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

September 8, 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: G70-C Application –Charles Frye Pad, Permit # R13-2922F

Mr. Durham:

SWN Production Company, LLC respectfully submits the enclosed G70-C application for the Charles Frye Pad located in Ohio County, West Virginia.

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

ORIGIN ID:MIFA (832) 796-7632
LIZ GEE
SOUTHWESTERN ENERGY
PO BOX 12359
SPRING, TX 77389
UNITED STATES US

SHIP DATE: 12SEP16
ACTWGT: 0.25 LB
CAD: 102872503/INET3790

BILL SENDER

TO FRED DURHAM, DIRECTOR
WV DEPT OF ENVIRONMENTAL PROTECTION
OFFICE OF OIL AND GAS
601 57TH ST SE
CHARLESTON WV 25304
(304) 926-0499
INV:
PO:
REF: CHARLESFRYEAIRPERMIT
DEPT:

544J1/A053/14E8

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Vendor:616193 WEST VIRGINIA DEP

Check Date 9/9/16 N0:0001013214

Invoice Date	Invoice No	Description	Invoice Amount	Amount Withheld	Discount Taken	Amount Paid
9/9/16	090916	CHARLES FRYE PAD	1,500.00		0.00	1,500.00
	TOTAL FOR CHECK		1,500.00	0.00	0.00	1,500.00

SOUTHWESTERN ENERGY COMPANY AND SUBSIDIARIES

SWN Production (Arkansas), LLC
SWN Production Company, LLC
SWN Drilling Company, LLC

Southwestern Energy Services Company
SWN Midstream Services Company, LLC
Desoto Gathering Company, LLC

Angelina Gathering Company, LLC
A.W.Realty Company, LLC

Contact the A/P department with questions. Phone: 832-796-7888 E-mail: accountspayable@swn.com

THIS CHECK IS VOID WITHOUT A GRAY COLORED BACKGROUND, MICROPRINTING AND AN AUTHENTIC WATERMARK ON THE BACK — HOLD AT ANGLE TO VIEW WATERMARK.

swn Southwestern Energy®

PO BOX 12359
SPRING,TX 77391-2359

Wells Fargo
Houston TX

General Fund 56-382 / 412

Check Date	Check No.
9/9/16	0001013214

Net Amount
$**********1,500.00

VOID AFTER 180 DAYS

Pay One Thousand Five Hundred Dollars And Zero Cents

To The Order Of

WEST VIRGINIA DEP
DIVISION OF AIR QUALITY PERMITTING
601 57TH STREET SOUTHEAST
CHARLESTON, WV 25304
US

By _____ Chief Executive Officer

By _____ Senior Vice President

⑈1013214⑈ ⑆041203824⑆ 9600153529⑈

SWN PRODUCTION COMPANY, LLC

CHARLES FRYE PAD

GENERAL PERMIT G70-C

SUBMITTED TO WVDEP DIVISION OF AIR QUALITY
SEPTEMBER 2016

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INTRODUCTION

SWN Production Company, LLC (SWN), submits this G70-C General Permit application for the Charles Frye Pad, a natural gas production facility near Valley Grove in Ohio County. The facility currently operates under Permit No. R13-2922F issued on August 29, 2015. With this application, SWN requests authorization to construct and operate under the General Permit G70-C for Oil and Natural Gas Production Facilities. Included with this application are changes in the emission estimates for the emission sources at the facility. The equipment to be authorized includes the following:

- One (1) Caterpillar G3306 NA Compressor Engine
- One (1) Zenith ZPP-644 4.4L Engine
- Six (6) 1.0-mmBtu/hr Gas Production Units (GPU)
- Two (2) 0.5-mmBtu/hr Heater Treaters
- Six (6) 400-bbl Condensate Tanks
- Six (6) 400-bbl Produced Water Tanks
- Condensate Truck Loading
- Produced Water Truck Loading
- One (1) 15.0-mmBtu/hr Vapor Combustor with Pilot
- Fugitive Emissions
- Fugitive Haul Road Emissions

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

Proposed Emissions

Emissions calculations for the facility are presented in Attachment S. A fuel heating value of 905 Btu/scf was used to calculate emissions from natural gas-fired equipment. Actual heating value may vary (generally 905 - 1,300) but using a lower heating value in the emissions calculations provides a more conservative (higher) estimate of fuel use. GPU and heater treater emissions were calculated using AP-42/EPA emission factors for natural gas combustion.

Emissions from the Caterpillar engine were calculated with manufacturer data when available and AP-42/EPA emissions factors for the remaining pollutants. The Zenith engine is an EPA-certified 2013 Model Year engine with NMHC+NO_x and CO emission standards in g/kW-hr. NMHC and NO_x are grouped together for the purposes of the emission standard; therefore, the

total emission factor was used to conservatively estimate emissions for both VOC and NO_x, respectively. All other pollutants were estimated using AP-42 emission factors.

Condensate and produced water tank emissions were calculated using Bryan Research Engineering ProMax® software. Vapors from the produced water storage tanks and condensate storage tanks are routed to a vapor recovery unit (VRU). A vapor combustor will be used to control emissions from the tanks in the event of any downtime of the VRU. Vapors from the combustor will be destroyed with a minimum 98% efficiency. An overall control efficiency of 98% was used for the purpose of establishing potential emissions from the storage tanks.

Emissions from condensate and produced water truck loading operations were calculated using Bryan Research Engineering ProMax® software. Liquid loading emissions were estimated for submerged loading dedicated normal service and overall reduction efficiency of 69%. Vapor balance capture efficiency is 70% and control efficiency is 98%.

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

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

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-C. Emissions of carbon monoxide and volatile organic compounds are less than 80 tons per year (TPY). Oxides of nitrogen emissions are less than 50 TPY and particulate matter 10/2.5 and sulfur dioxide emissions are each less than 20 TPY. Also, the facility will have less than 8 TPY for each hazardous air pollutant and less than 20 tons for total hazardous air pollutants. The engines are subject to NSPS Subpart JJJJ and MACT Subpart ZZZZ.

45 CSR 22 - AIR QUALITY MANAGEMENT FEE PROGRAM:

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

45 CSR 30 - REQUIREMENTS FOR OPERATING PERMITS:

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

FEDERAL

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

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

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

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

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

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

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

The Caterpillar engine has a horsepower rating of 145-hp (between 100-hp and 499-hp) and was manufactured after January 1, 2011; therefore, it is subject to this Subpart. The Zenith engine is a 57.4-kW (77-hp), four-stroke, rich-burn natural gas fired compressor engine manufactured after June 12, 2006 that is certified to applicable emission standards based on engine class and maximum horsepower.

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

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

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 are 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 this Subpart.

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

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

The wells at this location were completed prior to the effective date of this Subpart and are not subject to the compliance requirements. There is no centrifugal compressor using wet gas seals at this facility. The pneumatic controllers utilized at the facility are considered low-bleed and are not subject to this Subpart. The storage vessel venting is controlled to less than six (6) tons per year (tpy) volatile organic compounds (VOC) and federally enforceable limits have been requested. The storage vessels are not subject to this Subpart. The well site was constructed prior to September 18, 2015 and is therefore not subject to the fugitive source monitoring requirements of this Subpart. The pneumatic pumps at the facility were constructed prior to September 18, 2015 and are not subject to the control requirements of this Subpart.

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

The site is a minor (area) source of hazardous air pollutants. This Subpart applies to affected emission points that are located at facilities that are major and area sources of HAP, and either process, upgrade, or store hydrocarbon liquids prior to custody transfer or that process, upgrade, or store natural gas prior to entering the natural gas transmission and storage source category. For purposes of this Subpart natural gas enters the natural gas transmission and storage source category after the natural gas processing plant, if present. The facility does not contain the affected sources and is therefore not subject to this Subpart.

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

The facility is not a natural gas transmission and storage facility and is therefore not subject to this Subpart.

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

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

Owners and operators of new or reconstructed engines at area sources must meet the requirements of Subpart ZZZZ by complying with either 40 CFR Part 60 Subpart IIII (for CI engines) or 40 CFR Part 60 Subpart JJJJ (for SI engines). Based on emission calculations, this facility is a minor source of HAP. The engines are subject to NSPS Subpart JJJJ and will comply with MACT Subpart ZZZZ by complying with the requirements of NSPS Subpart JJJJ.

APPLICATION FOR GENERAL PERMIT REGISTRATION

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

G70-C 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: Charles Frye Pad

Operating Site Physical Address: 800 McCutcheon Road Valley Grove, WV 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: 40.05442
Longitude: -80.5818

SIC Code: 1311 NAICS Code: 211111	DAQ Facility ID No. (For existing facilities) 069-00109

CERTIFICATION OF INFORMATION

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

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

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

Responsible Official Signature: Carla L Suszkowski
Name and Title: Carla Suszkowski, P.E. Regulatory Manager – West Virginia Division Phone: 832-796-1000
Fax:
Email: Carla_Suszkowski@SWN.com Date: 9-8-16

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

If applicable:
Environmental Contact
Name and Title: Phone: Fax:
Email: Date:

OPERATING SITE INFORMATION	
Briefly describe the proposed new operation and/or any change(s) to the facility: Facility consists of one (1) Caterpillar G3306 NA flash gas compressor engine, one (1) Zenith vapor recovery unit engine, six (6) GPU burners, two (2) heater treaters, six (6) condensate tanks, six (6) produced water tanks, condensate and produced water truck loading, one (1) combustor with one (1) pilot, fugitive emissions, and fugitive haul road emissions.	
Directions to the facility: From Interstate 70 east of Wheeling, WV, take Exit 10 and turn left onto CR 65 (Cabella Drive). Travel 0.32 miles if exiting from I-70 east (0.55 miles if exiting from I-70 west) and turn right onto CR 41/1 (McCutcheon Road). Travel 0.72 miles on CR 41/1 and entrance to well pad will be on the left.	
ATTACHMENTS AND SUPPORTING DOCUMENTS	
I have enclosed the following required documents:	
Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22). ☒ Check attached to front of application. ☐ I wish to pay by electronic transfer. Contact for payment (incl. name and email address): ☐ I wish to pay by credit card. Contact for payment (incl. name and email address): ☒$500 (Construction, Modification, and Relocation) ☐$300 (Class II Administrative Update) ☒$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ and/or OOOO [1] ☐$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH [2] [1] Only one NSPS fee will apply. [2] Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ. *NSPS and NESHAP fees apply to new construction or if the source is being modified.*	
☒ Responsible Official or Authorized Representative Signature (if applicable)	
☒ Single Source Determination Form **(must be completed in its entirety)** – Attachment A	
☐ Siting Criteria Waiver (if applicable) – Attachment B	☒ Current Business Certificate – Attachment C
☒ Process Flow Diagram – Attachment D	☒ Process Description – Attachment E
☒ Plot Plan – Attachment F	☒ Area Map – Attachment G
☒ G70-C 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 the Charles Frye Pad 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 the Charles Frye Pad 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.

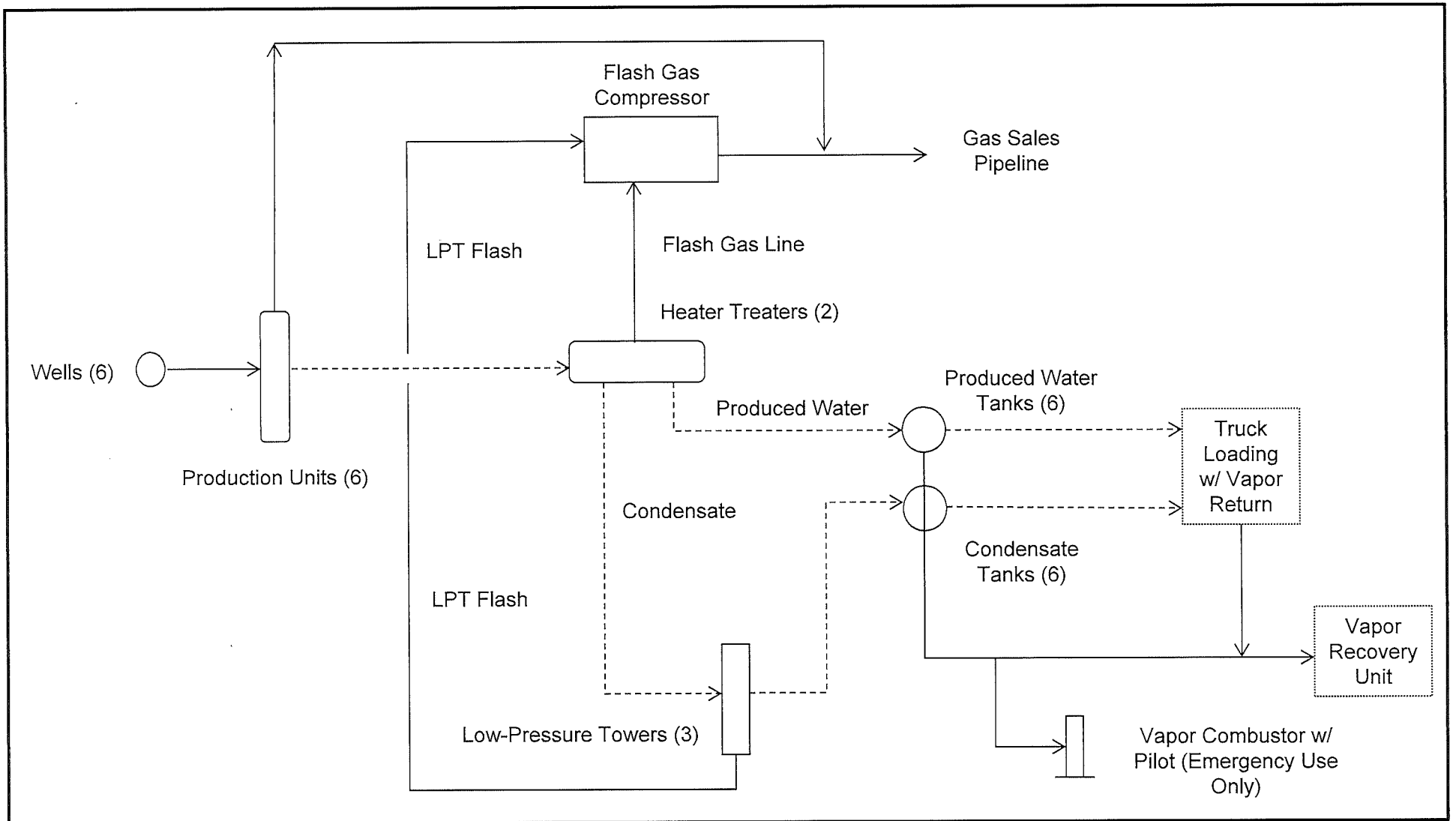
This certificate shall be permanent until cessation of the business for which the certificate of registration was granted, or until it is suspended, revoked or cancelled by the Tax Commissioner.

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.

atL006 v.4
L1180094016

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
Charles Frye Pad
Attachment D: Process Flow Diagram
September 2016

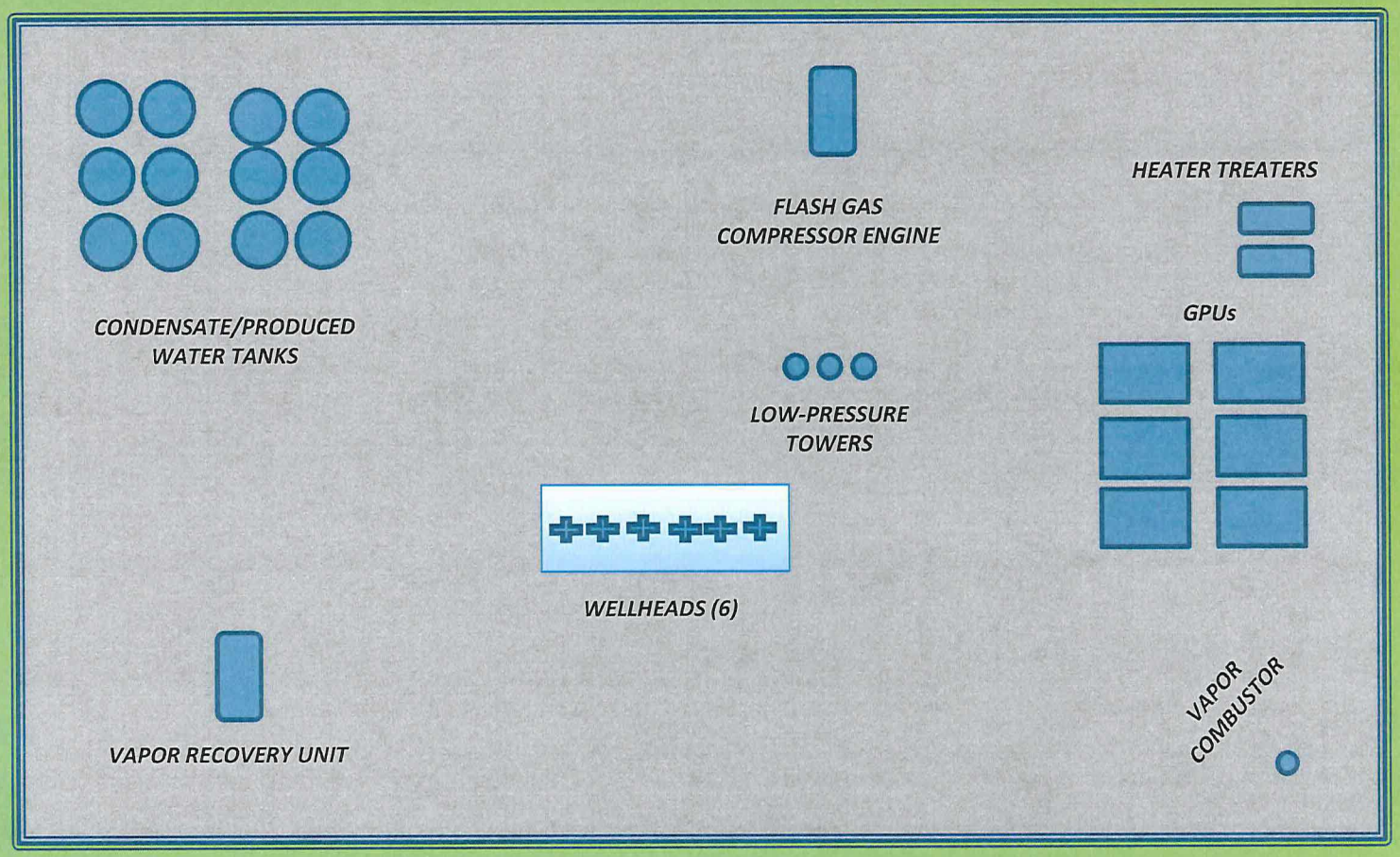
ATTACHMENT E: PROCESS DESCRIPTION

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 also occurs on-site. A description of the facility process flow is as follows: Condensate, gas and water pass from each of the six (6) wellheads to the gas production units, where the first stage of separation occurs. Fluids (condensate and produced water) are sent to the heater treaters and gas is sent to the sales line. The flash gas from the heater treaters is captured via a natural gas-fired engine-driven compressor. Produced water from the heater treaters flows into the produced water storage tanks. Condensate flows into low pressure separators, where additional flash gas is routed to the compressor. Condensate is then sent to condensate storage tanks. Vapors from the produced water storage tanks and condensate storage tanks are routed to a vapor recovery unit (VRU). The combustor at the facility will be used to control emissions from the tanks in the event of any downtime of the VRU. Vapors from the combustor will be destroyed with a minimum 98% efficiency. The vapor combustor has a natural gas-fired pilot to ensure a constant flame for combustion.

The natural gas stream exits the facility for transmission via pipeline. Condensate and produced water are transported offsite via truck. Truck loading emissions are controlled with vapor return with a minimum of 70% capture efficiency and are routed to the VRU.

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

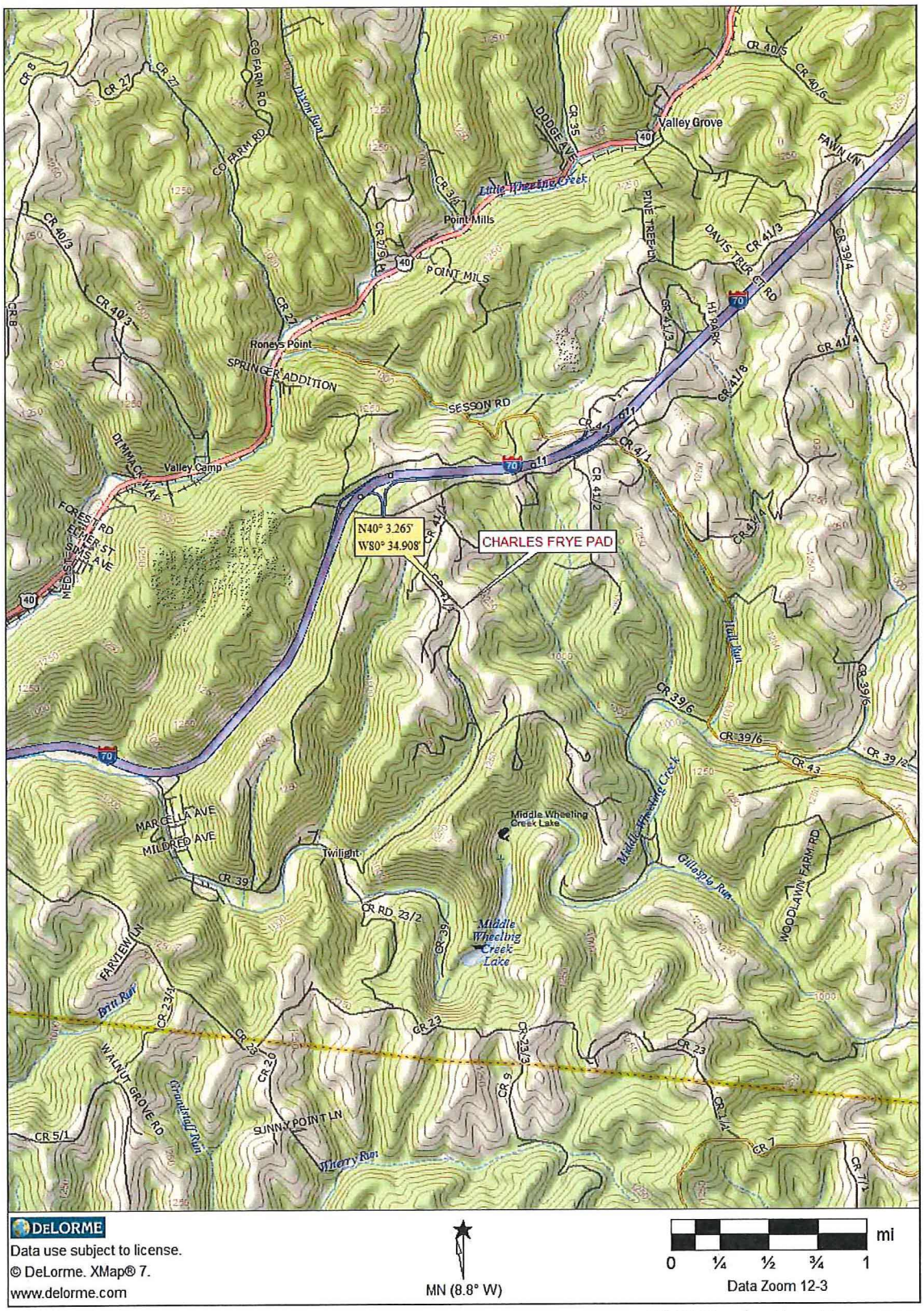
ATTACHMENT F: PLOT PLAN



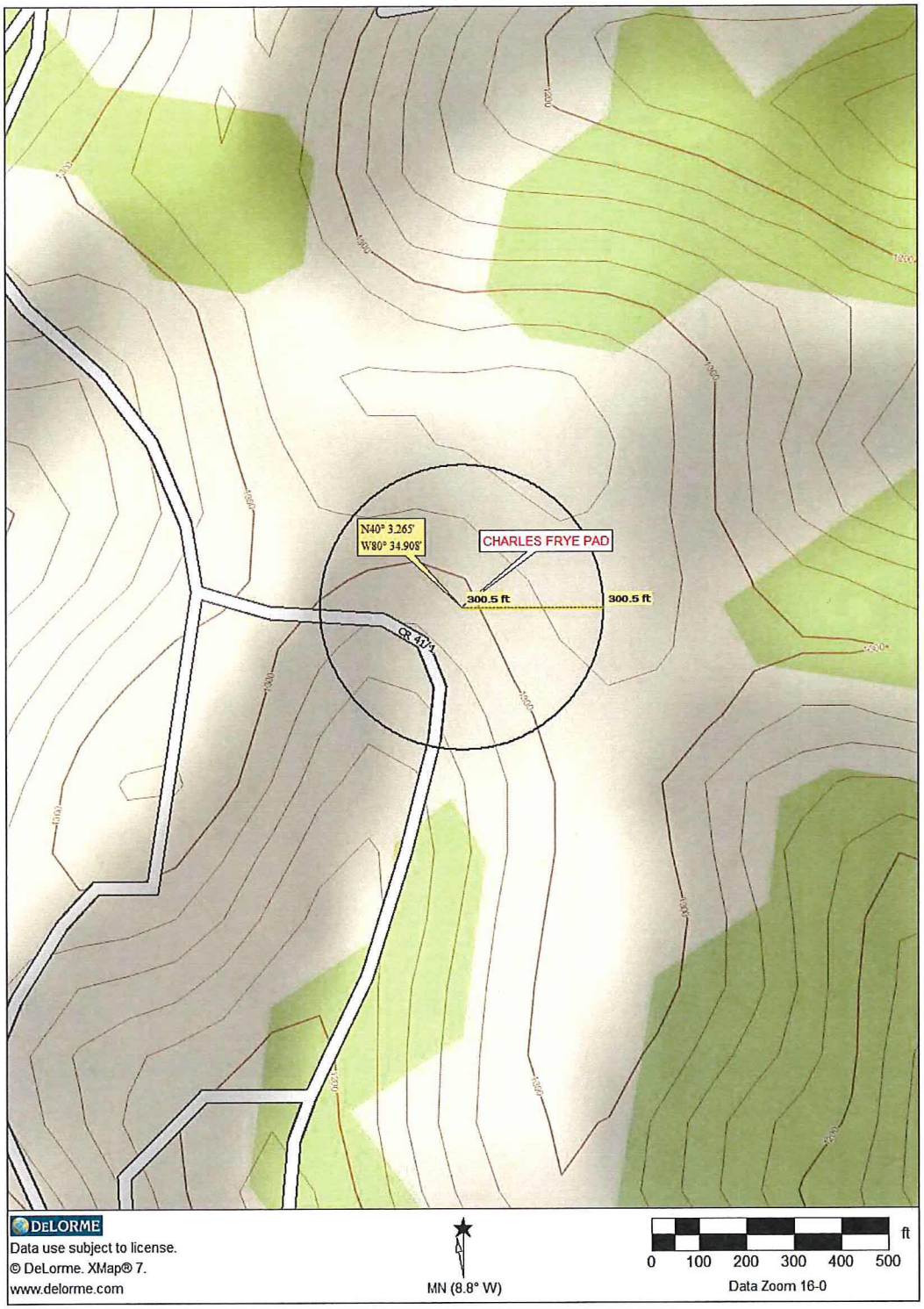
NOTE: *Image is only a representation of production/emissions equipment. Actual location specifications and equipment placement are not to scale.*

SWN Production Company, LLC
Charles Frye Pad
Attachment F: Simple Plot Plan
September 2016

ATTACHMENT G: AREA MAP



SWN Production Company, LLC
Charles Frye Pad
Attachment G: Area Map
September 2016



SWN Production Company, LLC
Charles Frye Pad
Attachment G: Area Map with 300' Radius
September 2016

ATTACHMENT H: G70-C SECTION APPLICABILITY FORM

General Permit G70-C Registration
Section Applicability Form

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

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

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

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

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

ATTACHMENT I: EMISSIONS UNITS/ERD TABLE

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

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

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed	Manufac. Date[3]	Design Capacity	Type[4] and Date of Change	Control Device(s)[5]	ERD(s)[6]
EU-MC4220	EP-MC4220	145-hp Caterpillar G3306 NA Engine	2015	after 1/1/2011	145-hp	Existing	NSCR	NSCR
EU-VRU	EP-VRU	77-hp Zenith ZPP-644 4.4L Engine	2015	2013	77-hp	New	NSCR	NSCR
EU-GPU1	EP-GPU1	1.0-mmBtu/hr GPU Burner	2012	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU2	EP-GPU2	1.0-mmBtu/hr GPU Burner	2012	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU3	EP-GPU3	1.0-mmBtu/hr GPU Burner	2012	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU4	EP-GPU4	1.0-mmBtu/hr GPU Burner	2015	N/A	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU5	EP-GPU5	1.0-mmBtu/hr GPU Burner	2015	TBD	1.0-mmBtu/hr	Existing	N/A	N/A
EU-GPU6	EP-GPU6	1.0-mmBtu/hr GPU Burner	2015	TBD	1.0-mmBtu/hr	Existing	N/A	N/A
EU-HT1	EP-HT1	0.5-mmBtu/hr Heater Treater	2012	N/A	0.5-mmBtu/hr	Existing	N/A	N/A
EU-HT2	EP-HT2	0.5-mmBtu/hr Heater Treater	2012	N/A	0.5-mmBtu/hr	Existing	N/A	N/A
EU-TANKS-COND	APC-COMB-TKLD	Six (6) 400-bbl Condensate Tanks Routed to Vapor Combustor	2012	N/A	400-bbl	Modification	APC-COMB-TKLD	APC-VRU
EU-TANKS-PW	APC-COMB-TKLD	Six (6) 400-bbl Produced Water Tanks Routed to Vapor Combustor	2012	N/A	400-bbl	Modification	APC-COMB-TKLD	APC-VRU
EU-LOAD-COND	APC-COMB-TKLD	Condensate Truck Loading w/ Vapor Return Routed to Combustor	2012	N/A	22,075,200 gal/yr	Existing	Vapor Return and APC-COMB-TKLD	APC-VRU
EU-LOAD-PW	APC-COMB-TKLD	Produced Water Truck Loading w/ Vapor Return Routed to Combustor	2012	N/A	15,330,000 gal/yr	Existing	Vapor Return and APC-COMB-TKLD	APC-VRU
APC-COMB-TKLD	APC-COMB-TKLD	15.0-mmBtu/hr Vapor Combustor	2012	N/A	15.0-mmBtu/hr	Modification	N/A	N/A
EU-PILOT	APC-COMB-TKLD	Vapor Combustor Pilot	2012	N/A	50-scfh	Existing	N/A	N/A

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

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

[3] When required by rule

[4] New, modification, removal, existing

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

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

ATTACHMENT J: FUGITIVE EMISSIONS SUMMARY SHEET

Fugitive emissions at this site consist of haul road emissions, condensate and produced water loading operations, and equipment leaks. EPA emission factors used for equipment leaks have been included for reference.

