G35-D General Permit Application

East Comet Natural Gas Compressor Site

Grafton, West Virginia

Prepared By:

Environmental Resources Management, Inc.
Hurricane, West Virginia

August 2017

ARSENAL MIDSTREAM

People Powered. Asset Strong.

August 29, 2017

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

RE: G35-D General Permit Registration Application
Arsenal Midstream
East Comet Natural Gas Compression Site
Facility ID#

Dear Director Durham:

Enclosed are one (1) original hard copy and two (2) complete PDFs included on CD-ROM of a G35-D General Permit Registration Application for the authority to construct the Comet natural gas compression site located in Taylor County, West Virginia.

A legal advertisement will be published in the next few days and proof of publication will be forwarded as soon as it is received. Please contact me for payment of the application fee by credit card.

If you have any questions concerning this permit application, please contact me at (724) 940-1112 or by email at myingling@arsenalresources.com.

Sincerely,

Meghan M.B. Yingling
Environmental Compliance Manager
Arsenal Midstream

Enclosures

Cc: Bill Veigel, Sr. Director of Production, Arsenal Resources
Stacey Lucas, V.P. HSE, Arsenal Resources
Grant Morgan, ERM

6031 Wallace Road Ext. Suite 300
Wexford, PA 15090
P: 724-940-1100
F: 800-428-0981
www.arsenalresources.com

1.0 INTRODUCTION NARRATIVE

Arsenal Midstream, LLC submits this G35-D Class II General Permit application to the West Virginia Department of Environmental Protection's Department of Air Quality (WVDAQ) for the East Comet Compressor Station (Comet) site located in Taylor County, West Virginia. This application addresses the operational activities associated with the compression of natural gas at the Comet Station.

Arsenal wishes to submit this G35-D to repermit the following equipment currently at the Comet Station:

- Three (3) 1380 hp G3516ULB Compressor Engines;
- One (1) 670 hp G3508 TALE Compressor Engine;
- One (1) Exterran 10 mmscf/day Dehydration Unit;
- One (1) 0.20 MMBtu/hr Glycol Reboiler;
- One (1) Exterran 45 mmscf/day Dehydration Unit;
- One (1) 1.00 MMBtu/hr Glycol Reboiler;
- Two (2) 100 bbl Produced Water tanks;
- One (1) 100 bbl Regen Overhead Condensation Tank;
- Six (6) 520 gal Oil storage tanks;
- One (1) 520 gal TEG glycol tank;
- One (1) 600 gal rainwater storage tank; and
- One (1) 300 gal Methanol Tank.

In addition to the repermitting of the equipment above, Arsenal submits this permit application for the authority to construct the following emission units:

- One (1) 1380 hp G3516ULB Compressor Engine.

Statement of aggregation

The East Comet Compressor Station is located in Taylor County, WV and operated by Arsenal. Stationary sources of air pollutants may require aggregation of total emission levels if these sources share the same industrial grouping, are operating under common control, and are classified as contiguous or adjacent properties. Arsenal operates Comet with the same industrial grouping as nearby facilities, and some of these facilities are under common control. However, the Comet site is not subject to the aggregation of stationary emission sources because these sites do not meet the definition of contiguous or adjacent facilities.

The Comet Station operates under SIC code 1311 (Crude Petroleum and Natural Gas Extraction). There are surrounding sites operated by Arsenal that share the same two digit major SIC code of 13 for Crude Petroleum and Natural Gas Extraction. Therefore, the Comet Station does share the same SIC codes as the surrounding wells and compressor stations.

Arsenal is the sole operator of the Comet Station. Arsenal is also the sole operator of other production sites and compressor stations in the area. Therefore, Arsenal does qualify as having nearby operations under common control.

Based on the EPA's Source Determination Guidance for Certain Emission Units in the Oil and Natural Gas Sector, effective on August 2, 2016, the term "adjacent" is defined as follows:

> *Equipment and activities in the oil and gas sector that are under common control will be considered part of the same source if they are located near each other – specifically, if they are located on the same site or on sites that share equipment and are within ¼ mile of each other.*

The Comet compressor station does not share equipment with the surrounding wells and compressor stations.

The additional consideration that the EPA put forth in the Source Determination Guidance is that the facilities must be within ¼ mile to be considered as adjacent facilities. Comet Compressor station does not fall within the ¼ mile rule and therefore, does not meet the definition of contiguous or adjacent properties.

Based on the above reasoning, Arsenal is not subject to the aggregation of stationary emission sources since the stationary sources are not considered contiguous or adjacent facilities.

2.0 REGULATORY DISCUSSION

This section outlines the State air quality regulations that could be reasonably expected to apply to the Comet Station and makes an applicability determination for each regulation based on activities conducted at the site and the emissions of regulated air pollutants. This review is presented to supplement and/or add clarification to the information provided in the WVDEP G35-D permit application forms. The West Virginia State Regulations address federal regulations, including Prevention of Significant Deterioration permitting, Title V permitting, New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants.

The regulatory requirements in reference to Comet are described in detail in the below section.

West Virginia State Air Regulations

45 CSR 02 – To Prevent and Control Particulate Air Pollution From Combustion of Fuel in Indirect Heat Exchangers

The reboilers associated with gas production units are indirect heat exchangers that combust natural gas but are exempt from this regulation since the heat input capacities are less than 10 MMBtu/hr.

45 CSR 04 – To Prevent and Control the Discharge of Air Pollutants into the Air Which Causes or Contributes to an Objectionable Odor

Operations conducted at the Comet Station are subject to this requirement. Based on the nature of the process at the well pad, the presence of objectionable odors is unlikely.

45 CSR 06 – Control of Air Pollution from the Combustion of Refuse

The Comet Compressor Station does not have a combustion device and is therefore not subject to this rule.

45 CSR 10 – To Prevent and Control Air Pollution from the Emission of Sulfur Oxides

The reboilers combust natural gas but are exempt from this regulation since the heat input capacities are less than 10 MMBtu/hr.

45 CSR 13 – Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants

This G35-D permit application is being submitted for the operational activities associated with Arsenal's compression of natural gas.

45 CSR 14 – Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration

Federal construction permitting programs regulate new and modified sources of attainment pollutants under Prevention of Significant Deterioration (PSD). The G35-D applicability criterion excludes facilities that meet the definition of a major source as defined in 45 CSR 19 for being eligible for the general permit.

Operation of equipment at the Comet Station will not exceed emission thresholds established by this permitting program. Arsenal will monitor future construction and modification activities at the site closely and will compare any future increase in emissions with the PSD thresholds to ensure these activities will not trigger this program.

45 CSR 16 - Standards of Performance for New Stationary Sources (NSPS)

45 CSR 16 applies to all registrants that are subject to any of the NSPS requirements described in more detail in the Federal Regulations section.

45 CSR 19 – Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contributed to Non-attainment

Federal construction permitting programs regulate new and modified sources of nonattainment pollutants under Non-Attainment New Source Review (NNSR). The G35-D applicability criterion excludes facilities that meet the definition of a major source as defined in 45 CSR 19 for being eligible for the general permit.

Taylor County, WV is in attainment for all pollutants with the National Ambient Air Quality Standards (NAAQS). Therefore, this regulation would not apply to the Comet Station.

45 CSR 25 – Control of Air Pollution from Hazardous Waste Treatment, Storage, and Disposal Facilities

No hazardous waste will be burned at this well site; therefore, it is not subject to this hazardous waste rule.

45 CSR 30 – Requirements for Operating Permits

45 CSR 30 applies to the requirements of the federal Title V operating permit program (40 CFR 70). The major source thresholds for the Title V operating permit program regulations are 10 tons per year (tpy) of a single hazardous air pollutant (HAP), 25 tpy of any combination of HAPs, or 100 tpy of all other regulated pollutants.

The potential emissions of all regulated pollutants at the proposed facility are below the corresponding major source threshold(s). Therefore, the Comet Station will not be a major source under the Title V program.

45 CSR 34 – National Emission Standards for Hazardous Air Pollutants (NESHAP)

45 CSR 34 applies to all registrants that are subject to any of the NESHAP requirements. The NESHAP Rules are discussed further in the Federal Regulation section of this document.

