



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

MARK EDISON PAD

G70-D REGISTRATION APPLICATION

I	CM	4/10/2017	G70-D REGISTRATION	AL	4/11/2017
REV	BY	DATE	DESCRIPTION	FACILITIES REVIEWED	DATE

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this G70-D General Permit application for the Mark Edison Pad, a proposed natural gas production facility in Marshall County. With this application, SWN requests authorization to operate under the General Permit G70-D for Oil and Natural Gas Production Facilities. Equipment to be authorized includes the following:

- One (1) Caterpillar G3306 NA Compressor Engine
- One (1) Zenith ZPP-644 4.4 L Compressor Engine
- One (1) 1.0-mmBtu/hr Gas Production Unit
- One (1) 0.5-mmBtu/hr Heater Treater
- One (1) 24-MMSCFD TEG Dehydration Unit
- One (1) 0.75-mmBtu/hr TEG Reboiler
- Two (2) 400-bbl Condensate Tanks
- Two (2) 400-bbl Produced Water Tanks
- Condensate Truck Loading
- Produced Water Truck Loading
- One (1) 15.0-mmBtu/hr Vapor Combustor with Pilot
- Fugitive Emissions
- Fugitive Haul Road Emissions

Note that other small storage tanks may be present on site (i.e., methanol, lube oil) but are considered de minimis sources per Table 45-13B and are listed on the application form.

Proposed Emissions

Emissions calculations for the facility are presented in Attachment T. A fuel heating value of 905 Btu/scf was used to calculate emissions from natural gas-fired equipment. Actual heating value may vary (generally 905 - 1,300) but using a lower heating value in the emissions calculations provides a more conservative (higher) estimate of fuel use.

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

Condensate and produced water tank emissions and loading emissions were calculated using ProMax process simulation software. Tank emissions are routed to a vapor combustor with 100% capture efficiency and 98% destruction efficiency. Loading emissions are routed to a vapor combustor with 70% capture efficiency and 98% destruction efficiency.

TEG dehydration unit emissions were estimated using the George Gantzer No. 8-H PVT and GRI-GLYCalc™ 4.0 software. Still vent emissions are reduced by an air-cooled condenser and non-condensable gases are routed to the reboiler as fuel with an estimated 50% destruction efficiency. Flash tank off-gases are routed to the heater treater and then recompressed. Flash tank off-gases can also be used as supplemental fuel for the reboiler; therefore, a destruction efficiency of 98% was used in GLYCalc as a conservative measure.

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

Regulatory Discussion

STATE

45 CSR 13 - PERMITS FOR CONSTRUCTION, MODIFICATION, RELOCATION AND OPERATION OF STATIONARY SOURCES OF AIR POLLUTANTS, NOTIFICATION REQUIREMENTS, ADMINISTRATIVE UPDATES, TEMPORARY PERMITS, GENERAL PERMITS, AND PROCEDURES FOR EVALUATION:

The facility requests to operate under the General Permit G70-D. Emissions of carbon monoxide and volatile organic compounds are less than 80 tons per year (TPY). Oxides of nitrogen emissions are less than 50 TPY and particulate matter 10/2.5 and sulfur dioxide emissions are each less than 20 TPY. Also, the facility will have less than 8 TPY for each hazardous air pollutant and less than 20 tons for total hazardous air pollutants.

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 (m³) 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 m³ (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 proposed 145-hp, four-stroke, rich-burn natural gas-fired flash gas compressor engine is assumed to have been constructed after the June 12, 2006 effective date and manufactured after July 1, 2008; therefore, it will be subject to this Subpart. Although final selection of the engine has not yet been made, it is presumed that the engine was manufactured after January 1, 2011 and therefore subject to Stage 2 emission limitations under this Subpart. The Zenith engine will be certified to meet the standards of this Subpart. SWN will comply with all applicable requirements.

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

The emission sources affected by this Subpart include well completions, pneumatic controllers, equipment leaks from natural gas processing plants, sweetening units at natural gas processing

plants, reciprocating compressors, centrifugal compressors and storage vessels which are constructed, modified or reconstructed after August 23, 2011 and before September 18, 2015.

The existing well at this location was completed during the effective date of this Subpart and is subject to the compliance requirements. The remaining proposed equipment at this production pad will be constructed after the effective date of this Subpart.

40 CFR PART 60 SUBPART OOOOA - STANDARDS OF PERFORMANCE FOR CRUDE OIL AND NATURAL GAS FACILITIES FOR WHICH CONSTRUCTION, MODIFICATION, OR RECONSTRUCTION COMMENCED AFTER SEPTEMBER 18, 2015:

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

The well at this location was completed before the effective date of this Subpart and is not subject to the compliance requirements. There is no centrifugal compressor using wet gas seals at this facility. The pneumatic controllers utilized at the facility are considered low-bleed and are not subject to this Subpart. The storage vessel venting is controlled to less than six (6) TPY VOC and federally enforceable limits are requested; therefore, the storage vessels are not subject to this Subpart.

The site is considered a new affected facility because it was constructed after September 18, 2015 and it is subject to the fugitive source monitoring requirements of 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. Even though the TEG dehydration unit at this facility is considered an affected area source, it is exempt from the requirements of § 63.764(d)(2) since the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 Mg (1.0 TPY), as

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

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 (HP) located at a major source of HAP emissions. On January 18, 2008, EPA published an amendment that promulgated standards for RICE constructed or reconstructed after June 12, 2006 with a site rating less than or equal to 500 HP located at major sources, and for engines constructed and reconstructed after June 12, 2006 located at area sources. On August 10, 2010, EPA published another amendment that promulgated standards for existing (constructed or reconstructed before June 12, 2006) RICE at area sources and existing RICE (constructed or reconstructed before June 12, 2006) with a site rating of less than or equal to 500 HP at major sources.

Owners and operators of new or reconstructed engines at area sources must meet the requirements of Subpart ZZZZ by complying with either 40 CFR Part 60 Subpart IIII (for CI engines) or 40 CFR Part 60 Subpart JJJJ (for SI engines). Based on emission calculations, this facility is a minor source of HAP. The 145-hp, four-stroke, rich-burn natural gas-fired flash gas compressor engine is considered a new engine manufactured after January 1, 2011 and will meet the requirements of this Subpart by complying with requirements under NSPS Subpart JJJJ. The Zenith engine will meet the requirements of this Subpart by complying with requirements under NSPS Subpart JJJJ.

APPLICATION FOR GENERAL PERMIT REGISTRATION



west virginia department of environmental protection

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

G70-D GENERAL PERMIT REGISTRATION APPLICATION

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

- CONSTRUCTION CLASS I ADMINISTRATIVE UPDATE
MODIFICATION CLASS II ADMINISTRATIVE UPDATE
RELOCATION

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: Mark Edison Pad

Operating Site Physical Address: 749 Hanlin Hill Lane
If none available, list road, city or town and zip of facility.

City: Wheeling

Zip Code: 26003

County: Marshall

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

Latitude: 39.97614

Longitude: -80.65023

SIC Code: 1311

DAQ Facility ID No. (For existing facilities)

NAICS Code: 211111

CERTIFICATION OF INFORMATION

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

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

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

Responsible Official Signature:

Carla Suszkowski

Name and Title: Carla Suszkowski

Phone: 832-796-1000

Fax: 405-849-3102

Email: Carla_Suszkowski@SWN.com

Date: 4-12-2017

If applicable:

Authorized Representative Signature:

Name and Title:

Phone:

Fax:

Email:

Date:

If applicable:

Environmental Contact

Name and Title: Clay Murrel

Phone: 304-884-1715

Fax:

Email: Clay_Murrel@SWN.com

Date:

OPERATING SITE INFORMATION

Briefly describe the proposed new operation and/or any change(s) to the facility: This application includes one (1) Caterpillar G3306 NA engine (EU-ENG1), one (1) Zenith ZPP-644 4.4 L engine (EU-ENG2), one (1) 1.0-mmBtu/hr natural gas-fired gas production unit (GPU) burner (EU-GPU1), one (1) 0.5-mmBtu/hr natural gas-fired heater treater (EU-HT1), one (1) 24-MMSCFD TEG dehydration unit (EU-DEHY1), one (1) 0.75-mmBtu/hr TEG reboiler (EU-RB1), two (2) 400-bbl condensate tanks (EU-TANKS-COND), two (2) 400-bbl produced water tanks (EU-TANKS-PW), condensate and produced water truck loading (EU-LOAD-COND and EU-LOAD-PW), one (1) 15.0-mmBtu/hr vapor combustor (APC-COMB) with one (1) 50-SCFH pilot (EU-PILOT), fugitive emissions (EU-FUG), and fugitive haul road emissions (EU-HR).

Directions to the facility: From Exit 2 on I-470, go south on CR 91/1, W. Bethlehem Blvd. for 0.45 miles. Turn right on WV-88, Ridgecrest Rd, go 5.7 miles. Turn left on CR 88/10, Hanlin Hill Rd, go 0.7 miles.

ATTACHMENTS AND SUPPORTING DOCUMENTS

I have enclosed the following required documents:

Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22).

- Check attached to front of application.
- I wish to pay by electronic transfer. Contact for payment (incl. name and email address):
- I wish to pay by credit card. Contact for payment (incl. name and email address):
- \$500 (Construction, Modification, and Relocation) \$300 (Class II Administrative Update)
- \$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ, OOOO and/or OOOOa ¹
- \$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH ²

¹ Only one NSPS fee will apply.
² Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ.
NSPS and NESHAP fees apply to new construction or if the source is being modified.

- Responsible Official or Authorized Representative Signature (if applicable)
- Single Source Determination Form (**must be completed**) – Attachment A
- Siting Criteria Waiver (if applicable) – Attachment B Current Business Certificate – Attachment C
- Process Flow Diagram – Attachment D Process Description – Attachment E
- Plot Plan – Attachment F Area Map – Attachment G
- G70-D Section Applicability Form – Attachment H Emission Units/ERD Table – Attachment I
- Fugitive Emissions Summary Sheet – Attachment J
- Gas Well Affected Facility Data Sheet (if applicable) – Attachment K
- Storage Vessel(s) Data Sheet (include gas sample data, USEPA Tanks, simulation software (e.g. ProMax, E&P Tanks, HYSYS, etc.), etc. where applicable) – Attachment L
- Natural Gas Fired Fuel Burning Unit(s) Data Sheet (GPUs, Heater Treaters, In-Line Heaters if applicable) – Attachment M
- Internal Combustion Engine Data Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment N
- Tanker Truck/Rail Car Loading Data Sheet (if applicable) – Attachment O
- Glycol Dehydration Unit Data Sheet(s) (include wet gas analysis, GRI- GLYCalc™ input and output reports and information on reboiler if applicable) – Attachment P
- Pneumatic Controllers Data Sheet – Attachment Q
- Pneumatic Pump Data Sheet – Attachment R
- Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment S
- Emission Calculations (please be specific and include all calculation methodologies used) – Attachment T
- Facility-wide Emission Summary Sheet(s) – Attachment U
- Class I Legal Advertisement – Attachment V
- One (1) paper copy and two (2) copies of CD or DVD with pdf copy of application and attachments

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

ATTACHMENT A: SINGLE SOURCE DETERMINATION

ATTACHMENT A - SINGLE SOURCE DETERMINATION FORM

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

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

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

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

Yes No

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

Yes No

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








Yes No

Proximity Map



Mark Edison Pad

NAD83 UTM Zone 17N
529.936 4,425.168 Kilometers
-80.650231 39.976137 Decimal Degrees

- | | |
|--|---|
|  Schools |  Compressor Stations |
|  Residential Structures |  Processing Plant |
|  Rivers and Lakes |  Power Plant |
| |  Hospital |

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: **[Signature]**
the West Virginia State Tax Commissioner,
in accordance with Chapter 11, Article 12, of the West Virginia Code.

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

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

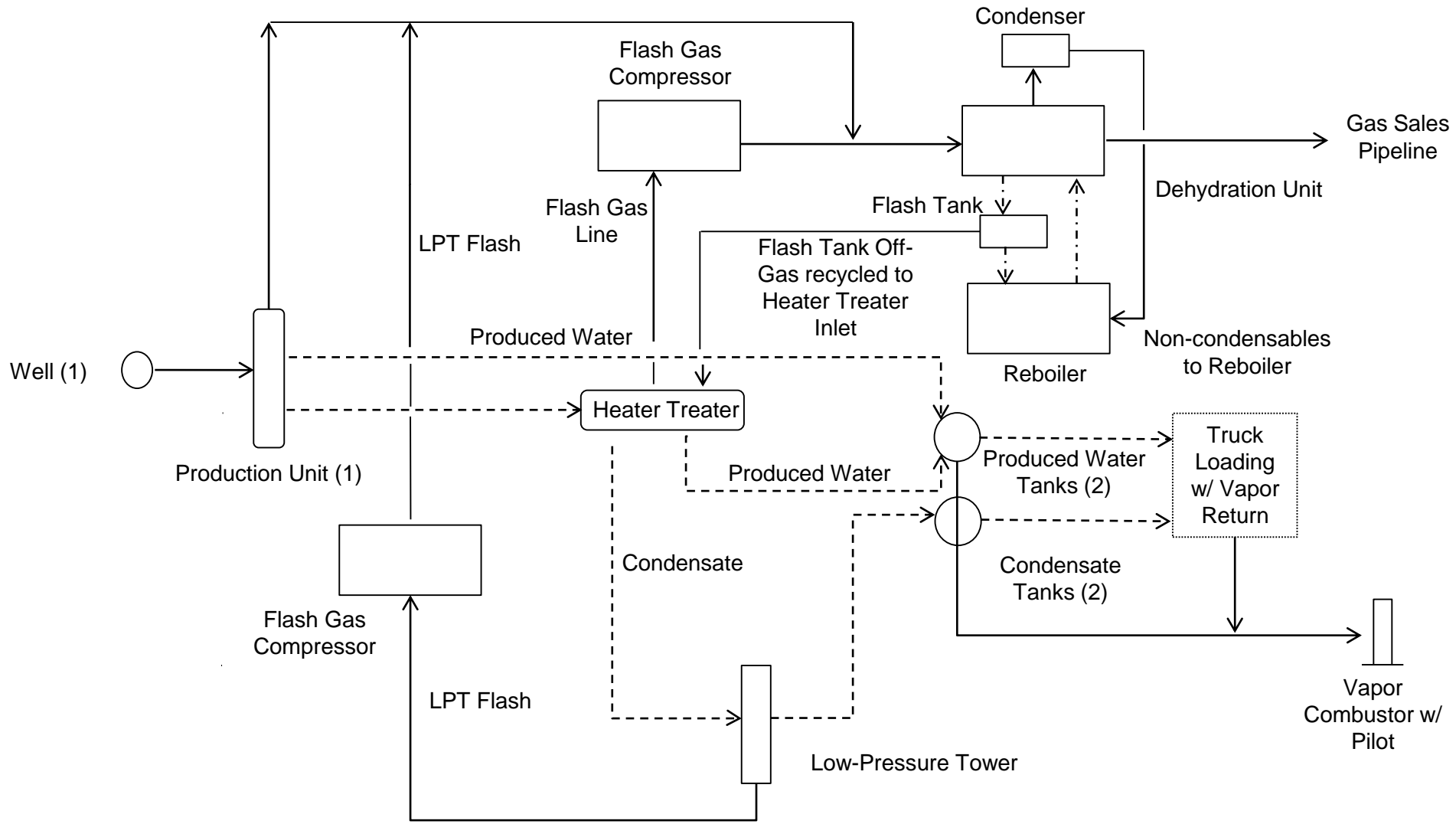
This certificate shall be permanent until cessation of the business for which the certificate of registration
was granted, or until it is suspended, revoked or cancelled by the Tax Commissioner.

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

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

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ATTACHMENT D: PROCESS FLOW DIAGRAM



- Gas/Vapor
- Liquids (Condensate and Produced Water)
- Glycol

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

SWN Production Company, LLC
Mark Edison Pad
 Attachment D: Process Flow Diagram
 April 2017

ATTACHMENT E: PROCESS DESCRIPTION

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

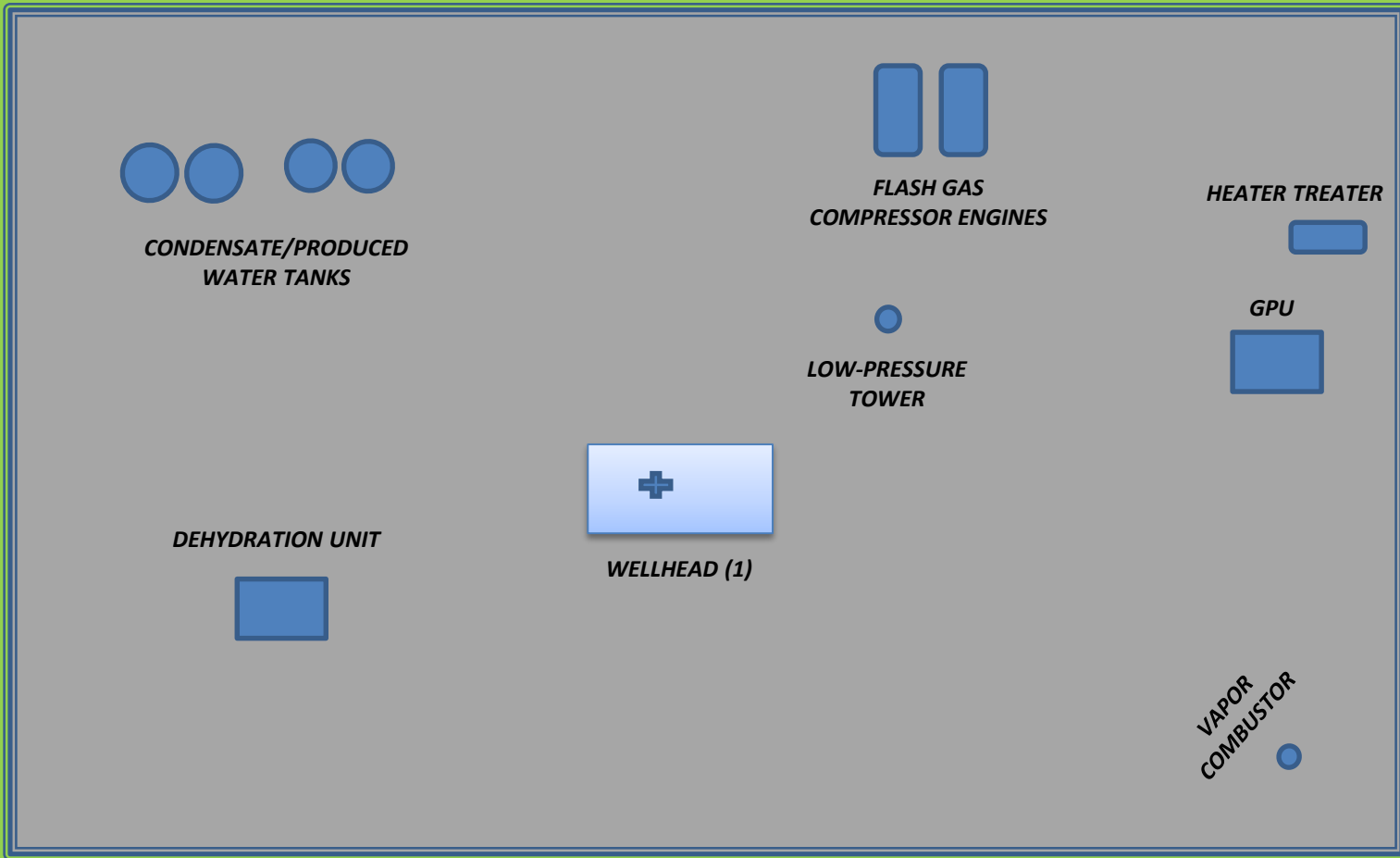
Working, breathing and flashing vapors from the condensate and produced water storage tanks are routed to the vapor combustor with 100% capture efficiency to be burned with at least 98% combustion efficiency. The vapor combustor has one (1) natural gas-fired pilot to ensure a constant flame for combustion.

