SWN PRODUCTION COMPANY, LLC

OV ROYALTY PAD

GENERAL PERMIT G-70B
CONSTRUCTION PERMIT APPLICATION

SUBMITTED TO WVDEP DIVISION OF AIR QUALITY
NOVEMBER 2015

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this G70-B General Permit Construction Permit application for the OV Royalty Pad (OV Royalty), a natural gas production facility in Brooke County. OV Royalty was previously authorized under Permit No. R13-2990. All previously authorized equipment has been removed; therefore, all equipment in this application is new to OV Royalty. SWN requests authorization with this submittal to construct and operate under the General Permit G-70B for Oil and Natural Gas Production Facilities. The equipment to be added includes the following:

- Two (2) Caterpillar G3306 NA Compressor Engines
- One (1) Caterpillar G3406 NA Engine
- Five (5) 1.0-mmBtu/hr Gas Production Units (GPU)
- Two (2) 0.5-mmBtu/hr Heater Treaters
- Two (2) 1.5-mmBtu/hr Stabilizer Heaters
- Eight (8) 400-bbl Condensate Tanks
- Four (4) 400-bbl Produced Water Tanks
- One (1) 30-mmBtu/hr Vapor Combustor with Pilots
- One (1) NK 100 VRU with Associated Zenith ZPP-644 Engine
- Condensate Loading
- Produced Water Loading
- Fugitive Emissions
- Fugitive Haul Road Emissions

Note that other small storage tanks may be present on site (i.e., methanol) 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 S. 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 engines, Zenith VRU engine, and heaters were calculated with manufacturer data when available and AP-42/EPA emissions factors for the remaining pollutants.

Condensate tank emissions were calculated by creating a profile in the EPA TANKS 4.0.9d model using properties obtained in a representative liquids analysis as the tank contents. Although

produced water storage tanks contain primarily water, a profile was created in EPA TANKS 4.0.9d assuming 1% of the total throughput as condensate and 99% as water to provide a conservative emissions estimate of the trace hydrocarbons that may be entrained in the water. Flashing emissions were calculated using ProMax process simulation software. Condensate loading has been calculated using the properties from EPA TANKS 4.0.9d and process simulation.

Fugitive emissions were calculated with a component count by equipment type from a similar facility, and representative extended gas and liquids analyses. Fugitive haul road emissions were calculated using EPA/AP-42 methodologies.

Greenhouse gas emissions were calculated with the latest EPA factors and manufacture data when available. Documents used as references for the emissions calculations, including engine specification sheets, AP-42 and EPA emission factor references, gas and liquids analyses, and process simulation results are included in Attachments L.

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-B. 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. The engines are subject to NSPS Subpart JJJJ and MACT Subpart ZZZZ.

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 KB—STANDARDS OF PERFORMANCE FOR VOLATILE ORGANIC LIQUID STORAGE VESSELS (INCLUDING PETROLEUM LIQUID STORAGE VESSELS) FOR WHICH CONSTRUCTION, RECONSTRUCTION, OR MODIFICATION COMMENCED AFTER JULY 23, 1984

The affected facility to which this subpart applies is each storage vessel with a capacity greater than or equal to 75 cubic meters (m^3) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. The tanks at this facility were constructed after the effective date of this subpart but are less than 75 m^3 (which equals approximately 471 bbl); therefore, this subpart does not apply.

40 CFR PART 60 SUBPART KKK - STANDARDS OF PERFORMANCE FOR STATIONARY FOR EQUIPMENT LEAKS OF VOC FROM ONSHORE NATURAL GAS PROCESSING PLANTS:

The facility is not considered an affected source (natural gas processing plant) and is therefore not subject to this Subpart.

40 CFR PART 60 SUBPART IIII - STANDARDS OF PERFORMANCE FOR STATIONARY COMPRESSION IGNITION INTERNAL COMBUSTION ENGINES:

The facility does not contain the affected source (diesel-fired engine) and is therefore not subject to this Subpart.

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

The engines were manufactured after June 12, 2006 and are subject to the requirements of this subpart. The manufacture dates of the two Caterpillar G3306 NA engines, the one Caterpillar G3406 NA engine, and the VRU engine are not yet known but are presumed to be subject to NSPS Subpart JJJJ as new engines.

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.

Wells located at this production facility are not drilled principally to produce natural gas, therefore they are not affected sources subject to gas well completion requirements.

Pneumatic controllers affected by this Subpart include continuous bleed, natural gas-driven pneumatic controllers with a natural gas bleed rate greater than 6 SCFH. No pneumatic devices with a continuous bleed greater than 6 SCFH will be installed at this facility.

Storage vessels affected by this Subpart include those with VOC emissions greater than 6 TPY. The storage vessels have estimated VOC emissions below 6 TPY per tank and are not expected to be subject to this Subpart.

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. The facility is a minor (area) source of HAP and does not have an affected facility as defined by the area source requirements (TEG dehydrators).

40 CFR PART 63 SUBPART HHH - NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES FROM NATURAL TRANSMISSION AND STORAGE FACILITIES:

The facility is not a natural gas transmission and storage facility and is therefore 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 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 engines are subject to NSPS Subpart JJJJ and comply with MACT Subpart ZZZZ by complying with the requirements of NSPS Subpart JJJJ.

APPLICATION FOR GENERAL PERMIT REGISTRATION

dep	**west virginia** department of environmental protection	Division of Air Quality 601 57th Street SE Charleston, WV 25304 Phone (304) 926-0475 Fax (304) 926-0479 www.dep.wv.gov

G70-B 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: OV Royalty Pad

Operating Site Physical Address: Not applicable. Facility is located at 40.28566, -80.584609.
If none available, list road, city or town and zip of facility.

City: Wellsburg, WV | Zip Code: 26070 | County: Brooke

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Latitude: 40.285661
Longitude: -80.584609

SIC Code: 1311
NAICS Code: 211111

DAQ Facility ID No. (For existing facilities)
009-00110

CERTIFICATION OF INFORMATION

This G70-B 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-B Registration Application will be returned to the applicant. Furthermore, if the G70-B forms are not utilized, the application will be returned to the applicant. No substitution of forms is allowed.**

I hereby certify that Paul Geiger 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-B 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: _____ 12-1-15
Name and Title: **Paul Geiger, Sr. Vice President Ops Management** Phone: 832-796-1000
Fax: 832-796-4818
Email: Paul_Geiger@swn.com Date: 12-2-15

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

If applicable:
Environmental Contact
Name and Title: Kristi Evans Phone: Fax:
Email: Kristi_Evans@swn.com Date:

OPERATING SITE INFORMATION
Briefly describe the proposed new operation and/or any change(s) to the facility: Four engines, nine heaters, eight condensate tanks, four produced water tanks, and a vapor combustor will be added. Fugitive emissions, condensate loading, produced water loading and haul road emissions will also occur.
Directions to the facility: From CR 2 in Wellsburg, turn east on CR 27 and travel 3.19 miles to CR 18 (North View Road, a.k.a. Rabbit Hill Road). Drovers Inn is on the corner. Turn left (north) onto CR 18 and travel 2.62 miles to access road on left.

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-B 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	
☒ Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment R	
☒ Emission Calculations (please be specific and include all calculation methodologies used) – Attachment S	
☒ Facility-wide Emission Summary Sheet(s) – Attachment T	
☒ Class I Legal Advertisement – Attachment U	
☒ 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: AGGREGATION ANALYSIS

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).

Is there a facility owned by or associated with the natural gas industry located within one (1) mile of the proposed facility? Yes ☐ No ☒

If Yes, please complete the questionnaire on the following page (Attachment A).

Please provide a source aggregation analysis for the proposed facility below:

The aggregation of facilities is appropriate only if separate emissions sources meet the following three-prong test:

1. The sources belong to a single major industrial grouping (same two-digit major SIC code);
2. The sources are under common control of the same person (or persons under common control); and
3. The sources are located on one or more "contiguous or adjacent" properties.

Under the third prong, SWN determined that there were no other facilities contiguous with or adjacent to OV Royalty to be permitted. Neither the WV DEP nor EPA have established a distance under which source aggregations are required, but the terms "contiguous" or "adjacent" require analyzing distances between operations. To be considered contiguous, two operations must share a common fence line. As for adjacent, operations located more than a quarter of a mile apart are clearly not adjacent, but operations within a quarter of a mile require an analysis to determine if they meet the common sense notion of a plant. No other SWN locations are located within a quarter mile of OV Royalty to be permitted; therefore, no additional facilities are contiguous or adjacent.

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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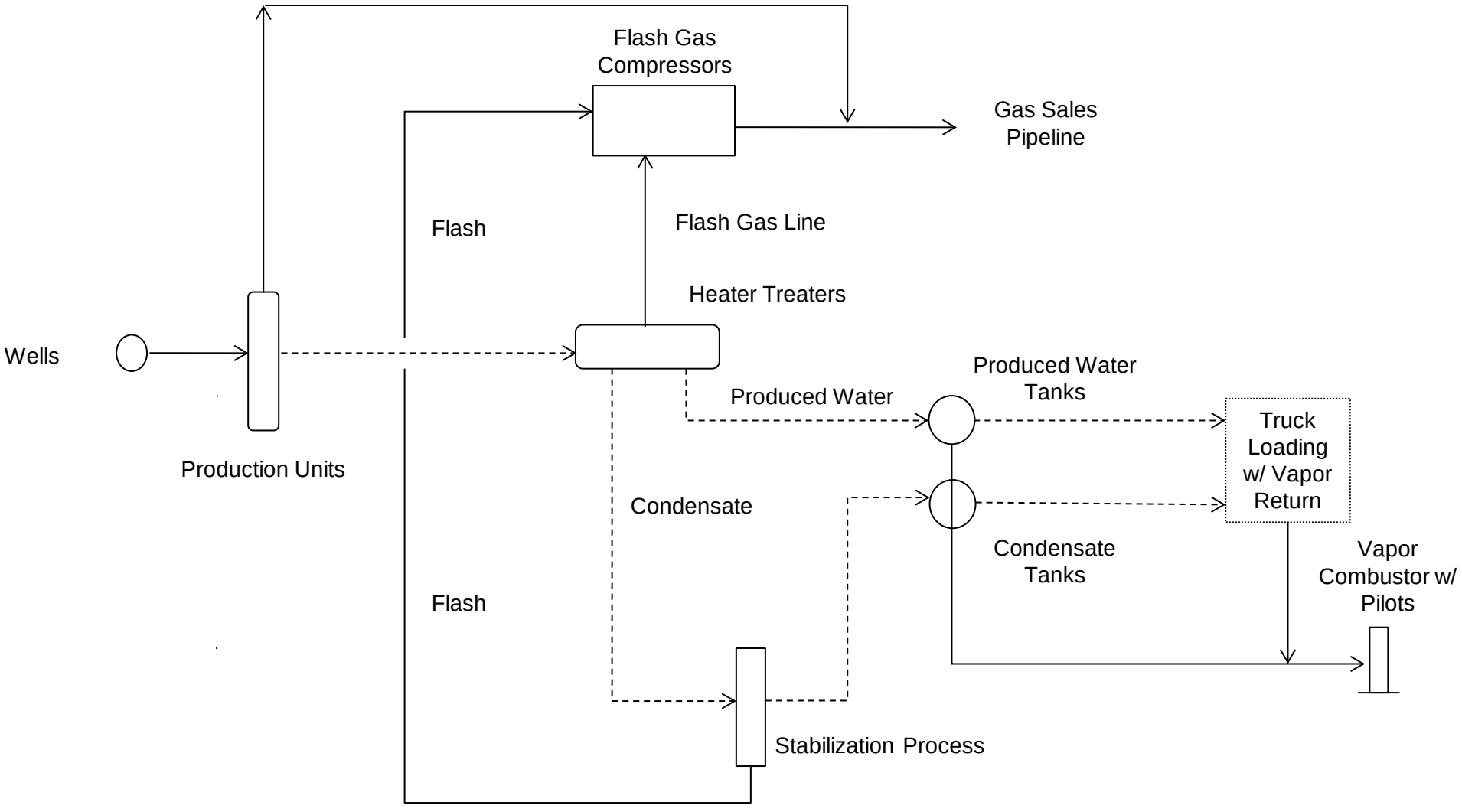
ATTACHMENT D: PROCESS FLOW DIAGRAM



Gas/Vapor

Liquids (Condensate and Produced Water)

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

SWN Production Company, LLC
OV Royalty Pad
Attachment D: Process Flow Diagram
November 2015

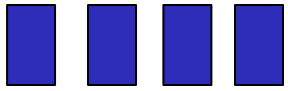
ATTACHMENT E: PROCESS DESCRIPTION

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 will also occur on-site. A description of the facility process is as follows: Condensate, gas and water come from the wellhead(s) to the production unit(s), where the first stage of separation occurs. Fluids (condensate and produced water) will be sent to the heater treater(s). Produced water from the heater treater(s) flows into the produced water storage tank(s). Condensate flows into the condensate storage tank(s). Flash gases from the heater treater(s) are routed via hard-piping (with 100% capture efficiency per WVDEP guidance) to the inlet of the flash gas compressor(s) to be compressed.

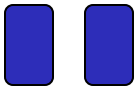
The natural gas stream will exit the facility for transmission via pipeline. Condensate and produced water are transported offsite via truck. Loading emissions will be controlled with vapor return, which has at least 70% capture efficiency, and will be routed to the vapor combustor for at least 98% destruction efficiency, for an overall control efficiency of 69%. Working, breathing and flashing vapors from the condensate and produced water storage tanks will be controlled by the VRU but are represented in the calculations as being controlled by the combustor for operational flexibility and as a conservative calculation of emissions. The vapor combustor has three (3) natural gas-fired pilots to ensure a constant flame for combustion.

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

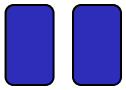
ATTACHMENT F: PLOT PLAN



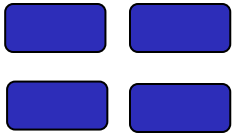
GPUs



Heater Treaters

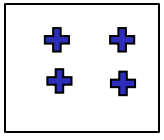


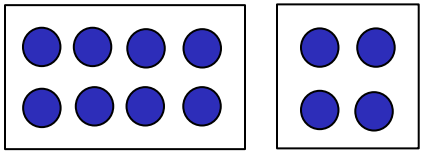
Stabilizer Heater



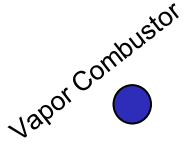
Compressor Engines

Wellheads





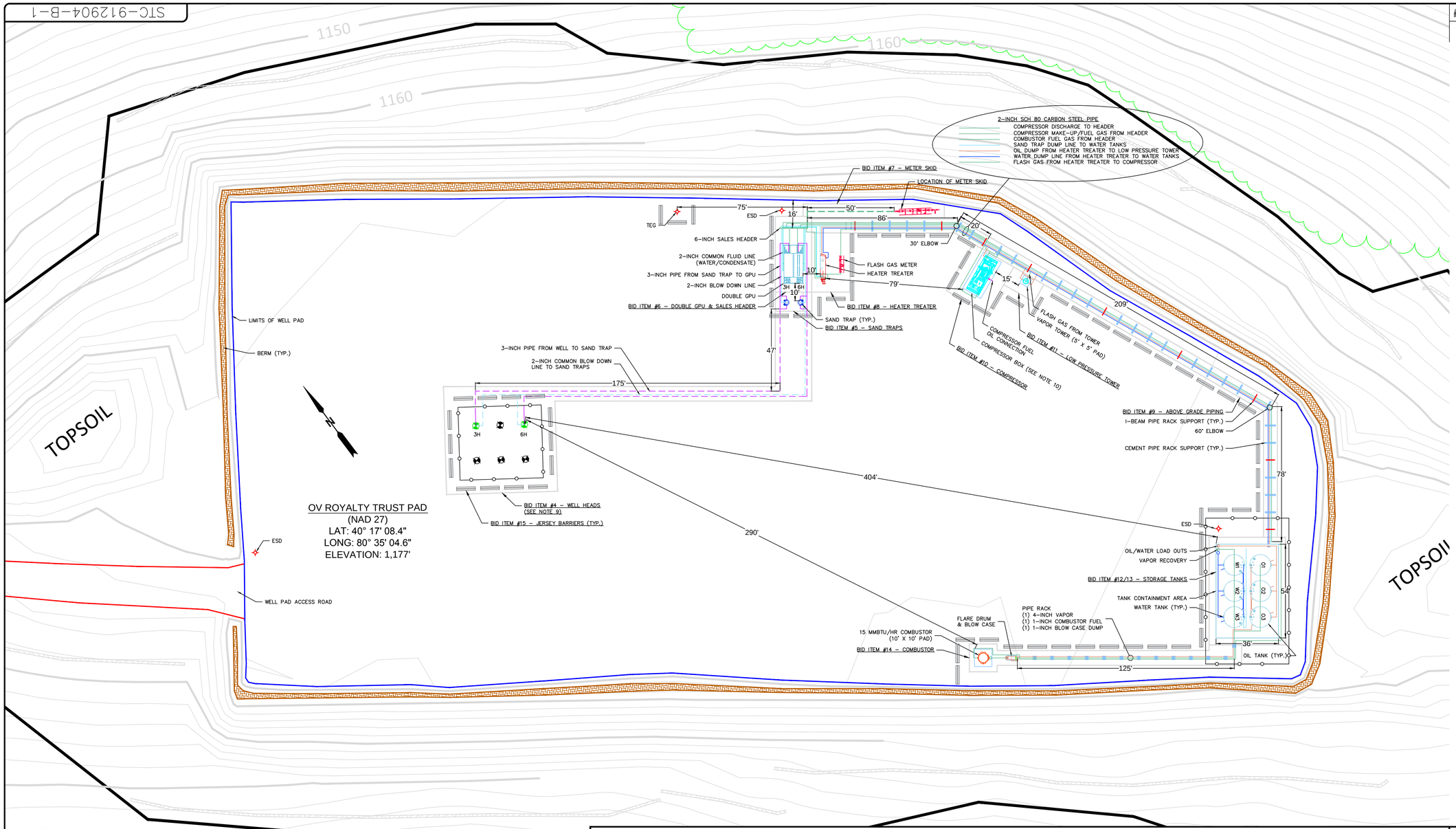
Condensate/Produced Water Storage Tanks



SWN Production Company, LLC
OV Royalty Pad
Attachment F: Simple Plot Plan
November 2015

The equipment demonstrates general location layout and equipment counts may be different than what is shown.

STC-912904-B-1



#	Revision Description	DATE DWN	CHK
		DRAWN BY:	CHKD BY:

LEGEND

- ABOVE GROUND WELL HEAD DISCHARGE PIPING
- BELOW GROUND WELL HEAD DISCHARGE PIPING
- ABOVE GROUND GAS PIPING
- ABOVE GROUND PRODUCED WATER PIPING
- ABOVE GROUND OIL/CONDENSATE PIPING
- ABOVE GROUND DISCHARGE PIPING
- BELOW GROUND DISCHARGE PIPING
- 1280 EXISTING GROUND CONTOUR (2-FOOT INTERVAL)
- BELOW GROUND 6-INCH SALES PIPING
- WELL PAD LIMITS

BID ITEM #16 – ELECTRICAL WIRING SUPPORT

WIRING

1. 12 PAIR WIRE FROM EACH WELLHEAD TO METERS NEAR THE HEADER
2. 2 PAIR WIRE FROM HEADER/ METER AREA TO EDGE OF LOCATION/ LEASE ROAD FOR ESD
3. 2 PAIR WIRE FROM HEADER/METER AREA TO COMPRESSOR
4. 24 PAIR WIRE FROM HEADER/METER AREA TO TANK BATTERY FOR JUNCTION BOX
5. 4 PAIR WIRE (SPARE) FROM HEADER/METER AREA TO TANK BATTERY FOR JUNCTION BOX
6. 12 PAIR WIRE FROM TANK BATTERY JUNCTION BOX TO COMBUSTOR
7. 4 PAIR WIRE FROM HEADER/METER AREA TO TEG UNIT

TEG UNIT

1. SMALL UNIT MUST BE 10 FT FROM ANY FIRED VESSEL
2. LARGER UNIT MUST BE 25 FT FROM ANY FIRED VESSEL

NOTES

1. ALL WIRING USED IS 18 GAUGE CLX EXCEPT THE 4 PAIR WIRE USED FOR THE TEG WHICH IS 12 GAUGE CLX
2. APPROXIMATELY 10 – 15 FT OF EXTRA WIRE SHOULD BE LEFT AT ALL JUNCTIONS, AND APPROXIMATELY 20 FT OF EXTRA WIRE AT THE COMPRESSOR
3. LINES COMING FROM EACH SPECIFIC WELLHEAD MUST BE MARKED/IDENTIFIED WITH ITS RESPECTIVE WELL OF ORIGIN AT THE OTHER END/JUNCTION NEAR THE HEADER

*FOLLOW CONSTRAINED FACILITY SPACING STANDARD

NOTES:

1. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL EXISTING STRUCTURES, UTILITIES, FACILITIES, AND ALL PROPOSED WORK ON THE SITE DURING CONSTRUCTION. MANY EXISTING FEATURES ARE SENSITIVE TO VIBRATIONS AND HEAVY EQUIPMENT LOADING. THE CONTRACTOR MUST EXERCISE CAUTION AND DILIGENCE TO AVOID CAUSING DAMAGE. ANY EXISTING FEATURES DAMAGED BY THE CONTRACTOR THAT NEED TO BE REPAIRED BY THE OWNER WILL BE AT THE CONTRACTOR'S EXPENSE.
2. CONTRACTOR SHALL ADHERE TO ALL SPACING REQUIREMENTS SHOWN ON DRAWING.
3. CONTRACTOR IS RESPONSIBLE FOR PROVIDING A DAILY OPERATION SUMMARY OF WORK PERFORMED TO CHK PERSONNEL.
4. CONTRACTOR IS RESPONSIBLE FOR DAILY HOUSEKEEPING WHILE ONSITE. RESPONSIBILITIES INCLUDE KEEPING ALL MATERIAL LEFT ONSITE ORGANIZED AND NEATLY PUT AWAY, LOCATION IS WALKED AND CLEANED UP DAILY, AND GATE IS LOCKED AFTER DAILY OPERATIONS CEASE.
5. FINAL CLEANUP AT THE END OF THE PROJECT INCLUDES CLEANING EQUIPMENT WITH CLEANING MATERIALS APPROPRIATE TO SURFACE AND MATERIAL BEING CLEANED, CLEAN DEBRIS FROM STORMWATER DRAINAGE SYSTEMS AND ROADWAYS, AND REMOVE WASTE AND SURPLUS MATERIALS, RUBBISH, AND CONSTRUCTION FACILITIES FROM SITE. ANY LEFTOVER MATERIAL NEEDS TO BE TAKEN OFFSITE AND COMMUNICATED WITH CHK CONSTRUCTION FOREMAN.
6. CONTRACTOR WILL NEED TO SUPPLY CHK PERSONNEL WITH ALL UNDERGROUND PIPING PHOTOS AND SKETCHES OF SEGMENT LENGTHS AT PROJECT COMPLETION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO DOCUMENT BELOW GRADE PIPING WITH PHOTOS DURING CONSTRUCTION AND TO SKETCH PIPING BETWEEN ABOVE/BELOW GRADE PIPING TRANSITIONS. THESE ITEMS WILL BE USED TO COMPLETE THE AS-BUILT DRAWING OF THE PAD BY OTHERS.
7. CONTRACTOR IS RESPONSIBLE FOR COMPLETING COMMISSION SHEETS AND PRE-PAD TANK BATTERY INSPECTION SHEETS ONCE FULL INSTALLATION OF PAD IS COMPLETE.
8. ALL PROCESS PIPING SHALL BE INSTALLED IN ACCORDANCE WITH ASME B31.3 CODES AND STANDARDS.
9. CONTRACTOR SHALL EXCAVATE ALL PIPE TRENCHES TO A MINIMUM OF 3 FEET DEEP. THE CONTRACTOR SHALL INSTALL 6 TO 8 INCHES OF CHK SUPPLIED AGGREGATE IN TRENCH FOR PIPE BEDDING PRIOR TO PIPE INSTALLATION. PIPES IN TRENCH SHALL BE SPACED 10-INCHES ON CENTER. AFTER PIPING IS INSTALLED CONTRACTOR SHALL PLACE 6 TO 8 INCHES OF CHK SUPPLIED AGGREGATE ABOVE PIPING. THE CONTRACTOR SHALL BACKFILL THE REMAINDER OF THE TRENCH WITH SUITABLE EXCAVATED MATERIAL (I.E. MAXIMUM PARTICLE SIZE OF 3 INCHES, CONTRACTOR SHALL SCREEN EXCAVATED MATERIAL TO REMOVE OVERSIZED MATERIAL). BACKFILL SHALL BE COMPACTED IN 6-INCH LOOSE LIFTS UNTIL SUBGRADE IS ACHIEVED. THE CONTRACTOR SHALL USE THE +3-INCH STONE, FROM SCREENING, TO RETURN SITE TO ORIGINAL GRADE ONLY AFTER SUBGRADE HAS BEEN ACHIEVED. #4 STONE (SUPPLIED BY CHK) MAY NEED TO BE USED TO SUPPLEMENT THE +3-INCH STONE TO RETURN SITE TO ORIGINAL GRADE.
10. CONTRACTOR SHALL CONSTRUCT AND FILL COMPRESSOR PAD BOX. COMPRESSOR PAD BOX SHALL BE CONSTRUCTED OF TREATED 2" X 6" LUMBER TO THE DIMENSIONS 12' X 24' X 6". AFTER BOX CONSTRUCTION AND INSTALLATION, 3" LIMESTONE SAND SHALL BE INSTALLED AND COMPACTED. AN ADDITIONAL 2" SCREED SHALL THEN BE INSTALLED TO FILL THE COMPRESSOR BOX. COMPRESSOR SHALL BE SET ON THE CONSTRUCTED PAD USING REQUIRED LIFTING AND HANDLING EQUIPMENT. COMPRESSOR PAD FILL MATERIALS WILL BE SUPPLIED BY CHK. CONTRACTOR SHALL SUPPLY LUMBER, LABOR AND EQUIPMENT TO CONSTRUCT THE BOX, LABOR AND EQUIPMENT TO FILL AND COMPACT THE BOX MATERIAL, EQUIPMENT TO SET COMPRESSOR, AND LABOR TO INSTALL COMPRESSOR.

FACILITIES BID DESIGN

OV ROYALTY TRUST PAD

PAD #912904 | BROOKE CO

STC-912904-B-1

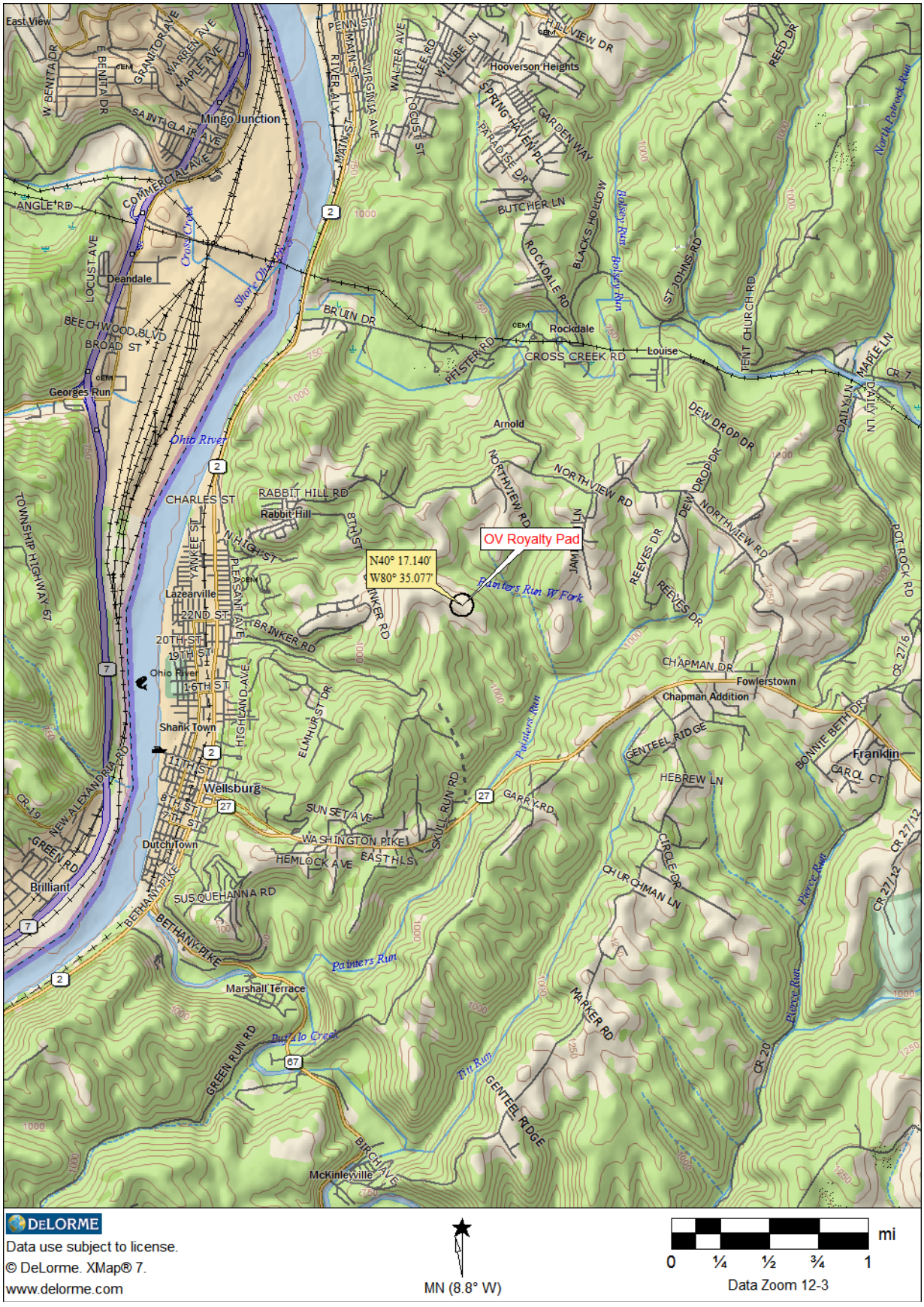
DWN	JJL	DATE	06/28/13
CHKD	CAF	DATE	07/01/13
SCALE	1"=30'	SHEET	1 OF 1

DO NOT SCALE DRAWING

A

Chesapeake ENERGY

ATTACHMENT G: AREA MAP



OV Royalty Pad
Figure 1: Area Map
Brooke County, West Virginia
November 2015

OV Royalty Pad
Figure 2: Map with 300’ Radius
November 2015

ATTACHMENT H: G70-B SECTION APPLICABILITY FORM

ATTACHMENT H – G70-B SECTION APPLICABILITY FORM

General Permit G70-B Registration
Section Applicability Form

General Permit G70-B 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, centrifugal compressors, reciprocating compressors, reciprocating internal combustion engines (RICEs), tank truck 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-B 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-B APPLICABLE SECTIONS	
☐ Section 5.0	Gas Well Affected Facility (NSPS, Subpart OOOO)
☒ Section 6.0	Storage Vessels Containing Condensate and/or Produced Water[1]
☐ Section 7.0	Storage Vessel Affected Facility (NSPS, Subpart OOOO)
☒ Section 8.0	Control Devices and Emission Reduction Devices not subject to NSPS Subpart OOOO 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)
☐ Section 11.0	Centrifugal Compressor Affected Facility (NSPS, Subpart OOOO)[2]
☐ Section 12.0	Reciprocating Compressor Affected Facility (NSPS, Subpart OOOO)[2]
☒ Section 13.0	Reciprocating Internal Combustion Engines, Generator Engines, Microturbines
☒ Section 14.0	Tanker Truck Loading[3]
☐ Section 15.0	Glycol Dehydration Units[4]

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

2 *Applicants that are subject to Section 11 and 12 may also be subject to the applicable RICE requirements of Section 13.*

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

4 *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	145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	TBD	TBD	145-hp	New	NSCR	NSCR
EU-ENG2	EP-ENG2	145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	TBD	TBD	145-hp	New	NSCR	NSCR
EU-ENG3	EP-ENG3	215-hp Caterpillar G3406 NA Engine	TBD	TBD	215-hp	New	NSCR	NSCR
EU-ENG4	EP-ENG4	77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	TBD	TBD	77-kW	New	NSCR	NSCR
EU-GPU1 - EU-GPU5	EP-GPU1 - EP-GPU5	Five (5) 1.0-mmBtu/hr GPU Burners	TBD	TBD	1-mmBtu/hr	New	N/A	N/A
EU-HT1 - EU-HT2	EP-HT1 - EP-HT2	Two (2) 0.5-mmBtu/hr Heater Treaters	TBD	TBD	0.5-mmBtu/hr	New	N/A	N/A
EU-SH1 - EU-SH2	EP-SH1 - EP-SH2	Two (2) 1.5-mmBtu/hr Stabilizer Heaters	TBD	TBD	1.5-mmBtu/hr	New	N/A	N/A
EU-TANKS-COND	APC-COMB-TKLD	Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	TBD	TBD	400-bbl	New	APC-COMB-TKLD	APC-VRU-TANKS
EU-TANKS-PW	APC-COMB-TKLD	Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	TBD	TBD	400-bbl	New	APC-COMB-TKLD	APC-VRU-TANKS
EU-LOAD-COND	APC-COMB-TKLD	Condensate Truck Loading w/ Vapor Return Routed to Combustor	TBD	TBD	38,325,000 gal/yr	New	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	TBD	15,330,000 gal/yr	New	Vapor Return and APC-COMB-TKLD	Vapor Return and APC-COMB-TKLD
APC-COMB-TKLD	APC-COMB-TKLD	One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	TBD	TBD	30-mmBtu/hr	New	N/A	N/A
EU-PILOT	APC-COMB-TKLD	Vapor Combustor Pilots	TBD	TBD	150-scfh	New	N/A	N/A
EU-HR	EP-HR	Fugitive Haul Road Emissions	TBD	TBD	N/A	New	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: 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 (CO_2e)
Pumps	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Valves	☐ Yes ☐ No	94-gas 103-light oil	EPA	☐ Gas ☐ Liquid ☒ Both	0.90 – gas 2.35 – light oil	0.01 – gas 0.21 – light oil	
Safety Relief Valves	☐ Yes ☐ No	34	EPA	☒ Gas ☐ Liquid ☐ Both	0.64	0.01	
Open Ended Lines	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Sampling Connections	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Connections (Not sampling)	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Compressors	☐ Yes ☐ No	9	EPA	☒ Gas ☐ Liquid ☐ Both	0.17	<0.01	
Flanges	☐ Yes ☐ No	403-gas 406-light oil	EPA	☐ Gas ☐ Liquid ☒ Both	0.33-gas 0.41-light oil	0.01-gas 0.04-light oil	
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 loading, etc.) N/A

ATTACHMENT L: STORAGE VESSELS DATA SHEET

REPRESENTATIVE GAS ANALYSES

TANKS 4.0.9D REPORTS

PROMAX PROCESS SIMULATION RESULTS

ATTACHMENT L – STORAGE VESSEL DATA SHEET

Complete this data sheet if you are the owner or operator of a storage vessel that contains condensate and/or produced water. This form must be completed for ***each*** new or modified bulk liquid storage vessel(s) that contains condensate and/or produced water. (If you have more than one (1) identical tank (i.e. 4-400 bbl condensate tanks), then you can list all on one (1) data sheet). **Include gas sample analysis, flashing emissions, working and breathing losses, USEPA Tanks, simulation software (ProMax, E&P Tanks, HYSYS, etc.), and any other supporting documents where applicable.**

The following information is REQUIRED:

☒ Composition of the representative sample used for the simulation
☒ For each stream that contributes to flashing emissions:
- ☒ Temperature and pressure (inlet and outlet from separator(s))
- ☒ Simulation-predicted composition
- ☒ Molecular weight
- ☒ Flow rate

☒ Resulting flash emission factor or flashing emissions from simulation
☒ Working/breathing loss emissions from tanks and/or loading emissions if simulation is used to quantify those emissions

Additional information may be requested if necessary.

GENERAL INFORMATION (REQUIRED)

1. Bulk Storage Area Name Condensate Storage	2. Tank Name Eight (8) 400-bbl Condensate Storage Tanks
3. Emission Unit ID number EU-TANKS-COND	4. Emission Point ID number EP-TANKS-COND
5. Date Installed , Modified or Relocated *(for existing tanks)* TBD Was the tank manufactured after August 23, 2011? ☒ Yes ☐ No	6. Type of change: ☒ New construction ☐ New stored material ☐ Other ☐ Relocation
7A. Description of Tank Modification *(if applicable)* N/A	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Was USEPA Tanks simulation software utilized? ☒ Yes ☐ No ***If Yes, please provide the appropriate documentation and items 8-42 below are not required.***	

1. Bulk Storage Area Name Produced Water Storage	2. Tank Name Four (4) 400-bbl Produced Water Storage Tanks
3. Emission Unit ID number EU-TANKS-PW	4. Emission Point ID number EP-TANKS-PW
5. Date Installed , Modified or Relocated *(for existing tanks)* TBD Was the tank manufactured after August 23, 2011? ☒ Yes ☐ No	6. Type of change: ☒ New construction ☐ New stored material ☐ Other ☐ Relocation
7A. Description of Tank Modification *(if applicable)* N/A	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Was USEPA Tanks simulation software utilized? ☒ Yes ☐ No ***If Yes, please provide the appropriate documentation and items 8-42 below are not required.***	

STORAGE TANK DATA TABLE

List all deminimis storage tanks (i.e. lube oil, glycol, diesel etc.)

Source ID #[1]	Status[2]	Content[3]	Volume[4]
EU-TANKS-METH	NEW	Methanol	250 gal
EU-TANKS-METH	NEW	Methanol	250 gal
EU-TANKS-METH	NEW	Methanol	250 gal
EU-TANKS-METH	NEW	Methanol	250 gal
EU-TANKS-METH	NEW	Methanol	250 gal
EU-TANKS-LUBEOIL	NEW	Lube Oil	50 gal

1. Enter the appropriate Source Identification Numbers (Source ID #) for each storage tank located at the compressor station. Tanks should be designated T01, T02, T03, etc.
2. Enter storage tank Status using the following:
   - EXIST Existing Equipment
   - NEW Installation of New Equipment
   - REM Equipment Removed
3. Enter storage tank content such as condensate, pipeline liquids, glycol (DEG or TEG), lube oil, diesel, mercaptan etc.
4. Enter the maximum design storage tank volume in gallons.

TABLE 1-A

COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C_{7+}

SEPARATOR GOR.....: 5065 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 300 psig
SEPARATOR TEMPERATURE.....: 62 °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	0.552	0.000	0.028	0.008	0.453	0.000
Carbon Dioxide	0.112	0.000	0.011	0.014	0.093	0.000
Methane	71.526	0.000	6.698	1.096	59.262	0.000
Ethane	18.189	4.903	10.944	7.700	16.818	4.534
Propane	6.822	1.894	13.880	10.060	8.157	2.265
Iso-butane	0.533	0.176	2.495	2.148	0.904	0.298
N-butane	1.514	0.481	10.341	8.577	3.184	1.012
2-2 Dimethylpropane	0.000	0.000	0.187	0.188	0.035	0.014
Iso-pentane	0.183	0.067	3.123	3.004	0.739	0.272
N-pentane	0.284	0.104	6.276	5.985	1.418	0.518
2-2 Dimethylbutane	0.004	0.002	0.098	0.107	0.022	0.009
Cyclopentane	0.004	0.001	0.000	0.000	0.003	0.001
2-3 Dimethylbutane	0.006	0.002	0.305	0.328	0.062	0.026
2 Methylpentane	0.052	0.022	2.297	2.508	0.477	0.199
3 Methylpentane	0.029	0.012	1.407	1.511	0.290	0.119
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.091	0.038	5.434	5.878	1.102	0.457
Heptanes Plus	0.099	0.044	36.477	50.886	6.981	3.723
TOTAL	100.000	7.746	100.000	100.000	100.000	13.447

HEPTANES PLUS (C_{7+}) FRACTION CHARACTERISTICS

	Specific Gravity		Molecular Weight	Vapor Volume	Gross Heating Value
COMPONENT	°API	**	lb/lb-mole	Scf/Gal	***
Gas	N/A	3.4589	100.178	22.713	5,352
Oil	53.825	0.7635	127.765	18.711	126,680
Wellstream	N/A	0.7632	127.448	18.749	N/A

TOTAL SAMPLE CHARACTERISTICS

	Specific Gravity		Molecular Weight	Vapor Volume	Gross Heating Value	
					Dry	Saturated
COMPONENT	°API	**	lb/lb-mole	Scf/Gal	***	***
Gas	N/A	0.7607	21.942	129.099	1,335	1,313
Oil	81.464	0.6644	79.702	26.101	N/A	112,234
Wellstream	N/A	1.1349	32.869	57.947	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.

TABLE 1-B

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

SEPARATOR GOR.....: 5065 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 300 psig
SEPARATOR TEMPERATURE.....: 62 °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	0.552	0.000	0.028	0.008	0.453	0.000
Carbon Dioxide	0.112	0.000	0.011	0.014	0.093	0.000
Methane	71.526	0.000	6.698	1.096	59.262	0.000
Ethane	18.189	4.903	10.944	7.700	16.818	4.534
Propane	6.822	1.894	13.880	10.060	8.157	2.265
Iso-butane	0.533	0.176	2.495	2.148	0.904	0.298
N-butane	1.514	0.481	10.341	8.577	3.184	1.012
2-2 Dimethylpropane	0.000	0.000	0.187	0.188	0.035	0.014
Iso-pentane	0.183	0.067	3.123	3.004	0.739	0.272
N-pentane	0.284	0.104	6.276	5.985	1.418	0.518
2-2 Dimethylbutane	0.004	0.002	0.098	0.107	0.022	0.009
Cyclopentane	0.004	0.001	0.000	0.000	0.003	0.001
2-3 Dimethylbutane	0.006	0.002	0.305	0.328	0.062	0.026
2 Methylpentane	0.052	0.022	2.297	2.508	0.477	0.199
3 Methylpentane	0.029	0.012	1.407	1.511	0.290	0.119
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.091	0.038	5.434	5.878	1.102	0.457
Methylcyclopentane	0.007	0.002	0.686	0.638	0.135	0.048
Benzene	0.001	0.000	0.084	0.062	0.017	0.005
Cyclohexane	0.009	0.003	0.828	0.742	0.164	0.056
2-Methylhexane	0.010	0.005	1.625	1.988	0.316	0.148
3-Methylhexane	0.011	0.005	1.491	1.800	0.291	0.135
2,2,4 Trimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000
Other Heptanes	0.009	0.004	0.724	0.828	0.144	0.063
n-Heptane	0.020	0.009	3.773	4.579	0.730	0.339
Methylcyclohexane	0.009	0.004	1.678	1.774	0.325	0.132
Toluene	0.002	0.001	0.326	0.288	0.063	0.021
Other C-8's	0.011	0.005	4.633	5.709	0.885	0.418
n-Octane	0.004	0.002	2.389	3.219	0.455	0.235
Ethylbenzene	0.000	0.000	0.295	0.300	0.056	0.022
M&P-Xylene	0.001	0.000	0.338	0.345	0.065	0.025
O-Xylene	0.000	0.000	0.650	0.650	0.123	0.047
Other C-9's	0.003	0.002	2.778	3.823	0.528	0.278
n-Nonane	0.001	0.001	1.531	2.266	0.290	0.165
Other C10's	0.001	0.001	2.995	4.530	0.567	0.329
n-Decane	0.000	0.000	0.936	1.512	0.177	0.110
Undecanes Plus	0.000	0.000	8.717	15.832	1.649	1.147
TOTAL	100.000	7.746	100.000	100.000	100.000	13.447

TABLE 1-B

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

SEPARATOR GOR.....: 5065 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 300 psig
SEPARATOR TEMPERATURE.....: 62 °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	42.269	0.8143	177.400	14.372	129,114
Wellstream	N/A	0.8143	177.400	14.372	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	0.7607	21.942	129.099	1,335	1,313
Oil	81.464	0.6644	79.702	26.101	N/A	112,234
Wellstream	N/A	1.1349	32.869	57.947	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.