Federal Regulations

New Source Performance Standards

40 CFR 60, Subpart OOOO (Standards of Performance for Crude oil and Natural Gas Production, Transmission and Distribution)

Subpart OOOO establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities that commence construction, modification or reconstruction between August 23, 2011 and September 18, 2015. The applicable provisions and requirements of Subpart OOOO are included under the G35-D permit.

The Comet Station is a reciprocating compressor engine affected facility under OOOO.

There are several equipment types that have been installed at Comet that do not meet the affected facility definitions as specified by EPA. These include:

- Storage vessels: Emissions from each storage vessel were determined to be below 6 tons per year (tpy) of VOC. Therefore, the produced water tanks are not affected storage vessels.

- Pneumatic devices: All pneumatic devices installed at the East Comet facility are either low-continuous bleed or intermittent bleed and do not qualify as affected sources.

Subpart OOOOa (Standards Of Performance For Crude Oil And Natural Gas Facilities For Which Construction, Modification, Or Reconstruction Commenced After September 18, 2015)

The East Comet Station does have equipment that is an affected facility under OOOOa. The East Comet Station will qualify as a collection of Fugitive Components Affected Facility. As a Fugitive Component Affected Facility, in order to comply, LDAR monitoring at the East Comet site must be performed within 60 days of startup of production and then quarterly thereafter.

The East Comet Station is a reciprocating compressor engine affected facility under OOOOa.

There are several equipment types that have been installed at East Comet that do not meet the affected facility definitions as specified by EPA. These include:

- Storage vessels: Emissions from each storage vessel were determined to be below 6 tons per year (tpy) of VOC. Therefore, the produced water tanks are not affected storage vessels.
- Pneumatic devices: All pneumatic devices installed at the East Comet facility are either low-continuous bleed or intermittent bleed and do not qualify as affected sources.

40 CFR 60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines)

The Comet station has compressor engines that were constructed after June 12, 2006 and are subject to this rule. Four (4) of these engines are non-emergency, spark-ignition, lean-burn reciprocating internal combustion engine with a horsepower rating of 1380 bhp. These units are subject to the following emission standards:

- NOx – 1.0 g/bhp-hr
- CO – 2.0 g/bhp-hr
- VOCs – 0.7 g/bhp-hr

The Comet station has a fifth engine that is also subject to JJJJ due to its construction date being after June 12, 2006. This engine is a non-emergency, spark ignition, lean-burn reciprocating

internal combustion engine with a horsepower rating of 670 bhp. This unit is subject to the following emission standards:

- NOx – 1.0 g/bhp-hr
- CO – 2.0 g/bhp-hr
- VOCs – 0.7 g/bhp-hr

No additional NSPS are expected to be applicable to this facility.

National Emissions Standards for Hazardous Air Pollutants

The following NESHAP included in the G35-D permit are not applicable to the Comet facility:

- *40 CFR 63 Subpart HH (National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities).*

The engines at Comet are subject to NESHAP ZZZZ 40 CFR 63.6590 (c) *Stationary RICE subject to Regulations under 40 CFR Part 60.* An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

(c)(1) A new or reconstructed stationary RICE located at an area source.

No additional NESHAP are expected to be applicable to this facility.

west virginia department of environmental protection

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

G35-D GENERAL PERMIT REGISTRATION APPLICATION

PREVENTION AND CONTROL OF AIR POLLUTION IN REGARD TO THE CONSTRUCTION, MODIFICATION, RELOCATION, ADMINISTRATIVE UPDATE AND OPERATION OF NATURAL GAS COMPRESSOR AND/OR DEHYDRATION FACILITIES

☐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): **Arsenal Midstream, LLC**

Federal Employer ID No. (FEIN): **47-1919654**

Applicant's Mailing Address: **65 Professional Place Suite 200**

City: **Bridgeport** | State: **WV** | ZIP Code: **26330**

Facility Name: **East Comet Compressor Station**

Operating Site Physical Address: **Route 50E, Wendel Road, Wendel, Taylor County, WV**
If none available, list road, city or town and zip of facility.

City: **Wendel** | Zip Code: **26354** | County: **Taylor**

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Latitude: **39.30600**
Longitude: **-80.10700**

SIC Code: **1311**

NAICS Code: **211111**

DAQ Facility ID No. (For existing facilities)
091-00034

CERTIFICATION OF INFORMATION

This G35-D General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of the Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. **Any administratively incomplete or improperly signed or unsigned G35-D Registration Application will be returned to the applicant. Furthermore, if the G35-D forms are not utilized, the application will be returned to the applicant. No substitution of forms is allowed.**

I hereby certify that Meghan Yingling 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 G35-D General Permit Registration Application and any supporting documents appended hereto is, to the best of my knowledge, true, accurate and complete, and that all reasonable efforts have been made to provide the most comprehensive information possible.

Responsible Official Signature: _____
Name and Title: Stacey A. Lucas, VP HSE/Compliance Phone: 724-940-1118 Fax:
Email: slucas@arsenalresources.com Date: 8/29/17

If applicable:
Authorized Representative Signature: _____
Name and Title: **Meghan M.B. Yingling, Environmental Compliance Manager** Phone: **724-940-1112** Fax:
Email: **myingling@arsenalresources.com** Date: 8-29-17

If applicable:
Environmental Contact
Name and Title: **Meghan M.B. Yingling, Environmental Compliance Manager** Phone: **724-940-1112** Fax:
Email: **myingling@arsenalresources.com** Date:

OPERATING SITE INFORMATION
Briefly describe the proposed new operation and/or any change(s) to the facility: Addition of one (1) 1380 hp compressor engine.
Directions to the facility: From I-79 take Exit 124 go East on Route 279 for 2.5 miles to junction with US Route 50, Turn Left onto US Route 50 east. Go 5.3 miles to Wendel Road (RT 36). Turn right and go 1.2 miles to double white gates on left. Go 0.3 miles to compressor station on right.

ATTACHMENTS AND SUPPORTING DOCUMENTS	
I have enclosed the following required documents:	
Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22). ☐ Check attached to front of application. ☐ I wish to pay by electronic transfer. Contact for payment (incl. name and email address): ☒ I wish to pay by credit card. Contact for payment (incl. name and email address): **Meghan Yingling myingling@arsenalresources.com** ☒$500 (Construction, Modification, and Relocation) ☐$300 (Class II Administrative Update) ☒$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ and/or OOOO and/or OOOOa [1] ☐$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH [2] [1] Only one NSPS fee will apply. [2] Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ. *NSPS and NESHAP fees apply to new construction or if the source is being modified.*	
☒ Responsible Official or Authorized Representative Signature (if applicable)	
☒ Single Source Determination Form **(must be completed 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
☒ G35-D Section Applicability Form – Attachment H	☒ Emission Units/ERD Table – Attachment I
☒ Fugitive Emissions Summary Sheet – Attachment J	
☒ 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 K	
☒ Natural Gas Fired Fuel Burning Unit(s) Data Sheet (GPUs, Heater Treaters, In-Line Heaters if applicable) – Attachment L	
☒ Internal Combustion Engine Data Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment M	
☒ Tanker Truck Loading Data Sheet (if applicable) – Attachment N	
☒ Glycol Dehydration Unit Data Sheet(s) (include wet gas analysis, GRI- GLYCalc™ input and output reports and information on reboiler if applicable) – Attachment O	
☒ Pneumatic Controllers Data Sheet – Attachment P	
☐ Centrifugal Compressor Data Sheet – Attachment Q	
☒ Reciprocating Compressor Data Sheet – Attachment R	
☒ Blowdown and Pigging Operations Data Sheet – Attachment S	
☐ Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment T	
☒ Emission Calculations (please be specific and include all calculation methodologies used) – Attachment U	
☒ Facility-wide Emission Summary Sheet(s) – Attachment V	
☒ Class I Legal Advertisement – Attachment W	
☒ 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

ATTACHMENT A - SINGLE SOURCE DETERMINATION FORM

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

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

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

Is there equipment and activities in the same industrial grouping (defined by SIC code)?
Yes ☐ No ☒

Is there equipment and activities under the control of the same person/people?
Yes ☐ No ☒

Is there equipment and activities located on the same site or on sites that share equipment and are within ¼ mile of each other?
Yes ☐ No ☒

Attachment B
(Not Applicable)