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

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

ATTACHMENT F: PLOT PLAN

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



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

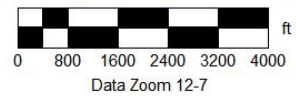
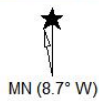
ATTACHMENT G: AREA MAPS



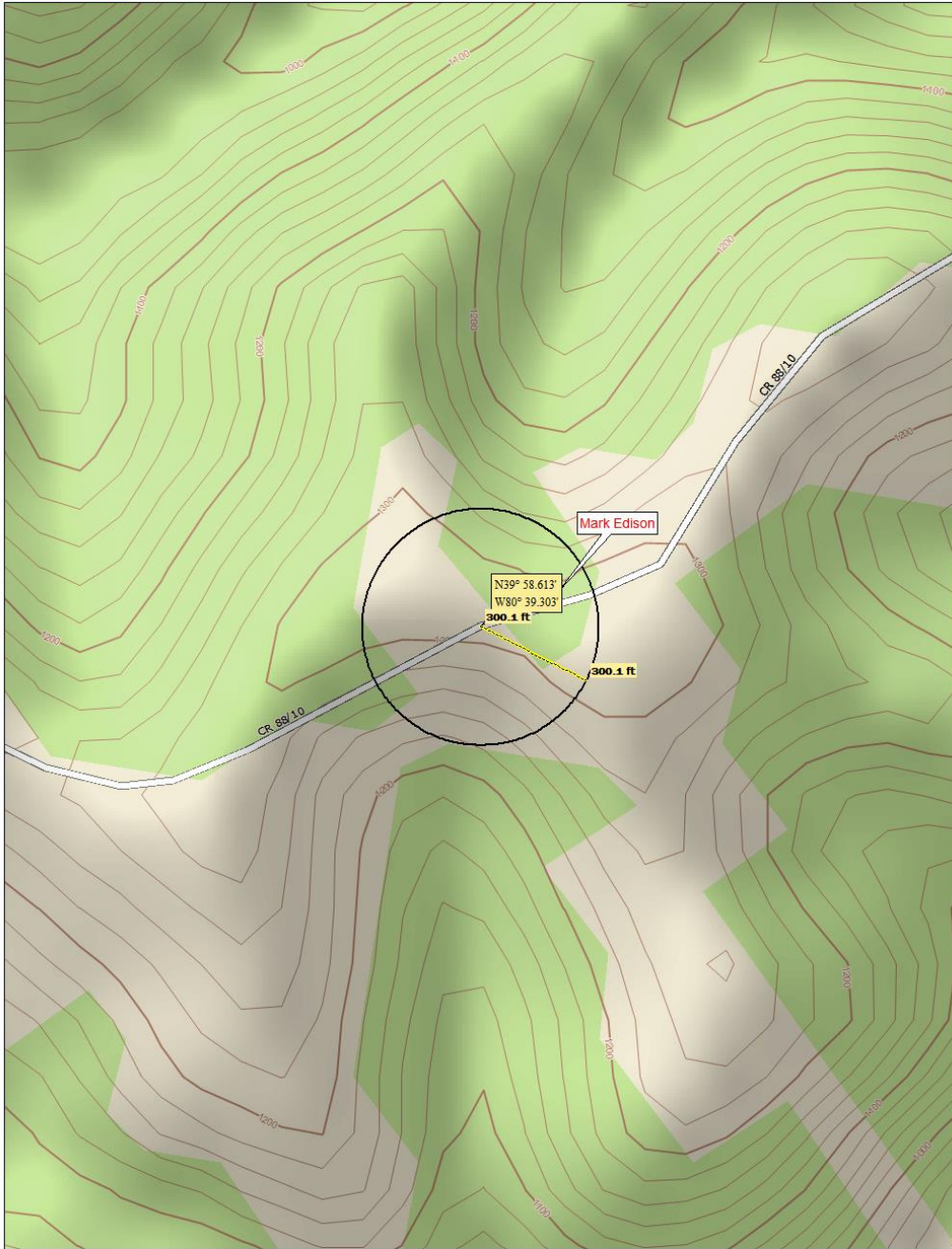
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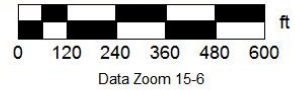
www.delorme.com



SWN Production Company, LLC
Mark Edison Pad
 Attachment G: Area Map
 April 2017



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SWN Production Company, LLC
Mark Edison Pad
Attachment G: Area Map with 300' Radius
April 2017

ATTACHMENT H: G70-D SECTION APPLICABILITY FORM

ATTACHMENT H – G70-D SECTION APPLICABILITY FORM

**General Permit G70-D Registration
Section Applicability Form**

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

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

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

- 1 Applicants that are subject to Section 6 may also be subject to Section 7 if the applicant is subject to the NSPS, Subparts OOOO or OOOOa control requirements or the applicable control device requirements of Section 8.
- 2 Applicants that are subject to Section 14 may also be subject to control device and emission reduction device requirements of Section 8.
- 3 Applicants that are subject to Section 15 may also be subject to the requirements of Section 9 (reboilers). Applicants that are subject to Section 15 may also be subject to control device and emission reduction device requirements of Section 8.

ATTACHMENT I: EMISSIONS UNITS/ERD TABLE

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

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

Emission Unit ID ¹	Emission Point ID ²	Emission Unit Description	Year Installed	Manufac. Date ³	Design Capacity	Type ⁴ and Date of Change	Control Device(s) ⁵	ERD(s) ⁶
EU-ENG1	EP-ENG1	145-hp Caterpillar G3306 NA Engine	TBD	after 1/1/2011	145-hp	New	NSCR	NSCR
EU-ENG2	EP-ENG2	103.3-hp Zenith ZPP-644 4.4L Engine	TBD	after 1/1/2011	103.3-hp	New	NSCR	NSCR
EU-GPU1	EP-GPU1	1.0-mmBtu/hr GPU Burner	TBD	N/A	1.0-mmBtu/hr	New	N/A	N/A
EU-HT1	EP-HT1	0.5-mmBtu/hr Heater Treater	TBD	N/A	0.5-mmBtu/hr	New	N/A	N/A
EU-DEHY1	EP-RB1	24.0-MMSCFD TEG Dehydration Unit	TBD	N/A	24.0 MMSCFD	New	Condenser and EU-RB1	Condenser and EU-RB1
EU-RB1	EP-RB1	0.75-mmBtu/hr TEG Reboiler	TBD	N/A	0.75-mmBtu/hr	New	N/A	N/A
EU-TANKS-COND	APC-COMB	Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	TBD	N/A	400-bbl	New	APC-COMB	APC-COMB
EU-TANKS-PW	APC-COMB	Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	TBD	N/A	400-bbl	New	APC-COMB	APC-COMB
EU-LOAD-COND	APC-COMB	Condensate Truck Loading w/ Vapor Return Routed to Combustor	TBD	N/A	6,132,000 gal/yr	New	Vapor Return and APC-COMB	Vapor Return and APC-COMB
EU-LOAD-PW	APC-COMB	Produced Water Truck Loading w/ Vapor Return Routed to Combustor	TBD	N/A	5,365,500 gal/yr	New	Vapor Return and APC-COMB	Vapor Return and APC-COMB
APC-COMB	APC-COMB	15.0-mmBtu/hr Vapor Combustor	TBD	N/A	15.0-mmBtu/hr	New	N/A	N/A
EU-PILOT	APC-COMB	Vapor Combustor Pilot	TBD	N/A	50-scfh	New	N/A	N/A
EU-FUG	EP-FUG	Fugitive Emissions	TBD	N/A	N/A	New	N/A	N/A
EU-HR	EP-HR	Fugitive Haul Road Emissions	TBD	N/A	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: EU-FUG

Leak Detection Method Used		<input type="checkbox"/> Audible, visual, and olfactory (AVO) inspections		<input type="checkbox"/> Infrared (FLIR) cameras		<input type="checkbox"/> Other (please describe)		<input type="checkbox"/> None required	
Component Type	Closed Vent System	Count	Source of Leak Factors (EPA, other (specify))	Stream type (gas, liquid, etc.)	Estimated Emissions (tpy)				
					VOC	HAP	GHG (methane, CO _{2e})		
Pumps	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both					
Valves	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	56 – gas 50 – LL	EPA	<input type="checkbox"/> Gas <input type="checkbox"/> Liquid <input checked="" type="checkbox"/> Both	0.592 – gas 1.14 – LL	0.01 – gas 0.10 – LL	31.62 – gas 0.55 – LL		
Safety Relief Valves	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	13	EPA	<input checked="" type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both	0.27	<0.01	14.35		
Open Ended Lines	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	2	EPA	<input checked="" type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both	0.01	<0.01	0.50		
Sampling Connections	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both					
Connections (Not sampling)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	194	EPA	<input type="checkbox"/> Gas <input checked="" type="checkbox"/> Liquid <input type="checkbox"/> Both	0.37	0.03	0.18		
Compressors	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	6	EPA	<input checked="" type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both	0.12	<0.01	6.63		
Flanges	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	249	EPA	<input checked="" type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both	0.23	<0.01	12.19		
Other ¹	<input type="checkbox"/> Yes <input type="checkbox"/> No			<input type="checkbox"/> Gas <input type="checkbox"/> Liquid <input type="checkbox"/> Both					

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

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

Please indicate if there are any closed vent bypasses (include component):

N/A

Specify all equipment used in the closed vent system (e.g. VRU, ERD, thief hatches, tanker truck/rail car loading, etc.)

N/A

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

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

^aWater/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.

^bThese 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.

^cThe "other" equipment type was derived from compressors, diaphragms, 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 K: GAS WELL AFFECTED FACILITY DATA SHEET

ATTACHMENT K – GAS WELL AFFECTED FACILITY DATA SHEET

Complete this data sheet if you are the owner or operator of a gas well affected facility for which construction, modification or reconstruction commenced after August 23, 2011. This form must be completed for natural gas well affected facilities regardless of when flowback operations occur (or have occurred).

API Number	Date of Flowback	Date of Well Completion	Green Completion and/or Combustion Device	Subject to OOOO or OOOOa?
047-051-01692	10/13/2014	9/15/2014	Green Completion	OOOO

Note: If future wells are planned and no API number is available please list as PLANNED. If there are existing wells that commenced construction prior to August 23, 2011, please acknowledge as existing.

This is the same API (American Petroleum Institute) well number(s) provided in the well completion notification and as provided to the WVDEP, Office of Oil and Gas for the well permit. The API number may be provided on the application without the state code (047).

Every oil and gas well permitted in West Virginia since 1929 has been issued an API number. This API is used by agencies to identify and track oil and gas wells.

The API number has the following format: 047-001-00001

- Where,*
- 047 = State code. The state code for WV is 047.*
- 001 = County Code. County codes are odd numbers, beginning with 001 (Barbour) and continuing to 109 (Wyoming).*
- 00001= Well number. Each well will have a unique well number.*

ATTACHMENT L: STORAGE VESSELS DATA SHEET

REPRESENTATIVE GAS ANALYSES
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 Two (2) 400-bbl Condensate Storage Tanks
3. Emission Unit ID number EU-TANKS-COND	4. Emission Point ID number APC-COMB
5. Date Installed , Modified or Relocated (<i>for existing tanks</i>) TBD Was the tank manufactured after August 23, 2011 and on or before September 18, 2015? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Was the tank manufactured after September 18, 2015? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	6. Type of change: <input checked="" type="checkbox"/> New construction <input type="checkbox"/> New stored material <input type="checkbox"/> Other <input type="checkbox"/> Relocation
7A. Description of Tank Modification (<i>if applicable</i>)	
7B. Will more than one material be stored in this tank? <i>If so, a separate form must be completed for each material.</i> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
7C. Was USEPA Tanks simulation software utilized? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
<i>If Yes, please provide the appropriate documentation and items 8-42 below are not required.</i>	

1. Bulk Storage Area Name Produced Water Storage	2. Tank Name Two (2) 400-bbl Produced Water Storage Tanks
3. Emission Unit ID number EU-TANKS-PW	4. Emission Point ID number APC-COMB
5. Date Installed , Modified or Relocated <i>(for existing tanks)</i> TBD Was the tank manufactured after August 23, 2011 and on or before September 18, 2015? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Was the tank manufactured after September 18, 2015? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	6. Type of change: <input checked="" type="checkbox"/> New construction <input type="checkbox"/> New stored material <input type="checkbox"/> Other <input type="checkbox"/> Relocation
7A. Description of Tank Modification <i>(if applicable)</i>	
7B. Will more than one material be stored in this tank? <i>If so, a separate form must be completed for each material.</i> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
7C. Was USEPA Tanks simulation software utilized? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <i>If Yes, please provide the appropriate documentation and items 8-42 below are not required.</i>	

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-LUBE OIL	NEW	Lube Oil	50 gal
EU-TANKS-LUBE OIL	NEW	Lube Oil	50 gal
EU-TANKS-METHANOL	NEW	Methanol	50 gal
EU-TANKS-METHANOL	NEW	Methanol	50 gal
EU-TANKS-METHANOL	EXIST	Methanol	50 gal

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

TABLE 1-B

COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C₁₁₊

SEPARATOR GOR.....: 16357 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 390 psig
SEPARATOR TEMPERATURE.....: 83 °F

Component	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.513	0.000	0.026	0.008	0.483	0.000
Carbon Dioxide	0.149	0.000	0.013	0.006	0.140	0.000
Methane	71.427	0.000	8.861	3.883	67.513	0.000
Ethane	17.491	4.716	9.965	6.891	17.020	4.589
Propane	6.802	1.887	11.708	8.331	7.109	1.972
Iso-butane	0.668	0.220	2.480	2.097	0.781	0.258
N-butane	1.828	0.581	9.597	7.820	2.314	0.735
2-2 Dimethylpropane	0.008	0.003	0.080	0.079	0.012	0.005
Iso-pentane	0.316	0.117	3.603	3.409	0.522	0.192
N-pentane	0.440	0.161	6.541	6.127	0.822	0.300
2-2 Dimethylbutane	0.005	0.002	0.123	0.133	0.012	0.005
Cyclopentane	0.003	0.001	0.000	0.000	0.003	0.001
2-3 Dimethylbutane	0.009	0.004	0.351	0.372	0.030	0.013
2 Methylpentane	0.065	0.027	2.260	2.425	0.202	0.085
3 Methylpentane	0.038	0.016	1.493	1.575	0.129	0.053
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.107	0.044	5.195	5.523	0.425	0.176
Methylcyclopentane	0.008	0.003	0.422	0.386	0.034	0.012
Benzene	0.001	0.000	0.069	0.050	0.005	0.001
Cyclohexane	0.010	0.003	0.744	0.655	0.056	0.019
2-Methylhexane	0.014	0.007	1.868	2.245	0.130	0.061
3-Methylhexane	0.015	0.007	1.690	2.006	0.120	0.055
2,2,4 Trimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000
Other Heptanes	0.013	0.006	0.902	1.015	0.069	0.030
n-Heptane	0.025	0.012	3.836	4.576	0.263	0.123
Methylcyclohexane	0.011	0.004	1.712	1.779	0.117	0.048
Toluene	0.002	0.001	0.328	0.284	0.022	0.008
Other C-8's	0.017	0.008	5.124	6.211	0.336	0.159
n-Octane	0.005	0.003	2.442	3.234	0.157	0.081
Ethylbenzene	0.000	0.000	0.307	0.306	0.019	0.007
M&P-Xylene	0.001	0.000	0.359	0.360	0.023	0.009
O-Xylene	0.000	0.000	0.685	0.673	0.043	0.016
Other C-9's	0.005	0.003	3.105	4.203	0.199	0.105
n-Nonane	0.001	0.001	1.492	2.172	0.094	0.053
Other C10's	0.002	0.001	3.126	4.651	0.197	0.115
n-Decane	0.000	0.000	0.894	1.419	0.056	0.035
Undecanes Plus	0.001	0.001	8.599	15.098	0.539	0.369
TOTAL	100.000	7.837	100.000	100.000	100.000	9.690

TABLE 1-B

COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C₁₁₊

SEPARATOR GOR.....: 16357 Scf/Sep Bbl
SEPARATOR PRESSURE.....: 390 psig
SEPARATOR TEMPERATURE.....: 83 °F

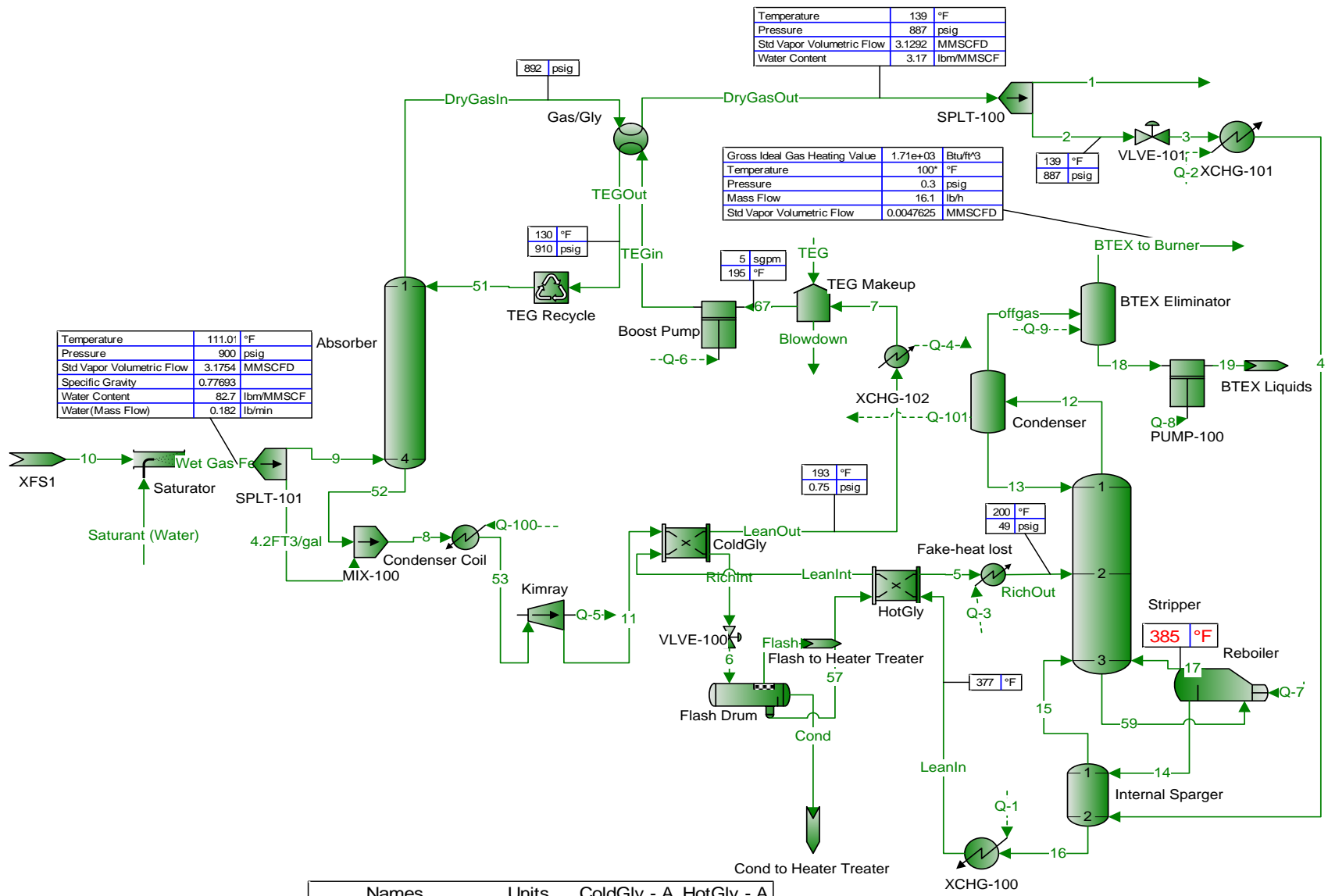
UNDECANES PLUS (C ₁₁₊) FRACTION CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			***	
Gas	N/A	0.8250	156.000	16.558	8,400	
Oil	42.783	0.8119	174.000	14.609	128,920	
Wellstream	N/A	0.8119	173.968	14.612	N/A	

TOTAL SAMPLE CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			***	Saturated ***
Gas	N/A	0.7718	22.258	127.606	1,352	1,330
Oil	84.980	0.6536	79.788	25.649	N/A	111,577
Wellstream	N/A	0.8928	25.856	46.942	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.