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	OV Royalty Pad - 2,500 BOPD
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	12.00
Liquid Height (ft) :	19.00
Avg. Liquid Height (ft):	10.00
Volume (gallons):	16,074.56
Turnovers:	2,384.20
Net Throughput(gal/yr):	38,325,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Pittsburgh, Pennsylvania (Avg Atmospheric Pressure = 14.11 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

OV Royalty Pad - 2,500 BOPD - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
OV Royalty Pad - Alan Degarmo	All	51.94	47.06	56.81	50.33	8.4662	7.8178	9.1546	55.4860			106.72	Option 4: RVP=12.05

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

OV Royalty Pad - 2,500 BOPD - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
OV Royalty Pad - Alan Degarmo	57,626.70	1,706.11	59,332.81

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	OV Royalty - 1,000 BWPD
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):		20.00
Diameter (ft):		12.00
Liquid Height (ft) :		19.00
Avg. Liquid Height (ft):		10.00
Volume (gallons):		16,074.56
Turnovers:		953.68
Net Throughput(gal/yr):		15,330,000.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		0.00
Slope (ft/ft) (Cone Roof)		0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Pittsburgh, Pennsylvania (Avg Atmospheric Pressure = 14.11 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

OV Royalty - 1,000 BWPD - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Produced Water	All	51.94	47.06	56.81	50.33	0.2052	0.1723	0.2436	20.6523			18.17	
OV Royalty Pad - Alan Degarmo						8.4662	7.8178	9.1546	55.4860	0.0100	0.1888	106.72	Option 4: RVP=12.05
Water						0.1911	0.1592	0.2284	18.0200	0.9900	0.8112	18.02	Option 2: A=8.10765, B=1750.286, C=235

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

OV Royalty - 1,000 BWPD - Vertical Fixed Roof Tank

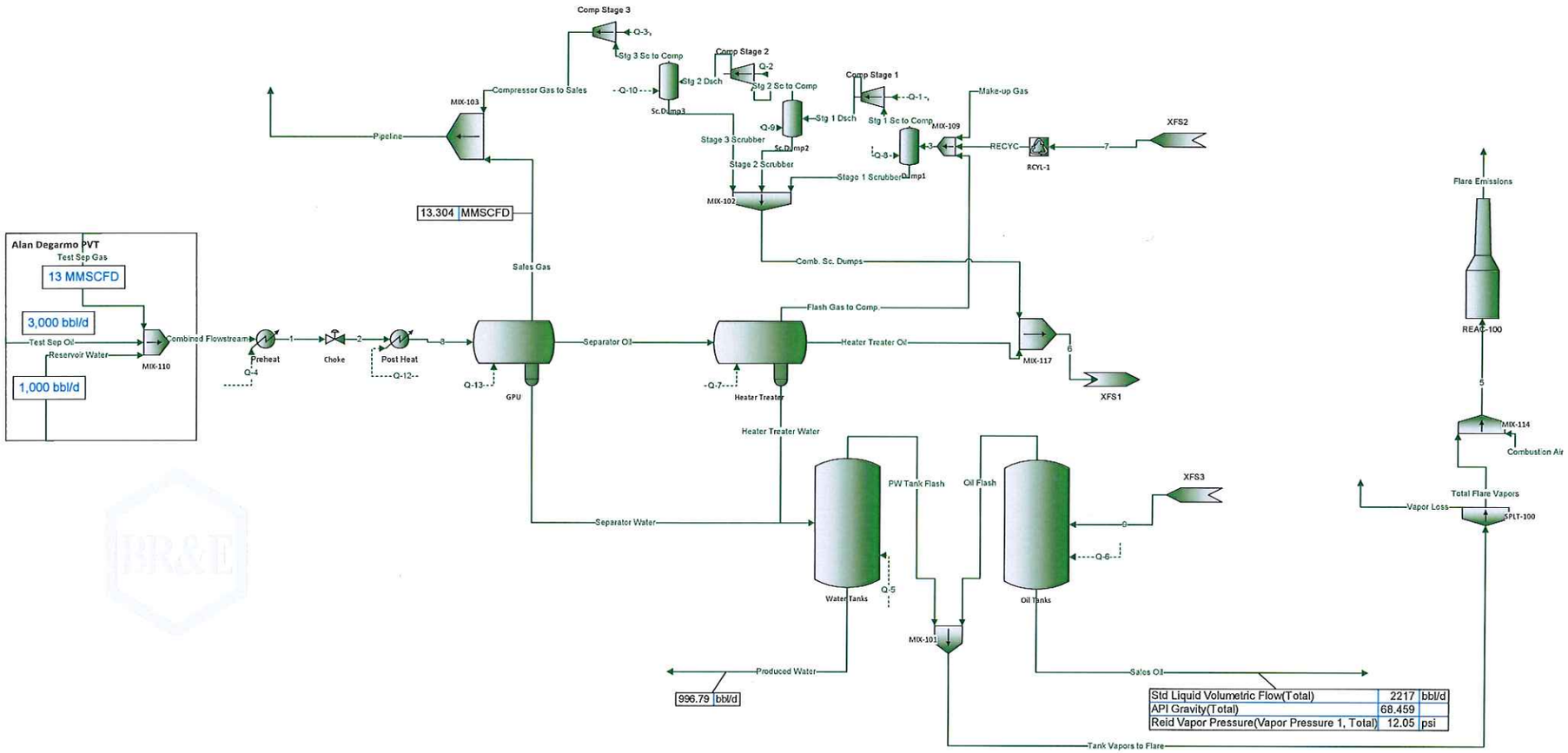
	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Produced Water	229.82	11.32	241.14
Water	186.43	9.18	195.62
OV Royalty Pad - Alan Degarmo	43.38	2.14	45.52

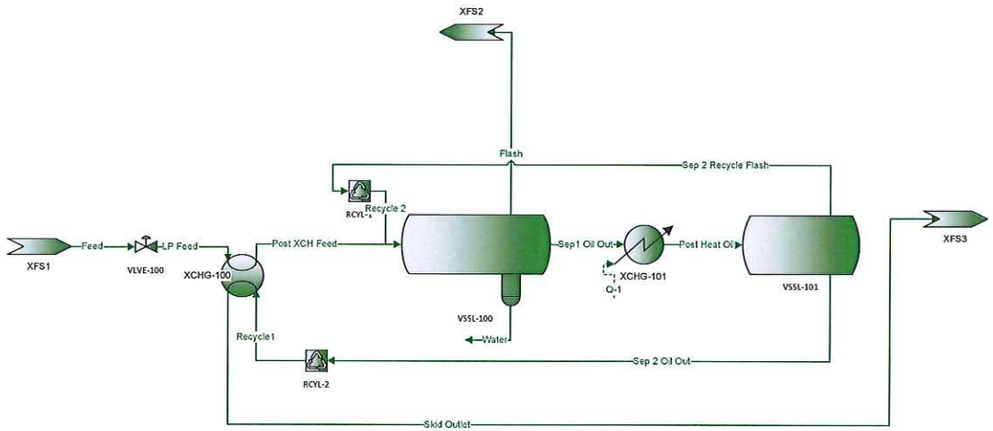
Process Simulation Results

Names	Units	Reservoir Water	Test Sep Oil	Test Sep Gas	Oil Flash	PW Tank Flash	Sales Gas	Sales Oil	Produced Water
Temperature	°F	62*	62*	62*	100*	80	75*	100	80#
Pressure	psia	314.7*	314.7*	314.7*	15.196	15.196	264.7*	15.196*	15.196*
Mole Fraction Vapor	%	0	0	99.977	100	100	100	0	0
Mole Fraction Light Liquid	%	100	100	0.023406	0	0	0	100	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0	0
Molecular Weight	lb/lbmol	18.015	80.706	21.942	55.486	21.957	22.405	106.72	18.016
Molar Flow	lbmol/h	809.87	347.81	1427.4	2.8953	0.32816	1460.7	212.83	807.21
Mass Flow	lb/h	14590	28071	31320	160.65	7.2054	32727	22714	14542
Enthalpy	Btu/h	-9.973e+007	-2.7766e+007	-4.979e+007	-1.5108e+005	-12409	-5.1193e+007	-2.0627e+007	-9.9156e+007
Nitrogen(Mole Fraction)	%	0*	0.028*	0.552*	0.00045861	0.2799	0.54239	7.4685e-007	3.3077e-006
CO2(Mole Fraction)	%	0*	0.011*	0.112*	0.016055	0.96081	0.10553	0.00023046	0.00046059
C1(Mole Fraction)	%	0*	6.6979*	71.526*	0.97446	67.785	70.084	0.0047391	0.0016447
C2(Mole Fraction)	%	0*	10.944*	18.189*	10.662	18.328	18.371	0.28981	0.00051279
C3(Mole Fraction)	%	0*	13.88*	6.822*	30.463	7.364	7.3393	2.7426	0.00022141
Isobutane(Mole Fraction)	%	0*	2.495*	0.533*	6.9223	0.20194	0.60196	1.5062	2.1317e-006
n-Butane(Mole Fraction)	%	0*	10.341*	1.514*	27.255	1.2672	1.7964	8.3006	2.9697e-005
2,2-Dimethylpropane(Mole Fraction)	%	0*	0.187*	0*	0.3069	0.0055452	0.017287	0.12703	5.8394e-008
Isopentane(Mole Fraction)	%	0*	3.123*	0.183*	5.3765	0.10842	0.24163	3.9796	1.7136e-006
n-Pentane(Mole Fraction)	%	0*	6.2759*	0.284*	8.9181	0.16715	0.378	8.6081	2.6495e-006

Expected Production 15 MMCFD, 2500 BOPD, 1000 BWPD

- Oil Flash : 2.5 lb/bbl
- Water Flash : .05 lb/bbl


Comp Stage 3
Q-3
Stg 3 Sc to Comp
Comp Stage 2
Q-2
Stg 2 Dsch
Stg 2 Sc to Comp
Comp Stage 1
Q-1
Make-up Gas
Compressor Gas to Sales
Q-10
Sc.Dump3
MIX-103
Stg 1 Dsch
Stg 1 Sc to Comp
MIX-109
XFS2
Pipeline
Stage 3 Scrubber
Q-9
Sc.Dump2
RECYC
RCYL-1
Q-8
Stage 2 Scrubber
Sc.Dump1
Stage 1 Scrubber
MIX-102
13.304 MMSCFD
Comb. Sc. Dumps
Sales Gas
Flash Gas to Comp.
Alan Degarmo PVT
Test Sep Gas
13 MMSCFD
3,000 bbl/d
Test Sep Oil
Reservoir Water
1,000 bbl/d
MIX-110
Combined Flowstream
Preheat
Q-4
Choke
Post Heat
Q-12
Q-13
GPU
Separator Oil
Heater Treater Oil
Q-7
Heater Treater
MIX-117
XFS1
Heater Treater Water
Separator Water
PW Tank Flash
Oil Flash
XFS3
Q-6
Q-5
Water Tanks
Oil Tanks
MIX-101
Produced Water
996.79 bbl/d
Sales Oil
Tank Vapors to Flare
Flare Emissions
REAC-100
MIX-114
Combustion Air
Total Flare Vapors
Vapor Loss
SPLT-100
Std Liquid Volumetric Flow(Total) 2217 bbl/d
API Gravity(Total) 68.459
Reid Vapor Pressure(Vapor Pressure 1, Total) 12.05 psi


XFS2
Flash
Sep 2 Recycle Flash
RCYL-1
Recycle 2
XFS1
Feed
VLVE-100
LP Feed
XCHG-100
Post XCH Feed
Sep1 Oil Out
XCHG-101
Q-1
Post Heat Oil
V55L-101
XFS3
V55L-100
Water
Recycle1
RCYL-2
Sep 2 Oil Out
Skid Outlet

ATTACHMENT M: NATURAL GAS FIRED FUEL BURNING UNITS DATA SHEET

ATTACHMENT M – SMALL HEATERS AND REBOILERS NOT SUBJECT TO 40CFR60 SUBPART DC
DATA SHEET

Complete this data sheet for each small heater and reboiler not subject to 40CFR60 Subpart Dc at the facility. ***The Maximum Design Heat Input (MDHI) must be less than 10 MMBTU/hr.***

Emission Unit ID#[1]	Emission Point ID#[2]	Emission Unit Description (manufacturer, model #)	Year Installed/ Modified	Type[3] and Date of Change	Maximum Design Heat Input (MMBTU/hr)[4]	Fuel Heating Value (BTU/scf)[5]
EU-GPU1	EP-GPU1	Gas Production Unit Burner	TBD	New	1.0	905
EU-GPU2	EP-GPU2	Gas Production Unit Burner	TBD	New	1.0	905
EU-GPU3	EP-GPU3	Gas Production Unit Burner	TBD	New	1.0	905
EU-GPU4	EP-GPU4	Gas Production Unit Burner	TBD	New	1.0	905
EU-GPU5	EP-GPU5	Gas Production Unit Burner	TBD	New	1.0	905
EU-HT1	EP-HT1	Heater Treater	TBD	New	0.5	905
EU-HT2	EP-HT2	Heater Treater	TBD	New	0.5	905
EU-SH1	EP-SH1	Stabilizer Heater	TBD	New	1.5	905
EU-SH2	EP-SH2	Stabilizer Heater	TBD	New	1.5	905

1 Enter the appropriate Emission Unit (or Source) identification number for each fuel burning unit located at the production pad. Gas Producing Unit Burners should be designated GPU-1, GPU-2, etc. Heater Treaters should be designated HT-1, HT-2, etc. Heaters or Line Heaters should be designated LH-1, LH-2, etc. For sources, use 1S, 2S, 3S…or other appropriate designation. Enter glycol dehydration unit Reboiler Vent data on the Glycol Dehydration Unit Data Sheet.

2 Enter the appropriate Emission Point identification numbers for each fuel burning unit located at the production pad. Gas Producing Unit Burners should be designated GPU-1, GPU-2, etc. Heater Treaters should be designated HT-1, HT-2, etc. Heaters or Line Heaters should be designated LH-1, LH-2, etc. For emission points, use 1E, 2E, 3E…or other appropriate designation.

3 New, modification, removal

4 Enter design heat input capacity in MMBtu/hr.

5 Enter the fuel heating value in BTU/standard cubic foot.

ATTACHMENT N: INTERNAL COMBUSTION ENGINE DATA SHEETS

ENGINE SPECIFICATION SHEETS

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.*

	EU-ENG1	EU-ENG2	EU-ENG3
Emission Unit ID#[1]	EU-ENG1	EU-ENG2	EU-ENG3
Engine Manufacturer/Model	Caterpillar G3306 NA	Caterpillar G3306 NA	Caterpillar G3406 NA
Manufacturers Rated bhp/rpm	145-hp/1,800-rpm	145-hp/1,800-rpm	215-hp/1,800-rpm
Source Status[2]	NS	NS	NS
Date Installed/ Modified/Removed/Relocated[3]	TBD	TBD	TBD
Engine Manufactured /Reconstruction Date[4]	TBD	TBD	TBD
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	4SRB
APCD Type[7]	NSCR	NSCR	NSCR
Fuel Type[8]	RG	RG	RG
H_2S (gr/100 scf)	Negligible	Negligible	Negligible
Operating bhp/rpm	145-hp/1,800-rpm	145-hp/1,800-rpm	215-hp/1,800-rpm
BSFC (BTU/bhp-hr)	8,625	8,625	7,767
Hourly Fuel Throughput	1,382 ft^3/hr gal/hr	1,382 ft^3/hr gal/hr	1,845 ft^3/hr gal/hr
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)	12.11 $MMft^3$/yr gal/yr	12.11 $MMft^3$/yr gal/yr	16.16 $MMft^3$/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	0.32	1.40	0.32	1.40	0.47	2.06
MD	CO	0.64	2.80	0.64	2.80	0.95	4.16
MD	VOC	0.24	1.05	0.24	1.05	0.36	1.58
AP	SO_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AP	PM_{10}	0.01	0.04	0.01	0.04	0.02	0.07
MD	Formaldehyde	0.02	0.09	0.02	0.09	0.03	0.13
AP	Total HAPs	0.03	0.15	0.03	0.15	0.05	0.21
MD and EPA	GHG (CO_2e)	155.19	616.64	155.19	616.64	252.84	1,004.64

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-ENG4					
Engine Manufacturer/Model		Zenith ZPP-644 4.4L					
Manufacturers Rated bhp/rpm		103.3-hp/3,000-rpm					
Source Status[2]		NS					
Date Installed/ Modified/Removed/Relocated[3]		TBD					
Engine Manufactured /Reconstruction Date[4]		TBD					
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					
APCD Type[7]		NSCR					
Fuel Type[8]		RG					
H_2S (gr/100 scf)		Negligible					
Operating bhp/rpm		103.3-hp/3,000-rpm					
BSFC (BTU/bhp-hr)		11,149					
Hourly Fuel Throughput		707 ft^3/hr gal/hr		ft^3/hr gal/hr		ft^3/hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		6.20 $MMft^3$/yr gal/yr		$MMft^3$/yr gal/yr		$MMft^3$/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	0.46	2.01				
MD	CO	0.75	3.29				
MD	VOC	0.46	2.01				
AP	SO_2	<0.01	<0.01				
AP	PM_{10}	0.01	0.04				
MD	Formaldehyde	0.01	0.06				
AP	Total HAPs	0.02	0.09				
MD and EPA	GHG (CO_2e)	74.96	297.87				

1 Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion compressor/generator engine located at the compressor station. Multiple compressor 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-ENGINES, 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: TBD	Model #: TBD
Design Operating Temperature: 1,135 °F	Design gas volume: 1,018 scfm
Service life of catalyst:	Provide manufacturer data? ☒Yes ☐ No
Volume of gas handled: acfm at °F	Operating temperature range for NSCR/Ox Cat: From 600 °F to 1250 °F
Reducing agent used, if any:	Ammonia slip (ppm):

Pressure drop against catalyst bed (delta P): 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)?

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,

G3306 NA

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1800	FUEL SYSTEM:	LPG IMPCO
COMPRESSION RATIO:	10.5:1		WITH CUSTOMER SUPPLIED AIR FUEL RATIO CONTROL
JACKET WATER OUTLET (°F):	210	**SITE CONDITIONS:**	
COOLING SYSTEM:	JW+OC	FUEL:	Nat Gas
IGNITION SYSTEM:	MAG	FUEL PRESSURE RANGE(psig):	1.5-10.0
EXHAUST MANIFOLD:	WC	FUEL METHANE NUMBER:	84.8
COMBUSTION:	Catalyst	FUEL LHV (Btu/scf):	905
EXHAUST O2 EMISSION LEVEL %:	0.5	ALTITUDE(ft):	500
SET POINT TIMING:	30.0	MAXIMUM INLET AIR TEMPERATURE(°F):	77
		NAMEPLATE RATING:	145 bhp@1800rpm

			MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING	**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**50%**
ENGINE POWER	(1)	bhp	145	145	109	72
INLET AIR TEMPERATURE		°F	77	77	77	77
ENGINE DATA						
FUEL CONSUMPTION (LHV)	(2)	Btu/bhp-hr	7775	7775	8318	9509
FUEL CONSUMPTION (HHV)	(2)	Btu/bhp-hr	8625	8625	9227	10548
AIR FLOW	(3)(4)	lb/hr	922	922	739	556
AIR FLOW WET (77°F, 14.7 psia)	(3)(4)	scfm	208	208	167	125
INLET MANIFOLD PRESSURE	(5)	in Hg(abs)	26.2	26.2	21.8	17.6
EXHAUST STACK TEMPERATURE	(6)	°F	1101	1101	1067	1037
EXHAUST GAS FLOW (@ stack temp, 14.5 psia)	(7)(4)	ft3/min	678	678	532	393
EXHAUST GAS MASS FLOW	(7)(4)	lb/hr	978	978	784	590
EMISSIONS DATA						
NOx (as NO2)	(8)	g/bhp-hr	13.47	13.47	12.15	9.76
CO	(8)	g/bhp-hr	13.47	13.47	11.44	9.56
THC (mol. wt. of 15.84)	(8)	g/bhp-hr	2.20	2.20	2.49	3.22
NMHC (mol. wt. of 15.84)	(8)	g/bhp-hr	0.33	0.33	0.37	0.48
NMNEHC (VOCs) (mol. wt. of 15.84)	(8)(9)	g/bhp-hr	0.22	0.22	0.25	0.32
HCHO (Formaldehyde)	(8)	g/bhp-hr	0.27	0.27	0.31	0.33
CO2	(8)	g/bhp-hr	485	485	525	601
EXHAUST OXYGEN	(10)	% DRY	0.5	0.5	0.5	0.5
HEAT REJECTION						
HEAT REJ. TO JACKET WATER (JW)	(11)	Btu/min	6049	6049	5237	4455
HEAT REJ. TO ATMOSPHERE	(11)	Btu/min	751	751	602	459
HEAT REJ. TO LUBE OIL (OC)	(11)	Btu/min	990	990	857	729

HEAT EXCHANGER SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+OC)	(12)	Btu/min	7842

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.
Max. rating is the maximum capability for the specified fuel at site altitude and reduced inlet air temperature.
Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY:
Data generated by Gas Engine Rating Pro Version 3.04.00
Ref. Data Set DM5053-07-000, Printed 31Jan2011

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Sheridan, WY 82801
Office: 307.673.0883
EST@emittechnologies.com

Prepared For:
Jason Stinson
MIDCON COMPRESSION, LP

MANUFACTURED ON OR AFTER 1/1/2011

INFORMATION PROVIDED BY CATERPILLAR

Engine:	G3306 NA
Horsepower:	145
RPM:	1800
Compression Ratio:	10.5:1
Exhaust Flow Rate:	678 CFM
Exhaust Temperature:	1101 °F
Reference:	DM5053-07
Fuel:	Natural Gas
Annual Operating Hours:	8760

Uncontrolled Emissions

NOx:	13.47 g/bhp-hr
CO:	13.47 g/bhp-hr
THC:	2.20 g/bhp-hr
NMHC:	0.33 g/bhp-hr
NMNEHC:	0.22 g/bhp-hr
HCHO:	0.27 g/bhp-hr
Oxygen:	0.50 %

POST CATALYST EMISSIONS

NOx:	<1.0 g/bhp-hr
CO:	<2.0 g/bhp-hr
VOC:	<0.7 g/bhp-hr

CONTROL EQUIPMENT

Catalytic Converter

Model:	**EAH-1200T-0404F-21CEE**
Catalyst Type:	NSCR, Precious group metals
Manufacturer:	EMIT Technologies, Inc.
Element Size:	Round 12 x 3.5
Catalyst Elements:	1
Housing Type:	2 Element Capacity
Catalyst Installation:	Accessible Housing
Construction:	10 gauge Carbon Steel
Sample Ports:	6 (0.5" NPT)
Inlet Connections:	4" Flat Face Flange
Outlet Connections:	4" Flat Face Flange
Configuration:	End In / End Out
Silencer:	Integrated
Silencer Grade:	Hospital
Insertion Loss:	35-40 dBA

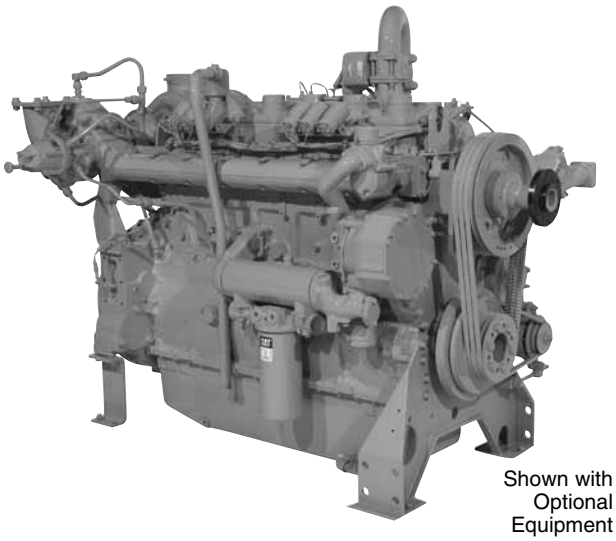
Air Fuel Ratio Controller

Model:	**ENG-S-075-T**
Manufacturer:	EMIT Technologies, Inc.
Description:	EDGE NG Air Fuel Ratio Controller 4-Wire Narrowband O2 Sensor Digital Power Valve O2 Sensor Weldment Wiring Harness (2) 25' Type K Thermocouple
Digital Power Valve Size:	0.75" NPT

G3406 Gas Petroleum Engine

160-272 bkW (215-365 bhp) 1800 rpm

0.5% O_2 and 2.0% O_2 Ratings



Shown with Optional Equipment

CAT® ENGINE SPECIFICATIONS

In-line 6, 4-Stroke-Cycle

Emissions Settings	0.5% O_2 and 2.0% O_2
Bore	137 mm (5.4 in.)
Stroke	165 mm (6.5 in.)
Displacement	14.59 L (891 cu. in.)
Aspiration	Naturally Aspirated or Turbocharged-Aftercooled
Governor and Protection	Woodward PSG
Combustion	Rich Burn
Engine Weight, net dry (approx)	1360.8 kg (3000 lb)
Power Density	6.7 kg/kW (11 lb/bhp)
Power per Displacement	18.6 bhp/L
Total Cooling System Capacity	37.9 L (10 gal)
Jacket Water	30.3 L (8 gal)
SCAC	7.6 L (2 gal)
Lube Oil System (refill)	75.7 L (20 gal)
Oil Change Interval	750 hours
Rotation (from flywheel end)	Counterclockwise
Flywheel and Flywheel Housing	SAE No. 1
Flywheel Teeth	113

FEATURES

Engine Design
- Proven reliability and durability
- Ability to burn a wide spectrum of gaseous fuels
- Robust diesel strength design prolongs life and lowers owning and operating costs
- Broad operating speed range

Emissions
- Rich burn engine design easily meets emission requirements
- 0.5% O_2 rating meets U.S. EPA Spark Ignited Stationary NSPS Emissions for 2007/8 and 2010/11 with the use of aftermarket AFRC and TWC

Full Range of Attachments

Large variety of factory-installed engine attachments reduces packaging time

Testing

Every engine is full-load tested to ensure proper engine performance.