ATTACHMENT J – FUGITIVE EMISSIONS SUMMARY SHEET

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

Source/Equipment: FUG

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

Component Type	Closed Vent System	Count	Source of Leak Factors (EPA, other (specify))	Stream type (gas, liquid, etc.)	Estimated Emissions (tpy)		
					VOC	HAP	GHG (CO_2e)
Pumps	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Valves	☐ Yes ☒ No	119 – gas 129 – light oil	EPA	☐ Gas ☐ Liquid ☒ Both	1.25 – gas 2.94 – light oil	0.02 – gas 0.25 – light oil	67.19 – gas 1.43 – light oil
Safety Relief Valves	☐ Yes ☒ No	38	EPA	☒ Gas ☐ Liquid ☐ Both	0.78	0.01	41.96
Open Ended Lines	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Sampling Connections	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Connections (Not sampling)	☐ Yes ☒ No	510	EPA	☐ Gas ☒ Liquid ☐ Both	0.98	0.08	0.47
Compressors	☐ Yes ☒ No	6	EPA	☒ Gas ☐ Liquid ☐ Both	0.12	<0.01	6.63
Flanges	☐ Yes ☒ No	488	EPA	☒ Gas ☐ Liquid ☐ Both	0.44	0.01	23.88
Other[1]	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			

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

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

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

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 K: GAS WELL AFFECTED FACILITY DATA SHEET

ATTACHMENT K – GAS WELL AFFECTED FACILITY DATA SHEET

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

API Number	Date of Flowback	Date of Well Completion	Green Completion and/or Combustion Device
470-690-01610	6/21/2015	6/12/2015	Green Completion
470-690-01630	6/21/2015	6/10/2015	Green Completion
470-690-01620	6/22/2015	6/08/2015	Green Completion
PLANNED	TBD	TBD	TBD
PLANNED	TBD	TBD	TBD
PLANNED	TBD	TBD	TBD

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

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

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

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

Where,

047 = State code. The state code for WV is 047.

001 = County Code. County codes are odd numbers, beginning with 001 (Barbour) and continuing to 109 (Wyoming).

00001= Well number. Each well will have a unique well number.

ATTACHMENT L: STORAGE VESSELS DATA SHEET

PROMAX PROCESS SIMULATION RESULTS

GAS AND LIQUIDS ANALYSES

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 Six (6) 400-bbl Condensate Storage Tanks
3. Emission Unit ID number EU-TANKS-COND	4. Emission Point ID number APC-COMB-TKLD
5. Date Installed , Modified or Relocated *(for existing tanks)* 2012 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)* Authorize existing tank under G70-C	
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 Six (6) 400-bbl Produced Water Storage Tanks
3. Emission Unit ID number EU-TANKS-PW	4. Emission Point ID number APC-COMB-TKLD
5. Date Installed , Modified or Relocated *(for existing tanks)* 2012 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)* Authorize existing tank under G70-C	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* ☐ Yes ☒ No	
7C. Was USEPA Tanks simulation software utilized? ☒ Yes ☐ No ***If Yes, please provide the appropriate documentation and items 8-42 below are not required.***	

STORAGE TANK DATA TABLE

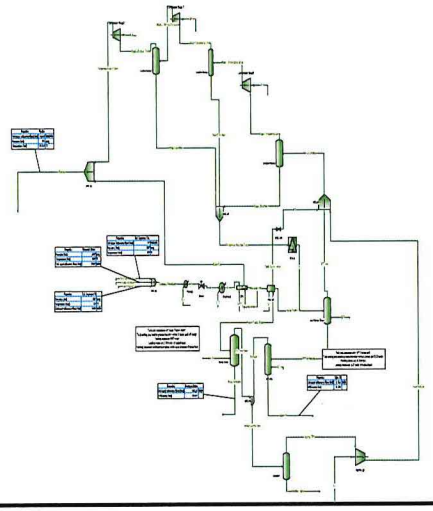
List all deminimis storage tanks (i.e. lube oil, glycol, diesel etc.)

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

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

Charles Frye Pad
Plant Schematic

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	



* User Specified Values
? Extrapolated or Approximate Values

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Connections

	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
From Block	MIX-101	Water Tanks	--	GPU	Oil Tanks
To Block	--	--	MIX-102	MIX-101	--

Stream Composition

Mole Fraction	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
Nitrogen	0.00497228	4.79172E-09	0 *	0.00509241	1.57798E-09
Methane	0.698097	6.49224E-06	0 *	0.710836	1.68976E-05
CO2	0.00144937	1.81217E-06	0 *	0.001453	1.20041E-06
Ethane	0.179396	8.02153E-06	0 *	0.175966	0.00215892
Propane	0.0759153	6.44672E-06	0 *	0.069141	0.0349731
Isobutane	0.00746816	1.45921E-07	0 *	0.00668619	0.0225237
n-Butane	0.0199785	2.0462E-06	0 *	0.0182349	0.108585
Isopentane	0.00304298	1.52767E-07	0 *	0.0029561	0.0524918
n-Pentane	0.0041293	2.21825E-07	0 *	0.00406755	0.0966998
n-Hexane	0.000945381	1.12634E-08	0 *	0.000964448	0.0767692
Methylcyclopentane	7.60176E-05	3.15539E-08	0 *	7.74725E-05	0.00615833
Benzene	1.20624E-05	5.92002E-07	0 *	1.22742E-05	0.000969428
Cyclohexane	0.000106372	1.01856E-07	0 *	0.000108588	0.0107002
n-Heptane	0.00029099	2.35246E-09	0 *	0.000298454	0.0683248
n-Octane	0.00015236	8.56205E-10	0 *	0.000156453	0.110946
n-Nonane	2.98098E-05	1.32726E-09	0 *	3.06158E-05	0.0673008
n-Decane	9.23883E-06	2.14886E-10	0 *	9.48879E-06	0.0586629
n-Undecane	6.04083E-06	2.81336E-10	0 *	6.20429E-06	0.125248
Dodecane	0	0	0 *	0	0
Water	0.00172792	0.999972	1 *	0.00167796	0.00362548
Triethylene Glycol	0	0	0 *	0	0
Oxygen	0	0	0 *	0	0
Argon	0	0	0 *	0	0
Carbon Monoxide	0	0	0 *	0	0
Cyclopentane	8.01722E-06	7.20328E-09	0 *	8.01408E-06	0.000275309
Isohexane	0	0	0 *	0	0
3-Methylpentane	0.00085767	7.17691E-08	0 *	0.000872727	0.0564215
Neohexane	0.00106256	7.68864E-09	0 *	0.00107079	0.0414851
2,3-Dimethylbutane	0.000121246	3.97011E-09	0 *	0.000122982	0.00644661
Methylcyclohexane	0.000109198	2.89906E-08	0 *	0.00011199	0.0248843
Isooctane	0	0	0 *	0	0
Decane, 2-Methyl-	0	0	0 *	0	0
Toluene	1.66207E-05	6.93508E-07	0 *	1.70511E-05	0.0048068
m-Xylene	1.51314E-05	5.81811E-07	0 *	1.55387E-05	0.0151249
Ethylbenzene	5.2281E-06	1.8472E-07	0 *	5.36858E-06	0.00439997

Molar Flow	Pipeline lbmol/h	Produced Water lbmol/h	Reservoir Water lbmol/h	Sales Gas lbmol/h	Sales Oil lbmol/h
Nitrogen	9.63363	3.8622E-06	0 *	9.60642	2.31986E-07
Methane	1352.54	0.00523285	0 *	1340.94	0.00248418
CO2	2.8081	0.00146063	0 *	2.74096	0.000176478
Ethane	347.573	0.00646547	0 *	331.946	0.317392
Propane	147.083	0.00519616	0 *	130.429	5.14153
Isobutane	14.4693	0.000117614	0 *	12.613	3.31131
n-Butane	38.7078	0.00164927	0 *	34.3986	15.9635
Isopentane	5.89567	0.000123132	0 *	5.57644	7.71703
n-Pentane	8.00039	0.000178794	0 *	7.6731	14.2162
n-Hexane	1.83165	9.07844E-06	0 *	1.81935	11.2862
Methylcyclopentane	0.147282	2.5433E-05	0 *	0.146146	0.905361
Benzene	0.0233705	0.000477163	0 *	0.0231543	0.14252
Cyclohexane	0.206091	8.20973E-05	0 *	0.204843	1.57308

* User Specified Values
? Extrapolated or Approximate Values

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Molar Flow	Pipeline lbmol/h	Produced Water lbmol/h	Reservoir Water lbmol/h	Sales Gas lbmol/h	Sales Oil lbmol/h
n-Heptane	0.563783	1.89612E-06	0 *	0.56301	10.0447
n-Octane	0.295193	6.90114E-07	0 *	0.295136	16.3106
n-Nonane	0.0577555	1.06979E-06	0 *	0.0577543	9.89417
n-Decane	0.0178999	1.73201E-07	0 *	0.0178999	8.62427
n-Undecane	0.0117039	2.26761E-07	0 *	0.0117039	18.4132
Dodecane	0	0	0 *	0	0
Water	3.34779	805.993	809.874 *	3.16534	0.532996
Triethylene Glycol	0	0	0 *	0	0
Oxygen	0	0	0 *	0	0
Argon	0	0	0 *	0	0
Carbon Monoxide	0	0	0 *	0	0
Cyclopentane	0.0155331	5.80596E-06	0 *	0.0151179	0.0404743
Isohexane	0	0	0 *	0	0
3-Methylpentane	1.66171	5.7847E-05	0 *	1.64633	8.29476
Neohexane	2.05867	6.19716E-06	0 *	2.01997	6.0989
2,3-Dimethylbutane	0.234911	3.19997E-06	0 *	0.231996	0.947743
Methylcyclohexane	0.211567	2.33668E-05	0 *	0.21126	3.65834
Isooctane	0	0	0 *	0	0
Decane, 2-Methyl-	0	0	0 *	0	0
Toluene	0.032202	0.000558978	0 *	0.0321656	0.706667
m-Xylene	0.0293166	0.000468949	0 *	0.0293125	2.22357
Ethylbenzene	0.0101293	0.000148887	0 *	0.0101274	0.646857

Mass Fraction	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
Nitrogen	0.00615534	7.45079E-09	0 *	0.00640207	4.50088E-10
Methane	0.494899	5.7811E-06	0 *	0.511767	2.7601E-06
CO2	0.00281874	4.42679E-06	0 *	0.00286974	5.37907E-07
Ethane	0.238376	1.33882E-05	0 *	0.237454	0.000660977
Propane	0.14793	1.5779E-05	0 *	0.136824	0.0157021
Isobutane	0.0191817	4.70764E-07	0 *	0.0174402	0.0133295
n-Butane	0.0513141	6.60137E-06	0 *	0.0475638	0.0642602
Isopentane	0.00970194	6.11791E-07	0 *	0.00957147	0.0385612
n-Pentane	0.0131655	8.88349E-07	0 *	0.0131702	0.071037
n-Hexane	0.00360015	5.38761E-08	0 *	0.00372987	0.0673597
Methylcyclopentane	0.000282714	1.47401E-07	0 *	0.000292605	0.00527711
Benzene	4.16371E-05	2.56676E-06	0 *	4.30271E-05	0.000771014
Cyclohexane	0.000395602	4.7581E-07	0 *	0.000410127	0.00916906
n-Heptane	0.0012885	1.30841E-08	0 *	0.0013421	0.0697083
n-Octane	0.000769088	5.42872E-09	0 *	0.00080203	0.129038
n-Nonane	0.000168952	9.44879E-09	0 *	0.000176219	0.0878871
n-Decane	5.80893E-05	1.69708E-09	0 *	6.05887E-05	0.084985
n-Undecane	4.17262E-05	2.44091E-09	0 *	4.35217E-05	0.199334
Dodecane	0	0	0 *	0	0
Water	0.00137561	0.99994	1 *	0.00135661	0.000665022
Triethylene Glycol	0	0	0 *	0	0
Oxygen	0	0	0 *	0	0
Argon	0	0	0 *	0	0
Carbon Monoxide	0	0	0 *	0	0
Cyclopentane	2.48471E-05	2.80412E-08	0 *	2.52236E-05	0.000196595
Isohexane	0	0	0 *	0	0
3-Methylpentane	0.00326613	3.43294E-07	0 *	0.00337515	0.049506
Neohexane	0.00404638	3.67771E-08	0 *	0.00414115	0.0364003
2,3-Dimethylbutane	0.000461724	1.89903E-08	0 *	0.000475615	0.00565646
Methylcyclohexane	0.000473799	1.57998E-07	0 *	0.000493469	0.0248774
Isooctane	0	0	0 *	0	0
Decane, 2-Methyl-	0	0	0 *	0	0
Toluene	6.76736E-05	3.54681E-06	0 *	7.0506E-05	0.00450948
m-Xylene	7.09889E-05	3.42853E-06	0 *	7.40333E-05	0.0163495

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Process Streams Report
All Streams
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Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Mass Fraction	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
Ethylbenzene	2.45277E-05	1.08853E-06	0 *	2.55784E-05	0.00475621

Mass Flow	Pipeline lb/h	Produced Water lb/h	Reservoir Water lb/h	Sales Gas lb/h	Sales Oil lb/h
Nitrogen	269.871	0.000108193	0 *	269.109	6.4987E-06
Methane	21698.1	0.0839477	0 *	21511.9	0.0398523
CO2	123.583	0.0642818	0 *	120.628	0.00776669
Ethane	10451.2	0.194411	0 *	9981.3	9.54367
Propane	6485.73	0.229128	0 *	5751.34	226.719
Isobutane	840.988	0.006836	0 *	733.093	192.461
n-Butane	2249.78	0.0958589	0 *	1999.32	927.836
Isopentane	425.366	0.00888385	0 *	402.333	556.774
n-Pentane	577.218	0.0128998	0 *	553.605	1025.68
n-Hexane	157.843	0.000782337	0 *	156.784	972.589
Methylcyclopentane	12.3951	0.00214042	0 *	12.2996	76.1947
Benzene	1.82551	0.037272	0 *	1.80863	11.1325
Cyclohexane	17.3445	0.00690927	0 *	17.2395	132.39
n-Heptane	56.4922	0.000189995	0 *	56.4147	1006.5
n-Octane	33.7194	7.88307E-05	0 *	33.713	1863.14
n-Nonane	7.40743	0.000137206	0 *	7.40728	1268.98
n-Decane	2.54683	2.46433E-05	0 *	2.54682	1227.08
n-Undecane	1.82942	3.54446E-05	0 *	1.82942	2878.13
Dodecane	0	0	0 *	0	0
Water	60.3114	14520.2	14590.1 *	57.0245	9.60207
Triethylene Glycol	0	0	0 *	0	0
Oxygen	0	0	0 *	0	0
Argon	0	0	0 *	0	0
Carbon Monoxide	0	0	0 *	0	0
Cyclopentane	1.08938	0.000407189	0 *	1.06026	2.83858
Isohexane	0	0	0 *	0	0
3-Methylpentane	143.198	0.00498499	0 *	141.873	714.804
Neohexane	177.407	0.000534042	0 *	174.072	525.575
2,3-Dimethylbutane	20.2435	0.000275759	0 *	19.9923	81.6721
Methylcyclohexane	20.773	0.0022943	0 *	20.7428	359.198
Isooctane	0	0	0 *	0	0
Decane, 2-Methyl-	0	0	0 *	0	0
Toluene	2.96704	0.0515034	0 *	2.96369	65.1112
m-Xylene	3.11239	0.0497859	0 *	3.11196	236.066
Ethylbenzene	1.07537	0.0158066	0 *	1.07518	68.6736

Std. Liquid Volumetric Fraction	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
Nitrogen	0.00272042	9.23353E-09	0 *	0.00280631	3.84232E-10
Methane	0.588556	1.92781E-05	0 *	0.603636	6.34028E-06
CO2	0.00123008	5.4169E-06	0 *	0.00124209	4.53418E-07
Ethane	0.238593	3.75751E-05	0 *	0.235726	0.00127789
Propane	0.104011	3.1109E-05	0 *	0.0954155	0.0213254
Isobutane	0.0121533	8.36359E-07	0 *	0.0109595	0.0163129
n-Butane	0.0313231	1.12991E-05	0 *	0.0287963	0.0757676
Isopentane	0.00553433	9.7857E-07	0 *	0.00541524	0.0424883
n-Pentane	0.00744379	1.40839E-06	0 *	0.00738554	0.0775809
n-Hexane	0.00193332	8.11263E-08	0 *	0.00198659	0.0698709
Methylcyclopentane	0.000133795	1.95603E-07	0 *	0.000137343	0.00482393
Benzene	1.67855E-05	2.9015E-06	0 *	1.7204E-05	0.000600385
Cyclohexane	0.00018006	6.07259E-07	0 *	0.000185143	0.00806113
n-Heptane	0.00066764	1.90101E-08	0 *	0.000689723	0.0697679
n-Octane	0.000388169	7.68287E-09	0 *	0.000401482	0.125798
n-Nonane	8.34201E-05	1.30817E-08	0 *	8.62959E-05	0.0838193

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad		
Flowsheet:	Charles Frye Pad		

Std. Liquid Volumetric Fraction	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
n-Decane	2.81997E-05	2.3101E-09	0 *	2.91723E-05	0.0796898
n-Undecane	2.00027E-05	3.28106E-09	0 *	2.06927E-05	0.184575
Dodecane	0	0	0 *	0	0
Water	0.000490554	0.999878	1 *	0.000479819	0.000458078
Triethylene Glycol	0	0	0 *	0	0
Oxygen	0	0	0 *	0	0
Argon	0	0	0 *	0	0
Carbon Monoxide	0	0	0 *	0	0
Cyclopentane	1.18167E-05	3.73938E-08	0 *	1.18976E-05	0.000180595
Isohexane	0	0	0 *	0	0
3-Methylpentane	0.00174096	5.13102E-07	0 *	0.00178435	0.0509714
Neohexane	0.002207	5.62464E-08	0 *	0.0022402	0.0383489
2,3-Dimethylbutane	0.000247219	2.8511E-08	0 *	0.000252573	0.00585001
Methylcyclohexane	0.000218312	2.04135E-07	0 *	0.000225515	0.0221412
Isooctane	0	0	0 *	0	0
Decane, 2-Methyl-	0	0	0 *	0	0
Toluene	2.76809E-05	4.06799E-06	0 *	2.86034E-05	0.00356287
m-Xylene	2.91376E-05	3.94597E-06	0 *	3.01385E-05	0.0129622
Ethylbenzene	1.00343E-05	1.24869E-06	0 *	1.03785E-05	0.00375842

Volumetric Flow	Pipeline ft^3/h	Produced Water gpm	Reservoir Water gpm	Sales Gas ft^3/h	Sales Oil gpm
Nitrogen	245.326	2.92812E-07	0	244.477	2.23514E-08
Methane	32736.9	0.000415098	0	32472	0.000245413
CO2	65.0801	0.000101614	0	63.6067	1.01867E-05
Ethane	7548.69	0.000655882	0	7231.55	0.0403051
Propane	2900.58	0.000660647	0	2587.11	0.849888
Isobutane	263.551	1.80143E-05	0	231.704	0.679735
n-Butane	683.317	0.000249397	0	612.823	3.17838
Isopentane	94.5262	2.15113E-05	0	90.5302	1.80237
n-Pentane	125.872	3.12938E-05	0	122.338	3.29341
n-Hexane	25.0508	1.80341E-06	0	25.3788	2.97472
Methylcyclopentane	2.12952	4.4728E-06	0	2.1498	0.205194
Benzene	0.353289	6.99244E-05	0	0.355242	0.0250318
Cyclohexane	2.95925	1.40438E-05	0	2.9925	0.341939
n-Heptane	6.59505	4.23641E-07	0	6.76886	2.97998
n-Octane	2.90096	1.7021E-07	0	3.02184	5.33218
n-Nonane	0.439882	2.89216E-07	0	0.470719	3.53823
n-Decane	0.100314	5.11199E-08	0	0.111648	3.36307
n-Undecane	0.0418041	7.25204E-08	0	0.0485068	7.75892
Dodecane	0	0	0	0	0
Water	75.1025	29.1406	29.6033	74.8118	0.0141879
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	0.24591	8.73002E-07	0	0.242393	0.00762033
Isohexane	0	0	0	0	0
3-Methylpentane	23.3816	1.13896E-05	0	23.5968	2.17775
Neohexane	30.3382	1.22758E-06	0	30.26	1.63962
2,3-Dimethylbutane	3.3723	6.283E-07	0	3.38934	0.249903
Methylcyclohexane	2.68024	4.61323E-06	0	2.74067	0.939639
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	0.419245	9.56302E-05	0	0.428433	0.148524
m-Xylene	0.324994	9.16838E-05	0	0.337182	0.540885
Ethylbenzene	0.115023	2.89536E-05	0	0.119025	0.15706

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Stream Properties

Property	Units	Pipeline	Produced Water	Reservoir Water	Sales Gas	Sales Oil
Temperature	°F	69.3477	85	150 *	70 *	85 *
Pressure	psig	215	0.5	4230 *	215 *	0.5
Mole Fraction Vapor		0.999897	0	0	1	0
Mole Fraction Light Liquid		1.51617E-05	1	1	0	0.996949
Molecular Weight	lb/lbmol	22.6292	18.0159	18.0153	22.2827	98.2133
Mass Density	lb/ft^3	0.977766	62.1218	61.4467	0.958963	42.6185
Molar Flow	lbmol/h	1937.47	806.015	809.874	1886.42	147.014
Mass Flow	lb/h	43843.4	14521.1	14590.1	42034.6	14438.7
Vapor Volumetric Flow	ft^3/h	44840.4	233.751	237.443	43833.4	338.79
Liquid Volumetric Flow	gpm	5590.49	29.143	29.6033	5464.94	42.2388
Std Vapor Volumetric Flow	MMSCFD	17.6457	7.34089	7.37603	17.1808	1.33895
Std Liquid Volumetric Flow	sgpm	245.777	29.0304	29.1667 *	237.582	41.9038
Specific Gravity			0.996036	0.985212	0.769362	0.683328
API Gravity			10.0152	9.5073		71.882
Enthalpy	Btu/h	-6.83315E+07	-9.89151E+07	-9.82871E+07	-6.61807E+07	-1.35828E+07
Kinematic Viscosity	cSt		0.833349	0.467278	0.691723	0.565849
Net Ideal Gas Heating Value	Btu/ft^3	1227.5	0.0518629	0	1210	4979.43
Net Liquid Heating Value	Btu/lb	20506.2	-1058.61	-1059.76	20531.1	19081.4

Remarks

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Connections

	Test Separator Gas	Test Separator Oil			
From Block	--	--			
To Block	MIX-102	MIX-102			

Stream Composition

Mole Fraction	Test Separator Gas	Test Separator Oil			
Nitrogen	0.00513133 *	0.00026 *			
Methane	0.714456 *	0.08861 *			
CO2	0.00149039 *	0.00013 *			
Ethane	0.174955 *	0.09965 *			
Propane	0.0680377 *	0.11788 *			
Isobutane	0.00668174 *	0.0248 *			
n-Butane	0.0182848 *	0.09597 *			
Isopentane	0.00316082 *	0.03603 *			
n-Pentane	0.00440114 *	0.06541 *			
n-Hexane	0.00107028 *	0.05195 *			
Methylcyclopentane	8.00208E-05 *	0.00422 *			
Benzene	1.00026E-05 *	0.00069 *			
Cyclohexane	0.000100026 *	0.00744 *			
n-Heptane	0.000250065 *	0.04738 *			
n-Octane	0.000220057 *	0.07566 *			
n-Nonane	6.00156E-05 *	0.04597 *			
n-Decane	2.00052E-05 *	0.0402 *			
n-Undecane	1.00026E-05 *	0.08599 *			
Dodecane	0 *	0 *			
Water	0 *	0 *			
Triethylene Glycol	0 *	0 *			
Oxygen	0 *	0 *			
Argon	0 *	0 *			
Carbon Monoxide	0 *	0 *			
Cyclopentane	3.00078E-05 *	0 *			
Isohexane	0 *	0 *			
3-Methylpentane	0.00103027 *	0.03753 *			
Neohexane	0.000290075 *	0.03558 *			
2,3-Dimethylbutane	9.00234E-05 *	0.00474 *			
Methylcyclohexane	0.000110029 *	0.01712 *			
Isooctane	0 *	0 *			
Decane, 2-Methyl-	0 *	0 *			
Toluene	2.00052E-05 *	0.00328 *			
m-Xylene	1.00026E-05 *	0.01044 *			
Ethylbenzene	0 *	0.00307 *			

Molar Flow	Test Separator Gas lbmol/h	Test Separator Oil lbmol/h			
Nitrogen	9.57798 *	0.0556531 *			
Methane	1333.58 *	18.967 *			
CO2	2.78191 *	0.0278266 *			
Ethane	326.566 *	21.3301 *			
Propane	126.997 *	25.2323 *			
Isobutane	12.4719 *	5.30845 *			
n-Butane	34.1297 *	20.5424 *			
Isopentane	5.89989 *	7.71224 *			
n-Pentane	8.21503 *	14.001 *			
n-Hexane	1.99775 *	11.1199 *			
Methylcyclopentane	0.149364 *	0.903293 *			
Benzene	0.0186705 *	0.147695 *			
Cyclohexane	0.186705 *	1.59254 *			

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Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Molar Flow	Test Separator Gas lbmol/h	Test Separator Oil lbmol/h			
n-Heptane	0.466763 *	10.1417 *			
n-Octane	0.410752 *	16.1951 *			
n-Nonane	0.112023 *	9.8399 *			
n-Decane	0.0373411 *	8.60483 *			
n-Undecane	0.0186705 *	18.4062 *			
Dodecane	0 *	0 *			
Water	0 *	0 *			
Triethylene Glycol	0 *	0 *			
Oxygen	0 *	0 *			
Argon	0 *	0 *			
Carbon Monoxide	0 *	0 *			
Cyclopentane	0.0560116 *	0 *			
Isohexane	0 *	0 *			
3-Methylpentane	1.92306 *	8.03331 *			
Neohexane	0.541445 *	7.61592 *			
2,3-Dimethylbutane	0.168035 *	1.0146 *			
Methylcyclohexane	0.205376 *	3.66454 *			
Isooctane	0 *	0 *			
Decane, 2-Methyl-	0 *	0 *			
Toluene	0.0373411 *	0.702086 *			
m-Xylene	0.0186705 *	2.23469 *			
Ethylbenzene	0 *	0.657135 *			

Mass Fraction	Test Separator Gas	Test Separator Oil			
Nitrogen	0.00646446 *	9.33158E-05 *			
Methane	0.515445 *	0.0182125 *			
CO2	0.00294972 *	7.33003E-05 *			
Ethane	0.236583 *	0.0383896 *			
Propane	0.134921 *	0.0665966 *			
Isobutane	0.0174649 *	0.0184676 *			
n-Butane	0.0477933 *	0.0714651 *			
Isopentane	0.0102557 *	0.033305 *			
n-Pentane	0.0142801 *	0.060463 *			
n-Hexane	0.00414778 *	0.0573568 *			
Methylcyclopentane	0.00030286 *	0.00455021 *			
Benzene	3.51371E-05 *	0.000690529 *			
Cyclohexane	0.000378575 *	0.00802218 *			
n-Heptane	0.00112685 *	0.0608257 *			
n-Octane	0.00113044 *	0.110728 *			
n-Nonane	0.000346158 *	0.075538 *			
n-Decane	0.000128005 *	0.073281 *			
n-Undecane	7.03122E-05 *	0.172205 *			
Dodecane	0 *	0 *			
Water	0 *	0 *			
Triethylene Glycol	0 *	0 *			
Oxygen	0 *	0 *			
Argon	0 *	0 *			
Carbon Monoxide	0 *	0 *			
Cyclopentane	9.46437E-05 *	0 *			
Isohexane	0 *	0 *			
3-Methylpentane	0.00399272 *	0.041436 *			
Neohexane	0.00112416 *	0.0392831 *			
2,3-Dimethylbutane	0.000348879 *	0.00523332 *			
Methylcyclohexane	0.000485838 *	0.0215362 *			
Isooctane	0 *	0 *			
Decane, 2-Methyl-	0 *	0 *			
Toluene	8.28933E-05 *	0.00387196 *			
m-Xylene	4.77562E-05 *	0.0142003 *			

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Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Mass Fraction	Test Separator Gas	Test Separator Oil			
Ethylbenzene	0 *	0.00417576 *			

Mass Flow	Test Separator Gas lb/h	Test Separator Oil lb/h			
Nitrogen	268.312 *	1.55903 *			
Methane	21393.9 *	304.278 *			
CO2	122.43 *	1.22463 *			
Ethane	9819.53 *	641.377 *			
Propane	5600.01 *	1112.63 *			
Isobutane	724.895 *	308.539 *			
n-Butane	1983.69 *	1193.97 *			
Isopentane	425.67 *	556.429 *			
n-Pentane	592.704 *	1010.16 *			
n-Hexane	172.157 *	958.263 *			
Methylcyclopentane	12.5704 *	76.0207 *			
Benzene	1.45839 *	11.5367 *			
Cyclohexane	15.713 *	134.027 *			
n-Heptane	46.7706 *	1016.22 *			
n-Octane	46.9195 *	1849.94 *			
n-Nonane	14.3675 *	1262.02 *			
n-Decane	5.31295 *	1224.31 *			
n-Undecane	2.91836 *	2877.04 *			
Dodecane	0 *	0 *			
Water	0 *	0 *			
Triethylene Glycol	0 *	0 *			
Oxygen	0 *	0 *			
Argon	0 *	0 *			
Carbon Monoxide	0 *	0 *			
Cyclopentane	3.92825 *	0 *			
Isohexane	0 *	0 *			
3-Methylpentane	165.721 *	692.274 *			
Neohexane	46.6592 *	656.304 *			
2,3-Dimethylbutane	14.4805 *	87.4335 *			
Methylcyclohexane	20.165 *	359.807 *			
Isooctane	0 *	0 *			
Decane, 2-Methyl-	0 *	0 *			
Toluene	3.44055 *	64.6891 *			
m-Xylene	1.98216 *	237.246 *			
Ethylbenzene	0 *	69.7647 *			

Std. Liquid Volumetric Fraction	Test Separator Gas	Test Separator Oil			
Nitrogen	0.00282821 *	7.35727E-05 *			
Methane	0.606806 *	0.0386384 *			
CO2	0.00127426 *	5.70642E-05 *			
Ethane	0.23441 *	0.0685469 *			
Propane	0.093908 *	0.0835324 *			
Isobutane	0.010954 *	0.0208735 *			
n-Butane	0.0288797 *	0.0778217 *			
Isopentane	0.0057912 *	0.0338918 *			
n-Pentane	0.00799254 *	0.0609853 *			
n-Hexane	0.00220494 *	0.0549474 *			
Methylcyclopentane	0.000141883 *	0.00384151 *			
Benzene	1.40222E-05 *	0.00049661 *			
Cyclohexane	0.000170572 *	0.00651372 *			
n-Heptane	0.000577989 *	0.0562243 *			
n-Octane	0.00056479 *	0.0996964 *			
n-Nonane	0.000169191 *	0.066535 *			

