Southwestern Energy®

Corporate Office
P.O. Box 12359
Spring, Texas 77391-2359
www.swn.com

June 2, 2016

Mr. Fred Durham, Director
West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304

Phone: (304) 926-0499
Fax: (304) 926-0479

RE: Class 1 Modification –Alice Edge Pad, Permit # G70-A173

Mr. Durham:

SWN Production Company, LLC respectfully submits the enclosed Class 1 Modification for the Alice Edge Pad, Permit # G70-A173 located in Ohio County, West Virginia.

This modification proposes to update condensate and produced water throughput volumes and remove two engines, EU-ENG3 and EU-ENG4.

If you have any questions regarding the information in this application, please contact me at (501) 548-6728 or at Travis_Lee@swn.com.

Sincerely,

Travis Lee
Sr. HS&E Coordinator

SWN PRODUCTION COMPANY, LLC

ALICE EDGE PAD

GENERAL PERMIT G-70B
CLASS I ADMINSTRATIVE UPDATE

SUBMITTED TO WVDEP DIVISION OF AIR QUALITY
MAY 2016

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this Class I Adminstrative Update for the Alice Edge Pad, a natural gas production facility. It currently operates under Registration No. G70-A173. SWN requests authorization with this submittal to update the condensate and produced water throughputs and affected associated emission sources, which include the condensate tanks, produced water tanks, condensate loading, and produced water loading, and to remove the Zenith XPP-644 4.4L 6 Cylinder engine (EU-ENG3) and the Bucks GM Vortec 5.7L engine (EU-ENG4). Please note that the current registration (G70-A173), Section 1.0 Emission Units Table incorrectly lists the throughput of the condensate and produced water truck loading. SWN would like to correct those throughputs to that which is represented in this application. The facility emission sources include the following:

- Eleven (11) 1.0-mmBtu/hr Gas Production Units (GPU)
- Five (5) 0.5-mmBtu/hr Heater Treaters
- Three (3) 1.5-mmBtu/hr Stabilizer Heaters
- Two (2) Caterpillar G3508TALE Compressor Engines
- Two (2) Caterpillar G3306 NA Compressor Engines
- Twelve (12) 400-bbl Condensate Tanks
- Four (4) 400-bbl Produced Water Tanks
- Condensate Loading
- Produced Water Loading
- One (1) 30-mmBtu/hr Vapor Combustor with Pilots
- Fugitive Emissions
- Fugitive Haul Road Emissions

Note that other small storage tanks may be present on site (i.e., methanol, lube oil) but are considered de minimis sources per Table 45-13B and are not addressed further in this application.

Proposed Emissions

Emissions calculations for the facility are presented in Attachment I. A fuel heating value of 905 Btu/scf was used to calculate emissions from natural gas-fired equipment. Actual heating value may vary (generally 905 - 1,300) but using a lower heating value in the emissions calculations provides a more conservative (higher) estimate of fuel use. Emissions from the Caterpillar engines, and heaters were calculated with manufacturer data when available and AP-42/EPA emissions factors for the remaining pollutants.

Working and breathing losses from the condensate and produced water storage tanks were calculated with EPA TANKS 4.0.9d using a representative analysis and process simulation results. The condensate throughput has been decreased from the previous permit and the emissions revised. The produced water throughput has been increased from the previous permit and the emissions have been revised.

Greenhouse gas emissions have been updated with the latest EPA factors. Documents used as references for the emissions calculations, including engine specification sheets, AP-42 and EPA emission factor references, gas and liquids analyses, and process simulation results are included in Attachment P.

Regulatory Discussion

STATE

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

The facility requests to operate under the General Permit G70-B. Emissions of each regulated air pollutant are less than 100 tons per year for each criteria pollutant, less than 10 tons per year for each hazardous air pollutant and less than 25 tons for total hazardous air pollutants. The engines are subject to NSPS Subpart JJJJ and MACT Subpart ZZZZ.

45 CSR 22 - AIR QUALITY MANAGEMENT FEE PROGRAM:

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

45 CSR 30 - REQUIREMENTS FOR OPERATING PERMITS:

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

FEDERAL

40 CFR PART 60 SUBPART KB—STANDARDS OF PERFORMANCE FOR VOLATILE ORGANIC LIQUID STORAGE VESSELS (INCLUDING PETROLEUM LIQUID STORAGE VESSELS) FOR WHICH CONSTRUCTION, RECONSTRUCTION, OR MODIFICATION COMMENCED AFTER JULY 23, 1984

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

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

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

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

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

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

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.

APPLICATION FOR GENERAL PERMIT REGISTRATION

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

G70-B GENERAL PERMIT REGISTRATION APPLICATION

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

☐CONSTRUCTION
☐MODIFICATION
☐RELOCATION

☒CLASS I ADMINISTRATIVE UPDATE
☐CLASS II ADMINISTRATIVE UPDATE

SECTION 1. GENERAL INFORMATION

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

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

Applicant's Mailing Address: **10000 Energy Drive**

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

Facility Name: **Alice Edge Pad**

Operating Site Physical Address: **US RT 40, Valley Grove, 26060**
If none available, list road, city or town and zip of facility.

City: **Valley Grove**	Zip Code: **26060**	County: **Ohio**

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Latitude: **40.099853**
Longitude: **-80.56066**

SIC Code: **1311** NAICS Code: **211111**	DAQ Facility ID No. (For existing facilities) **069 - 00113**

CERTIFICATION OF INFORMATION

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

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

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

Responsible Official Signature: Carla Suszkowski
Name and Title: **Carla Suszkowski, P.E., Regulatory Manager – West Virginia Division**
Phone: **832-796-6372** Fax:
Email: **Carla_Suszkowski@SWN.com** Date: 6-2-16

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

If applicable:
Environmental Contact
Name and Title: **Travis Lee, Sr. Health, Safety & Environmental Coordinator**
Phone: **501-548-6728** Fax:
Email: **Travis_Lee@SWN.com** Date:

OPERATING SITE INFORMATION	
Briefly describe the proposed new operation and/or any change(s) to the facility: **Update the condensate and produced water throughputs and affected associated emission sources, which include the condensate tanks, produced water tanks, condensate loading, and produced water loading.**	
Directions to the facility: **From Interstate 70 east of Wheeling, WV, take Exit 5 (Elm Grove Exit) and travel east on US RT 40. Continue straight on US RT 40 for approximately 6.8 miles to well pad entrance on the left, immediately after the bridge.**	
ATTACHMENTS AND SUPPORTING DOCUMENTS	
I have enclosed the following required documents:	
Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22). ☐ Check attached to front of application. ☐ I wish to pay by electronic transfer. Contact for payment (incl. name and email address): ☐ I wish to pay by credit card. Contact for payment (incl. name and email address): ☐$500 (Construction, Modification, and Relocation) ☐$300 (Class II Administrative Update) ☐$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ and/or OOOO [1] ☐$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH [2] [1] Only one NSPS fee will apply. [2] Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ. *NSPS and NESHAP fees apply to new construction or if the source is being modified.*	
☒ Responsible Official or Authorized Representative Signature (if applicable)	
☒ Single Source Determination Form **(must be completed in its entirety)** – Attachment A	
☐ Siting Criteria Waiver (if applicable) – Attachment B	☒ Current Business Certificate – Attachment C
☒ Process Flow Diagram – Attachment D	☒ Process Description – Attachment E
☒ Plot Plan – Attachment F	☒ Area Map – Attachment G
☒ G70-B Section Applicability Form – Attachment H	☒ Emission Units/ERD Table – Attachment I
☐ Fugitive Emissions Summary Sheet – Attachment J	
☐ Gas Well Affected Facility Data Sheet (if applicable) – Attachment K	
☒ Storage Vessel(s) Data Sheet (include gas sample data, USEPA Tanks, simulation software (e.g. ProMax, E&P Tanks, HYSYS, etc.), etc. where applicable) – Attachment L	
☐ Natural Gas Fired Fuel Burning Unit(s) Data Sheet (GPUs, Heater Treaters, In-Line Heaters if applicable) – Attachment M	
☐ Internal Combustion Engine Data Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment N	
☒ Tanker Truck Loading Data Sheet (if applicable) – Attachment O	
☐ Glycol Dehydration Unit Data Sheet(s) (include wet gas analysis, GRI- GLYCalc™ input and output reports and information on reboiler if applicable) – Attachment P	
☐ Pneumatic Controllers Data Sheet – Attachment Q	
☒ Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment R	
☒ Emission Calculations (please be specific and include all calculation methodologies used) – Attachment S	
☒ Facility-wide Emission Summary Sheet(s) – Attachment T	
☐ Class I Legal Advertisement – Attachment U	
☒ One (1) paper copy and two (2) copies of CD or DVD with pdf copy of application and attachments	

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

ATTACHMENT A: 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).