Attachment C

WEST VIRGINIA
STATE TAX DEPARTMENT

BUSINESS REGISTRATION CERTIFICATE

ISSUED TO:
ARSENAL MIDSTREAM LLC
65 PROFESSIONAL PL 200
BRIDGEPORT, WV 26330-1889

BUSINESS REGISTRATION ACCOUNT NUMBER: **2306-9776**

This certificate is issued on: **05/17/2017**

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

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

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

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

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

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

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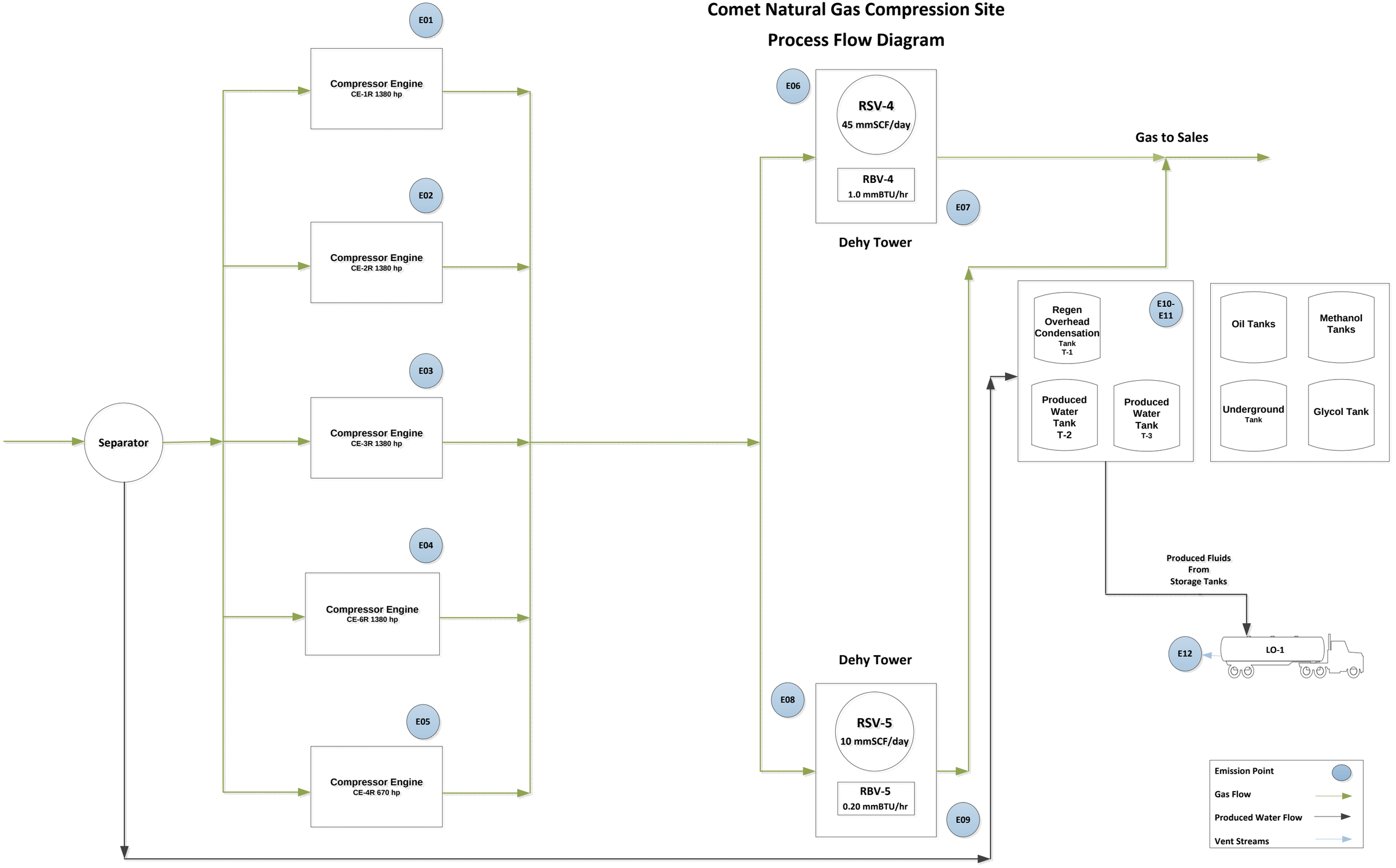
L0904785088

Attachment D

Attachment D

Comet Natural Gas Compression Site

Process Flow Diagram



Attachment E

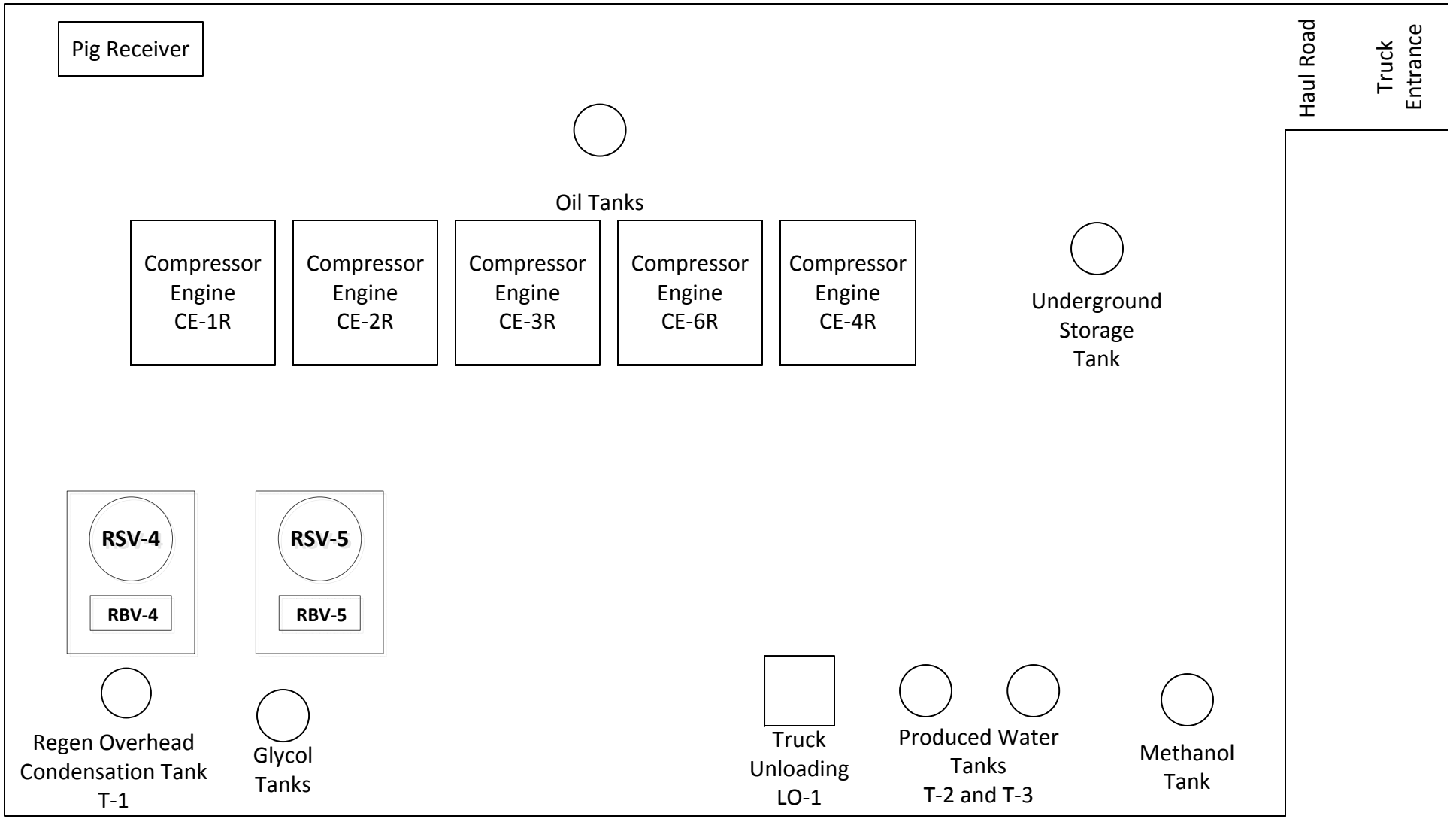
Attachment E – Process Description

Pipeline quality natural gas enters the site and is routed through a knockout separator. From the separation unit, gas flows to the produced water tanks (T-2 and T-3). From there, the gas flows through four (4) 1380 hp G3516 Compressor engines (CE-1R, CE-2R, CE-3R, and CE-6R) and one (1) 670 hp G3508 Compressor Engine (CE-4R). From the compressors, the gas flows through one (1) 10 MMSCF/D and one (1) 45 MMSCF/D Tri-Ethylene Glycol (TEG) Dehydration units (RSV-4 and RSV-5) to dry gas prior to delivery to the sales gas lines. From the dehydration units the gas enters the sales line.