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Std. Liquid Volumetric Fraction	Test Separator Gas	Test Separator Oil			
n-Decane	6.15137E-05 *	0.0634625 *			
n-Undecane	3.33662E-05 *	0.147266 *			
Dodecane	0 *	0 *			
Water	0 *	0 *			
Triethylene Glycol	0 *	0 *			
Oxygen	0 *	0 *			
Argon	0 *	0 *			
Carbon Monoxide	0 *	0 *			
Cyclopentane	4.45562E-05 *	0 *			
Isohexane	0 *	0 *			
3-Methylpentane	0.00210679 *	0.0394014 *			
Neohexane	0.000606962 *	0.0382225 *			
2,3-Dimethylbutane	0.000184914 *	0.00499868 *			
Methylcyclohexane	0.000221601 *	0.0177024 *			
Isooctane	0 *	0 *			
Decane, 2-Methyl-	0 *	0 *			
Toluene	3.35642E-05 *	0.00282533 *			
m-Xylene	1.94039E-05 *	0.0103977 *			
Ethylbenzene	0 *	0.00304752 *			

Volumetric Flow	Test Separator Gas ft^3/h	Test Separator Oil gpm			
Nitrogen	145.481	0.00629492			
Methane	18584.6	2.12844			
CO2	35.9408	0.00201302			
Ethane	3756.03	2.90403			
Propane	1214.17	4.31255			
Isobutane	101.264	1.10365			
n-Butane	257.636	4.13785			
Isopentane	35.2939	1.7975			
n-Pentane	46.768	3.23685			
n-Hexane	7.43111	2.90006			
Methylcyclopentane	0.658505	0.201618			
Benzene	0.0930515	0.0255949			
Cyclohexane	0.798672	0.339443			
n-Heptane	0.865401	2.95928			
n-Octane	0.117481	5.18678			
n-Nonane	-0.1178	3.4375			
n-Decane	-0.0485117	3.27108			
n-Undecane	-0.00259842	7.55245			
Dodecane	0	0			
Water	0	0			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	0.319514	0			
Isohexane	0	0			
3-Methylpentane	7.8702	2.08497			
Neohexane	2.57176	2.0236			
2,3-Dimethylbutane	0.734809	0.264236			
Methylcyclohexane	0.553845	0.917095			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	0.111369	0.144209			
m-Xylene	0.0245282	0.528655			
Ethylbenzene	0	0.154956			

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Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Stream Properties

Property	Units	Test Separator Gas	Test Separator Oil			
Temperature	°F	83 *	83 *			
Pressure	psig	390 *	390 *			
Mole Fraction Vapor		0.999775	0			
Mole Fraction Light Liquid		0.000224912	1			
Molecular Weight	lb/lbmol	22.2364	78.052			
Mass Density	lb/ft^3	1.71517	40.3512			
Molar Flow	lbmol/h	1866.57	214.05			
Mass Flow	lb/h	41505.7	16707.1			
Vapor Volumetric Flow	ft^3/h	24199.2	414.041			
Liquid Volumetric Flow	gpm	3017.04	51.6207			
Std Vapor Volumetric Flow	MMSCFD	17 *	1.94949			
Std Liquid Volumetric Flow	sgpm	235.044	52.5 *			
Specific Gravity			0.646976			
API Gravity			82.8853			
Enthalpy	Btu/h	-6.52631E+07	-1.65566E+07			
Kinematic Viscosity	cSt		0.409605			
Net Ideal Gas Heating Value	Btu/ft^3	1209.23	3985.93			
Net Liquid Heating Value	Btu/lb	20562.8	19224.5			

Remarks

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Process Streams Report
Stream: Pipeline
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 12:56 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Connections

From: MIX-101 To: --

Composition

Mole Fraction	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	0.00497228	0.00497279	0.000131498	9.75364E-07	2.018E-05
Methane	0.698097	0.698168	0.0573713	0.000265435	0.00866783
CO2	0.00144937	0.00144951	0.000305958	1.10395E-05	5.44329E-05
Ethane	0.179396	0.179413	0.0830779	7.2569E-05	0.0122857
Propane	0.0759153	0.0759213	0.12225	3.2389E-05	0.0180151
Isobutane	0.00746816	0.00746848	0.0294701	1.06971E-06	0.00433706
n-Butane	0.0199785	0.0199789	0.113574	6.61867E-06	0.0167166
Isopentane	0.00304298	0.00304265	0.0421892	6.02503E-07	0.00620812
n-Pentane	0.0041293	0.00412859	0.0752264	7.87321E-07	0.0110693
n-Hexane	0.000945381	0.000944619	0.0566803	6.87659E-08	0.00833983
Methylcyclopentane	7.60176E-05	7.59568E-05	0.00452971	5.39398E-08	0.000666534
Benzene	1.20624E-05	1.20528E-05	0.000709837	4.87288E-07	0.000104859
Cyclohexane	0.000106372	0.000106264	0.00782437	1.17156E-07	0.00115136
n-Heptane	0.00029099	0.000290265	0.0497823	2.28735E-08	0.00732485
n-Octane	0.00015236	0.000151157	0.0803448	6.96519E-09	0.0118217
n-Nonane	2.98098E-05	2.90812E-05	0.0482528	3.96883E-09	0.00709979
n-Decane	9.23883E-06	8.63373E-06	0.0399686	8.13452E-10	0.00588086
n-Undecane	6.04083E-06	4.91446E-06	0.0743241	6.87871E-10	0.0109358
Dodecane	0	0	0	0	0
Water	0.00172792	0.00164024	0.000362075	0.999606	0.85258
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	8.01722E-06	8.01488E-06	0.000208505	1.02655E-08	3.06875E-05
Isohexane	0	0	0	0	0
3-Methylpentane	0.00085767	0.000857125	0.0417997	1.91618E-07	0.00615046
Neohexane	0.00106256	0.0010622	0.0311765	6.74402E-08	0.00458728
2,3-Dimethylbutane	0.000121246	0.000121186	0.00479695	1.80421E-08	0.000705825
Methylcyclohexane	0.000109198	0.000108934	0.0181291	4.94623E-08	0.0026675
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	1.66207E-05	1.65695E-05	0.00348354	5.23517E-07	0.000513005
m-Xylene	1.51314E-05	1.49682E-05	0.0108645	4.4036E-07	0.00159895
Ethylbenzene	5.2281E-06	5.18062E-06	0.00316603	1.44932E-07	0.000465964

Molar Flow	Total lbmol/h	Vapor lbmol/h	Light Liquid lbmol/h	Heavy Liquid lbmol/h	Mixed Liquid lbmol/h
Nitrogen	9.63363	9.63362	3.86278E-06	1.66076E-07	4.02886E-06
Methane	1352.54	1352.54	0.0016853	4.51958E-05	0.0017305
CO2	2.8081	2.80809	8.98759E-06	1.8797E-06	1.08673E-05
Ethane	347.573	347.571	0.00244044	1.23564E-05	0.0024528
Propane	147.083	147.08	0.00359113	5.5149E-06	0.00359665
Isobutane	14.4693	14.4684	0.000865693	1.8214E-07	0.000865875
n-Butane	38.7078	38.7044	0.00333626	1.12696E-06	0.00333739
Isopentane	5.89567	5.89443	0.00123932	1.02588E-07	0.00123942
n-Pentane	8.00039	7.99818	0.0022098	1.34058E-07	0.00220993
n-Hexane	1.83165	1.82998	0.001665	1.17088E-08	0.00166501
Methylcyclopentane	0.147282	0.147149	0.000133062	9.18436E-09	0.000133071
Benzene	0.0233705	0.0233495	2.08517E-05	8.29707E-08	2.09346E-05
Cyclohexane	0.206091	0.205861	0.000229843	1.99483E-08	0.000229863
n-Heptane	0.563783	0.562321	0.00146237	3.89468E-09	0.00146237
n-Octane	0.295193	0.292832	0.00236015	1.18597E-09	0.00236015
n-Nonane	0.0577555	0.056338	0.00141744	6.75774E-10	0.00141744
n-Decane	0.0178999	0.0167258	0.00117409	1.38507E-10	0.00117409
n-Undecane	0.0117039	0.00952061	0.00218329	1.17124E-10	0.00218329

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Process Streams Report
Stream: Pipeline
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 12:56 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Molar Flow	Total lbmol/h	Vapor lbmol/h	Light Liquid lbmol/h	Heavy Liquid lbmol/h	Mixed Liquid lbmol/h
Dodecane	0	0	0	0	0
Water	3.34779	3.17758	1.06361E-05	0.170203	0.170214
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	0.0155331	0.015527	6.12488E-06	1.7479E-09	6.12663E-06
Isohexane	0	0	0	0	0
3-Methylpentane	1.66171	1.66048	0.00122788	3.26268E-08	0.00122791
Neohexane	2.05867	2.05776	0.00091582	1.14831E-08	0.000915832
2,3-Dimethylbutane	0.234911	0.23477	0.000140912	3.07204E-09	0.000140915
Methylcyclohexane	0.211567	0.211035	0.000532547	8.42196E-09	0.000532555
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	0.032202	0.0320995	0.00010233	8.91395E-08	0.000102419
m-Xylene	0.0293166	0.0289973	0.000319148	7.49803E-08	0.000319223
Ethylbenzene	0.0101293	0.0100363	9.30031E-05	2.46777E-08	9.30278E-05

Mass Fraction	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	0.00615534	0.00615609	4.62985E-05	1.5165E-06	2.08809E-05
Methane	0.494899	0.49496	0.0115678	0.000236341	0.00513622
CO2	0.00281874	0.00281908	0.000169235	2.69654E-05	8.8485E-05
Ethane	0.238376	0.238403	0.031397	0.00012111	0.0136453
Propane	0.14793	0.147944	0.0677529	7.9269E-05	0.0293423
Isobutane	0.0191817	0.0191829	0.0215281	3.45079E-06	0.00931105
n-Butane	0.0513141	0.051316	0.0829666	2.13512E-05	0.0358881
Isopentane	0.00970194	0.0097011	0.0382573	2.41267E-06	0.0165444
n-Pentane	0.0131655	0.0131635	0.0682154	3.15276E-06	0.0294992
n-Hexane	0.00360015	0.00359732	0.0613901	3.28902E-07	0.0265462
Methylcyclopentane	0.000282714	0.000282494	0.00479134	2.51955E-07	0.00207199
Benzene	4.16371E-05	4.16049E-05	0.000696881	2.11258E-06	0.000302541
Cyclohexane	0.000395602	0.00039521	0.00827629	5.47241E-07	0.0035791
n-Heptane	0.0012885	0.00128532	0.0626952	1.27209E-07	0.0271104
n-Octane	0.000769088	0.000763033	0.115349	4.41588E-08	0.0498788
n-Nonane	0.000168952	0.000164826	0.0777823	2.82518E-08	0.0336342
n-Decane	5.80893E-05	5.42858E-05	0.0714745	6.42378E-09	0.0309066
n-Undecane	4.17262E-05	3.39466E-05	0.146014	5.96759E-09	0.0631387
Dodecane	0	0	0	0	0
Water	0.00137561	0.00130583	8.19829E-05	0.999493	0.567333
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	2.48471E-05	2.48404E-05	0.000183789	3.99586E-08	7.9496E-05
Isohexane	0	0	0	0	0
3-Methylpentane	0.00326613	0.00326412	0.0452731	9.16491E-07	0.0195773
Neohexane	0.00404638	0.00404508	0.0337671	3.22561E-07	0.0146016
2,3-Dimethylbutane	0.000461724	0.000461504	0.00519555	8.6294E-08	0.00224668
Methylcyclohexane	0.000473799	0.000472665	0.0223722	2.69547E-07	0.00967422
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	6.76736E-05	6.74667E-05	0.00403409	2.6772E-06	0.00174592
m-Xylene	7.09889E-05	7.02246E-05	0.0144969	2.59477E-06	0.00627014
Ethylbenzene	2.45277E-05	2.43054E-05	0.00422454	8.53998E-07	0.00182724

Mass Flow	Total lb/h	Vapor lb/h	Light Liquid lb/h	Heavy Liquid lb/h	Mixed Liquid lb/h
Nitrogen	269.871	269.871	0.00010821	4.65234E-06	0.000112862
Methane	21698.1	21698	0.0270364	0.000725051	0.0277614

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Process Streams Report
Stream: Pipeline
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 12:56 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Mass Flow	Total lb/h	Vapor lb/h	Light Liquid lb/h	Heavy Liquid lb/h	Mixed Liquid lb/h
CO2	123.583	123.583	0.000395539	8.27248E-05	0.000478264
Ethane	10451.2	10451.1	0.0733817	0.000371544	0.0737532
Propane	6485.73	6485.57	0.158353	0.000243183	0.158596
Isobutane	840.988	840.938	0.050316	1.05864E-05	0.0503265
n-Butane	2249.78	2249.59	0.193911	6.55016E-05	0.193976
Isopentane	425.366	425.276	0.0894155	7.40163E-06	0.0894229
n-Pentane	577.218	577.059	0.159434	9.67209E-06	0.159444
n-Hexane	157.843	157.699	0.143482	1.00901E-06	0.143483
Methylcyclopentane	12.3951	12.3839	0.0111984	7.72951E-07	0.0111992
Benzene	1.82551	1.82387	0.00162876	6.481E-06	0.00163524
Cyclohexane	17.3445	17.3252	0.0193435	1.67884E-06	0.0193452
n-Heptane	56.4922	56.3456	0.146532	3.90255E-07	0.146533
n-Octane	33.7194	33.4498	0.269597	1.35471E-07	0.269597
n-Nonane	7.40743	7.22564	0.181794	8.66715E-08	0.181794
n-Decane	2.54683	2.37978	0.167051	1.9707E-08	0.167051
n-Undecane	1.82942	1.48815	0.341267	1.83075E-08	0.341267
Dodecane	0	0	0	0	0
Water	60.3114	57.2449	0.000191612	3.06626	3.06645
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	1.08938	1.08895	0.000429556	1.22586E-07	0.000429678
Isohexane	0	0	0	0	0
3-Methylpentane	143.198	143.092	0.105813	2.81163E-06	0.105816
Neohexane	177.407	177.328	0.0789211	9.89558E-07	0.0789221
2,3-Dimethylbutane	20.2435	20.2314	0.0121431	2.64734E-07	0.0121434
Methylcyclohexane	20.773	20.7207	0.0522886	8.26919E-07	0.0522895
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	2.96704	2.9576	0.00942854	8.21317E-06	0.00943675
m-Xylene	3.11239	3.0785	0.0338823	7.96029E-06	0.0338903
Ethylbenzene	1.07537	1.0655	0.00987367	2.61991E-06	0.00987629

Std. Liquid Volumetric Fraction	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	0.00272042	0.00272056	3.68181E-05	1.87782E-06	2.08365E-05
Methane	0.588556	0.588588	0.0247532	0.000787478	0.0137913
CO2	0.00123008	0.00123014	0.000132887	3.29696E-05	8.71847E-05
Ethane	0.238593	0.238605	0.0565452	0.000339629	0.0308369
Propane	0.104011	0.104014	0.0857163	0.000156155	0.0465812
Isobutane	0.0121533	0.0121532	0.0245428	6.12566E-06	0.0133198
n-Butane	0.0313231	0.0313221	0.0911261	3.65157E-05	0.0494619
Isopentane	0.00553433	0.00553347	0.0392674	3.85596E-06	0.0213083
n-Pentane	0.00744379	0.00744214	0.0693987	4.99432E-06	0.0376581
n-Hexane	0.00193332	0.00193167	0.0593189	4.94855E-07	0.0321868
Methylcyclopentane	0.000133795	0.000133682	0.00408	3.34074E-07	0.00221397
Benzene	1.67855E-05	1.67714E-05	0.000505504	2.38614E-06	0.000275379
Cyclohexane	0.00018006	0.000179869	0.00677806	6.97855E-07	0.0036781
n-Heptane	0.00066764	0.000665945	0.0584526	1.84674E-07	0.0317166
n-Octane	0.000388169	0.000385086	0.104754	6.24439E-08	0.0568397
n-Nonane	8.34201E-05	8.13772E-05	0.0691032	3.90824E-08	0.0374955
n-Decane	2.81997E-05	2.63514E-05	0.0624323	8.73708E-09	0.0338759
n-Undecane	2.00027E-05	1.62722E-05	0.125946	8.01506E-09	0.0683387
Dodecane	0	0	0	0	0
Water	0.000490554	0.000465637	5.26048E-05	0.998617	0.456794
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	1.18167E-05	1.18127E-05	0.000157272	5.32425E-08	8.53604E-05

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Process Streams Report
Stream: Pipeline
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 12:56 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Std. Liquid Volumetric Fraction	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Isohexane	0	0	0	0	0
3-Methylpentane	0.00174096	0.00173977	0.0434217	1.36871E-06	0.0235613
Neohexane	0.002207	0.00220614	0.0331391	4.92918E-07	0.0179815
2,3-Dimethylbutane	0.000247219	0.000247084	0.00500543	1.29452E-07	0.00271602
Methylcyclohexane	0.000218312	0.000217774	0.0185482	3.47973E-07	0.0100645
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	2.76809E-05	2.75943E-05	0.00296905	3.0681E-06	0.00161241
m-Xylene	2.91376E-05	2.88219E-05	0.0107065	2.98394E-06	0.00581074
Ethylbenzene	1.00343E-05	9.94271E-06	0.00310973	9.78852E-07	0.00168779

Volumetric Flow	Total ft^3/h	Vapor ft^3/h	Light Liquid gpm	Heavy Liquid gpm	Mixed Liquid gpm
Nitrogen	245.326	245.326	4.14347E-07	1.24146E-08	4.26762E-07
Methane	32736.9	32736.9	0.000180963	3.54075E-06	0.000184504
CO2	65.0801	65.0801	6.14706E-07	1.29306E-07	7.44012E-07
Ethane	7548.69	7548.68	0.000323037	1.24115E-06	0.000324278
Propane	2900.58	2900.58	0.000602268	6.95116E-07	0.000602963
Isobutane	263.551	263.549	0.000177504	2.76723E-08	0.000177532
n-Butane	683.317	683.312	0.000663315	1.69072E-07	0.000663484
Isopentane	94.5262	94.5239	0.000286086	1.77877E-08	0.000286104
n-Pentane	125.872	125.868	0.000506142	2.32894E-08	0.000506165
n-Hexane	25.0508	25.0474	0.000431346	2.30936E-09	0.000431349
Methylcyclopentane	2.12952	2.12929	2.95623E-05	1.60426E-09	2.95639E-05
Benzene	0.353289	0.35326	3.60196E-06	1.20806E-08	3.61404E-06
Cyclohexane	2.95925	2.95886	4.88424E-05	3.39002E-09	4.88458E-05
n-Heptane	6.59505	6.59164	0.000424665	8.64149E-10	0.000424666
n-Octane	2.90096	2.89492	0.000753257	2.90523E-10	0.000753257
n-Nonane	0.439882	0.43592	0.000493945	1.81472E-10	0.000493945
n-Decane	0.100314	0.0967404	0.000445546	4.06089E-11	0.000445546
n-Undecane	0.0418041	0.0346276	0.000894736	3.72102E-11	0.000894736
Dodecane	0	0	0	0	0
Water	75.1025	75.0533	-1.1893E-07	0.00613683	0.00613671
Triethylene Glycol	0	0	0	0	0
Oxygen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Cyclopentane	0.24591	0.245901	1.13856E-06	2.60995E-10	1.13882E-06
Isohexane	0	0	0	0	0
3-Methylpentane	23.3816	23.3791	0.000316597	6.37814E-09	0.000316604
Neohexane	30.3382	30.3362	0.000241631	2.25815E-09	0.000241633
2,3-Dimethylbutane	3.3723	3.37201	3.64588E-05	5.98864E-10	3.64594E-05
Methylcyclohexane	2.68024	2.67917	0.00013305	1.65194E-09	0.000133052
Isooctane	0	0	0	0	0
Decane, 2-Methyl-	0	0	0	0	0
Toluene	0.419245	0.419076	2.09987E-05	1.51551E-08	2.10138E-05
m-Xylene	0.324994	0.324388	7.55218E-05	1.45696E-08	7.55364E-05
Ethylbenzene	0.115023	0.114847	2.19428E-05	4.76968E-09	2.19476E-05

Properties

Property	Units	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Temperature	°F	69.3477	69.3477	69.3477	69.3477	69.3477
Pressure	psig	215	215	215	215	215
Mole Fraction Vapor		0.999897	1	0	0	0
Mole Fraction Light Liquid		1.51617E-05	0	1	0	0.147137
Molecular Weight	lb/lbmol	22.6292	22.6288	79.564	18.0173	27.0731
Mass Density	lb/ft^3	0.977766	0.977647	40.9659	62.2654	50.8361
Molar Flow	lbmol/h	1937.47	1937.27	0.0293753	0.17027	0.199646
Mass Flow	lb/h	43843.4	43838	2.33722	3.06782	5.40503
Vapor Volumetric Flow	ft^3/h	44840.4	44840.2	0.0570527	0.04927	0.106323

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Process Streams Report
Stream: Pipeline
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 12:56 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015

Properties

Property	Units	Total	Vapor	Light Liquid	Heavy Liquid	Mixed Liquid
Liquid Volumetric Flow	gpm	5590.49	5590.47	0.00711307	0.00614275	0.0132558
Std Vapor Volumetric Flow	MMSCFD	17.6457	17.6439	0.000267539	0.00155076	0.0018183
Std Liquid Volumetric Flow	sgpm	245.777	245.764	0.00728158	0.00613817	0.0134197
Specific Gravity			0.78131	0.656831	0.998339	0.815086
API Gravity				82.2335	10.0498	41.3798
Enthalpy	Btu/h	-6.83315E+07	-6.83083E+07	-2321.57	-20935.5	-23257
Kinematic Viscosity	cSt		0.675564	0.441945	1.0064	0.703514
Net Ideal Gas Heating Value	Btu/ft^3	1227.5	1227.56	4060.19	0.471739	597.807
Net Liquid Heating Value	Btu/lb	20506.2	20507.8	19209	-1049.33	7710.68

Remarks

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Process Streams Report
Stream: Produced Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:19 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Connections

From: Water Tanks To: --

Composition

Mole Fraction	Total	Light Liquid			
Nitrogen	4.79172E-09	4.79172E-09			
Methane	6.49224E-06	6.49224E-06			
CO2	1.81217E-06	1.81217E-06			
Ethane	8.02153E-06	8.02153E-06			
Propane	6.44672E-06	6.44672E-06			
Isobutane	1.45921E-07	1.45921E-07			
n-Butane	2.0462E-06	2.0462E-06			
Isopentane	1.52767E-07	1.52767E-07			
n-Pentane	2.21825E-07	2.21825E-07			
n-Hexane	1.12634E-08	1.12634E-08			
Methylcyclopentane	3.15539E-08	3.15539E-08			
Benzene	5.92002E-07	5.92002E-07			
Cyclohexane	1.01856E-07	1.01856E-07			
n-Heptane	2.35246E-09	2.35246E-09			
n-Octane	8.56205E-10	8.56205E-10			
n-Nonane	1.32726E-09	1.32726E-09			
n-Decane	2.14886E-10	2.14886E-10			
n-Undecane	2.81336E-10	2.81336E-10			
Dodecane	0	0			
Water	0.999972	0.999972			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	7.20328E-09	7.20328E-09			
Isohexane	0	0			
3-Methylpentane	7.17691E-08	7.17691E-08			
Neohexane	7.68864E-09	7.68864E-09			
2,3-Dimethylbutane	3.97011E-09	3.97011E-09			
Methylcyclohexane	2.89906E-08	2.89906E-08			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	6.93508E-07	6.93508E-07			
m-Xylene	5.81811E-07	5.81811E-07			
Ethylbenzene	1.8472E-07	1.8472E-07			

Molar Flow	Total lbmol/h	Light Liquid lbmol/h			
Nitrogen	3.8622E-06	3.8622E-06			
Methane	0.00523285	0.00523285			
CO2	0.00146063	0.00146063			
Ethane	0.00646547	0.00646547			
Propane	0.00519616	0.00519616			
Isobutane	0.000117614	0.000117614			
n-Butane	0.00164927	0.00164927			
Isopentane	0.000123132	0.000123132			
n-Pentane	0.000178794	0.000178794			
n-Hexane	9.07844E-06	9.07844E-06			
Methylcyclopentane	2.5433E-05	2.5433E-05			
Benzene	0.000477163	0.000477163			
Cyclohexane	8.20973E-05	8.20973E-05			
n-Heptane	1.89612E-06	1.89612E-06			
n-Octane	6.90114E-07	6.90114E-07			
n-Nonane	1.06979E-06	1.06979E-06			
n-Decane	1.73201E-07	1.73201E-07			
n-Undecane	2.26761E-07	2.26761E-07			

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Process Streams Report
Stream: Produced Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:19 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Molar Flow	Total lbmol/h	Light Liquid lbmol/h			
Dodecane	0	0			
Water	805.993	805.993			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	5.80596E-06	5.80596E-06			
Isohexane	0	0			
3-Methylpentane	5.7847E-05	5.7847E-05			
Neohexane	6.19716E-06	6.19716E-06			
2,3-Dimethylbutane	3.19997E-06	3.19997E-06			
Methylcyclohexane	2.33668E-05	2.33668E-05			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	0.000558978	0.000558978			
m-Xylene	0.000468949	0.000468949			
Ethylbenzene	0.000148887	0.000148887			

Mass Fraction	Total	Light Liquid			
Nitrogen	7.45079E-09	7.45079E-09			
Methane	5.7811E-06	5.7811E-06			
CO2	4.42679E-06	4.42679E-06			
Ethane	1.33882E-05	1.33882E-05			
Propane	1.5779E-05	1.5779E-05			
Isobutane	4.70764E-07	4.70764E-07			
n-Butane	6.60137E-06	6.60137E-06			
Isopentane	6.11791E-07	6.11791E-07			
n-Pentane	8.88349E-07	8.88349E-07			
n-Hexane	5.38761E-08	5.38761E-08			
Methylcyclopentane	1.47401E-07	1.47401E-07			
Benzene	2.56676E-06	2.56676E-06			
Cyclohexane	4.7581E-07	4.7581E-07			
n-Heptane	1.30841E-08	1.30841E-08			
n-Octane	5.42872E-09	5.42872E-09			
n-Nonane	9.44879E-09	9.44879E-09			
n-Decane	1.69708E-09	1.69708E-09			
n-Undecane	2.44091E-09	2.44091E-09			
Dodecane	0	0			
Water	0.99994	0.99994			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	2.80412E-08	2.80412E-08			
Isohexane	0	0			
3-Methylpentane	3.43294E-07	3.43294E-07			
Neohexane	3.67771E-08	3.67771E-08			
2,3-Dimethylbutane	1.89903E-08	1.89903E-08			
Methylcyclohexane	1.57998E-07	1.57998E-07			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	3.54681E-06	3.54681E-06			
m-Xylene	3.42853E-06	3.42853E-06			
Ethylbenzene	1.08853E-06	1.08853E-06			

Mass Flow	Total lb/h	Light Liquid lb/h			
Nitrogen	0.000108193	0.000108193			
Methane	0.0839477	0.0839477			

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Process Streams Report
Stream: Produced Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:19 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Mass Flow	Total lb/h	Light Liquid lb/h			
CO2	0.0642818	0.0642818			
Ethane	0.194411	0.194411			
Propane	0.229128	0.229128			
Isobutane	0.006836	0.006836			
n-Butane	0.0958589	0.0958589			
Isopentane	0.00888385	0.00888385			
n-Pentane	0.0128998	0.0128998			
n-Hexane	0.000782337	0.000782337			
Methylcyclopentane	0.00214042	0.00214042			
Benzene	0.037272	0.037272			
Cyclohexane	0.00690927	0.00690927			
n-Heptane	0.000189995	0.000189995			
n-Octane	7.88307E-05	7.88307E-05			
n-Nonane	0.000137206	0.000137206			
n-Decane	2.46433E-05	2.46433E-05			
n-Undecane	3.54446E-05	3.54446E-05			
Dodecane	0	0			
Water	14520.2	14520.2			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	0.000407189	0.000407189			
Isohexane	0	0			
3-Methylpentane	0.00498499	0.00498499			
Neohexane	0.000534042	0.000534042			
2,3-Dimethylbutane	0.000275759	0.000275759			
Methylcyclohexane	0.0022943	0.0022943			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	0.0515034	0.0515034			
m-Xylene	0.0497859	0.0497859			
Ethylbenzene	0.0158066	0.0158066			

Std. Liquid Volumetric Fraction	Total	Light Liquid			
Nitrogen	9.23353E-09	9.23353E-09			
Methane	1.92781E-05	1.92781E-05			
CO2	5.4169E-06	5.4169E-06			
Ethane	3.75751E-05	3.75751E-05			
Propane	3.1109E-05	3.1109E-05			
Isobutane	8.36359E-07	8.36359E-07			
n-Butane	1.12991E-05	1.12991E-05			
Isopentane	9.7857E-07	9.7857E-07			
n-Pentane	1.40839E-06	1.40839E-06			
n-Hexane	8.11263E-08	8.11263E-08			
Methylcyclopentane	1.95603E-07	1.95603E-07			
Benzene	2.9015E-06	2.9015E-06			
Cyclohexane	6.07259E-07	6.07259E-07			
n-Heptane	1.90101E-08	1.90101E-08			
n-Octane	7.68287E-09	7.68287E-09			
n-Nonane	1.30817E-08	1.30817E-08			
n-Decane	2.3101E-09	2.3101E-09			
n-Undecane	3.28106E-09	3.28106E-09			
Dodecane	0	0			
Water	0.999878	0.999878			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	3.73938E-08	3.73938E-08			

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Process Streams Report
Stream: Produced Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:19 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Std. Liquid Volumetric Fraction	Total	Light Liquid			
Isohexane	0	0			
3-Methylpentane	5.13102E-07	5.13102E-07			
Neohexane	5.62464E-08	5.62464E-08			
2,3-Dimethylbutane	2.8511E-08	2.8511E-08			
Methylcyclohexane	2.04135E-07	2.04135E-07			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	4.06799E-06	4.06799E-06			
m-Xylene	3.94597E-06	3.94597E-06			
Ethylbenzene	1.24869E-06	1.24869E-06			

Volumetric Flow	Total gpm	Light Liquid gpm			
Nitrogen	2.92812E-07	2.92812E-07			
Methane	0.000415098	0.000415098			
CO2	0.000101614	0.000101614			
Ethane	0.000655882	0.000655882			
Propane	0.000660647	0.000660647			
Isobutane	1.80143E-05	1.80143E-05			
n-Butane	0.000249397	0.000249397			
Isopentane	2.15113E-05	2.15113E-05			
n-Pentane	3.12938E-05	3.12938E-05			
n-Hexane	1.80341E-06	1.80341E-06			
Methylcyclopentane	4.4728E-06	4.4728E-06			
Benzene	6.99244E-05	6.99244E-05			
Cyclohexane	1.40438E-05	1.40438E-05			
n-Heptane	4.23641E-07	4.23641E-07			
n-Octane	1.7021E-07	1.7021E-07			
n-Nonane	2.89216E-07	2.89216E-07			
n-Decane	5.11199E-08	5.11199E-08			
n-Undecane	7.25204E-08	7.25204E-08			
Dodecane	0	0			
Water	29.1406	29.1406			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	8.73002E-07	8.73002E-07			
Isohexane	0	0			
3-Methylpentane	1.13896E-05	1.13896E-05			
Neohexane	1.22758E-06	1.22758E-06			
2,3-Dimethylbutane	6.283E-07	6.283E-07			
Methylcyclohexane	4.61323E-06	4.61323E-06			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	9.56302E-05	9.56302E-05			
m-Xylene	9.16838E-05	9.16838E-05			
Ethylbenzene	2.89536E-05	2.89536E-05			