Gas Engine Rating Pro

GERP is a PC-based program designed to provide site performance capabilities for Cat® natural gas engines for the gas compression industry. GERP provides engine data for your site's altitude, ambient temperature, fuel, engine coolant heat rejection, performance data, installation drawings, spec sheets, and pump curves.

Product Support Offered Through Global Cat Dealer Network

More than 2,200 dealer outlets

Cat factory-trained dealer technicians service every aspect of your petroleum engine

Cat parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S•O•S℠ program matches your oil and coolant samples against Caterpillar set standards to determine:
- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience

Over 60 years of natural gas engine production

Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products.
- Cast engine blocks, heads, cylinder liners, and flywheel housings
- Machine critical components
- Assemble complete engine

Web Site

For all your petroleum power requirements, visit www.catoilandgas.cat.com.

STANDARD EQUIPMENT

Air Inlet System
Air cleaner — heavy-duty
Air cleaner rain cap
Service indicator

Control System
Governor — Woodward PSG mechanical
Governor locking — positive control

Cooling System
Thermostats and housing
Jacket water pump
Aftercooler water pump
Aftercooler core

Exhaust System
Watercooled exhaust manifolds
Dry exhaust elbow

Flywheel & Flywheel Housing
SAE No. 1 flywheel
SAE No. 1 flywheel housing
SAE standard rotation

Fuel System
Gas pressure regulator
Natural gas carburetor

Ignition System
Altronic III ignition system

Instrumentation
Service meter

Lube System
Crankcase breather — top mounted
Oil cooler
Oil filter — RH
Auxiliary oil reservoir
Oil pan — full sump
Oil filler in valve cover, dipstick — RH

Mounting System
Engine supports

Protection System
Shutoffs

General
Paint — Cat yellow
Crankshaft vibration damper and drive pulleys
Lifting eyes

OPTIONAL EQUIPMENT

Air Inlet System
Precleaner

Charging System
Battery chargers
Charging alternators
Charging alternators f/u/w c customer supplied shutoffs
Ammeter gauge
Ammeter gauge and wiring
Control mounting

Control System
PSG Woodward governor

Cooling System
Radiators
Non-sparking blower fan
Blower fans for customer supplied radiators
Fan drives for customer supplied radiators
ATAAC conversion
Aftercooler
Expansion tank
Heat exchangers

Exhaust System
Flexible fittings
Elbow
Flange
Pipe
Rain cap
Muffler

Fuel System
Fuel filter
Natural gas valve and jet kits

Ignition System
CSA shielded ignition
Wiring harness

Instrumentation
Gauges and instrument panels

Lube System
Auxiliary oil reservoir removal
Lubricating oil

Mounting System
Vibration isolators

Power Take-Offs
Auxiliary drive pulleys
Enclosed clutch and clutch support
Front stub shaft and flywheel stub shaft

Protection System
Gas valves

Starting System
Air starting motor
Electric air start control
Air pressure regulator
Air silencer
Electric starting motor — single 12- and 24-volt
Starting aids
Battery sets, cables, and rack

General
Damper guard

TECHNICAL DATA

G3406 Gas Petroleum Engine — 1800 rpm

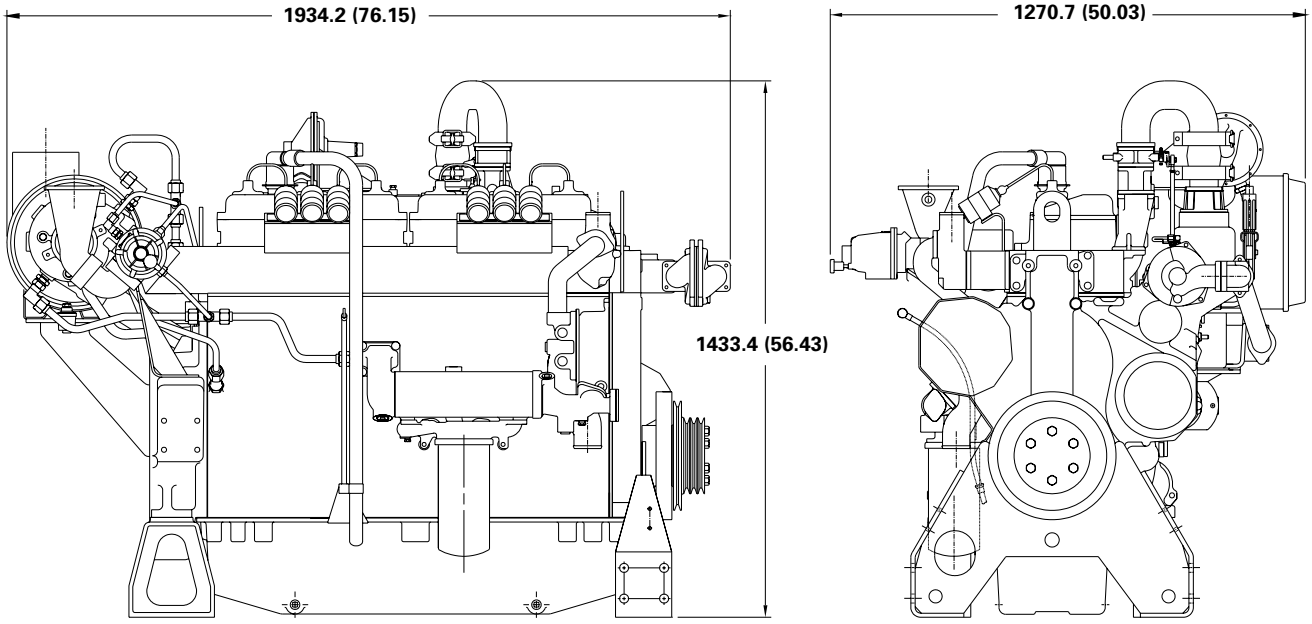
		DM5302-01	TM8513-05	DM5084-03
Engine Power				
@ 100% Load	bkW (bhp)	242 (325)	160 (215)	205 (276)
@ 75% Load	bkW (bhp)	192 (244)	120 (161)	154 (207)
Engine Speed	rpm	**1800**	**1800**	**1800**
Max Altitude @ Rated Torque and 38°C (100°F)	m (ft)	1219.2 (4000)	0	914.4 (3000)
Speed Turndown @ Max Altitude, Rated Torque, and 38°C (100°F)	%	55	45	0
SCAC Temperature	°C (°F)	54 (130)	—	—
Emissions*				
NOx	g/bkW-hr (g/bhp-hr)	35.29 (26.31)	37.47 (27.94)	20.69 (15.43)
CO	g/bkW-hr (g/bhp-hr)	2.15 (1.6)	1.9 (1.4)	20.69 (15.42)
CO_2	g/bkW-hr (g/bhp-hr)	620 (463)	685 (511)	699 (521)
VOC**	g/bkW-hr (g/bhp-hr)	0.21 (.16)	0.24 (0.18)	—
Fuel Consumption***				
@ 100% Load	MJ/bkW-hr (Btu/bhp-hr)	9.96 (7037)	10.99 (7767)	10.49 (7418)
@ 75% Load	MJ/bkW-hr (Btu/bhp-hr)	10.53 (7443)	11.75 (8304)	11.44 (8082)
Heat Balance				
Heat Rejection to Jacket Water				
@ 100% Load	bkW (Btu/min)	200 (11,401)	160 (9081)	223 (12,709)
@ 75% Load	bkW (Btu/min)	173 (9822)	138 (7868)	178 (10,156)
Heat Rejection to Aftercooler				
@ 100% Load	bkW (Btu/min)	12.6 (716)	—	6.53 (372)
@ 75% Load	bkW (Btu/min)	7.9 (450)	—	3.86 (220)
Heat Rejection to Exhaust				
@ 100% Load	bkW (Btu/min)	161 (9180)	128 (7292)	140 (7991)
@ 75% Load	bkW (Btu/min)	125 (7091)	99 (5636)	105 (6022)
Exhaust System				
Exhaust Gas Flow Rate				
@ 100% Load	m^3/min (cfm)	38.74 (1368)	30.04 (1061)	33.1 (1168)
@ 75% Load	m^3/min (cfm)	30.33 (1071)	23.84 (842)	25.4 (900)
Exhaust Stack Temperature				
@ 100% Load	°C (°F)	526 (978)	560 (1040)	540 (1004)
@ 75% Load	°C (°F)	512 (953)	535 (995)	505 (942)
Intake System				
Air Inlet Flow Rate				
@ 100% Load	m^3/min (scfm)	13 (459)	9.68 (342)	10.84 (383)
@ 75% Load	m^3/min (scfm)	10.36 (366)	7.93 (280)	8.72 (308)
Gas Pressure	kPag (psig)	137-145 (19.9-21)	10.34-34.47 (1.5-5)	10.24-34.47 (1.5-5)

*at 100% load and speed, all values are listed as not to exceed

**Volatile organic compounds as defined in U.S. EPA 40 CFR 60, subpart JJJJ

***ISO 3046/1

GAS PETROLEUM ENGINE



PACKAGE DIMENSIONS		
Length	mm (in.)	1934.2 (76.15)
Width	mm (in.)	1270.7 (50.03)
Height	mm (in.)	1433.4 (56.43)
Shipping Weight	kg (lb)	1360.8 (3000)

Note: General configuration not to be used for installation. See general dimension drawings for detail.

Dimensions are in mm (inches).

RATING DEFINITIONS AND CONDITIONS

Engine performance is obtained in accordance with SAE J1995, ISO3046/1, BS5514/1, and DIN6271/1 standards.

Transient response data is acquired from an engine/generator combination at normal operating temperature and in accordance with ISO3046/1 standard ambient conditions. Also in accordance with SAE J1995, BS5514/1, and DIN6271/1 standard reference conditions.

Conditions: Power for gas engines is based on fuel having an LHV of 33.74 kJ/L (905 Btu/cu ft) at 101 kPa (29.91 in. Hg) and 15° C (59° F). Fuel rate is based on a cubic meter at 100 kPa (29.61 in. Hg) and 15.6° C (60.1° F). Air flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and 25° C (77° F). Exhaust flow is based on a cubic foot at 100 kPa (29.61 in. Hg) and stack temperature.

6655 Corporation Pkwy., Ste 160
Fort Worth, TX 76126
Office: | Direct: +1 (307) 675.5083
dcokenour@emittechnologies.com

Prepared For:
Derek Pearce
MIDCON COMPRESSION, LP

QUOTE: QUO-13721-T4F3

Manufactured on or after 1/1/2011

INFORMATION PROVIDED BY CATERPILLAR

Engine:	G3406 NA
Horsepower:	215
RPM:	1800
Compression Ratio:	10.3
Exhaust Flow Rate:	1018 CFM
Exhaust Temperature:	1135 °F
Reference:	N/A
Fuel:	Natural Gas
Annual Operating Hours:	8760

Uncontrolled Emissions

	g/bhp-hr
NOx:	16.52
CO:	16.52
THC:	2.08
NMHC	0.31
NMNEHC:	0.21
HCHO:	0.27
O2:	0.40 %

POST CATALYST EMISSIONS

	% Reduction	g/bhp-hr
NOx:	>94 %	<1.00
CO:	>88 %	<2.00
VOC:	---	<0.70
HCHO:	>76 %	<0.06

CONTROL EQUIPMENT

Catalyst Element

Model:	RE-1450-T
Catalyst Type:	NSCR, Standard Precious Group Metals
Substrate Type:	BRAZED
Manufacturer:	EMIT Technologies, Inc
Element Quantity:	1
Element Size:	Round 14.5" x 3.5"

6655 Corporation Pkwy., Ste 160
Fort Worth, TX 76126
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WARRANTY

EMIT Technologies, Inc. warrants that the goods supplied will be free from defects in workmanship by EMIT Technologies, Inc. for a period of two (2) years from date of shipment. EMIT Technologies, Inc. will not be responsible for any defects which result from improper use, neglect, failure to properly maintain or which are attributable to defects, errors or omissions in any drawings, specifications, plans or descriptions, whether written or oral, supplied to EMIT Technologies, Inc. by Buyer.

Catalyst performance using an EMIT Air/Fuel ratio controller is dependent upon properly defined set-points, variable with engine and fuel gas composition. Air/fuel ratio controller performance is guaranteed, but not limited, to fuel gas with a HHV content of 1400 BTU/SCF.

Catalyst performance will be guaranteed for a period of 1 year from installation, or 8760 operating hours, whichever comes first. The catalyst shall be operated with an automatic air/fuel ratio controller. The performance guarantee shall not cover the effects of excessive ash masking due to operation at low load, improper engine maintenance, or inappropriate lubrication oil. The performance guarantee shall not cover the effects of continuous engine misfires (cylinder or ignition) exposing the catalyst to excessive exothermic reaction temperatures. In most cases, excluding thermal deactivation, catalyst performance is redeemable by means of proper washing (refer to EMIT Catalyst/Silencer Housing Manual for element wash information, or contact a local EMIT Sales representative).

The exhaust temperature operating range at the converter inlet is a minimum of 600°F for oxidation catalyst and 750 ˚F for NSCR catalyst, and a maximum of 1250°F.

If a properly functioning, high temperature shut down switch is not installed, thermal deactivation of catalyst at sustained temperatures above 1250˚F is not covered. If excessive exposure to over oxygenation of NSCR catalyst occurs due to improperly functioning or non-existent Air/Fuel ratio control, then deactivation of catalyst is not warranted.

The catalyst conversion efficiencies (% reduction) will be guaranteed for engine loads of 50 to 100 percent. Standard Oxidation Catalyst conversion efficiencies (% reduction) will be guaranteed for fuel gas containing less than 1.5% mole fraction of non-methane, non-ethane hydrocarbons. Applications where fuel gas exceeds this level will require a Premium Oxidation Catalyst to maintain guaranteed VOC conversion efficiencies.

Engine lubrication oil shall contain less than 0.5 wt% Sulfated Ash with a maximum allowable specific oil consumption of 0.7 g/bhp-hr. The catalyst shall be limited to a maximum ash loading of 0.022 lb/ft3. Phosphorous and zinc additives are limited to 0.03 wt%. New or Reconstructed engines must operate for a minimum of 100 hours prior to catalyst installation, otherwise the warranty is void.

The catalyst must not be exposed to the following know poisoning agents, including: antimony, arsenic, chromium, copper, iron, lead, lithium, magnesium, mercury, nickel, phosphorous, potassium, silicon, sodium, sulfur, tin, and zinc. Total poison concentrations in the fuel gas must be limited to 0.25 ppm or less for catalyst to function properly.

Shipment - Promised shipping dates are approximate lead times from the point of manufacture and are not guaranteed. EMIT Technologies, Inc. will not be liable for any loss, damage or delay in manufacture or delivery resulting from any cause beyond its control including, but not limited to a period equal to the time lost by reason of that delay. All products will be crated as per best practice to prevent any damage during shipment. Unless otherwise specified, Buyer will pay for any special packing and shipping requirements. Acceptance of goods by common carrier constitutes delivery to Buyer. EMIT Technologies, Inc. shall not be responsible for goods damaged or lost in transit.

Terms: Credit is extended to purchaser for net 30 time period. If payment is not received in the net 30 timeframe, interest on the unpaid balance will accrue at a rate of 1.5% per month from the invoice date.

Order Cancellation Terms: Upon cancellation of an order once submittal of a Purchase Order has occurred, the customer will pay a 25% restocking fee for Catalyst Housings, Catalyst Elements, and Air/Fuel Ratio Controllers; 50% restocking fee for Cooler Top Solutions Exhaust System Accessories, and other Custom Built Products; 100% of all associated shipping costs incurred by EMIT; 100% of all project expenses incurred by EMIT for Field Services.

ZENITH POWER PRODUCTS LLC

ABOUT ZPP
ENGINE MODELS
Model 410
Model 416
Model 420
Model 428
Model 644
EPA/CARB EMISSIONS
DISTRIBUTORS
NEWS
CONTACT US

DUAL FUEL/GASOLINE & NATURAL GAS 4.4 Liter

For Industrial Application

ZPP 644

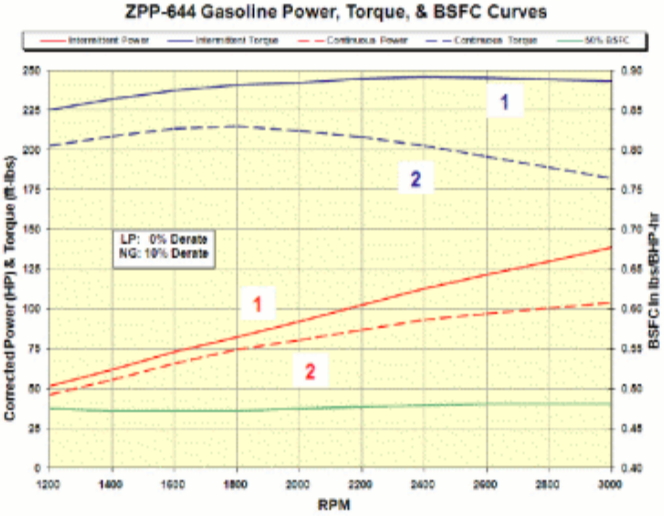
click to enlarge >

SPECIFICATION DATA

Intermittent output	139 HP/3,000 rpm
Continuous output	104 HP/3,000 rpm
Peak torque	246 ft-lbs/2,200 rpm
Fuel and type	Gasoline / Multi-port - LPG/NG mixer type
Engine configuration	6 Cylinder in-line, OHV
Block Material / Head Material	Cast Iron / Cast Iron
Bore x stroke (mm)	98.4 x 91.0
Total piston displacement	4416 cc
Compression ratio	9.7:1
Length x width x height (mm)	1054 x 586 x 810
Dry weight (excluding shipped lose parts)	193 Kg
Catalyst (2007 emmisions compliance)	Remote mounted

Note: HP and Torque figures shown for 2008 LSI - EPA/CARB certified engine with catalyst.

PERFORMANCE CURVES



Curve 1 - Intermittent Gross Output

This is the highest out put obtainable at standard ambient conditions from a basic engine equipped only with the built-in accessories essential to its operation. These levels may be only maintained for operating periods of short duration.

Applications: Scissor lifts, Aerial platforms, Scrubbers / Sweepers, Utility vehicles, Construction equipment

Curve 2 - Continuous Gross Output

This is the output that can be obtained at standard ambient conditions from a basice engine, operating in a continuous duty mode.

Applications: Generator, Welders Water pumps, Gas compressors Carpet cleaners, etc

Actual power levels may vary depending on OEM calibration and application.