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

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

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

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

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

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

ATTACHMENT C: BUSINESS REGISTRATION CERTIFICATE

WEST VIRGINIA
STATE TAX DEPARTMENT
BUSINESS REGISTRATION
CERTIFICATE

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

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

This certificate is issued on: 12/8/2014

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

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

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

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

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

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

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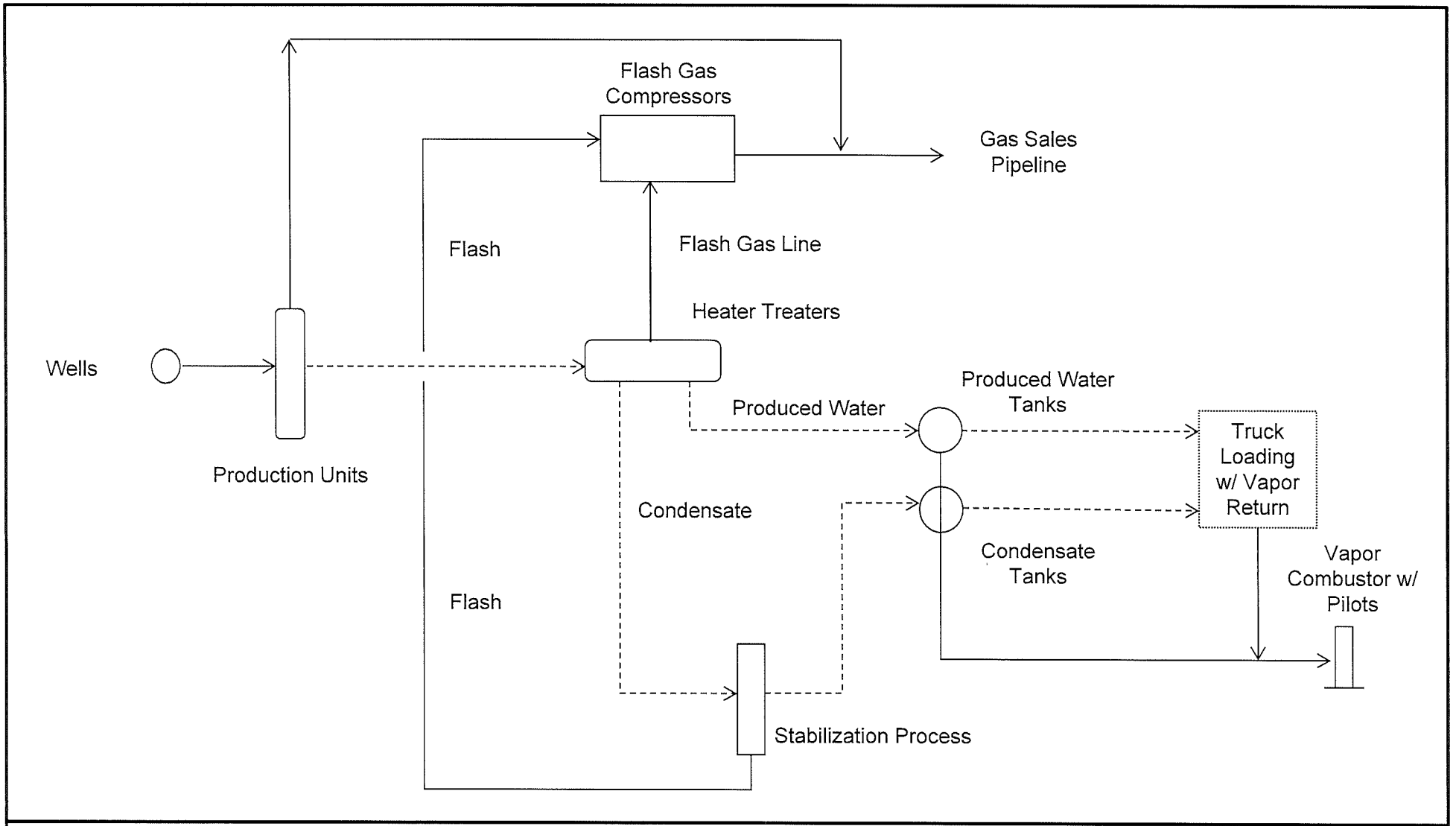
ATTACHMENT D: PROCESS FLOW DIAGRAM



Gas/Vapor

Liquids (Condensate and Produced Water)

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

SWN Production Company, LLC
Alice Edge Pad
Attachment D: Process Flow Diagram
May 2016

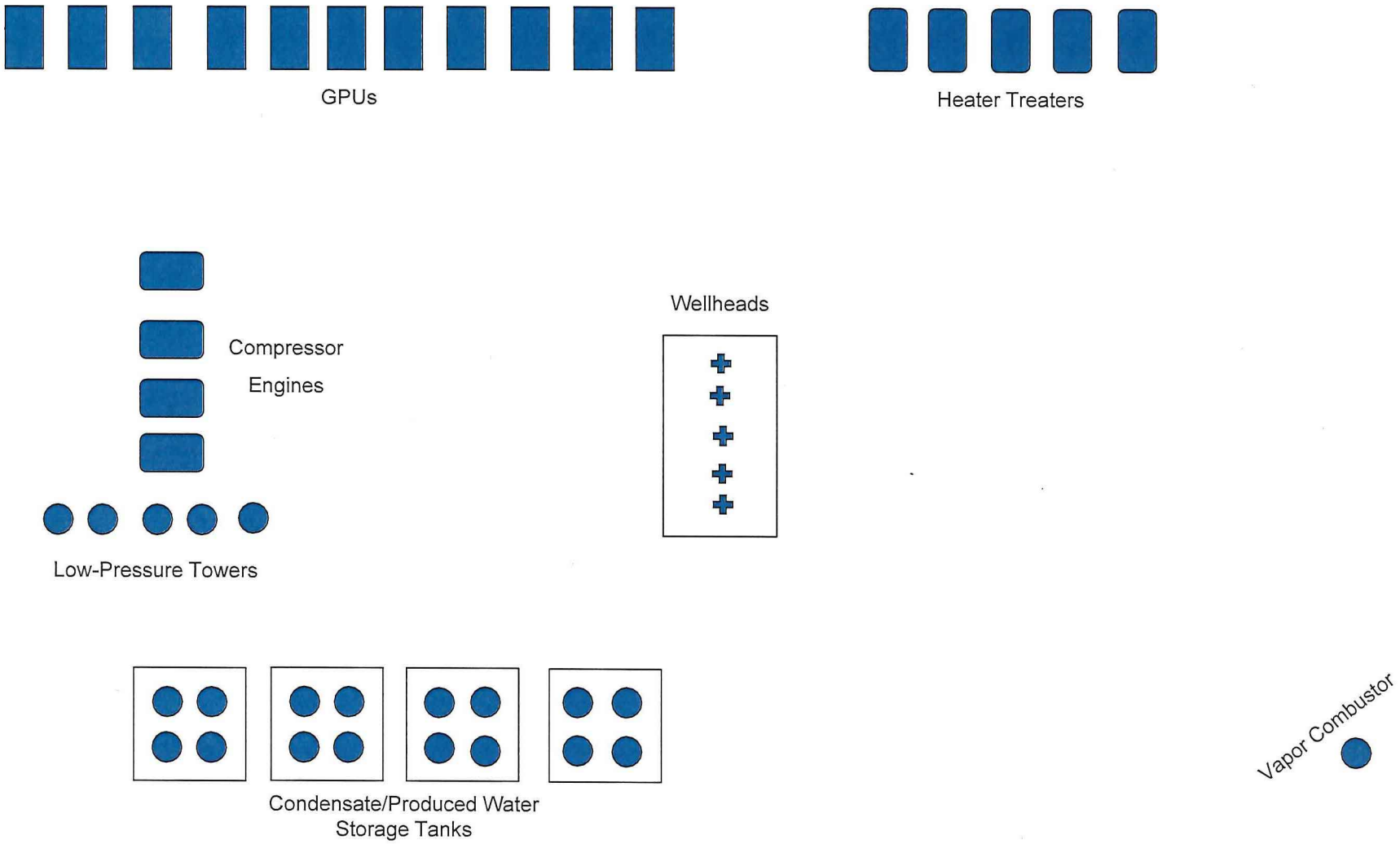
ATTACHMENT E: PROCESS DESCRIPTION

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

Condensate flows to the condensate storage tank(s). The natural gas stream will exit the facility for transmission via pipeline. Condensate and produced water are transported offsite via truck. Loading emissions will be controlled with vapor return, which has at least 70% capture efficiency, and will be routed to the vapor combustor for at least 98% destruction efficiency, for an overall control efficiency of 69%. Working, breathing and flashing vapors from the condensate and produced water storage tanks will be routed to the vapor combustors with a 100% capture efficiency to be burned with at least 98% combustion efficiency. The vapor combustor has three (3) natural gas-fired pilots to ensure a constant flame for combustion.