Properties

Property	Units	Total	Light Liquid			
Temperature	°F	85	85			
Pressure	psig	0.5	0.5			
Mole Fraction Vapor		0	0			
Mole Fraction Light Liquid		1	1			
Molecular Weight	lb/lbmol	18.0159	18.0159			
Mass Density	lb/ft^3	62.1218	62.1218			
Molar Flow	lbmol/h	806.015	806.015			
Mass Flow	lb/h	14521.1	14521.1			
Vapor Volumetric Flow	ft^3/h	233.751	233.751			

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Process Streams Report
Stream: Produced Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:19 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Properties

Property	Units	Total	Light Liquid			
Liquid Volumetric Flow	gpm	29.143	29.143			
Std Vapor Volumetric Flow	MMSCFD	7.34089	7.34089			
Std Liquid Volumetric Flow	sgpm	29.0304	29.0304			
Specific Gravity		0.996036	0.996036			
API Gravity		10.0152	10.0152			
Enthalpy	Btu/h	-9.89151E+07	-9.89151E+07			
Kinematic Viscosity	cSt	0.833349	0.833349			
Net Ideal Gas Heating Value	Btu/ft^3	0.0518629	0.0518629			
Net Liquid Heating Value	Btu/lb	-1058.61	-1058.61			

Remarks

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Process Streams Report
Stream: Reservoir Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:58 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:58 AM, 4/7/2015

Connections

From: --	To: MIX-102

Composition

Mole Fraction	Total	Light Liquid			
Nitrogen	0 *	0			
Methane	0 *	0			
CO2	0 *	0			
Ethane	0 *	0			
Propane	0 *	0			
Isobutane	0 *	0			
n-Butane	0 *	0			
Isopentane	0 *	0			
n-Pentane	0 *	0			
n-Hexane	0 *	0			
Methylcyclopentane	0 *	0			
Benzene	0 *	0			
Cyclohexane	0 *	0			
n-Heptane	0 *	0			
n-Octane	0 *	0			
n-Nonane	0 *	0			
n-Decane	0 *	0			
n-Undecane	0 *	0			
Dodecane	0 *	0			
Water	1 *	1			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			
Isohexane	0 *	0			
3-Methylpentane	0 *	0			
Neohexane	0 *	0			
2,3-Dimethylbutane	0 *	0			
Methylcyclohexane	0 *	0			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0 *	0			
m-Xylene	0 *	0			
Ethylbenzene	0 *	0			

Molar Flow	Total lbmol/h	Light Liquid lbmol/h			
Nitrogen	0 *	0			
Methane	0 *	0			
CO2	0 *	0			
Ethane	0 *	0			
Propane	0 *	0			
Isobutane	0 *	0			
n-Butane	0 *	0			
Isopentane	0 *	0			
n-Pentane	0 *	0			
n-Hexane	0 *	0			
Methylcyclopentane	0 *	0			
Benzene	0 *	0			
Cyclohexane	0 *	0			
n-Heptane	0 *	0			
n-Octane	0 *	0			
n-Nonane	0 *	0			
n-Decane	0 *	0			
n-Undecane	0 *	0			

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Process Streams Report
Stream: Reservoir Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:58 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:58 AM, 4/7/2015

Molar Flow	Total lbmol/h	Light Liquid lbmol/h			
Dodecane	0 *	0			
Water	809.874 *	809.874			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			
Isohexane	0 *	0			
3-Methylpentane	0 *	0			
Neohexane	0 *	0			
2,3-Dimethylbutane	0 *	0			
Methylcyclohexane	0 *	0			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0 *	0			
m-Xylene	0 *	0			
Ethylbenzene	0 *	0			

Mass Fraction	Total	Light Liquid			
Nitrogen	0 *	0			
Methane	0 *	0			
CO2	0 *	0			
Ethane	0 *	0			
Propane	0 *	0			
Isobutane	0 *	0			
n-Butane	0 *	0			
Isopentane	0 *	0			
n-Pentane	0 *	0			
n-Hexane	0 *	0			
Methylcyclopentane	0 *	0			
Benzene	0 *	0			
Cyclohexane	0 *	0			
n-Heptane	0 *	0			
n-Octane	0 *	0			
n-Nonane	0 *	0			
n-Decane	0 *	0			
n-Undecane	0 *	0			
Dodecane	0 *	0			
Water	1 *	1			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			
Isohexane	0 *	0			
3-Methylpentane	0 *	0			
Neohexane	0 *	0			
2,3-Dimethylbutane	0 *	0			
Methylcyclohexane	0 *	0			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0 *	0			
m-Xylene	0 *	0			
Ethylbenzene	0 *	0			

Mass Flow	Total lb/h	Light Liquid lb/h			
Nitrogen	0 *	0			
Methane	0 *	0			

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Process Streams Report
Stream: Reservoir Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:58 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:58 AM, 4/7/2015

Mass Flow	Total lb/h	Light Liquid lb/h
CO2	0 *	0
Ethane	0 *	0
Propane	0 *	0
Isobutane	0 *	0
n-Butane	0 *	0
Isopentane	0 *	0
n-Pentane	0 *	0
n-Hexane	0 *	0
Methylcyclopentane	0 *	0
Benzene	0 *	0
Cyclohexane	0 *	0
n-Heptane	0 *	0
n-Octane	0 *	0
n-Nonane	0 *	0
n-Decane	0 *	0
n-Undecane	0 *	0
Dodecane	0 *	0
Water	14590.1 *	14590.1
Triethylene Glycol	0 *	0
Oxygen	0 *	0
Argon	0 *	0
Carbon Monoxide	0 *	0
Cyclopentane	0 *	0
Isohexane	0 *	0
3-Methylpentane	0 *	0
Neohexane	0 *	0
2,3-Dimethylbutane	0 *	0
Methylcyclohexane	0 *	0
Isooctane	0 *	0
Decane, 2-Methyl-	0 *	0
Toluene	0 *	0
m-Xylene	0 *	0
Ethylbenzene	0 *	0

Std. Liquid Volumetric Fraction	Total	Light Liquid
Nitrogen	0 *	0
Methane	0 *	0
CO2	0 *	0
Ethane	0 *	0
Propane	0 *	0
Isobutane	0 *	0
n-Butane	0 *	0
Isopentane	0 *	0
n-Pentane	0 *	0
n-Hexane	0 *	0
Methylcyclopentane	0 *	0
Benzene	0 *	0
Cyclohexane	0 *	0
n-Heptane	0 *	0
n-Octane	0 *	0
n-Nonane	0 *	0
n-Decane	0 *	0
n-Undecane	0 *	0
Dodecane	0 *	0
Water	1 *	1
Triethylene Glycol	0 *	0
Oxygen	0 *	0
Argon	0 *	0
Carbon Monoxide	0 *	0
Cyclopentane	0 *	0

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? Extrapolated or Approximate Values

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Process Streams Report
Stream: Reservoir Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:58 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:58 AM, 4/7/2015

Std. Liquid Volumetric Fraction	Total	Light Liquid			
Isohexane	0 *	0			
3-Methylpentane	0 *	0			
Neohexane	0 *	0			
2,3-Dimethylbutane	0 *	0			
Methylcyclohexane	0 *	0			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0 *	0			
m-Xylene	0 *	0			
Ethylbenzene	0 *	0			

Volumetric Flow	Total gpm	Light Liquid gpm			
Nitrogen	0	0			
Methane	0	0			
CO2	0	0			
Ethane	0	0			
Propane	0	0			
Isobutane	0	0			
n-Butane	0	0			
Isopentane	0	0			
n-Pentane	0	0			
n-Hexane	0	0			
Methylcyclopentane	0	0			
Benzene	0	0			
Cyclohexane	0	0			
n-Heptane	0	0			
n-Octane	0	0			
n-Nonane	0	0			
n-Decane	0	0			
n-Undecane	0	0			
Dodecane	0	0			
Water	29.6033	29.6033			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	0	0			
Isohexane	0	0			
3-Methylpentane	0	0			
Neohexane	0	0			
2,3-Dimethylbutane	0	0			
Methylcyclohexane	0	0			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	0	0			
m-Xylene	0	0			
Ethylbenzene	0	0			

Properties

Property	Units	Total	Light Liquid			
Temperature	°F	150 *	150			
Pressure	psig	4230 *	4230			
Mole Fraction Vapor		0	0			
Mole Fraction Light Liquid		1	1			
Molecular Weight	lb/lbmol	18.0153	18.0153			
Mass Density	lb/ft^3	61.4467	61.4467			
Molar Flow	lbmol/h	809.874	809.874			
Mass Flow	lb/h	14590.1	14590.1			
Vapor Volumetric Flow	ft^3/h	237.443	237.443			

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Process Streams Report
Stream: Reservoir Water
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 10:58 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 10:58 AM, 4/7/2015	

Properties

Property	Units	Total	Light Liquid			
Liquid Volumetric Flow	gpm	29.6033	29.6033			
Std Vapor Volumetric Flow	MMSCFD	7.37603	7.37603			
Std Liquid Volumetric Flow	sgpm	29.1667 *	29.1667			
Specific Gravity		0.985212	0.985212			
API Gravity		9.5073	9.5073			
Enthalpy	Btu/h	-9.82871E+07	-9.82871E+07			
Kinematic Viscosity	cSt	0.467278	0.467278			
Net Ideal Gas Heating Value	Btu/ft^3	0	0			
Net Liquid Heating Value	Btu/lb	-1059.76	-1059.76			

Remarks

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Process Streams Report
Stream: Sales Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:25 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Connections

From:	To:
GPU	MIX-101

Composition

Mole Fraction	Total	Vapor			
Nitrogen	0.00509241	0.00509241			
Methane	0.710836	0.710836			
CO2	0.001453	0.001453			
Ethane	0.175966	0.175966			
Propane	0.069141	0.069141			
Isobutane	0.00668619	0.00668619			
n-Butane	0.0182349	0.0182349			
Isopentane	0.0029561	0.0029561			
n-Pentane	0.00406755	0.00406755			
n-Hexane	0.000964448	0.000964448			
Methylcyclopentane	7.74725E-05	7.74725E-05			
Benzene	1.22742E-05	1.22742E-05			
Cyclohexane	0.000108588	0.000108588			
n-Heptane	0.000298454	0.000298454			
n-Octane	0.000156453	0.000156453			
n-Nonane	3.06158E-05	3.06158E-05			
n-Decane	9.48879E-06	9.48879E-06			
n-Undecane	6.20429E-06	6.20429E-06			
Dodecane	0	0			
Water	0.00167796	0.00167796			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	8.01408E-06	8.01408E-06			
Isohexane	0	0			
3-Methylpentane	0.000872727	0.000872727			
Neohexane	0.00107079	0.00107079			
2,3-Dimethylbutane	0.000122982	0.000122982			
Methylcyclohexane	0.00011199	0.00011199			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	1.70511E-05	1.70511E-05			
m-Xylene	1.55387E-05	1.55387E-05			
Ethylbenzene	5.36858E-06	5.36858E-06			

Molar Flow	Total lbmol/h	Vapor lbmol/h			
Nitrogen	9.60642	9.60642			
Methane	1340.94	1340.94			
CO2	2.74096	2.74096			
Ethane	331.946	331.946			
Propane	130.429	130.429			
Isobutane	12.613	12.613			
n-Butane	34.3986	34.3986			
Isopentane	5.57644	5.57644			
n-Pentane	7.6731	7.6731			
n-Hexane	1.81935	1.81935			
Methylcyclopentane	0.146146	0.146146			
Benzene	0.0231543	0.0231543			
Cyclohexane	0.204843	0.204843			
n-Heptane	0.56301	0.56301			
n-Octane	0.295136	0.295136			
n-Nonane	0.0577543	0.0577543			
n-Decane	0.0178999	0.0178999			
n-Undecane	0.0117039	0.0117039			

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Process Streams Report
Stream: Sales Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:25 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Molar Flow	Total lbmol/h	Vapor lbmol/h
Dodecane	0	0
Water	3.16534	3.16534
Triethylene Glycol	0	0
Oxygen	0	0
Argon	0	0
Carbon Monoxide	0	0
Cyclopentane	0.0151179	0.0151179
Isohexane	0	0
3-Methylpentane	1.64633	1.64633
Neohexane	2.01997	2.01997
2,3-Dimethylbutane	0.231996	0.231996
Methylcyclohexane	0.21126	0.21126
Isooctane	0	0
Decane, 2-Methyl-	0	0
Toluene	0.0321656	0.0321656
m-Xylene	0.0293125	0.0293125
Ethylbenzene	0.0101274	0.0101274

Mass Fraction	Total	Vapor
Nitrogen	0.00640207	0.00640207
Methane	0.511767	0.511767
CO2	0.00286974	0.00286974
Ethane	0.237454	0.237454
Propane	0.136824	0.136824
Isobutane	0.0174402	0.0174402
n-Butane	0.0475638	0.0475638
Isopentane	0.00957147	0.00957147
n-Pentane	0.0131702	0.0131702
n-Hexane	0.00372987	0.00372987
Methylcyclopentane	0.000292605	0.000292605
Benzene	4.30271E-05	4.30271E-05
Cyclohexane	0.000410127	0.000410127
n-Heptane	0.0013421	0.0013421
n-Octane	0.00080203	0.00080203
n-Nonane	0.000176219	0.000176219
n-Decane	6.05887E-05	6.05887E-05
n-Undecane	4.35217E-05	4.35217E-05
Dodecane	0	0
Water	0.00135661	0.00135661
Triethylene Glycol	0	0
Oxygen	0	0
Argon	0	0
Carbon Monoxide	0	0
Cyclopentane	2.52236E-05	2.52236E-05
Isohexane	0	0
3-Methylpentane	0.00337515	0.00337515
Neohexane	0.00414115	0.00414115
2,3-Dimethylbutane	0.000475615	0.000475615
Methylcyclohexane	0.000493469	0.000493469
Isooctane	0	0
Decane, 2-Methyl-	0	0
Toluene	7.0506E-05	7.0506E-05
m-Xylene	7.40333E-05	7.40333E-05
Ethylbenzene	2.55784E-05	2.55784E-05

Mass Flow	Total lb/h	Vapor lb/h
Nitrogen	269.109	269.109
Methane	21511.9	21511.9

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Process Streams Report
Stream: Sales Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:25 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Mass Flow	Total lb/h	Vapor lb/h			
CO2	120.628	120.628			
Ethane	9981.3	9981.3			
Propane	5751.34	5751.34			
Isobutane	733.093	733.093			
n-Butane	1999.32	1999.32			
Isopentane	402.333	402.333			
n-Pentane	553.605	553.605			
n-Hexane	156.784	156.784			
Methylcyclopentane	12.2996	12.2996			
Benzene	1.80863	1.80863			
Cyclohexane	17.2395	17.2395			
n-Heptane	56.4147	56.4147			
n-Octane	33.713	33.713			
n-Nonane	7.40728	7.40728			
n-Decane	2.54682	2.54682			
n-Undecane	1.82942	1.82942			
Dodecane	0	0			
Water	57.0245	57.0245			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	1.06026	1.06026			
Isohexane	0	0			
3-Methylpentane	141.873	141.873			
Neohexane	174.072	174.072			
2,3-Dimethylbutane	19.9923	19.9923			
Methylcyclohexane	20.7428	20.7428			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	2.96369	2.96369			
m-Xylene	3.11196	3.11196			
Ethylbenzene	1.07518	1.07518			

Std. Liquid Volumetric Fraction	Total	Vapor			
Nitrogen	0.00280631	0.00280631			
Methane	0.603636	0.603636			
CO2	0.00124209	0.00124209			
Ethane	0.235726	0.235726			
Propane	0.0954155	0.0954155			
Isobutane	0.0109595	0.0109595			
n-Butane	0.0287963	0.0287963			
Isopentane	0.00541524	0.00541524			
n-Pentane	0.00738554	0.00738554			
n-Hexane	0.00198659	0.00198659			
Methylcyclopentane	0.000137343	0.000137343			
Benzene	1.7204E-05	1.7204E-05			
Cyclohexane	0.000185143	0.000185143			
n-Heptane	0.000689723	0.000689723			
n-Octane	0.000401482	0.000401482			
n-Nonane	8.62959E-05	8.62959E-05			
n-Decane	2.91723E-05	2.91723E-05			
n-Undecane	2.06927E-05	2.06927E-05			
Dodecane	0	0			
Water	0.000479819	0.000479819			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	1.18976E-05	1.18976E-05			

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Process Streams Report
Stream: Sales Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:25 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Std. Liquid Volumetric Fraction	Total	Vapor
Isohexane	0	0
3-Methylpentane	0.00178435	0.00178435
Neohexane	0.0022402	0.0022402
2,3-Dimethylbutane	0.000252573	0.000252573
Methylcyclohexane	0.000225515	0.000225515
Isooctane	0	0
Decane, 2-Methyl-	0	0
Toluene	2.86034E-05	2.86034E-05
m-Xylene	3.01385E-05	3.01385E-05
Ethylbenzene	1.03785E-05	1.03785E-05

Volumetric Flow	Total ft^3/h	Vapor ft^3/h
Nitrogen	244.477	244.477
Methane	32472	32472
CO2	63.6067	63.6067
Ethane	7231.55	7231.55
Propane	2587.11	2587.11
Isobutane	231.704	231.704
n-Butane	612.823	612.823
Isopentane	90.5302	90.5302
n-Pentane	122.338	122.338
n-Hexane	25.3788	25.3788
Methylcyclopentane	2.1498	2.1498
Benzene	0.355242	0.355242
Cyclohexane	2.9925	2.9925
n-Heptane	6.76886	6.76886
n-Octane	3.02184	3.02184
n-Nonane	0.470719	0.470719
n-Decane	0.111648	0.111648
n-Undecane	0.0485068	0.0485068
Dodecane	0	0
Water	74.8118	74.8118
Triethylene Glycol	0	0
Oxygen	0	0
Argon	0	0
Carbon Monoxide	0	0
Cyclopentane	0.242393	0.242393
Isohexane	0	0
3-Methylpentane	23.5968	23.5968
Neohexane	30.26	30.26
2,3-Dimethylbutane	3.38934	3.38934
Methylcyclohexane	2.74067	2.74067
Isooctane	0	0
Decane, 2-Methyl-	0	0
Toluene	0.428433	0.428433
m-Xylene	0.337182	0.337182
Ethylbenzene	0.119025	0.119025

Properties

Property	Units	Total	Vapor
Temperature	°F	70 *	70
Pressure	psig	215 *	215
Mole Fraction Vapor		1	1
Mole Fraction Light Liquid		0	0
Molecular Weight	lb/lbmol	22.2827	22.2827
Mass Density	lb/ft^3	0.958963	0.958963
Molar Flow	lbmol/h	1886.42	1886.42
Mass Flow	lb/h	42034.6	42034.6
Vapor Volumetric Flow	ft^3/h	43833.4	43833.4

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Process Streams Report
Stream: Sales Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:25 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 9:38 AM, 4/15/2015

Properties

Property	Units	Total	Vapor			
Liquid Volumetric Flow	gpm	5464.94	5464.94			
Std Vapor Volumetric Flow	MMSCFD	17.1808	17.1808			
Std Liquid Volumetric Flow	sgpm	237.582	237.582			
Specific Gravity		0.769362	0.769362			
API Gravity						
Enthalpy	Btu/h	-6.61807E+07	-6.61807E+07			
Kinematic Viscosity	cSt	0.691723	0.691723			
Net Ideal Gas Heating Value	Btu/ft^3	1210	1210			
Net Liquid Heating Value	Btu/lb	20531.1	20531.1			

Remarks

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? Extrapolated or Approximate Values

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Process Streams Report
Stream: Sales Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:23 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015

Connections

From:	To:
Oil Tanks	--

Composition

Mole Fraction	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	1.57798E-09	1.58278E-09	1.12992E-11	1.57798E-09
Methane	1.68976E-05	1.6949E-05	7.6867E-08	1.68976E-05
CO2	1.20041E-06	1.20396E-06	4.0184E-08	1.20041E-06
Ethane	0.00215892	0.00216552	1.90036E-06	0.00215892
Propane	0.0349731	0.0350801	8.86821E-06	0.0349731
Isobutane	0.0225237	0.0225927	8.33546E-07	0.0225237
n-Butane	0.108585	0.108917	6.63138E-06	0.108585
Isopentane	0.0524918	0.0526524	7.75746E-07	0.0524918
n-Pentane	0.0966998	0.0969957	1.0852E-06	0.0966998
n-Hexane	0.0767692	0.0770041	1.08764E-07	0.0767692
Methylcyclopentane	0.00615833	0.00617718	7.08212E-08	0.00615833
Benzene	0.000969428	0.000972393	6.33802E-07	0.000969428
Cyclohexane	0.0107002	0.0107329	1.66622E-07	0.0107002
n-Heptane	0.0683248	0.0685339	2.82466E-08	0.0683248
n-Octane	0.110946	0.111286	1.11242E-08	0.110946
n-Nonane	0.0673008	0.0675068	6.62312E-09	0.0673008
n-Decane	0.0586629	0.0588424	1.38169E-09	0.0586629
n-Undecane	0.125248	0.125631	1.30659E-09	0.125248
Dodecane	0	0	0	0
Water	0.00362548	0.000576633	0.999977	0.00362548
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	0.000275309	0.000276151	1.29451E-08	0.000275309
Isohexane	0	0	0	0
3-Methylpentane	0.0564215	0.0565942	2.91066E-07	0.0564215
Neohexane	0.0414851	0.0416121	9.72505E-08	0.0414851
2,3-Dimethylbutane	0.00644661	0.00646634	2.50928E-08	0.00644661
Methylcyclohexane	0.0248843	0.0249604	7.15537E-08	0.0248843
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	0.0048068	0.0048215	7.06691E-07	0.0048068
m-Xylene	0.0151249	0.0151712	5.89413E-07	0.0151249
Ethylbenzene	0.00439997	0.00441343	1.90049E-07	0.00439997

Molar Flow	Total lbmol/h	Light Liquid lbmol/h	Heavy Liquid lbmol/h	Mixed Liquid lbmol/h
Nitrogen	2.31986E-07	2.31981E-07	5.06761E-12	2.31986E-07
Methane	0.00248418	0.00248414	3.44742E-08	0.00248418
CO2	0.000176478	0.00017646	1.80222E-08	0.000176478
Ethane	0.317392	0.317391	8.52296E-07	0.317392
Propane	5.14153	5.14153	3.97732E-06	5.14153
Isobutane	3.31131	3.31131	3.73838E-07	3.31131
n-Butane	15.9635	15.9635	2.97412E-06	15.9635
Isopentane	7.71703	7.71703	3.47916E-07	7.71703
n-Pentane	14.2162	14.2162	4.86705E-07	14.2162
n-Hexane	11.2862	11.2862	4.87797E-08	11.2862
Methylcyclopentane	0.905361	0.905361	3.17627E-08	0.905361
Benzene	0.14252	0.142519	2.84255E-07	0.14252
Cyclohexane	1.57308	1.57308	7.47288E-08	1.57308
n-Heptane	10.0447	10.0447	1.26683E-08	10.0447
n-Octane	16.3106	16.3106	4.98912E-09	16.3106
n-Nonane	9.89417	9.89417	2.97041E-09	9.89417
n-Decane	8.62427	8.62427	6.19677E-10	8.62427
n-Undecane	18.4132	18.4132	5.85997E-10	18.4132

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Process Streams Report
Stream: Sales Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 3:23 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Molar Flow	Total lbmol/h	Light Liquid lbmol/h	Heavy Liquid lbmol/h	Mixed Liquid lbmol/h
Dodecane	0	0	0	0
Water	0.532996	0.0845146	0.448481	0.532996
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	0.0404743	0.0404743	5.80579E-09	0.0404743
Isohexane	0	0	0	0
3-Methylpentane	8.29476	8.29476	1.30541E-07	8.29476
Neohexane	6.0989	6.0989	4.36161E-08	6.0989
2,3-Dimethylbutane	0.947743	0.947743	1.12539E-08	0.947743
Methylcyclohexane	3.65834	3.65834	3.20912E-08	3.65834
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	0.706667	0.706666	3.16945E-07	0.706667
m-Xylene	2.22357	2.22357	2.64347E-07	2.22357
Ethylbenzene	0.646857	0.646857	8.52353E-08	0.646857

Mass Fraction	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	4.50088E-10	4.50331E-10	1.75692E-11	4.50088E-10
Methane	2.7601E-06	2.76161E-06	6.84461E-08	2.7601E-06
CO2	5.37907E-07	5.38153E-07	9.81608E-08	5.37907E-07
Ethane	0.000660977	0.000661345	3.17171E-06	0.000660977
Propane	0.0157021	0.0157109	2.17055E-05	0.0157021
Isobutane	0.0133295	0.0133369	2.68911E-06	0.0133295
n-Butane	0.0642602	0.0642962	2.13936E-05	0.0642602
Isopentane	0.0385612	0.0385828	3.10661E-06	0.0385612
n-Pentane	0.071037	0.0710768	4.34589E-06	0.071037
n-Hexane	0.0673597	0.0673974	5.20242E-07	0.0673597
Methylcyclopentane	0.00527711	0.00528006	3.30829E-07	0.00527711
Benzene	0.000771014	0.000771444	2.74795E-06	0.000771014
Cyclohexane	0.00916906	0.0091742	7.78349E-07	0.00916906
n-Heptane	0.0697083	0.0697473	1.57101E-07	0.0697083
n-Octane	0.129038	0.12911	7.05312E-08	0.129038
n-Nonane	0.0878871	0.0879363	4.71493E-08	0.0878871
n-Decane	0.084985	0.0850326	1.09118E-08	0.084985
n-Undecane	0.199334	0.199446	1.1336E-08	0.199334
Dodecane	0	0	0	0
Water	0.000665022	0.000105508	0.999928	0.000665022
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	0.000196595	0.000196705	5.03926E-08	0.000196595
Isohexane	0	0	0	0
3-Methylpentane	0.049506	0.0495337	1.39223E-06	0.049506
Neohexane	0.0364003	0.0364207	4.65171E-07	0.0364003
2,3-Dimethylbutane	0.00565646	0.00565962	1.20024E-07	0.00565646
Methylcyclohexane	0.0248774	0.0248913	3.8996E-07	0.0248774
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	0.00450948	0.004512	3.61416E-06	0.00450948
m-Xylene	0.0163495	0.0163586	3.47327E-06	0.0163495
Ethylbenzene	0.00475621	0.00475887	1.11991E-06	0.00475621

Mass Flow	Total lb/h	Light Liquid lb/h	Heavy Liquid lb/h	Mixed Liquid lb/h
Nitrogen	6.4987E-06	6.49856E-06	1.41961E-10	6.4987E-06
Methane	0.0398523	0.0398518	5.53051E-07	0.0398523

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Process Streams Report
Stream: Sales Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 3:23 PM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015	

Mass Flow	Total lb/h	Light Liquid lb/h	Heavy Liquid lb/h	Mixed Liquid lb/h
CO2	0.00776669	0.0077659	7.93149E-07	0.00776669
Ethane	9.54367	9.54364	2.56277E-05	9.54367
Propane	226.719	226.719	0.000175382	226.719
Isobutane	192.461	192.46	2.17283E-05	192.461
n-Butane	927.836	927.835	0.000172862	927.836
Isopentane	556.774	556.774	2.51017E-05	556.774
n-Pentane	1025.68	1025.68	3.51152E-05	1025.68
n-Hexane	972.589	972.589	4.20361E-06	972.589
Methylcyclopentane	76.1947	76.1947	2.67313E-06	76.1947
Benzene	11.1325	11.1324	2.22037E-05	11.1325
Cyclohexane	132.39	132.39	6.28914E-06	132.39
n-Heptane	1006.5	1006.5	1.26939E-06	1006.5
n-Octane	1863.14	1863.14	5.69899E-07	1863.14
n-Nonane	1268.98	1268.98	3.80971E-07	1268.98
n-Decane	1227.08	1227.08	8.81686E-08	1227.08
n-Undecane	2878.13	2878.13	9.15962E-08	2878.13
Dodecane	0	0	0	0
Water	9.60207	1.52255	8.07952	9.60207
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	2.83858	2.83858	4.07177E-07	2.83858
Isohexane	0	0	0	0
3-Methylpentane	714.804	714.804	1.12494E-05	714.804
Neohexane	525.575	525.575	3.75863E-06	525.575
2,3-Dimethylbutane	81.6721	81.6721	9.6981E-07	81.6721
Methylcyclohexane	359.198	359.198	3.15091E-06	359.198
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	65.1112	65.1111	2.92028E-05	65.1112
m-Xylene	236.066	236.066	2.80644E-05	236.066
Ethylbenzene	68.6736	68.6736	9.049E-06	68.6736

Std. Liquid Volumetric Fraction	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Nitrogen	3.84232E-10	3.84372E-10	2.17732E-11	3.84232E-10
Methane	6.34028E-06	6.34264E-06	2.28248E-07	6.34028E-06
CO2	4.53418E-07	4.53547E-07	1.20117E-07	4.53418E-07
Ethane	0.00127789	0.00127838	8.90176E-06	0.00127789
Propane	0.0213254	0.0213336	4.27938E-05	0.0213254
Isobutane	0.0163129	0.0163192	4.77752E-06	0.0163129
n-Butane	0.0757676	0.0757968	3.66183E-05	0.0757676
Isopentane	0.0424883	0.0425047	4.96912E-06	0.0424883
n-Pentane	0.0775809	0.0776108	6.89005E-06	0.0775809
n-Hexane	0.0698709	0.0698979	7.83385E-07	0.0698709
Methylcyclopentane	0.00482393	0.00482579	4.39019E-07	0.00482393
Benzene	0.000600385	0.000600616	3.10635E-06	0.000600385
Cyclohexane	0.00806113	0.00806424	9.93389E-07	0.00806113
n-Heptane	0.0697679	0.0697948	2.28257E-07	0.0697679
n-Octane	0.125798	0.125846	9.98187E-08	0.125798
n-Nonane	0.0838193	0.0838516	6.52781E-08	0.0838193
n-Decane	0.0796898	0.0797205	1.48536E-08	0.0796898
n-Undecane	0.184575	0.184646	1.52379E-08	0.184575
Dodecane	0	0	0	0
Water	0.000458078	7.26632E-05	0.999876	0.000458078
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	0.000180595	0.000180664	6.72006E-08	0.000180595

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Process Streams Report
Stream: Sales Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:23 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015

Std. Liquid Volumetric Fraction	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Isohexane	0	0	0	0
3-Methylpentane	0.0509714	0.0509911	2.08091E-06	0.0509714
Neohexane	0.0383489	0.0383637	7.11433E-07	0.0383489
2,3-Dimethylbutane	0.00585001	0.00585226	1.802E-07	0.00585001
Methylcyclohexane	0.0221412	0.0221497	5.03836E-07	0.0221412
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	0.00356287	0.00356424	4.14529E-06	0.00356287
m-Xylene	0.0129622	0.0129672	3.9975E-06	0.0129622
Ethylbenzene	0.00375842	0.00375987	1.2847E-06	0.00375842