Fluids are removed from the site via tanker truck on an as needed basis.

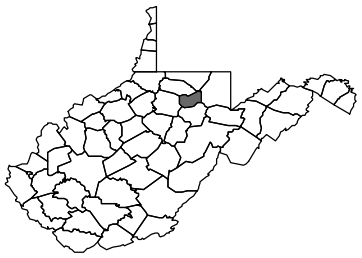
Attachment F

ATTACHMENT F – PLOT PLAN

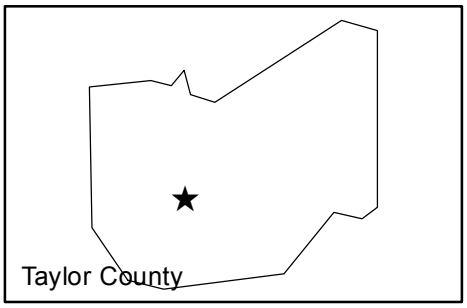


East Comet Natural Gas Compression Site
LAT: 39.30600 LON: -80.10700

Attachment G



West Virginia



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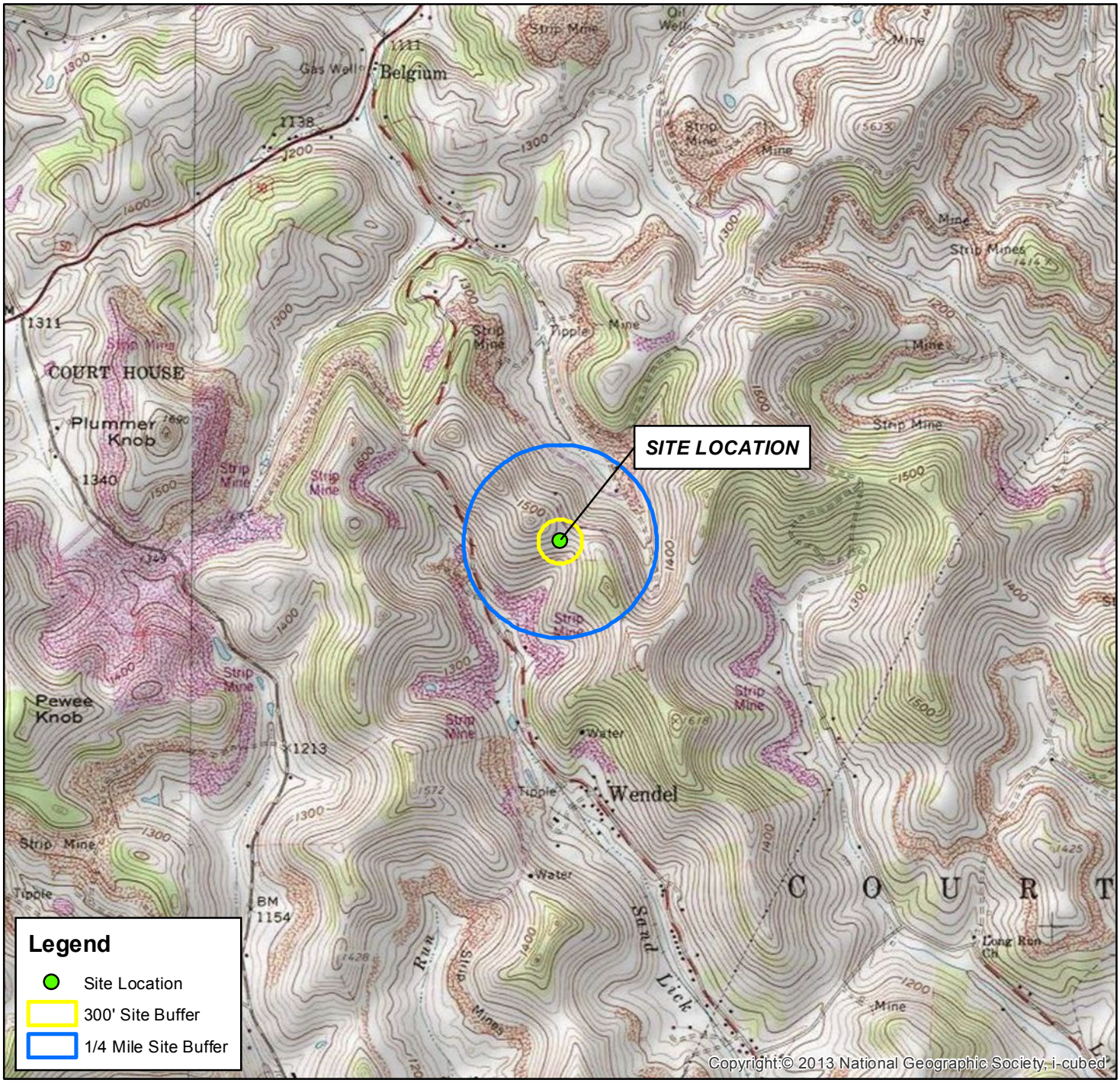
TAYLOR COUNTY
WEST VIRGINIA



USGS 1:24K 7.5' Quadrangle:
Grafton, WV

SITE LOCATION MAP

ERM	**Arsenal Resources** Arsenal East Comet Compressor Station Taylor County, West Virginia	GIS Review: GM CHK'D: GM 0419542
Drawn By: SRV-8/3/17	**Environmental Resources Management**	ATTACHMENT G

J:\Projects\SiteLocationMaps\Arsenal Resources_MXD\AttachmentG-SiteLocationMap_Comet_20170803.mxd - 8/3/2017|SRV

Attachment H

ATTACHMENT H – G35-D SECTION APPLICABILITY FORM

General Permit G35-D Registration
Section Applicability Form

General Permit G35-D was developed to allow qualified applicants to seek registration for a variety of sources. These sources include 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 G35-D allows the registrant to choose which sections of the permit they are seeking registration under. Therefore, please mark which additional sections that you are applying for registration under. If the applicant is seeking registration under multiple sections, please select all that apply. Please keep in mind, that if this registration is approved, the issued registration will state which sections will apply to your affected facility.

GENERAL PERMIT G35-D APPLICABLE SECTIONS	
☒ Section 5.0	Storage Vessels Containing Condensate and/or Produced Water[1]
☐ Section 6.0	Storage Vessel Affected Facility (NSPS, Subpart OOOO/OOOOa)
☐ Section 7.0	Control Devices and Emission Reduction Devices not subject to NSPS Subpart OOOO/OOOOa and/or NESHAP Subpart HH
☒ Section 8.0	Small Heaters and Reboilers not subject to 40CFR60 Subpart Dc
☐ Section 9.0	Pneumatic Controllers Affected Facility (NSPS, Subpart OOOO/OOOOa)
☐ Section 10.0	Centrifugal Compressor Affected Facility (NSPS, Subpart OOOO/OOOOa)[2]
☒ Section 11.0	Reciprocating Compressor Affected Facility (NSPS, Subpart OOOO/OOOOa)[2]
☒ Section 12.0	Reciprocating Internal Combustion Engines, Generator Engines. Microturbine Generators
☒ Section 13.0	Tanker Truck Loading[3]
☒ Section 14.0	Glycol Dehydration Units[4]
☒ Section 15.0	Blowdown and Pigging Operations
☒ Section 16.0	Fugitive Emission Components (NSPS, Subpart OOOOa)

1 *Applicants that are subject to Section 5 may also be subject to Section 6 if the applicant is subject to the NSPS, Subpart OOOO/OOOOa control requirements or the applicable control device requirements of Section 7.*

2 *Applicants that are subject to Section 10 and 11 may also be subject to the applicable RICE requirements of Section 12.*

3 *Applicants that are subject to Section 13 may also be subject to control device and emission reduction device requirements of Section 7.*

4 Applicants that are subject to Section 14 may also be subject to the requirements of Section 8 (reboilers). Applicants that are subject to Section 14 may also be subject to control device and emission reduction device requirements of Section 7.