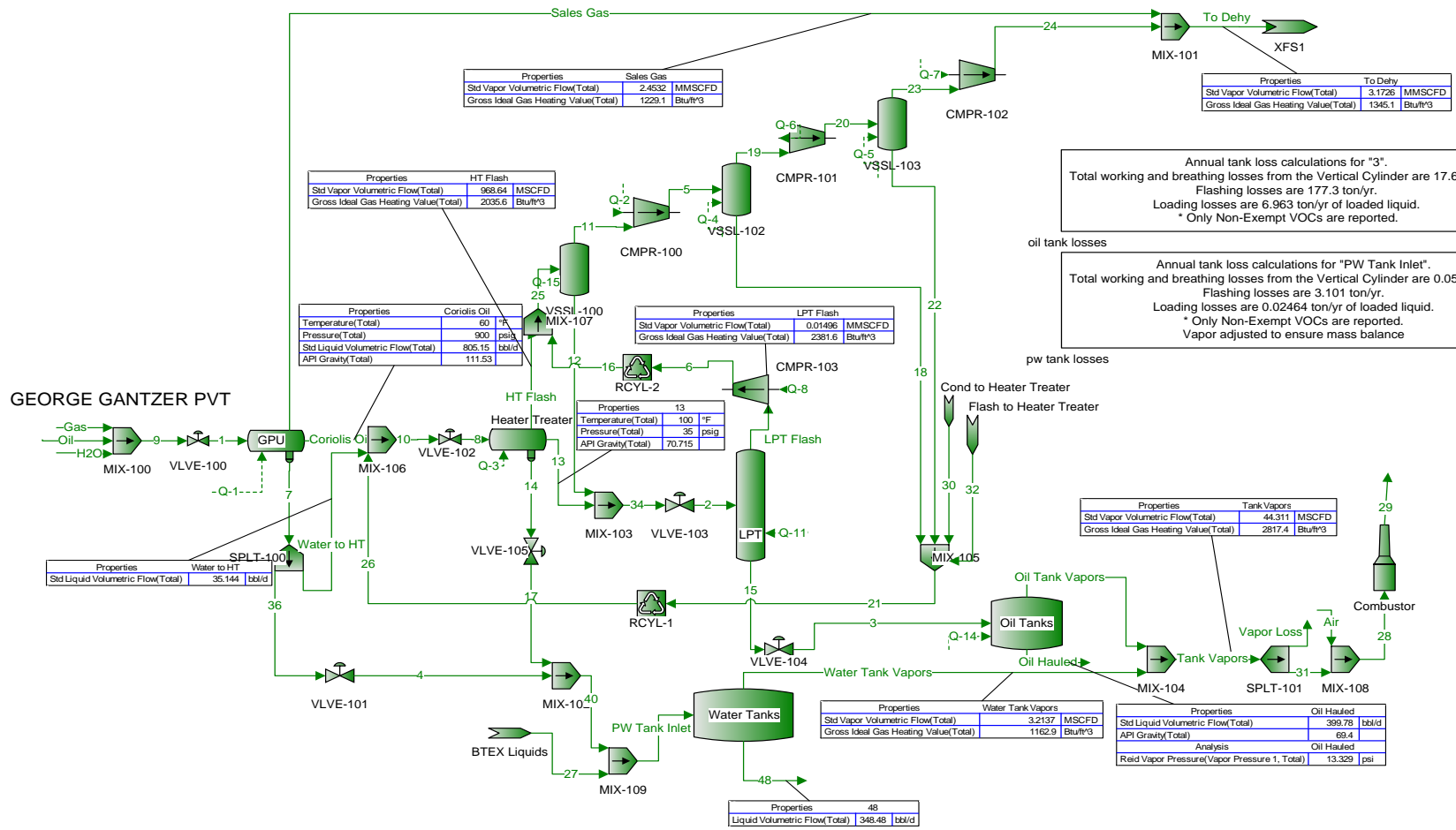


Temperature	139	°F
Pressure	887	psig
Std Vapor Volumetric Flow	3.1292	MMSCFD
Water Content	3.17	lbm/MMSCF

Gross Ideal Gas Heating Value	1.71e+03	Btu/ft³G
Temperature	100	°F
Pressure	0.3	psig
Mass Flow	16.1	lb/h
Std Vapor Volumetric Flow	0.0047625	MMSCFD

Temperature	111.0	°F
Pressure	900	psig
Std Vapor Volumetric Flow	3.1754	MMSCFD
Specific Gravity	0.77693	
Water Content	82.7	lbm/MMSCF
Water (Mass Flow)	0.182	lb/min

Names	Units	ColdGly - A	HotGly - A
Total Energy Supply	MMBTU/h	0.0154	0.311



ProMax AP-42 Emissions Report
 Condensate Annual Emissions
 Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	11.2	6.418	17.62
Propane	4.702	2.694	7.396
i-Butane	0.983	0.5633	1.546
n-Butane	3.188	1.827	5.015
2,2-Dimethylbutane	0.01267	0.007259	0.01993
i-Pentane	0.6836	0.3917	1.075
n-Pentane	0.9168	0.5253	1.442
2,2-Dimethylpropane	0.02168	0.01242	0.0341
Cyclopentane	0.001101	0.0006306	0.001731
2,3-Dimethylbutane	0.02485	0.01424	0.03908
2-Methylpentane	0.1441	0.08256	0.2266
3-Methylpentane	0.08438	0.04835	0.1327
n-Hexane	0.2273	0.1302	0.3575
Methylcyclopentane	0.01635	0.009366	0.02571
Benzene	0.001591	0.0009116	0.002502
Cyclohexane	0.01944	0.01114	0.03057
2-Methylhexane	0.009949	0.005701	0.01565
3-Methylhexane	0.03157	0.01809	0.04966
2,2,4-Trimethylpentane	0	0	0
n-Heptane	0.06361	0.03645	0.1001
Methylcyclohexane	0.02303	0.0132	0.03622
Toluene	0.002435	0.001395	0.00383
C8	0.03197	0.01832	0.05029
Ethylbenzene	0.0008179	0.0004687	0.001287
m-Xylene	0.0005897	0.0003379	0.0009277
o-Xylene	0.001497	0.000858	0.002355
C9	0.00609	0.00349	0.00958
C10	0.001671	0.0009575	0.002629
C11	0.0003654	0.0002094	0.0005748
C12	7.88E-05	4.51E-05	0.0001239
C13	1.75E-05	1.00E-05	2.75E-05
C14	3.23E-06	1.85E-06	5.09E-06
C15	7.24E-07	4.15E-07	1.14E-06
C16	1.35E-07	7.74E-08	2.13E-07
C17	3.04E-08	1.74E-08	4.79E-08
C18	6.87E-09	3.94E-09	1.08E-08
C19	9.38E-10	5.37E-10	1.48E-09
C20	1.92E-10	1.10E-10	3.02E-10
C21	6.18E-11	3.54E-11	9.73E-11
C22	1.26E-11	7.21E-12	1.98E-11
C23	1.93E-12	1.10E-12	3.03E-12
C24	6.20E-13	3.55E-13	9.75E-13
C25	1.55E-13	8.86E-14	2.43E-13
C26	2.84E-14	1.63E-14	4.46E-14
C27	8.52E-15	4.88E-15	1.34E-14
C28	2.01E-16	1.15E-16	3.17E-16
C29	9.19E-17	5.27E-17	1.45E-16
C30	2.23E-17	1.28E-17	3.51E-17
TEG	3.35E-15	1.92E-15	5.27E-15

ProMax Loading Losses Report
 Condensate Annual Emissions
 Tank Truck or Rail Tank Car with Submerged Loading: Dedicated Normal Service

Components	Annual Loading Losses (ton/yr)	Max. Hourly Loading Losses (lb/hr)
Mixture	6.963	10.09
Propane	2.923	4.236
i-Butane	0.6111	0.8856
n-Butane	1.982	2.872
2,2-Dimethylbutane	0.007876	0.01141
i-Pentane	0.425	0.6159
n-Pentane	0.57	0.8259
2,2-Dimethylpropane	0.01348	0.01953
Cyclopentane	0.0006842	0.0009915
2,3-Dimethylbutane	0.01545	0.02238
2-Methylpentane	0.08957	0.1298
3-Methylpentane	0.05246	0.07602
n-Hexane	0.1413	0.2047
Methylcyclopentane	0.01016	0.01473
Benzene	0.0009891	0.001433
Cyclohexane	0.01208	0.01751
2-Methylhexane	0.006185	0.008963
3-Methylhexane	0.01963	0.02844
2,2,4-Trimethylpentane	0	0
n-Heptane	0.03955	0.05731
Methylcyclohexane	0.01432	0.02075
Toluene	0.001514	0.002193
C8	0.01988	0.0288
Ethylbenzene	0.0005085	0.0007369
m-Xylene	0.0003666	0.0005313
o-Xylene	0.0009309	0.001349
C9	0.003786	0.005487
C10	0.001039	0.001505
C11	0.0002272	0.0003292
C12	4.90E-05	7.10E-05
C13	1.09E-05	1.58E-05
C14	2.01E-06	2.91E-06
C15	4.50E-07	6.52E-07
C16	8.40E-08	1.22E-07
C17	1.89E-08	2.74E-08
C18	4.27E-09	6.19E-09
C19	5.83E-10	8.45E-10
C20	1.19E-10	1.73E-10
C21	3.84E-11	5.57E-11
C22	7.83E-12	1.13E-11
C23	1.20E-12	1.74E-12
C24	3.85E-13	5.58E-13
C25	9.61E-14	1.39E-13
C26	1.76E-14	2.56E-14
C27	5.29E-15	7.67E-15
C28	1.25E-16	1.81E-16
C29	5.71E-17	8.28E-17
C30	1.39E-17	2.01E-17
TEG	2.08E-15	3.02E-15

Flashing Emissions Report

Condensate Annual Emissions

Tank flashed at the stream temperature (56.81 °F) and the atmospheric pressure of Pittsburgh, Pennsylvania (14.11 psia)

Components	Flashing Losses (ton/yr)
Mixture	177.3
Propane	70.45
i-Butane	15.81
n-Butane	50.63
2,2-Dimethylbutane	0.2055
i-Pentane	11.47
n-Pentane	15.65
2,2-Dimethylpropane	0.3659
Cyclopentane	0.02122
2,3-Dimethylbutane	0.4129
2-Methylpentane	2.484
3-Methylpentane	1.463
n-Hexane	3.787
Methylcyclopentane	0.3213
Benzene	0.04578
Cyclohexane	0.4069
2-Methylhexane	0.6815
3-Methylhexane	0.5569
2,2,4-Trimethylpentane	0
n-Heptane	1.162
Methylcyclohexane	0.419
Toluene	0.06891
C8	0.6014
Ethylbenzene	0.02136
m-Xylene	0.01177
o-Xylene	0.04744
C9	0.1151
C10	0.03453
C11	0.007835
C12	0.001828
C13	0.0004369
C14	8.85E-05
C15	2.04E-05
C16	4.94E-06
C17	1.40E-06
C18	3.71E-07
C19	6.95E-08
C20	1.23E-08
C21	4.19E-09
C22	1.29E-09
C23	2.30E-10
C24	5.34E-11
C25	1.44E-11
C26	2.05E-12
C27	5.06E-13
C28	6.56E-14
C29	3.04E-14
C30	4.23E-14
TEG	2.27E-13

ProMax AP-42 Emissions Report
 Produced Water Annual Emissions
 Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	0.04322	0.01383	0.05705
Propane	0.019	0.006081	0.02508
i-Butane	0.0008937	0.000286	0.00118
n-Butane	0.003332	0.001066	0.004399
2,2-Dimethylbutane	1.62E-06	5.17E-07	2.13E-06
i-Pentane	0.0003106	9.94E-05	0.00041
n-Pentane	8.77E-05	2.81E-05	0.0001157
2,2-Dimethylpropane	5.25E-06	1.68E-06	6.93E-06
Cyclopentane	2.52E-05	8.07E-06	3.33E-05
2,3-Dimethylbutane	1.93E-05	6.19E-06	2.55E-05
2-Methylpentane	3.92E-05	1.25E-05	5.17E-05
3-Methylpentane	0.0001068	3.42E-05	0.000141
n-Hexane	3.74E-05	1.20E-05	4.93E-05
Methylcyclopentane	0.0001444	4.62E-05	0.0001906
Benzene	0.001377	0.0004406	0.001817
Cyclohexane	0.0006816	0.0002181	0.0008998
2-Methylhexane	3.13E-05	1.00E-05	4.13E-05
3-Methylhexane	4.40E-05	1.41E-05	5.81E-05
2,2,4-Trimethylpentane	0	0	0
n-Heptane	5.36E-05	1.71E-05	7.07E-05
Methylcyclohexane	0.000554	0.0001773	0.0007312
Toluene	0.003736	0.001195	0.004931
C8	6.89E-05	2.20E-05	9.09E-05
Ethylbenzene	0.003001	0.0009605	0.003962
m-Xylene	0.002508	0.0008026	0.003311
o-Xylene	0.007061	0.00226	0.009321
C9	6.79E-05	2.17E-05	8.96E-05
C10	1.47E-05	4.72E-06	1.95E-05
C11	5.78E-06	1.85E-06	7.63E-06
C12	4.67E-06	1.49E-06	6.16E-06
C13	2.07E-06	6.63E-07	2.73E-06
C14	4.03E-07	1.29E-07	5.31E-07
C15	6.84E-08	2.19E-08	9.03E-08
C16	1.53E-08	4.91E-09	2.03E-08
C17	3.54E-09	1.13E-09	4.67E-09
C18	3.64E-10	1.16E-10	4.80E-10
C19	2.47E-11	7.90E-12	3.26E-11
C20	1.06E-12	3.41E-13	1.41E-12
C21	3.36E-14	1.08E-14	4.43E-14
C22	4.53E-15	1.45E-15	5.97E-15
C23	4.19E-16	1.34E-16	5.53E-16
C24	7.19E-17	2.30E-17	9.49E-17
C25	2.09E-17	6.69E-18	2.76E-17
C26	3.17E-18	1.02E-18	4.19E-18
C27	8.56E-19	2.74E-19	1.13E-18
C28	1.37E-19	4.39E-20	1.81E-19
C29	5.27E-20	1.69E-20	6.95E-20
C30	8.47E-20	2.71E-20	1.12E-19
TEG	2.69E-13	8.61E-14	3.55E-13

ProMax Loading Losses Report
 Produced Water Annual Emissions
 Tank Truck or Rail Tank Car with Submerged Loading: Dedicated Normal Service

Components	Annual Loading Losses (ton/yr)	Max. Hourly Loading Losses (lb/hr)
Mixture	0.02464	0.04269
Propane	0.01083	0.01877
i-Butane	0.0005095	0.0008829
n-Butane	0.0019	0.003292
2,2-Dimethylbutane	9.21E-07	1.60E-06
i-Pentane	0.0001771	0.0003068
n-Pentane	5.00E-05	8.66E-05
2,2-Dimethylpropane	2.99E-06	5.18E-06
Cyclopentane	1.44E-05	2.49E-05
2,3-Dimethylbutane	1.10E-05	1.91E-05
2-Methylpentane	2.23E-05	3.87E-05
3-Methylpentane	6.09E-05	0.0001056
n-Hexane	2.13E-05	3.69E-05
Methylcyclopentane	8.23E-05	0.0001427
Benzene	0.0007849	0.00136
Cyclohexane	0.0003886	0.0006734
2-Methylhexane	1.79E-05	3.09E-05
3-Methylhexane	2.51E-05	4.35E-05
2,2,4-Trimethylpentane	0	0
n-Heptane	3.05E-05	5.29E-05
Methylcyclohexane	0.0003158	0.0005472
Toluene	0.00213	0.00369
C8	3.93E-05	6.80E-05
Ethylbenzene	0.001711	0.002965
m-Xylene	0.00143	0.002478
o-Xylene	0.004026	0.006975
C9	3.87E-05	6.70E-05
C10	8.40E-06	1.46E-05
C11	3.29E-06	5.71E-06
C12	2.66E-06	4.61E-06
C13	1.18E-06	2.05E-06
C14	2.30E-07	3.98E-07
C15	3.90E-08	6.76E-08
C16	8.74E-09	1.52E-08
C17	2.02E-09	3.49E-09
C18	2.07E-10	3.59E-10
C19	1.41E-11	2.44E-11
C20	6.07E-13	1.05E-12
C21	1.92E-14	3.32E-14
C22	2.58E-15	4.47E-15
C23	2.39E-16	4.14E-16
C24	4.10E-17	7.10E-17
C25	1.19E-17	2.07E-17
C26	1.81E-18	3.13E-18
C27	4.88E-19	8.46E-19
C28	7.82E-20	1.36E-19
C29	3.00E-20	5.20E-20
C30	4.83E-20	8.37E-20
TEG	1.53E-13	2.66E-13

Flashing Emissions Report

Produced Water Annual Emissions

Tank flashed at the stream temperature (56.81 °F) and the atmospheric pressure of Pittsburgh, Pennsylvania (14.11 psia)

Components	Flashing Losses (ton/yr)
Mixture	3.101
Propane	1.628
i-Butane	0.103
n-Butane	0.3122
2,2-Dimethylbutane	0.0005049
i-Pentane	0.03933
n-Pentane	0.03047
2,2-Dimethylpropane	0.0009812
Cyclopentane	0.0005582
2,3-Dimethylbutane	0.00224
2-Methylpentane	0.009453
3-Methylpentane	0.01023
n-Hexane	0.01862
Methylcyclopentane	0.008199
Benzene	0.009971
Cyclohexane	0.01621
2-Methylhexane	0.01011
3-Methylhexane	0.0117
2,2,4-Trimethylpentane	0
n-Heptane	0.03557
Methylcyclohexane	0.03152
Toluene	0.02772
C8	0.1213
Ethylbenzene	0.02624
m-Xylene	0.02075
o-Xylene	0.06321
C9	0.1284
C10	0.167
C11	0.1384
C12	0.07564
C13	0.0392
C14	0.01094
C15	0.002643
C16	0.0005864
C17	0.0001472
C18	4.32E-05
C19	9.35E-06
C20	1.86E-06
C21	1.45E-07
C22	5.30E-08
C23	2.11E-08
C24	1.23E-08
C25	1.10E-08
C26	6.31E-09
C27	8.27E-09
C28	3.09E-09
C29	2.88E-09
C30	1.63E-08
TEG	9.22E-12

ATTACHMENT M: NATURAL GAS FIRED FUEL BURNING UNITS DATA SHEET

AP-42 EMISSION FACTORS

**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-HT1	EP-HT1	Heater Treater	TBD	NEW	0.5	905
EU-RB1	EP-RB1	TEG Reboiler	TBD	NEW	0.75	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.

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/10⁶ scf to kg/10⁶ m³, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from lb/10⁶ 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 NO₂. 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/10⁶ scf to kg/10⁶ m³, multiply by 16. To convert from lb/10⁶ scf to lb/MMBtu, divide by 1,020. Emission Factors preceded 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.

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.*

Emission Unit ID# ¹		EU-ENG1		EU-ENG2			
Engine Manufacturer/Model		Caterpillar G3306 NA		Zenith ZPP-644 4.4L			
Manufacturers Rated bhp/rpm		145-hp/1,800-rpm		103.3-hp/3,000-rpm			
Source Status ²		NS		NS			
Date Installed/ Modified/Removed/Relocated ³		TBD		TBD			
Engine Manufactured /Reconstruction Date ⁴		After 1/1/2011		After 1/1/2011			
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable) ⁵		<input checked="" type="checkbox"/> 40CFR60 Subpart JJJ <input type="checkbox"/> JJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input checked="" type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources		<input checked="" type="checkbox"/> 40CFR60 Subpart JJJ <input checked="" type="checkbox"/> JJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input checked="" type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources		<input type="checkbox"/> 40CFR60 Subpart JJJ <input type="checkbox"/> JJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources	
Engine Type ⁶		4SRB		4SRB			
APCD Type ⁷		NSCR		NSCR			
Fuel Type ⁸		PQ		PQ			
H ₂ S (gr/100 scf)		Negligible		Negligible			
Operating bhp/rpm		145-hp/1,800-rpm		103.3-hp/3,000-rpm			
BSFC (BTU/bhp-hr)		8,625		11,149			
Hourly Fuel Throughput		1,382 ft ³ /hr gal/hr		707 ft ³ /hr gal/hr		ft ³ /hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		12.11 MMft ³ /yr gal/yr		6.20 MMft ³ /yr gal/yr		MMft ³ /yr gal/yr	
Fuel Usage or Hours of Operation Metered		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Yes <input type="checkbox"/> No <input type="checkbox"/>	
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	0.46	2.01		
MD	CO	0.64	2.80	0.75	3.29		
MD	VOC	0.22	0.98	0.46	2.01		
AP	SO ₂	<0.01	<0.01	<0.01	<0.01		
AP	PM ₁₀	0.01	0.05	0.01	0.03		
MD	Formaldehyde	0.09	0.38	0.01	0.06		
AP	Total HAPs	0.10	0.44	0.02	0.09		
MD and EPA	GHG (CO ₂ e)	155.19	679.73	74.96	328.34		

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

2 Enter the Source Status using the following codes:

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

- 3 Enter the date (or anticipated date) of the engine's installation (construction of source), modification, relocation or removal.
- 4 Enter the date that the engine was manufactured, modified or reconstructed.
- 5 Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart IIII/JJJJ? If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance as appropriate.

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

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

2SLB Two Stroke Lean Burn	4SRB Four Stroke Rich Burn	
4SLB Four Stroke Lean Burn		
- 7 Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

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

PQ Pipeline Quality Natural Gas	RG Raw Natural Gas /Production Gas	D Diesel
---------------------------------	------------------------------------	----------
- 9 Enter the Potential Emissions Data Reference designation using the following codes. Attach all reference data used.

MD Manufacturer's Data	AP AP-42	
GR GRI-HAPCalc™	OT Other	(please list)
- 10 Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.
- 11 PTE for engines shall be calculated from manufacturer's data unless unavailable.