Volumetric Flow	Total gpm	Light Liquid gpm	Heavy Liquid gpm	Mixed Liquid gpm
Nitrogen	2.23514E-08	2.2351E-08	3.842E-13	2.23514E-08
Methane	0.000245413	0.000245411	2.73468E-09	0.000245413
CO2	1.01867E-05	1.01854E-05	1.25377E-09	1.01867E-05
Ethane	0.0403051	0.040305	8.64601E-08	0.0403051
Propane	0.849888	0.849887	5.05683E-07	0.849888
Isobutane	0.679735	0.679735	5.72588E-08	0.679735
n-Butane	3.17838	3.17838	4.49737E-07	3.17838
Isopentane	1.80237	1.80237	6.07811E-08	1.80237
n-Pentane	3.29341	3.29341	8.51867E-08	3.29341
n-Hexane	2.97472	2.97472	9.68995E-09	2.97472
Methylcyclopentane	0.205194	0.205194	5.58599E-09	0.205194
Benzene	0.0250318	0.0250318	4.16554E-08	0.0250318
Cyclohexane	0.341939	0.341939	1.27833E-08	0.341939
n-Heptane	2.97998	2.97998	2.83043E-09	2.97998
n-Octane	5.33218	5.33218	1.23051E-09	5.33218
n-Nonane	3.53823	3.53823	8.03045E-10	3.53823
n-Decane	3.36307	3.36307	1.82896E-10	3.36307
n-Undecane	7.75892	7.75892	1.87407E-10	7.75892
Dodecane	0	0	0	0
Water	0.0141879	-0.00202691	0.0162148	0.0141879
Triethylene Glycol	0	0	0	0
Oxygen	0	0	0	0
Argon	0	0	0	0
Carbon Monoxide	0	0	0	0
Cyclopentane	0.00762033	0.00762033	8.72977E-10	0.00762033
Isohexane	0	0	0	0
3-Methylpentane	2.17775	2.17775	2.57023E-08	2.17775
Neohexane	1.63962	1.63962	8.63983E-09	1.63962
2,3-Dimethylbutane	0.249903	0.249903	2.20965E-09	0.249903
Methylcyclohexane	0.939639	0.939639	6.33566E-09	0.939639
Isooctane	0	0	0	0
Decane, 2-Methyl-	0	0	0	0
Toluene	0.148524	0.148524	5.42231E-08	0.148524
m-Xylene	0.540885	0.540885	5.16823E-08	0.540885
Ethylbenzene	0.15706	0.15706	1.65754E-08	0.15706

Properties

Property	Units	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Temperature	°F	85 *	85	85	85
Pressure	psig	0.5	0.5	0.5	0.5
Mole Fraction Vapor		0	0	0	0
Mole Fraction Light Liquid		0.996949	1	0	0.996949
Molecular Weight	lb/lbmol	98.2133	98.4587	18.0162	98.2133
Mass Density	lb/ft^3	42.6185	42.611	62.1221	42.6185
Molar Flow	lbmol/h	147.014	146.566	0.448492	147.014
Mass Flow	lb/h	14438.7	14430.7	8.0801	14438.7
Vapor Volumetric Flow	ft^3/h	338.79	338.66	0.130068	338.79

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Process Streams Report
Stream: Sales Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 3:23 PM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 11:55 AM, 4/16/2015

Properties

Property	Units	Total	Light Liquid	Heavy Liquid	Mixed Liquid
Liquid Volumetric Flow	gpm	42.2388	42.2226	0.0162163	42.2388
Std Vapor Volumetric Flow	MMSCFD	1.33895	1.33486	0.0040847	1.33895
Std Liquid Volumetric Flow	sgpm	41.9038	41.8877	0.0161535	41.9038
Specific Gravity		0.683328	0.683208	0.996041	0.683328
API Gravity		71.882	71.9161	10.0145	71.882
Enthalpy	Btu/h	-1.35828E+07	-1.35278E+07	-55039.6	-1.35828E+07
Kinematic Viscosity	cSt	0.565849	0.565747	0.833387	0.565849
Net Ideal Gas Heating Value	Btu/ft^3	4979.43	4994.67	0.0661532	4979.43
Net Liquid Heating Value	Btu/lb	19081.4	19092.6	-1058.3	19081.4

Remarks

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Process Streams Report
Stream: Test Separator Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:56 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:56 AM, 4/7/2015

Connections

From: -- To: MIX-102

Composition

Mole Fraction	Total	Vapor	Light Liquid
Nitrogen	0.00513133 *	0.00513243	0.000255793
Methane	0.714456 *	0.714594	0.100947
CO2	0.00149039 *	0.00149061	0.000485624
Ethane	0.174955 *	0.174968	0.117211
Propane	0.0680377 *	0.0680215	0.140222
Isobutane	0.00668174 *	0.00667637	0.0305585
n-Butane	0.0182848 *	0.0182626	0.116612
Isopentane	0.00316082 *	0.00315145	0.0448197
n-Pentane	0.00440114 *	0.00438424	0.079528
n-Hexane	0.00107028 *	0.00105777	0.0566534
Methylcyclopentane	8.00208E-05 *	7.90815E-05	0.00425539
Benzene	1.00026E-05 *	9.88822E-06	0.000518452
Cyclohexane	0.000100026 *	9.86112E-05	0.0063889
n-Heptane	0.000250065 *	0.000242714	0.0329256
n-Octane	0.000220057 *	0.000202946	0.0762813
n-Nonane	6.00156E-05 *	4.84633E-05	0.0514124
n-Decane	2.00052E-05 *	1.25959E-05	0.0329557
n-Undecane	1.00026E-05 *	3.70724E-06	0.0279941
Dodecane	0 *	0	0
Water	0 *	0	0
Triethylene Glycol	0 *	0	0
Oxygen	0 *	0	0
Argon	0 *	0	0
Carbon Monoxide	0 *	0	0
Cyclopentane	3.00078E-05 *	2.98439E-05	0.00075854
Isohexane	0 *	0	0
3-Methylpentane	0.00103027 *	0.00102025	0.0455421
Neohexane	0.000290075 *	0.000288304	0.00816453
2,3-Dimethylbutane	9.00234E-05 *	8.92988E-05	0.00331112
Methylcyclohexane	0.000110029 *	0.000106803	0.0144478
Isooctane	0 *	0	0
Decane, 2-Methyl-	0 *	0	0
Toluene	2.00052E-05 *	1.92867E-05	0.00321395
m-Xylene	1.00026E-05 *	8.98412E-06	0.00453733
Ethylbenzene	0 *	0	0

Molar Flow	Total lbmol/h	Vapor lbmol/h	Light Liquid lbmol/h
Nitrogen	9.57798 *	9.57787	0.000107385
Methane	1333.58 *	1333.54	0.042379
CO2	2.78191 *	2.7817	0.000203871
Ethane	326.566 *	326.517	0.0492064
Propane	126.997 *	126.938	0.058867
Isobutane	12.4719 *	12.4591	0.0128288
n-Butane	34.1297 *	34.0808	0.048955
Isopentane	5.89989 *	5.88107	0.0188159
n-Pentane	8.21503 *	8.18164	0.0333868
n-Hexane	1.99775 *	1.97396	0.0237838
Methylcyclopentane	0.149364 *	0.147578	0.00178647
Benzene	0.0186705 *	0.0184529	0.000217653
Cyclohexane	0.186705 *	0.184023	0.00268214
n-Heptane	0.466763 *	0.452941	0.0138226
n-Octane	0.410752 *	0.378728	0.0320238
n-Nonane	0.112023 *	0.0904396	0.0215836
n-Decane	0.0373411 *	0.0235058	0.0138352
n-Undecane	0.0186705 *	0.00691826	0.0117523

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Process Streams Report
Stream: Test Separator Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 10:56 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 10:56 AM, 4/7/2015	

Molar Flow	Total lbmol/h	Vapor lbmol/h	Light Liquid lbmol/h		
Dodecane	0 *	0	0		
Water	0 *	0	0		
Triethylene Glycol	0 *	0	0		
Oxygen	0 *	0	0		
Argon	0 *	0	0		
Carbon Monoxide	0 *	0	0		
Cyclopentane	0.0560116 *	0.0556931	0.000318444		
Isohexane	0 *	0	0		
3-Methylpentane	1.92306 *	1.90395	0.0191192		
Neohexane	0.541445 *	0.538018	0.00342757		
2,3-Dimethylbutane	0.168035 *	0.166645	0.00139005		
Methylcyclohexane	0.205376 *	0.19931	0.00606537		
Isooctane	0 *	0	0		
Decane, 2-Methyl-	0 *	0	0		
Toluene	0.0373411 *	0.0359918	0.00134926		
m-Xylene	0.0186705 *	0.0167657	0.00190483		
Ethylbenzene	0 *	0	0		

Mass Fraction	Total	Vapor	Light Liquid		
Nitrogen	0.00646446 *	0.00646893	0.000103053		
Methane	0.515445 *	0.515791	0.02329		
CO2	0.00294972 *	0.00295158	0.000307362		
Ethane	0.236583 *	0.236714	0.0506862		
Propane	0.134921 *	0.134954	0.0889233		
Isobutane	0.0174649 *	0.0174593	0.0255434		
n-Butane	0.0477933 *	0.0477583	0.0974738		
Isopentane	0.0102557 *	0.0102302	0.0465052		
n-Pentane	0.0142801 *	0.014232	0.0825187		
n-Hexane	0.00414778 *	0.00410128	0.0702122		
Methylcyclopentane	0.00030286 *	0.000299448	0.00515046		
Benzene	3.51371E-05 *	3.47519E-05	0.000582411		
Cyclohexane	0.000378575 *	0.000373399	0.00773272		
n-Heptane	0.00112685 *	0.00109425	0.0474475		
n-Octane	0.00113044 *	0.00104304	0.125313		
n-Nonane	0.000346158 *	0.00027966	0.0948301		
n-Decane	0.000128005 *	8.06348E-05	0.0674347		
n-Undecane	7.03122E-05 *	2.60721E-05	0.0629292		
Dodecane	0 *	0	0		
Water	0 *	0	0		
Triethylene Glycol	0 *	0	0		
Oxygen	0 *	0	0		
Argon	0 *	0	0		
Carbon Monoxide	0 *	0	0		
Cyclopentane	9.46437E-05 *	9.41719E-05	0.000765075		
Isohexane	0 *	0	0		
3-Methylpentane	0.00399272 *	0.00395581	0.0564417		
Neohexane	0.00112416 *	0.00111783	0.0101185		
2,3-Dimethylbutane	0.000348879 *	0.000346236	0.00410357		
Methylcyclohexane	0.000485838 *	0.000471821	0.0204012		
Isooctane	0 *	0	0		
Decane, 2-Methyl-	0 *	0	0		
Toluene	8.28933E-05 *	7.99543E-05	0.00425876		
m-Xylene	4.77562E-05 *	4.29142E-05	0.00692764		
Ethylbenzene	0 *	0	0		

Mass Flow	Total lb/h	Vapor lb/h	Light Liquid lb/h		
Nitrogen	268.312 *	268.309	0.00300823		
Methane	21393.9 *	21393.2	0.679863		

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Process Streams Report
Stream: Test Separator Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 10:56 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 10:56 AM, 4/7/2015	

Mass Flow	Total lb/h	Vapor lb/h	Light Liquid lb/h		
CO2	122.43 *	122.421	0.00897226		
Ethane	9819.53 *	9818.05	1.47959		
Propane	5600.01 *	5597.41	2.59578		
Isobutane	724.895 *	724.149	0.745641		
n-Butane	1983.69 *	1980.85	2.84537		
Isopentane	425.67 *	424.312	1.35754		
n-Pentane	592.704 *	590.296	2.40882		
n-Hexane	172.157 *	170.107	2.04958		
Methylcyclopentane	12.5704 *	12.4201	0.150348		
Benzene	1.45839 *	1.44139	0.0170012		
Cyclohexane	15.713 *	15.4873	0.225727		
n-Heptane	46.7706 *	45.3855	1.38505		
n-Octane	46.9195 *	43.2615	3.65804		
n-Nonane	14.3675 *	11.5993	2.7682		
n-Decane	5.31295 *	3.34445	1.9685		
n-Undecane	2.91836 *	1.08138	1.83698		
Dodecane	0 *	0	0		
Water	0 *	0	0		
Triethylene Glycol	0 *	0	0		
Oxygen	0 *	0	0		
Argon	0 *	0	0		
Carbon Monoxide	0 *	0	0		
Cyclopentane	3.92825 *	3.90592	0.0223334		
Isohexane	0 *	0	0		
3-Methylpentane	165.721 *	164.073	1.6476		
Neohexane	46.6592 *	46.3639	0.295372		
2,3-Dimethylbutane	14.4805 *	14.3607	0.119788		
Methylcyclohexane	20.165 *	19.5695	0.595534		
Isooctane	0 *	0	0		
Decane, 2-Methyl-	0 *	0	0		
Toluene	3.44055 *	3.31623	0.124318		
m-Xylene	1.98216 *	1.77993	0.202226		
Ethylbenzene	0 *	0	0		

Std. Liquid Volumetric Fraction	Total	Vapor	Light Liquid		
Nitrogen	0.00282821 *	0.00282933	7.80408E-05		
Methane	0.606806 *	0.607034	0.0474593		
CO2	0.00127426 *	0.00127468	0.000229831		
Ethane	0.23441 *	0.23447	0.0869292		
Propane	0.093908 *	0.0939026	0.107132		
Isobutane	0.010954 *	0.0109471	0.0277309		
n-Butane	0.0288797 *	0.02885	0.101952		
Isopentane	0.0057912 *	0.00577507	0.0454557		
n-Pentane	0.00799254 *	0.00796329	0.0799447		
n-Hexane	0.00220494 *	0.00217957	0.0646065		
Methylcyclopentane	0.000141883 *	0.000140243	0.00417656		
Benzene	1.40222E-05 *	1.38644E-05	0.000402313		
Cyclohexane	0.000170572 *	0.00016819	0.00603074		
n-Heptane	0.000577989 *	0.000561101	0.0421261		
n-Octane	0.00056479 *	0.000520968	0.108373		
n-Nonane	0.000169191 *	0.000136649	0.0802292		
n-Decane	6.15137E-05 *	3.87381E-05	0.0560933		
n-Undecane	3.33662E-05 *	1.23687E-05	0.0516905		
Dodecane	0 *	0	0		
Water	0 *	0	0		
Triethylene Glycol	0 *	0	0		
Oxygen	0 *	0	0		
Argon	0 *	0	0		
Carbon Monoxide	0 *	0	0		
Cyclopentane	4.45562E-05 *	4.43209E-05	0.000623453		

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Process Streams Report
Stream: Test Separator Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:56 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:56 AM, 4/7/2015

Std. Liquid Volumetric Fraction	Total	Vapor	Light Liquid
Isohexane	0 *	0	0
3-Methylpentane	0.00210679 *	0.00208669	0.0515509
Neohexane	0.000606962 *	0.000603365	0.00945655
2,3-Dimethylbutane	0.000184914 *	0.000183459	0.00376479
Methylcyclohexane	0.000221601 *	0.000215144	0.0161071
Isooctane	0 *	0	0
Decane, 2-Methyl-	0 *	0	0
Toluene	3.35642E-05 *	3.23646E-05	0.00298486
m-Xylene	1.94039E-05 *	1.74314E-05	0.00487223
Ethylbenzene	0 *	0	0

Volumetric Flow	Total ft^3/h	Vapor ft^3/h	Light Liquid gpm
Nitrogen	145.481	145.481	1.31009E-05
Methane	18584.6	18584.6	0.00504907
CO2	35.9408	35.9406	1.59108E-05
Ethane	3756.03	3755.98	0.00691099
Propane	1214.17	1214.09	0.0102115
Isobutane	101.264	101.243	0.00268193
n-Butane	257.636	257.556	0.00989805
Isopentane	35.2939	35.2589	0.00437535
n-Pentane	46.768	46.7063	0.00769556
n-Hexane	7.43111	7.38171	0.0061598
Methylcyclopentane	0.658505	0.655344	0.000394104
Benzene	0.0930515	0.0927538	3.71133E-05
Cyclohexane	0.798672	0.794155	0.000563123
n-Heptane	0.865401	0.833366	0.00399398
n-Octane	0.117481	0.036175	0.0101369
n-Nonane	-0.1178	-0.177497	0.00744267
n-Decane	-0.0485117	-0.0901179	0.00518727
n-Undecane	-0.00259842	-0.0407315	0.00475426
Dodecane	0	0	0
Water	0	0	0
Triethylene Glycol	0	0	0
Oxygen	0	0	0
Argon	0	0	0
Carbon Monoxide	0	0	0
Cyclopentane	0.319514	0.31904	5.90637E-05
Isohexane	0	0	0
3-Methylpentane	7.8702	7.83069	0.00492701
Neohexane	2.57176	2.5645	0.000905278
2,3-Dimethylbutane	0.734809	0.731926	0.000359457
Methylcyclohexane	0.553845	0.541871	0.00149291
Isooctane	0	0	0
Decane, 2-Methyl-	0	0	0
Toluene	0.111369	0.109189	0.000271784
m-Xylene	0.0245282	0.0209889	0.000441254
Ethylbenzene	0	0	0

Properties

Property	Units	Total	Vapor	Light Liquid
Temperature	°F	83 *	83	83
Pressure	psig	390 *	390	390
Mole Fraction Vapor		0.999775	1	0
Mole Fraction Light Liquid		0.000224912	0	1
Molecular Weight	lb/lbmol	22.2364	22.2257	69.5338
Mass Density	lb/ft^3	1.71517	1.71402	38.7265
Molar Flow	lbmol/h	1866.57	1866.15	0.419812
Mass Flow	lb/h	41505.7	41476.5	29.1912
Vapor Volumetric Flow	ft^3/h	24199.2	24198.5	0.753778

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Process Streams Report
Stream: Test Separator Gas
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 10:56 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 10:56 AM, 4/7/2015

Properties

Property	Units	Total	Vapor	Light Liquid		
Liquid Volumetric Flow	gpm	3017.04	3016.95	0.0939775		
Std Vapor Volumetric Flow	MMSCFD	17 *	16.9962	0.0038235		
Std Liquid Volumetric Flow	sgpm	235.044	234.948	0.0955013		
Specific Gravity			0.767395	0.620925		
API Gravity				91.3767		
Enthalpy	Btu/h	-6.52631E+07	-6.52331E+07	-30033.8		
Kinematic Viscosity	cSt		0.407711	0.348456		
Net Ideal Gas Heating Value	Btu/ft^3	1209.23	1208.7	3566.87		
Net Liquid Heating Value	Btu/lb	20562.8	20563.6	19311.7		

Remarks

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Process Streams Report
Stream: Test Separator Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 11:12 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:12 AM, 4/7/2015	

Connections

From: --	To: MIX-102

Composition

Mole Fraction	Total	Light Liquid			
Nitrogen	0.00026 *	0.00026			
Methane	0.08861 *	0.08861			
CO2	0.00013 *	0.00013			
Ethane	0.09965 *	0.09965			
Propane	0.11788 *	0.11788			
Isobutane	0.0248 *	0.0248			
n-Butane	0.09597 *	0.09597			
Isopentane	0.03603 *	0.03603			
n-Pentane	0.06541 *	0.06541			
n-Hexane	0.05195 *	0.05195			
Methylcyclopentane	0.00422 *	0.00422			
Benzene	0.00069 *	0.00069			
Cyclohexane	0.00744 *	0.00744			
n-Heptane	0.04738 *	0.04738			
n-Octane	0.07566 *	0.07566			
n-Nonane	0.04597 *	0.04597			
n-Decane	0.0402 *	0.0402			
n-Undecane	0.08599 *	0.08599			
Dodecane	0 *	0			
Water	0 *	0			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			
Isohexane	0 *	0			
3-Methylpentane	0.03753 *	0.03753			
Neohexane	0.03558 *	0.03558			
2,3-Dimethylbutane	0.00474 *	0.00474			
Methylcyclohexane	0.01712 *	0.01712			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0.00328 *	0.00328			
m-Xylene	0.01044 *	0.01044			
Ethylbenzene	0.00307 *	0.00307			

Molar Flow	Total lbmol/h	Light Liquid lbmol/h			
Nitrogen	0.0556531 *	0.0556531			
Methane	18.967 *	18.967			
CO2	0.0278266 *	0.0278266			
Ethane	21.3301 *	21.3301			
Propane	25.2323 *	25.2323			
Isobutane	5.30845 *	5.30845			
n-Butane	20.5424 *	20.5424			
Isopentane	7.71224 *	7.71224			
n-Pentane	14.001 *	14.001			
n-Hexane	11.1199 *	11.1199			
Methylcyclopentane	0.903293 *	0.903293			
Benzene	0.147695 *	0.147695			
Cyclohexane	1.59254 *	1.59254			
n-Heptane	10.1417 *	10.1417			
n-Octane	16.1951 *	16.1951			
n-Nonane	9.8399 *	9.8399			
n-Decane	8.60483 *	8.60483			
n-Undecane	18.4062 *	18.4062			

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Process Streams Report
Stream: Test Separator Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 11:12 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:12 AM, 4/7/2015	

Molar Flow	Total lbmol/h	Light Liquid lbmol/h
Dodecane	0 *	0
Water	0 *	0
Triethylene Glycol	0 *	0
Oxygen	0 *	0
Argon	0 *	0
Carbon Monoxide	0 *	0
Cyclopentane	0 *	0
Isohexane	0 *	0
3-Methylpentane	8.03331 *	8.03331
Neohexane	7.61592 *	7.61592
2,3-Dimethylbutane	1.0146 *	1.0146
Methylcyclohexane	3.66454 *	3.66454
Isooctane	0 *	0
Decane, 2-Methyl-	0 *	0
Toluene	0.702086 *	0.702086
m-Xylene	2.23469 *	2.23469
Ethylbenzene	0.657135 *	0.657135

Mass Fraction	Total	Light Liquid
Nitrogen	9.33158E-05 *	9.33158E-05
Methane	0.0182125 *	0.0182125
CO2	7.33003E-05 *	7.33003E-05
Ethane	0.0383896 *	0.0383896
Propane	0.0665966 *	0.0665966
Isobutane	0.0184676 *	0.0184676
n-Butane	0.0714651 *	0.0714651
Isopentane	0.033305 *	0.033305
n-Pentane	0.060463 *	0.060463
n-Hexane	0.0573568 *	0.0573568
Methylcyclopentane	0.00455021 *	0.00455021
Benzene	0.000690529 *	0.000690529
Cyclohexane	0.00802218 *	0.00802218
n-Heptane	0.0608257 *	0.0608257
n-Octane	0.110728 *	0.110728
n-Nonane	0.075538 *	0.075538
n-Decane	0.073281 *	0.073281
n-Undecane	0.172205 *	0.172205
Dodecane	0 *	0
Water	0 *	0
Triethylene Glycol	0 *	0
Oxygen	0 *	0
Argon	0 *	0
Carbon Monoxide	0 *	0
Cyclopentane	0 *	0
Isohexane	0 *	0
3-Methylpentane	0.041436 *	0.041436
Neohexane	0.0392831 *	0.0392831
2,3-Dimethylbutane	0.00523332 *	0.00523332
Methylcyclohexane	0.0215362 *	0.0215362
Isooctane	0 *	0
Decane, 2-Methyl-	0 *	0
Toluene	0.00387196 *	0.00387196
m-Xylene	0.0142003 *	0.0142003
Ethylbenzene	0.00417576 *	0.00417576

Mass Flow	Total lb/h	Light Liquid lb/h
Nitrogen	1.55903 *	1.55903
Methane	304.278 *	304.278

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Process Streams Report
Stream: Test Separator Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 11:12 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:12 AM, 4/7/2015	

Mass Flow	Total lb/h	Light Liquid lb/h			
CO2	1.22463 *	1.22463			
Ethane	641.377 *	641.377			
Propane	1112.63 *	1112.63			
Isobutane	308.539 *	308.539			
n-Butane	1193.97 *	1193.97			
Isopentane	556.429 *	556.429			
n-Pentane	1010.16 *	1010.16			
n-Hexane	958.263 *	958.263			
Methylcyclopentane	76.0207 *	76.0207			
Benzene	11.5367 *	11.5367			
Cyclohexane	134.027 *	134.027			
n-Heptane	1016.22 *	1016.22			
n-Octane	1849.94 *	1849.94			
n-Nonane	1262.02 *	1262.02			
n-Decane	1224.31 *	1224.31			
n-Undecane	2877.04 *	2877.04			
Dodecane	0 *	0			
Water	0 *	0			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			
Isohexane	0 *	0			
3-Methylpentane	692.274 *	692.274			
Neohexane	656.304 *	656.304			
2,3-Dimethylbutane	87.4335 *	87.4335			
Methylcyclohexane	359.807 *	359.807			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	64.6891 *	64.6891			
m-Xylene	237.246 *	237.246			
Ethylbenzene	69.7647 *	69.7647			

Std. Liquid Volumetric Fraction	Total	Light Liquid			
Nitrogen	7.35727E-05 *	7.35727E-05			
Methane	0.0386384 *	0.0386384			
CO2	5.70642E-05 *	5.70642E-05			
Ethane	0.0685469 *	0.0685469			
Propane	0.0835324 *	0.0835324			
Isobutane	0.0208735 *	0.0208735			
n-Butane	0.0778217 *	0.0778217			
Isopentane	0.0338918 *	0.0338918			
n-Pentane	0.0609853 *	0.0609853			
n-Hexane	0.0549474 *	0.0549474			
Methylcyclopentane	0.00384151 *	0.00384151			
Benzene	0.00049661 *	0.00049661			
Cyclohexane	0.00651372 *	0.00651372			
n-Heptane	0.0562243 *	0.0562243			
n-Octane	0.0996964 *	0.0996964			
n-Nonane	0.066535 *	0.066535			
n-Decane	0.0634625 *	0.0634625			
n-Undecane	0.147266 *	0.147266			
Dodecane	0 *	0			
Water	0 *	0			
Triethylene Glycol	0 *	0			
Oxygen	0 *	0			
Argon	0 *	0			
Carbon Monoxide	0 *	0			
Cyclopentane	0 *	0			

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Process Streams Report
Stream: Test Separator Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0	
Location:	Charles Frye Pad	Modified: 11:12 AM, 4/7/2015	
Flowsheet:	Charles Frye Pad	Status: Solved 11:12 AM, 4/7/2015	

Std. Liquid Volumetric Fraction	Total	Light Liquid			
Isohexane	0 *	0			
3-Methylpentane	0.0394014 *	0.0394014			
Neohexane	0.0382225 *	0.0382225			
2,3-Dimethylbutane	0.00499868 *	0.00499868			
Methylcyclohexane	0.0177024 *	0.0177024			
Isooctane	0 *	0			
Decane, 2-Methyl-	0 *	0			
Toluene	0.00282533 *	0.00282533			
m-Xylene	0.0103977 *	0.0103977			
Ethylbenzene	0.00304752 *	0.00304752			

Volumetric Flow	Total gpm	Light Liquid gpm			
Nitrogen	0.00629492	0.00629492			
Methane	2.12844	2.12844			
CO2	0.00201302	0.00201302			
Ethane	2.90403	2.90403			
Propane	4.31255	4.31255			
Isobutane	1.10365	1.10365			
n-Butane	4.13785	4.13785			
Isopentane	1.7975	1.7975			
n-Pentane	3.23685	3.23685			
n-Hexane	2.90006	2.90006			
Methylcyclopentane	0.201618	0.201618			
Benzene	0.0255949	0.0255949			
Cyclohexane	0.339443	0.339443			
n-Heptane	2.95928	2.95928			
n-Octane	5.18678	5.18678			
n-Nonane	3.4375	3.4375			
n-Decane	3.27108	3.27108			
n-Undecane	7.55245	7.55245			
Dodecane	0	0			
Water	0	0			
Triethylene Glycol	0	0			
Oxygen	0	0			
Argon	0	0			
Carbon Monoxide	0	0			
Cyclopentane	0	0			
Isohexane	0	0			
3-Methylpentane	2.08497	2.08497			
Neohexane	2.0236	2.0236			
2,3-Dimethylbutane	0.264236	0.264236			
Methylcyclohexane	0.917095	0.917095			
Isooctane	0	0			
Decane, 2-Methyl-	0	0			
Toluene	0.144209	0.144209			
m-Xylene	0.528655	0.528655			
Ethylbenzene	0.154956	0.154956			

Properties

Property	Units	Total	Light Liquid			
Temperature	°F	83 *	83			
Pressure	psig	390 *	390			
Mole Fraction Vapor		0	0			
Mole Fraction Light Liquid		1	1			
Molecular Weight	lb/lbmol	78.052	78.052			
Mass Density	lb/ft^3	40.3512	40.3512			
Molar Flow	lbmol/h	214.05	214.05			
Mass Flow	lb/h	16707.1	16707.1			
Vapor Volumetric Flow	ft^3/h	414.041	414.041			

* User Specified Values
? Extrapolated or Approximate Values

ProMax 3.2.13116.0
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Process Streams Report
Stream: Test Separator Oil
Phases Grouped by Columns

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	Modified: 11:12 AM, 4/7/2015
Flowsheet:	Charles Frye Pad	Status: Solved 11:12 AM, 4/7/2015

Properties

Property	Units	Total	Light Liquid			
Liquid Volumetric Flow	gpm	51.6207	51.6207			
Std Vapor Volumetric Flow	MMSCFD	1.94949	1.94949			
Std Liquid Volumetric Flow	sgpm	52.5 *	52.5			
Specific Gravity		0.646976	0.646976			
API Gravity		82.8853	82.8853			
Enthalpy	Btu/h	-1.65566E+07	-1.65566E+07			
Kinematic Viscosity	cSt	0.409605	0.409605			
Net Ideal Gas Heating Value	Btu/ft^3	3985.93	3985.93			
Net Liquid Heating Value	Btu/lb	19224.5	19224.5			

Remarks

* User Specified Values
? Extrapolated or Approximate Values

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Flowsheet Environment
SRK Environment

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	
Flowsheet:	Charles Frye Pad	

Environment Settings

Number of Poynting Intervals	0	Freeze Out Temperature Threshold Difference	10 °F
Gibbs Excess Model Evaluation Temperature	77 °F	Phase Tolerance	0.01

Components

Component Name	Henry`s Law Component	Phase Initiator	Component Name	Henry`s Law Component	Phase Initiator
Nitrogen	False	False	Dodecane	False	False
Methane	False	False	Water	False	True
CO2	False	False	Triethylene Glycol	False	True
Ethane	False	False	Oxygen	False	False
Propane	False	False	Argon	False	False
Isobutane	False	False	Carbon Monoxide	False	False
n-Butane	False	False	Cyclopentane	False	False
Isopentane	False	False	Isohexane	False	False
n-Pentane	False	False	3-Methylpentane	False	False
n-Hexane	False	False	Neohexane	False	False
Methylcyclopentane	False	False	2,3-Dimethylbutane	False	False
Benzene	False	False	Methylcyclohexane	False	False
Cyclohexane	False	False	Isooctane	False	False
n-Heptane	False	False	Decane, 2-Methyl-	False	False
n-Octane	False	False	Toluene	False	False
n-Nonane	False	False	m-Xylene	False	False
n-Decane	False	False	Ethylbenzene	False	False
n-Undecane	False	False			

Physical Property Method Sets

Liquid Molar Volume	COSTALD	Overall Package	SRK
Stability Calculation	SRK	Vapor Package	SRK
Light Liquid Package	SRK	Heavy Liquid Package	SRK

Remarks

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Environments Report

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	

Project-Wide Constants

Atmospheric Pressure	14.6959 psia	IG Ref Pressure	14.6959 psia
IG Ref Temperature	60 °F	IG Ref Volume	379.485 ft^3/lbmol
Liq Ref Temperature	60 °F		

Environment [SRK Environment]

Environment Settings

Number of Poynting Intervals	0	Freeze Out Temperature Threshold Difference	10 °F
Gibbs Excess Model Evaluation Temperature	77 °F	Phase Tolerance	0.01

Components

Component Name	Henry`s Law Component	Phase Initiator	Component Name	Henry`s Law Component	Phase Initiator
Nitrogen	False	False	Dodecane	False	False
Methane	False	False	Water	False	True
CO2	False	False	Triethylene Glycol	False	True
Ethane	False	False	Oxygen	False	False
Propane	False	False	Argon	False	False
Isobutane	False	False	Carbon Monoxide	False	False
n-Butane	False	False	Cyclopentane	False	False
Isopentane	False	False	Isohexane	False	False
n-Pentane	False	False	3-Methylpentane	False	False
n-Hexane	False	False	Neohexane	False	False
Methylcyclopentane	False	False	2,3-Dimethylbutane	False	False
Benzene	False	False	Methylcyclohexane	False	False
Cyclohexane	False	False	Isooctane	False	False
n-Heptane	False	False	Decane, 2-Methyl-	False	False
n-Octane	False	False	Toluene	False	False
n-Nonane	False	False	m-Xylene	False	False
n-Decane	False	False	Ethylbenzene	False	False
n-Undecane	False	False			

Physical Property Method Sets

Liquid Molar Volume	COSTALD	Overall Package	SRK
Stability Calculation	SRK	Vapor Package	SRK
Light Liquid Package	SRK	Heavy Liquid Package	SRK

Remarks

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20150417_SWN_Charlie Frye_Promax.pmx
Project Warnings Report

Client Name:	Southwestern Energy	Job: V1.0
Location:	Charles Frye Pad	

ProMax:ProMax!Project!Flowsheets!Charles Frye Pad !Blocks!Scrubber Dump 2!Properties!PDrop
Warning: A negative pressure drop of -40 psi was encountered in block Scrubber Dump 2.
ProMax:ProMax!Project!Flowsheets!Charles Frye Pad !Blocks!CMPR-100
Warning: The change in entropy is negative.
ProMax:ProMax!Project!Flowsheets!Charles Frye Pad !Blocks!Compressor Stage 1
Warning: The change in entropy is negative.
ProMax:ProMax!Project!Flowsheets!Charles Frye Pad !Blocks!Compressor Stage 2
Warning: The change in entropy is negative.
ProMax:ProMax!Project!Flowsheets!Charles Frye Pad !Blocks!Compressor Stage 3
Warning: The change in entropy is negative.