Attachment I

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 K 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]
CE-1R	E01	Caterpillar G3516 ULB Compressor Engine	4/2012	10/12/2011	1380 bhp	Existing	Oxidation Catalyst	1D
CE-2R	E02	Caterpillar G3516 ULB Compressor Engine	5/2012	10/12/2011	1380 bhp	Existing	Oxidation Catalyst	2D
CE-3R	E03	Caterpillar G3516 ULB Compressor Engine	4/2015	After 2010	1380 bhp	Existing	Oxidation Catalyst	3D
CE-6R	E04	Caterpillar G3516 ULB Compressor Engine	6/2017	3/27/2006	1380 bhp	New	Oxidation Catalyst	4D
CE-4R	E05	Caterpillar G3508 TALE	1/2014	5/2008	670 bhp	Existing	Oxidation Catalyst	5D
RSV-4	E06	TEG Dehydration Still Vent	8/2014	8/2014	45 mmSCF/day	Existing	N/A	N/A
RBV-4	E07	TEG Dehydration Reboiler	8/2014	8/2014	1.0 mmBTU/hr	Existing	N/A	N/A
RSV-5	E08	TEG Dehydration Still Vent	1/2014	1/2014	10 mmSCF/day	Modification	N/A	N/A
RBV-5	E09	TEG Dehydration Reboiler	1/2014	1/2014	0.20 mmBTU/hr	Existing	N/A	N/A
T-2	E10	Produced Water Tank	9/2011	9/2011	100 bbl	Existing	N/A	N/A
T-3	E11	Produced Water Tank	9/2011	9/2011	100 bbl	Existing	N/A	N/A
LO-1	E12	Produced Water Tank Truck Loading S10-S12	N/A	N/A	N/A	Existing	N/A	N/A

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

Attachment J

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:

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

Is the facility subject to quarterly LDAR monitoring under 40CFR60 Subpart OOOOa? ☒ Yes ☐ No. If no, why?

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	149	EPA	☒ Gas ☐ Liquid ☐ Both	<0.01	<0.01	<0.01
Safety Relief Valves	☒ Yes ☐ No	6	EPA	☐ Gas ☐ Liquid ☐ Both	<0.01	<0.01	<0.01
Open Ended Lines	☒ Yes ☐ No	8	EPA	☐ Gas ☐ Liquid ☐ Both	<0.01	<0.01	<0.01
Sampling Connections	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Connections (Not sampling)	☒ Yes ☐ No	656	EPA	☒ Gas ☐ Liquid ☐ Both	<0.01	<0.01	<0.01
Compressors	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Flanges	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			
Other[1]	☐ Yes ☐ No			☐ Gas ☐ Liquid ☐ Both			

[1] Other equipment types may include compressor seals, relief valves, diaphragms, drains, meters, etc.
Please indicate if there are any closed vent bypasses (include component):
Specify all equipment used in the closed vent system (e.g. VRU, ERD, thief hatches, tanker truck loading, etc.)

Attachment K

ATTACHMENT K – 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

1. Bulk Storage Area Name: **Comet Compressor Station**	2. Tank Name: **Produced Water Tank**
3. Emission Unit ID number **T-2, T-3**	4. Emission Point ID number **E10, E11**
5. Date Installed , Modified or Relocated *(for existing tanks)* **9/2011 and 9/2011** 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)*	
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.***	

TANK INFORMATION

8. Design Capacity *(specify barrels or gallons).* Use the internal cross-sectional area multiplied by internal height. **100 bbl**	
9A. Tank Internal Diameter (ft.) **8**	9B. Tank Internal Height (ft.) **10**
10A. Maximum Liquid Height (ft.) **8.5**	10B. Average Liquid Height (ft.) **5**
11A. Maximum Vapor Space Height (ft.) **1.5**	11B. Average Vapor Space Height (ft.) **5**
12. Nominal Capacity *(specify barrels or gallons).* This is also known as "working volume". **100 bbl**	
13A. Maximum annual throughput (gal/yr) **436,800**	13B. Maximum daily throughput (gal/day) **1196.71**
14. Number of tank turnovers per year **52**	15. Maximum tank fill rate (gal/min) **0.83**
16. Tank fill method ☒ Submerged ☐ Splash ☐ Bottom Loading	
17. Is the tank system a variable vapor space system? ☐ Yes ☒ No If yes, (A) What is the volume expansion capacity of the system (gal)? (B) What are the number of transfers into the system per year?	
18. Type of tank (check all that apply): ☒ Fixed Roof ☐ vertical ☐ horizontal ☐ flat roof ☐ cone roof ☒ dome roof ☐ other (describe) ☐ External Floating Roof ☐ pontoon roof ☐ double deck roof ☐ Domed External (or Covered) Floating Roof ☐ Internal Floating Roof ☐ vertical column support ☐ self-supporting ☐ Variable Vapor Space ☐ lifter roof ☐ diaphragm ☐ Pressurized ☐ spherical ☐ cylindrical ☐ Other (describe)	

PRESSURE/VACUUM CONTROL DATA

19. Check as many as apply:

☒ Does Not Apply ☐ Rupture Disc (psig)

☐ Inert Gas Blanket of _____ ☐ Carbon Adsorption[1]

☐ Vent to Vapor Combustion Device[1] (vapor combustors, flares, thermal oxidizers, enclosed combustors)

☐ Conservation Vent (psig) ☐ Condenser[1]

Vacuum Setting Pressure Setting

☐ Emergency Relief Valve (psig)

Vacuum Setting Pressure Setting

☐ Thief Hatch Weighted ☐ Yes ☐ No

[1] Complete appropriate Air Pollution Control Device Sheet

20. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).

Material Name	**Flashing Loss**		**Breathing Loss**		**Working Loss**		**Total Emissions Loss**		**Estimation Method[1]**
	lb/hr	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	
Produced Water	**See Attachment V**								

[1] EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

Remember to attach emissions calculations, including TANKS Summary Sheets and other modeling summary sheets if applicable.

TANK CONSTRUCTION AND OPERATION INFORMATION		
21. Tank Shell Construction: ☒ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☐ Other (describe)		
21A. Shell Color: **Tan**	21B. Roof Color: **Tan**	21C. Year Last Painted: **2015**
22. Shell Condition (if metal and unlined): ☒ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable		
22A. Is the tank heated? ☐ Yes ☒ No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?
23. Operating Pressure Range (psig): **Must be listed for tanks using VRUs with closed vent system.**		
24. Is the tank a **Vertical Fixed Roof Tank**? ☒ Yes ☐ No	24A. If yes, for dome roof provide radius (ft): **4**	24B. If yes, for cone roof, provide slop (ft/ft):
25. Complete item 25 for **Floating Roof Tanks** ☐ Does not apply ☒		
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type *(check one):* ☐ Metallic (mechanical) shoe seal ☐ Liquid mounted resilient seal ☐ Vapor mounted resilient seal ☐ Other (describe):		
25C. Is the Floating Roof equipped with a secondary seal? ☐ Yes ☐ No		
25D. If yes, how is the secondary seal mounted? *(check one)* ☐ Shoe ☐ Rim ☐ Other (describe):		
25E. Is the floating roof equipped with a weather shield? ☐ Yes ☐ No		
25F. Describe deck fittings:		
26. Complete the following section for **Internal Floating Roof Tanks** ☒ Does not apply		
26A. Deck Type: ☐ Bolted ☐ Welded	26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction: ☐ 5 ft. wide ☐ 6 ft. wide ☐ 7 ft. wide ☐ 5 x 7.5 ft. wide ☐ 5 x 12 ft. wide ☐ other (describe)		
26D. Deck seam length (ft.):	26E. Area of deck (ft^2):	26F. For column supported tanks, # of columns:	26G. For column supported tanks, diameter of column:
27. Closed Vent System with VRU? ☐ Yes ☒ No		
28. Closed Vent System with Enclosed Combustor? ☐ Yes ☒ No		
SITE INFORMATION		
29. Provide the city and state on which the data in this section are based:		
30. Daily Avg. Ambient Temperature (°F):	31. Annual Avg. Maximum Temperature (°F):	
32. Annual Avg. Minimum Temperature (°F):	33. Avg. Wind Speed (mph):	
34. Annual Avg. Solar Insulation Factor (BTU/ft^2-day):	35. Atmospheric Pressure (psia):	
LIQUID INFORMATION		
36. Avg. daily temperature range of bulk liquid (°F):	36A. Minimum (°F):	36B. Maximum (°F):
37. Avg. operating pressure range of tank (psig):	37A. Minimum (psig):	37B. Maximum (psig):
38A. Minimum liquid surface temperature (°F):	38B. Corresponding vapor pressure (psia):	
39A. Avg. liquid surface temperature (°F):	39B. Corresponding vapor pressure (psia):	
40A. Maximum liquid surface temperature (°F):	40B. Corresponding vapor pressure (psia):	
41. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.		
41A. Material name and composition:		
41B. CAS number:		