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

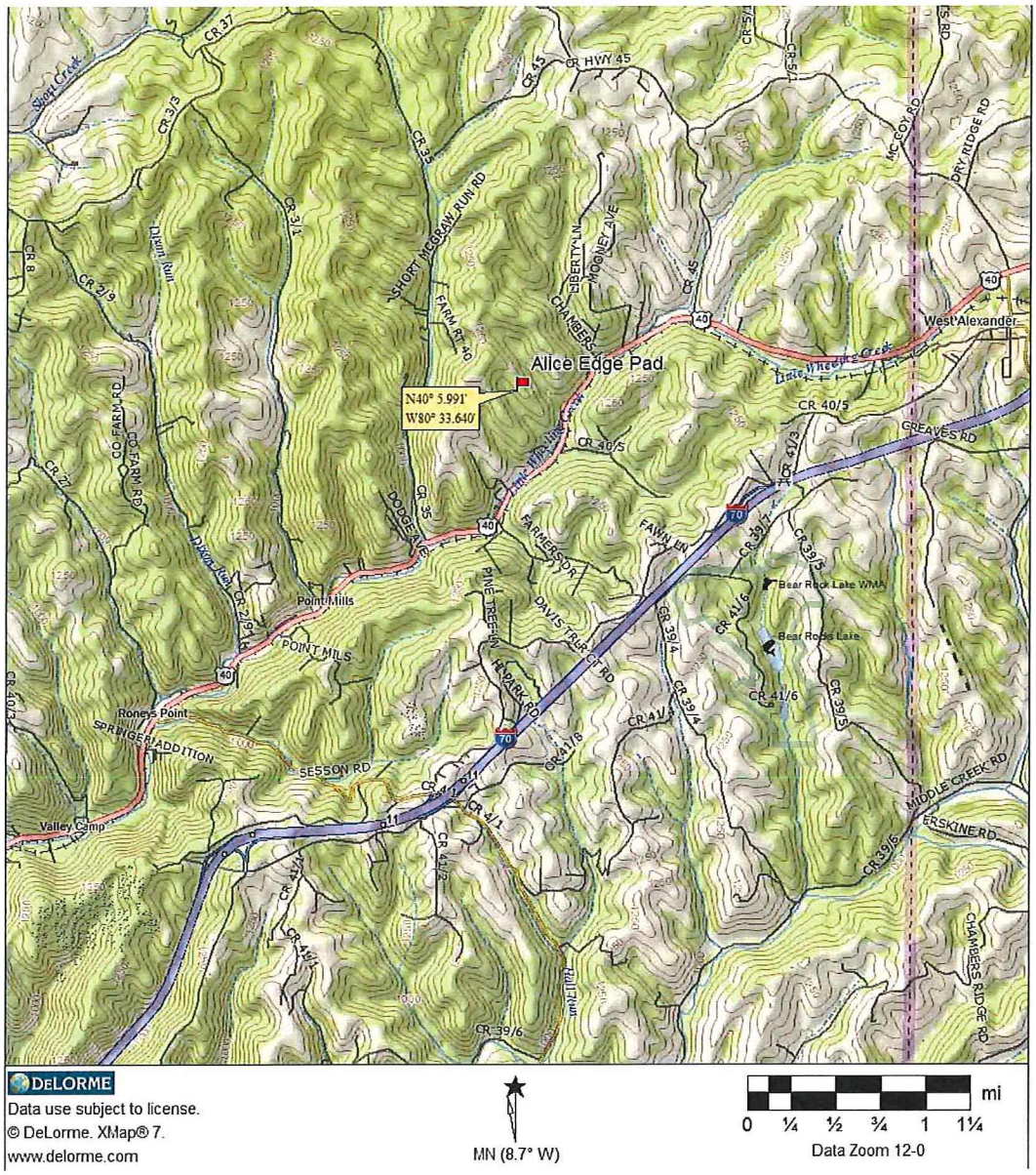
ATTACHMENT F: PLOT PLAN



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

SWN Production Company, LLC
Alice Edge Pad
Attachment E: Simple Plot Plan
May 2016

ATTACHMENT G: AREA MAP



SWN Production Company, LLC
Alice Edge Pad
Figure 1: Area Map
May 2016

ATTACHMENT H: G70-B SECTION APPLICABILITY FORM

General Permit G70-B Registration
Section Applicability Form

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

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

GENERAL PERMIT G70-B APPLICABLE SECTIONS	
☐Section 5.0	Gas Well Affected Facility (NSPS, Subpart OOOO)
☒Section 6.0	Storage Vessels Containing Condensate and/or Produced Water[1]
☐Section 7.0	Storage Vessel Affected Facility (NSPS, Subpart OOOO)
☒Section 8.0	Control Devices and Emission Reduction Devices not subject to NSPS Subpart OOOO and/or NESHAP Subpart HH
☒Section 9.0	Small Heaters and Reboilers not subject to 40CFR60 Subpart Dc
☐Section 10.0	Pneumatic Controllers Affected Facility (NSPS, Subpart OOOO)
☐Section 11.0	Centrifugal Compressor Affected Facility (NSPS, Subpart OOOO)[2]
☐Section 12.0	Reciprocating Compressor Affected Facility (NSPS, Subpart OOOO)[2]
☒Section 13.0	Reciprocating Internal Combustion Engines, Generator Engines, Microturbines
☒Section 14.0	Tanker Truck Loading[3]
☐Section 15.0	Glycol Dehydration Units[4]

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

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

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

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

ATTACHMENT I: EMISSION 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-ENG5	EP-ENG5	Caterpillar G3306 NA Engine	2015	After 1/1/2011	145-hp	Existing	NSCR	NSCR
EU-ENG6	EP-ENG6	Caterpillar G3306 NA Engine	2015	After 1/1/2011	145-hp	Existing	NSCR	NSCR
EU-MC1498	EP-MC1498	Caterpillar G3508 TALE AFR	2015	2/25/2010	622-hp	Existing	None	None
EU-MC2322	EP-MC2322	Caterpillar G3508 TALE	2015	1/24/2007	567-hp	Existing	None	None
EU-ENG3	EP-ENG3	Zenith XPP-644 4.4L 6 Cylinder	TBD	TBD	77.0-kW	Removal	NSCR	NSCR
EU-ENG4	EP-ENG4	Bucks GM Vortec 5.7L	TBD	TBD	146.2-kW	Removal	NSCR	NSCR
EU-GPU1	EP-GPU1	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU2	EP-GPU2	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU3	EP-GPU3	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU4	EP-GPU4	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU5	EP-GPU5	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU6	EP-GPU6	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU7	EP-GPU7	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU8	EP-GPU8	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU9	EP-GPU9	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU10	EP-GPU10	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU11	EP-GPU11	GPU Burner	2015	2015	1.0-mmBtu/hr	Existing	N/A	N/A
EU-HT1	EP-HT1	Heater Treater	2015	2015	0.5-mmBtu/hr	Existing	N/A	N/A
EU-HT2	EP-HT2	Heater Treater	2015	2015	0.5-mmBtu/hr	Existing	N/A	N/A
EU-HT3	EP-HT3	Heater Treater	2015	2015	0.5-mmBtu/hr	Existing	N/A	N/A
EU-HT4	EP-HT4	Heater Treater	2015	2015	0.5-mmBtu/hr	Existing	N/A	N/A
EU-HT5	EP-HT5	Heater Treater	2015	2015	0.5-mmBtu/hr	Existing	N/A	N/A
EU-SH1	EP-SH1	Stabilizer Heater	2015	2015	1.5-mmBtu/hr	Existing	N/A	N/A
EU-SH2	EP-SH2	Stabilizer Heater	2015	2015	1.5-mmBtu/hr	Existing	N/A	N/A
EU-SH3	EP-SH3	Stabilizer Heater	2015	2015	1.5-mmBtu/hr	Existing	N/A	N/A

EU-TANKS-COND	APC-COMB-TKLD	Twelve (12) Condensate Tanks	2015	2015	400-bbl each	Modification	APC-COMB-TKLD	APC-COMB-TKLD
EU-TANKS-PW	APC-COMB-TKLD	Four (4) Produced Water Tanks	2015	2015	400-bbl each	Modification	APC-COMB-TKLD	APC-COMB-TKLD
EU-LOAD-COND	EP-LOAD-COND	Condensate Truck Loading	N/A	2015	65,919,000 gal/yr	Modification	Vapor Return and APC-COMB-TKLD	Vapor Return and APC-COMB-TKLD
EU-LOAD-PW	EP-LOAD-PW	Produced Water Truck Loading	N/A	2015	76,650,000 gal/yr	Modification	Vapor Return and APC-COMB-TKLD	Vapor Return and APC-COMB-TKLD
APC-COMB-TKLD	APC-COMB-TKLD	Vapor Combustor	2015	2015	30.0-mmBtu/hr	Modification	N/A	N/A
EU-PILOT	EP-PILOT	Vapor Combustor Pilots	2015	2015	150-SCFH	Existing	N/A	N/A
EU-FUG	EP-FUG	Fugitive Emissions	N/A	N/A	N/A	Existing	N/A	N/A
EU-HR	EP-HR	Fugitive Haul Road Emissions	N/A	N/A	N/A	Existing	N/A	N/A

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] When required by rule
[4] New, modification, removal, existing
[5] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.
[6] For ERDs use the following numbering system: 1D, 2D, 3D,... or other appropriate designation.

ATTACHMENT L: STORAGE VESSELS DATA SHEET

REPRESENTATIVE GAS ANALYSES

TANKS 4.0.9D REPORTS

PROMAX PROCESS SIMULATION RESULTS

ATTACHMENT L – STORAGE VESSEL DATA SHEET

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

The following information is REQUIRED:

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

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

Additional information may be requested if necessary.