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ENGINE SPECIFICATIONS

General	
Cylinders	6
Cylinder Arrangement	Vertical in-line
Bore	3.94 in / 98.43 mm
Stroke	3.64 in / 90.98 mm
Cylinder Displacement	42.24 cu in / 692.3 cc
Total Displacement	269.6 cu in / 4416 cc
Compression Ratio	9.7:1

Fuel System	
Gasoline Multi-port	
LPG / NG	Mixer Type
Fuel Pressure (gasoline)	3 bar
Fuel Pressure LPG / NG	<5 in
Fuel Requirement	unleaded gasoline
Fuel Pump	Electric
Electronic Governor	ZEEMS III

Physical Data	
Length	41.5 in / 1054.0 mm
Width	23.1 in / 586.0 mm
Height	31.9 in / 810.0 mm
Weight	470 lb / 214.0 kg
Oil Capacity	6.0 qt / 5.7 L

Electrical	
Starter Motor	12 V - 1.4 Kw
Alternator	12 V - 55 A w/ built in regulator
DIS Ignition	Computer Controlled
Distributor with coil - Non-certified applications	
Hall effect dist. w/ coil - Certified applications	

Cooling	
Thermostat	180°F / 82 °C

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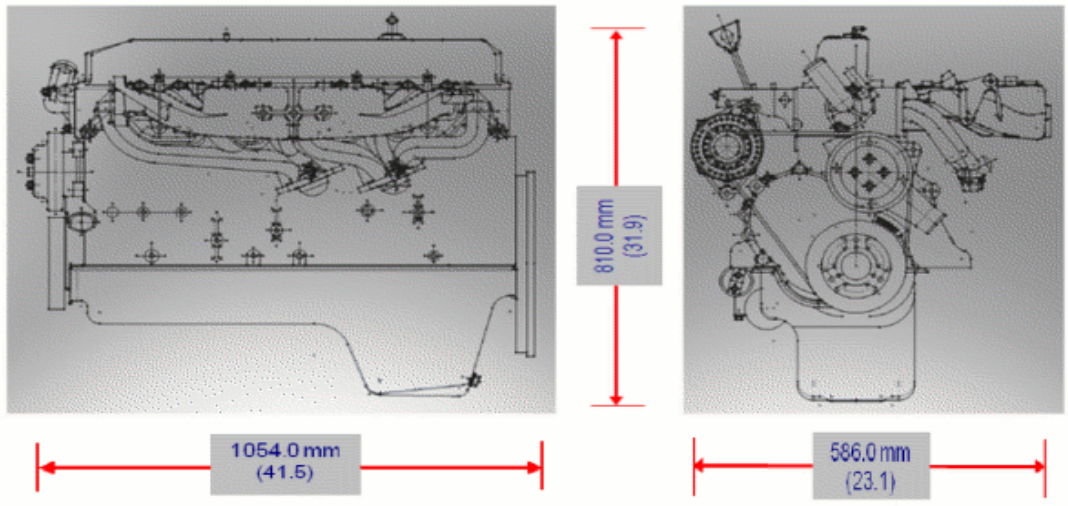

DESIGN AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

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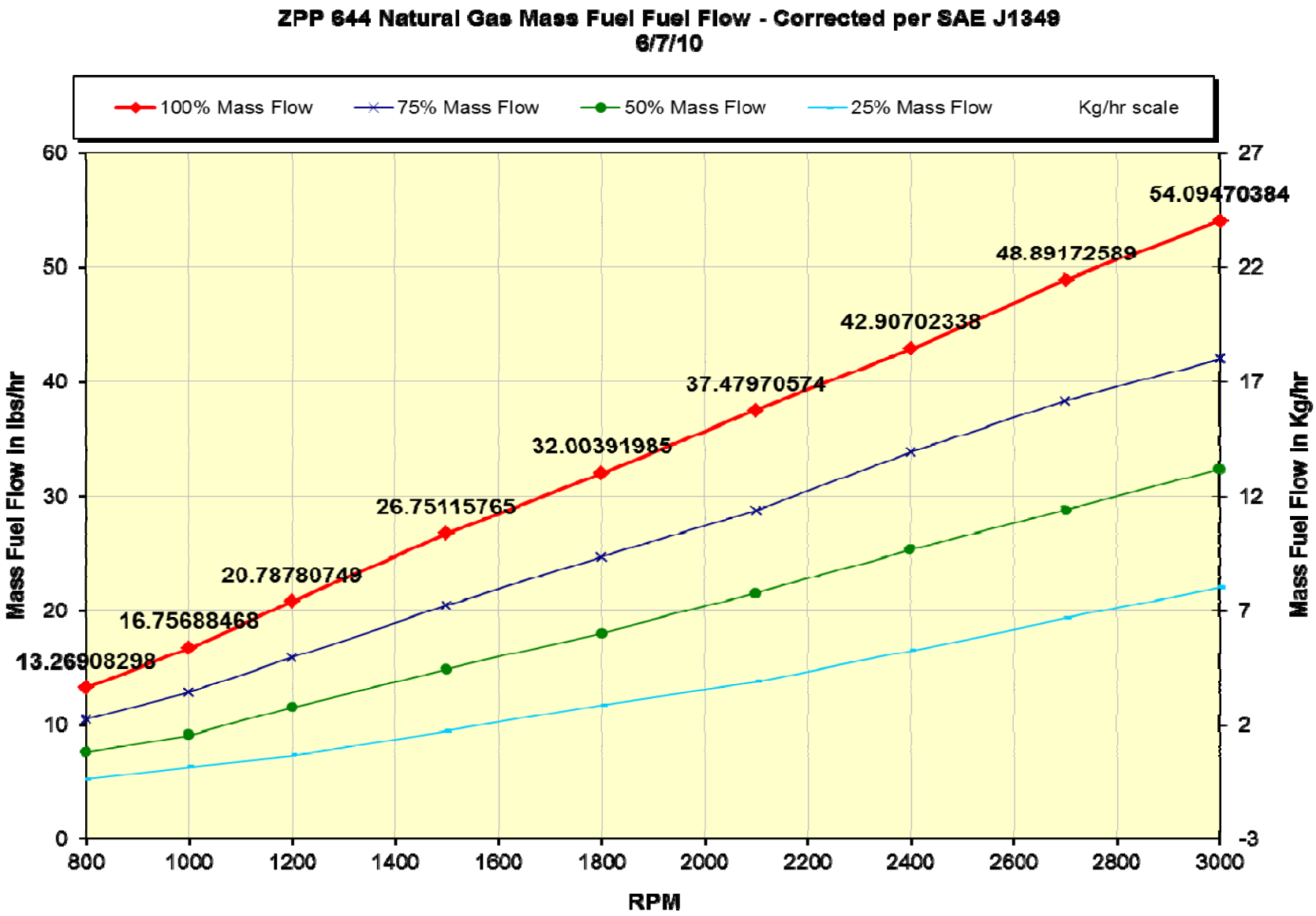
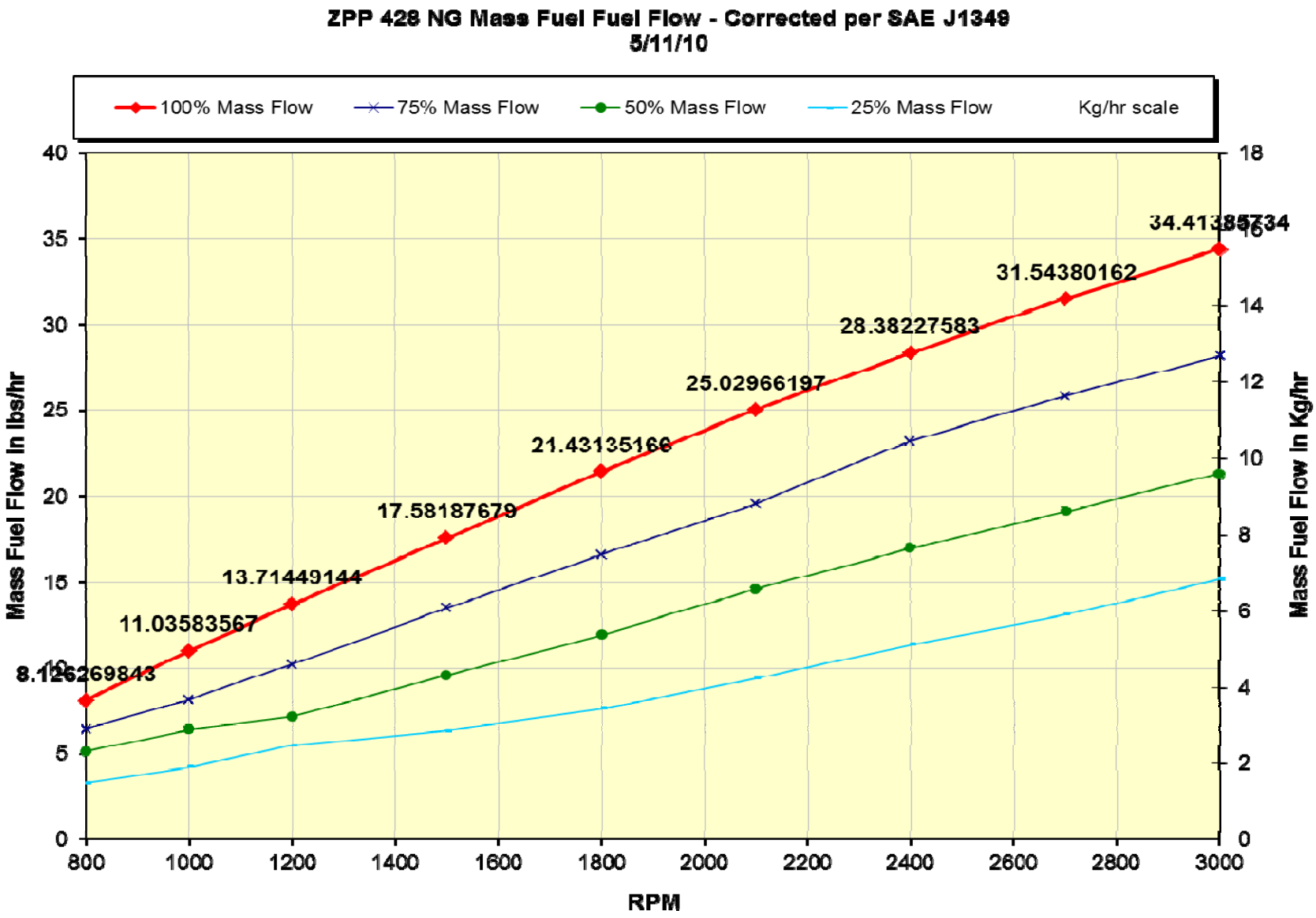
HY-BON/EDI VRU Packages w/ HP Ratings

Compressor	Engine	Max HP Natural Gas	EPA Certified
Blackmer 372	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
Blackmer 612	Zenith 2.8 L 4 Cylinder	54 HP @ 2200 RPM	Yes
Blackmer 942	Zenith 4.4 L 6 Cylinder	77 HP @ 2200 RPM	Yes
Blackmer 362	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
Blackmer 602	Zenith 4.4 L 6 Cylinder	77 HP @ 2200 RPM	Yes
Blackmer 162	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
NK-60 (Rotocomp)	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
NK-100 (Rotocomp)	Zenith 4.4 L 6 Cylinder	77 HP @ 2200 RPM	Yes

** See fuel rates in tabs below for desired Engines **


ZPP 644 Natural Gas Mass Fuel Fuel Flow - Corrected per SAE J1349
6/7/10
100% Mass Flow
75% Mass Flow
50% Mass Flow
25% Mass Flow
Kg/hr scale
Mass Fuel Flow In lbs/hr
Mass Fuel Flow In Kg/hr
RPM
13.26908298
16.75688468
20.78780749
26.75115765
32.00391985
37.47970574
42.90702338
48.89172589
54.09470384
0
10
20
30
40
50
60
-3
2
7
12
17
22
27
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000


ZPP 428 NG Mass Fuel Fuel Flow - Corrected per SAE J1349
5/11/10
100% Mass Flow
75% Mass Flow
50% Mass Flow
25% Mass Flow
Kg/hr scale
Mass Fuel Flow In lbs/hr
Mass Fuel Flow In Kg/hr
RPM
8.126269843
11.03583567
13.71449144
17.58187679
21.43135166
25.02966197
28.38227583
31.54380162
34.41385734
0
5
10
15
20
25
30
35
40
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6
8
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12
14
16
18
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2014 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT OF 1990

OFFICE OF TRANSPORTATION AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: **Zenith Power Products**
(U.S. Manufacturer or Importer)

Certificate Number: EZPPB04.4P44-005

Effective Date: 02/10/2014

Expiration Date: 12/31/2014

Byron J. Bunker, Division Director
Compliance Division

Issue Date: 02/10/2014

Revision Date: N/A

Manufacturer: Zenith Power Products
Engine Family: EZPPB04.4P44
Certification Type: Mobile and Stationary
Fuel : Natural Gas (CNG/LNG)
LPG/Propane
Gasoline (up to and including 10% Ethanol)
Emission Standards : CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
HC + NOx (g/kW-hr) : 2.7CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
HC + NOx (g/kW-hr) : 2.7
Emergency Use Only : N

64

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 1048, 40 CFR Part 60, 1065, 1068, and 60 (stationary only and combined stationary and mobile) and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048, 40 CFR Part 60. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 1048, 40 CFR Part 60. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 1048, 40 CFR Part 60.

This certificate does not cover large nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

ATTACHMENT O: TANKER TRUCK LOADING DATA SHEET

ATTACHMENT O – TANKER TRUCK LOADING DATA SHEET

Complete this data sheet for each new or modified bulk liquid transfer area or loading rack at the facility. This is to be used for bulk liquid transfer operations to tanker trucks. Use extra pages if necessary.

Truck Loadout Collection Efficiencies

The following applicable capture efficiencies of a truck loadout are allowed:

- For tanker trucks passing the MACT level annual leak test – 99.2%
- For tanker trucks passing the NSPS level annual leak test – 98.7%
- For tanker trucks not passing one of the annual leak tests listed above – 70%

Compliance with this requirement shall be demonstrated by keeping records of the applicable MACT or NSPS Annual Leak Test certification for ***every*** truck and railcar loaded/unloaded. This requirement can be satisfied if the trucking company provided certification that its entire fleet was compliant. This certification must be submitted in writing to the Director of the DAQ. These additional requirements must be noted in the Registration Application.

Emission Unit ID#: EU-LOAD-COND	Emission Point ID#: APC-COMB-TKLD	Year Installed/Modified: TBD
Emission Unit Description: Condensate Truck Loading Emissions		
Loading Area Data		
Number of Pumps: 1	Number of Liquids Loaded: 1	Max number of trucks loading at one (1) time: 1
Are tanker trucks pressure tested for leaks at this or any other location? ☐ Yes ☒ No ☐ Not Required If Yes, Please describe:		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☒ Closed System to tanker truck not passing an annual leak test and has vapor return?		

Projected Maximum Operating Schedule (for rack or transfer point as a whole)

Time	Jan – Mar	Apr - Jun	Jul – Sept	Oct - Dec
Hours/day	24	24	24	24
Days/week	5	5	5	5

Bulk Liquid Data (use extra pages as necessary)

Liquid Name	Condensate		
Max. Daily Throughput (1000 gal/day)	105		
Max. Annual Throughput (1000 gal/yr)	38,325		
Loading Method[1]	SUB		
Max. Fill Rate (gal/min)	125		
Average Fill Time (min/loading)	Approx 60		
Max. Bulk Liquid Temperature (^{o}F)	50.33		
True Vapor Pressure[2]	9.1546		
Cargo Vessel Condition[3]	U		
Control Equipment or Method[4]	O = Vapor Return s/ Combustion Controls		
Max. Collection Efficiency (%)	70%		

Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	16.74		
	Annual (ton/yr)	42.77		
Max.HAP Emission Rate	Loading (lb/hr)	1.39		
	Annual (ton/yr)	3.56		
Estimation Method[5]		EPA		

Emission Unit ID#: EU-LOAD-PW	Emission Point ID#: APC-COMB-TKLD	Year Installed/Modified: TBD
Emission Unit Description: Produced Water Truck Loading Emissions		
Loading Area Data		
Number of Pumps: 1	Number of Liquids Loaded: 1	Max number of trucks loading at one (1) time: 1
Are tanker trucks pressure tested for leaks at this or any other location? ☐ Yes ☒ No ☐ Not Required If Yes, Please describe:		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☒ Closed System to tanker truck not passing an annual leak test and has vapor return?		

Projected Maximum Operating Schedule (for rack or transfer point as a whole)				
Time	Jan – Mar	Apr - Jun	Jul – Sept	Oct - Dec
Hours/day	24	24	24	24
Days/week	5	5	5	5

Bulk Liquid Data (use extra pages as necessary)			
Liquid Name	Produced Water		
Max. Daily Throughput (1000 gal/day)	42		
Max. Annual Throughput (1000 gal/yr)	15,330		
Loading Method[1]	SUB		
Max. Fill Rate (gal/min)	125		
Average Fill Time (min/loading)	Approx 60		
Max. Bulk Liquid Temperature (°F)	50.33		
True Vapor Pressure[2]	0.2436		
Cargo Vessel Condition[3]	U		
Control Equipment or Method[4]	O = Vapor Return s/ Combustion Controls		
Max. Collection Efficiency (%)	70%		
Max. Control Efficiency (%)	98%		
Max.VOC Emission Rate – Loading (lb/hr)	0.16		
Max.VOC Emission Rate – Annual (ton/yr)	0.16		
Max.HAP Emission Rate – Loading (lb/hr)	0.01		
Max.HAP Emission Rate – Annual (ton/yr)	0.01		

Estimation Method[5]	EPA		

1 BF Bottom Fill SP Splash Fill SUB Submerged Fill

2 At maximum bulk liquid temperature

3 B Ballasted Vessel C Cleaned U Uncleaned (dedicated service)
O Other (describe)

4 List as many as apply (complete and submit appropriate Air Pollution Control Device Sheets)
CA Carbon Adsorption VB Dedicated Vapor Balance (closed system)
ECD Enclosed Combustion Device F Flare
TO Thermal Oxidization or Incineration

5 EPA EPA Emission Factor in AP-42 MB Material Balance
TM Test Measurement based upon test data submittal O Other (describe)

ATTACHMENT Q: PNEUMATIC CONTROLLERS DATA SHEET

ATTACHMENT Q – PNEUMATIC CONTROLLERS DATA SHEET
Are there any continuous bleed natural gas driven pneumatic controllers at this facility that commenced construction, modification or reconstruction after August 23, 2011? ☐ Yes ☒ No Please list approximate number.
Are there any continuous bleed natural gas driven pneumatic controllers at this facility with a bleed rate greater than 6 standard cubic feet per hour that are required based on functional needs, including but not limited to response time, safety and positive actuation that commenced construction, modification or reconstruction after August 23, 2011? ☐ Yes ☒ No Please list approximate number.

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

VAPOR COMBUSTION
VAPOR RECOVERY UNIT

ATTACHMENT R – 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 11,188 scfh 268,500 scfd	Maximum Design Heat Input (from mfg. spec sheet) 30.0 MMBTU/hr Design Heat Content 2,682 BTU/scf

Control Device Information

Type of Vapor Combustion Control?

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

Manufacturer: MRW Technologies Model: TBF-6.5-34-268500	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-TANKS-COND	Condensate Tanks	EU-LOAD-PW	Produced Water Truck Loading
EU-TANKS-PW	Produced Water Tanks		
EU-LOAD-COND	Condensate Truck Loading		

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	feet	feet	☐ Yes ☐ No Provide determination.

Waste Gas Information

Maximum Waste Gas Flow Rate 187 (scfm)	Heat Value of Waste Gas Stream 2,682 BTU/ft^3	Exit Velocity of the Emissions Stream (ft/s)

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

Pilot Gas Information

Number of Pilot Lights 3	Fuel Flow Rate to Pilot Flame per Pilot 50 scfh	Heat Input per Pilot 45,250 BTU/hr	Will automatic re-ignition be used? ☒ 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.

VAPOR RECOVERY UNIT

General Information

Emission Unit ID#: APC-VRU-TANKS	Installation Date: TBD ☒ New ☐ Modified ☐ Relocated

Device Information

Manufacturer: Hybon/EDI
Model: TBD

List the emission units whose emissions are controlled by this vapor recovery unit (Emission Point ID# APC-VRU-TANKS) The VRU is expected to be the primary control, with the combustor as the backup device. However, emission calculations are estimated based on the combustor as the primary control device as a conservative estimate.

Emission Unit ID#	Emission Source Description	Emission Unit ID#	Emission Source Description
EU-TANKS-COND	Condensate Tanks		
EU-TANKS-PW	Produced Water Tanks		

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

Additional information attached? ☐ Yes ☒ No
Please attach copies of manufacturer's data sheets, drawings, and performance testing.

The registrant may claim a capture and control efficiency of 95 % (which accounts for 5% downtime) for the vapor recovery unit.

The registrant may claim a capture and control efficiency of 98% if the VRU has a backup flare that meet the requirements of Section 8.1.2 of this general permit.

The registrant may claim a capture and control efficiency of 98% if the VRU has a backup VRU.

Tank Battery Combustor Specification Sheet
MRW Technologies, Inc.
Combustor Model Number: TBF-6.5-34-268500

Expected Destruction Removal Efficiency (DRE):	98% or Greater of Non-Methane Hydrocarbons
Unit Size:	6.5-foot Diameter 34-Foot Overall Height
Design Heat Input:	30 MMBTU/HR
Design Flow Rates:	268,500 SCFD
Design Heat Content:	2682 BTU/SCF
Waste Gas Flame Arrestor:	Enardo
Pilot Type:	MRW Electric Ignition
Pilot Operation (Continuous/Intermittent):	Three (3) Continuous
Pilot Fuel Consumption:	150 SCFH or Less Total (50 SCFH per Pilot)
Pilot Monitoring Device:	Flame Rod
Automatic Re-Ignition:	Included
Remote Alarm Indication:	Included

Description of Control Scheme:

The Combustor pilots are monitored via flame rod. If one of the pilot flames are 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.

