	4.332	5.422%	5.423%	0.05	0.22
i-Butane	58.122	3.048%	1.772	2.217%	2.218%	0.02	0.09
n-Butane	58.122	8.045%	4.676	5.852%	5.853%	0.05	0.23
i-Pentane	72.149	5.183%	3.739	4.680%	4.681%	0.04	0.19
n-Pentane	72.149	5.869%	4.234	5.299%	5.300%	0.05	0.21
n-Hexane	86.175	5.090%	4.386	5.490%	5.491%	0.05	0.22
Other Hexanes	86.175	7.647%	6.589	8.247%	8.248%	0.08	0.33
Heptanes (as n-Heptane)	100.202	12.459%	12.484	15.624%	15.627%	0.14	0.62
Benzene	78.114	0.103%	0.080	0.101%	0.101%	<0.01	<0.01
Toluene	92.141	0.568%	0.523	0.655%	0.655%	0.01	0.03
Ethylbenzene	106.167	0.508%	0.539	0.675%	0.675%	0.01	0.03
Xylenes	106.167	1.326%	1.408	1.762%	1.762%	0.02	0.07
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	8.562%	9.780	12.240%	12.242%	0.11	0.49
Nonanes (as n-Nonane)	128.255	4.206%	5.394	6.751%	6.752%	0.06	0.27
Decanes (as n-Decane)	142.282	11.332%	16.123	20.179%	20.182%	0.18	0.80
TOTAL =		**100.00%**	**79.90**	**100.00%**	**100.00%**	**0.91**	**3.99**
		TOTAL HC =	**79.89**	**TOTAL VOC =**	**95.21%**	**0.87**	**3.80**
				TOTAL HAP =	**8.68%**	**0.08**	**0.35**

Notes:

[1] Component counts taken by equipment type at representative facility and made site-specific according to the number of each equipment type at this site.

[2] Emission Factor Source: EPA-453/R-95-017. TOC multiplied by pollutant content of streams (weight %) to obtain pollutant emissions.

[3] Equipment Type Key: WH = Well Head, GPU = Gas Production Unit, HT = Heater Treater, LPT = Low-Pressure Tower, FGC = Flash Gas Compressor, OT = Oil Tank, TT-O = Tank Truck - Oil, DEHY = Dehydration Unit

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-ENG1	0.47	2.08	0.95	4.15	0.36	1.59	<0.01	<0.01	0.04	0.16	0.04	0.16	<0.01	0.02	283.67	1,242.48
EP-ENG2	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	28.69	125.65
EP-ENG3	1.52	6.66	0.61	2.68	0.88	3.87	0.01	0.03	0.10	0.45	0.10	0.45	0.02	0.10	1,537.61	6,734.74
EP-RB1	0.08	0.36	0.07	0.30	2.20	9.66	<0.01	<0.01	0.01	0.03	0.01	0.03	0.45	1.95	98.93	433.30
EP-GPU1 - EP-GPU8	0.88	3.87	0.74	3.25	0.05	0.21	0.01	0.02	0.07	0.29	0.07	0.29	0.02	0.08	936.78	4,103.11
EP-HT1 - EP-HT2	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-LH1	0.17	0.73	0.14	0.61	0.01	0.04	<0.01	<0.01	0.01	0.06	0.01	0.06	<0.01	0.01	175.65	769.33
EU-LOAD-COND	-	-	-	-	1.16	5.09	-	-	-	-	-	-	0.20	0.89	5.06	22.15
EU-LOAD-PW	-	-	-	-	0.01	0.05	-	-	-	-	-	-	0.24	1.06	6.07	26.58
APC-COMB	4.16	18.20	8.28	36.26	2.89	12.67	<0.01	<0.01	0.09	0.38	0.09	0.38	0.07	0.29	3,528.83	15,456.28
TOTAL	7.70	33.74	16.43	71.97	7.89	34.57	0.01	0.06	0.32	1.42	0.32	1.42	1.11	4.85	6,718.38	29,426.50

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 includes uncombusted emissions from the glycol dehydrator flash tank, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions. Additionally, Emissions from RP-RB1 include emissions from the dehydration unit.

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-ENG1	0.03	0.13	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.05	0.22
EP-ENG2	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.01	0.03
EP-ENG3	0.27	1.20	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	0.01	-	-	0.45	1.97
EP-RB1	<0.01	<0.01	0.11	0.47	0.12	0.52	0.02	0.11	0.06	0.25	0.06	0.28	0.37	1.62
EP-GPU1 - EP-GPU8	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	0.02	0.07	0.02	0.07
EP-HT1 - EP-HT2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-LH1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EU-LOAD-COND	-	-	<0.01	0.01	0.01	0.03	0.01	0.03	0.02	0.09	0.06	0.28	0.10	0.44
EU-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	<0.01	<0.01	<0.01	0.02	0.02	0.07	0.01	0.06	0.03	0.15	0.12	0.53	0.19	0.83
TOTAL	0.31	1.36	0.12	0.52	0.15	0.64	0.05	0.20	0.11	0.49	0.27	1.19	1.19	5.21

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 includes uncombusted emissions from the glycol dehydrator flash tank, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions. Additionally, Emissions from RP-RB1 include emissions from the dehydration unit.

ATTACHMENT V: LEGAL ADVERTISEMENT

Note: Affidavit of Publication will be submitted upon receipt by SWN from the publisher.

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that SWN Production Company, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a G70-D General Permit Registration for a natural gas production facility (Fork Ridge Pad) located in Marshall County, West Virginia. From the intersection of SR 250 and CR 2 in Moundsville, travel south on SR 250 14.17 miles to the intersection of SR 250 and CR 17 (Fork Ridge Road). Turn right onto CR 17 and travel 3.64 miles to the well pad entrance on the right. Latitude and longitude coordinates are: 39.87078, -80.63898.

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be:

Nitrogen Oxides (NOx)	33.74 tons/yr
Carbon Monoxide (CO)	71.97 tons/yr
Volatile Organic Compounds (VOC)	41.19 tons/yr
Sulfur Dioxide (SO_2)	0.06 tons/yr
Particulate Matter (PM)	1.99 tons/yr
Acetaldehyde	0.40 tons/yr
Acrolein	0.25 tons/yr
Benzene	0.53 tons/yr
Ethylbenzene	0.23 tons/yr
Formaldehyde	1.36 tons/yr
Methanol	0.14 tons/yr
n-Hexane	1.46 tons/yr
Toluene	0.67 tons/yr
Xylenes	0.57 tons/yr
Carbon Dioxide	29,291.69 tons/yr
Methane	13.73 tons/yr
Nitrous Oxide	0.05 tons/yr
CO_2 Equivalent	29,650.52 tons/yr

Operations is planned to begin on or about October 15, 2017. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice. Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1250, during normal business hours.

Dated this the XXth of August 2017

By: SWN Production Company, LLC
Carla Suszkowski, P.E.
Regulatory Manager – West Virginia Division
10000 Energy Drive
Spring, TX 77389