GENERAL INFORMATION (REQUIRED)

1. Bulk Storage Area Name Condensate Storage	2. Tank Name Twelve (12) 400-bbl Condensate Storage Tanks
3. Emission Unit ID number EU-TANKS-COND	4. Emission Point ID number EP-TANKS-COND
5. Date Installed , Modified or Relocated *(for existing tanks)* 2015 Was the tank manufactured after August 23, 2011? ☒ Yes ☐ No	6. Type of change: ☐ New construction ☐ New stored material ☒ Other ☐ Relocation
7A. Description of Tank Modification *(if applicable)* Decrease in condensate throughput.	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Was USEPA Tanks simulation software utilized? ☒ Yes ☐ No ***If Yes, please provide the appropriate documentation and items 8-42 below are not required.***	

1. Bulk Storage Area Name Produced Water Storage	2. Tank Name Four (4) 400-bbl Produced Water Storage Tanks
3. Emission Unit ID number EU-TANKS-PW	4. Emission Point ID number EP-TANKS-PW
5. Date Installed , Modified or Relocated *(for existing tanks)* 2015 Was the tank manufactured after August 23, 2011? ☒ Yes ☐ No	6. Type of change: ☐ New construction ☐ New stored material ☒ Other ☐ Relocation
7A. Description of Tank Modification *(if applicable)* Increase in produced water throughput.	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Was USEPA Tanks simulation software utilized? ☒ Yes ☐ No ***If Yes, please provide the appropriate documentation and items 8-42 below are not required.***	

STORAGE TANK DATA TABLE

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

Source ID #[1]	Status[2]	Content[3]	Volume[4]

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

Chesapeake Energy Corporation
George Gantzer No. 8-H

TABLE 1-B

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

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

	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
Component	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.513	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

Chesapeake Energy Corporation
George Gantzer No. 8-H

TABLE 1-B

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

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

UNDECANES PLUS (C_{11+}) FRACTION CHARACTERISTICS					
	Specific Gravity		Molecular Weight	Vapor Volume	Gross Heating Value
COMPONENT	°API	**	lb/lb-mole	Scf/Gal	***
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						
	Specific Gravity		Molecular Weight	Vapor Volume	Gross Heating Value	
					Dry	Saturated
COMPONENT	°API	**	lb/lb-mole	Scf/Gal	***	***
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.

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

Identification

User Identification:	Alice Edge Pad - 4300 BOPD
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):	20.00
Diameter (ft):	12.00
Liquid Height (ft) :	19.00
Avg. Liquid Height (ft):	10.00
Volume (gallons):	16,074.56
Turnovers:	4,100.83
Net Throughput(gal/yr):	65,919,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

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

Roof Characteristics

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

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Elkins, West Virginia (Avg Atmospheric Pressure = 13.73 psia)

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

Alice Edge Pad - 4300 BOPD - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gantzer PVT	All	50.67	44.90	56.45	49.08	7.1594	6.4925	7.8776	58.3720			111.67	Option 4: RVP=10.86

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

Emissions Report for: Annual

Alice Edge Pad - 4300 BOPD - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gantzer PVT	85,587.44	1,626.17	87,213.61

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

Identification

User Identification:	Alice Edge Pad - 5,000 BWPD
City:	Ohio County
State:	West Virginia
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):		20.00
Diameter (ft):		12.00
Liquid Height (ft) :		19.00
Avg. Liquid Height (ft):		10.00
Volume (gallons):		16,074.56
Turnovers:		4,768.40
Net Throughput(gal/yr):		76,650,000.00
Is Tank Heated (y/n):	N	

Paint Characteristics

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

Roof Characteristics

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

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Elkins, West Virginia (Avg Atmospheric Pressure = 13.73 psia)

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

Alice Edge Pad - 5,000 BWPD - Vertical Fixed Roof Tank
Ohio County, West Virginia

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gantzer PVT - Alice Edge	All	50.67	44.90	56.45	49.08	0.1937	0.1570	0.2378	20.4471			18.17	
Gantzer PVT						7.1594	6.4925	7.8776	58.3720	0.0100	0.1717	111.67	Option 4: RVP=10.86
Water						0.1823	0.1467	0.2254	18.0200	0.9900	0.8283	18.02	Option 2: A=8.10765, B=1750.286, C=235

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

Emissions Report for: Annual

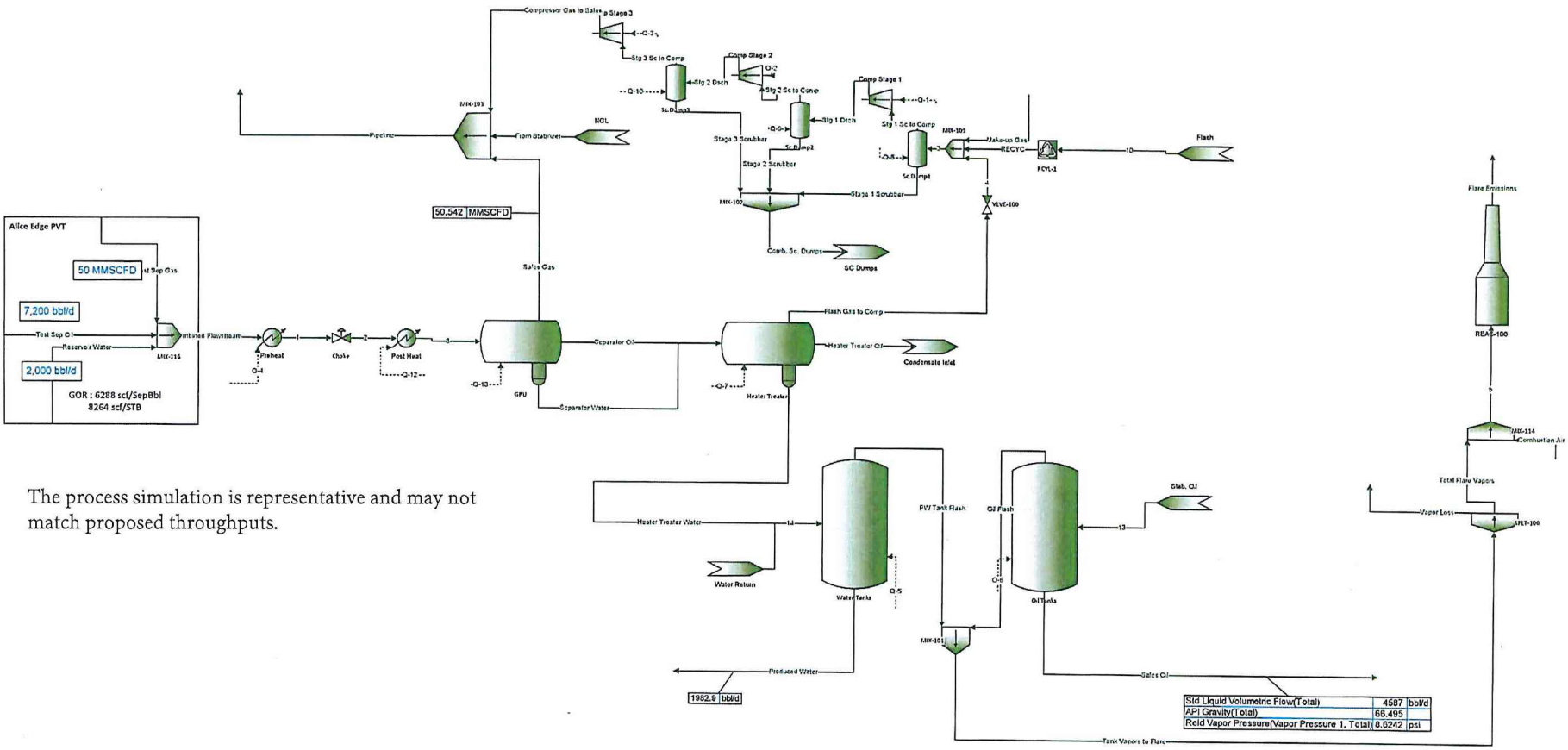
Alice Edge Pad - 5,000 BWPD - Vertical Fixed Roof Tank
Ohio County, West Virginia

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gantzer PVT - Alice Edge	1,250.16	12.81	1,262.97
Gantzer PVT	214.67	2.20	216.87
Water	1,035.49	10.61	1,046.10