ATTACHMENT S: EMISSIONS CALCULATIONS

EMISSIONS ESTIMATE CALCULATIONS
AP-42 REFERENCES

SWN Production Company, LLC
OV Royalty 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 w/ Catalytic Converter	EU-ENG1	EP-ENG1	0.32	1.40	0.64	2.80	0.24	1.05	<0.01	<0.01	0.02	0.09
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG2	EP-ENG2	0.32	1.40	0.64	2.80	0.24	1.05	0.01	0.04	0.02	0.09
215-hp Caterpillar G3406 NA Engine	EU-ENG3	EP-ENG3	0.47	2.06	0.95	4.16	0.36	1.58	<0.01	<0.01	0.03	0.14
77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	EU-ENG4	EP-ENG4	0.46	2.01	0.75	3.29	0.47	2.06	<0.01	<0.01	0.01	0.04
Five (5) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU5	EP-GPU1 - EP-GPU5	0.55	2.40	0.45	1.95	0.03	0.15	<0.01	0.01	0.04	0.18
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	EP-HT1 - EP-HT2	0.12	0.52	0.10	0.44	0.01	0.02	<0.01	<0.01	0.01	0.04
Two (2) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 - EU-SH2	EP-SH1 - EP-SH2	0.34	1.48	0.28	1.22	0.02	0.08	<0.01	0.01	0.03	0.11
Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	APC-COMB-TKLD	-	-	-	-	-	-	-	-	-	-
Four (4) 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	-	-	-	-	9.76	42.77	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	APC-COMB-TKLD	-	-	-	-	0.04	0.16	-	-	-	-
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	APC-COMB-TKLD	4.14	18.13	8.27	36.22	5.87	25.71	-	-	0.09	0.39
Vapor Combustor Pilots	EU-PILOT	APC-COMB-TKLD	0.02	0.09	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	EP-FUG	-	-	-	-	1.10	4.81	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	EP-HR	-	-	-	-	-	-	-	-	4.03	13.23
Total =			**6.74**	**29.50**	**12.09**	**52.94**	**18.13**	**79.45**	**0.02**	**0.08**	**4.28**	**14.32**
Total Exclusive of Fugitve Emissions =			**6.74**	**29.50**	**12.09**	**52.94**	**17.03**	**74.64**	**0.02**	**0.08**	**0.25**	**1.09**
General Permit G-70B Limits =			**-**	**50.00**	**-**	**80.00**	**-**	**80.00**	**-**	**20.00**	**-**	**20.00**

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
OV Royalty 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 w/ Catalytic Converter	EU-ENG1	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG2	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
215-hp Caterpillar G3406 NA Engine	EU-ENG3	<0.01	<0.01	<0.01	<0.01	0.03	0.01	-	<0.01	<0.01	0.05
77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	EU-ENG4	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01
Five (5) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU5	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Two (2) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 - EU-SH2	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Four (4) 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	-	-	0.59	0.04	0.13	0.81
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-TKLD	-	-	0.01	0.02	-	-	0.36	0.02	0.08	0.49
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.05	<0.01	0.01	0.06
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		**0.01**	**0.01**	**0.02**	**0.07**	**0.07**	**0.01**	**1.02**	**0.07**	**0.22**	**1.50**

Continued on Next Page

SWN Production Company, LLC
OV Royalty 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 w/ Catalytic Converter	EU-ENG1	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG2	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
215-hp Caterpillar G3406 NA Engine	EU-ENG3	0.02	0.02	0.01	<0.01	0.13	0.02	-	<0.01	<0.01	0.21
77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	EU-ENG4	0.01	0.01	<0.01	<0.01	0.06	0.01	-	<0.01	<0.01	0.09
Five (5) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU5	-	-	<0.01	-	<0.01	-	0.04	<0.01	-	0.05
Two (2) 0.5-mmBtu/hr Heater Treaters	EU-HT1 - EU-HT2	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Two (2) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 - EU-SH2	-	-	<0.01	-	<0.01	-	0.03	<0.01	-	0.03
Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	0.04	0.17	-	-	2.60	0.17	0.58	3.56
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-TKLD	-	-	0.02	0.10	-	-	1.58	0.10	0.35	2.15
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.01	-	-	0.20	0.01	0.04	0.27
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
	Total =	**0.06**	**0.06**	**0.09**	**0.29**	**0.38**	**0.06**	**4.47**	**0.29**	**0.98**	**6.68**

SWN Production Company, LLC
OV Royalty 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 w/ Catalytic Converter	EU-ENG1	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 w/ Catalytic Converter	EU-ENG2	155.04	616.04	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.64
215-hp Caterpillar G3406 NA Engine	EU-ENG3	252.63	1,003.83	<0.01	0.01	0.09	0.37	<0.01	<0.01	0.11	0.44	252.84	1,004.64
77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	EU-ENG4	74.89	297.56	<0.01	0.01	0.04	0.14	<0.01	<0.01	0.04	0.17	74.96	297.87
Five (5) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU5	584.89	2,324.02	0.01	0.04	0.28	1.09	<0.01	<0.01	0.33	1.31	585.49	2,326.42
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
Two (2) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 - EU-SH2	350.93	1,394.41	0.01	0.03	0.17	0.66	<0.01	<0.01	0.20	0.78	351.29	1,395.85
Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Four (4) 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	0.03	0.10	0.64	2.55	-	-	-	-	0.64	2.55
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	0.01	0.04	0.71	2.84	17.85	70.92	-	-	-	-	17.86	70.96
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	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	63.17
Fugitive Emissions	EU-FUG	<0.01	0.02	1.12	4.45	28.00	111.36	-	-	-	-	28.00	111.38
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
	Total =	**5,215.60**	**20,724.01**	**1.96**	**7.78**	**48.91**	**194.45**	**0.01**	**0.04**	**2.89**	**11.47**	**5,267.40**	**20,929.94**

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
OV Royalty 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 w/ Catalytic Converter	EU-ENG1	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 w/ Catalytic Converter	EU-ENG2	155.04	679.06	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.73
215-hp Caterpillar G3406 NA Engine	EU-ENG3	252.63	1,106.54	<0.01	0.02	0.09	0.40	<0.01	<0.01	0.11	0.48	252.84	1,107.42
77-kw Zenith ZPP-644 4.4L 6 Cylinder Engine	EU-ENG4	74.89	328.00	<0.01	0.01	0.04	0.15	<0.01	<0.01	0.04	0.18	74.96	328.34
Five (5) 1.0-mmBtu/hr GPU Burners	EU-GPU1 - EU-GPU5	584.89	2,561.80	0.01	0.05	0.28	1.21	<0.01	<0.01	0.33	1.44	585.49	2,564.44
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
Two (2) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 - EU-SH2	350.93	1,537.08	0.01	0.03	0.17	0.72	<0.01	<0.01	0.20	0.86	351.29	1,538.67
Eight (8) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Four (4) 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	0.03	0.11	0.64	2.81	-	-	-	-	0.64	2.81
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	0.01	0.04	0.71	3.13	17.85	78.18	-	-	-	-	17.86	78.22
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	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	69.56	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.01	0.04	15.90	69.63
Fugitive Emissions	EU-FUG	<0.01	0.02	1.12	4.91	28.00	122.75	-	-	-	-	28.00	122.77
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
	Total =	**5,215.60**	**22,844.31**	**1.96**	**8.58**	**48.91**	**214.34**	**0.01**	**0.04**	**2.89**	**12.64**	**5,267.40**	**23,071.31**

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
OV Royalty 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	Caterpillar	Caterpillar
Model:	G3306 NA	G3306 NA	G3406 NA
Design Class:	4S-RB	4S-RB	4S-RB
Controls:	NSCR	NSCR	NSCR
Horsepower (hp):	145	145	215
Fuel Use (Btu/hp-hr):	8,625	8,625	7,767
Fuel Use (scfh):	1,382	1,382	1,845
Annual Fuel Use (mmscf):	12.11	12.11	16.16
Fuel Use (mmBtu/hr):	1.25	1.25	1.67
Exhaust Flow (acfm):	678	678	1,018
Exhaust Temp (°F):	1,101	1,101	1,135
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):	13.47	13.47	16.52
CO (g/hp-hr):	13.47	13.47	16.52
NMNEHC/VOC (g/hp-hr):	0.22	0.22	0.21
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.22	0.22	0.48

Post-Catalyst Emission Factors

NOx Control Eff. %	92.58%	92.58%	93.95%
CO Control Eff. %	85.15%	85.15%	87.89%
NOx (g/hp-hr):	1.00	1.00	1.00
CO (g/hp-hr):	2.00	2.00	2.00
NMNEHC/VOC (g/hp-hr):	0.70	0.70	0.70
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.76	0.76	0.76

Uncontrolled Criteria Air Pollutant Emissions

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	4.31	18.88	4.31	18.88	7.83	34.30
CO	4.31	18.88	4.31	18.88	7.83	34.30
NMNEHC/VOC (does not include HCHO)	0.07	0.31	0.07	0.31	0.10	0.44
Total VOC (includes HCHO)	0.07	0.31	0.07	0.31	0.23	1.00
SO_2	<0.01	<0.01	0.01	0.04	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.04	0.01	0.04	0.02	0.07
PM_{COND}	0.01	0.04	0.01	0.04	0.02	0.07
PM_{TOT}	0.02	0.09	0.02	0.09	0.03	0.14

SWN Production Company, LLC
OV Royalty Pad
Engine Emissions Calculations - Criteria Air Pollutants (Continued)

Proposed Criteria Air Pollutant Emissions[2]

Unit ID:	EU-ENG1		EU-ENG2		EU-ENG3	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.32	1.40	0.32	1.40	0.47	2.06
CO	0.64	2.80	0.64	2.80	0.95	4.16
NMNEHC/VOC (does not include HCHO)	0.22	0.96	0.22	0.96	0.33	1.45
Total VOC (includes HCHO)	0.24	1.05	0.24	1.05	0.36	1.58
SO_2	<0.01	<0.01	<0.01	0.04	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.04	0.01	0.04	0.02	0.07
PM_{COND}	0.01	0.04	0.01	0.04	0.02	0.07
PM_{TOT}	0.02	0.09	0.02	0.09	0.03	0.14

AP-42 Emission Factors (lb/mmBtu)[3]

	4S-RB
Pollutant	**3.2-3 (7/00)**
SO_2	5.88E-04
$PM_{10/2.5}$	9.50E-03
PM_{COND}	9.91E-03
PM_{TOT}	1.94E-02

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] 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
OV Royalty 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	Caterpillar	Caterpillar
Model:	G3306 NA	G3306 NA	G3406 NA
Design Class:	4S-RB	4S-RB	4S-RB
Controls:	NSCR	NSCR	NSCR
Horsepower (hp):	145	145	215
Fuel Use (Btu/hp-hr):	8,625	8,625	7,767
Fuel Use (scfh):	1,382	1,382	1,845
Annual Fuel Use (mmscf):	12.11	12.11	16.16
Fuel Use (mmBtu/hr):	1.25	1.25	1.67
Exhaust Flow (acfm):	678	678	1,018
Exhaust Temp (°F):	1,101	1,101	1,135
Operating Hours:	8,760	8,760	8,760

Manufacturer Formaldehyde Factor

Pre-Control (g/hp-hr):	0.27	0.27	0.27
Control Efficiency[1]:	76.00%	76.00%	76.00%
Permit Factor (g/hp-hr):	0.06	0.06	0.06

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	0.02	<0.01	0.02
Acrolein	<0.01	0.01	<0.01	0.01	<0.01	0.02
Benzene	<0.01	0.01	<0.01	0.01	<0.01	0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.09	0.38	0.09	0.38	0.13	0.56
Methanol	<0.01	0.02	<0.01	0.02	0.01	0.02
Toluene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total HAPs =	**0.10**	**0.44**	**0.10**	**0.44**	**0.15**	**0.64**

SWN Production Company, LLC
OV Royalty 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	0.02	<0.01	0.02
Acrolein	<0.01	0.01	<0.01	0.01	<0.01	0.02
Benzene	<0.01	0.01	<0.01	0.01	<0.01	0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.02	0.09	0.02	0.09	0.03	0.13
Methanol	<0.01	0.02	<0.01	0.02	0.01	0.02
Toluene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total HAPs =	**0.03**	**0.15**	**0.03**	**0.15**	**0.05**	**0.21**

AP-42 Emission Factors (lb/mmBtu)

	4S-RB
Pollutant	**3.2-3 (7/00)**
Acetaldehyde	2.79E-03
Acrolein	2.63E-03
Benzene	1.58E-03
Ethylbenzene	2.18E-05
Methanol	3.06E-03
Toluene	5.58E-04
Xylenes	1.95E-04

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

SWN Production Company, LLC
OV Royalty 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	Caterpillar	Caterpillar
Model:	G3306 NA	G3306 NA	G3406 NA
Design Class:	4S-RB	4S-RB	4S-RB
Controls:	NSCR	NSCR	NSCR
Horsepower (hp):	145	145	215
Fuel Use (Btu/hp-hr):	8,625	8,625	7,767
Fuel Use (scfh):	1,382	1,382	1,845
Fuel Use (mmBtu/hr):	1.25	1.25	1.67
Exhaust Flow (acfm):	678	678	1,018
Exhaust Temp (°F):	1,101	1,101	1,135
Operating Hours:	8,760	8,760	8,760

Manufacturer data used to calculate CO_2 emissions (g/hp-hr):

	485	485	533

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	155.04	616.04	155.04	616.04	252.63	1,003.83
CH_4	<0.01	0.01	<0.01	0.01	<0.01	0.01
N_2O	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CH_4 as CO_2e	0.07	0.27	0.07	0.27	0.09	0.37
N_2O as CO_2e	0.08	0.33	0.08	0.33	0.11	0.44
Total CO_2 + CO_2e =	**155.19**	**616.64**	**155.19**	**616.64**	**252.84**	**1,004.64**

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] 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
OV Royalty Pad
Proposed Engine Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	**EU-ENG4**
Emission Point ID:	EP-ENG4
Make:	Zenith
Model:	ZPP-644 4.4L
Design Class:	4S-RB
Controls:	NSCR
Capacity (kW):	77.0
Capacity(hp):	103.3
Fuel Use (Btu/kW-hr):	8,314
Fuel Use (scfh):	707
Annual Fuel Use (mmscf):	6.20
Fuel Use (mmBtu/hr):	0.64
Operating Hours:	8,760
Fuel Heating Value (Btu/scf):	905

Emission Factors[1,2]

NMHC+NOx as NOx (g/kW-hr):	2.70
CO (g/kW-hr):	4.40
NMHC+NOx as VOC (g/kW-hr):	2.70

Proposed Criteria Air Pollutant Emissions

Unit ID: **EU-ENG4**

Pollutant	lb/hr	TPY
NMHC+NOx as NOx	0.46	2.01
CO	0.75	3.29
NMHC+NOx as VOC	0.46	2.01
SO_2	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.04
PM_{COND}	0.01	0.04
PM_{TOT}	0.01	0.04

AP-42 Emission Factors (lb/mmBtu)[3]

4S-RB

Pollutant	3.2-3 (7/00)
SO_2	5.88E-04
$PM_{10/2.5}$	9.50E-03
PM_{COND}	9.91E-03
PM_{TOT}	1.94E-02

Notes:

[1] EU-ENG4 is certified to meet EPA emissions standards of 2.7 g/kW-hr NMHC+NOx and 4.4 g/kW-hr CO. Total NMHC+NOx factor used to conservatively estimate emissions of NOx and VOC, respectively. All other pollutants calculated using AP-42.

[2] EU-ENG4 emissions factors are from NSPS Subpart JJJJ emission limits for Stage 2 engines, converted to g/kw-hr.

[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
OV Royalty Pad
Proposed Engine Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-ENG4**
Emission Point ID:	EP-ENG4
Make:	Zenith
Model:	ZPP-644 4.4L
Design Class:	4S-RB
Capacity (kW):	77.0
Fuel Use (Btu/kW-hr):	8,314
Fuel Use (scfh):	707
Annual Fuel Use (mmscf):	6.20
Fuel Use (mmBtu/hr):	0.64
Operating Hours:	8,760
Fuel Heating Value (Btu/scf):	905

Proposed HAP Emissions

Unit ID: **EU-ENG4**

Pollutant	lb/hr	TPY
Acetaldehyde	<0.01	0.01
Acrolein	<0.01	0.01
Benzene	<0.01	<0.01
Ethylbenzene	<0.01	<0.01
Formaldehyde	0.01	0.06
Methanol	<0.01	0.01
Toluene	<0.01	<0.01
Xylenes	<0.01	<0.01
Total HAP =	**0.02**	**0.09**

AP-42 Emission Factors (lb/mmBtu)

Pollutant	3.2-3 (7/00)
Acetaldehyde	2.79E-03
Acrolein	2.63E-03
Benzene	1.58E-03
Ethylbenzene	2.18E-05
Formaldehyde	2.05E-02
Methanol	3.06E-03
Toluene	5.58E-04
Xylenes	1.95E-04

SWN Production Company, LLC
OV Royalty Pad
Proposed Engine Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-ENG4**
Emission Point ID:	EP-ENG4
Make:	Zenith
Model:	ZPP-644 4.4L
Design Class:	4S-RB
Controls:	NSCR
Capacity (kW):	77.0
Fuel Use (Btu/kW-hr):	8,314
Fuel Use (scfh):	707
Annual Fuel Use (mmscf):	6.20
Fuel Use (mmBtu/hr):	0.64
Operating Hours:	8,760
Fuel Heating Value (Btu/scf):	905

Greenhouse Gas (GHG) Emissions

Unit ID: **EU-ENG4**

Pollutant	lb/hr	tonnes/yr
CO_2	74.89	297.56
CH_4	<0.01	0.01
N_2O	<0.01	<0.01
CH_4 as CO_2e	0.04	0.14
N_2O as CO_2e	0.04	0.17
Total CO_2 + CO_2e =	**74.96**	**297.87**

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

SWN Production Company, LLC
OV Royalty Pad
Gas Production Unit Burner Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU5
Description:	Gas Production Unit Burner
Number of Units:	5
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Criteria Air Pollutant Emissions

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**		**EU-GPU1 - EU-GPU5 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.11	0.48	0.55	2.40
CO	0.09	0.39	0.45	1.95
VOC	0.01	0.03	0.03	0.15
SO_2	<0.01	<0.01	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.03	0.03	0.14
PM_{COND}	<0.01	0.01	<0.01	<0.05
PM_{TOT}	0.01	0.04	0.04	0.18

AP-42 Emission Factors for Units <100 mmBtu/hr (lb/mmscf)[1]

Pollutant	1.4-1, -2 (7/98)
NOx	100.0
CO	84.0
VOC	5.5
SO_2	0.6
$PM_{10/2.5}$	5.7
PM_{COND}	1.9
PM_{TOT}	7.6

Notes:
[1] All PM (total, condensable and filterable) is assumed to be <1 micrometer in diameter. Total PM is the sum of filterable PM and condensable PM.

SWN Production Company, LLC
OV Royalty Pad
Gas Production Unit Burner Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU5
Description:	Gas Production Unit Burner
Number of Units:	5
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Hazardous Air Pollutant Emissions

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**		**EU-GPU1 - EU-GPU5 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	<0.01	0.01	<0.01	<0.04
Formaldehyde	<0.01	<0.01	<0.01	<0.01
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Total HAPs =	**<0.01**	**0.01**	**0.01**	**0.05**

AP-42 Emission Factors (lb/mmscf)

Pollutant	1.4-3 (7/98)
n-Hexane	1.80E+00
Formaldehyde	7.50E-02
Benzene	2.10E-03
Toluene	3.40E-03

SWN Production Company, LLC
OV Royalty Pad
Gas Production Unit Burner Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU5
Description:	Gas Production Unit Burner
Number of Units:	5
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions[1]

Unit ID:	**EU-GPU1 - EU-GPU5 (EACH)**		**EU-GPU1 - EU-GPU5 (TOTAL)**	
Pollutant	**lb/hr**	**tonnes/yr**	**lb/hr**	**tonnes/yr**
CO_2	116.98	464.80	584.89	2,324.02
CH_4	<0.01	0.01	<0.01	<0.04
N_2O	<0.01	<0.01	<0.01	<0.01
CH_4 as CO_2e	0.06	0.22	0.28	1.09
N_2O as CO_2e	0.07	0.26	0.33	1.31
Total CO_2 + CO_2e =	**117.10**	**465.28**	**585.49**	**2,326.42**

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

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

Notes:
[1] 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
OV Royalty Pad
Heater Treater Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**
Emission Point ID:	EP-HT1 - EP-HT2
Description:	Heater Treater
Number of Units:	2
Burner Design (mmBtu/hr):	0.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	4.84
Annual Operating Hours:	8,760

Criteria Air Pollutant Emissions

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**		**EU-HT1 and EU-HT2 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.06	0.26	0.12	0.52
CO	0.05	0.22	0.10	0.44
VOC	<0.01	0.01	0.01	0.02
SO_2	<0.01	<0.01	<0.01	<0.01
$PM_{10/2.5}$	<0.01	0.01	0.01	0.03
PM_{COND}	<0.01	<0.01	<0.01	0.01
PM_{TOT}	<0.01	0.02	0.01	0.04

AP-42 Emission Factors for Units <100 mmBtu/hr (lb/mmscf)[1]

Pollutant	1.4-1, -2 (7/98)
NOx	100.0
CO	84.0
VOC	5.5
SO_2	0.6
$PM_{10/2.5}$	5.7
PM_{COND}	1.9
PM_{TOT}	7.6

Notes:
[1] All PM (total, condensable and filterable) is assumed to be <1 micrometer in diameter. Total PM is the sum of filterable PM and condensable PM.

SWN Production Company, LLC
OV Royalty Pad
Heater Treater Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**
Emission Point ID:	EP-HT1 - EP-HT2
Description:	Heater Treater
Number of Units:	2
Burner Design (mmBtu/hr):	0.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	4.84
Annual Operating Hours:	8,760

Hazardous Air Pollutant Emissions

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**		**EU-HT1 and EU-HT2 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	<0.01	<0.01	<0.01	0.01
Formaldehyde	<0.01	<0.01	<0.01	<0.01
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Total HAPs =	**<0.01**	**<0.01**	**<0.01**	**0.01**

AP-42 Emission Factors (lb/mmscf)

Pollutant	1.4-3 (7/98)
n-Hexane	1.80E+00
Formaldehyde	7.50E-02
Benzene	2.10E-03
Toluene	3.40E-03

SWN Production Company, LLC
OV Royalty Pad
Heater Treater Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**
Emission Point ID:	EP-HT1 - EP-HT2
Description:	Heater Treater
Number of Units:	2
Burner Design (mmBtu/hr):	0.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	4.84
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions[1]

Unit ID:	**EU-HT1 - EU-HT2 (EACH)**		**EU-HT1 and EU-HT2 (TOTAL)**	
Pollutant	**lb/hr**	**tonnes/yr**	**lb/hr**	**tonnes/yr**
CO_2	58.49	232.40	116.98	464.80
CH_4	<0.01	<0.01	<0.01	<0.01
N_2O	<0.01	<0.01	<0.01	<0.01
CH_4 as CO_2e	0.03	0.11	0.06	0.22
N_2O as CO_2e	0.03	0.13	0.07	0.26
Total CO_2 + CO_2e =	**58.55**	**232.64**	**117.10**	**465.28**

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

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

Notes:
[1] 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
OV Royalty Pad
Stabilizer Heater Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	**EU-SH1 - EU-SH2**
Emission Point ID:	EP-SH1 - EP-SH2
Description:	Stabilizer Heater
Number of Units:	2
Burner Design (mmBtu/hr):	1.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	14.52
Annual Operating Hours:	8,760

Criteria Air Pollutant Emissions

Unit ID:	**EU-SH1 - EU-SH2**		**EU-SH1 and EU-SH2 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.17	0.74	0.34	1.48
CO	0.14	0.61	0.28	1.22
VOC	0.01	0.04	0.02	0.08
SO_2	<0.01	<0.01	<0.01	0.01
$PM_{10/2.5}$	0.01	0.04	0.02	0.08
PM_{COND}	<0.01	0.01	0.01	0.03
PM_{TOT}	0.01	0.06	0.03	0.11

AP-42 Emission Factors for Units <100 mmBtu/hr (lb/mmscf)[1]

Pollutant	1.4-1, -2 (7/98)
NOx	100.0
CO	84.0
VOC	5.5
SO_2	0.6
$PM_{10/2.5}$	5.7
PM_{COND}	1.9
PM_{TOT}	7.6

Notes:
[1]All PM (total, condensable and filterable) is assumed to be <1 micrometer in diameter. Total PM is the sum of filterable PM and condensable PM.