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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

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.

ATTACHMENT M: NATURAL GAS FIRED FUEL BURNING UNITS DATA SHEET

AP-42 EMISSION FACTORS

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

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

Emission Unit ID#[1]	Emission Point ID#[2]	Emission Unit Description (manufacturer, model #)	Year Installed/ Modified	Type[3] and Date of Change	Maximum Design Heat Input (MMBTU/hr)[4]	Fuel Heating Value (BTU/scf)[5]
EU-GPU1	EP-GPU1	Gas Production Unit Burner	2012	N/A	1.0	905
EU-GPU2	EP-GPU2	Gas Production Unit Burner	2012	N/A	1.0	905
EU-GPU3	EP-GPU3	Gas Production Unit Burner	2012	N/A	1.0	905
EU-GPU4	EP-GPU4	Gas Production Unit Burner	2015	N/A	1.0	905
EU-GPU5	EP-GPU5	Gas Production Unit Burner	2015	N/A	1.0	905
EU-GPU6	EP-GPU6	Gas Production Unit Burner	2015	N/A	1.0	905
EU-HT1	EP-HT1	Heater Treater	2012	N/A	0.5	905
EU-HT2	EP-HT2	Heater Treater	2012	N/A	0.5	905

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

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

3 New, modification, removal

4 Enter design heat input capacity in MMBtu/hr.

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

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.

ATTACHMENT N: INTERNAL COMBUSTION ENGINE DATA SHEETS

ENGINE SPECIFICATION SHEETS

EPA CERTIFICATE OF CONFORMITY

AP-42 AND EPA EMISSION FACTORS

ATTACHMENT N – INTERNAL COMBUSTION ENGINE DATA SHEET

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

Emission Unit ID#[1]	EU-MC4220	EU-VRU	
Engine Manufacturer/Model	Caterpillar G3306 NA	Zenith ZPP-644 4.4L	
Manufacturers Rated bhp/rpm	145-hp/1,800-rpm	77-hp (57.4-Kw)/2,200-rpm	
Source Status[2]	ES	NS	
Date Installed/ Modified/Removed/Relocated[3]	2015	2015	
Engine Manufactured /Reconstruction Date[4]	After 1/1/2011	2013	
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable)[5]	☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☒40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	☒40CFR60 Subpart JJJJ ☒JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☒40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	
Engine Type[6]	4SRB	4SRB	
APCD Type[7]	NSCR	NSCR	
Fuel Type[8]	RG	RG	
H_2S (gr/100 scf)	Negligible	Negligible	
Operating bhp/rpm	145-hp/1,800-rpm	77-hp (57.4-Kw)/2,200-rpm	
BSFC (BTU/bhp-hr)	8,625	8,314 BTU/kW-hr	
Hourly Fuel Throughput	1,382 ft^3/hr gal/hr	527 ft^3/hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)	12.11 $MMft^3$/yr gal/yr	4.62 $MMft^3$/yr gal/yr	
Fuel Usage or Hours of Operation Metered	Yes ☐ No ☒	Yes ☐ No ☒	

Calculation Methodology[9]	Pollutant[10]	Hourly PTE (lb/hr)[11]	Annual PTE (tons/year)[11]	Hourly PTE (lb/hr)[11]	Annual PTE (tons/year)[11]		
MD	NO_x	0.32	1.40	0.34	1.49		
MD	CO	0.64	2.80	0.56	2.45		
MD	VOC	0.16	0.70	0.34	1.49		
AP	SO_2	<0.01	<0.01	<0.01	<0.01		
AP	PM_{10}	0.01	0.04	<0.01	<0.01		
MD	Formaldehyde	0.09	0.39	0.01	0.04		
AP	Total HAPs	0.10	0.45	0.01	0.07		
MD and EPA	GHG (CO_2e)	155.19	679.74	55.90	244.84		

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

2 Enter the Source Status using the following codes:

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

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

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

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

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

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

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

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

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

8 Enter the Fuel Type using the following codes:

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

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

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

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

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

Engine Air Pollution Control Device
(Emission Unit ID# APC-NSCR-MC4220, use extra pages as necessary)

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

☒ NSCR ☐ SCR ☐ Oxidation Catalyst

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

Manufacturer: N/A	Model #: N/A
Design Operating Temperature: 1,101 °F	Design gas volume: 678 scfm
Service life of catalyst:	Provide manufacturer data? ☒ Yes ☐ No
Volume of gas handled: acfm at °F	Operating temperature range for NSCR/Ox Cat: From 600 °F to 1,250 °F
Reducing agent used, if any:	Ammonia slip (ppm):

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

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

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

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

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

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

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

☒ NSCR ☐ SCR ☐ Oxidation Catalyst

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

Manufacturer: TBD	Model #: TBD
Design Operating Temperature: 1,135 °F	Design gas volume: 1,018 scfm
Service life of catalyst:	Provide manufacturer data? ☒Yes ☐ No
Volume of gas handled: acfm at °F	Operating temperature range for NSCR/Ox Cat: From 600 °F to 1,250 °F
Reducing agent used, if any:	Ammonia slip (ppm):

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

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

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

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

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

G3306 NA

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA

CATERPILLAR®

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

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

			MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING	**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**50%**
ENGINE POWER	(1)	bhp	145	145	109	72
INLET AIR TEMPERATURE		°F	77	77	77	77
ENGINE DATA						
FUEL CONSUMPTION (LHV)	(2)	Btu/bhp-hr	7775	7775	8318	9509
FUEL CONSUMPTION (HHV)	(2)	Btu/bhp-hr	8625	8625	9227	10548
AIR FLOW	(3)(4)	lb/hr	922	922	739	556
AIR FLOW WET (77°F, 14.7 psia)	(3)(4)	scfm	208	208	167	125
INLET MANIFOLD PRESSURE	(5)	in Hg(abs)	26.2	26.2	21.8	17.6
EXHAUST STACK TEMPERATURE	(6)	°F	1101	1101	1067	1037
EXHAUST GAS FLOW (@ stack temp, 14.5 psia)	(7)(4)	ft3/min	678	678	532	393
EXHAUST GAS MASS FLOW	(7)(4)	lb/hr	978	978	784	590
EMISSIONS DATA						
NOx (as NO2)	(8)	g/bhp-hr	13.47	13.47	12.15	9.76
CO	(8)	g/bhp-hr	13.47	13.47	11.44	9.56
THC (mol. wt. of 15.84)	(8)	g/bhp-hr	2.20	2.20	2.49	3.22
NMHC (mol. wt. of 15.84)	(8)	g/bhp-hr	0.33	0.33	0.37	0.48
NMNEHC (VOCs) (mol. wt. of 15.84)	(8)(9)	g/bhp-hr	0.22	0.22	0.25	0.32
HCHO (Formaldehyde)	(8)	g/bhp-hr	0.27	0.27	0.31	0.33
CO2	(8)	g/bhp-hr	485	485	525	601
EXHAUST OXYGEN	(10)	% DRY	0.5	0.5	0.5	0.5
HEAT REJECTION						
HEAT REJ. TO JACKET WATER (JW)	(11)	Btu/min	6049	6049	5237	4455
HEAT REJ. TO ATMOSPHERE	(11)	Btu/min	751	751	602	459
HEAT REJ. TO LUBE OIL (OC)	(11)	Btu/min	990	990	857	729
HEAT EXCHANGER SIZING CRITERIA						
TOTAL JACKET WATER CIRCUIT (JW+OC)	(12)	Btu/min	7842			

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature.
100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature.
Max. rating is the maximum capability for the specified fuel at site altitude and reduced inlet air temperature.
Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

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

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

Prepared For:
Jason Stinson
MIDCON COMPRESSION, LP

MANUFACTURED ON OR AFTER 1/1/2011

INFORMATION PROVIDED BY CATERPILLAR

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

Uncontrolled Emissions

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

POST CATALYST EMISSIONS

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

CONTROL EQUIPMENT

Catalytic Converter

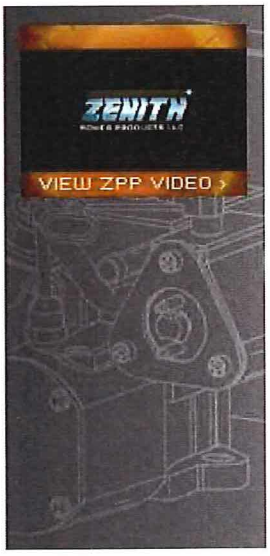
Model:	**EAH-1200T-0404F-21CEE**
Catalyst Type:	NSCR, Precious group metals
Manufacturer:	EMIT Technologies, Inc.
Element Size:	Round 12 x 3.5
Catalyst Elements:	1
Housing Type:	2 Element Capacity
Catalyst Installation:	Accessible Housing
Construction:	10 gauge Carbon Steel
Sample Ports:	6 (0.5" NPT)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

Air Fuel Ratio Controller

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

ZENITH
POWER PRODUCTS LLC

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



DUAL FUEL/GASOLINE & NATURAL GAS 4.4 Liter

For Industrial Application

ZPP 644

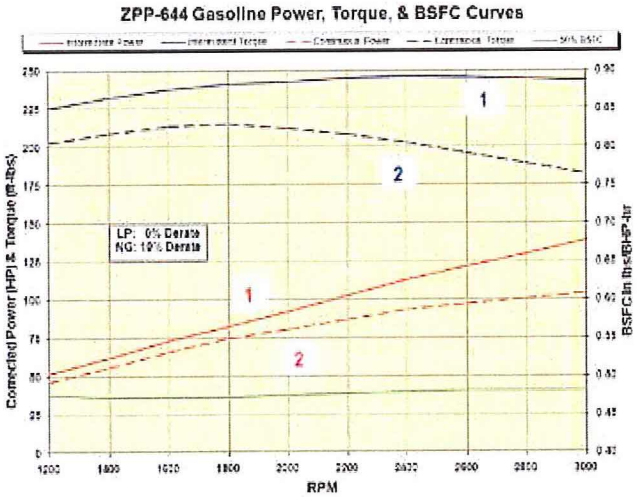
click to enlarge >

SPECIFICATION DATA

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

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

PERFORMANCE CURVES



Curve 1 - Intermittent Gross Output

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

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

Curve 2 - Continuous Gross Output

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

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

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

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ENGINE SPECIFICATIONS

General

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

Fuel System

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

Physical Data

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

Electrical

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

Cooling

Thermostat	180°F / 82 °C

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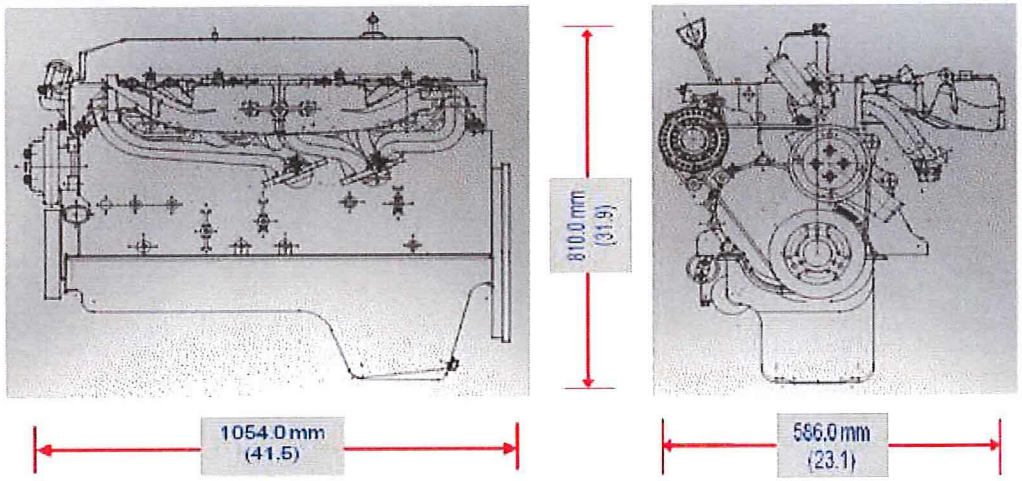

DESIGN AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

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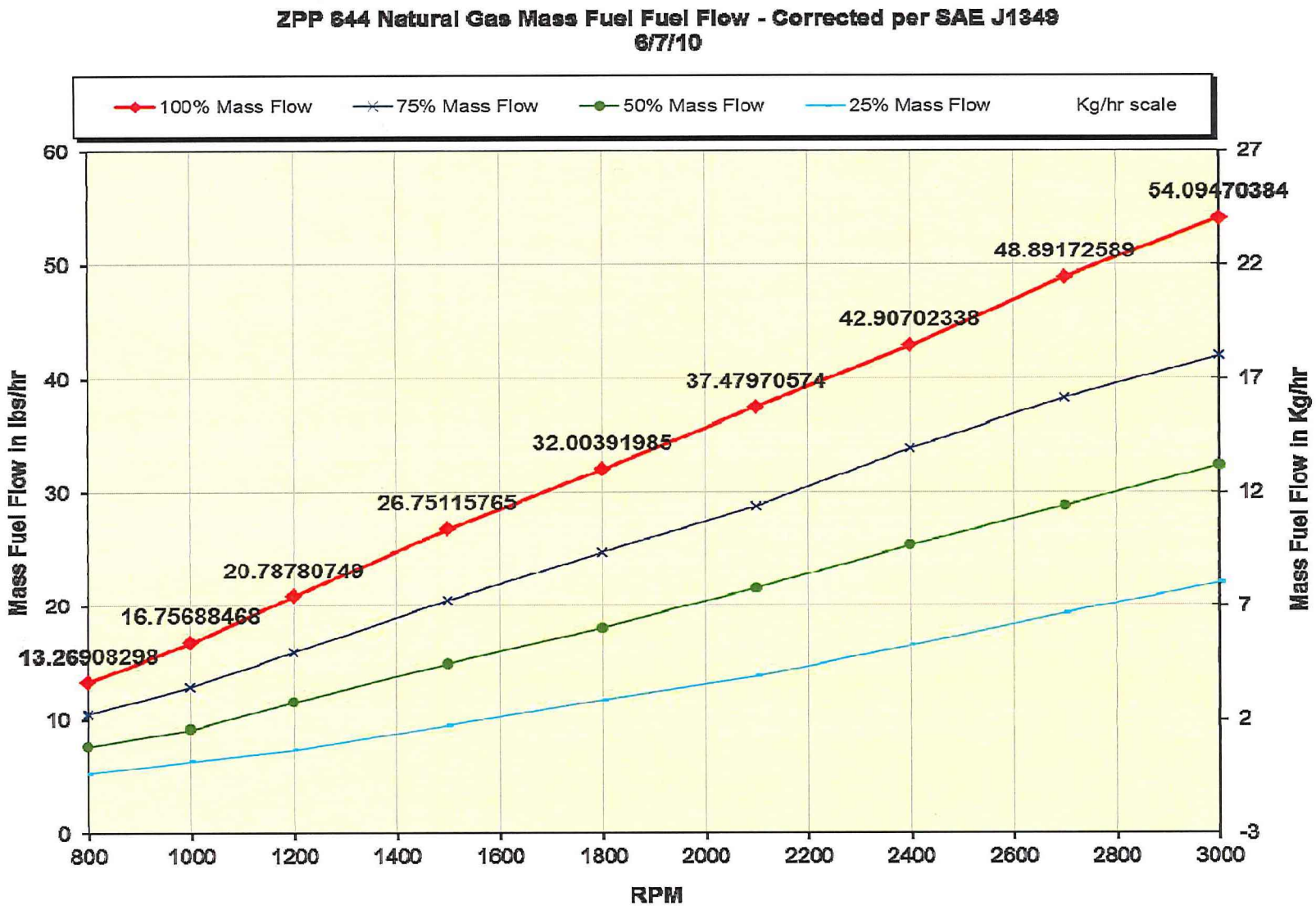
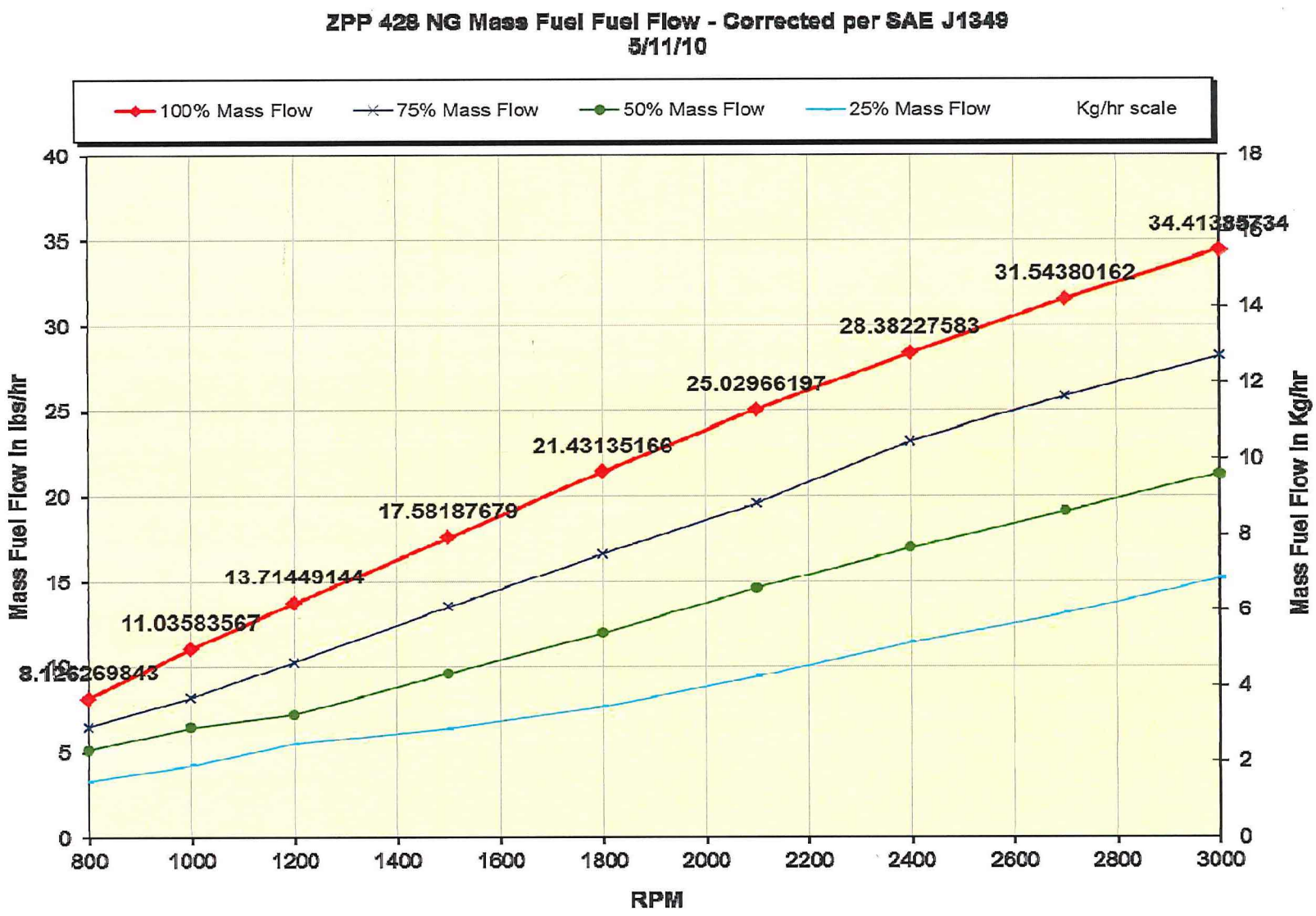
HY-BON/EDI VRU Packages w/ HP Ratings

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

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


ZPP 844 Natural Gas Mass Fuel Fuel Flow - Corrected per SAE J1349
6/7/10
100% Mass Flow
75% Mass Flow
50% Mass Flow
25% Mass Flow
Kg/hr scale
Mass Fuel Flow in lbs/hr
Mass Fuel Flow in Kg/hr
RPM
13.26908298
16.75688468
20.78780749
26.75115765
32.00391985
37.47970574
42.90702338
48.89172589
54.09470384
0
10
20
30
40
50
60
-3
2
7
12
17
22
27
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000


ZPP 428 NG Mass Fuel Fuel Flow - Corrected per SAE J1349
5/11/10
100% Mass Flow
75% Mass Flow
50% Mass Flow
25% Mass Flow
Kg/hr scale
Mass Fuel Flow In lbs/hr
Mass Fuel Flow In Kg/hr
RPM
8.126269843
11.03583567
13.71449144
17.58187679
21.43135166
25.02966197
28.38227583
31.54380162
34.41385734
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000

1. INTRODUCTION

This report documents the certification test procedure and results for the 644 engine. The 644 is required to comply with the emissions standards defined in 1048.101 for natural gas (NG) and LPG constant-speed mobile applications and LPG stationary applications. ZPP is voluntarily certifying the 644 per 60.4231(d) for stationary NG applications.

Since the rated power of the NG 644 is less than 100 HP, the engine must comply with the emissions standard specified in 60.4243(c), which references 40 CFR part 1048. ZPP has elected to certify both the NG and LPG versions of the 644 to 2.1 g/kW-hr HC+NOx, 6.0 g/kW-hr CO point on the sliding scale specified in 1048.101(a)(3).

2. UNIT UNDER TEST

The 644 engine is equipped with a 3-way catalyst, air valve carburetor, and a closed-loop A/F control system with pre-cat and post-cat oxygen sensors. The 644 engine configuration is summarized in Table 1 on the following page. Figure 1 is a picture of the test engine and catalyst.

The engine was tested for three fuel system configurations:

- Natural gas (NG) mono-fuel
- LPG mono-fuel
- NG/LPG dual-fuel

The S/N of the certification test engine is 0700006. The S/N of the certification test catalyst is 002.

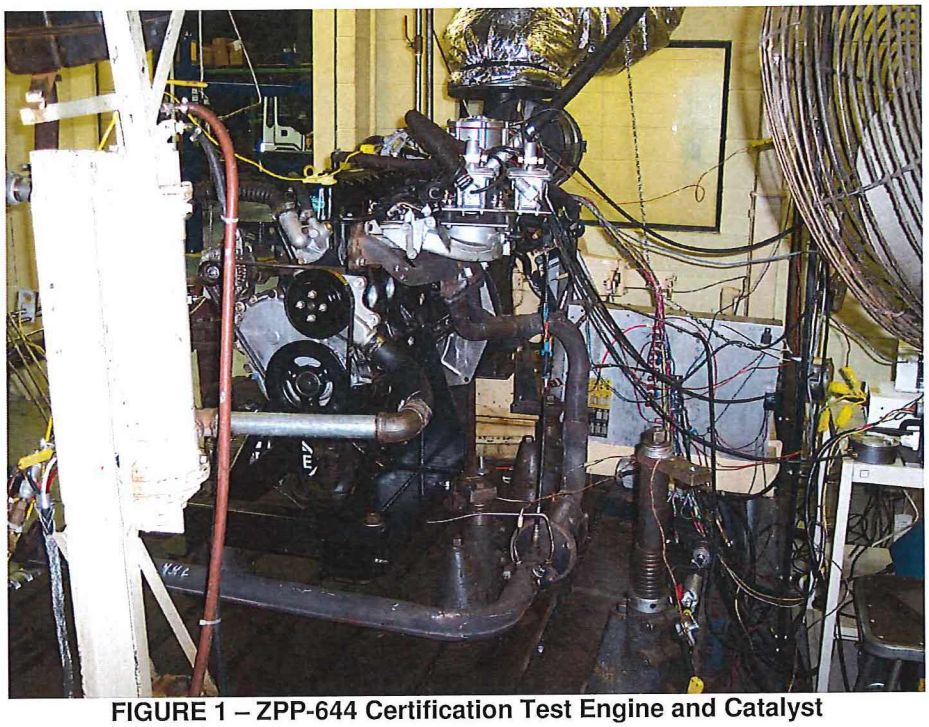


FIGURE 1 – ZPP-644 Certification Test Engine and Catalyst

TABLE 1 – ZPP-644 Engine Specifications

Spec	Units	644		
		Nat Gas	LPG	NG/LPG
Engine Family code		AZPPB04.4STA		
Base Engine P/N		P644NE	P644LE	P644BF
# of Cylinders		6 In-Line		
Nominal Displacement	L	4.4		
Air Induction		Naturally Aspirated		
Rated Power	HP (kW)	98 (73)	108 (81)	108 (81)
Rated Torque	ft-lbs (N*m)	171 (232)	189 (257)	189 (257)
Rated Speed	RPM	3000		
Torque @ 1800 rpm	ft-lbs (N*m)	191 (259)	218 (296)	218 (296)
Compression Ratio		9.7 : 1		
Valve Configuration		Overhead Valves		
Valve Lifters		Hydraulic		
Firing Order		1-5-3-6-2-4		
Bore x Stroke	mm	98.4 x 91.0		
Cylinder Displacement	cc	692.3		
Total Displacement	cc	4416		
Block Material		Cast Iron		
Head Material		Cast Iron		
Length x Width x Height	mm	1054 x 586 x 810		
Dry Weight	Kg	193		
Catalyst Location		Remote Mount		
Oil Capacity	L	5.7		
Catalyst		3-way ZPP-C674-21		
Fuel Types		Pipeline-quality natural gas Commercial-grade LPG		
Fuel System		Air Valve Carburetor		
Applications		Generator sets, compressors, pumps, etc.		
Speed Operation		Constant Speed		

3. LABORATORY EQUIPMENT

The certification engine test was conducted in ZPP's engine lab. The engine was run on a 400 HP GE 16492 eddy-current dynamometer.

The emissions analyzer used was a SEMTECH-DS. When properly calibrated per Table 1 of 1065.303, the SEMTECH-DS is 1065-compliant for constant-speed certification testing. The SEMTECH-DS uses a raw gas sampling system and a heated sample line.

Emissions mass flow was determined by measuring emissions concentrations and mass fuel flow. Engine speed and torque were measured to determine engine work per 1065 Subparts B-D.

The following is a list of measurement subsystems included in the SEMTECH-DS emission analyzer.

- Heated Flame Ionization Detector (FID) for total hydrocarbon (THC) measurement.
- Non-Dispersive Ultraviolet (NDUV) analyzer for nitric oxide (NO) and nitrogen dioxide (NO2) measurement.
- Non-Dispersive Infrared (NDIR) analyzer for carbon monoxide (CO) and carbon dioxide (CO2) measurement.
- Electrochemical sensor for oxygen (O2) measurement.

Methane and total hydrocarbons were measured with a JUM-109A NMHC analyzer.

The natural gas fuel used for testing was pipeline-quality natural gas which met the requirements for natural gas composition in 40 CFR 1065.715. Composition analyses for the natural gas are included in Appendix 2.

The LPG was commercial-grade LPG per 1065-720(b). A copy of the sales invoice is included in the Appendix 2. The supplier stated that the LPG complies with the HD-5 specification.

LPG fuel flow was measured with a scale and stopwatch. NG fuel flow was measured with an Eldridge mass fuel flow meter.

The key pieces of laboratory equipment that were used to test the 644 engine are listed in Table 2.

TABLE 2 – Certification Engine Test Equipment List

Item	Manufacturer & P/N	S/N
Eddy-Current Dynamometer	GE 16492 400 HP	8245668
Torque transducer	Lebow Load Cell	100541A
5-gas raw gas emissions analyzer	SEMTECH-DS	J06-SDS05
Nonmethane cutter	JUM 109A NMHC Analyzer	205389
Scale for measuring LPG fuel weight	Avery Weigh-Tronix scale P/N E1010	051240314
Natural gas mass flow meter	Eldridge Natural gas flowmeter 8089MPNH-SSS-133-AC115	20082003
Weather station	SEMTECH-DS Weather Station	D1440015

4. TEST PROCEDURE

Testing procedures and emissions calculations follow the guidelines set in 40 CFR 1065.

The following test cycles were used:

- For NG stationary, ISO D1 test cycles per 60.4241 were required.
- For NG constant-speed mobile, ISO D2 test cycles per 1048.505(b)(2) were required.
- For LPG stationary and constant-speed mobile, ISO D2 test cycles per 60.4240 and 1048.505(b)(2) were required.

Test speeds for both fuels/cycles were 3000 rpm (rated speed) and 1800 rpm.

For natural gas, the methane and total hydrocarbons were measured with a JUM 109A NMHC analyzer. The non-methane hydrocarbons were then calculated per 1065.660.

The test engine and catalyst were the same 644 engine and catalyst that were used for mobile certification testing in 2008. At the beginning of the stationary emissions testing, the 644 had accumulated 57 operating hours.