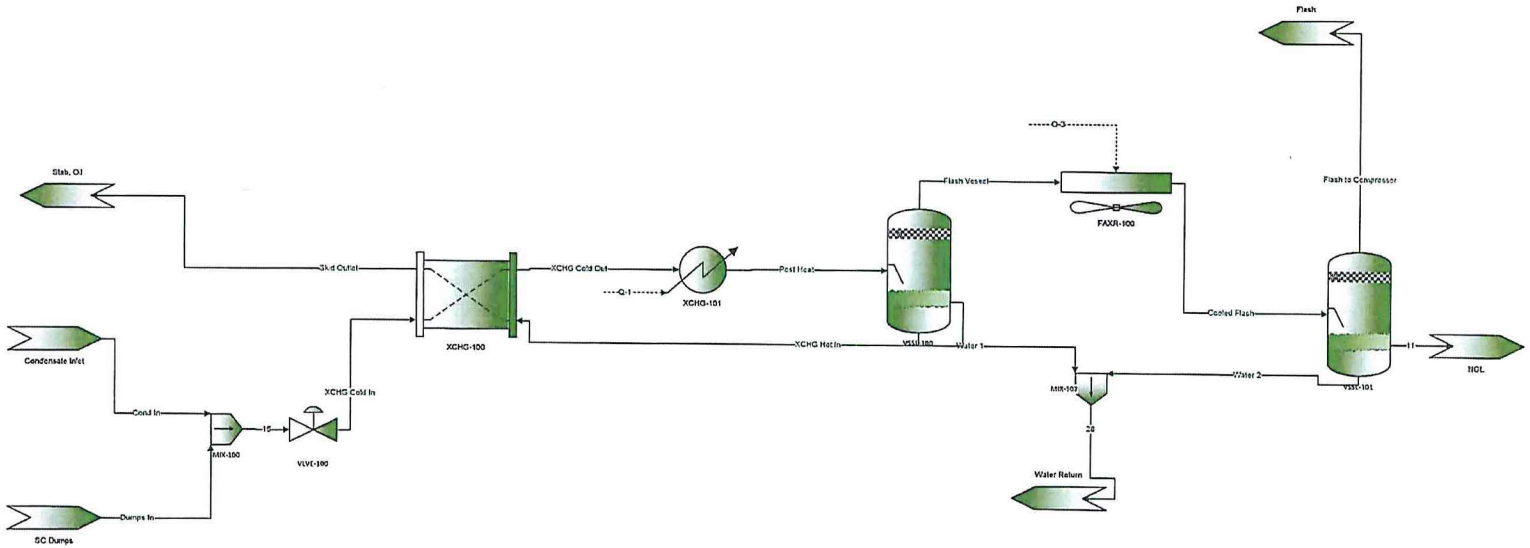
Names	Units	Reservoir Water	Test Sep Gas	Test Sep Oil	Oil Flash	PW Tank Flash	Sales Oil	Produced Water
Temperature	°F	67*	67*	67*	114.5*	105	114.5	105#
Pressure	psia	234.7*	234.7*	234.7*	15.196	15.196	15.196*	15.196*
Mole Fraction Vapor	%	0	100	0	100	100	0	0
Mole Fraction Light Liquid	%	100	0	100	0	0	100	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0
Molecular Weight	lb/lbmol	18.015	22.212	82.535	54.932	34.251	111.02	18.016
Molar Flow	lbmol/h	1619.7	5489.9	824.62	2.4496	0.08135	431.09	1605.7
Mass Flow	lb/h	29180	1.2194e+005	68060	134.56	2.7863	47859	28929
Enthalpy	Btu/h	-1.9932e+008	-1.9187e+008	-6.6699e+007	-1.3267e+005	-3699.3	-4.2633e+007	-1.9653e+008
Water(Mole Fraction)	%	100*	0*	0*	3.6432	7.2648	0.045217	99.998
Nitrogen(Mole Fraction)	%	0*	0.566*	0.041*	0.0012647	0.040962	2.015e-006	4.2706e-007
CO2(Mole Fraction)	%	0*	0.157*	0.019*	0.033771	0.42175	0.0004435	0.00015817
C1(Mole Fraction)	%	0*	70.941*	4.976*	1.9467	24.666	0.008972	0.0005239
C2(Mole Fraction)	%	0*	18.015*	9.135*	12.385	28.855	0.30004	0.00066767
C3(Mole Fraction)	%	0*	7.03*	12.852*	26.355	23.469	2.0269	0.00050032
Isobutane(Mole Fraction)	%	0*	0.631*	2.713*	5.9267	1.4589	1.0648	1.1544e-005
n-Butane(Mole Fraction)	%	0*	1.759*	10.891*	22.291	9.2937	5.51	0.00017059
2,2-Dimethylpropane(Mole Fraction)	%	0*	0.009*	0.096*	0.16377	0.027415	0.054807	2.0001e-007
Isopentane(Mole Fraction)	%	0*	0.264*	3.815*	5.7654	1.163	3.3634	1.3196e-005
n-Pentane(Mole Fraction)	%	0*	0.377*	7.307*	9.5396	1.9363	7.1719	2.369e-005

Flash Factor Water - .0198 lb/bbl

Flash Factor Oil – 0.676 lb/bbl



The process simulation is representative and may not match proposed throughputs.


Stab. Oil
Condensate Inlet
SC Dumps
Cond In
Dumps In
MIX-100
VLVE-100
XCHG Cold In
Stab Outlet
XCHG-100
XCHG Cold Out
Q-1
XCHG-101
Post Heat
Flash Vessel
XCHG Hot In
Water 1
Q-3
FAXR-100
Cooled Flash
MIX-102
Water Return
Water 2
Flash
Flash to Compressor
NGL

ATTACHMENT O: TANKER TRUCK LOADING DATA SHEET

ATTACHMENT O – TANKER TRUCK LOADING DATA SHEET

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

Truck Loadout Collection Efficiencies

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

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

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

Emission Unit ID#: EU-LOAD-COND	Emission Point ID#: EP-LOAD-COND	Year Installed/Modified: 2015
Emission Unit Description: Condensate Truck Loading		
Loading Area Data		
Number of Pumps: One (1)	Number of Liquids Loaded: One (1)	Max number of trucks loading at one (1) time: One (1)
Are tanker trucks pressure tested for leaks at this or any other location? ☒ Yes ☐ No ☐ Not Required If Yes, Please describe: Vessel pressure tested in accordance with DOT requirements, if applicable.		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☐ Closed System to tanker truck not passing an annual leak test and has vapor return?		

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

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

Bulk Liquid Data (use extra pages as necessary)

Liquid Name	Condensate		
Max. Daily Throughput (1000 gal/day)	~180.6		
Max. Annual Throughput (1000 gal/yr)	65,919		
Loading Method[1]	SUB		
Max. Fill Rate (gal/min)	125		
Average Fill Time (min/loading)	~60		
Max. Bulk Liquid Temperature (°F)	50.33		
True Vapor Pressure[2]	4.424 *See Note		
Cargo Vessel Condition[3]	U		
Control Equipment or Method[4]	O = Vapor Return w/ Combustion Controls		

Max. Collection Efficiency (%)		70%		
Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	8.01		
	Annual (ton/yr)	35.20		
Max.HAP Emission Rate	Loading (lb/hr)	0.65		
	Annual (ton/yr)	2.85		
Estimation Method[5]		EPA		

**Note: AP-42 Section 7.1 - Properties of Selected Petroleum Liquids correlation with RVP obtained from representative loading ticket.*

Emission Unit ID#: EU-LOAD-PW	Emission Point ID#: EP-LOAD-PW	Year Installed/Modified: 2015
Emission Unit Description: Produced Water Truck Loading		
Loading Area Data		
Number of Pumps: One (1)	Number of Liquids Loaded: One (1)	Max number of trucks loading at one (1) time: One (1)
Are tanker trucks pressure tested for leaks at this or any other location? ☒ Yes ☐ No ☐ Not Required If Yes, Please describe: Vessel pressure tested in accordance with DOT requirements, if applicable.		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☐ Closed System to tanker truck not passing an annual leak test and has vapor return?		

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

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

Bulk Liquid Data (use extra pages as necessary)

Liquid Name		Produced Water		
Max. Daily Throughput (1000 gal/day)		~210		
Max. Annual Throughput (1000 gal/yr)		76,650		
Loading Method[1]		SUB		
Max. Fill Rate (gal/min)		125		
Average Fill Time (min/loading)		~60		
Max. Bulk Liquid Temperature (°F)		50.33		
True Vapor Pressure[2]		0.2414		
Cargo Vessel Condition[3]		U		
Control Equipment or Method[4]		O = Vapor Return w/ Combustion Controls		
Max. Collection Efficiency (%)		70%		
Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	0.16		
	Annual (ton/yr)	0.80		
Max.HAP Emission	Loading (lb/hr)	0.01		

Rate	Annual (ton/yr)	0.06		
Estimation Method[5]		EPA		

1	BF	Bottom Fill	SP	Splash Fill	SUB	Submerged Fill
2	At maximum bulk liquid temperature					
3	B	Ballasted Vessel	C	Cleaned	U	Uncleaned (dedicated service)
	O	Other (describe)				
4	List as many as apply (complete and submit appropriate Air Pollution Control Device Sheets)					
	CA	Carbon Adsorption	VB	Dedicated Vapor Balance (closed system)		
	ECD	Enclosed Combustion Device	F	Flare		
	TO	Thermal Oxidization or Incineration				
5	EPA	EPA Emission Factor in AP-42			MB	Material Balance
	TM	Test Measurement based upon test data submittal			O	Other (describe)

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

VAPOR COMBUSTION

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

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

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

The following five (5) rows are only to be completed if registering an alternative air pollution control device.	
Emission Unit ID:	Make/Model:
Primary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: ☐ Yes ☐ No
Secondary Control Device ID:	Make/Model:
Control Efficiency (%):	APCD/ERD Data Sheet Completed: ☐ Yes ☐ No

VAPOR COMBUSTION
(Including Enclosed Combustors)

General Information

Control Device ID#: APC-COMB-TKLD	Installation Date: 2015 ☐ New ☒ Modified ☐ Relocated	
Maximum Rated Total Flow Capacity 11,188 scfh 268,500 scfd	Maximum Design Heat Input (from mfg. spec sheet) 30.0 MMBTU/hr	Design Heat Content 2,682 BTU/scf

Control Device Information

Type of Vapor Combustion Control?