SWN Production Company, LLC
OV Royalty Pad
Line Heater Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-SH1 - EU-SH2**
Emission Point ID:	EP-SH1 - EP-SH2
Description:	Stabilizer Heater
Number of Units:	2
Burner Design (mmBtu/hr):	1.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	14.52
Annual Operating Hours:	8,760

Hazardous Air Pollutant Emissions

Unit ID:	**EU-SH1 - EU-SH2**		**EU-SH1 and EU-SH2 (TOTAL)**	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	<0.01	0.01	0.01	0.03
Formaldehyde	<0.01	<0.01	<0.01	<0.01
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Total HAPs =	**<0.01**	**0.01**	**0.01**	**0.03**

AP-42 Emission Factors (lb/mmscf)

Pollutant	1.4-3 (7/98)
n-Hexane	1.80E+00
Formaldehyde	7.50E-02
Benzene	2.10E-03
Toluene	3.40E-03

SWN Production Company, LLC
OV Royalty Pad
Line Heater Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-SH1 - EU-SH2**
Emission Point ID:	EP-SH1 - EP-SH2
Description:	Stabilizer Heater
Number of Units:	2
Burner Design (mmBtu/hr):	1.5
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	14.52
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions[1]

Unit ID:	**EU-SH1 - EU-SH2**		**EU-SH1 and EU-SH2 (TOTAL)**	
Pollutant	**lb/hr**	**tonnes/yr**	**lb/hr**	**tonnes/yr**
CO_2	175.47	697.21	350.93	1394.41
CH_4	<0.01	0.01	0.01	0.03
N_2O	<0.01	<0.01	<0.01	<0.01
CH_4 as CO_2e	0.08	0.33	0.17	0.66
N_2O as CO_2e	0.10	0.39	0.20	0.78
Total CO_2 + CO_2e =	**175.65**	**697.93**	**351.29**	**1,395.85**

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

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

Notes:
[1] 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
OV Royalty Pad
Storage Tank Emissions - Criteria Air Pollutants

Tank Information

Unit ID:	**EU-TANKS-COND**	**EU-TANKS-PW**
Emission Point ID:	APC-COMB-TKLD	APC-COMB-TKLD
Contents: [1]	Condensate	Produced Water
Number of Tanks: [2]	8	4
Capacity (bbl) - Per Tank:	400	400
Capacity (gal) - Per Tank:	16,800	16,800
Total Throughput (bbl/yr):	912,500	365,000
Total Throughput (gal/yr):	38,325,000	15,330,000
Total Throughput (bbl/d):	2,500	1,000
Tank Flashing Emission Factor (lb/bbl):	2.50	0.05
Total Working Losses (lb/yr): [3]	57,626.70	229.82
Breathing Losses per Tank (lb/yr): [3]	1,706.11	11.32
Tank Vapor Capture Efficiency:	100%	100%
Captured Vapors Routed to:	Vapor Combustor	Vapor Combustor

Uncontrolled Storage Tank Emissions

Unit ID:	**EU-TANKS-COND**		**EU-TANKS-PW**	
Emissions	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Working Losses	6.58	28.81	0.03	0.11
Breathing Losses	1.55	6.80	0.01	0.04
Flashing Losses	260.42	1,140.63	2.08	9.13
Total VOC =	**268.55**	**1,176.24**	**2.12**	**9.28**

Notes:

[1] Produced water tanks assumed to contain 99% produced water and 1% condensate.

[2] SWN requests to combine working, breathing and flashing emissions from each tank type to be combined into one emissions point with a total throughput limit rather than an individual tank limit.

[3] Tank working and breathing emissions were calculated using maximum throughput in EPA TANKS 4.0.9d for working losses and multiplying results for breathing losses by the number of tanks for total potential evaporative losses from all tanks. Flashing calculated using Promax process simulation. Reports located in Appendix A. Uncontrolled tank working/breathing/flashing emissions are routed to a vapor combustor with 100% capture efficiency.

Total Annual Emissions (TPY) = Tank Working + Breathing + Flashing Emissions (TPY) * (1 - Capture Efficiency (%))

SWN Production Company, LLC
OV Royalty Pad
Storage Tank Emissions - Hazardous Air Pollutants

Uncontrolled Storage Tank Emissions

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Total VOC = [1]	**268.55**	**1,176.24**	**2.12**	**9.28**
n-Hexane	16.34	71.56	0.13	0.56
Benzene	0.23	1.00	<0.01	0.01
Toluene	1.05	4.59	0.01	0.04
Ethylbenzene	1.09	4.79	0.01	0.04
Xylenes	3.66	16.03	0.03	0.13
Total HAP =	**22.37**	**97.97**	**0.18**	**0.77**

Estimated HAP Composition (% by Weight)[3]

Pollutant	Wt%
n-Hexane	6.084%
Benzene	0.085%
Toluene	0.390%
Ethylbenzene	0.407%
Xylenes	1.363%
Total HAP =	**8.329%**

Notes:

[1] VOC emissions calculated in Criteria Air Pollutant calculations.

[2] Uncontrolled tank working/breathing/flashing emissions are routed to a vapor combustor with 100% capture efficiency.

[3] Speciated liquids analysis located in Fugitive Emissions Calculations. HAP weight % calculated as % of total hydrocarbons in the sample. All HAP assumed to volatilize from liquids for most conservative emissions estimate.

SWN Production Company, LLC
OV Royalty Pad
Condensate Truck Loading Emissions - Criteria and Hazardous Air Pollutants

Loading Information

Unit ID:	**EU-LOAD-COND**
Emission Point ID:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Saturation Factor:	0.6
Em. Factor (lb/1000 gal): [1]	7.44
Throughput (1000 gal):	38,325
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

9.1546	= P, True vapor pressure of liquid loaded (max. psia)[3]
55.486	= M, Molecular weight of vapor (lb/lb-mol)
50.33	= T, Temperature of bulk liquid loaded (average °F)
510.33	= T, Temperature of bulk liquid loaded (°F + 460 = °R)

Uncontrolled Loading Emissions[4]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**55.80**	**32.55**	**142.57**
n-Hexane	3.39	1.98	8.67
Benzene	0.05	0.03	0.12
Toluene	0.22	0.13	0.56
Ethylbenzene	0.23	0.13	0.58
Xylenes	0.76	0.44	1.94
Total HAP [5] =	**4.65**	**2.71**	**11.87**

SWN Production Company, LLC
OV Royalty Pad
Condensate Truck Loading Emissions - Criteria and Hazardous Air Pollutants (Continued)

Uncaptured Loading Emissions[4]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**16.74**	**9.76**	**42.77**
n-Hexane	1.02	0.59	2.60
Benzene	0.01	0.01	0.04
Toluene	0.07	0.04	0.17
Ethylbenzene	0.07	0.04	0.17
Xylenes	0.23	0.13	0.58
Total HAP [5] =	**1.39**	**0.81**	**3.56**

Notes:

[1] AP-42 5.2-4 Eq.1: Loading Loss (lb/1000 gal) = 12.46 *S*P*M/T.

[2] Uncontrolled emissions that are captured by the collection system are routed to a vapor combustor. Per AP-42 5.2-6, 70% capture efficiency can be assumed for trucks not subject to NSPS. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

[3] AP-42 Section 7.1 - Properties of Selected Petroleum Liquids correlation with RVP estimated based on stabilization process.

[4] Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

[5] Speciated liquids analysis located in Fugitive Emissions Calculations. HAP weight % calculated as % of total hydrocarbons in the sample. All HAP assumed to volatilize from liquids for most conservative emissions estimate.

Pollutant	Wt%
n-Hexane	6.084%
Benzene	0.085%
Toluene	0.390%
Ethylbenzene	0.407%
Xylenes	1.363%
Total HAPs =	**8.329%**

SWN Production Company, LLC
OV Royalty Pad
Condensate Truck Loading Emissions - Greenhouse Gases

Loading Information

Unit ID:	**EU-LOAD-COND**
Fill Method:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
TOC Em. Factor (tonne/10^6 gal): [1]	0.91
Throughput (10^6 gal):	38.325
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Input CH_4 from Promax =	0.9745%
Input CO_2 from Promax =	0.0161%

Uncontrolled Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	0.15	0.09	0.34	0.37
CH_4 as CO_2e	3.67	2.14	8.50	9.37
CO_2	<0.01	<0.01	0.01	0.01
Total CO_2 + CO_2e =	**3.67**	**2.14**	**8.50**	**9.37**

SWN Production Company, LLC
OV Royalty Pad
Condensate Truck Loading Emissions - Greenhouse Gases (Continued)

Uncaptured Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	0.04	0.03	0.10	0.11
CH_4 as CO_2e	1.10	0.64	2.55	2.81
CO_2	<0.01	<0.01	<0.01	<0.01
Total CO_2 + CO_2e =	**1.10**	**0.64**	**2.55**	**2.81**

API Compendium Table 5-12

Loading Type	Emission Factor (tonne TOC/10^6 gal)
Rail/Truck - Submerged Loading - Dedicated Normal Service	0.91
Rail/Truck - Submerged Loading - Vapor Balance Service	1.51
Rail/Truck - Splash Loading - Dedicated Normal Service	2.20
Rail/Truck - Splash Loading - Vapor Balance Service	1.51
Marine Loading - Ships/Ocean Barges	0.28
Marine Loading - Barges	0.45

Notes:

[1] API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, Table 5-12.

[2] Uncontrolled emissions that are captured by the collection system are routed to a vapor combustor. Per AP-42 5.2-6, 70% capture efficiency can be assumed for trucks not subject to NSPS. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

[3] Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

[4] 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

SWN Production Company, LLC
OV Royalty Pad
Produced Water Truck Loading Emissions - Criteria and Hazardous Air Pollutants

Loading Information

Unit ID:	**EU-LOAD-PW**
Emission Point ID:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Saturation Factor:	0.6
Em. Factor (lb/1000 gal): [1]	0.07
Throughput (1000 gal):	15,330
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

0.2436	= P, True vapor pressure of liquid loaded (max. psia)
20.6523	= M, Molecular weight of vapor (lb/lb-mol)
50.33	= T, Temperature of bulk liquid loaded (average °F)
510.33	= T, Temperature of bulk liquid loaded (°F + 460 = °R)

Uncontrolled Loading Emissions[3]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**0.53**	**0.12**	**0.54**
n-Hexane	0.03	0.01	0.03
Benzene	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01
Xylenes	0.01	<0.01	0.01
Total HAP[4] =	**0.04**	**0.01**	**0.04**

SWN Production Company, LLC
OV Royalty Pad
Produced Water Truck Loading Emissions - Criteria and Hazardous Air Pollutants (Continued)

Uncaptured Loading Emissions[3]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**0.16**	**0.04**	**0.16**
n-Hexane	0.01	<0.01	0.01
Benzene	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01
Total HAP[4] =	**0.01**	**<0.01**	**0.01**

Notes:

[1] AP-42 5.2-4 Eq.1: Loading Loss (lb/1000 gal) = 12.46 *S*P*M/T. Properties based on mixture of 99% water and 1% condensate.

[2] Uncontrolled emissions that are captured by the collection system are routed to a vapor combustor. Per AP-42 5.2-6, 70% capture efficiency can be assumed for trucks not subject to NSPS. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

[3] Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

[4] Speciated liquids analysis located in Fugitive Emissions Calculations. HAP weight % calculated as % of total hydrocarbons in the sample. All HAP assumed to volatilize from liquids for most conservative emissions estimate.

Pollutant	Wt%
n-Hexane	6.084%
Benzene	0.085%
Toluene	0.390%
Ethylbenzene	0.407%
Xylenes	1.363%
Total HAPs =	**8.329%**

SWN Production Company, LLC
OV Royalty Pad
Produced Water Truck Loading Emissions - Greenhouse Gases

Loading Information

Unit ID:	**EU-LOAD-PW**
Fill Method:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
TOC Em. Factor (tonne/10^6 gal): [1]	0.91
Throughput (10^6 gal):	15.330
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Input CH_4 from Promax =	67.7850%
Input CO_2 from Promax =	0.9608%

Uncontrolled Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	10.20	2.38	9.46	10.42
CH_4 as CO_2e	254.98	59.50	236.41	260.59
CO_2	0.14	0.03	0.13	0.15
Total CO_2 + CO_2e =	**255.13**	**59.53**	**236.54**	**260.74**

SWN Production Company, LLC
OV Royalty Pad
Produced Water Truck Loading Emissions - Greenhouse Gases (Continued)

Uncaptured Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	3.06	0.71	2.84	3.13
CH_4 as CO_2e	76.49	17.85	70.92	78.18
CO_2	0.04	0.01	0.04	0.04
Total CO_2 + CO_2e =	**76.54**	**17.86**	**70.96**	**78.22**

API Compendium Table 5-12

Loading Type	Emission Factor (tonne TOC/10^6 gal)
Rail/Truck - Submerged Loading - Dedicated Normal Service	0.91
Rail/Truck - Submerged Loading - Vapor Balance Service	1.51
Rail/Truck - Splash Loading - Dedicated Normal Service	2.20
Rail/Truck - Splash Loading - Vapor Balance Service	1.51
Marine Loading - Ships/Ocean Barges	0.28
Marine Loading - Barges	0.45

Notes:

[1] API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, Table 5-12.

[2] Uncontrolled emissions that are captured by the collection system are routed to a vapor combustor. Per AP-42 5.2-6, 70% capture efficiency can be assumed for trucks not subject to NSPS. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

[3] Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

[4] 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

SWN Production Company, LLC
OV Royalty Pad
Tanks/Loading 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	-	-	-	4.14	18.13
	CO	0.2755	-		-	8.27	36.22
	PM	7.6	-		-	0.09	0.39
	VOC	Mass Balance	293.54	1,285.70	98.00%	5.87	25.71
	n-Hexane	Mass Balance	17.86	78.21	98.00%	0.36	1.58
	Benzene	Mass Balance	0.25	1.09	98.00%	0.01	0.02
	Toluene	Mass Balance	1.15	5.02	98.00%	0.02	0.10
	Ethylbenzene	Mass Balance	1.19	5.24	98.00%	0.02	0.10
	Xylenes	Mass Balance	4.00	17.53	98.00%	0.08	0.35

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 the combustor = 30.00 mmBtu/hr Total Heat Input

[2] Total captured emissions are based on 100% capture efficiency from storage tanks and 70% capture efficiency from truck loading with 98% destruction efficiency from the vapor combustor based on 8,760 hours of operation per year. Uncaptured vapors reported at loading emission units. Captured emissions from sources controlled by VOC combustor shown in following tables.

SWN Production Company, LLC
OV Royalty Pad
Tanks/Loading Vapor Combustor Emissions Calculations - Criteria and Hazardous Air Pollutants (Continued)

Source	Captured VOC Emissions	
	lb/hr	TPY
Condensate Storage Tanks	268.55	1,176.24
Produced Water Storage Tanks	2.12	9.28
Condensate Truck Loading	22.79	99.80
Produced Water Truck Loading	0.08	0.38
Total VOC =	**293.54**	**1,285.70**

Source	Captured HAP Emissions (lb/hr)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	16.34	0.23	1.05	1.09	3.66
Produced Water Storage Tanks	0.13	<0.01	0.01	0.01	0.03
Condensate Truck Loading	1.39	0.02	0.09	0.09	0.31
Produced Water Truck Loading	0.01	<0.01	<0.01	<0.01	<0.01
Total HAP =	**17.86**	**0.25**	**1.15**	**1.19**	**4.00**

Source	Captured HAP Emissions (TPY)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	71.56	1.00	4.59	4.79	16.03
Produced Water Storage Tanks	0.56	0.01	0.04	0.04	0.13
Condensate Truck Loading	6.07	0.09	0.39	0.41	1.36
Produced Water Truck Loading	0.02	<0.01	<0.01	<0.01	0.01
Total HAP =	**78.21**	**1.09**	**5.02**	**5.24**	**17.53**

SWN Production Company, LLC
OV Royalty Pad
Tanks/Loading 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):	30.00
Stream HHV (Btu/scf):	2,682
Annual Throughput (mmscf):	97.99
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions

Pollutant	lb/hr	tonnes/yr	tons/yr
CO_2	3,509.31	13,944.14	15,370.78
CH_4	0.07	0.26	0.29
N_2O	0.01	0.03	0.03
CH_4 as CO_2e	1.65	6.57	7.24
N_2O as CO_2e	1.97	7.83	8.63
Total CO_2 + CO_2e =	**3,512.94**	**13,958.54**	**15,386.66**

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

SWN Production Company, LLC
OV Royalty Pad
Vapor Combustor Pilot Emissions Calculations - Criteria Air Pollutants

Criteria Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors [1] (lb/mmscf)	Emissions lb/hr	Emissions TPY
EU-PILOT APC-COMB-TKLD	NOx	100	0.02	0.09
	CO	84	0.01	0.06
	VOC	5.5	<0.01	<0.01
	SO_2	0.6	<0.01	<0.01
	PM	7.6	<0.01	<0.01

905	Pilot Stream Heat Content (Btu/SCF)
8,760	Pilot Hours/Yr
150	Pilot Gas Flow Rate (SCFH)[2]
135,750	Total Pilot Gas Fuel Use (Btu/hr)
1.31	Total Annual Fuel Use (MMSCF)

Notes:

[1] AP-42 Table 1.4-1, -2 (7/98)

[2] Combustor is equipped with three (3) pilots with a pilot fuel consumption of 50 SCFH per pilot.

SWN Production Company, LLC
OV Royalty Pad
Vapor Combustor Pilot Emissions Calculations - Hazardous Air Pollutants

Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors [1] (lb/mmscf)	Emissions lb/hr	Emissions TPY
EU-PILOT APC-COMB-TKLD	n-Hexane	1.8	<0.01	<0.01
	Formaldehyde	0.075	<0.01	<0.01
	Benzene	0.0021	<0.01	<0.01
	Toluene	0.0034	<0.01	<0.01
		Total HAPs =	**<0.01**	**<0.01**

905	Pilot Stream Heat Content (Btu/SCF)
8,760	Pilot Hours/Yr
150	Pilot Gas Flow Rate (SCFH)2
135,750	Total Pilot Gas Fuel Use (Btu/hr)
1.31	Total Annual Fuel Use (MMSCF)

Notes:
[1] AP-42 Table 1.4-3 (7/98)

SWN Production Company, LLC
OV Royalty Pad
Vapor Combustor Pilot Emissions Calculations - Greenhouse Gases

Greenhouse Gas (GHG) Emissions

Unit ID	Pollutant	Emissions		
		lb/hr	tonnes/yr	tons/yr
EU-PILOT APC-COMB-TKLD	CO_2	15.88	63.10	69.56
	CH_4	<0.01	<0.01	<0.01
	N_2O	<0.01	<0.01	<0.01
	CH_4 as CO_2e	0.01	0.03	0.03
	N_2O as CO_2e	0.01	0.04	0.04
Total CO_2 + CO_2e =		**15.90**	**63.17**	**69.63**

905	Pilot Stream Heat Content (Btu/SCF)
8,760	Pilot Hours/Yr
150	Pilot Gas Flow Rate (SCFH)2
135,750	Total Pilot Gas Fuel Use (Btu/hr)
1.31	Total Annual Fuel Use (MMSCF)

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

SWN Production Company, LLC
OV Royalty 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	94	9.92E-03	0.00%	0.93	4.07	22.05%
Flanges - Gas	403	8.60E-04	0.00%	0.35	1.53	22.05%
Compressor Seals - Gas	9	1.94E-02	0.00%	0.17	0.74	22.05%
Relief Valves - Gas	34	1.94E-02	0.00%	0.66	2.89	22.05%
Open-Ended Lines - Gas	0	4.41E-03	0.00%	0.00	0.00	22.05%
Total TOC (Gas Components) =				**2.11**	**9.23**	-
Valves - Light Oil	103	5.51E-03	0.00%	0.57	2.50	94.33%
Flanges - Light Oil	406	2.43E-04	0.00%	0.10	0.44	94.33%
Pump Seals - Light Oil	0	2.87E-02	0.00%	0.00	0.00	94.33%
Other - Light Oil	0	1.65E-02	0.00%	0.00	0.00	94.33%
Total TOC (Liquid Components) =				**0.67**	**2.94**	-

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	0.21	0.90	1,801.47	0.49	2.15	<0.01	0.01
Flanges - Gas	0.08	0.33	669.36	0.18	0.81	<0.01	<0.01
Compressor Seals - Gas	0.04	0.17	337.30	0.09	0.39	<0.01	<0.01
Relief Valves - Gas	0.15	0.64	1,274.23	0.35	1.53	<0.01	0.01
Open-Ended Lines - Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Gas Service =	**0.47**	**2.04**	**4,082.35**	**1.11**	**4.87**	**<0.01**	**0.02**
Valves - Light Oil	0.54	2.35	4,690.86	0.01	0.03	<0.01	<0.01
Flanges - Light Oil	0.09	0.41	813.57	<0.01	0.01	<0.01	<0.01
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Liquid Service =	**0.63**	**2.77**	**5,518.80**	**0.01**	**0.04**	**<0.01**	**<0.01**
Total (Gas + Liquid Components) =	**1.10**	**4.81**	**9,601.15**	**1.12**	**4.91**	**<0.01**	**0.02**

SWN Production Company, LLC
OV Royalty 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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Gas Service =	**0.01**	**<0.01**	**<0.01**	**0.00**	**<0.01**	**0.00**	**0.01**
Valves - Light Oil	0.03	<0.01	<0.01	<0.01	0.01	0.00	0.05
Flanges - Light Oil	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Liquid Service =	**0.04**	**<0.01**	**<0.01**	**<0.01**	**0.01**	**0.00**	**0.06**
Total (Gas + Liquid Components) =	**0.05**	**<0.01**	**<0.01**	**<0.01**	**0.01**	**0.00**	**0.06**

Hazardous Air Pollutant (HAP) Emissions (TPY)

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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Gas Service =	**0.03**	**<0.01**	**<0.01**	**0.00**	**<0.01**	**0.00**	**0.03**
Valves - Light Oil	0.15	<0.01	0.01	0.01	0.03	0.00	0.21
Flanges - Light Oil	0.03	<0.01	<0.01	<0.01	0.01	0.00	0.04
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components in Liquid Service =	**0.18**	**<0.01**	**0.01**	**0.01**	**0.04**	**0.00**	**0.24**
Total (Gas + Liquid Components) =	**0.20**	**<0.01**	**0.01**	**0.01**	**0.04**	**0.00**	**0.27**