41C. Liquid density (lb/gal):			
41D. Liquid molecular weight (lb/lb-mole):			
41E. Vapor molecular weight (lb/lb-mole):			
41F. Maximum true vapor pressure (psia):			
41G. Maximum Reid vapor pressure (psia):			
41H. Months Storage per year. From: To:			
42. Final maximum gauge pressure and temperature prior to transfer into tank used as inputs into flashing emission calculations.			

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]
Oil	**Existing**	**Engine Oil**	**520 gal x6**
Methanol	**Existing**	**Methanol**	**300 gal**
Stormwater Tank (Underground)	**Existing**	**Stormwater**	**600 gal**
Glycol	**Existing**	**TEG Glycol**	**520 gal**
Regen overhead condensation tank (T-1)	**Exisitng**	**Condensation from TEG Overhead**	**4,200 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.

Attachment L

ATTACHMENT L – 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]
RBV-4	E07	Exterran Reboiler	2015	NA	1.0	1030
RBV-5	E09	Exterran Reboiler	2012	NA	0.20	1030

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

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

[3] New, modification, removal

[4] Enter design heat input capacity in MMBtu/hr.

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

Attachment M

ATTACHMENT M – 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]		CE-1R		CE-2R		CE-3R	
Engine Manufacturer/Model		CAT G3516		CAT G3516		CAT G3516	
Manufacturers Rated bhp/rpm		1380/1400		1380/1400		1380/1400	
Source Status[2]		ES		ES		ES	
Date Installed/ Modified/Removed/Relocated[3]		4/2012		5/2012		4/2015	
Engine Manufactured /Reconstruction Date[4]		10/12/2011		10/12/2011		After 2010	
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable)[5]		☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources		☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources		☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	
Engine Type[6]		4SLB		4SLB		4SLB	
APCD Type[7]		OxCat		OxCat		OxCat	
Fuel Type[8]		RG		RG		RG	
H_2S (gr/100 scf)		0.025		0.025		0.025	
Operating bhp/rpm		1380/1400		1380/1400		1380/1400	
BSFC (BTU/bhp-hr)		7,442		7,442		7,442	
Hourly Fuel Throughput		9,971 ft^3/hr gal/hr		9,971 ft^3/hr gal/hr		9,971 ft^3/hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		87.34 $MMft^3$/yr gal/yr		87.34 $MMft^3$/yr gal/yr		87.34 $MMft^3$/yr gal/yr	
Fuel Usage or Hours of Operation Metered		Yes ☒ No ☐		Yes ☒ No ☐		Yes ☒ No ☐	
Calculation Methodology[9]	**Pollutant[10]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**
Vendor Guarantee	NO_x	1.52	6.66	1.52	6.66	1.52	6.66
Vendor Guarantee	CO	0.56	2.43	0.56	2.43	0.56	2.43
Vendor Guarantee	VOC	0.32	1.39	0.32	1.39	0.32	1.39
AP-42	SO_2	<0.01	0.03	<0.01	0.03	<0.01	0.03
AP-42	PM_{10}	0.10	0.45	0.10	0.45	0.10	0.45
Vendor Guarantee	Formaldehyde	0.13	0.57	0.13	0.57	0.13	0.57
AP-42	Total HAPs	0.15	0.67	0.15	0.67	0.15	0.67
AP-42	GHG (CO_2e)	1,441.54	6,313.93	1,441.54	6,313.93	1,441.54	6,313.93

ATTACHMENT M – 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]		CE-6R		CE-4R			
Engine Manufacturer/Model		CAT G3516B		CAT G3508			
Manufacturers Rated bhp/rpm		1380/1400		670/1400			
Source Status[2]		NS		NS			
Date Installed/ Modified/Removed/Relocated[3]		6/2017		1/2014			
Engine Manufactured /Reconstruction Date[4]		3/27/2006		5/2008			
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable)[5]		☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources		☒40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources		☐40CFR60 Subpart JJJJ ☐JJJJ Certified? ☐40CFR60 Subpart IIII ☐IIII Certified? ☐40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS JJJJ Window ☐ NESHAP ZZZZ Remote Sources	
Engine Type[6]		4SLB		4SLB			
APCD Type[7]		OxCat		OxCat			
Fuel Type[8]		RG		RG			
H_2S (gr/100 scf)		0.025		0.025			
Operating bhp/rpm		1380/1400		670/1400			
BSFC (BTU/bhp-hr)		7,442		7,656			
Hourly Fuel Throughput		9,971 ft^3/hr gal/hr		4,980 ft^3/hr gal/hr		ft^3/hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		87.34 $MMft^3$/yr gal/yr		43.63 $MMft^3$/yr gal/yr		$MMft^3$/yr gal/yr	
Fuel Usage or Hours of Operation Metered		Yes ☒ No ☐		Yes ☒ No ☐		Yes ☐ No ☐	
Calculation Methodology[9]	**Pollutant[10]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**	**Hourly PTE (lb/hr)[11]**	**Annual PTE (tons/year)[11]**
Vendor Guarantee	NO_x	1.52	6.66	2.95	12.94		
Vendor Guarantee	CO	0.56	2.43	0.22	0.97		
Vendor Guarantee	VOC	0.32	1.39	0.31	1.35		
AP-42	SO_2	<0.01	0.03	<0.01	0.01		
AP-42	PM_{10}	0.10	0.45	0.05	0.22		
Vendor Guarantee	Formaldehyde	0.13	0.57	0.04	0.16		
AP-42	Total HAPs	0.15	0.67	0.05	0.21		
AP-42	GHG (CO_2e)	1,441.54	6,313.93	720.00	3,153.61		

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# CE-1R, 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: **DCL**	Model #: **DC65A-12**
Design Operating Temperature: °F	Design gas volume: 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 °F to °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# CE-2R, 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: **DCL**	Model #: **DC65A-12**
Design Operating Temperature: °F	Design gas volume: 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 °F to °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# CE-3R, 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: **DCL**	Model #: **DC65A-12**
Design Operating Temperature: °F	Design gas volume: 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 °F to °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# CE-6R, 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: **DCL**	Model #: **DC65A-12**
Design Operating Temperature: °F	Design gas volume: 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 °F to °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# CE-4R, 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: **DCL**	Model #: **DC63Q-8**
Design Operating Temperature: °F	Design gas volume: 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 °F to °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,

Attachment N

ATTACHMENT N – 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 and will be noted on the issued G35-D Registration.