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

Manufacturer: MRW Technologies Model: TBF-6.5-34-268500	Hours of operation per year? 8,760

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

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

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

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

Waste Gas Information

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

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

Pilot Gas Information

Number of Pilot Lights	Fuel Flow Rate to Pilot Flame per Pilot	Heat Input per Pilot	Will automatic re-ignition be used?
3	50 scfh	45,250 BTU/hr	☒ Yes ☐ No

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

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

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

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

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

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

Description of Control Scheme:

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

ATTACHMENT S: EMISSIONS CALCULATIONS

EMISSION CALCULATIONS

AP-42 FACTORS

SWN Production Company, LLC
Alice Edge Pad
Summary of Criteria Air Pollutant Emissions

Equipment	Unit ID	NOx		CO		Total VOC[1]		SO_2		PM Total	
		lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG5	0.32	1.40	0.64	2.80	0.24	1.05	<0.01	<0.01	0.02	0.09
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG6	0.32	1.40	0.64	2.80	0.24	1.05	0.01	0.04	0.02	0.09
622-hp Caterpillar G3508 TALE AFR Engine	EU-MC1498	2.74	12.00	3.51	15.37	1.10	4.82	0.01	0.04	0.05	0.22
567-hp Caterpillar G3508 TALE Engine	EU-MC2322	2.50	10.95	3.16	13.84	1.03	4.51	0.01	0.04	0.05	0.22
Eleven (11) 1.0-mmBtu/hr GPU Burners	EU-GPU1 to EU-GPU11	1.21	5.28	0.99	4.29	0.07	0.33	0.01	0.03	0.09	0.40
Five (5) 0.5-mmBtu/hr Heater Treaters	EU-HT1 to EU-HT5	0.30	1.30	0.25	1.10	0.02	0.05	<0.01	0.01	0.02	0.09
Three (3) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 to EU-SH3	0.51	2.22	0.42	1.83	0.03	0.12	<0.01	0.01	0.04	0.17
Twelve (12) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	-	-	8.04	35.20	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	-	-	0.18	0.80	-	-	-	-
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	4.14	18.13	8.27	36.22	3.13	13.71	-	-	0.09	0.39
Vapor Combustor Pilots	EU-PILOT	0.02	0.09	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	-	-	-	-	2.04	8.95	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	8.45	27.76
Allowable Emissions =		**12.06**	**52.77**	**17.89**	**78.31**	**16.11**	**70.59**	**0.04**	**0.19**	**8.83**	**29.44**

Notes:

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

SWN Production Company, LLC
Alice Edge Pad
Summary of Hazardous Air Pollutants

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG5	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG6	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	-	<0.01	<0.01	0.03
622-hp Caterpillar G3508 TALE AFR Engine	EU-MC1498	0.05	0.03	<0.01	<0.01	0.23	0.01	-	<0.01	<0.01	0.33
567-hp Caterpillar G3508 TALE Engine	EU-MC2322	0.04	0.02	<0.01	<0.01	0.40	0.01	-	<0.01	<0.01	0.48
Eleven (11) 1.0-mmBtu/hr GPU Burners	EU-GPU1 to EU-GPU11	-	-	<0.01	-	<0.01	-	0.02	<0.01	-	0.02
Five (5) 0.5-mmBtu/hr Heater Treaters	EU-HT1 to EU-HT5	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	0.01
Three (3) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 to EU-SH3	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
Twelve (12) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	0.01	0.03	-	-	0.46	0.03	0.12	0.65
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	0.01	<0.01	<0.01	0.01
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	-	-	<0.01	0.01	-	-	0.18	0.01	0.04	0.25
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.01	-	-	0.09	0.01	0.02	0.13
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Allowable Emissions =		**0.09**	**0.06**	**0.02**	**0.05**	**0.68**	**0.03**	**0.78**	**0.06**	**0.18**	**1.95**

Continued on Next Page

SWN Production Company, LLC
Alice Edge Pad
Summary of Hazardous Air Pollutants (Continued)

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG5	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG6	0.02	0.01	0.01	<0.01	0.09	0.02	-	<0.01	<0.01	0.15
622-hp Caterpillar G3508 TALE AFR Engine	EU-MC1498	0.20	0.12	0.01	<0.01	1.02	0.06	-	0.01	<0.01	1.43
567-hp Caterpillar G3508 TALE Engine	EU-MC2322	0.17	0.10	0.01	<0.01	1.75	0.05	-	0.01	<0.01	2.09
Eleven (11) 1.0-mmBtu/hr GPU Burners	EU-GPU1 to EU-GPU11	-	-	<0.01	-	<0.01	-	0.10	<0.01	-	0.10
Five (5) 0.5-mmBtu/hr Heater Treaters	EU-HT1 to EU-HT5	-	-	<0.01	-	<0.01	-	0.02	<0.01	-	0.02
Three (3) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 to EU-SH3	-	-	<0.01	-	<0.01	-	0.04	<0.01	-	0.04
Twelve (12) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	-	-	0.02	0.15	-	-	2.04	0.14	0.50	2.85
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	0.05	<0.01	0.01	0.06
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	-	-	0.01	0.06	-	-	0.79	0.05	0.18	1.08
Vapor Combustor Pilots	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.03	-	-	0.41	0.02	0.09	0.55
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
Allowable Emissions =		**0.40**	**0.25**	**0.08**	**0.24**	**2.96**	**0.14**	**3.44**	**0.24**	**0.79**	**8.53**

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

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\,Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\,Eq.}$		Total CO_2 + $CO_{2\,Eq.}$[1]	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG5	155.04	616.04	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.64
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG6	155.04	616.04	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.64
622-hp Caterpillar G3508 TALE AFR Engine	EU-MC1498	730.88	2,904.12	0.01	0.05	0.30	1.19	<0.01	<0.01	0.36	1.42	731.54	2,906.73
567-hp Caterpillar G3508 TALE Engine	EU-MC2322	761.25	3,024.80	0.01	0.04	0.25	0.99	<0.01	<0.01	0.30	1.18	761.80	3,026.98
Eleven (11) 1.0-mmBtu/hr GPU Burners	EU-GPU1 to EU-GPU11	1,286.75	5,112.85	0.02	0.10	0.61	2.41	<0.01	0.01	0.72	2.87	1,288.08	5,118.13
Five (5) 0.5-mmBtu/hr Heater Treaters	EU-HT1 to EU-HT5	292.44	1,162.01	0.01	0.02	0.14	0.55	<0.01	<0.01	0.16	0.65	292.74	1,163.21
Three (3) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 to EU-SH3	526.40	2,091.62	0.01	0.04	0.25	0.99	<0.01	<0.01	0.30	1.17	526.94	2,093.78
Four (4) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.01	0.09	0.35	2.20	8.76	-	-	-	-	2.21	8.76
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	0.02	0.09	1.30	5.16	32.47	129.04	-	-	-	-	32.50	129.13
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	3,509.31	13,944.14	0.07	0.26	1.65	6.57	0.01	0.03	1.97	7.83	3,512.94	13,958.54
Vapor Combustor Pilots	EU-PILOT	15.88	63.10	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.01	0.04	15.90	63.17
Fugitive Emissions	EU-FUG	0.01	0.04	1.60	6.34	40.00	158.53	-	-	-	-	40.01	158.57
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Allowable Emissions =		**7,433.02**	**29,534.84**	**3.12**	**12.38**	**78.02**	**309.60**	**0.01**	**0.05**	**3.98**	**15.82**	**7,515.04**	**29,860.28**

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

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

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\,Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\,Eq.}$		Total CO_2 + $CO_{2\,Eq.}$[1]	
		lb/hr	tons/yr[2]	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG5	155.04	679.06	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.73
145-hp Caterpillar G3306 NA Engine w/ Catalytic Converter	EU-ENG6	155.04	679.06	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.73
622-hp Caterpillar G3508 TALE AFR Engine	EU-MC1498	730.88	3,201.24	0.01	0.05	0.30	1.31	<0.01	0.01	0.36	1.57	731.54	3,204.12
567-hp Caterpillar G3508 TALE Engine	EU-MC2322	761.25	3,334.27	0.01	0.04	0.25	1.09	<0.01	<0.01	0.30	1.30	761.80	3,336.67
Eleven (11) 1.0-mmBtu/hr GPU Burners	EU-GPU1 to EU-GPU11	1,286.75	5,635.95	0.02	0.11	0.61	2.66	<0.01	0.01	0.72	3.17	1,288.08	5,641.77
Five (5) 0.5-mmBtu/hr Heater Treaters	EU-HT1 to EU-HT5	292.44	1,280.90	0.01	0.02	0.14	0.60	<0.01	<0.01	0.16	0.72	292.74	1,282.22
Three (3) 1.5-mmBtu/hr Stabilizer Heaters	EU-SH1 to EU-SH3	526.40	2,305.62	0.01	0.04	0.25	1.09	<0.01	<0.01	0.30	1.29	526.94	2,308.00
Four (4) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Four (4) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.01	0.09	0.39	2.20	9.65	-	-	-	-	2.21	9.66
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	0.02	0.10	1.30	5.69	32.47	142.24	-	-	-	-	32.50	142.34
One (1) 30.0-mmBtu/hr Vapor Combustor - Tank/Loading Stream	APC-COMB-TKLD	3,509.31	15,370.78	0.07	0.29	1.65	7.24	0.01	0.03	1.97	8.63	3,512.94	15,386.66
Vapor Combustor Pilots	EU-PILOT	15.88	69.56	<0.01	<0.01	0.01	0.03	<0.01	<0.01	0.01	0.04	15.90	69.63
Fugitive Emissions	EU-FUG	0.01	0.04	1.60	6.99	40.00	174.75	-	-	-	-	40.01	174.79
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
Allowable Emissions =		**7,433.02**	**32,556.59**	**3.12**	**13.65**	**78.02**	**341.28**	**0.01**	**0.06**	**3.98**	**17.44**	**7,515.04**	**32,915.32**

Notes:

[1] CO_2 Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO_2 = 1, CH_4 = 25, N_2O = 298

[2] EPA and API GHG calculation methodologies calculate emissions in metric tons (tonnes). These values have been converted to short tons for consistency with permitting threshold units.