SWN Production Company, LLC
OV Royalty 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
Valves - Gas	12	3	2	5	5	0	0
Flanges - Gas	37	15	9	24	33	3	2
Compressor Seals - Gas	0	0	0	0	3	0	0
Relief Valves - Gas	1	3	1	1	1	1	1
Open-Ended Lines - Gas	0	0	0	0	0	0	0
Valves - Light Oil	0	5	6	12	3	6	9
Flanges - Light Oil	0	20	24	48	12	24	30
Pump Seals - Light Oil	0	0	0	0	0	0	0
Other - Light Oil	0	0	0	0	0	0	0

Equipment Type	WH	GPU	HT	LPT	FGC	OT	TT-O
Number of Each Type On Pad =	5	5	2	0	3	8	1

SWN Production Company, LLC
OV Royalty 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	0.112%	0.049	0.225%	-	<0.01	0.02
Nitrogen	28.013	0.552%	0.155	0.705%	-	0.01	0.07
Methane	16.042	71.526%	11.474	52.296%	52.787%	1.11	4.87
Ethane	30.069	18.189%	5.469	24.927%	25.161%	0.53	2.32
Propane	44.096	6.822%	3.008	13.711%	13.839%	0.29	1.28
i-Butane	58.122	0.533%	0.310	1.412%	1.425%	0.03	0.13
n-Butane	58.122	1.514%	0.880	4.011%	4.048%	0.09	0.37
i-Pentane	72.149	0.183%	0.132	0.602%	0.607%	0.01	0.06
n-Pentane	72.149	0.298%	0.215	0.980%	0.989%	0.02	0.09
n-Hexane	86.175	0.091%	0.078	0.357%	0.361%	0.01	0.03
Other Hexanes	86.175	0.097%	0.084	0.381%	0.385%	0.01	0.04
Heptanes (as n-Heptane)	100.202	0.059%	0.059	0.269%	0.272%	0.01	0.03
Benzene	78.114	0.001%	0.001	0.004%	0.004%	<0.01	<0.01
Toluene	92.141	0.002%	0.002	0.008%	0.008%	<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	0.015%	0.017	0.078%	0.079%	<0.01	0.01
Nonanes (as n-Nonane)	128.255	0.004%	0.005	0.023%	0.024%	<0.01	<0.01
Decanes (as n-Decane)	142.282	0.001%	0.001	0.006%	0.007%	<0.01	<0.01
TOTAL =		**100.00%**	**21.94**	**100.00%**	**100.00%**	**2.13**	**9.32**
		TOTAL HC =	**21.74**	**TOTAL VOC =**	**22.05%**	**0.46**	**2.04**
				TOTAL HAP =	**0.38%**	**0.01**	**0.03**

SWN Production Company, LLC
OV Royalty 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	0.011%	0.005	0.006%	-	<0.01	<0.01
Nitrogen	28.013	0.028%	0.008	0.010%	-	<0.01	<0.01
Methane	16.042	6.698%	1.074	1.396%	1.396%	0.01	0.04
Ethane	30.069	10.944%	3.291	4.275%	4.275%	0.03	0.13
Propane	44.096	13.880%	6.121	7.950%	7.952%	0.05	0.23
i-Butane	58.122	2.495%	1.450	1.884%	1.884%	0.01	0.06
n-Butane	58.122	10.341%	6.010	7.807%	7.809%	0.05	0.23
i-Pentane	72.149	3.123%	2.253	2.927%	2.927%	0.02	0.09
n-Pentane	72.149	6.463%	4.663	6.057%	6.058%	0.04	0.18
n-Hexane	86.175	5.434%	4.683	6.083%	6.084%	0.04	0.18
Other Hexanes	86.175	5.621%	4.844	6.292%	6.293%	0.04	0.19
Heptanes (as n-Heptane)	100.202	9.291%	9.310	12.093%	12.095%	0.08	0.36
Benzene	78.114	0.084%	0.066	0.085%	0.085%	<0.01	<0.01
Toluene	92.141	0.326%	0.300	0.390%	0.390%	<0.01	0.01
Ethylbenzene	106.167	0.295%	0.313	0.407%	0.407%	<0.01	0.01
Xylenes	106.167	0.988%	1.049	1.363%	1.363%	0.01	0.04
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	7.022%	8.021	10.419%	10.421%	0.07	0.31
Nonanes (as n-Nonane)	128.255	4.309%	5.527	7.179%	7.180%	0.05	0.21
Decanes (as n-Decane)	142.282	12.648%	17.996	23.376%	23.380%	0.16	0.69
TOTAL =		**100.00%**	**76.98**	**100.00%**	**100.00%**	**0.67**	**2.94**
		TOTAL HC =	**76.97**	**TOTAL VOC =**	**94.33%**	**0.63**	**2.77**
				TOTAL HAP =	**8.33%**	**0.06**	**0.24**

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

[4] Analyses located in Appendix A.

SWN Production Company, LLC
OV Royalty Pad
Fugitive Unpaved Haul Road Emissions Calculations

Facility Data [1]

Vehicle Type	Light Vehicles (Pick-ups and Cars)	Medium Trucks (Service Trucks)	Heavy Trucks (Tanker Trucks)[2]
Average vehicle weight ((empty + full)/2) (tons)	2	15	23.5
Number of wheels per vehicle type (w)	4	10	18
Average number of round trips/day/vehicle type	10	5	18
Distance per round trip (miles/trip)	0.78	0.78	0.78
Vehicle miles travelled (miles/day)	7.80	3.90	14.37
Number of days operational (days/yr)	365	365	365
Vehicle miles travelled VMT (miles/yr)	2,848.11	1,424.05	5,246.51
Average vehicle speed S (mph)	10	10	10
Average number of round trips/hour/vehicle type	0.56	0.28	1.02
Average number of round trips/year/vehicle type	3,650	1,825	6,724
Estimated maximum number of round trips/hour/vehicle type	3	3	2
Estimated maximum number of round trips/day/vehicle type	7	4	21
Estimated maximum number of round trips/year/vehicle type	2,683	1,533	8,049

190	Average Tanker Volume (bbl)
7,980	Gallons Tanker Volume
1,000	bwpd
2,500	bopd
18.42	Tanker Trucks per Day
1,650	Length Leased Access Road (ft)
410	Longest Pad Side (ft)
4,120	Total Round Trip Feet

Formula & Calculation Inputs

$E=k(s/12)^a * (W/3)^b * ((365-P) / 365)$

Reference : AP-42, Section 13.2.2 (11/06), Equation 1a and 2

where:

	Rate	Units	Comment	
Days per year	365			
Annual average hours per day of road operations	18			
k = PM Particle Size Multiplier	4.90	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)	
k = PM10 Particle Size Multiplier	1.50	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM_{10})	
k = PM2.5 Particle Size Multiplier	0.15	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 ($PM_{2.5}$)	
s = Surface Material Silt Content	3.9	%	State Default Data from AP-42 Data (1999 NEI Data)	
P = Number of days > 0.01 inch of rain	150	days/year	AP-42 Section 13.2.2 (11/06), Figure 13.2.2-1	
a = PM Constant	0.70	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)	
a = PM10 & PM2.5 Constant	0.90	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM_{10} & $PM_{2.5}$)	
b = PM, PM10, & PM2.5 Constant	0.45	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2	
Total hourly fleet vehicle miles travelled (miles/hr)	1.45	VMT/hr		
Total annual fleet vehicle miles travelled (miles/yr)[3]	9,518.67	VMT/yr		
Average wheels[4]	13			
Average vehicle weight of the fleet (W)[5]	15.8	tons		
Moisture Ratio	1.00		Estimated based on 0.2% uncontrolled surface water content assuming no watering	EPA - BID Document 13.2.2 - 1998
Control Efficiency (CF)	0.00	%	Based on Moisture Ratio and Figure 13.2.2-2 Control	

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SWN Production Company, LLC
OV Royalty Pad
Fugitive Unpaved Haul Road Emissions Calculations

Emission Calculations

	Emission Factors			Control Efficiency	Total Vehicle Miles Travelled		Uncontrolled Emission Rates			Uncontrolled Emission Rates		
	PM	PM_{10}	$PM_{2.5}$				Total PM	Total PM_{10}	$PM_{2.5}$	Total PM	Total PM_{10}	$PM_{2.5}$
Vehicle Type	**(lbs/VMT)**	**(lbs/VMT)**	**(lbs/VMT)**	**(%)**	**(VMT/hr)**	**(VMT/yr)**	**(lb/hr)**	**(lb/hr)**	**(lb/hr)**	**(tons/yr)**	**(tons/yr)**	**(tons/yr)**
Light Vehicles	2.78	0.68	0.07	0.00	0.43	2,848.11	1.21	0.30	0.03	3.96	0.97	0.10
Medium Trucks	2.78	0.68	0.07	0.00	0.22	1,424.05	0.60	0.15	0.02	1.98	0.48	0.05
Heavy Trucks	2.78	0.68	0.07	0.00	0.80	5,246.51	2.22	0.54	0.05	7.29	1.78	0.18
			Total =	**0.00**	**1.45**	**9,518.67**	**4.03**	**0.99**	**0.10**	**13.23**	**3.23**	**0.33**

Notes:

1) Facility vehicle data based on estimates, GP5.1 and AP-42 13.2.2-2 defaults for industrial unpaved roads

2) Tank trucker average vehicle weight as $(W_{(empty)}+W_{(full)})/2 = (7 + 40)/2 = 23.7$ tons

3) Average vehicle miles travelled (VMT/yr) as (No. of round trip/vehicle * No. of vehicles/type * Roundtrip miles/trip)* 365 days/yr * No. of vehicle type)

4) Average wheels calculated as average of (No. of wheels per vehicle type * No. of vehicle/type)

5) Average vehicle fleet calculated as (Average weight of vehicle type * Percentage of each vehicle type on unpaved surface). Percentage of each vehicle type= $VMT_{vehicle\ type}$/VMT

6) Minimum one-per-day average pick-up trucks and service trucks even if tanker not required every day.

7) Per EPA BID calculations, all emissions based on average trips. Estimated maximum hourly, daily and yearly trips provided for information only.

Calculation of Emission Factors (AP-42, 13.2.2)

Equation 1a: $EF = k(s/12)^a (W/3)^b$ *where k, a, and b are empirical constants and*

EF = size-specific emission factor (lb/VMT)

s = surface material silt content %

W = mean vehicle weight (tons)

Equation 2: $EF_{ext} = EF*((365-P)/365)$ *where:*

EF_{ext} *= annual size-specific emission factor extrapolated for natural mitigation, lb/VMT*

EF = emission factor from Equation 1a

P = number of days in a year with at least 0.01 inches of precipitation

Calculation of Emissions

$E = EF_{ext} * VMT/yr * ((1-CF)/100) * 1\ ton/2000\ lbs$ *where:*

E = annual emissions (tons/yr)

EF_{ext} *= annual size-specific emission factor extrapolated for natural mitigation, lb/VMT*

CF = control efficiency (%)

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	2.21 E+00	A
NO_x[c] <90% Load	2.27 E+00	C
CO[c] 90 - 105% Load	3.72 E+00	A
CO[c] <90% Load	3.51 E+00	C
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	3.58 E-01	C
Methane[g]	2.30 E-01	C
VOC[h]	2.96 E-02	C
PM10 (filterable)[i,j]	9.50 E-03	E
PM2.5 (filterable)[j]	9.50 E-03	E
PM Condensable[k]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[l]	2.53 E-05	C
1,1,2-Trichloroethane[l]	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene[l]	6.63 E-04	D
1,3-Dichloropropene[l]	<1.27 E-05	E
Acetaldehyde[l,m]	2.79 E-03	C
Acrolein[l,m]	2.63 E-03	C
Benzene[l]	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride[l]	<1.77 E-05	E

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Chlorobenzene[l]	<1.29 E-05	E
Chloroform[l]	<1.37 E-05	E
Ethane[n]	7.04 E-02	C
Ethylbenzene[l]	<2.48 E-05	E
Ethylene Dibromide[l]	<2.13 E-05	E
Formaldehyde[l,m]	2.05 E-02	A
Methanol[l]	3.06 E-03	D
Methylene Chloride[l]	4.12 E-05	C
Naphthalene[l]	<9.71 E-05	E
PAH[l]	1.41 E-04	D
Styrene[l]	<1.19 E-05	E
Toluene[l]	5.58 E-04	A
Vinyl Chloride[l]	<7.18 E-06	E
Xylene[l]	1.95 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM-10, "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. PM10 = 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 6 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.

[i] No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.

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

[k] No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.

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

[m] For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.

[n] Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_x emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_x emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
205-82-3	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
74-98-6	Propane	1.6E+00	E
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

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

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

loading operation, resulting in high levels of vapor generation and loss. If the turbulence is great enough, liquid droplets will be entrained in the vented vapors.

A second method of loading is submerged loading. Two types are the submerged fill pipe method and the bottom loading method. In the submerged fill pipe method, the fill pipe extends almost to the bottom of the cargo tank. In the bottom loading method, a permanent fill pipe is attached to the cargo tank bottom. During most of submerged loading by both methods, the fill pipe opening is below the liquid surface level. Liquid turbulence is controlled significantly during submerged loading, resulting in much lower vapor generation than encountered during splash loading.

The recent loading history of a cargo carrier is just as important a factor in loading losses as the method of loading. If the carrier has carried a nonvolatile liquid such as fuel oil, or has just been cleaned, it will contain vapor-free air. If it has just carried gasoline and has not been vented, the air in the carrier tank will contain volatile organic vapors, which will be expelled during the loading operation along with newly generated vapors.

Cargo carriers are sometimes designated to transport only one product, and in such cases are practicing "dedicated service". Dedicated gasoline cargo tanks return to a loading terminal containing air fully or partially saturated with vapor from the previous load. Cargo tanks may also be "switch loaded" with various products, so that a nonvolatile product being loaded may expel the vapors remaining from a previous load of a volatile product such as gasoline. These circumstances vary with the type of cargo tank and with the ownership of the carrier, the petroleum liquids being transported, geographic location, and season of the year.

One control measure for vapors displaced during liquid loading is called "vapor balance service", in which the cargo tank retrieves the vapors displaced during product unloading at bulk plants or service stations and transports the vapors back to the loading terminal. Figure 5.2-5 shows a tank truck in vapor balance service filling a service station underground tank and taking on displaced gasoline vapors for return to the terminal. A cargo tank returning to a bulk terminal in vapor balance service normally is saturated with organic vapors, and the presence of these vapors at the start of submerged loading of the tanker truck results in greater loading losses than encountered during nonvapor balance, or "normal", service. Vapor balance service is usually not practiced with marine vessels, although some vessels practice emission control by means of vapor transfer within their own cargo tanks during ballasting operations, discussed below.

Emissions from loading petroleum liquid can be estimated (with a probable error of ±30 percent)[4] using the following expression:

$$L_L = 12.46 \frac{SPM}{T} \quad (1)$$

where:

L_L = loading loss, pounds per 1000 gallons ($lb/10^3$ gal) of liquid loaded

S = a saturation factor (see Table 5.2-1)
P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia) (see Figure 7.1-5, Figure 7.1-6, and Table 7.1-2)
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Table 7.1-2)
T = temperature of bulk liquid loaded, °R (°F + 460)

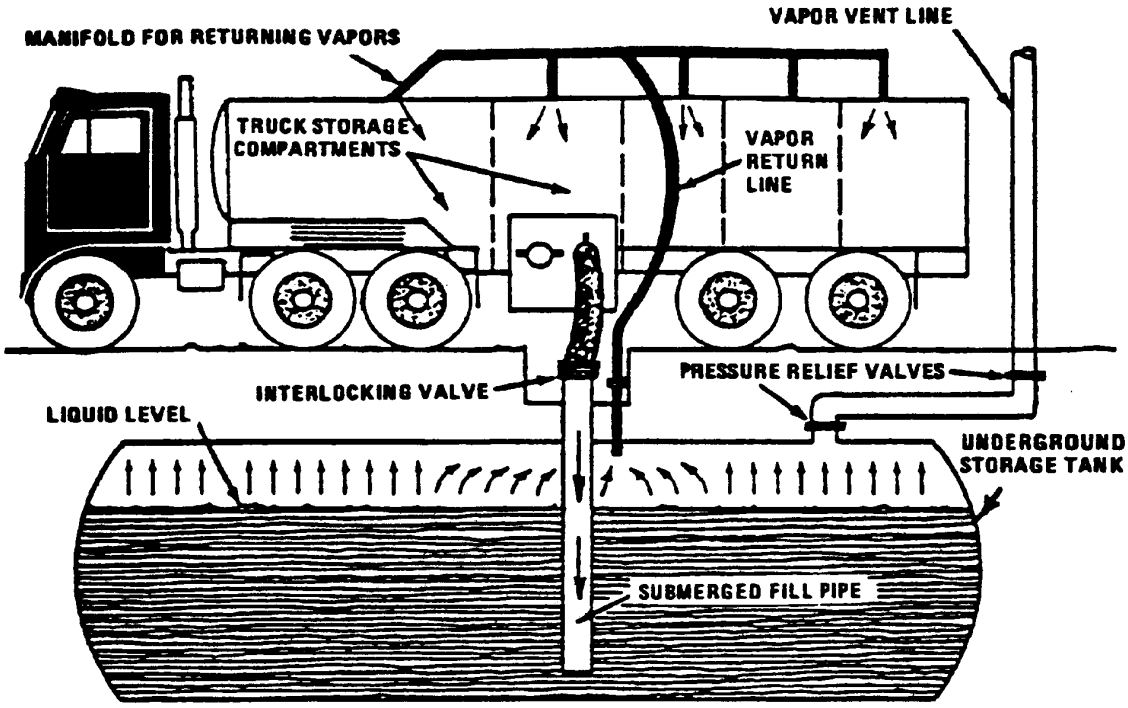

Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

Table 5.2-1. SATURATION (S) FACTORS FOR CALCULATING PETROLEUM LIQUID LOADING LOSSES

Cargo Carrier	Mode Of Operation	S Factor
Tank trucks and rail tank cars	Submerged loading of a clean cargo tank	0.50
	Submerged loading: dedicated normal service	0.60
	Submerged loading: dedicated vapor balance service	1.00
	Splash loading of a clean cargo tank	1.45
	Splash loading: dedicated normal service	1.45
	Splash loading: dedicated vapor balance service	1.00
Marine vessels[a]	Submerged loading: ships	0.2
	Submerged loading: barges	0.5

[a] For products other than gasoline and crude oil. For marine loading of gasoline, use factors from Table 5.2-2. For marine loading of crude oil, use Equations 2 and 3 and Table 5.2-3.

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.

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 T: FACILITY-WIDE EMISSION SUMMARY SHEETS

ATTACHMENT T – 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}		$PM_{2.5}$		GHG (CO_2e)	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-ENG1	0.32	1.40	0.64	2.80	0.24	1.05	<0.01	<0.01	0.02	0.09	0.02	0.09	155.19	679.73
EP-ENG2	0.32	1.40	0.64	2.80	0.24	1.05	0.01	0.04	0.02	0.09	0.02	0.09	155.19	679.73
EP-ENG3	0.47	2.06	0.95	4.16	0.36	1.58	<0.01	<0.01	0.03	0.14	0.03	0.14	252.84	1,107.42
EP-ENG4	0.46	2.01	0.75	3.29	0.47	2.06	<0.01	<0.01	0.01	0.04	0.01	0.04	74.96	328.34
EP-GPU1 - EP-GPU5	0.55	2.40	0.45	1.95	0.03	0.15	<0.01	0.01	0.04	0.18	0.04	0.18	585.49	2,564.44
EP-HT1 - EP-HT2	0.12	0.52	0.10	0.44	0.01	0.02	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-SH1 - EP-SH2	0.34	1.48	0.28	1.22	0.02	0.08	<0.01	0.01	0.03	0.11	0.03	0.11	351.29	1,538.67
APC-COMB-TKLD	4.16	18.22	8.28	36.28	15.67	68.64	<0.01	<0.01	0.09	0.40	0.09	0.40	3,547.34	15,537.32
TOTAL	6.74	29.50	12.09	52.94	17.03	74.64	0.02	0.08	0.25	1.09	0.25	1.09	5,239.40	22,948.54

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 uncaptured emissions from loading operations, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions.

ATTACHMENT T – 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	0.02	0.09	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.03	0.15
EP-ENG2	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-ENG3	0.03	0.13	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.05	0.21
EP-ENG4	0.00	0.06	0.00	<0.01	<0.01	<0.01	0.00	<0.01	<0.01	<0.01	-	-	<0.01	0.09
EP-GPU1 - EP-GPU5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	0.01	0.04	0.01	0.05
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-SH1 - EP-SH2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	0.01	0.03	0.01	0.03
APC-COMB-TKLD	<0.01	<0.01	0.01	0.06	0.06	0.27	0.06	0.28	0.21	0.94	0.96	4.19	1.31	5.73
TOTAL	0.07	0.38	0.02	0.09	0.06	0.28	0.06	0.28	0.21	0.94	0.97	4.27	1.44	6.41

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 uncaptured emissions from loading operations, uncombusted emissions from the tanks and loading operations, as well as combustor pilot emissions.

ATTACHMENT U: CLASS I 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-B General Permit Registration for a natural gas production facility (OV Royalty Pad) located in Brooke County, West Virginia. From CR 2 in Wellsburg, turn east on CR 27 and travel 3.19 miles to CR 18 (North View Road, a.k.a. Rabbit Hill Road). Drovers Inn is on the corner. Turn left (north) onto CR 18 and travel 2.62 miles to access road on left. Latitude and longitude coordinates are 40.285661, -80.584609.

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

Nitrogen Oxides (NOx)	29.50 tons/yr
Carbon Monoxide (CO)	52.94 tons/yr
Volatile Organic Compounds (VOC)	79.45 tons/yr
Sulfur Dioxide (SO_2)	0.08 tons/yr
Particulate Matter (PM)	14.32 tons/yr
Acetaldehyde	0.06 tons/yr
Acrolein	0.06 tons/yr
Benzene	0.09 tons/yr
Ethylbenzene	0.29 tons/yr
Formaldehyde	0.38 tons/yr
Methanol	0.06 tons/yr
n-Hexane	4.47 tons/yr
Toluene	0.29 tons/yr
Xylenes	0.98 tons/yr
Carbon Dioxide	22,844.31 tons/yr
Methane	8.58 tons/yr
Nitrous Oxide	0.04 tons/yr
CO_2 Equivalent	23,071.31 tons/yr

The change in equipment and operations is planned to begin on or about January 10, 2016. 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 25 of November, 2015

By: SWN Production Company, LLC
Paul Geiger
Senior Vice President – Ops Management
10000 Energy Drive
Spring, TX 77389