Emission Unit ID#: **LO-1**	Emission Point ID#: **E13**	Year Installed/Modified: **N/A**
Emission Unit Description: **Produced Water Tank Truck Loading T1-T3**		
Loading Area Data		
Number of Pumps: **NA**	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. **NA**		
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	7	7	7	7

Bulk Liquid Data (use extra pages as necessary)

Liquid Name	Produced Water		
Max. Daily Throughput (1000 gal/day)	1.20		
Max. Annual Throughput (1000 gal/yr)	436.75		
Loading Method[1]	SP		
Max. Fill Rate (gal/min)	0.83		
Average Fill Time (min/loading)	NA		
Max. Bulk Liquid Temperature (^{o}F)	70		

True Vapor Pressure[2]		NA		
Cargo Vessel Condition[3]		U		
Control Equipment or Method[4]		None		
Max. Collection Efficiency (%)		NA		
Max. Control Efficiency (%)		NA		
Max.VOC Emission Rate	Loading (lb/hr)	<0.01		
	Annual (ton/yr)	<0.01		
Max.HAP Emission Rate	Loading (lb/hr)	<0.01		
	Annual (ton/yr)	<0.01		
Estimation Method[5]		O - ProMax		

1 BF Bottom Fill SP Splash Fill SUB Submerged Fill

2 At maximum bulk liquid temperature

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

O Other (describe)

4 List as many as apply (complete and submit appropriate Air Pollution Control Device Sheets)

CA Carbon Adsorption VB Dedicated Vapor Balance (closed system)

ECD Enclosed Combustion Device F Flare

TO Thermal Oxidization or Incineration

5 EPA EPA Emission Factor in AP-42 MB Material Balance

TM Test Measurement based upon test data submittal O Other (describe)

Attachment O

ATTACHMENT O – GLYCOL DEHYDRATION UNIT DATA SHEET

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

Manufacturer: **Exterran**	Model: **HANO-486836035**
Max. Dry Gas Flow Rate: **10** mmscf/day	Reboiler Design Heat Input: **0.20** MMBTU/hr
Design Type: ☒ TEG ☐ DEG ☐ EG	Source Status[1]: **MS**
Date Installed/Modified/Removed[2]: **1/2014**	Regenerator Still Vent APCD/ERD[3]: **NA**
Control Device/ERD ID#[3]: **NA**	Fuel HV (BTU/scf): **1030**
H_2S Content (gr/100 scf): **<0.25**	Operation (hours/year): **8760**
Pump Rate (scfm): **46.5**	
Water Content (wt %) in: Wet Gas: **0.17** Dry Gas: **0.014**	

Is the glycol dehydration unit exempt from 40CFR63 Section 764(d)? ☒ Yes ☐ No: If Yes, answer the following:

The actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters per day, as determined by the procedures specified in §63.772(b)(1) of this subpart. ☐ Yes ☒ No

The actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram per year (1 ton per year), as determined by the procedures specified in §63.772(b)(2) of this subpart. ☒ Yes ☐ No

Is the glycol dehydration unit located within an Urbanized Area (UA) or Urban Cluster (UC)? ☐ Yes ☐ No

Is a lean glycol pump optimization plan being utilized? ☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler.
☐ Yes ☒ No
If yes:
Is the reboiler configured to accept flash drum vapors (straight from the glycol dehydrator)? ☐ Yes ☒ No
Is the reboiler configured to accept still vent vapors (after a condenser)? ☐ Yes ☒ No
Is the reboiler configured to accept both in the same operation? ☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler and mixed with fuel.
☐ Yes ☒ No

What happens when temperature controller shuts off fuel to the reboiler?
☒ Still vent emissions to the atmosphere.
☐ Still vent emissions stopped with valve.
☐ Still vent emissions to glow plug.

Please indicate if the following equipment is present.
☐ Flash Tank
☐ Burner management system that continuously burns condenser or flash tank vapors

Control Device Technical Data

Pollutants Controlled	Manufacturer's Guaranteed Control Efficiency (%)
NA	**NA**

Emissions Data

Emission Unit ID / Emission Point ID[4]	Description	Calculation Methodology[5]	PTE[6]	Controlled Maximum Hourly Emissions (lb/hr)	Controlled Maximum Annual Emissions (tpy)
RBV-4	Reboiler Vent	AP-42	NO_x	0.02	0.11
		AP-42	CO	0.02	0.09
		AP-42	VOC	<0.01	<0.01
		AP-42	SO_2	<0.01	<0.01
		AP-42	PM_{10}	<0.01	<0.01
		AP-42	GHG (CO_2e)	29.27	128.22
RSV-4	Glycol Regenerator Still Vent	GRI-GlyCalc™	VOC	0.10	0.43
		GRI-GlyCalc™	Benzene	<0.01	0.03
		GRI-GlyCalc™	Toluene	0.01	0.06
		GRI-GlyCalc™	Ethylbenzene	<0.01	<0.01
		GRI-GlyCalc™	Xylenes	0.03	0.15
		GRI-GlyCalc™	n-Hexane	<0.01	<0.01
NA	Glycol Flash Tank	GRI-GlyCalc™	VOC		
		GRI-GlyCalc™	Benzene		
		GRI-GlyCalc™	Toluene		
		GRI-GlyCalc™	Ethylbenzene		
		GRI-GlyCalc™	Xylenes		
		GRI-GlyCalc™	n-Hexane		

1 Enter the Source Status using the following codes:
NS Construction of New Source ES Existing Source
MS Modification of Existing Source

2 Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.

3 Enter the Air Pollution Control Device (APCD)/Emission Reduction Device (ERD) type designation using the following codes and the device ID number:
NA None CD Condenser FL Flare
CC Condenser/Combustion Combination TO Thermal Oxidizer
O Other (please list)

4 Enter the appropriate Emission Unit ID Numbers and Emission Point ID Numbers for the glycol dehydration unit reboiler vent and glycol regenerator still vent. The glycol dehydration unit reboiler vent and glycol regenerator still vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a Glycol Dehydration Emission Unit Data Sheet shall be completed for each, using Source Identification RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

5 Enter the Potential Emissions Data Reference designation using the following codes:
MD Manufacturer's Data AP AP-42
GR GRI-GLYCalc™ OT Other (please list)

6 Enter the Reboiler Vent and Glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The Glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalc™ (Radian International LLC & Gas Research Institute). **Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc™ Aggregate Calculations Report (shall include emissions reports, equipment reports, and stream reports) to this Glycol Dehydration Emission Unit Data Sheet(s). Backup pumps do not have to be considered as operating for purposes of PTE.** This PTE data shall be incorporated in the Emissions Summary Sheet.

ATTACHMENT O – GLYCOL DEHYDRATION UNIT DATA SHEET

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

Manufacturer: **Exterran**	Model: **HANO-486836035**
Max. Dry Gas Flow Rate: **45** mmscf/day	Reboiler Design Heat Input: **1.0** MMBTU/hr
Design Type: ☒ TEG ☐ DEG ☐ EG	Source Status[1]: **MS**
Date Installed/Modified/Removed[2]: **8/2014**	Regenerator Still Vent APCD/ERD[3]: **NA**
Control Device/ERD ID#[3]: **NA**	Fuel HV (BTU/scf): **1030**
H_2S Content (gr/100 scf): **<0.25**	Operation (hours/year): **8760**
Pump Rate (scfm): **46.5**	
Water Content (wt %) in: Wet Gas: **0.17** Dry Gas: **0.014**	

Is the glycol dehydration unit exempt from 40CFR63 Section 764(d)? ☒ Yes ☐ No: If Yes, answer the following:

The actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters per day, as determined by the procedures specified in §63.772(b)(1) of this subpart. ☐ Yes ☒ No

The actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere are less than 0.90 megagram per year (1 ton per year), as determined by the procedures specified in §63.772(b)(2) of this subpart. ☒ Yes ☐ No

Is the glycol dehydration unit located within an Urbanized Area (UA) or Urban Cluster (UC)? ☐ Yes ☐ No

Is a lean glycol pump optimization plan being utilized? ☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler.
☐ Yes ☒ No
If yes:
Is the reboiler configured to accept flash drum vapors (straight from the glycol dehydrator)? ☐ Yes ☒ No
Is the reboiler configured to accept still vent vapors (after a condenser)? ☐ Yes ☒ No
Is the reboiler configured to accept both in the same operation? ☐ Yes ☒ No

Recycling the glycol dehydration unit back to the flame zone of the reboiler and mixed with fuel.
☐ Yes ☒ No

What happens when temperature controller shuts off fuel to the reboiler?
☒ Still vent emissions to the atmosphere.
☐ Still vent emissions stopped with valve.
☐ Still vent emissions to glow plug.