[3] Per API Compendium (2009) Chapter 5: Because most of the CH_4 and CO_2 emissions from storage tanks occur as a result of flashing (which is controlled by the vapor combustor in this case), working and breathing loss emissions of these gases are very small in production and virtually non-existent in the downstream segments. Vapors from the tanks are routed to the vapor combustor at this site. Therefore, GHG emissions from the condensate and produced water tanks are assumed to be negligible.

SWN Production Company, LLC
Alice Edge Pad
Storage Tank Emissions - Criteria Air Pollutants

Tank Information

Unit ID:	EU-TANKS-COND	EU-TANKS-PW
Contents: [1]	Condensate	Produced Water
Number of Tanks: [2]	12	4
Capacity (bbl) - Per Tank:	400	400
Capacity (gal) - Per Tank:	16,800	16,800
Total Throughput (bbl/yr):	1,569,500	1,825,000
Total Throughput (gal/yr):	65,919,000	76,650,000
Total Throughput (bbl/d):	4,300	5,000
Tank Flashing Emission Factor (lb/bbl):	0.6760	0.01980
Total Working Losses (lb/yr): [3]	85,587.44	214.67
Breathing Losses per Tank (lb/yr): [3]	1,626.17	2.20
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	9.77	42.79	0.03	0.11
Breathing Losses	2.22	9.72	0.00	0.00
Flashing Losses	121.12	530.49	4.13	18.07
Total VOC =	**133.11**	**583.00**	**4.15**	**18.18**

SWN Production Company, LLC
Alice Edge Pad
Storage Tank Emissions - Criteria Air Pollutants (Continued)

Uncaptured Storage Tank Emissions

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Emissions	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Working Losses	-	-	-	-
Breathing Losses	-	-	-	-
Flashing Losses	-	-	-	-
Total VOC =	**-**	**-**	**-**	**-**

Notes:

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

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

[3] Tank working and breathing emissions were calculated using maximum throughput in EPA TANKS 4.0.9d for working losses and multiplying results for breathing losses by the number of tanks for total potential evaporative losses from all tanks. Flashing calculated using Promax process simulation. Reports located in Appendix L. Uncontrolled tank working/breathing/flashing emissions are routed to a vapor combustor with 100% capture efficiency. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

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

SWN Production Company, LLC
Alice Edge 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]	**133.11**	**583.00**	**4.15**	**18.18**
n-Hexane	7.70	33.72	0.24	1.05
Benzene	0.09	0.41	<0.01	0.01
Toluene	0.52	2.28	0.02	0.07
Ethylbenzene	0.56	2.45	0.02	0.08
Xylenes	1.91	8.35	0.06	0.26
Total HAP =	**10.78**	**47.20**	**0.34**	**1.47**

Uncaptured Storage Tank Emissions[2]

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Total VOC = [1]	-	-	-	-
n-Hexane	-	-	-	-
Benzene	-	-	-	-
Toluene	-	-	-	-
Ethylbenzene	-	-	-	-
Xylenes	-	-	-	-
Total HAP =	-	-	-	-

SWN Production Company, LLC
Alice Edge Pad
Storage Tank Emissions - 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] 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. Uncaptured emissions shown represent those not captured by the collection system or controlled by the vapor combustor.

[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
Alice Edge Pad
Condensate Truck Loading Emissions - Criteria and Hazardous Air Pollutants

Loading Information

Unit ID:	**EU-LOAD-COND**
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Saturation Factor:	0.6
Em. Factor (lb/1000 gal): [1]	3.56
Throughput (1000 gal):	65,919
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

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

Uncontrolled Loading Emissions[4]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**26.70**	**26.79**	**117.34**
n-Hexane	1.54	1.55	6.79
Benzene	0.02	0.02	0.08
Toluene	0.10	0.10	0.46
Ethylbenzene	0.11	0.11	0.49
Xylenes	0.38	0.38	1.68
Total HAP [5] =	**2.16**	**2.17**	**9.50**

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

Uncaptured Loading Emissions[4]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**8.01**	**8.04**	**35.20**
n-Hexane	0.46	0.46	2.04
Benzene	0.01	0.01	0.02
Toluene	0.03	0.03	0.14
Ethylbenzene	0.03	0.03	0.15
Xylenes	0.11	0.12	0.50
Total HAP [5] =	**0.65**	**0.65**	**2.85**

Notes:

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

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

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

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

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

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

SWN Production Company, LLC
Alice Edge Pad
Condensate Truck Loading Emissions - Greenhouse Gases

Loading Information

Unit ID:	**EU-LOAD-COND**
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):	65.919
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Input CH_4 from Promax =	1.9467%
Input CO_2 from Promax =	0.0338%

Uncontrolled Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	0.29	0.29	1.17	1.29
CH_4 as CO_2e	7.32	7.35	29.19	32.18
CO_2	0.01	0.01	0.02	0.02
Total CO_2 + CO_2e =	**7.33**	**7.35**	**29.21**	**32.20**

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

Uncaptured Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	0.09	0.09	0.35	0.39
CH_4 as CO_2e	2.20	2.20	8.76	9.65
CO_2	<0.01	<0.01	0.01	0.01
Total CO_2 + CO_2e =	**2.20**	**2.21**	**8.76**	**9.66**

API Compendium Table 5-12

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

Notes:

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

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

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

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

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

Loading Information

Unit ID:	**EU-LOAD-PW**
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Saturation Factor:	0.6
Em. Factor (lb/1000 gal): [1]	0.07
Throughput (1000 gal):	76,650
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

0.2414	= P, True vapor pressure of liquid loaded (max. psia)[5]
20.013	= M, Molecular weight of vapor (lb/lb-mol)[5]
50.33	= T, Temperature of bulk liquid loaded (average °F)[5]
510.33	= T, Temperature of bulk liquid loaded (°F + 460 = °R)

Uncontrolled Loading Emissions[3]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**0.53**	**0.61**	**2.68**
n-Hexane	0.03	0.04	0.15
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	0.04
Total HAP[4] =	**0.04**	**0.05**	**0.22**

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

Uncaptured Loading Emissions[3]

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	**0.16**	**0.18**	**0.80**
n-Hexane	0.01	0.01	0.05
Benzene	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	0.01
Total HAP[4] =	**0.01**	**0.01**	**0.06**

Notes:

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

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

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

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

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

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

SWN Production Company, LLC
Alice Edge Pad
Produced Water Truck Loading Emissions - Greenhouse Gases

Loading Information

Unit ID:	**EU-LOAD-PW**
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):	76.650
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency: [2]	70.00%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	Vapor Combustor

Input CH_4 from Promax =	24.6660%
Input CO_2 from Promax =	0.4218%

Uncontrolled Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	3.71	4.33	17.20	18.97
CH_4 as CO_2e	92.78	108.25	430.12	474.13
CO_2	0.06	0.07	0.29	0.32
Total CO_2 + CO_2e =	**92.85**	**108.32**	**430.42**	**474.45**

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

Uncaptured Loading Emissions[3, 4]

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr	tons/yr
CH_4	1.11	1.30	5.16	5.69
CH_4 as CO_2e	27.84	32.47	129.04	142.24
CO_2	0.02	0.02	0.09	0.10
Total CO_2 + CO_2e =	**27.85**	**32.50**	**129.13**	**142.34**

API Compendium Table 5-12

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

Notes:

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

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

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

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

SWN Production Company, LLC
Alice Edge Pad
Tanks/Loading Vapor Combustor Emissions Calculations - Criteria and Hazardous Air Pollutants

Criteria and Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors[1]	Total Captured Emissions[2]		Combustor Destruction Efficiency	Total Controlled Emissions (Post-Capture and Combustion)	
			lb/hr	TPY	%	lb/hr	TPY
APC-COMB-TKLD	NOx	0.138	-	-	-	4.14	18.13
	CO	0.2755	-		-	8.27	36.22
	PM	7.6	-		-	0.09	0.39
	VOC	Mass Balance	156.44	685.20	98.00%	3.13	13.71
	n-Hexane	Mass Balance	9.05	39.63	98.00%	0.18	0.79
	Benzene	Mass Balance	0.11	0.48	98.00%	<0.01	0.01
	Toluene	Mass Balance	0.61	2.68	98.00%	0.01	0.05
	Ethylbenzene	Mass Balance	0.66	2.88	98.00%	0.01	0.06
	Xylenes	Mass Balance	2.24	9.81	98.00%	0.04	0.18