**Engine Air Pollution Control Device
(Emission Unit ID# APC-NSCR-ENG-1, use extra pages as necessary)**

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

NSCR SCR Oxidation Catalyst

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

Manufacturer: N/A

Model #: N/A

Design Operating Temperature: 1,101 °F

Design gas volume: 678 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 1,250 °F

Reducing agent used, if any:

Ammonia slip (ppm):

Pressure drop against catalyst bed (delta P): inches of H₂O

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



ENGINE SPEED (rpm): 1800
 COMPRESSION RATIO: 10.5:1
 JACKET WATER OUTLET (°F): 210
 COOLING SYSTEM: JW+OC
 IGNITION SYSTEM: MAG
 EXHAUST MANIFOLD: WC
 COMBUSTION: Catalyst
 EXHAUST O2 EMISSION LEVEL %: 0.5
 SET POINT TIMING: 30.0

FUEL SYSTEM: LPG IMPCO
 WITH CUSTOMER SUPPLIED AIR FUEL RATIO CONTROL

SITE CONDITIONS:
 FUEL: Nat Gas
 FUEL PRESSURE RANGE (psig): 1.5-10.0
 FUEL METHANE NUMBER: 84.8
 FUEL LHV (Btu/scf): 905
 ALTITUDE (ft): 500
 MAXIMUM INLET AIR TEMPERATURE (°F): 77
 NAMEPLATE RATING: 145 bhp@1800rpm

RATING	NOTES	LOAD	MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
			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)	ft ³ /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 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



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 >](#)

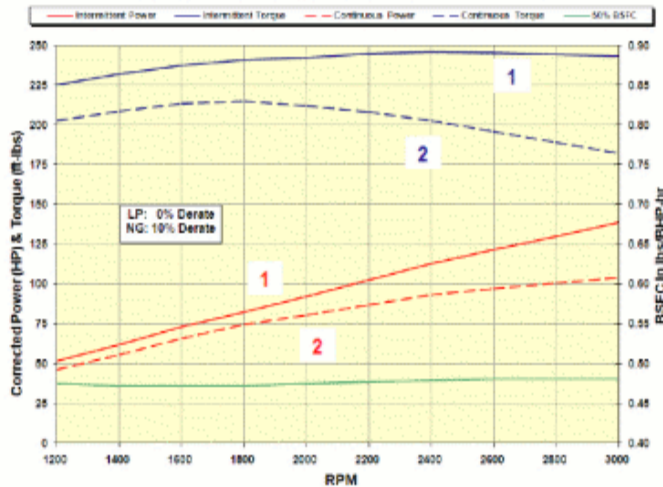
SPECIFICATION DATA

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 emmissions compliance)	Remote mounted

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

PERFORMANCE CURVES

ZPP-644 Gasoline Power, Torque, & BSFC 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 basic 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

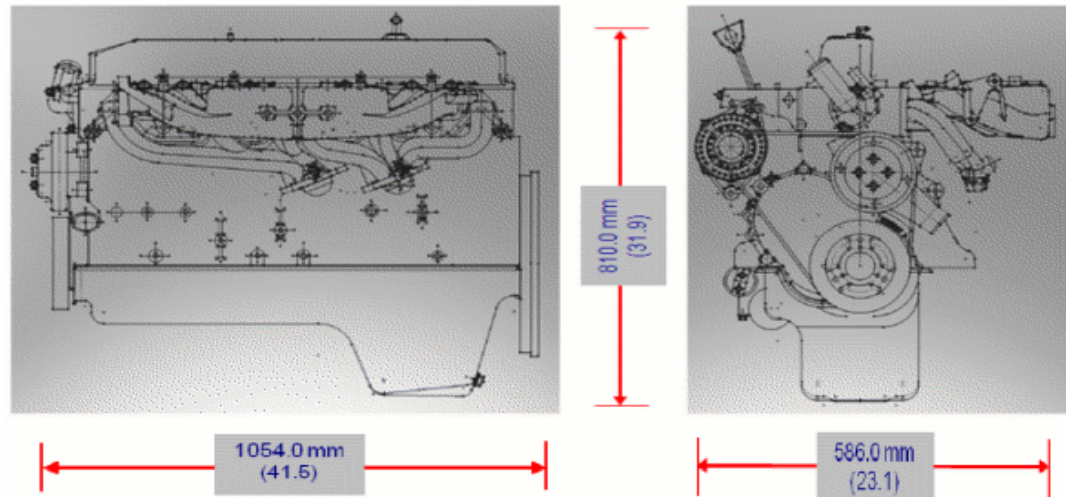
Electrical

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

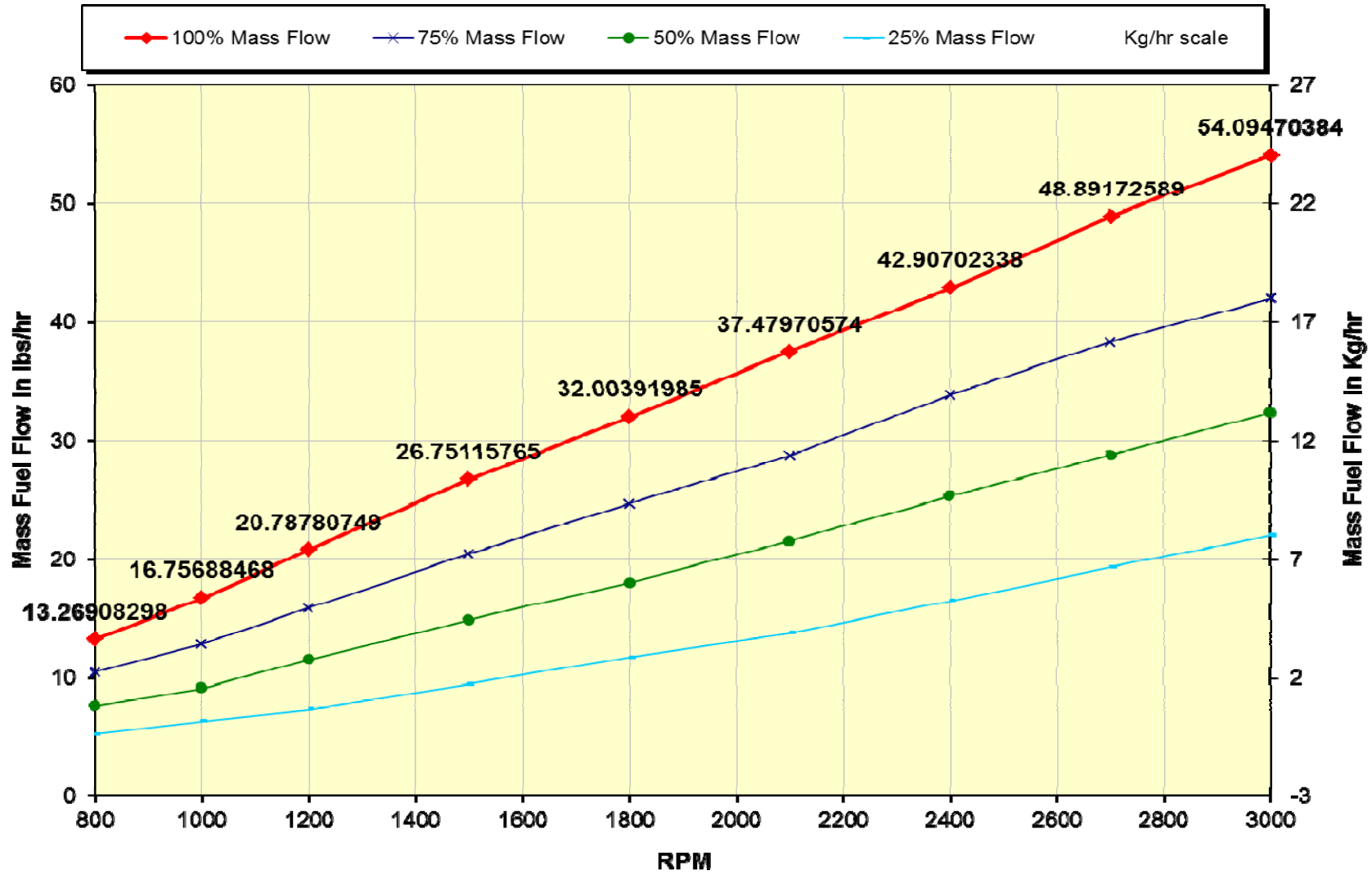
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HY-BON/EDI VRU Packages w/ HP Ratings

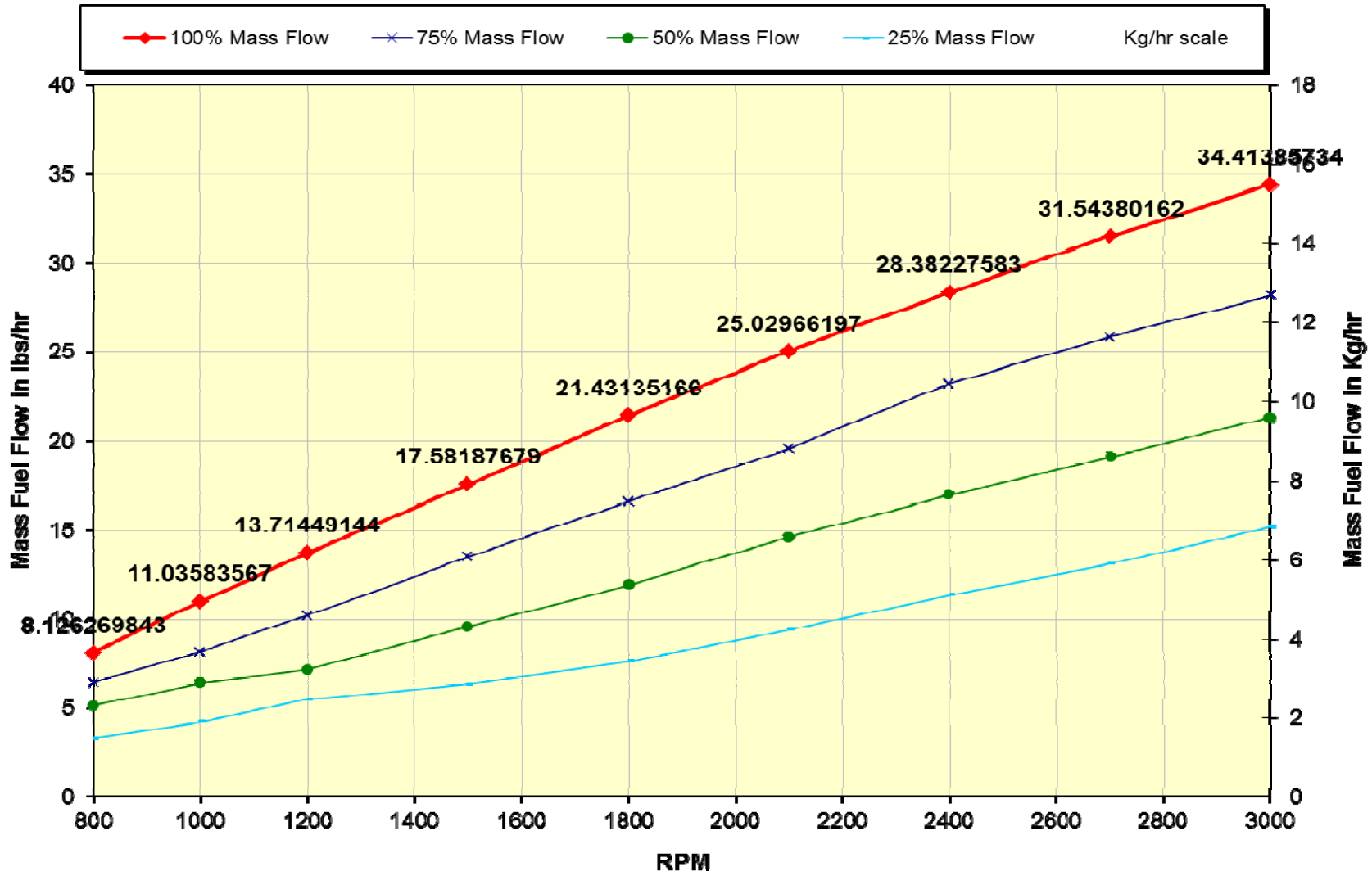
Compressor	Engine	Max HP Natural Gas	EPA Certified
Blackmer 372	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
Blackmer 612	Zenith 2.8 L 4 Cylinder	54 HP @ 2200 RPM	Yes
Blackmer 942	Zenith 4.4 L 6 Cylinder	77 HP @ 2200 RPM	Yes
Blackmer 362	Kubota 3 Cylinder	24 HP @ 3600 RPM	Yes
Blackmer 602	Zenith 4.4 L 6 Cylinder	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**



**ZPP 428 NG Mass Fuel Fuel Flow - Corrected per SAE J1349
5/11/10**





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

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.

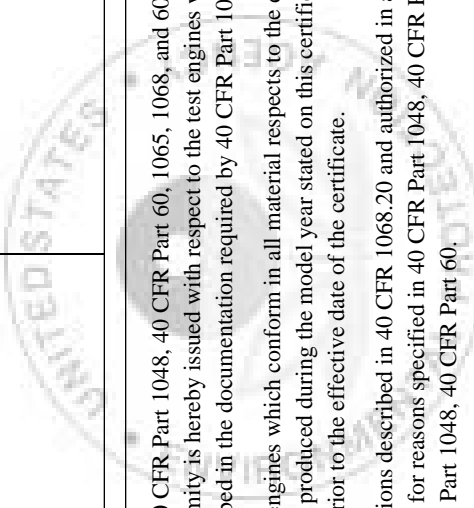


Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN
 ENGINES^a
 (SCC 2-02-002-53)

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 ¹	<1.29 E-05	E
Chloroform ¹	<1.37 E-05	E
Ethane ⁿ	7.04 E-02	C
Ethylbenzene ¹	<2.48 E-05	E
Ethylene Dibromide ¹	<2.13 E-05	E
Formaldehyde ^{1,m}	2.05 E-02	A
Methanol ¹	3.06 E-03	D
Methylene Chloride ¹	4.12 E-05	C
Naphthalene ¹	<9.71 E-05	E
PAH ¹	1.41 E-04	D
Styrene ¹	<1.19 E-05	E
Toluene ¹	5.58 E-04	A
Vinyl Chloride ¹	<7.18 E-06	E
Xylene ¹	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 NO_x 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/10⁶ 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:

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

^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 CO₂. CO₂ [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO₂,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10⁶ scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

^e Based on 100% conversion of fuel sulfur to SO₂. Assumes sulfur content in natural gas of 2,000 gr/10⁶ scf.

^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 $\leq 1 \mu\text{m}$ 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.

ATTACHMENT O: TANKER TRUCK LOADING DATA SHEET

ATTACHMENT O – TANKER TRUCK/RAIL CAR 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/rail cars. Use extra pages if necessary.

Truck/Rail Car Loadout Collection Efficiencies

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

- For tanker trucks/rail cars passing the MACT level annual leak test – 99.2%
- For tanker trucks/rail cars passing the NSPS level annual leak test – 98.7%
- For tanker trucks/rail cars 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/rail car 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#: EP-LOAD-COND/APC-COMB	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/rail cars loading at one (1) time: 1
--------------------	-----------------------------	---

Are tanker trucks/rail cars 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/rail car loadout systems utilized?
 Closed System to tanker truck/rail car passing a MACT level annual leak test?
 Closed System to tanker truck/rail car passing a NSPS level annual leak test?
 Closed System to tanker truck/rail car 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)	16.8		
Max. Annual Throughput (1000 gal/yr)	6,132.00		
Loading Method ¹	SUB		
Max. Fill Rate (gal/min)	125		
Average Fill Time (min/loading)	Approx. 60		
Max. Bulk Liquid Temperature (°F)	Refer to ProMax		
True Vapor Pressure ²	Refer to ProMax		
Cargo Vessel Condition ³	U		
Control Equipment or Method ⁴	O = Vapor Return/ Combustion Controls		
Max. Collection Efficiency (%)	70%		

Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	10.10		
	Annual (ton/yr)	6.65		
Max.HAP Emission Rate	Loading (lb/hr)	0.82		
	Annual (ton/yr)	0.54		
Estimation Method ⁵		O = ProMax process simulation		

Emission Unit ID#: EU-LOAD-PW		Emission Point ID#: EP-LOAD-PW/APC-COMB		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/rail cars loading at one (1) time: 1	
Are tanker trucks/rail cars pressure tested for leaks at this or any other location? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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/rail car loadout systems utilized? <input type="checkbox"/> Closed System to tanker truck/rail car passing a MACT level annual leak test? <input type="checkbox"/> Closed System to tanker truck/rail car passing a NSPS level annual leak test? <input type="checkbox"/> Closed System to tanker truck/rail car 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
Hours/day	24		24		24
Days/week	5		5		5
Bulk Liquid Data (use extra pages as necessary)					
Liquid Name	Produced Water				
Max. Daily Throughput (1000 gal/day)	14.70				
Max. Annual Throughput (1000 gal/yr)	5,365.50				
Loading Method ¹	SUB				
Max. Fill Rate (gal/min)	125				
Average Fill Time (min/loading)	Approx. 60				
Max. Bulk Liquid Temperature (°F)	Refer to ProMax				
True Vapor Pressure ²	Refer to ProMax				
Cargo Vessel Condition ³	U				
Control Equipment or Method ⁴	O = Vapor Return/ Combustion Controls				
Max. Collection Efficiency (%)	70%				
Max. Control Efficiency (%)	98%				
Max.VOC Emission Rate	Loading (lb/hr)	0.05			
	Annual (ton/yr)	0.02			
Max.HAP Emission Rate	Loading (lb/hr)	<0.01			
	Annual (ton/yr)	<0.01			
Estimation Method ⁵	O = ProMax process simulation				

- | | | | | | | |
|---|-----|---|----|---|-----|-------------------------------|
| 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 P: GLYCOL DEHYDRATION UNIT DATA SHEET

GRI-GLYCALC REPORTS

EXTENDED ANALYSIS

ATTACHMENT P – GLYCOL DEHYDRATION UNIT DATA SHEET

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

Manufacturer: N/A	Model: N/A				
Max. Dry Gas Flow Rate: 24.0 mmscf/day	Reboiler Design Heat Input: 0.75 MMBTU/hr				
Design Type: <input checked="" type="checkbox"/> TEG <input type="checkbox"/> DEG <input type="checkbox"/> EG	Source Status ¹ : NS				
Date Installed/Modified/Removed ² : TBD	Regenerator Still Vent APCD/ERD ³ : CC				
Control Device/ERD ID# ³ : APC-COND/EP-RB1	Fuel HV (BTU/scf): 905				
H ₂ S Content (gr/100 scf): Negligible	Operation (hours/year): 8,760				
Pump Rate (gpm): 7.50					
Water Content (wt %) in: Wet Gas: Dry Gas:					
<p>Is the glycol dehydration unit exempt from 40CFR63 Section 764(d)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No: If Yes, answer the following:</p> <p>The actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters per day, as determined by the procedures specified in §63.772(b)(1) of this subpart. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>The actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram per year (1 ton per year), as determined by the procedures specified in §63.772(b)(2) of this subpart. <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>					
Is the glycol dehydration unit located within an Urbanized Area (UA) or Urban Cluster (UC)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Is a lean glycol pump optimization plan being utilized? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
<p>Recycling the glycol dehydration unit back to the flame zone of the reboiler.</p> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
<p>Recycling the glycol dehydration unit back to the flame zone of the reboiler and mixed with fuel.</p> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
<p>What happens when temperature controller shuts off fuel to the reboiler?</p> <input checked="" type="checkbox"/> Still vent emissions to the atmosphere. <input type="checkbox"/> Still vent emissions stopped with valve. <input type="checkbox"/> Still vent emissions to glow plug.					
<p>Please indicate if the following equipment is present.</p> <input checked="" type="checkbox"/> Flash Tank <input type="checkbox"/> Burner management system that continuously burns condenser or flash tank vapors					
Control Device Technical Data					
Pollutants Controlled			Manufacturer's Guaranteed Control Efficiency (%)		
See GlyCalc					
Emissions Data					
Emission Unit ID / Emission Point ID ⁴	Description	Calculation Methodology ⁵	PTE ⁶	Controlled Maximum Hourly Emissions (lb/hr)	Controlled Maximum Annual Emissions (tpy)
EU-RB1/EPRB1	Reboiler Vent	AP	NO _x	0.08	0.36
		AP	CO	0.07	0.30
		AP	VOC	<0.01	0.02
		AP	SO ₂	<0.01	<0.01
		AP	PM ₁₀	<0.01	0.02
		AP	GHG (CO ₂ e)		87.82

EU-DEHY1/EP-RB1	Glycol Regenerator Still Vent	GRI-GlyCalc™	VOC	2.99	13.09
		GRI-GlyCalc™	Benzene	0.11	0.49
		GRI-GlyCalc™	Toluene	0.18	0.77
		GRI-GlyCalc™	Ethylbenzene	0.00	0.00
		GRI-GlyCalc™	Xylenes	0.05	0.24
		GRI-GlyCalc™	n-Hexane	0.12	0.51
EU-DEHY1/APC-COMB	Glycol Flash Tank	GRI-GlyCalc™	VOC	1.57	6.88
		GRI-GlyCalc™	Benzene	<0.01	0.01
		GRI-GlyCalc™	Toluene	<0.01	0.02
		GRI-GlyCalc™	Ethylbenzene	0.00	0.00
		GRI-GlyCalc™	Xylenes	<0.01	0.01
		GRI-GlyCalc™	n-Hexane	0.04	0.16

Note: Glycol Regenerator Still Vent and Flash Tank emissions include a 20% safety factor.

- 1 Enter the Source Status using the following codes:
NS Construction of New Source ES Existing Source
MS Modification of Existing Source
- 2 Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.
- 3 Enter the Air Pollution Control Device (APCD)/Emission Reduction Device (ERD) type designation using the following codes and the device ID number:
NA None CD Condenser FL Flare
CC Condenser/Combustion Combination TO Thermal Oxidizer O Other (please list)
- 4 Enter the appropriate Emission Unit ID Numbers and Emission Point ID Numbers for the glycol dehydration unit reboiler vent and glycol regenerator still vent. The glycol dehydration unit reboiler vent and glycol regenerator still vent should be designated RBV-1 and RSV-1, respectively. If the well site incorporates multiple glycol dehydration units, a Glycol Dehydration Emission Unit Data Sheet shall be completed for each, using Source Identification RBV-2 and RSV-2, RBV-3 and RSV-3, etc.
- 5 Enter the Potential Emissions Data Reference designation using the following codes:
MD Manufacturer's Data AP AP-42
GR GRI-GLYCalc™ OT Other (please list)
- 6 Enter the Reboiler Vent and Glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The Glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalc™ (Radian International LLC & Gas Research Institute). **Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc™ Aggregate Calculations Report (shall include emissions reports, equipment reports, and stream reports) to this Glycol Dehydration Emission Unit Data Sheet(s). Backup pumps do not have to be considered as operating for purposes of PTE.** This PTE data shall be incorporated in the Emissions Summary Sheet.