To comply with the 1065.550 drift requirements, each emissions analyzer channel was zeroed and spanned at the beginning and end of each modal test. In addition, each emissions analyzer channel was zeroed between each mode.

Figures 3 and 4 below are the LPG and NG torque & power curves that were obtained from the 644 certification test engine.

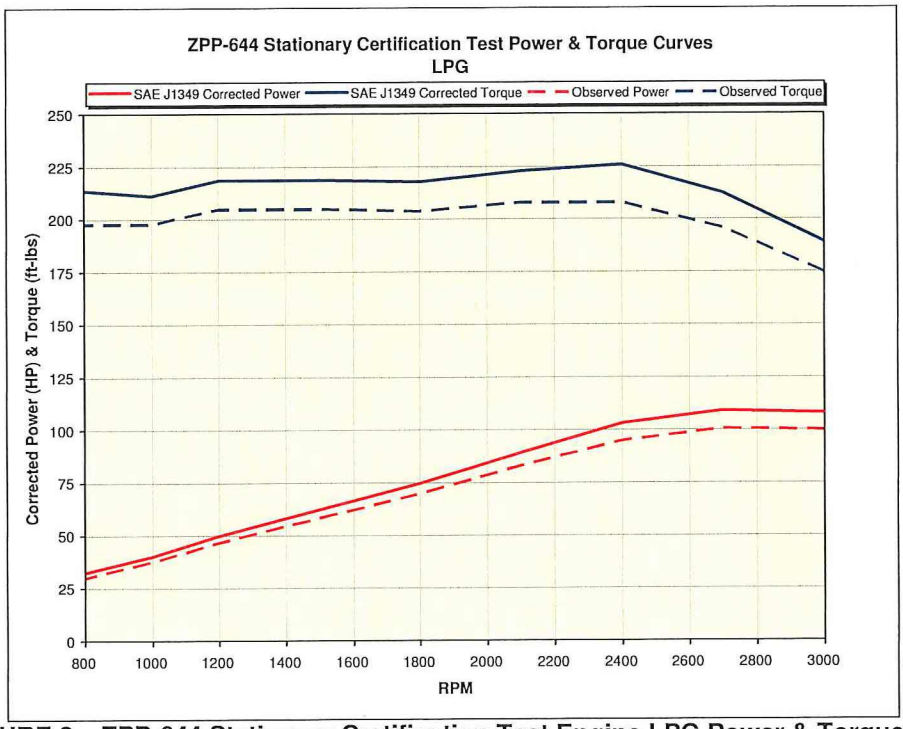


FIGURE 3 – ZPP-644 Stationary Certification Test Engine LPG Power & Torque Curves

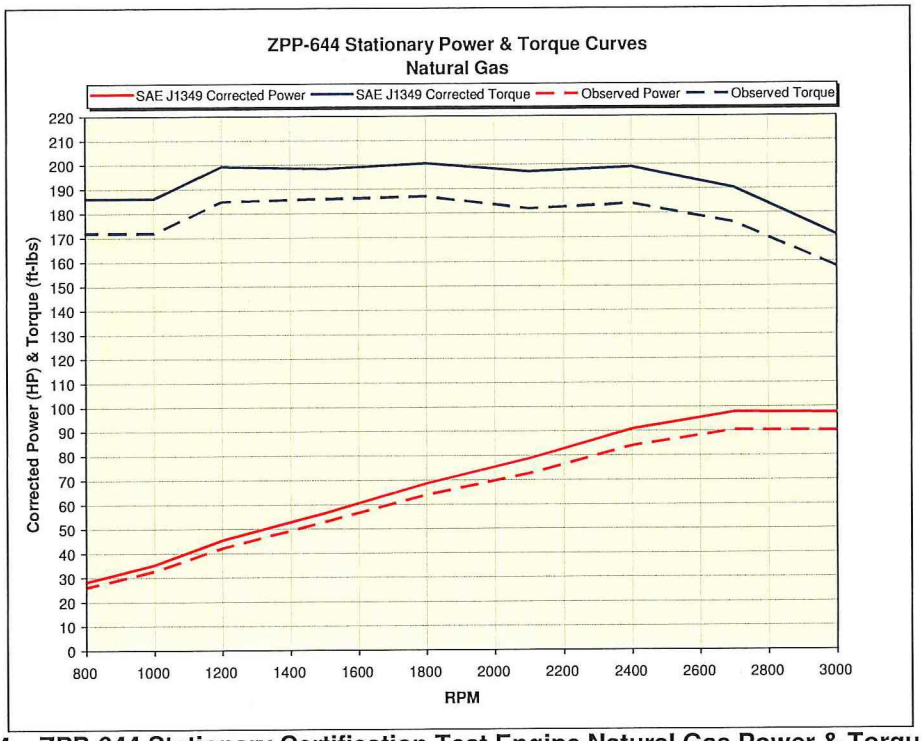


FIGURE 4 – ZPP-644 Stationary Certification Test Engine Natural Gas Power & Torque Curves

5. TEST RESULTS

The ZPP-644's stationary and constant-speed mobile certification test results are summarized in Figure 5 and Table 3. All of the test results complied with the emissions standards with a factor of 2 safety margin or better.

Individual test result summaries are contained in the Appendix 1.

At the end of the stationary and constant-speed mobile certification testing, the 644 test engine had accumulated a total of 110 operating hours. As noted in the "Test Procedure" section, the engine had previously accumulated 57 hours from the gasoline and LPG mobile certification testing in 2008.

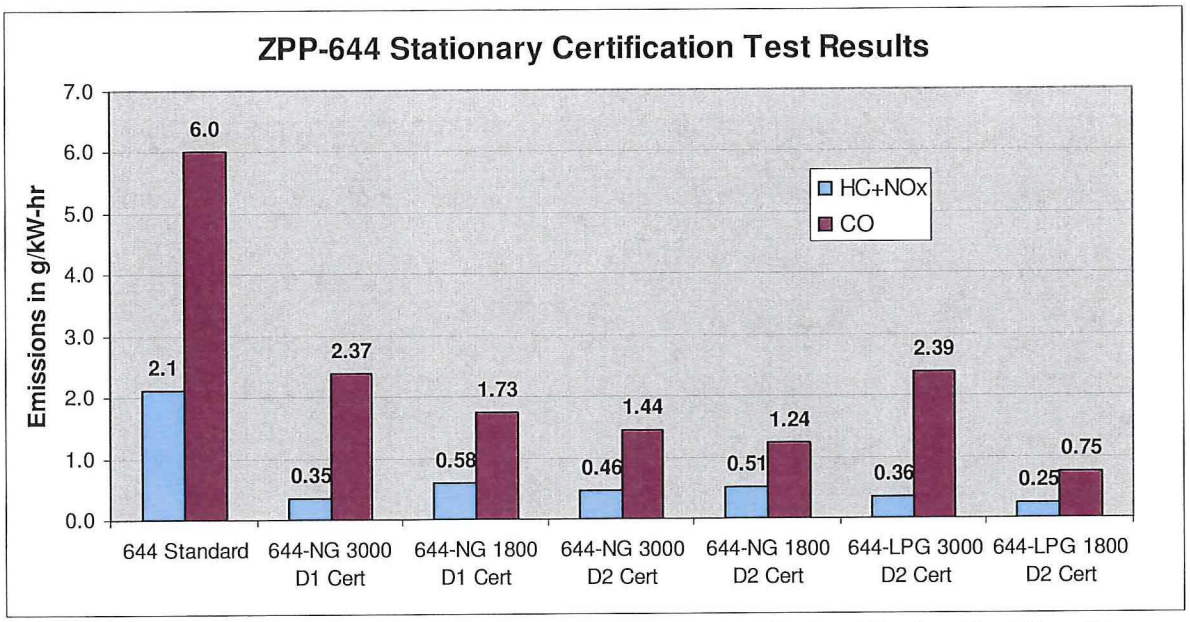


FIGURE 5 – ZPP-644 Stationary and Constant-Speed Mobile Certification Test Results

Test	Emissions in g/kW-hr				
	THC	NMHC	NOx	HC+NOx	CO
644 Standard				2.1	6.0
644-NG 3000 D1 Cert	0.44	0.00	0.35	0.35	2.37
644-NG 1800 D1 Cert	0.51	0.00	0.58	0.58	1.73
644-NG 3000 D2 Cert	0.43	0.00	0.46	0.46	1.44
644-NG 1800 D2 Cert	0.54	0.00	0.51	0.51	1.24
644-LPG 3000 D2 Cert	0.10	NA	0.26	0.36	2.39
644-LPG 1800 D2 Cert	0.09	NA	0.16	0.25	0.75

TABLE 3 – ZPP-644 Stationary and Constant-Speed Mobile Certification Test Results

As evidence that the ZPP-644 engine complies with the 1048.101(c) field test requirement, the brake-specific emissions in each certification test mode were calculated. The modal brake-specific emissions are listed with each test sheet in Appendix 1. All of the modal brake-specific emissions values were less than 13% of the field testing standard (HC+NOx < 3.8 g/kW-hr, CO < 6.5 g/kW-hr).

The emissions test results were drift-checked per 1065.550 and drift-corrected per 1065.672. The results are recorded on the test data sheets in the Appendix 1. All drift values were less than 20% of the +/-4% limit.

6. SUMMARY

The ZPP-644 certification test results demonstrate that the ZPP-644 engine is fully capable of meeting the stationary emissions standards defined in CFR 40, Part 60, Subpart JJJJ and the constant-speed mobile emission standards defined in CFR 40, Part 1048 for both natural gas and LPG fuels.

	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY **2013 MODEL YEAR** **CERTIFICATE OF CONFORMITY** **WITH THE CLEAN AIR ACT OF 1990**	**OFFICE OF TRANSPORTATION** **AND AIR QUALITY** **ANN ARBOR, MICHIGAN 48105**

Certificate Issued To: Zenith Power Products (U.S. Manufacturer or Importer) **Certificate Number: DZPPB04.4P44-002**	**Effective Date:** **01/18/2013** **Expiration Date:** **12/31/2013**	**Byron J. Bunker, Division Director** **Compliance Division**	**Issue Date:** **01/18/2013** **Revision Date:** **N/A**

Manufacturer: Zenith Power Products
Engine Family: DZPPB04.4P44
Certificate Number: DZPPB04.4P44-002
Certification Type: Mobile and Stationary
Fuel : Natural Gas (CNG/LNG)
LPG/Propane
Gasoline (up to and including 10% Ethanol)
Emission Standards : NMHC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
HC + NOx (g/kW-hr) : 2.7NMHC + NOx (g/kW-hr) : 2.7
HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
Emergency Use Only : N

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

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

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

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

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

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

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

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

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

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

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

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

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

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

[f] Emission factor for TOC is based on measured emission levels from 6 source tests.

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

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

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

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

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

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

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

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

ATTACHMENT O: TANKER TRUCK LOADING DATA SHEET

AP-42 EMISSION FACTORS

ATTACHMENT O – TANKER TRUCK LOADING DATA SHEET

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

Truck Loadout Collection Efficiencies

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

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

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

Emission Unit ID#: EU-LOAD-COND	Emission Point ID#: APC-COMB-TKLD	Year Installed/Modified: 2012
Emission Unit Description: Condensate Truck Loading Emissions		
Loading Area Data		
Number of Pumps: 1	Number of Liquids Loaded: 1	Max number of trucks loading at one (1) time: 1
Are tanker trucks pressure tested for leaks at this or any other location? ☐ Yes ☒ No ☐ Not Required If Yes, Please describe:		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☐ Closed System to tanker truck not passing an annual leak test and has vapor return?		

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

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

Bulk Liquid Data (use extra pages as necessary)

Liquid Name	Condensate		
Max. Daily Throughput (1000 gal/day)	60.48		
Max. Annual Throughput (1000 gal/yr)	22,075.20		
Loading Method[1]	SUB		
Max. Fill Rate (gal/min)	125		
Average Fill Time (min/loading)	Approx. 60		
Max. Bulk Liquid Temperature (°F)	85		
True Vapor Pressure[2]	Refer to Promax		
Cargo Vessel Condition[3]	U		
Control Equipment or Method[4]	O = Vapor Return/ Combustion Controls		

Max. Collection Efficiency (%)		70%		
Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	4.40		
	Annual (ton/yr)	19.28		
Max.HAP Emission Rate	Loading (lb/hr)	0.09		
	Annual (ton/yr)	0.38		
Estimation Method[5]		EPA		

Emission Unit ID#: EU-LOAD-PW	Emission Point ID#: APC-COMB-TKLD	Year Installed/Modified: 2012
Emission Unit Description: Produced Water Truck Loading Emissions		
Loading Area Data		
Number of Pumps: 1	Number of Liquids Loaded: 1	Max number of trucks loading at one (1) time: 1
Are tanker trucks pressure tested for leaks at this or any other location? ☐ Yes ☒ No ☐ Not Required If Yes, Please describe:		
Provide description of closed vent system and any bypasses. Vapors are collected and routed to a vapor combustor.		
Are any of the following truck loadout systems utilized? ☐ Closed System to tanker truck passing a MACT level annual leak test? ☐ Closed System to tanker truck passing a NSPS level annual leak test? ☐ Closed System to tanker truck not passing an annual leak test and has vapor return?		

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

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

Bulk Liquid Data (use extra pages as necessary)

Liquid Name		Produced Water		
Max. Daily Throughput (1000 gal/day)		42		
Max. Annual Throughput (1000 gal/yr)		15,330		
Loading Method[1]		SUB		
Max. Fill Rate (gal/min)		125		
Average Fill Time (min/loading)		Approx. 60		
Max. Bulk Liquid Temperature (°F)		85		
True Vapor Pressure[2]		Refer to Promax		
Cargo Vessel Condition[3]		U		
Control Equipment or Method[4]		O = Vapor Return/ Combustion Controls		
Max. Collection Efficiency (%)		70%		
Max. Control Efficiency (%)		98%		
Max.VOC Emission Rate	Loading (lb/hr)	0.68		
	Annual (ton/yr)	2.98		
	Loading (lb/hr)	<0.01		

Max.HAP Emission Rate	Annual (ton/yr)	<0.01		
Estimation Method[5]		EPA		

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

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)

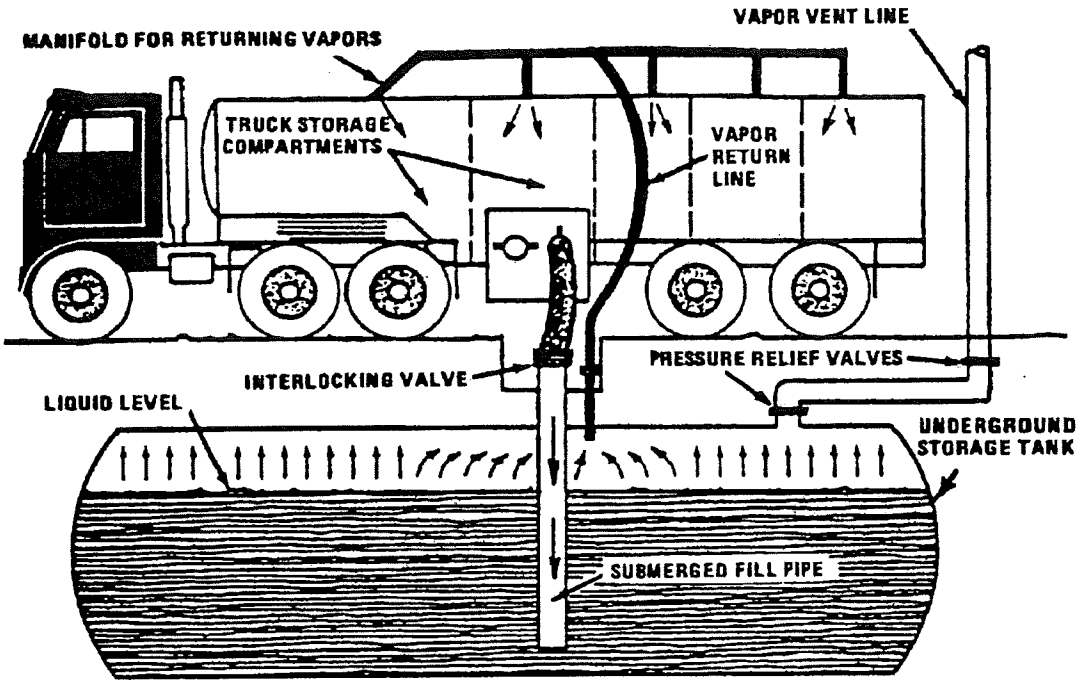


Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

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.

ATTACHMENT Q: PNEUMATIC CONTROLLERS DATA SHEET

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

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

VAPOR COMBUSTION

VAPOR RECOVERY UNIT

COMBUSTOR MANUFACTURER SPECIFICATION SHEET

AP-42 EMISSION FACTORS

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: 2012 ☐ New ☐ Modified ☐ Relocated

Maximum Rated Total Flow Capacity 6,125 scfh 147,500 scfd	Maximum Design Heat Input (from mfg. spec sheet) 15.0 MMBTU/hr	Design Heat Content 2,450 BTU/scf

Control Device Information

Type of Vapor Combustion Control?
☒ Enclosed Combustion Device ☐ Elevated Flare ☐ Ground Flare
☐ Thermal Oxidizer

Manufacturer: MRW Technologies Model: TBF-5.5-30-147500	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-COND	Condensate Truck Loading
EU-TANKS-PW	Produced Water Tanks	EU-LOAD-PW	Produced Water Truck Loading

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

Assist Type (Flares only)	Flare Height	Tip Diameter	Was the design per §60.18?
☐ Steam ☐ Air ☐ Pressure ☒ Non	34 feet	N/A feet	☐ Yes ☒ No Provide determination.

Waste Gas Information

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

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

Pilot Gas Information

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

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

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

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

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

VAPOR RECOVERY UNIT

General Information

Emission Unit ID#: APC-VRU-TANKS	Installation Date: 2015 ☐ New ☐ Modified ☐ Relocated

Device Information

Manufacturer: TBD
Model: TBD

List the emission units whose emissions are controlled by this vapor recovery unit (Emission Point ID# APC-VRU)

Emission Unit ID#	Emission Source Description	Emission Unit ID#	Emission Source Description
EU-TANKS-COND	Six (6) 400-bbl Condensate Tanks	EU-TANKS-PW	Six (6) 400-bbl Produced Water Tanks
EU-LOAD-COND	Condensate Truck Loading	EU-LOAD-PW	Produced Water Truck Loading

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

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

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

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

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

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

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

Description of Control Scheme:

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

C O M B U S T I O N S Y S T E M S
1910 West C Street, Jenks, OK 74037 • tel: 918.299.8877 • fax: 918.299.8870 • email: mrw@mrw-tech.com

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

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

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

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

EMISSION FACTOR RATING: B

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

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

ATTACHMENT S: EMISSIONS CALCULATIONS

SWN Production Company, LLC
Charles Frye Pad
Summary of Criteria Air Pollutant Emissions

Equipment	Unit ID	Emission Point ID	NOx		CO		Total VOC[1]		SO_2		PM Total	
			lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
145-hp Caterpillar G3306 NA Engine	EU-MC4220	EP-MC4220	0.32	1.40	0.64	2.80	0.16	0.70	<0.01	<0.01	0.02	0.09
77-hp Zenith ZPP-644 4.4L Engine	EU-VRU	EP-VRU	0.34	1.49	0.56	2.45	0.34	1.49	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU1	EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU2	EP-GPU2	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU3	EP-GPU3	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU4	EP-GPU4	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU5	EP-GPU5	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
1.0-mmBtu/hr GPU Burner	EU-GPU6	EP-GPU6	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04
0.5-mmBtu/hr Heater Treater	EU-HT1	EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02
0.5-mmBtu/hr Heater Treater	EU-HT2	EP-HT2	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02
Six (6) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	APC-COMB-TKLD	-	-	-	-	-	-	-	-	-	-
Six (6) 400-bbl Produced Water Tanks Routed to Vapor Combustor	EU-TANKS-PW	APC-COMB-TKLD	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	APC-COMB-TKLD	-	-	-	-	4.40	19.28	-	-	-	-
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	APC-COMB-TKLD	-	-	-	-	0.68	2.98	-	-	-	-
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	APC-COMB-TKLD	2.07	9.07	4.13	18.10	1.07	4.66	-	-	0.05	0.20
Vapor Combustor Pilot	EU-PILOT	APC-COMB-TKLD	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fugitive Emissions	EU-FUG	EP-FUG	-	-	-	-	1.49	6.51	-	-	-	-
Fugitive Haul Road Emissions	EU-HR	EP-HR	-	-	-	-	-	-	-	-	2.57	11.27
		Total =	**3.51**	**15.37**	**5.99**	**26.22**	**8.18**	**35.81**	**0.01**	**0.02**	**2.71**	**11.86**

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

SWN Production Company, LLC
Charles Frye Pad
Summary of Hazardous Air Pollutants

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-MC4220	<0.01	<0.01	<0.01	<0.01	0.09	<0.01	-	<0.01	<0.01	0.10
77-hp Zenith ZPP-644 4.4L Engine	EU-VRU	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	-	<0.01	<0.01	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU3	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU4	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU5	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
1.0-mmBtu/hr GPU Burner	EU-GPU6	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
0.5-mmBtu/hr Heater Treater	EU-HT2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Six (6) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Six (6) 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	0.00	-	-	0.08	<0.01	<0.01	0.09
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	0.00	-	-	0.00	0.00	0.00	<0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	-	-	<0.01	<0.01	-	-	0.02	<0.01	<0.01	0.02
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.07	<0.01	0.01	0.09
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
	Total =	**<0.01**	**<0.01**	**0.01**	**<0.01**	**0.10**	**0.01**	**0.18**	**0.01**	**0.02**	**0.33**

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SWN Production Company, LLC
Charles Frye Pad
Summary of Hazardous Air Pollutants (Continued)

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde-hyde	Acrolein	Benzene	Ethyl-benzene	Formalde-hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAP
145-hp Caterpillar G3306 NA Engine	EU-MC4220	0.02	0.01	0.01	<0.01	0.39	0.02	-	<0.01	<0.01	0.45
77-hp Zenith ZPP-644 4.4L Engine	EU-VRU	0.01	0.01	<0.01	<0.01	0.04	0.01	-	<0.01	<0.01	0.07
1.0-mmBtu/hr GPU Burner	EU-GPU1	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU2	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU3	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU4	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU5	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
1.0-mmBtu/hr GPU Burner	EU-GPU6	-	-	<0.01	-	<0.01	-	0.01	<0.01	-	0.01
0.5-mmBtu/hr Heater Treater	EU-HT1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
0.5-mmBtu/hr Heater Treater	EU-HT2	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Six (6) 400-bbl Condensate Tanks Routed to Vapor Combustor	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-
Six (6) 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	-	-	0.37	<0.01	<0.01	0.38
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	-	-	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	<0.01
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	-	-	<0.01	<0.01	-	-	0.09	<0.01	<0.01	0.09
Vapor Combustor Pilot	EU-PILOT	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Fugitive Emissions	EU-FUG	-	-	<0.01	0.02	-	-	0.28	0.02	0.06	0.38
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-
	Total =	**0.03**	**0.02**	**0.02**	**0.02**	**0.44**	**0.03**	**0.80**	**0.03**	**0.07**	**1.44**

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

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\,Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\,Eq.}$		Total CO_2 + $CO_{2\,Eq.}$[1]	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
145-hp Caterpillar G3306 NA Engine	EU-MC4220	155.04	616.05	<0.01	0.01	0.07	0.27	<0.01	<0.01	0.08	0.33	155.19	616.65
77-hp Zenith ZPP-644 4.4L Engine	EU-VRU	55.84	221.89	<0.01	<0.01	0.03	0.10	<0.01	<0.01	0.03	0.12	55.90	222.12
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU2	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU3	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU4	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU5	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
1.0-mmBtu/hr GPU Burner	EU-GPU6	116.98	464.80	<0.01	0.01	0.06	0.22	<0.01	<0.01	0.07	0.26	117.10	465.28
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	232.40	<0.01	<0.01	0.03	0.11	<0.01	<0.01	0.03	0.13	58.55	232.64
0.5-mmBtu/hr Heater Treater	EU-HT2	58.49	232.40	<0.01	<0.01	0.03	0.11	<0.01	<0.01	0.03	0.13	58.55	232.64
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor[2]	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor[2]	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.02	0.78	3.10	19.52	77.56	-	-	-	-	19.52	77.58
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	0.01	0.54	2.15	13.56	53.86	-	-	-	-	13.56	53.87
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	1,754.66	6,972.07	0.03	0.13	0.83	3.28	<0.01	0.01	0.99	3.92	1,756.47	6,979.27
Vapor Combustor Pilot	EU-PILOT	5.29	21.03	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	21.05
Fugitive Emissions	EU-FUG	0.01	0.03	1.29	5.14	32.31	128.40	-	-	-	-	32.32	128.43
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
	Total =	**2,789.69**	**11,084.73**	**2.67**	**10.60**	**66.70**	**265.03**	**0.01**	**0.02**	**1.56**	**6.21**	**2,857.95**	**11,355.96**

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
Charles Frye Pad
Summary of Greenhouse Gas Emissions - Short Tons per Year (Tons)

Equipment	Unit ID	Carbon Dioxide (CO_2)		Methane (CH_4)		Methane (CH_4) as $CO_{2\,Eq.}$		Nitrous Oxide (N_2O)		Nitrous Oxide (N_2O) as $CO_{2\,Eq.}$		Total CO_2 + $CO_{2\,Eq.}$[1]	
		lb/hr	tons/yr[2]	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr[2]	lb/hr	tons/yr	lb/hr	tons/yr
145-hp Caterpillar G3306 NA Engine	EU-MC4220	155.04	679.07	<0.01	0.01	0.07	0.30	<0.01	<0.01	0.08	0.36	155.19	679.74
77-hp Zenith ZPP-644 4.4L Engine	EU-VRU	55.84	244.59	<0.01	<0.01	0.03	0.12	<0.01	<0.01	0.03	0.14	55.90	244.84
1.0-mmBtu/hr GPU Burner	EU-GPU1	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU2	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU3	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU4	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU5	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
1.0-mmBtu/hr GPU Burner	EU-GPU6	116.98	512.36	<0.01	0.01	0.06	0.24	<0.01	<0.01	0.07	0.29	117.10	512.89
0.5-mmBtu/hr Heater Treater	EU-HT1	58.49	256.18	<0.01	<0.01	0.03	0.12	<0.01	<0.01	0.03	0.14	58.55	256.44
0.5-mmBtu/hr Heater Treater	EU-HT2	58.49	256.18	<0.01	<0.01	0.03	0.12	<0.01	<0.01	0.03	0.14	58.55	256.44
Five (5) 400-bbl Condensate Tanks Routed to Vapor Combustor[3]	EU-TANKS-COND	-	-	-	-	-	-	-	-	-	-	-	-
Five (5) 400-bbl Produced Water Tanks Routed to Vapor Combustor[3]	EU-TANKS-PW	-	-	-	-	-	-	-	-	-	-	-	-
Condensate Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-COND	<0.01	0.02	0.78	3.42	19.52	85.50	-	-	-	-	19.52	85.51
Produced Water Truck Loading w/ Vapor Return Routed to Combustor	EU-LOAD-PW	<0.01	0.01	0.54	2.37	13.56	59.37	-	-	-	-	13.56	59.39
15.0-mmBtu/hr Vapor Combustor	APC-COMB-TKLD	1,754.66	7,685.39	0.03	0.14	0.83	3.62	<0.01	0.01	0.99	4.32	1,756.47	7,693.33
Vapor Combustor Pilot	EU-PILOT	5.29	23.18	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	5.30	23.21
Fugitive Emissions	EU-FUG	0.01	0.03	1.29	5.66	32.31	141.53	-	-	-	-	32.32	141.57
Fugitive Haul Road Emissions	EU-HR	-	-	-	-	-	-	-	-	-	-	-	-
	Total =	**2,789.69**	**12,218.82**	**2.67**	**11.69**	**66.70**	**292.14**	**0.01**	**0.02**	**1.56**	**6.84**	**2,857.95**	**12,517.80**

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
Charles Frye Pad
Engine Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	EU-MC4220	EU-VRU
Emission Point ID:	EP-MC4220	EP-VRU
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Controls:	NSCR	NSCR
Horsepower (hp):	145	77.0
Capacity (kW):	NA	57.4
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	527
Annual Fuel Use (mmscf):	12.11	4.62
Fuel Use (mmBtu/hr):	1.25	0.48
Exhaust Flow (acfm):	678	678
Exhaust Temp (°F):	1,101	1,101
Operating Hours:	8,760	8,760
Fuel Heating Value (Btu/scf):	905	905

Uncontrolled Manufacturer Emission Factors [1, 2]

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

Post-Catalyst Emission Factors

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

Uncontrolled Criteria Air Pollutant Emissions

Unit ID:	EU-MC4220		EU-VRU	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	4.31	18.88	NA	NA
NMHC + NOx as NOx	NA	NA	0.34	1.49
CO	4.31	18.88	0.56	2.45
NMNEHC/VOC (does not include HCHO)	0.07	0.31	NA	NA
Total VOC (includes HCHO)	0.16	0.70	NA	NA
NMHC + NOx as VOC	NA	NA	0.34	1.49
SO_2	<0.01	<0.01	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.04	<0.01	<0.01
PM_{COND}	0.01	0.04	<0.01	<0.01
PM_{TOT}	0.02	0.09	0.01	0.04

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

Proposed Criteria Air Pollutant Emissions[3]

Unit ID:	EU-MC4220		EU-VRU	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
NOx	0.32	1.40	NA	NA
NMHC + NOx as NOx	NA	NA	0.34	1.49
CO	0.64	2.80	0.56	2.45
NMNEHC/VOC (does not include HCHO)	0.22	0.96	NA	NA
Total VOC (includes HCHO)	0.16	0.70	NA	NA
NMHC + NOx as VOC	NA	NA	0.34	1.49
SO_2	<0.01	<0.01	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.04	<0.01	<0.01
PM_{COND}	0.01	0.04	<0.01	<0.01
PM_{TOT}	0.02	0.09	0.01	0.04

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

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

Notes:

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

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

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

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

SWN Production Company, LLC
Charles Frye Pad
Engine Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	EU-MC4220	EU-VRU
Emission Point ID:	EP-MC4220	EP-VRU
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Controls:	NSCR	NSCR
Horsepower (hp):	145	77.0
Capacity (kW):	NA	57.4
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	527
Annual Fuel Use (mmscf):	12.11	4.62
Fuel Use (mmBtu/hr):	1.25	0.48
Exhaust Flow (acfm):	678	678
Exhaust Temp (°F):	1,101	1,101
Operating Hours:	8,760	8,760

Proposed HAP Emissions[1]

Unit ID:	EU-MC4220		EU-VRU	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Acetaldehyde	<0.01	0.02	<0.01	0.01
Acrolein	<0.01	0.01	<0.01	0.01
Benzene	<0.01	0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01
Formaldehyde	0.09	0.39	0.01	0.04
Methanol	<0.01	0.02	<0.01	0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01
Total HAP =	**0.10**	**0.45**	**0.01**	**0.07**

AP-42 Emission Factors (lb/mmBtu)

	4S-RB
Pollutant	**3.2-3 (7/00)**
Acetaldehyde	2.79E-03
Acrolein	2.63E-03
Benzene	1.58E-03
Ethylbenzene	2.18E-05
Formaldehyde	2.05E-02
Methanol	3.06E-03
Toluene	5.58E-04
Xylenes	1.95E-04

Notes:
[1] Manufacturer data for uncontrolled Caterpillar G3306 HCHO emissions (g/hp-hr): 0.27

SWN Production Company, LLC
Charles Frye Pad
Engine Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-MC4220**	**EU-VRU**
Emission Point ID:	EP-MC4220	EP-VRU
Make:	Caterpillar	Zenith
Model:	G3306 NA	ZPP-644 4.4L
Design Class:	4S-RB	4S-RB
Controls:	NSCR	NSCR
Horsepower (hp):	145	77.0
Capacity (kW):	NA	57.4
Fuel Use (Btu/hp-hr):	8,625	NA
Fuel Use (Btu/kW-hr):	NA	8,314
Fuel Use (scfh):	1,382	527
Fuel Use (mmBtu/hr):	1.25	0.48
Exhaust Flow (acfm):	678	678
Exhaust Temp (°F):	1,101	1,101
Operating Hours:	8,760	8,760

Manufacturer Emission Factors (g/hp-hr)[1]

CO_2 =	485	NA
CH_4 =	NA	NA

Greenhouse Gas (GHG) Emissions[1]

Pollutant	lb/hr	tonnes/yr	lb/hr	tonnes/yr
CO_2	155.04	616.05	55.84	221.89
CH_4	<0.01	0.01	<0.01	<0.01
N_2O	<0.01	<0.01	<0.01	<0.01
CH_4 as CO_2e	0.07	0.27	0.03	0.10
N_2O as CO_2e	0.08	0.33	0.03	0.12
Total CO_2 + CO_2e =	**155.19**	**616.65**	**55.90**	**222.12**

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

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

Notes:

[1] Conversion to short tons (tons) found in site-wide Summary of Greenhouse Gases - Short Tons per Year (tons) table.