Notes:

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

Hours per Year: 8,760
Number of Combustors: 1

NOx and CO emission factors (lb/mmBtu): *TCEQ Air Permit Technical Guidance for Chemical Sources: Flares and Vapor Oxidizers:* High Btu waste streams (>1,000 Btu/scf) based on heat input to the combustor = 30.00 mmBtu/hr Total Heat Input

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

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

Source	Captured VOC Emissions	
	lb/hr	TPY
Condensate Storage Tanks	133.11	583.00
Produced Water Storage Tanks	4.15	18.18
Condensate Truck Loading	18.75	82.14
Produced Water Truck Loading	0.43	1.88
Total VOC =	**156.44**	**685.20**

Source	Captured HAP Emissions (lb/hr)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	7.70	0.09	0.52	0.56	1.91
Produced Water Storage Tanks	0.24	<0.01	0.02	0.02	0.06
Condensate Truck Loading	1.08	0.01	0.07	0.08	0.27
Produced Water Truck Loading	0:02	<0.01	<0.01	<0.01	0.01
Total HAP =	**9.05**	**0.11**	**0.61**	**0.66**	**2.24**

Source	Captured HAP Emissions (TPY)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	33.72	0.41	2.28	2.45	8.35
Produced Water Storage Tanks	1.05	0.01	0.07	0.08	0.26
Condensate Truck Loading	4.75	0.06	0.32	0.35	1.18
Produced Water Truck Loading	0.11	<0.01	0.01	0.01	0.03
Total HAP =	**39.63**	**0.48**	**2.68**	**2.88**	**9.81**

SWN Production Company, LLC
Alice Edge Pad
Tanks/Loading Vapor Combustor Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**APC-COMB-TKLD**
Description:	Vapor Combustor
Number of Combustors:	1
Burner Design Capacity (mmBtu/hr):	30.00
Stream HHV (Btu/scf):	2,682
Annual Throughput (mmscf):	97.99
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

where:

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

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

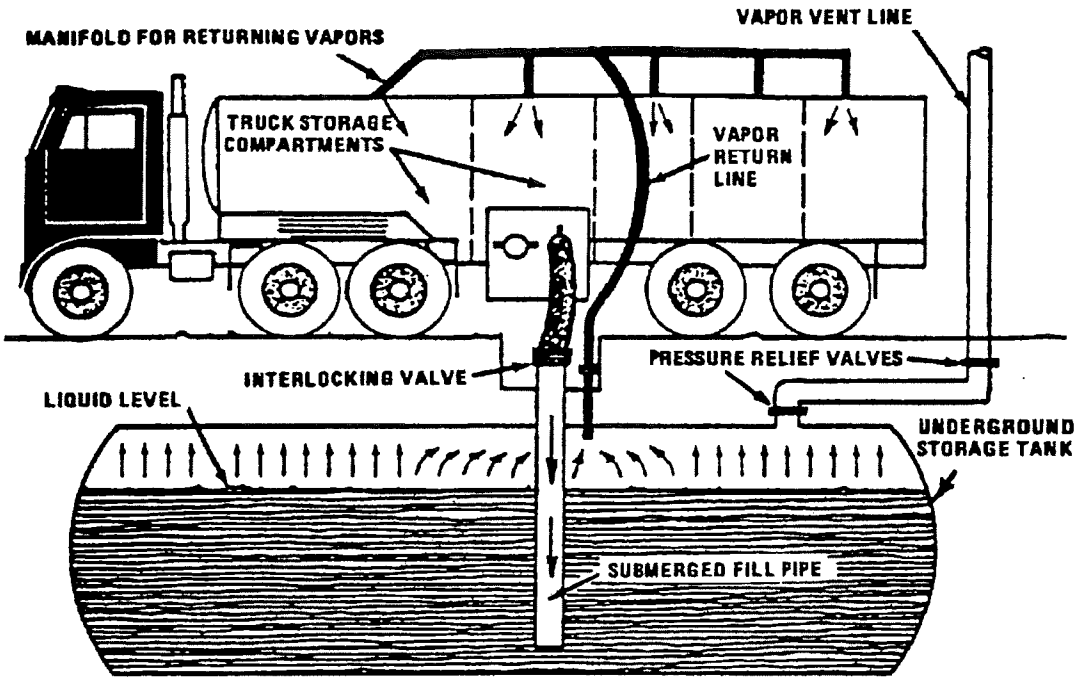


Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

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

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

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

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

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

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

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

EMISSION FACTOR RATING: B

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

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

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

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

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

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

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

ATTACHMENT T: FACILITY-WIDE EMISSION SUMMARY SHEETS

ATTACHMENT T – FACILITY-WIDE CONTROLLED EMISSIONS SUMMARY SHEET

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

Emission Point ID#	NO_x		CO		VOC		SO_2		PM_{10}		$PM_{2.5}$		GHG (CO_2e)	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-ENG5	0.32	1.40	0.64	2.80	0.24	1.05	<0.01	<0.01	0.01	0.04	0.01	0.04	155.19	679.73
EP-ENG6	0.32	1.40	0.64	2.80	0.24	1.05	0.01	0.04	0.01	0.04	0.01	0.04	155.19	679.73
EP-MC1498	2.74	12.00	3.51	15.37	1.10	4.82	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	731.54	3204.12
EP-MC2322	2.50	10.95	3.16	13.84	1.03	4.51	0.01	0.04	0.04	0.18	0.04	0.18	761.80	3336.67
EP-GPU1	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU2	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU3	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU4	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU5	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU6	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU7	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU8	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU9	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU10	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-GPU11	0.11	0.48	0.09	0.39	0.01	0.03	<0.01	<0.01	0.01	0.03	0.01	0.03	116.98	512.36
EP-HT1	0.06	0.26	0.05	0.22	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	58.44	255.99
EP-HT2	0.06	0.26	0.05	0.22	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	58.44	255.99
EP-HT3	0.06	0.26	0.05	0.22	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	58.44	255.99
EP-HT4	0.06	0.26	0.05	0.22	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	58.44	255.99
EP-HT5	0.06	0.26	0.05	0.22	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	58.44	255.99

EP-SH1	0.17	0.74	0.14	0.61	0.01	0.04	<0.01	<0.01	0.01	0.04	0.01	0.04	175.47	768.54
EP-SH2	0.17	0.74	0.14	0.61	0.01	0.04	<0.01	<0.01	0.01	0.04	0.01	0.04	175.47	768.54
EP-SH3	0.17	0.74	0.14	0.61	0.01	0.04	<0.01	<0.01	0.01	0.04	0.01	0.04	175.47	768.54
EP-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-LOAD-COND	-	-	-	-	8.04	35.20	-	-	-	-	-	-	2.21	9.66
EP-LOAD-PW	-	-	-	-	0.18	0.80	-	-	-	-	-	-	32.50	142.34
APC-COMB-TKLD	4.14	18.13	8.27	36.22	3.13	13.71	-	-	0.09	0.39	0.09	0.39	3512.94	15386.66
EP-PILOT	0.02	0.09	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15.90	69.63
EP-FUG	-	-	-	-	2.04	8.95	-	-	-	-	-	-	40.01	174.79
EP-HR	-	-	-	-	-	-	-	-	2.06	6.75	0.21	0.70	-	-
TOTAL	12.06	52.77	17.89	78.31	16.11	70.59	0.04	0.19	2.35	7.90	0.50	1.85	7515.04	32915.32

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.

ATTACHMENT T – FACILITY-WIDE HAP CONTROLLED EMISSIONS SUMMARY SHEET

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

Emission Point ID#	Formaldehyde		Benzene		Toluene		Ethylbenzene		Xylenes		Hexane		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-ENG5	0.02	0.09	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.03	0.15
EP-ENG6	0.02	0.09	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.03	0.15
EP-MC1498	0.23	1.02	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.33	1.43
EP-MC2322	0.40	1.75	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.48	2.09
EP-GPU1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU7	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU8	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU9	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-GPU11	<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-HT2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-HT3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-HT4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-HT5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01

EP-SH1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-SH2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-SH3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	0.01	<0.01	0.01
EP-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-LOAD-COND	-	-	0.01	0.02	0.03	0.14	0.03	0.15	0.12	0.50	0.46	2.04	0.65	2.85
EP-LOAD-PW	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.05	0.01	0.06
APC-COMB-TKLD	-	-	<0.01	0.01	0.01	0.05	0.01	0.06	0.04	0.18	0.18	0.79	0.25	1.08
EP-PILOT	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	<0.01	<0.01
EP-FUG	-	-	<0.01	<0.01	0.01	0.02	0.01	0.03	0.02	0.09	0.09	0.41	0.13	0.55
EP-HR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	0.68	2.96	0.02	0.08	0.06	0.24	0.05	0.24	0.18	0.79	0.78	3.44	1.95	8.53

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