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Mark Edison 24 MMSCFD TEG Dehydration Unit
 File Name: C:\Users\hmoseley\Dropbox\Flatrock OKC - Hillary\Southwestern\Mark Edison\Mark Edison GLYCalc.ddf
 Date: April 06, 2017

DESCRIPTION:

 Description: George Gantzer No. 8H PVT analysis temp = 70F, pressure = 900 psig. Kimray 45015 PV (7.5 gpm) glycol pump. Flash tank recycled to heater treater/reboiler fuel. Still vent emissions to BTEX Skid w/ overheads to reboiler (glow plug).

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

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

Component	Conc. (vol %)
Carbon Dioxide	0.1490
Nitrogen	0.5130
Methane	71.4270
Ethane	17.4910
Propane	6.8020
Isobutane	0.6680
n-Butane	1.8280
Isopentane	0.3270
n-Pentane	0.4400
n-Hexane	0.1070
Cyclohexane	0.0100
Other Hexanes	0.1250
Heptanes	0.0678
Methylcyclohexane	0.0110
Benzene	0.0010
Toluene	0.0020
Xylenes	0.0010
C8+ Heavies	0.0310

DRY GAS:

 Flow Rate: 24.0 MMSCF/day
 Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

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

PUMP:

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

FLASH TANK:

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

REGENERATOR OVERHEADS CONTROL DEVICE:

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

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

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Mark Edison 24 MMSCFD TEG Dehydration Unit

File Name: C:\Users\hmoseley\Dropbox\Flatrock OKC - Hillary\Southwestern\Mark Edison\Mark Edison GLYCalc.ddf

Date: April 06, 2017

DESCRIPTION:

Description: George Gantzer No. 8H PVT analysis temp = 70F, pressure = 900 psig. Kimray 45015 PV (7.5 gpm) glycol pump. Flash tank recycled to heater treater/reboiler fuel. Still vent emissions to BTEX Skid w/ overheads to reboiler (glow plug).

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.3393	8.143	1.4861
Ethane	0.6193	14.862	2.7124
Propane	0.7419	17.806	3.2495
Isobutane	0.1477	3.545	0.6469
n-Butane	0.5625	13.499	2.4637
Isopentane	0.1187	2.849	0.5200
n-Pentane	0.2124	5.097	0.9303
n-Hexane	0.0966	2.319	0.4231
Cyclohexane	0.0690	1.656	0.3022
Other Hexanes	0.0859	2.061	0.3762
Heptanes	0.1015	2.437	0.4447
Methylcyclohexane	0.0669	1.605	0.2929
Benzene	0.0940	2.256	0.4117
Toluene	0.1475	3.539	0.6458
Xylenes	0.0454	1.089	0.1987
C8+ Heavies	0.0010	0.024	0.0043
Total Emissions	3.4494	82.786	15.1085
Total Hydrocarbon Emissions	3.4494	82.786	15.1085
Total VOC Emissions	2.4909	59.781	10.9100
Total HAP Emissions	0.3834	9.202	1.6793
Total BTEX Emissions	0.2868	6.883	1.2562

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.6792	16.301	2.9750
Ethane	1.2443	29.864	5.4502
Propane	1.5191	36.457	6.6535
Isobutane	0.3101	7.442	1.3582
n-Butane	1.2045	28.908	5.2757
Isopentane	0.2833	6.798	1.2407
n-Pentane	0.5223	12.535	2.2876

n-Hexane	0.3096	7.432	1.3563
Cyclohexane	0.2547	6.112	1.1155
Other Hexanes	0.2458	5.899	1.0767
Heptanes	0.5663	13.590	2.4802
Methylcyclohexane	0.3714	8.913	1.6267
Benzene	0.3718	8.923	1.6284
Toluene	1.1826	28.382	5.1796
Xylenes	1.0998	26.396	4.8173
C8+ Heavies	1.1223	26.936	4.9158

Total Emissions	11.2871	270.890	49.4374

Total Hydrocarbon Emissions	11.2871	270.890	49.4374
Total VOC Emissions	9.3635	224.724	41.0122
Total HAP Emissions	2.9638	71.132	12.9816
Total BTEX Emissions	2.6542	63.700	11.6253

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.9727	47.346	8.6406
Ethane	1.0676	25.622	4.6761
Propane	0.6639	15.934	2.9079
Isobutane	0.0931	2.234	0.4078
n-Butane	0.2826	6.782	1.2378
Isopentane	0.0605	1.453	0.2652
n-Pentane	0.0907	2.177	0.3973
n-Hexane	0.0308	0.740	0.1350
Cyclohexane	0.0063	0.150	0.0274
Other Hexanes	0.0321	0.771	0.1408
Heptanes	0.0284	0.681	0.1242
Methylcyclohexane	0.0074	0.177	0.0322
Benzene	0.0015	0.035	0.0065
Toluene	0.0031	0.075	0.0137
Xylenes	0.0012	0.030	0.0054
C8+ Heavies	0.0080	0.191	0.0348

Total Emissions	4.3499	104.399	19.0528

Total Hydrocarbon Emissions	4.3499	104.399	19.0528
Total VOC Emissions	1.3096	31.431	5.7361
Total HAP Emissions	0.0367	0.880	0.1606
Total BTEX Emissions	0.0058	0.140	0.0256

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	98.6369	2367.286	432.0296
Ethane	53.3801	1281.121	233.8046
Propane	33.1949	796.677	145.3935
Isobutane	4.6551	111.724	20.3895
n-Butane	14.1299	339.118	61.8890
Isopentane	3.0274	72.657	13.2599
n-Pentane	4.5358	108.860	19.8669
n-Hexane	1.5416	36.999	6.7524
Cyclohexane	0.3132	7.516	1.3718
Other Hexanes	1.6070	38.568	7.0387

Heptanes	1.4178	34.027	6.2100
Methylcyclohexane	0.3678	8.826	1.6108
Benzene	0.0737	1.768	0.3226
Toluene	0.1564	3.754	0.6851
Xylenes	0.0622	1.492	0.2723
C8+ Heavies	0.3977	9.545	1.7420

Total Emissions	217.4974	5219.939	952.6388

Total Hydrocarbon Emissions	217.4974	5219.939	952.6388
Total VOC Emissions	65.4805	1571.532	286.8045
Total HAP Emissions	1.8339	44.013	8.0324
Total BTEX Emissions	0.2923	7.014	1.2801

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr

Methane	2.3120	55.489	10.1267
Ethane	1.6869	40.485	7.3885
Propane	1.4058	33.739	6.1574
Isobutane	0.2408	5.779	1.0547
n-Butane	0.8451	20.282	3.7014
Isopentane	0.1793	4.303	0.7852
n-Pentane	0.3031	7.275	1.3276
n-Hexane	0.1274	3.059	0.5582
Cyclohexane	0.0753	1.806	0.3296
Other Hexanes	0.1180	2.833	0.5169
Heptanes	0.1299	3.117	0.5689
Methylcyclohexane	0.0742	1.781	0.3251
Benzene	0.0955	2.291	0.4181
Toluene	0.1506	3.614	0.6595
Xylenes	0.0466	1.118	0.2041
C8+ Heavies	0.0089	0.215	0.0392

Total Emissions	7.7994	187.185	34.1613

Total Hydrocarbon Emissions	7.7994	187.185	34.1613
Total VOC Emissions	3.8005	91.212	16.6461
Total HAP Emissions	0.4201	10.082	1.8400
Total BTEX Emissions	0.2926	7.023	1.2818

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction

Methane	435.0046	10.1267	97.67
Ethane	239.2549	7.3885	96.91
Propane	152.0470	6.1574	95.95
Isobutane	21.7477	1.0547	95.15
n-Butane	67.1647	3.7014	94.49
Isopentane	14.5005	0.7852	94.58
n-Pentane	22.1545	1.3276	94.01
n-Hexane	8.1086	0.5582	93.12
Cyclohexane	2.4873	0.3296	86.75
Other Hexanes	8.1154	0.5169	93.63
Heptanes	8.6902	0.5689	93.45

Methylcyclohexane	3.2375	0.3251	89.96
Benzene	1.9511	0.4181	78.57
Toluene	5.8647	0.6595	88.75
Xylenes	5.0896	0.2041	95.99
C8+ Heavies	6.6579	0.0392	99.41

Total Emissions	1002.0762	34.1613	96.59

Total Hydrocarbon Emissions	1002.0762	34.1613	96.59
Total VOC Emissions	327.8167	16.6461	94.92
Total HAP Emissions	21.0140	1.8400	91.24
Total BTEX Emissions	12.9054	1.2818	90.07

EQUIPMENT REPORTS:

CONDENSER AND COMBUSTION DEVICE

Condenser Outlet Temperature: 100.00 deg. F
 Condenser Pressure: 14.00 psia
 Condenser Duty: 1.75e-002 MM BTU/hr
 Hydrocarbon Recovery: 0.35 bbls/day
 Produced Water: 1.63 bbls/day
 Ambient Temperature: 50.00 deg. F
 Excess Oxygen: 5.00 %
 Combustion Efficiency: 50.00 %
 Supplemental Fuel Requirement: 1.75e-002 MM BTU/hr

Component	Emitted	Destroyed
Methane	49.95%	50.05%
Ethane	49.77%	50.23%
Propane	48.84%	51.16%
Isobutane	47.63%	52.37%
n-Butane	46.70%	53.30%
Isopentane	41.91%	58.09%
n-Pentane	40.67%	59.33%
n-Hexane	31.20%	68.80%
Cyclohexane	27.09%	72.91%
Other Hexanes	34.94%	65.06%
Heptanes	17.93%	82.07%
Methylcyclohexane	18.01%	81.99%
Benzene	25.28%	74.72%
Toluene	12.47%	87.53%
Xylenes	4.12%	95.88%
C8+ Heavies	0.09%	99.91%

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages: 1.25
 Calculated Dry Gas Dew Point: 0.87 lbs. H2O/MMSCF

Temperature: 70.0 deg. F
 Pressure: 900.0 psig
 Dry Gas Flow Rate: 24.0000 MMSCF/day
 Glycol Losses with Dry Gas: 0.2073 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 25.30 lbs. H2O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 18.42 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.43%	96.57%
Carbon Dioxide	99.49%	0.51%
Nitrogen	99.96%	0.04%
Methane	99.97%	0.03%
Ethane	99.90%	0.10%
Propane	99.86%	0.14%
Isobutane	99.81%	0.19%
n-Butane	99.75%	0.25%
Isopentane	99.76%	0.24%
n-Pentane	99.69%	0.31%
n-Hexane	99.53%	0.47%
Cyclohexane	97.74%	2.26%
Other Hexanes	99.64%	0.36%
Heptanes	99.19%	0.81%
Methylcyclohexane	97.70%	2.30%
Benzene	78.67%	21.33%
Toluene	72.74%	27.26%
Xylenes	58.79%	41.21%
C8+ Heavies	99.20%	0.80%

FLASH TANK

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

Component	Left in Glycol	Removed in Flash Gas
Water	99.45%	0.55%
Carbon Dioxide	6.45%	93.55%
Nitrogen	0.67%	99.33%
Methane	0.68%	99.32%
Ethane	2.28%	97.72%
Propane	4.38%	95.62%
Isobutane	6.25%	93.75%
n-Butane	7.85%	92.15%
Isopentane	8.76%	91.24%
n-Pentane	10.56%	89.44%
n-Hexane	16.98%	83.02%
Cyclohexane	46.42%	53.58%
Other Hexanes	13.74%	86.26%
Heptanes	28.80%	71.20%
Methylcyclohexane	52.02%	47.98%
Benzene	84.28%	15.72%
Toluene	89.23%	10.77%
Xylenes	95.34%	4.66%
C8+ Heavies	76.20%	23.80%

REGENERATOR

 No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	72.48%	27.52%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	2.55%	97.45%
n-Pentane	2.43%	97.57%
n-Hexane	1.81%	98.19%
Cyclohexane	6.12%	93.88%
Other Hexanes	4.00%	96.00%
Heptanes	1.27%	98.73%
Methylcyclohexane	6.84%	93.16%
Benzene	5.86%	94.14%
Toluene	8.77%	91.23%
Xylenes	13.46%	86.54%
C8+ Heavies	11.88%	88.12%

STREAM REPORTS:

WET GAS STREAM

 Temperature: 70.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 1.00e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.33e-002	2.53e+001
Carbon Dioxide	1.49e-001	1.73e+002
Nitrogen	5.13e-001	3.79e+002
Methane	7.14e+001	3.02e+004
Ethane	1.75e+001	1.39e+004
Propane	6.80e+000	7.91e+003
Isobutane	6.68e-001	1.02e+003
n-Butane	1.83e+000	2.80e+003
Isopentane	3.27e-001	6.22e+002
n-Pentane	4.40e-001	8.37e+002
n-Hexane	1.07e-001	2.43e+002
Cyclohexane	9.99e-003	2.22e+001
Other Hexanes	1.25e-001	2.84e+002
Heptanes	6.78e-002	1.79e+002
Methylcyclohexane	1.10e-002	2.85e+001
Benzene	9.99e-004	2.06e+000
Toluene	2.00e-003	4.86e+000

Xylenes	9.99e-004	2.80e+000
C8+ Heavies	3.10e-002	1.39e+002

Total Components	100.00	5.88e+004

DRY GAS STREAM

Temperature: 70.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 1.00e+006 scfh

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

Water	1.83e-003	8.70e-001
Carbon Dioxide	1.48e-001	1.72e+002
Nitrogen	5.13e-001	3.79e+002
Methane	7.14e+001	3.02e+004
Ethane	1.75e+001	1.39e+004
Propane	6.80e+000	7.90e+003
Isobutane	6.67e-001	1.02e+003
n-Butane	1.82e+000	2.79e+003
Isopentane	3.26e-001	6.21e+002
n-Pentane	4.39e-001	8.35e+002
n-Hexane	1.07e-001	2.42e+002
Cyclohexane	9.78e-003	2.17e+001
Other Hexanes	1.25e-001	2.83e+002
Heptanes	6.73e-002	1.78e+002
Methylcyclohexane	1.08e-002	2.78e+001
Benzene	7.87e-004	1.62e+000
Toluene	1.46e-003	3.54e+000
Xylenes	5.88e-004	1.65e+000
C8+ Heavies	3.08e-002	1.38e+002

Total Components	100.00	5.87e+004

LEAN GLYCOL STREAM

Temperature: 70.00 deg. F
 Flow Rate: 7.50e+000 gpm

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

TEG	9.85e+001	4.16e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	2.10e-012	8.86e-011
Nitrogen	3.67e-013	1.55e-011
Methane	8.08e-018	3.41e-016
Ethane	1.53e-007	6.46e-006
Propane	1.10e-008	4.63e-007
Isobutane	1.38e-009	5.83e-008
n-Butane	4.15e-009	1.75e-007
Isopentane	1.75e-004	7.41e-003
n-Pentane	3.08e-004	1.30e-002
n-Hexane	1.35e-004	5.69e-003
Cyclohexane	3.93e-004	1.66e-002
Other Hexanes	2.43e-004	1.02e-002
Heptanes	1.73e-004	7.31e-003
Methylcyclohexane	6.46e-004	2.73e-002

Benzene	5.48e-004	2.31e-002
Toluene	2.69e-003	1.14e-001
Xylenes	4.05e-003	1.71e-001
C8+ Heavies	3.58e-003	1.51e-001

Total Components	100.00	4.22e+003
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RICH GLYCOL AND PUMP GAS STREAM

Temperature: 70.00 deg. F
 Pressure: 914.70 psia
 Flow Rate: 8.06e+000 gpm
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.29e+001	4.16e+003
Water	1.96e+000	8.79e+001
Carbon Dioxide	3.12e-002	1.40e+000
Nitrogen	2.85e-002	1.27e+000
Methane	2.22e+000	9.93e+001
Ethane	1.22e+000	5.46e+001
Propane	7.75e-001	3.47e+001
Isobutane	1.11e-001	4.97e+000
n-Butane	3.42e-001	1.53e+001
Isopentane	7.41e-002	3.32e+000
n-Pentane	1.13e-001	5.07e+000
n-Hexane	4.15e-002	1.86e+000
Cyclohexane	1.31e-002	5.84e-001
Other Hexanes	4.16e-002	1.86e+000
Heptanes	4.45e-002	1.99e+000
Methylcyclohexane	1.71e-002	7.66e-001
Benzene	1.05e-002	4.69e-001
Toluene	3.24e-002	1.45e+000
Xylenes	2.98e-002	1.33e+000
C8+ Heavies	3.73e-002	1.67e+000
Total Components	100.00	4.48e+003

FLASH TANK OFF GAS STREAM

Temperature: 150.00 deg. F
 Pressure: 64.70 psia
 Flow Rate: 3.52e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.89e-001	4.82e-001
Carbon Dioxide	3.20e-001	1.31e+000
Nitrogen	4.87e-001	1.27e+000
Methane	6.63e+001	9.86e+001
Ethane	1.91e+001	5.34e+001
Propane	8.12e+000	3.32e+001
Isobutane	8.64e-001	4.66e+000
n-Butane	2.62e+000	1.41e+001
Isopentane	4.53e-001	3.03e+000
n-Pentane	6.78e-001	4.54e+000
n-Hexane	1.93e-001	1.54e+000
Cyclohexane	4.01e-002	3.13e-001

Other Hexanes	2.01e-001	1.61e+000
Heptanes	1.53e-001	1.42e+000
Methylcyclohexane	4.04e-002	3.68e-001
Benzene	1.02e-002	7.37e-002
Toluene	1.83e-002	1.56e-001
Xylenes	6.32e-003	6.22e-002
C8+ Heavies	2.52e-002	3.98e-001

Total Components	100.00	2.21e+002

FLASH TANK GLYCOL STREAM

Temperature: 150.00 deg. F
Flow Rate: 7.57e+000 gpm

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

TEG	9.77e+001	4.16e+003
Water	2.05e+000	8.74e+001
Carbon Dioxide	2.12e-003	9.01e-002
Nitrogen	2.01e-004	8.57e-003
Methane	1.60e-002	6.79e-001
Ethane	2.92e-002	1.24e+000
Propane	3.57e-002	1.52e+000
Isobutane	7.28e-003	3.10e-001
n-Butane	2.83e-002	1.20e+000
Isopentane	6.83e-003	2.91e-001
n-Pentane	1.26e-002	5.35e-001
n-Hexane	7.41e-003	3.15e-001
Cyclohexane	6.37e-003	2.71e-001
Other Hexanes	6.01e-003	2.56e-001
Heptanes	1.35e-002	5.74e-001
Methylcyclohexane	9.36e-003	3.99e-001
Benzene	9.28e-003	3.95e-001
Toluene	3.04e-002	1.30e+000
Xylenes	2.99e-002	1.27e+000
C8+ Heavies	2.99e-002	1.27e+000

Total Components	100.00	4.26e+003

FLASH GAS EMISSIONS

Flow Rate: 1.41e+004 scfh
Control Method: Combustion Device
Control Efficiency: 98.00

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

Water	6.18e+001	4.12e+002
Carbon Dioxide	3.76e+001	6.13e+002
Nitrogen	1.22e-001	1.27e+000
Methane	3.32e-001	1.97e+000
Ethane	9.58e-002	1.07e+000
Propane	4.06e-002	6.64e-001
Isobutane	4.32e-003	9.31e-002
n-Butane	1.31e-002	2.83e-001
Isopentane	2.26e-003	6.05e-002
n-Pentane	3.39e-003	9.07e-002

n-Hexane	9.65e-004	3.08e-002
Cyclohexane	2.01e-004	6.26e-003
Other Hexanes	1.01e-003	3.21e-002
Heptanes	7.63e-004	2.84e-002
Methylcyclohexane	2.02e-004	7.36e-003
Benzene	5.09e-005	1.47e-003
Toluene	9.16e-005	3.13e-003
Xylenes	3.16e-005	1.24e-003
C8+ Heavies	1.26e-004	7.95e-003

Total Components	100.00	1.03e+003

REGENERATOR OVERHEADS STREAM

 Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 5.87e+002 scfh

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

Water	8.63e+001	2.41e+001	
Carbon Dioxide	1.32e-001	9.01e-002	
Nitrogen	1.98e-002	8.57e-003	
Methane	2.74e+000	6.79e-001	
Ethane	2.68e+000	1.24e+000	
Propane	2.23e+000	1.52e+000	
Isobutane	3.45e-001	3.10e-001	
n-Butane	1.34e+000	1.20e+000	
Isopentane	2.54e-001	2.83e-001	
n-Pentane	4.68e-001	5.22e-001	
n-Hexane	2.32e-001	3.10e-001	
Cyclohexane	1.96e-001	2.55e-001	
Other Hexanes	1.84e-001	2.46e-001	
Heptanes	3.65e-001	5.66e-001	
Methylcyclohexane	2.45e-001	3.71e-001	
Benzene	3.08e-001	3.72e-001	
Toluene	8.30e-001	1.18e+000	
Xylenes	6.70e-001	1.10e+000	
C8+ Heavies	4.26e-001	1.12e+000	

Total Components	100.00	3.54e+001	

CONDENSER PRODUCED WATER STREAM

 Temperature: 100.00 deg. F
 Flow Rate: 4.76e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)

Water	1.00e+002	2.38e+001	999628.
Carbon Dioxide	1.17e-003	2.79e-004	12.
Nitrogen	2.54e-006	6.07e-007	0.
Methane	4.08e-004	9.72e-005	4.
Ethane	8.95e-004	2.13e-004	9.
Propane	9.32e-004	2.22e-004	9.
Isobutane	1.03e-004	2.47e-005	1.
n-Butane	5.35e-004	1.28e-004	5.
Isopentane	8.20e-005	1.95e-005	1.
n-Pentane	1.60e-004	3.81e-005	2.

n-Hexane	6.27e-005	1.49e-005	1.
Cyclohexane	2.71e-004	6.46e-005	3.
Other Hexanes	4.42e-005	1.05e-005	0.
Heptanes	3.75e-005	8.94e-006	0.
Methylcyclohexane	1.27e-004	3.04e-005	1.
Benzene	1.16e-002	2.76e-003	116.
Toluene	1.55e-002	3.69e-003	155.
Xylenes	5.27e-003	1.26e-003	53.
C8+ Heavies	2.03e-007	4.84e-008	0.