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

SWN Production Company, LLC
Charles Frye Pad
Gas Production Unit Burner Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU6 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU6
Description:	Gas Production Unit Burner
Number of Units:	6
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Criteria Air Pollutant Emissions

Unit ID: **EU-GPU1 - EU-GPU6 (EACH)**

Pollutant	lb/hr	TPY
NOx	0.11	0.48
CO	0.09	0.41
VOC	0.01	0.03
SO_2	<0.01	<0.01
$PM_{10/2.5}$	0.01	0.03
PM_{COND}	<0.01	0.01
PM_{TOT}	0.01	0.04

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

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

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

SWN Production Company, LLC
Charles Frye Pad
Gas Production Unit Burner Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU6 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU6
Description:	Gas Production Unit Burner
Number of Units:	6
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Hazardous Air Pollutant Emissions

Unit ID: **EU-GPU1 - EU-GPU6 (EACH)**

Pollutant	lb/hr	TPY
n-Hexane	<0.01	0.01
Formaldehyde	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Total HAP =	**<0.01**	**0.01**

AP-42 Emission Factors (lb/mmscf)

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

SWN Production Company, LLC
Charles Frye Pad
Gas Production Unit Burner Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	**EU-GPU1 - EU-GPU6 (EACH)**
Emission Point ID:	EP-GPU1 - EP-GPU6
Description:	Gas Production Unit Burner
Number of Units:	6
Burner Design (mmBtu/hr):	1.0
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	9.68
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions[1]

Unit ID: **EU-GPU1 - EU-GPU6 (EACH)**

Pollutant	lb/hr	tonnes/yr
CO_2	116.98	464.80
CH_4	<0.01	0.01
N_2O	<0.01	<0.01
CH_4 as CO_2e	0.06	0.22
N_2O as CO_2e	0.07	0.26
Total CO_2 + CO_2e =	**117.10**	**465.28**

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

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

Notes:
[1] Conversion to short tons (tons) found in site-wide Summary of Greenhouse Gases - Short Tons per Year (tons) table.
[2] CO_2e = CO_2 equivalent (Pollutant times GWP multiplier):
40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO_2 = 1, CH_4 = 25, N_2O = 298

SWN Production Company, LLC
Charles Frye Pad
Heater Treater Emissions Calculations - Criteria Air Pollutants

Equipment Information

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

Criteria Air Pollutant Emissions

Unit ID: **EU-HT1 - EU-HT2 (EACH)**

Pollutant	lb/hr	TPY
NOx	0.06	0.24
CO	0.05	0.20
VOC	<0.01	0.01
SO_2	<0.01	<0.01
$PM_{10/2.5}$	<0.01	0.01
PM_{COND}	<0.01	<0.01
PM_{TOT}	<0.01	0.02

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

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

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

SWN Production Company, LLC
Charles Frye Pad
Heater Treater Emissions Calculations - Hazardous Air Pollutants

Equipment Information

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

Hazardous Air Pollutant Emissions

Unit ID: **EU-HT1 - EU-HT2 (EACH)**

Pollutant	lb/hr	TPY
n-Hexane	<0.01	<0.01
Formaldehyde	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Total HAP =	**<0.01**	**<0.01**

AP-42 Emission Factors (lb/mmscf)

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

SWN Production Company, LLC
Charles Frye Pad
Heater Treater Emissions Calculations - Greenhouse Gases

Equipment Information

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

Greenhouse Gas (GHG) Emissions[1]

Unit ID: **EU-HT1 - EU-HT2 (EACH)**

Pollutant	lb/hr	tonnes/yr
CO_2	58.49	232.40
CH_4	<0.01	<0.01
N_2O	<0.01	<0.01
CH_4 as CO_2e	0.03	0.11
N_2O as CO_2e	0.03	0.13
Total CO_2 + CO_2e =	**58.55**	**232.64**

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

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

Notes:
[1] Conversion to short tons (tons) found in site-wide Summary of Greenhouse Gases - Short Tons per Year (tons) table.
[2] CO_2e = CO_2 equivalent (Pollutant times GWP multiplier):
40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier: CO_2 = 1, CH_4 = 25, N_2O = 298

SWN Production Company, LLC
Charles Frye Pad
Storage Tank Emissions - Criteria Air Pollutants

Tank Information

Unit ID:	**EU-TANKS-COND**	**EU-TANKS-PW**
Emission Point ID:	APC-COMB-TKLD	APC-COMB-TKLD
Contents:	Condensate	Produced Water
Number of Tanks:	6	6
Capacity (bbl) - Per Tank:	400	400
Capacity (gal) - Per Tank:	16,800	16,800
Total Throughput (bbl/yr):	525,600	365,000
Total Throughput (gal/yr):	22,075,200	15,330,000
Total Throughput (bbl/d):	1,440	1,000
Tank Vapor Capture Efficiency:	100%	100%
Captured Vapors Routed to:	VRU	VRU

Uncontrolled Storage Tank Emissions[1]

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Emissions	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Working Losses	9.81	42.98	1.92	8.43
Breathing Losses	2.13	9.34	<0.01	<0.01
Flashing Losses[2]	13.02	57.02	0.71	3.10
Total VOC =	**24.96**	**109.33**	**2.63**	**11.54**
Total VOC + 50% Safety Factor =	**37.44**	**164.00**	**3.95**	**17.31**

Controlled Storage Tank Emissions[2]

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Emissions	**lb/hr**	**TPY**	**lb/hr**	**TPY**
Working Losses	0.20	0.86	0.04	0.17
Breathing Losses	0.04	0.19	<0.01	<0.01
Flashing Losses	0.26	1.14	0.01	0.06
Total VOC =	**0.50**	**2.19**	**0.05**	**0.23**
Total VOC + 50% Safety Factor =	**0.75**	**3.28**	**0.08**	**0.35**
Per Tank =	**0.12**	**0.55**	**0.01**	**0.06**

Notes:

[1] Emissions calculated using ProMax Software. ProMax software provides estimates for working, breathing, and flashing losses associated with total throughput (i.e., emissions from all tanks). 50% compliance margin added to total storage tank emissions.

[2] Vapors routed to vapor combustor with 98% control efficiency in event of any VRU downtime. Overall control efficiency of 98% used for purpose of establishing PTE.

SWN Production Company, LLC
Charles Frye Pad
Storage Tank Emissions - Hazardous Air Pollutants

Uncontrolled Storage Tank Emissions[1]

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	0.79	3.44	0.01	0.04
Benzene	0.01	0.03	<0.01	0.02
Toluene	0.01	0.05	<0.01	0.01
Ethylbenzene	<0.01	0.02	<0.01	<0.01
Xylenes	0.01	0.05	<0.01	0.01
Total HAP =	**0.82**	**3.59**	**0.02**	**0.09**

Controlled Storage Tank Emissions[2]

Unit ID:	EU-TANKS-COND		EU-TANKS-PW	
Pollutant	**lb/hr**	**TPY**	**lb/hr**	**TPY**
n-Hexane	0.04	0.17	<0.01	<0.01
Benzene	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01
Total HAP =	**0.04**	**0.18**	**<0.01**	**<0.01**

Notes:

[1] Emissions calculated using ProMax Software. ProMax software provides estimates for working, breathing, and flashing losses associated with total throughput (i.e., emissions from all tanks). 50% compliance margin added to total storage tank emissions.

[2] Vapors routed to vapor combustor with 98% control efficiency in event of any VRU downtime. Overall control efficiency of 95% used for purpose of establishing PTE.

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

Loading Information

Unit ID:	**EU-LOAD-COND**
Emission Point ID:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Throughput (1000 gal):	22,075.20
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency:	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	VRU

Uncontrolled Loading Emissions[1]

Unit ID: **EU-LOAD-COND**

Pollutant	Avg. lb/hr	TPY
VOC =	**14.67**	**64.25**
n-Hexane	0.28	1.22
Benzene	<0.01	0.01
Toluene	<0.01	0.01
Ethylbenzene	0.00	<0.01
Xylenes	<0.01	0.01
Total HAP =	**0.29**	**1.26**

Controlled Loading Emissions[1]

Pollutant	Avg. lb/hr	TPY
VOC =	**4.40**	**19.28**
n-Hexane	0.08	0.37
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Ethylbenzene	<0.01	<0.01
Xylenes	<0.01	<0.01
Total HAP =	**0.09**	**0.38**

Notes:

[1] Liquid loading emissions were estimated using ProMax run for submerged loading dedicated normal service and overall reduction efficiency of 69%. Vapor balance capture efficiency is 70% and control efficiency is 98%.

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

Loading Information

Unit ID:	**EU-LOAD-PW**
Emission Point ID:	APC-COMB-TKLD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Throughput (1000 gal):	15,330.00
Control Type:	Vapor Return/Combustion
Vapor Capture Efficiency:	70%
Average Fill Rate (gal/hr):	7,500
Captured Vapors Routed to:	VRU

Uncontrolled Loading Emissions[1]

Unit ID: **EU-LOAD-PW**

Pollutant	Avg. lb/hr	TPY
VOC =	**2.27**	**9.94**
n-Hexane	0.00	<0.01
Benzene	<0.01	0.01
Toluene	0.00	<0.01
Ethylbenzene	0.00	<0.01
Xylenes	0.00	<0.01
Total HAP =	**<0.01**	**0.02**

Controlled Loading Emissions[1]

Unit ID: **EU-LOAD-PW**

Pollutant	Avg. lb/hr	TPY
VOC =	**0.68**	**2.98**
n-Hexane	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Ethylbenzene	<0.01	<0.01
Xylenes	<0.01	<0.01
Total HAP =	**<0.01**	**<0.01**

Notes:

[1] Liquid loading emissions were estimated using ProMax run for submerged loading dedicated normal service and overall reduction efficiency of 69%. Vapor balance capture efficiency is 70% and control efficiency is 98%.

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

Criteria and Hazardous Air Pollutant Emissions

Unit ID	Pollutant	Emission Factors[1]	Total Captured Emissions[2]		Combustor Destruction Efficiency	Total Controlled Emissions (Post-Capture and Combustion)	
			lb/hr	TPY	%	lb/hr	TPY
APC-COMB-TKLD	NOx	0.138	-	-	-	2.07	9.07
	CO	0.2755	-		-	4.13	18.10
	PM	7.6	-		-	0.05	0.20
	VOC	Mass Balance	53.25	233.24	98.00%	1.07	4.66
	n-Hexane	Mass Balance	0.99	4.33	98.00%	0.02	0.09
	Benzene	Mass Balance	0.02	0.06	98.00%	<0.01	<0.01
	Toluene	Mass Balance	0.02	0.07	98.00%	<0.01	<0.01
	Ethylbenzene	Mass Balance	0.01	0.03	98.00%	<0.01	<0.01
	Xylenes	Mass Balance	0.02	0.07	98.00%	<0.01	<0.01

Notes:

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

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

[2] Total captured emissions are based on 100% capture efficiency from storage tanks and 70% capture efficiency from truck loading with 95% destruction efficiency from the vapor combustor based on 8,760 hours of operation per year. Captured emissions from sources controlled by VOC combustor shown in following tables.

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

Source	Captured VOC Emissions	
	lb/hr	TPY
Condensate Storage Tanks	37.44	164.00
Produced Water Storage Tanks	3.95	17.31
Condensate Truck Loading	10.27	44.98
Produced Water Truck Loading	1.59	6.96
Total VOC =	**53.25**	**233.24**

Source	Captured HAP Emissions (lb/hr)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	0.79	0.01	0.01	<0.01	0.01
Produced Water Storage Tanks	0.01	<0.01	<0.01	<0.01	<0.01
Condensate Truck Loading	0.19	<0.01	<0.01	0.00	<0.01
Produced Water Truck Loading	0.00	<0.01	0.00	0.00	0.00
Total HAP =	**0.99**	**0.02**	**0.02**	**0.01**	**0.02**

Source	Captured HAP Emissions (TPY)				
	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes
Condensate Storage Tanks	3.44	0.03	0.05	0.02	0.05
Produced Water Storage Tanks	0.04	0.02	0.01	<0.01	0.01
Condensate Truck Loading	0.85	0.01	0.01	<0.01	0.01
Produced Water Truck Loading	<0.01	0.01	<0.01	<0.01	<0.01
Total HAP =	**4.33**	**0.06**	**0.07**	**0.03**	**0.07**

SWN Production Company, LLC
Charles Frye Pad
Vapor Combustor Emissions Calculations - Greenhouse Gases

Equipment Information

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

Greenhouse Gas (GHG) Emissions

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

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

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

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

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

Equipment Information

Source Type/Service	Number of Sources[1]	Em. Factor (lb/hr/source)[2]	Control Efficiency	TOC lb/hr	TOC TPY	VOC Wt %
Valves - Gas	119	9.92E-03	0.00%	1.18	5.17	24.18%
Flanges - Gas	488	8.60E-04	0.00%	0.42	1.84	24.18%
Compressor Seals - Gas	6	1.94E-02	0.00%	0.12	0.51	24.18%
Relief Valves - Gas	38	1.94E-02	0.00%	0.74	3.23	24.18%
			Total TOC (Gas Components) =	**2.45**	**10.75**	-
Valves - Light Oil	129	5.51E-03	0.00%	0.71	3.11	94.29%
Connectors - Light Oil	510	4.63E-04	0.00%	0.24	1.03	94.29%
			Total TOC (Liquid Components) =	**0.95**	**4.15**	-

VOC and Greenhouse Gas Emissions

Source Type/Service	VOC		CH_4		CO_2	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Valves - Gas	0.29	1.25	0.61	2.69	<0.01	0.02
Flanges - Gas	0.10	0.44	0.22	0.96	<0.01	0.01
Compressor Seals - Gas	0.03	0.12	0.06	0.26	<0.01	<0.01
Relief Valves - Gas	0.18	0.78	0.38	1.68	<0.01	0.01
Components in Gas Service =	**0.59**	**2.60**	**1.28**	**5.59**	**0.01**	**0.03**
Valves - Light Oil	0.67	2.94	0.01	0.06	<0.01	<0.01
Connectors - Light Oil	0.22	0.98	<0.01	0.02	<0.01	<0.01
Components in Liquid Service =	**0.89**	**3.91**	**0.02**	**0.08**	**<0.01**	**<0.01**
Total (Gas + Liquid Components) =	**1.49**	**6.51**	**1.29**	**5.66**	**0.01**	**0.03**

SWN Production Company, LLC
Charles Frye Pad
Fugitive Emissions Calculations (Continued)

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

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Flanges - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Components in Gas Service =	**0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**0.00**	**0.01**
Valves - Light Oil	0.04	<0.01	<0.01	<0.01	0.01	0.00	0.06
Connectors - Light Oil	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.02
Components in Liquid Service =	**0.05**	**<0.01**	**<0.01**	**<0.01**	**0.01**	**0.00**	**0.08**
Total (Gas + Liquid Components) =	**0.07**	**<0.01**	**<0.01**	**<0.01**	**0.01**	**0.00**	**0.09**

Hazardous Air Pollutant (HAP) Emissions (TPY)

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	0.02	<0.01	<0.01	<0.01	<0.01	0.00	0.02
Flanges - Gas	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Relief Valves - Gas	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Components in Gas Service =	**0.04**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**0.00**	**0.05**
Valves - Light Oil	0.18	<0.01	0.01	0.01	0.04	0.00	0.25
Connectors - Light Oil	0.06	<0.01	<0.01	<0.01	0.01	0.00	0.08
Components in Liquid Service =	**0.24**	**<0.01**	**0.02**	**0.02**	**0.06**	**0.00**	**0.34**
Total (Gas + Liquid Components) =	**0.28**	**<0.01**	**0.02**	**0.02**	**0.06**	**0.00**	**0.38**

SWN Production Company, LLC
Charles Frye Pad
Fugitive Emissions Calculations (Continued)

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

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

Equipment Type	WH	GPU	HT	LPT	FGC	OT	TT-O	DEHY
Number of Each Type On Pad =	6	6	2	3	2	6	1	0

SWN Production Company, LLC
Charles Frye Pad
Fugitive Emissions Calculations (Continued)

Speciated Gas Analysis[4]

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.0000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.1490%	0.066	0.295%	-	0.01	0.03
Nitrogen	28.013	0.5130%	0.144	0.646%	-	0.02	0.07
Methane	16.042	71.4270%	11.458	51.479%	51.968%	1.28	5.59
Ethane	30.069	17.4910%	5.259	23.629%	23.853%	0.59	2.56
Propane	44.096	6.8020%	2.999	13.476%	13.603%	0.33	1.46
i-Butane	58.122	0.6680%	0.388	1.744%	1.761%	0.04	0.19
n-Butane	58.122	1.8280%	1.062	4.773%	4.819%	0.12	0.52
i-Pentane	72.149	0.3270%	0.236	1.060%	1.070%	0.03	0.11
n-Pentane	72.149	0.4400%	0.317	1.426%	1.440%	0.04	0.15
n-Hexane	86.175	0.1070%	0.092	0.414%	0.418%	0.01	0.04
Other Hexanes	86.175	0.1350%	0.116	0.523%	0.528%	0.01	0.06
Heptanes (as n-Heptane)	100.202	0.0780%	0.078	0.351%	0.354%	0.01	0.04
Benzene	78.114	0.0010%	0.001	0.004%	0.004%	<0.01	<0.01
Toluene	92.141	0.0020%	0.002	0.008%	0.008%	<0.01	<0.01
Ethylbenzene	106.167	0.0002%	0.000	0.001%	0.001%	<0.01	<0.01
Xylenes	106.167	0.0010%	0.001	0.005%	0.005%	<0.01	<0.01
2,2,4-Trimethylpentane	114.230	0.0000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	0.0220%	0.025	0.113%	0.114%	<0.01	0.01
Nonanes (as n-Nonane)	128.255	0.0060%	0.008	0.035%	0.035%	<0.01	<0.01
Decanes (as n-Decane)	142.282	0.0030%	0.004	0.019%	0.019%	<0.01	<0.01
	TOTAL =	**100.00%**	**22.26**	**100.00%**	**100.00%**	**2.48**	**10.85**
		TOTAL HC =	**22.05**	TOTAL VOC =	**24.18%**	**0.59**	**2.60**
				TOTAL HAP =	**0.44%**	**0.01**	**0.05**

SWN Production Company, LLC
Charles Frye Pad
Fugitive Emissions Calculations (Continued)

Speciated Liquids Analysis[4]

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.000%	0.000	0.000%	-	0.00	0.00
Carbon Dioxide	44.010	0.013%	0.006	0.007%	-	<0.01	<0.01
Nitrogen	28.013	0.026%	0.007	0.009%	-	<0.01	<0.01
Methane	16.042	8.861%	1.421	1.836%	1.836%	0.02	0.08
Ethane	30.069	9.965%	2.996	3.870%	3.871%	0.04	0.16
Propane	44.096	11.708%	5.163	6.668%	6.669%	0.06	0.28
i-Butane	58.122	2.480%	1.441	1.862%	1.862%	0.02	0.08
n-Butane	58.122	9.597%	5.578	7.204%	7.206%	0.07	0.30
i-Pentane	72.149	3.683%	2.657	3.432%	3.433%	0.03	0.14
n-Pentane	72.149	6.541%	4.719	6.095%	6.096%	0.06	0.25
n-Hexane	86.175	5.195%	4.477	5.782%	5.783%	0.05	0.24
Other Hexanes	86.175	5.393%	4.647	6.002%	6.003%	0.06	0.25
Heptanes (as n-Heptane)	100.202	10.008%	10.028	12.952%	12.954%	0.12	0.54
Benzene	78.114	0.069%	0.054	0.070%	0.070%	<0.01	<0.01
Toluene	92.141	0.328%	0.302	0.390%	0.390%	<0.01	0.02
Ethylbenzene	106.167	0.307%	0.326	0.421%	0.421%	<0.01	0.02
Xylenes	106.167	1.044%	1.108	1.432%	1.432%	0.01	0.06
2,2,4-Trimethylpentane	114.230	0.000%	0.000	0.000%	0.000%	0.00	0.00
Octanes (as n-Octane)	114.229	7.566%	8.643	11.162%	11.164%	0.11	0.46
Nonanes (as n-Nonane)	128.255	4.597%	5.896	7.615%	7.616%	0.07	0.32
Decanes (as n-Decane)	142.282	12.619%	17.955	23.190%	23.193%	0.22	0.96
	TOTAL =	**100.00%**	**77.43**	**100.00%**	**100.00%**	**0.95**	**4.15**
		TOTAL HC =	**77.41**	TOTAL VOC =	**94.29%**	**0.89**	**3.91**
				TOTAL HAP =	**8.10%**	**0.08**	**0.34**

Notes:

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

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

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

[4] Gas and liquids analyses located in Attachment L.

SWN Production Company, LLC
Charles Frye Pad
Fugitive Haul Road Emissions

Facility Data[1]

Vehicle Type	Light Vehicles (Pick-ups and Cars)	Medium Trucks (Service Trucks)	Heavy Trucks (Tanker Trucks)[2]
Average vehicle weight ((empty + full)/2) (tons)	2	15	23.5
Number of wheels per vehicle type (w)	4	10	18
Average number of round trips/day/vehicle type	6	3	13
Distance per round trip (miles/trip)	0.99	0.99	0.99
Vehicle miles travelled (miles/day)	6.36	3.18	12.72
Number of days operational (days/yr)	365	365	365
Vehicle miles travelled VMT (miles/yr)	2,321	1,161	4,643
Average vehicle speed S (mph)	10	10	10
Average number of round trips/hour/vehicle type	0.36	0.18	0.71
Average number of round trips/year/vehicle type	2,344	1,172	4,687
Estimated maximum number of round trips/hour/vehicle type	3	3	2
Estimated maximum number of round trips/day/vehicle type	6	4	15
Estimated maximum number of round trips/year/vehicle type	2,300	1,533	5,688

190	Average Tanker Volume (bbl)
7,980	Gallons Tanker Volume
1,000	bwpd
1,440	bopd
12.84	Tanker Trucks per Day
1,475	Length Leased Access Road (ft)
1,140	Longest Pad Side (ft)
5,230	Total Round Trip Feet

Formula & Calculation Inputs

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

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

where:

	Rate	Units	Comment
Days per year	365		
Annual average hours per day of road operations	18		
k = PM Particle Size Multiplier	4.90	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)
k = PM10 Particle Size Multiplier	1.50	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM_{10})
k = PM2.5 Particle Size Multiplier	0.15	lb/VMT	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 ($PM_{2.5}$)
s = Surface Material Silt Content	3.9	%	State Default Data from AP-42 Data (1999 NEI Data)
P = Number of days > 0.01 inch of rain	150	days/year	AP-42 Section 13.2.2 (11/06), Figure 13.2.2-1
a = PM Constant	0.70	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM)
a = PM10 & PM2.5 Constant	0.90	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2 (PM_{10} & $PM_{2.5}$)
b = PM, PM10, & PM2.5 Constant	0.45	unitless	AP-42 Section 13.2.2 (11/06), Table 13.2.2-2
Total hourly fleet vehicle miles travelled (miles/hr)	1.24	VMT/hr	
Total annual fleet vehicle miles travelled (miles/yr)[3]	8,125.22	VMT/yr	
Average wheels[4]	13		
Average vehicle weight of the fleet (W)[5]	16.1	tons	
Moisture Ratio	1.00		Estimated based on 0.2% uncontrolled surface water content assuming no watering
Control Efficiency (CF)	0.00	%	Based on Moisture Ratio and Figure 13.2.2-2 Control

EPA - BID Document 13.2.2 - 1998

SWN Production Company, LLC
Charles Frye Pad
Fugitive Haul Road Emissions (Continued)

Vehicle Type	Emission Factors			Control Efficiency	Total Vehicle Miles Travelled		Uncontrolled Emission Rates			Uncontrolled Emission Rates		
	PM	PM_{10}	$PM_{2.5}$				Total PM	Total PM_{10}	$PM_{2.5}$	Total PM	Total PM_{10}	$PM_{2.5}$
	(lbs/VMT)	(lbs/VMT)	(lbs/VMT)	(%)	(VMT/hr)	(VMT/yr)	(lb/hr)	(lb/hr)	(lb/hr)	(tons/yr)	(tons/yr)	(tons/yr)
Light Vehicles	2.80	0.69	0.07	0.00	0.35	2,321.49	0.99	0.24	0.02	3.25	0.80	0.08
Medium Trucks	2.80	0.69	0.07	0.00	0.18	1,160.75	0.50	0.12	0.01	1.63	0.40	0.04
Heavy Trucks	2.80	0.69	0.07	0.00	0.71	4,642.98	1.98	0.48	0.05	6.51	1.59	0.16
			Total =	**0.00**	**1.24**	**8,125.22**	**3.47**	**0.85**	**0.08**	**11.39**	**2.78**	**0.28**

Notes:

1) Facility vehicle data based on estimates, GP5.1 and AP-42 13.2.2-2 defaults for industrial unpaved roads
2) Tank trucker average vehicle weight as $(W_{(empty)}+W_{(full)})/2 = (7 + 40)/2 = 23.7$ tons
3) Average vehicle miles travelled (VMT/yr) as (No. of round trip/vehicle * No. of vehicles/type * Roundtrip miles/trip)* 365 days/yr * No. of vehicle type)
4) Average wheels calculated as average of (No. of wheels per vehicle type * No. of vehicle/type)
5) Average vehicle fleet calculated as (Average weight of vehicle type * Percentage of each vehicle type on unpaved surface). Percentage of each vehicle type= $VMT_{vehicle\ type}/VMT$
6) Minimum one-per-day average pick-up trucks and service trucks even if tanker not required every day.
7) Per EPA BID calculations, all emissions based on average trips. Estimated maximum hourly, daily and yearly trips provided for information only.

Calculation of Emission Factors (AP-42, 13.2.2)

Equation 1a: $EF = k(s/12)^a (W/3)^b$ *where k, a, and b are empirical constants and*
EF = size-specific emission factor (lb/VMT)
s = surface material silt content %
W = mean vehicle weight (tons)

Equation 2: $EF_{ext} = EF*((365-P)/365)$ *where:*
EF_{ext} *= annual size-specific emission factor extrapolated for natural mitigation, lb/VMT*
EF = emission factor from Equation 1a
P = number of days in a year with at least 0.01 inches of precipitation

Calculation of Emissions

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

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-MC4220	0.32	1.40	0.64	2.80	0.16	0.70	<0.01	<0.01	0.02	0.09	0.02	0.09	155.19	679.74
EP-VRU	0.34	1.49	0.56	2.45	0.34	1.49	<0.01	<0.01	0.01	0.04	0.01	0.04	55.90	244.84
EP-GPU1	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-GPU2	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-GPU3	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-GPU4	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-GPU5	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-GPU6	0.11	0.48	0.09	0.41	0.01	0.03	<0.01	<0.01	0.01	0.04	0.01	0.04	117.10	512.89
EP-HT1	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.02	58.55	256.44
EP-HT2	0.06	0.24	0.05	0.20	<0.01	0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.02	58.55	256.44
APC-COMB-TKLD	2.08	9.09	4.14	18.12	6.15	26.92	<0.01	<0.01	0.05	0.21	0.05	0.21	1,794.85	7,861.44
TOTAL	3.51	15.37	5.99	26.22	6.69	29.30	0.01	0.02	0.14	0.59	0.14	0.59	2,825.63	12,376.24

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

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

ATTACHMENT T – FACILITY-WIDE HAP CONTROLLED EMISSIONS SUMMARY SHEET

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

Emission Point ID #	Formaldehyde		Benzene		Toluene		Ethylbenzene		Xylenes		Hexane		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-MC4220	0.09	0.39	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.10	0.45
EP-VRU	0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	0.01	0.07
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-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
APC-COMB-TKLD	<0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	0.10	0.45	0.11	0.47
TOTAL	0.10	0.44	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.12	0.51	0.24	1.06

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

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

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

ATTACHMENT U: CLASS I LEGAL ADVERTISEMENT

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

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that SWN Production Company, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a G70-C General Permit Registration for a natural gas production facility (Charles Frye Pad) located near Valley Grove in Ohio County, West Virginia. From Interstate 70 east of Wheeling, WV, take Exit 10 and turn left onto CR 65 (Cabella Drive). Travel 0.32 miles if exiting from I-70 east (0.55 miles if exiting from I-70 west) and turn right onto CR 41/1 (McCutcheon Road). Travel 0.72 miles on CR 41/1 and entrance to well pad will be on the left. Latitude and longitude coordinates are: 40.05442, -80.5818.

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

Nitrogen Oxides (NOx)	15.37 tons/yr
Carbon Monoxide (CO)	26.22 tons/yr
Volatile Organic Compounds (VOC)	35.81 tons/yr
Sulfur Dioxide (SO_2)	0.02 tons/yr
Particulate Matter (PM)	11.86 tons/yr
Acetaldehyde	0.03 tons/yr
Acrolein	0.02 tons/yr
Benzene	0.02 tons/yr
Ethylbenzene	0.02 tons/yr
Formaldehyde	0.44 tons/yr
Methanol	0.03 tons/yr
n-Hexane	0.80 tons/yr
Toluene	0.03 tons/yr
Xylenes	0.07 tons/yr
Carbon Dioxide	12,218.82 tons/yr
Methane	11.69 tons/yr
Nitrous Oxide	0.02 tons/yr
CO_2 Equivalent	12,517.80 tons/yr

Operations is planned to begin on or about October 25, 2016. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1250, during normal business hours.

Dated this XXth of September, 2016

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