Total Components	100.00	2.38e+001	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 100.00 deg. F
Flow Rate: 1.03e-002 gpm

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

Water	3.24e-002	1.42e-003
Carbon Dioxide	4.44e-003	1.94e-004
Nitrogen	1.33e-004	5.83e-006
Methane	1.22e-002	5.34e-004
Ethane	1.28e-001	5.61e-003
Propane	8.00e-001	3.50e-002
Isobutane	3.35e-001	1.47e-002
n-Butane	1.81e+000	7.94e-002
Isopentane	1.05e+000	4.58e-002
n-Pentane	2.22e+000	9.75e-002
n-Hexane	2.66e+000	1.16e-001
Cyclohexane	2.66e+000	1.17e-001
Other Hexanes	1.69e+000	7.40e-002
Heptanes	8.29e+000	3.63e-001
Methylcyclohexane	5.42e+000	2.38e-001
Benzene	4.13e+000	1.81e-001
Toluene	2.02e+001	8.84e-001
Xylenes	2.30e+001	1.01e+000
C8+ Heavies	2.56e+001	1.12e+000

Total Components	100.00	4.38e+000

CONDENSER VENT STREAM

Temperature: 100.00 deg. F
Pressure: 14.00 psia
Flow Rate: 6.88e+001 scfh

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

Water	6.85e+000	2.24e-001
Carbon Dioxide	1.12e+000	8.96e-002
Nitrogen	1.69e-001	8.56e-003
Methane	2.33e+001	6.79e-001
Ethane	2.27e+001	1.24e+000
Propane	1.86e+001	1.48e+000
Isobutane	2.80e+000	2.95e-001
n-Butane	1.07e+001	1.12e+000
Isopentane	1.82e+000	2.37e-001

n-Pentane	3.25e+000	4.25e-001
n-Hexane	1.24e+000	1.93e-001
Cyclohexane	9.05e-001	1.38e-001
Other Hexanes	1.10e+000	1.72e-001
Heptanes	1.12e+000	2.03e-001
Methylcyclohexane	7.52e-001	1.34e-001
Benzene	1.33e+000	1.88e-001
Toluene	1.77e+000	2.95e-001
Xylenes	4.71e-001	9.07e-002
C8+ Heavies	6.39e-003	1.97e-003

Total Components	100.00	7.22e+000

COMBUSTION DEVICE OFF GAS STREAM

Temperature: 1000.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 3.16e+001 scfh

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

Methane	2.54e+001	3.39e-001
Ethane	2.47e+001	6.19e-001
Propane	2.02e+001	7.42e-001
Isobutane	3.05e+000	1.48e-001
n-Butane	1.16e+001	5.62e-001
Isopentane	1.98e+000	1.19e-001
n-Pentane	3.54e+000	2.12e-001
n-Hexane	1.35e+000	9.66e-002
Cyclohexane	9.85e-001	6.90e-002
Other Hexanes	1.20e+000	8.59e-002
Heptanes	1.22e+000	1.02e-001
Methylcyclohexane	8.18e-001	6.69e-002
Benzene	1.45e+000	9.40e-002
Toluene	1.92e+000	1.47e-001
Xylenes	5.13e-001	4.54e-002
C8+ Heavies	6.96e-003	9.87e-004

Total Components	100.00	3.45e+000

CONDENSER CONTROL CURVE DATA REPORT:

CONDENSER CONTROL EFFICIENCY CURVES

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

Temp (F)	BTEX	Total HAP	VOC
40.0	97.06	95.85	67.53
45.0	96.44	95.02	66.07
50.0	95.71	94.06	64.58
55.0	94.85	92.96	63.06
60.0	93.86	91.70	61.51
65.0	92.72	90.28	59.91
70.0	91.40	88.67	58.26
75.0	89.90	86.88	56.57
80.0	88.04	84.70	54.65

85.0	86.04	82.43	52.80
90.0	83.78	79.91	50.86
95.0	81.21	77.12	48.85
100.0	78.31	74.05	46.74
105.0	75.06	70.66	44.54
110.0	71.42	66.96	42.26
115.0	67.37	62.91	39.90
120.0	62.90	58.52	37.45
125.0	58.02	53.79	34.95
130.0	52.73	48.74	32.40
135.0	47.09	43.41	29.83
140.0	41.19	37.89	27.25
145.0	35.17	32.29	24.70
150.0	29.19	26.76	22.20
155.0	23.45	21.47	19.75
160.0	18.10	16.56	17.29
165.0	13.19	12.07	14.63
170.0	8.98	8.22	11.61

ANNUAL AIR-COOLED CONDENSER PERFORMANCE:

ANNUAL AIR-COOLED CONDENSER PERFORMANCE

Nearest Site for Air Temperature Data: Pittsburgh, PA

Ambient Air Dry Bulb Temperature (deg. F)	Frequency (%)	Condenser Outlet Temperature (deg. F)
<=50	47.54	<=70
51-55	7.60	71-75
56-60	8.16	76-80
61-65	9.24	81-85
66-70	9.63	86-90
71-75	7.80	91-95
76-80	5.39	96-100
81-85	3.24	101-105
86-90	1.11	106-110
91-95	0.27	111-115
96-100	0.03	116-120
>100	0.00	>120

Condenser outlet temperature approach to ambient: 20.00 deg. F

Annual air-cooled condenser emissions and control efficiency:

	Uncontrolled emissions tons/year	Controlled emissions tons/year	% Control
Benzene	1.628	0.541	66.75
BTEX	11.625	1.458	87.46
Total HAP	12.982	2.051	84.20
VOC	41.012	18.624	54.59

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, and on or before September 18, 2015?

Yes No

Please list approximate number.

Are there any continuous bleed natural gas driven pneumatic controllers at this facility that commenced construction, modification or reconstruction after September 18, 2015?

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, and on or before September 18, 2015?

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 September 18, 2015?

Yes No

Please list approximate number.

ATTACHMENT R: PNEUMATIC PUMP DATA SHEET

**ATTACHMENT R – PNEUMATIC PUMP
DATA SHEET**

Are there any natural gas-driven diaphragm pumps located at a well site that commenced construction, modification or reconstruction after September 18, 2015?

Yes No

Please list.

Source ID #	Date	Pump Make/Model	Pump Size

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

VAPOR COMBUSTION

AP-42 EMISSION FACTORS

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

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

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

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

Emission Unit ID:	Make/Model:
Primary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: <input type="checkbox"/> Yes <input type="checkbox"/> No
Secondary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: <input type="checkbox"/> Yes <input type="checkbox"/> No

VAPOR COMBUSTION (Including Enclosed Combustors)

General Information

Control Device ID#: APC-COMB	Installation Date: TBD <input checked="" type="checkbox"/> New <input type="checkbox"/> Modified <input type="checkbox"/> Relocated	
Maximum Rated Total Flow Capacity 6,125 scfh 147,000 scfd	Maximum Design Heat Input (from mfg. spec sheet) 15 MMBTU/hr	Design Heat Content 2,450 BTU/scf

Control Device Information

Type of Vapor Combustion Control?		
<input checked="" type="checkbox"/> Enclosed Combustion Device <input type="checkbox"/> Thermal Oxidizer	<input type="checkbox"/> Elevated Flare	<input type="checkbox"/> Ground Flare
Manufacturer: MRW Technologies Model: TBF-5.5-30-147000	Hours of operation per year? 8,760	

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

Emission Unit ID#	Emission Source Description	Emission Unit ID#	Emission Source Description
EU-TANKS-COND	Condensate Tanks	EU-LOAD-COND	Condensate Truck Loading
EU-TANKS-PW	Produced Water Tanks	EU-LOAD-PW	Produced Water 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?
<input type="checkbox"/> Steam <input type="checkbox"/> Air <input type="checkbox"/> Pressure <input checked="" type="checkbox"/> Non	30 feet	5.5 feet	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Provide determination.

Waste Gas Information

Maximum Waste Gas Flow Rate 102.08 (scfm)	Heat Value of Waste Gas Stream 2,450 BTU/ft ³	Exit Velocity of the Emissions Stream (ft/s)
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Provide an attachment with the characteristics of the waste gas stream to be burned.

Pilot Gas Information

Number of Pilot Lights 1	Fuel Flow Rate to Pilot Flame per Pilot 50 scfh	Heat Input per Pilot 45,250 BTU/hr	Will automatic re-ignition be used? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> 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 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? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If Yes, what type? <input type="checkbox"/> Thermocouple <input type="checkbox"/> Infrared <input type="checkbox"/> Ultraviolet <input type="checkbox"/> Camera <input checked="" type="checkbox"/> Other: flame rod
---	---

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

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

CONDENSER

General Information

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



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

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

Description of Control Scheme:

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

C O M B U S T I O N S Y S T E M S

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/m³ (300 Btu/ft³). 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/m³ (450 Btu/ft³) 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 SO₂ when burned. The amount of SO₂ emitted depends directly on the quantity of sulfur in the flared gases.

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

EMISSION FACTOR RATING: B

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

^a Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.

^b Measured as methane equivalent.

^c Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

ATTACHMENT T: EMISSIONS CALCULATIONS

SWN Production Company, LLC
Mark Edison Pad
Summary of Criteria Air Pollutant Emissions

Equipment	Unit ID	Emission Point ID	NOx		CO		Total VOC ¹		SO ₂		PM Total	
			lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
145-hp Caterpillar G3306 NA Engine	EU-ENG1	EP-ENG1	0.32	1.40	0.64	2.80	0.31	1.36	<0.01	<0.01	0.02	0.11
103.3-hp Zenith ZPP-644 4.4L Engine	EU-ENG2	EP-ENG2	0.46	2.01	0.75	3.27	0.46	2.01	<0.01	<0.01	0.01	0.05
1.0-mmBtu/hr GPU Burner	EU-GPU1	EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
0.5-mmBtu/hr Heater Treater	EU-HT1	EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02
24.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	EP-RB1	-	-	-	-	2.99	13.09	-	-	-	-
0.75-mmBtu/hr TEG Reboiler	EU-RB1	EP-RB1	0.08	0.36	0.07	0.30	<0.01	0.02	<0.01	<0.01	0.01	0.03
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	APC-COMB	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	APC-COMB	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	APC-COMB	-	-	-	-	1.52	6.65	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	APC-COMB	-	-	-	-	0.01	0.02	-	-	-	-
15.0-mmBtu/hr Vapor Combustor	APC-COMB	APC-COMB	2.07	9.07	4.13	18.10	0.98	4.27	-	-	0.05	0.20
Vapor Combustor Pilot	EU-PILOT	APC-COMB	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	EP-FUG	-	-	-	-	0.62	2.72	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	EP-HR	-	-	-	-	-	-	-	-	0.82	2.71
Total =			3.10	13.59	5.73	25.11	6.89	30.19	<0.01	0.01	0.93	3.16

Notes:

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

SWN Production Company, LLC
 Mark Edison Pad
 Summary of Hazardous Air Pollutants

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-ENG1	<0.01	<0.01	<0.01	<0.01	0.09	<0.01	-	<0.01	<0.01	0.10
103.3-hp Zenith ZPP-644 4.4L Engine	EU-ENG2	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	-	<0.01	<0.01	0.02
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
24.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.11	0.00	-	-	0.12	0.18	0.05	0.46
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	<0.01	0.01	-	-	0.09	0.01	0.02	0.12
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB	-	-	<0.01	<0.01	-	-	0.06	<0.01	0.01	0.08
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.03	<0.01	0.01	0.03
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		0.01	<0.01	0.12	0.01	0.10	0.01	0.29	0.19	0.10	0.82

Continued on Next Page

SWN Production Company, LLC
 Mark Edison Pad
 Summary of Hazardous Air Pollutants (Continued)

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-ENG1	0.02	0.01	0.01	<0.01	0.38	0.02	-	<0.01	<0.01	0.44
103.3-hp Zenith ZPP-644 4.4L Engine	EU-ENG2	0.01	0.01	<0.01	<0.01	0.06	0.01	-	<0.01	<0.01	0.09
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
24.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.49	0.00	-	-	0.51	0.77	0.24	2.02
0.75-mmBtu/hr TEG Reboiler	EU-RB1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	<0.01	0.03	-	-	0.38	0.03	0.10	0.54
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB	-	-	<0.01	0.02	-	-	0.25	0.02	0.06	0.35
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.01	-	-	0.11	0.01	0.02	0.15
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Total =		0.02	0.02	0.52	0.05	0.44	0.03	1.28	0.83	0.42	3.60

SWN Production Company, LLC
 Mark Edison 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 ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ Eq.		Total CO ₂ + CO ₂ Eq. ¹	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
145-hp Caterpillar G3306 NA Engine	EU-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
103.3-hp Zenith ZPP-644 4.4L Engine	EU-ENG2	74.89	297.56	<0.01	0.01	0.04	0.14	<0.01	<0.01	0.04	0.17	74.96	297.87
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	232.40	<0.01	<0.01	0.03	0.11	<0.01	<0.01	0.03	0.13	58.55	232.64
24.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	<0.01	0.41	1.62	10.18	40.45	-	-	-	-	10.18	40.45
0.75-mmBtu/hr TEG Reboiler	EU-RB1	87.73	348.60	<0.01	0.01	0.04	0.16	<0.01	<0.01	0.05	0.20	87.82	348.96
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	<0.01	0.22	0.86	5.42	21.54	-	-	-	-	5.42	21.55
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	<0.01	0.19	0.75	4.74	18.85	-	-	-	-	4.75	18.86
15.0-mmBtu/hr Vapor Combustor	APC-COMB	1,754.66	6,972.07	0.03	0.13	0.83	3.28	<0.01	0.01	0.99	3.92	1,756.47	6,979.27
Vapor Combustor Pilot	EU-PILOT	5.29	21.03	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	21.05
Fugitive Emissions	EU-FUG	<0.01	0.01	0.60	2.40	15.07	59.88	-	-	-	-	15.07	59.90
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		2,311.57	9,184.93	1.46	5.80	36.50	145.03	<0.01	0.02	1.29	5.14	2,349.36	9,335.11

Notes:
¹ CO₂ Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO₂ = 1, CH₄ = 25, N₂O = 298
² Per API Compendium (2009) Chapter 5: Because most of the CH₄ and CO₂ 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
 Mark Edison 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 ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ Eq.		Total CO ₂ + CO ₂ Eq. ¹	
		lb/hr	tons/yr ²	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr
145-hp Caterpillar G3306 NA Engine	EU-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
103.3-hp Zenith ZPP-644 4.4L Engine	EU-ENG2	74.89	328.00	<0.01	0.01	0.04	0.15	<0.01	<0.01	0.04	0.18	74.96	328.34
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	256.18	<0.01	<0.01	0.03	0.12	<0.01	<0.01	0.03	0.14	58.55	256.44
24.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	0.01	0.41	1.78	10.18	44.58	-	-	-	-	10.18	44.59
0.75-mmBtu/hr TEG Reboiler	EU-RB1	87.73	384.27	<0.01	0.01	0.04	0.18	<0.01	<0.01	0.05	0.22	87.82	384.67
Two (2) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Two (2) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.01	0.22	0.95	5.42	23.75	-	-	-	-	5.42	23.75
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	<0.01	0.19	0.83	4.74	20.78	-	-	-	-	4.75	20.78
15.0-mmBtu/hr Vapor Combustor	APC-COMB	1,754.66	7,685.39	0.03	0.14	0.83	3.62	<0.01	0.01	0.99	4.32	1,756.47	7,693.33
Vapor Combustor Pilot	EU-PILOT	5.29	23.18	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	23.21
Fugitive Emissions	EU-FUG	<0.01	0.01	0.60	2.64	15.07	66.01	-	-	-	-	15.07	66.02
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Total =		2,311.57	10,124.66	1.46	6.39	36.50	159.87	<0.01	0.02	1.29	5.66	2,349.36	10,290.19

Notes:
¹ CO₂ Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO₂ = 1, CH₄ = 25, N₂O = 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 CH₄ and CO₂ 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
Mark Edison Pad
Engine Emissions Calculations - Criteria Air Pollutants**

Equipment Information

Unit ID:	<u>EU-ENG1</u>	<u>EU-ENG2</u>
Emission Point ID:	EP-ENG1	EP-ENG2
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Controls:	NSCR	NSCR
Horsepower (hp):	145	103.3
Capacity (kW):	NA	77.0
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	707
Annual Fuel Use (mmscf):	12.11	6.20
Fuel Use (mmBtu/hr):	1.25	0.64
Exhaust Flow (acfm):	678	NA
Exhaust Temp (°F):	1,101	NA
Manufacture Date:	after 1/1/2011	after 1/1/2011
Operating Hours:	8,760	8,760
Fuel Heating Value (Btu/scf):	905	905

Uncontrolled Manufacturer Emission Factors ¹

NOx (g/hp-hr):	13.47	NA
CO (g/hp-hr):	13.47	NA
NMNEHC/VOC (g/hp-hr):	0.22	NA
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.49	NA
NMHC + NOx as NOx (g/kW-hr):	NA	2.70
CO (g/kW-hr):	NA	4.40
NMHC + NOx as VOC (g/kW-hr):	NA	2.70

Post-Catalyst Emission Factors

NOx Control Eff. %	92.58%	NA
CO Control Eff. %	85.15%	NA
NOx (g/hp-hr):	1.00	NA
CO (g/hp-hr):	2.00	NA
NMNEHC/VOC (g/hp-hr):	0.70	NA
Total VOC = NMNEHC + HCHO (g/hp-hr):	0.97	NA
NMHC + NOx as NOx (g/kW-hr):	NA	2.70
CO (g/kW-hr):	NA	4.40
NMHC + NOx as VOC (g/kW-hr):	NA	2.70

Uncontrolled Criteria Air Pollutant Emissions

Pollutant	Unit ID: <u>EU-ENG1</u>		Unit ID: <u>EU-ENG2</u>	
	lb/hr	TPY	lb/hr	TPY
NOx	4.31	18.86	NA	NA
NMHC + NOx as NOx	NA	NA	0.46	2.01
CO	4.31	18.86	0.75	3.27
NMNEHC/VOC (does not include HCHO)	0.07	0.31	NA	NA
Total VOC (includes HCHO)	0.16	0.69	NA	NA
NMHC + NOx as VOC	NA	NA	0.46	2.01
SO ₂	<0.01	<0.01	<0.01	<0.01
PM _{10/2.5}	0.01	0.05	0.01	0.03
PM _{COND}	0.01	0.05	0.01	0.03
PM _{TOT}	0.02	0.11	0.01	0.05

**SWN Production Company, LLC
 Mark Edison Pad
 Engine Emissions Calculations - Criteria Air Pollutants (Continued)**

Proposed Criteria Air Pollutant Emissions^{2,3}

Pollutant	lb/hr	TPY	lb/hr	TPY
NO _x	0.32	1.40	NA	NA
NMHC + NO _x as NO _x	NA	NA	0.46	2.01
CO	0.64	2.80	0.75	3.27
NMNEHC/VOC (does not include HCHO)	0.22	0.98	NA	NA
Total VOC (includes HCHO)	0.31	1.36	NA	NA
NMHC + NO _x as VOC	NA	NA	0.46	2.01
SO ₂	<0.01	<0.01	<0.01	<0.01
PM _{10/2.5}	0.01	0.05	0.01	0.03
PM _{COND}	0.01	0.05	0.01	0.03
PM _{TOT}	0.02	0.11	0.01	0.05

AP-42 Emission Factors (lb/mmBtu)⁴

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 for the Caterpillar engine are 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 Zenith engine is certified to meet EPA emissions standards of 2.7 g/kW-hr NMHC+NO_x and 4.4 g/kW-hr CO. Total NMHC+NO_x factor used to conservatively estimate emissions of NO_x and VOC, respectively. All other pollutants calculated using AP-42.

⁴ 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
 Mark Edison Pad
 Engine Emissions Calculations - Hazardous Air Pollutants**

Equipment Information

Unit ID:	<u>EU-ENG1</u>	<u>EU-ENG2</u>
Emission Point ID:	EP-ENG1	EP-ENG2
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Controls:	NSCR	NSCR
Horsepower (hp):	145	103
Capacity (kW):	NA	77.0
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	707
Annual Fuel Use (mmscf):	12.11	6.20
Fuel Use (mmBtu/hr):	1.25	0.64
Exhaust Flow (acfm):	678	NA
Exhaust Temp (°F):	1,101	NA
Operating Hours:	8,760	8,760

Proposed HAP Emissions^{1,2}

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

Pollutant	lb/hr	TPY	lb/hr	TPY
Acetaldehyde	<0.01	0.02	<0.01	0.01
Acrolein	<0.01	0.01	<0.01	0.01
Benzene	<0.01	0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.09	0.38	0.01	0.06
Methanol	<0.01	0.02	<0.01	0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01
Total HAP =	0.10	0.44	0.02	0.09

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
Formaldehyde	2.05E-02
Methanol	3.06E-03
Toluene	5.58E-04
Xylenes	1.95E-04

Notes:

¹ Manuf. data for uncontrolled Caterpillar G3306 HCHO emissions (g/hp-hr): 0.27

² For conservative estimate, no reduction taken for any HAP .

**SWN Production Company, LLC
 Mark Edison Pad
 Engine Emissions Calculations - Greenhouse Gases**

Equipment Information

Unit ID:	<u>EU-ENG1</u>	<u>EU-ENG2</u>
Emission Point ID:	EP-ENG1	EP-ENG2
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Horsepower (hp):	145	103
Capacity (kW):	NA	77.0
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	707
Fuel Use (mmBtu/hr):	1.25	0.64
Exhaust Flow (acfm):	678	NA
Exhaust Temp (°F):	1,101	NA
Operating Hours:	8,760	8,760

Manufacturer Emission Factors (g/hp-hr)¹

CO ₂ =	485	NA
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Greenhouse Gas (GHG) Emissions¹

Pollutant	lb/hr	tonnes/yr	lb/hr	tonnes/yr
CO ₂	155.04	616.04	74.89	297.56
CH ₄	<0.01	0.01	<0.01	0.01
N ₂ O	<0.01	<0.01	<0.01	<0.01
CH ₄ as CO ₂ e	0.07	0.27	0.04	0.14
N ₂ O as CO ₂ e	0.08	0.33	0.04	0.17
Total CO₂ + CO₂e =	155.19	616.64	74.96	297.87

40 CFR 98 Tables ENG-1 and ENG-2 Emission Factors (kg/mmBtu)²

Carbon Dioxide (CO ₂)	53.06
Methane (CH ₄)	1.00E-03
Nitrous Oxide (N ₂ O)	1.00E-04

Notes:

¹ Manufacturer data used to estimate CO₂ emissions for the Caterpillar engine. All other emissions estimated using EPA data. Conversion to short tons (tons) found in site-wide Summary of Greenhouse Gases - Short Tons per Year (tons) table.

² CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

**SWN Production Company, LLC
 Mark Edison Pad
 Gas Production Unit Burner Emissions Calculations - Criteria Air Pollutants**

Equipment Information

Unit ID: **EU-GPU1**
 Emission Point ID: EP-GPU1
 Description: Gas Production Unit Burner
 Number of Units: 1
 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**

Pollutant	lb/hr	TPY
NO _x	0.11	0.48
CO	0.09	0.41
VOC	0.01	0.03
SO ₂	<0.01	<0.01
PM _{10/2.5}	0.01	0.03
PM _{COND}	<0.01	0.01
PM _{TOT}	0.01	0.04

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

Pollutant	1.4-1, -2 (7/98)
NO _x	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
 Mark Edison Pad
 Gas Production Unit Burner Emissions Calculations - Hazardous Air Pollutants**

Equipment Information

Unit ID: **EU-GPU1**
 Emission Point ID: EP-GPU1
 Description: Gas Production Unit Burner
 Number of Units: 1
 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**

Pollutant	lb/hr	TPY
n-Hexane	<0.01	0.01
Formaldehyde	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Total HAP =	<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
 Mark Edison Pad
 Gas Production Unit Burner Emissions Calculations - Greenhouse Gases**

Equipment Information

Unit ID:	<u>EU-GPU1</u>
Emission Point ID:	EP-GPU1
Description:	Gas Production Unit Burner
Number of Units:	1
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) Emissions¹

Unit ID: **EU-GPU1**

Pollutant	lb/hr	tonnes/yr
CO ₂	116.98	464.80
CH ₄	<0.01	0.01
N ₂ O	<0.01	<0.01
CH ₄ as CO ₂ e	0.06	0.22
N ₂ O as CO ₂ e	0.07	0.26
Total CO₂ + CO₂e =	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 ₂ O)	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 CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

**SWN Production Company, LLC
 Mark Edison Pad
 Heater Treater Emissions Calculations - Criteria Air Pollutants**

Equipment Information

Unit ID:	<u>EU-HT1</u>
Emission Point ID:	EP-HT1
Description:	Heater Treater
Number of Units:	1
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**

Pollutant	lb/hr	TPY
NO _x	0.06	0.24
CO	0.05	0.20
VOC	<0.01	0.01
SO ₂	<0.01	<0.01
PM _{10/2.5}	<0.01	0.01
PM _{COND}	<0.01	<0.01
PM _{TOT}	<0.01	0.02

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

Pollutant	1.4-1, -2 (7/98)
NO _x	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
 Mark Edison Pad
 Heater Treater Emissions Calculations - Hazardous Air Pollutants**

Equipment Information

Unit ID: **EU-HT1**
 Emission Point ID: EP-HT1
 Description: Heater Treater
 Number of Units: 1
 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**

Pollutant	lb/hr	TPY
n-Hexane	<0.01	<0.01
Formaldehyde	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Total HAP =	<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
Mark Edison Pad
Heater Treater Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	<u>EU-HT1</u>
Emission Point ID:	EP-HT1
Description:	Heater Treater
Number of Units:	1
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) Emissions¹

Unit ID: **EU-HT1**

Pollutant	lb/hr	tonnes/yr
CO ₂	58.49	232.40
CH ₄	<0.01	<0.01
N ₂ O	<0.01	<0.01
CH ₄ as CO ₂ e	0.03	0.11
N ₂ O as CO ₂ e	0.03	0.13
Total CO₂ + CO₂e =	58.55	232.64

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 ₂ O)	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 CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

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

Equipment Information

<u>Parameter</u>	<u>Units</u>	<u>Value</u>
Unit ID	-	EU-DEHY1
Emission Point ID:	-	EP-RB1
Maximum Throughput	MMSCFD	24.0
Operating Hours	Hours/Year	8,760
Wet Gas Temperature	°F	70
Wet Gas Pressure	psig	900
Pump Make	-	Kimray
Pump Model	-	45015 PV
Pump Type	Electric/Gas	Gas
Lean Glycol Flow Rate ¹	gpm	7.50
Flash Tank Temperature	°F	150
Flash Tank Pressure	psig	50
Flash Tank Controls ²	-	Combustion
Regenerator Still Vent Controls ³	-	Condenser/ Combustion
Flash Tank Control Efficiency	%	98%
Condenser Temperature	°F	100
Condenser Pressure	psia	14.00
Safety factor	%	20%

Proposed Emissions⁴

Unit ID: **EU-DEHY1**

Pollutant	lb/hr	TPY
n-Hexane	0.12	0.51
Benzene	0.11	0.49
Toluene	0.18	0.77
Ethylbenzene	<0.01	<0.01
Xylenes	0.05	0.24
Total HAPs =	0.46	2.02
Total VOCs =	2.99	13.09

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

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

Pollutant	<u>STILL VENT</u>		<u>FLASH TANK</u>		<u>TOTAL (EU-DEHY1)</u>	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
n-Hexane	0.0966	0.4231	0.0308	0.1350	0.1274	0.5581
Benzene	0.0940	0.4117	0.0015	0.0065	0.0955	0.4182
Toluene	0.1475	0.6458	0.0031	0.0137	0.1506	0.6595
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes	0.0454	0.1987	0.0012	0.0054	0.0466	0.2041
Total HAP =	0.3835	1.6793	0.0366	0.1606	0.4201	1.8399
Total VOCs =	2.4909	10.9100	1.3096	5.7361	3.8005	16.6461

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

Pollutant	<u>STILL VENT</u>		<u>FLASH TANK</u>		<u>TOTAL (EU-DEHY1)</u>	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
n-Hexane	0.3096	1.3563	1.5416	6.7524	1.8512	8.1087
Benzene	0.3718	1.6284	0.0737	0.3226	0.4455	1.9510
Toluene	1.1826	5.1796	0.1564	0.6851	1.3390	5.8647
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes	1.0998	4.8173	0.0622	0.2723	1.1620	5.0896
Total HAP =	2.9638	12.9816	1.8339	8.0324	4.7977	21.0140
Total VOCs =	9.3635	41.0122	65.4805	286.8045	74.8440	327.8167

Notes:

- ¹ Dehydration unit is equipped with two (2) 7.5 gpm Kimray 45015 gas injection pumps. One is a backup; only one pump will be in use at one time.
- ² Flash tank off gas is recycled to the heater treater then recompressed. Flash tank off-gases can also be used as supplemental fuel for the reboiler; therefore, a capture efficiency of 100% and a destruction efficiency of 98% were used in in GRI-GLYCalc™.
- ³ Regenerator still vent emissions are controlled by condenser, with non-condensables routed to the reboiler for destruction. 50% combustion control efficiency taken in GRI-GLYCalc™.
- ⁴ 20% safety factor added to controlled GRI-GLYCalc™ results to account for potential fluctuations in gas composition. Note that proposed emissions include still vent emissions only.
- ⁵ GRI-GLYCalc™ report attached.

SWN Production Company, LLC

Mark Edison Pad

Glycol Dehydration Unit Emissions - Greenhouse Gas Emissions

CH ₄ mol% from gas analysis =	71.427%
CO ₂ mol% from gas analysis =	0.149%

Proposed Emissions ¹

Unit ID: **EU-DEHY1**

Pollutant	lb/hr	tons/yr
CO ₂ =	<0.01	0.01
CH ₄ =	0.41	1.78
CH ₄ as CO ₂ e =	10.18	44.58
Total CO₂ + CO₂e =	10.18	44.59

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

Unit ID: **STILL VENT** **FLASH TANK** **TOTAL (EU-DEHY1)**

Pollutant	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
CO ₂ =	0.0019	0.0085	0.0113	0.0496	0.0133	0.0581
CH ₄ from GLYCalc =	0.3393	1.4861	1.9727	8.6406	2.3120	10.1267
CH ₄ as CO ₂ e =	8.4825	37.1525	49.3175	216.0150	57.8000	253.1675
Total CO₂ + CO₂e =	8.4844	37.1610	49.3288	216.0646	57.8133	253.2256

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

Unit ID: **STILL VENT** **FLASH TANK** **TOTAL (EU-DEHY1)**

Pollutant	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
CO ₂ =	0.0039	0.0171	0.5658	2.4784	0.5697	2.4955
CH ₄ from GLYCalc =	0.6792	2.9750	98.6369	432.0296	99.3161	435.0046
CH ₄ as CO ₂ e =	16.9800	74.3750	2,465.9225	10,800.7400	2,482.9025	10,875.1150
Total CO₂ + CO₂e =	16.9839	74.3921	2,466.4883	10,803.2184	2,483.4722	10,877.6105

Notes:

¹ Proposed CH₄ emissions based on GRI-GLYCalc™ results with 20% safety factor added for potential fluctuations in gas composition. Proposed CO₂ emissions calculated using mass balance based on CH₄ and CO₂ mol% in the gas sample. Note that proposed emissions include still vent emissions only. Flash tank emissions are controlled by the combustor and are represented there.

² Example CO₂ Calculation (Exhibit 5.1: API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, August 2009):
 CO₂ = tonnes CH₄ * tonne mole CH₄/16 tonne CH₄ * tonne mole gas/tonne mole CH₄ * tonne mole CO₂/tonne mole gas * 44 tonne CO₂/tonne mole CO₂

**SWN Production Company, LLC
 Mark Edison Pad
 Reboiler Emissions Calculations - Criteria Air Pollutants**

Equipment Information

Unit ID:	<u>EU-RB1</u>
Emission Point ID:	EP-RB1
Description:	TEG Reboiler
Number of Units:	1
Burner Design (mmBtu/hr):	0.75
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	7.26
Annual Operating Hours:	8,760

Criteria Air Pollutant Emissions

Unit ID: **EU-RB1**

Pollutant	lb/hr	TPY
NO _x	0.08	0.36
CO	0.07	0.30
VOC	<0.01	0.02
SO ₂	<0.01	<0.01
PM _{10/2.5}	<0.01	0.02
PM _{COND}	<0.01	0.01
PM _{TOT}	0.01	0.03

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

Pollutant	1.4-1, -2 (7/98)
NO _x	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
 Mark Edison Pad
 Reboiler Emissions Calculations - Hazardous Air Pollutants**

Equipment Information

Unit ID: **EU-RB1**
 Emission Point ID: EP-RB1
 Description: TEG Reboiler
 Number of Units: 1
 Burner Design (mmBtu/hr): 0.75
 Fuel HHV (Btu/scf): 905
 Annual Fuel Use (mmscf): 7.26
 Annual Operating Hours: 8,760

Hazardous Air Pollutant Emissions

Unit ID: **EU-RB1**

Pollutant	lb/hr	TPY
n-Hexane	<0.01	0.01
Formaldehyde	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Total HAP =	<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
 Mark Edison Pad
 Reboiler Emissions Calculations - Greenhouse Gases**

Equipment Information

Unit ID:	<u>EU-RB1</u>
Emission Point ID:	EP-RB1
Description:	TEG Reboiler
Number of Units:	1
Burner Design (mmBtu/hr):	0.75
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	7.26
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions¹

Unit ID: **EU-RB1**

Pollutant	lb/hr	tonnes/yr
CO ₂	87.73	348.60
CH ₄	<0.01	0.01
N ₂ O	<0.01	<0.01
CH ₄ as CO ₂ e	0.04	0.16
N ₂ O as CO ₂ e	0.05	0.20
Total CO₂ + CO₂e =	87.82	348.96

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 ₂ O)	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 CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

**SWN Production Company, LLC
Mark Edison Pad
Storage Tank Emissions - Criteria Air Pollutants**

Tank Information

	<u>EU-TANKS-COND</u>	<u>EU-TANKS-PW</u>
Unit ID:	APC-COMB	APC-COMB
Emission Point ID:	APC-COMB	APC-COMB
Contents: ^{1,3}	Condensate	Produced Water
Number of Tanks:	2	2
Capacity (bbl) - Per Tank:	400	400
Capacity (gal) - Per Tank:	16,800	16,800
Total:		
Total Throughput (bbl/yr):	146,000	127,750
Total Throughput (gal/yr):	6,132,000	5,365,500
Total Throughput (bbl/d):	400	350
Per Tank:		
Throughput (bbl/yr):	73,000	63,875
Throughput (gal/yr):	3,066,000	2,682,750
Throughput (bbl/d):	200	175
Turnovers:	365.00	319.38
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	2.56	11.20	0.01	0.04
Breathing Losses	1.47	6.42	<0.01	0.01
Flashing Losses ²	40.48	177.30	0.71	3.10
Total VOC =	44.50	194.92	0.72	3.16

Controlled Storage Tank Emissions³

Unit ID: **EU-TANKS-COND** **EU-TANKS-PW**

Emissions	lb/hr	TPY	lb/hr	TPY
Working Losses	0.05	0.22	<0.01	<0.01
Breathing Losses	0.03	0.13	<0.01	<0.01
Flashing Losses	0.81	3.55	0.01	0.06
Total VOC =	0.89	3.90	0.01	0.06
Per Tank =	0.45	1.95	0.01	0.03

Notes:

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

² Flashing calculated using Promax process simulation. Reports located in Attachment L. Uncontrolled tank working/breathing/flashing emissions are routed to a vapor combustor with 100% capture efficiency.

³ Controlled tank emissions are shown for reference only.

**SWN Production Company, LLC
 Mark Edison 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 = ^{1,2}	44.50	194.92	0.72	3.16
n-Hexane	2.57	11.27	0.04	0.18
Benzene	0.03	0.14	<0.01	<0.01
Toluene	0.17	0.76	<0.01	0.01
Ethylbenzene	0.19	0.82	<0.01	0.01
Xylenes	0.64	2.79	0.01	0.05
Total HAP =	3.60	15.78	0.06	0.26

Controlled Storage Tank Emissions ³

Unit ID: **EU-TANKS-COND** **EU-TANKS-PW**

Pollutant	lb/hr	TPY	lb/hr	TPY
Total VOC = ¹	0.89	3.90	0.01	0.06
n-Hexane	0.05	0.23	<0.01	<0.01
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	0.02	<0.01	<0.01
Ethylbenzene	<0.01	0.02	<0.01	<0.01
Xylenes	0.01	0.06	<0.01	<0.01
Total HAP =	0.07	0.32	<0.01	0.01

Estimated HAP Composition (% by Weight)⁴

Pollutant	Wt%
n-Hexane	5.783%
Benzene	0.070%
Toluene	0.390%
Ethylbenzene	0.421%
Xylenes	1.432%
Total HAP =	8.096%

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 Controlled tank emissions are shown for reference only.

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.

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

Loading Information

Unit ID: **EU-LOAD-COND**
Emission Point ID: APC-COMB
Fill Method: Submerged
Type of Service: Dedicated
Mode of Operation: Normal
Saturation Factor: 0.6
Throughput (1000 gal): 6,132.00
Control Type: Vapor Return/Combustion
Vapor Capture Efficiency: ¹ 70%
Average Fill Rate (gal/hr): 7,500
Captured Vapors Routed to: Vapor Combustor

Uncontrolled Loading Emissions²

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	33.66	5.06	22.18
n-Hexane	1.95	0.29	1.28
Benzene	0.02	<0.01	0.02
Toluene	0.13	0.02	0.09
Ethylbenzene	0.14	0.02	0.09
Xylenes	0.48	0.07	0.32
Total HAP =	2.72	0.41	1.80

Uncaptured Loading Emissions²

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	10.10	1.52	6.65
n-Hexane	0.58	0.09	0.38
Benzene	0.01	<0.01	<0.01
Toluene	0.04	0.01	0.03
Ethylbenzene	0.04	0.01	0.03
Xylenes	0.14	0.02	0.10
Total HAP =	0.82	0.12	0.54

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

Estimated HAP Composition (% by Weight)³

Pollutant	Wt%
n-Hexane	5.783%
Benzene	0.070%
Toluene	0.390%
Ethylbenzene	0.421%
Xylenes	1.432%
Total HAP =	8.096%

Notes:

¹ 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.

² Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

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
 Mark Edison Pad
 Condensate Truck Loading Emissions - Greenhouse Gases**

Loading Information

Unit ID:	<u>EU-LOAD-COND</u>
Emission Point ID:	APC-COMB
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):	6.13200
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: ²	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Analysis CH ₄ wt% =	51.47913%
Analysis CO ₂ wt% =	0.29461%

Uncontrolled Loading Emissions^{3,4}

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH ₄	7.75	0.72	2.87	3.17
CH ₄ as CO ₂ e	193.65	18.07	71.81	79.16
CO ₂	0.04	<0.01	0.02	0.02
Total CO₂ + CO₂e =	193.69	18.08	71.83	79.18

Uncaptured Loading Emissions^{3,4}

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH ₄	2.32	0.22	0.86	0.95
CH ₄ as CO ₂ e	58.09	5.42	21.54	23.75
CO ₂	0.01	<0.01	<0.01	0.01
Total CO₂ + CO₂e =	58.11	5.42	21.55	23.75

**SWN Production Company, LLC
 Mark Edison Pad
 Condensate Truck Loading Emissions - Greenhouse Gases (Continued)**

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 CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25

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

Loading Information

Unit ID: **EU-LOAD-PW**
Emission Point ID: APC-COMB
Fill Method: Submerged
Type of Service: Dedicated
Mode of Operation: Normal
Saturation Factor: 0.6
Throughput (1000 gal): 5,365.50
Control Type: Vapor Return/Combustion
Vapor Capture Efficiency: ¹ 70%
Average Fill Rate (gal/hr): 7,500
Captured Vapors Routed to: Vapor Combustor

Uncontrolled Loading Emissions²

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	0.16	0.02	0.08
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 =	0.01	<0.01	0.01

Uncaptured Loading Emissions²

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	0.05	0.01	0.02
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 =	<0.01	<0.01	<0.01

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

Estimated HAP Composition (% by Weight)³

Pollutant	Wt%
n-Hexane	5.783%
Benzene	0.070%
Toluene	0.390%
Ethylbenzene	0.421%
Xylenes	1.432%
Total HAP =	8.096%

Notes:

¹ 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.

² Maximum lb/hr based on average hourly truck loading rate. Average lb/hr based on TPY conversion assuming continuous operation.

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
 Mark Edison Pad
 Produced Water Truck Loading Emissions - Greenhouse Gases**

Loading Information

Unit ID:	<u>EU-LOAD-PW</u>
Emission Point ID:	APC-COMB
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):	5.3655
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: ²	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Analysis CH ₄ wt% =	51.47913%
Analysis CO ₂ wt% =	0.29461%

Uncontrolled Loading Emissions^{3,4}

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH ₄	7.75	0.63	2.51	2.77
CH ₄ as CO ₂ e	193.65	15.81	62.84	69.27
CO ₂	0.04	<0.01	0.01	0.02
Total CO₂ + CO₂e =	193.69	15.82	62.85	69.28

Uncaptured Loading Emissions^{3,4}

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH ₄	2.32	0.19	0.75	0.83
CH ₄ as CO ₂ e	58.09	4.74	18.85	20.78
CO ₂	0.01	<0.01	<0.01	<0.01
Total CO₂ + CO₂e =	58.11	4.75	18.86	20.78

**SWN Production Company, LLC
 Mark Edison Pad
 Produced Water Truck Loading Emissions - Greenhouse Gases (Continued)**

API Compendium Table 5-12

Loading Type	Emission Factor (tonne TOC/10⁶ 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 CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25

**SWN Production Company, LLC
 Mark Edison Pad
 Vapor Combustor Emissions Calculations - Criteria and Hazardous Air Pollutants**

Criteria and Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors ¹	Total Captured Emissions ²		Combustor Destruction Efficiency %	Total Controlled Emissions (Post-Capture and Combustion)	
			lb/hr	TPY		lb/hr	TPY
APC-COMB	NOx	0.138	-	-	-	2.07	9.07
	CO	0.2755	-	-	-	4.13	18.10
	PM	7.6	-	-	-	0.05	0.20
	VOC	Mass Balance	48.78	213.65	98.00%	0.98	4.27
	n-Hexane	Mass Balance	2.82	12.36	98.00%	0.06	0.25
	Benzene	Mass Balance	0.03	0.15	98.00%	<0.01	<0.01
	Toluene	Mass Balance	0.19	0.83	98.00%	<0.01	0.02
	Ethylbenzene	Mass Balance	0.21	0.90	98.00%	<0.01	0.02
	Xylenes	Mass Balance	0.70	3.06	98.00%	0.01	0.06

Notes:

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

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

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

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

Source	Captured VOC Emissions	
	lb/hr	TPY
Condensate Storage Tanks	44.50	194.92
Produced Water Storage Tanks	0.72	3.16
Condensate Truck Loading	3.54	15.52
Produced Water Truck Loading	0.01	0.05
Total VOC =	48.78	213.65

Source	Captured HAP Emissions (lb/hr)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	2.57	0.03	0.17	0.19	0.64
Produced Water Storage Tanks	0.04	<0.01	<0.01	<0.01	0.01
Condensate Truck Loading	0.20	<0.01	0.01	0.01	0.05
Produced Water Truck Loading	<0.01	<0.01	<0.01	<0.01	<0.01
Total HAP =	2.82	0.03	0.19	0.21	0.70

Source	Captured HAP Emissions (TPY)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	11.27	0.14	0.76	0.82	2.79
Produced Water Storage Tanks	0.18	<0.01	0.01	0.01	0.05
Condensate Truck Loading	0.90	0.01	0.06	0.07	0.22
Produced Water Truck Loading	<0.01	<0.01	<0.01	<0.01	<0.01
Total HAP =	12.36	0.15	0.83	0.90	3.06

**SWN Production Company, LLC
 Mark Edison Pad
 Vapor Combustor Emissions Calculations - Greenhouse Gases**

Equipment Information

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

Greenhouse Gas (GHG) Emissions

Pollutant	lb/hr	tonnes/yr	tons/yr
CO ₂	1,754.66	6,972.07	7,685.39
CH ₄	0.03	0.13	0.14
N ₂ O	<0.01	0.01	0.01
CH ₄ as CO ₂ e	0.83	3.28	3.62
N ₂ O as CO ₂ e	0.99	3.92	4.32
Total CO₂ + CO₂e =	1,756.47	6,979.27	7,693.33

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

Carbon Dioxide (CO ₂)	53.06
Methane (CH ₄)	1.00E-03
Nitrous Oxide (N ₂ O)	1.00E-04

Notes:

¹ CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

**SWN Production Company, LLC
 Mark Edison Pad
 Vapor Combustor Pilot Emissions Calculations - Criteria Air Pollutants**

Criteria Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors ¹	Emissions	
		(lb/mmscf)	lb/hr	TPY
EU-PILOT APC-COMB	NOx	100	<0.01	0.02
	CO	84	<0.01	0.02
	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
 50 Total Pilot Gas Flow Rate (SCFH)
 45,250 Total Pilot Gas Fuel Use (Btu/hr)
 0.44 Total Annual Fuel Use (MMSCF)

Notes:

¹ AP-42 Table 1.4-1, -2 (7/98)

**SWN Production Company, LLC
 Mark Edison Pad
 Vapor Combustor Pilot Emissions Calculations - Hazardous Air Pollutants**

Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors ¹	Emissions	
		(lb/mmscf)	lb/hr	TPY
EU-PILOT APC-COMB	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 HAP =			<0.01	<0.01

905 Pilot Stream Heat Content (Btu/SCF)
 8,760 Pilot Hours/Yr
 50 Total Pilot Gas Flow Rate (SCFH)
 45,250 Total Pilot Gas Fuel Use (Btu/hr)
 0.44 Total Annual Fuel Use (MMSCF)

Notes:

¹ AP-42 Table 1.4-3 (7/98)

**SWN Production Company, LLC
 Mark Edison 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	CO ₂	5.29	21.03	23.18
	CH ₄	<0.01	<0.01	<0.01
	N ₂ O	<0.01	<0.01	<0.01
	CH ₄ as CO ₂ e	<0.01	0.01	0.01
	N ₂ O as CO ₂ e	<0.01	0.01	0.01
Total CO₂ + CO₂e =		5.30	21.05	23.21

905 Pilot Stream Heat Content (Btu/SCF)
 8,760 Pilot Hours/Yr
 50 Total Pilot Gas Flow Rate (SCFH)
 45,250 Total Pilot Gas Fuel Use (Btu/hr)
 0.44 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 ₂ O)	1.00E-04

Notes:

¹ CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO₂ = 1, CH₄ = 25, N₂O = 298

SWN Production Company, LLC

Mark Edison 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	56	9.92E-03	0.00%	0.56	2.43	24.18%
Flanges - Gas	249	8.60E-04	0.00%	0.21	0.94	24.18%
Compressor Seals - Gas	6	1.94E-02	0.00%	0.12	0.51	24.18%
Relief Valves - Gas	13	1.94E-02	0.00%	0.25	1.10	24.18%
Open-Ended Lines - Gas	2	4.41E-03	0.00%	0.01	0.04	24.18%
Total TOC (Gas Components) =				1.15	5.02	-
Valves - Light Oil	50	5.51E-03	0.00%	0.28	1.21	94.29%
Connectors - Light Oil	194	4.63E-04	0.00%	0.09	0.39	94.29%
Total TOC (Liquid Components) =				0.37	1.60	-

VOC and Greenhouse Gas Emissions

Source Type/Service	VOC		CH ₄		CO ₂	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Valves - Gas	0.13	0.59	0.29	1.26	<0.01	0.01
Flanges - Gas	0.05	0.23	0.11	0.49	<0.01	<0.01
Compressor Seals - Gas	0.03	0.12	0.06	0.26	<0.01	<0.01
Relief Valves - Gas	0.06	0.27	0.13	0.57	<0.01	<0.01
Open-Ended Lines - Gas	<0.01	0.01	<0.01	0.02	<0.01	<0.01
Components in Gas Service =	0.28	1.21	0.60	2.61	<0.01	0.01
Valves - Light Oil	0.26	1.14	0.01	0.02	<0.01	<0.01
Connectors - Light Oil	0.08	0.37	<0.01	0.01	<0.01	<0.01
Components in Liquid Service =	0.34	1.51	0.01	0.03	<0.01	<0.01
Total (Gas + Liquid Components) =	0.62	2.72	0.60	2.64	<0.01	0.01

SWN Production Company, LLC
 Mark Edison 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	<0.01	<0.01	0.00	<0.01
Flanges - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Components in Gas Service =	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Valves - Light Oil	0.02	<0.01	<0.01	<0.01	<0.01	0.00	0.02
Connectors - Light Oil	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Components in Liquid Service =	0.02	<0.01	<0.01	<0.01	0.01	0.00	0.03
Total (Gas + Liquid Components) =	0.03	<0.01	<0.01	<0.01	0.01	0.00	0.03

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	<0.01	<0.01	0.00	0.01
Flanges - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Components in Gas Service =	0.02	<0.01	<0.01	<0.01	<0.01	0.00	0.02
Valves - Light Oil	0.07	<0.01	<0.01	0.01	0.02	0.00	0.10
Connectors - Light Oil	0.02	<0.01	<0.01	<0.01	0.01	0.00	0.03
Components in Liquid Service =	0.09	<0.01	0.01	0.01	0.02	0.00	0.13
Total (Gas + Liquid Components) =	0.11	<0.01	0.01	0.01	0.02	0.00	0.15

SWN Production Company, LLC
 Mark Edison Pad
 Fugitive Emissions Calculations (Continued)

Typical Component Count per Equipment Type based on Representative Facility³

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

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

SWN Production Company, LLC
 Mark Edison Pad
 Fugitive Emissions Calculations (Continued)

Speciated Gas Analysis⁴

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	Ib/hr	TPY
Hydrogen Sulfide	34.082	0.000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.149%	0.066	0.295%	-	<0.01	0.01
Nitrogen	28.013	0.513%	0.144	0.646%	-	0.01	0.03
Methane	16.042	71.427%	11.458	51.479%	51.968%	0.60	2.61
Ethane	30.069	17.491%	5.259	23.629%	23.853%	0.27	1.20
Propane	44.096	6.802%	2.999	13.476%	13.603%	0.16	0.68
i-Butane	58.122	0.668%	0.388	1.744%	1.761%	0.02	0.09
n-Butane	58.122	1.828%	1.062	4.773%	4.819%	0.06	0.24
i-Pentane	72.149	0.327%	0.236	1.060%	1.070%	0.01	0.05
n-Pentane	72.149	0.440%	0.317	1.426%	1.440%	0.02	0.07
n-Hexane	86.175	0.107%	0.092	0.414%	0.418%	<0.01	0.02
Other Hexanes	86.175	0.135%	0.116	0.523%	0.528%	0.01	0.03
Heptanes (as n-Heptane)	100.202	0.078%	0.078	0.351%	0.354%	<0.01	0.02
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	0.001%	0.001%	<0.01	<0.01
Xylenes	106.167	0.001%	0.001	0.005%	0.005%	<0.01	<0.01
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	0.022%	0.025	0.113%	0.114%	<0.01	0.01
Nonanes (as n-Nonane)	128.255	0.006%	0.008	0.035%	0.035%	<0.01	<0.01
Decanes (as n-Decane)	142.282	0.003%	0.004	0.019%	0.019%	<0.01	<0.01
TOTAL =		100.00%	22.26	100.00%	100.00%	1.16	5.07
		TOTAL HC =	22.05	TOTAL VOC =	24.18%	0.28	1.21
				TOTAL HAP =	0.44%	<0.01	0.02

SWN Production Company, LLC
 Mark Edison Pad
 Fugitive Emissions Calculations (Continued)

Speciated Liquids Analysis⁴

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	Ib/hr	TPY
Hydrogen Sulfide	34.082	0.000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.013%	0.006	0.007%	-	<0.01	<0.01
Nitrogen	28.013	0.026%	0.007	0.009%	-	<0.01	<0.01
Methane	16.042	8.861%	1.421	1.836%	1.836%	0.01	0.03
Ethane	30.069	9.965%	2.996	3.870%	3.871%	0.01	0.06
Propane	44.096	11.708%	5.163	6.668%	6.669%	0.02	0.11
i-Butane	58.122	2.480%	1.441	1.862%	1.862%	0.01	0.03
n-Butane	58.122	9.597%	5.578	7.204%	7.206%	0.03	0.12
i-Pentane	72.149	3.683%	2.657	3.432%	3.433%	0.01	0.05
n-Pentane	72.149	6.541%	4.719	6.095%	6.096%	0.02	0.10
n-Hexane	86.175	5.195%	4.477	5.782%	5.783%	0.02	0.09
Other Hexanes	86.175	5.393%	4.647	6.002%	6.003%	0.02	0.10
Heptanes (as n-Heptane)	100.202	10.008%	10.028	12.952%	12.954%	0.05	0.21
Benzene	78.114	0.069%	0.054	0.070%	0.070%	<0.01	<0.01
Toluene	92.141	0.328%	0.302	0.390%	0.390%	<0.01	0.01
Ethylbenzene	106.167	0.307%	0.326	0.421%	0.421%	<0.01	0.01
Xylenes	106.167	1.044%	1.108	1.432%	1.432%	0.01	0.02
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	7.566%	8.643	11.162%	11.164%	0.04	0.18
Nonanes (as n-Nonane)	128.255	4.597%	5.896	7.615%	7.616%	0.03	0.12
Decanes (as n-Decane)	142.282	12.619%	17.955	23.190%	23.193%	0.08	0.37
TOTAL =		100.00%	77.43	100.00%	100.00%	0.37	1.60
		TOTAL HC =	77.41	TOTAL VOC =	94.29%	0.34	1.51
				TOTAL HAP =	8.10%	0.03	0.13

Notes:

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

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

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

⁴ Gas and liquids analyses located in Attachment L.

**SWN Production Company, LLC
Mark Edison Pad
Fugitive Haul Road Emissions**

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	2	1	4
Distance per round trip (miles/trip)	0.77	0.77	0.77
Vehicle miles travelled (miles/day)	1.51	0.76	3.03
Number of days operational (days/yr)	365	365	365
Vehicle miles travelled VMT (miles/yr)	552	276	1,105
Average vehicle speed S (mph)	10	10	10
Average number of round trips/hour/vehicle type	0.11	0.05	0.22
Average number of round trips/year/vehicle type	720	360	1,441
Estimated maximum number of round trips/hour/vehicle type	3	3	2
Estimated maximum number of round trips/day/vehicle type	6	4	6
Estimated maximum number of round trips/year/vehicle type	2,300	1,533	2,279

190 Average Tanker Volume (bbl)
7,980 Gallons Tanker Volume
350 bwpd
400 bopd
3.95 Tanker Trucks per Day
1,588 Length Leased Access Road (ft)
436 Longest Pad Side (ft)
4,048 Total Round Trip Feet

Formula & Calculation Inputs

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

where:

Days per year
Annual average hours per day of road operations
k = PM Particle Size Multiplier
k = PM10 Particle Size Multiplier
k = PM2.5 Particle Size Multiplier
s = Surface Material Silt Content
P = Number of days > 0.01 inch of rain
a = PM Constant
a = PM10 & PM2.5 Constant
b = PM, PM10, & PM2.5 Constant
Total hourly fleet vehicle miles travelled (miles/hr)
Total annual fleet vehicle miles travelled (miles/yr)³
Average wheels⁴
Average vehicle weight of the fleet (W)⁵
Moisture Ratio
Control Efficiency (CF)

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

Rate	Units	Comment
365		
18		
4.90	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)
1.50	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM ₁₀)
0.15	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM _{2.5})
3.9	%	State Default Data from AP-42 Data (1999 NEI Data)
150	days/year	AP-42 Section 13.2.2 (11/06), Figure 13.2.2-1
0.70	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)
0.90	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM ₁₀ & PM _{2.5})
0.45	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2
0.29	VMT/hr	
1,933.06	VMT/yr	
13		
16.1	tons	
1.00		Estimated based on 0.2% uncontrolled surface water content assuming no watering
0.00	%	Based on Moisture Ratio and Figure 13.2.2-2 Control

EPA - BID Document 13.2.2 - 1998

SWN Production Company, LLC
 Mark Edison Pad
 Fugitive Haul Road Emissions (Continued)

Vehicle Type	Emission Factors			Control Efficiency (%)	Total Vehicle Miles Travelled		Uncontrolled Emission Rates			Uncontrolled Emission Rates		
	PM	PM ₁₀	PM _{2.5}		(VMT/hr)	(VMT/yr)	Total PM	Total PM ₁₀	PM _{2.5}	Total PM	Total PM ₁₀	PM _{2.5}
	(lbs/VMT)	(lbs/VMT)	(lbs/VMT)				(lb/hr)	(lb/hr)	(lb/hr)	(tons/yr)	(tons/yr)	(tons/yr)
Light Vehicles	2.80	0.69	0.07	0.00	0.08	552.30	0.24	0.06	0.01	0.77	0.19	0.02
Medium Trucks	2.80	0.69	0.07	0.00	0.04	276.15	0.12	0.03	<0.01	0.39	0.09	0.01
Heavy Trucks	2.80	0.69	0.07	0.00	0.17	1,104.61	0.47	0.12	0.01	1.55	0.38	0.04
Total =				0.00	0.29	1,933.06	0.82	0.20	0.02	2.71	0.66	0.07

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

$E = EF_{ext} * VMT/yr * ((1 - CF) / 100) * 1 \text{ ton} / 2000 \text{ lbs}$ where:
E = annual emissions (tons/yr)
EF_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT
CF = control efficiency (%)

ATTACHMENT U: FACILITY-WIDE EMISSION SUMMARY SHEETS

ATTACHMENT U – FACILITY-WIDE CONTROLLED EMISSIONS SUMMARY SHEET

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

Emission Point ID #	NO _x		CO		VOC		SO ₂		PM ₁₀		PM _{2.5}		CH ₄		GHG (CO ₂ e)	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-ENG1	0.32	1.40	0.64	2.80	0.31	1.36	<0.01	<0.01	0.02	0.11	0.02	0.11	<0.01	0.01	155.19	679.73
EP-ENG2	0.46	2.01	0.75	3.27	0.46	2.01	<0.01	<0.01	0.01	0.05	0.01	0.05	<0.01	0.01	74.96	328.34
EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	<0.01	0.01	117.10	512.89
EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	58.55	256.44
EP-RB1	-	-	-	-	2.99	13.09	-	-	-	-	-	-	0.41	1.78	10.18	44.59
EP-RB1	0.08	0.36	0.07	0.30	<0.01	0.02	<0.01	<0.01	0.01	0.03	0.01	0.03	<0.01	0.01	87.82	384.67
EP-LOAD-COND	-	-	-	-	1.52	6.65	-	-	-	-	-	-	0.22	0.95	5.42	23.75
EP-LOAD-PW	-	-	-	-	0.01	0.02	-	-	-	-	-	-	0.19	0.83	4.75	20.78
APC-COMB	2.08	9.09	4.14	18.12	0.98	4.27	<0.01	<0.01	0.05	0.21	0.05	0.21	0.03	0.15	1,761.77	7,716.54
TOTAL	3.10	13.59	5.73	25.11	6.27	27.47	<0.01	0.01	0.10	0.45	0.10	0.45	0.86	3.75	2,334.29	10,224.18

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

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

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

ATTACHMENT U – FACILITY-WIDE HAP CONTROLLED EMISSIONS SUMMARY SHEET

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

Emission Point ID #	Formaldehyde		Benzene		Toluene		Ethylbenzene		Xylenes		Hexane		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-ENG1	0.09	0.38	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.10	0.44
EP-ENG2	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.02	0.09
EP-GPU1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-HT1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-RB1	-	-	0.11	0.49	0.18	0.77	0.00	0.00	0.05	0.24	0.12	0.51	0.46	2.01
EP-RB1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-LOAD-COND	-	-	<0.01	<0.01	0.01	0.03	0.01	0.03	0.02	0.10	0.09	0.38	0.12	0.54
EP-LOAD-PW	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
APC-COMB	<0.01	<0.01	<0.01	0.01	0.01	0.04	0.01	0.05	0.04	0.16	0.14	0.63	0.20	0.89
TOTAL	0.10	0.44	0.12	0.51	0.19	0.82	0.01	0.05	0.09	0.40	0.27	1.17	0.79	3.45

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

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

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

ATTACHMENT V: LEGAL ADVERTISEMENT

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

AIR QUALITY PERMIT NOTICE Notice of Application

Notice is given that SWN Production Company, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a G70-D General Permit Registration for a natural gas production facility (Mark Edison Pad) located in Marshall County, West Virginia. From Exit 2 on I-470, go south on CR 91/1, W. Bethlehem Blvd. for 0.45 miles. Turn right on WV-88, Ridgecrest Rd, go 5.7 miles. Turn left on CR 88/10, Hanlin Hill Rd, go 0.7 miles. Latitude/longitude coordinates are: 39.976137, -80.650231.

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

Nitrogen Oxides (NOx)	13.59 tons/yr
Carbon Monoxide (CO)	25.11 tons/yr
Volatile Organic Compounds (VOC)	30.19 tons/yr
Sulfur Dioxide (SO ₂)	0.01 tons/yr
Particulate Matter (PM)	3.16 tons/yr
Acetaldehyde	0.02 tons/yr
Acrolein	0.02 tons/yr
Benzene	0.52 tons/yr
Ethylbenzene	0.05 tons/yr
Formaldehyde	0.44 tons/yr
Methanol	0.03 tons/yr
n-Hexane	1.28 tons/yr
Toluene	0.83 tons/yr
Xylenes	0.42 tons/yr
Carbon Dioxide	10,124.66 tons/yr
Methane	6.39 tons/yr
Nitrous Oxide	0.02 tons/yr
CO ₂ Equivalent	10,290.19 tons/yr

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

Dated this the XXth of April 2017

SWN Production Company, LLC
Mark Edison Pad
April 2017

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