Please indicate if the following equipment is present.
☐ Flash Tank
☐ Burner management system that continuously burns condenser or flash tank vapors

Control Device Technical Data

Pollutants Controlled	Manufacturer's Guaranteed Control Efficiency (%)
NA	**NA**

Emissions Data

Emission Unit ID / Emission Point ID[4]	Description	Calculation Methodology[5]	PTE[6]	Controlled Maximum Hourly Emissions (lb/hr)	Controlled Maximum Annual Emissions (tpy)
RBV-4	Reboiler Vent	AP-42	NO_x	0.10	0.43
		AP-42	CO	0.08	0.36
		AP-42	VOC	<0.01	0.02
		AP-42	SO_2	<0.01	<0.01
		AP-42	PM_{10}	<0.01	0.03
		AP-42	GHG (CO_2e)	117.10	512.89
RSV-4	Glycol Regenerator Still Vent	GRI-GlyCalc™	VOC	0.44	1.92
		GRI-GlyCalc™	Benzene	0.04	0.15
		GRI-GlyCalc™	Toluene	0.07	0.29
		GRI-GlyCalc™	Ethylbenzene	<0.01	<0.01
		GRI-GlyCalc™	Xylenes	0.15	0.67
		GRI-GlyCalc™	n-Hexane	<0.01	<0.01
NA	Glycol Flash Tank	GRI-GlyCalc™	VOC		
		GRI-GlyCalc™	Benzene		
		GRI-GlyCalc™	Toluene		
		GRI-GlyCalc™	Ethylbenzene		
		GRI-GlyCalc™	Xylenes		
		GRI-GlyCalc™	n-Hexane		

1 Enter the Source Status using the following codes:
NS Construction of New Source ES Existing Source
MS Modification of Existing Source

2 Enter the date (or anticipated date) of the glycol dehydration unit's installation (construction of source), modification or removal.

3 Enter the Air Pollution Control Device (APCD)/Emission Reduction Device (ERD) type designation using the following codes and the device ID number:
NA None CD Condenser FL Flare
CC Condenser/Combustion Combination TO Thermal Oxidizer
O Other (please list)

4 Enter the appropriate Emission Unit ID Numbers and Emission Point ID Numbers for the glycol dehydration unit reboiler vent and glycol regenerator still vent. The glycol dehydration unit reboiler vent and glycol regenerator still vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a Glycol Dehydration Emission Unit Data Sheet shall be completed for each, using Source Identification RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

5 Enter the Potential Emissions Data Reference designation using the following codes:
MD Manufacturer's Data AP AP-42
GR GRI-GLYCalc™ OT Other (please list)

6 Enter the Reboiler Vent and Glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The Glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalc™ (Radian International LLC & Gas Research Institute). **Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc™ Aggregate Calculations Report (shall include emissions reports, equipment reports, and stream reports) to this Glycol Dehydration Emission Unit Data Sheet(s). Backup pumps do not have to be considered as operating for purposes of PTE.** This PTE data shall be incorporated in the Emissions Summary Sheet.

Attachment P

ATTACHMENT P – PNEUMATIC CONTROLLERS DATA SHEET

Are there any continuous bleed natural gas driven pneumatic controllers at this facility that commenced construction, modification or reconstruction after August 23, 2011, and on or before September 18, 2015?

☐ Yes ☒ No

Please list approximate number.

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

☐ Yes ☒ No

Please list approximate number.

Are there any continuous bleed natural gas driven pneumatic controllers at this facility with a bleed rate greater than 6 standard cubic feet per hour that are required based on functional needs, including but not limited to response time, safety and positive actuation that commenced construction, modification or reconstruction after August 23, 2011, and on or before September 18, 2015?

☐ Yes ☒ No

Please list approximate number.

Are there any continuous bleed natural gas driven pneumatic controllers at this facility with a bleed rate greater than 6 standard cubic feet per hour that are required based on functional needs, including but not limited to response time, safety and positive actuation that commenced construction, modification or reconstruction after September 18, 2015?

☐ Yes ☒ No

Please list approximate number.

Attachment Q

ATTACHMENT Q – CENTRIFUGAL COMPRESSOR DATA SHEET

Are there any centrifugal compressors at this facility that commenced construction, modification or reconstruction after August 23, 2011, and on or before September 18, 2015?

☐ Yes ☒ No

Please list:

Emission Unit ID#	Compressor Description

Are there any centrifugal compressors at this facility that commenced construction, modification or reconstruction after September 18, 2015?

☐ Yes ☒ No

Please list:

Emission Unit ID#	Compressor Description

Attachment R

ATTACHMENT R – RECIPROCATING COMPRESSOR DATA SHEET

Are there any reciprocating compressors at this facility that commenced construction, modification or reconstruction after August 23, 2011, and on or before September 18, 2015?

☒ Yes ☐ No

Please list:

Emission Unit ID#	Compressor Description
CE-1R	CAT G3516 ULB Compressor Engine
CE-2R	CAT G3516 ULB Compressor Engine
CE-3R	CAT G3516 ULB Compressor Engine
CE-4R	CAT G3508 TALE Compressor Engine

Are there any reciprocating compressors at this facility that commenced construction, modification or reconstruction after September 18, 2015?

☒ Yes ☐ No

Please list:

Emission Unit ID#	Compressor Description
CE-6R	CAT G3516 ULB Compressor Engine

Attachment S

ATTACHMENT S – BLOWDOWN AND PIGGING OPERATIONS DATA SHEET

Will there be any blowdown and pigging operations that occur at this facility?

☒ Yes ☐ No

Please list:

Type of Event	# of Events (event/yr)	Amount Vented per event (scf/event)	MW of vented gas (lb/lb-mol)	Total Emissions (ton/yr)	VOC weight fraction	VOC emissions (ton/yr)
Compressor Blowdown	100	3,776	16.45	290.22	<0.01	0.5
Compressor Startup						
Plant Shutdown						
Low Pressure Pig Venting						
High Pressure Pig Venting	52	437.34	16.45	<0.01	0.002	<0.01

Type of Event	# of Events (event/yr)	Amount Vented per event (scf/event)	MW of vented gas (lb/lb-mol)	Total Emissions (ton/yr)	HAP weight fraction	HAP emissions (ton/yr)
Compressor Blowdown	100	3,776	16.45	290.22	<0.01	<0.01
Compressor Startup						
Plant Shutdown						
Low Pressure Pig Venting						
High Pressure Pig Venting	52	437.34	16.45	<0.01	<0.01	<0.01

Attachment T
(Not Applicable)

Attachment U

Attachment U
Natural Gas Compressor Engine (CE-1R, CE-2R, CE-3R, and CE-6R) G3516ULB

Pollutant	Emission Factor	Emission Factor Units	Emission Factor Basis / Source	Engine Rating (bhp)	Engine Rating (kW)	Fuel Consumption (Btu/bhp-hr)	Heat Value of Natural Gas (Btu/scf)	Annual Operating Hours	Catalyst Reduction (%)	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOCs	0.52	g/bhp-hr	Vendor Guarantee	1380.0	1029.1	7,442	1,030	8,760	80%	0.32	1.39
Formaldehyde	0.43	g/bhp-hr	Vendor Guarantee	1380.0	1029.1	7,442	1,030	8,760	90%	0.13	0.57
n-Hexane	1.11E-03	lb/MMBtu	AP-42 Chapter 3.2	1379.0	1028.3	7,442	1,030	8,760	0%	0.01	0.05
Benzene	4.40E-04	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	0.02
Toluene	4.08E-04	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	0.02
Ethylbenzene	3.97E-05	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	<0.01
Xylene	1.84E-04	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	<0.01
CO	2.61	g/bhp-hr	Vendor Guarantee	1380.0	1029.1	7,442	1,030	8,760	93%	0.56	2.43
NO_x	0.50	g/bhp-hr	Vendor Guarantee	1380.0	1029.1	7,442	1,030	8,760	0%	1.52	6.66
$PM_{Filterable}$	7.71E-05	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	<0.01
$PM_{Condensable}$	9.91E-03	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	0.10	0.45
PM_{Total}	9.99E-03	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	0.10	0.45
SO_2	5.88E-04	lb/MMBtu	AP-42 Chapter 3.2	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	0.03
CO_2	53.06	kg CO_2 / MMBtu	40 CFR Subpart C	1380.0	1029.1	7,442	1,030	8,760	0%	1440.05	6307.42
CH_4	0.001	kg CH_4 / MMBtu	40 CFR Subpart C	1380.0	1029.1	7,442	1,030	8,760	0%	0.03	0.12
N_2O	0.0001	kg N_2O / MMBtu	40 CFR Subpart C	1380.0	1029.1	7,442	1,030	8,760	0%	<0.01	0.01
Total HAPs										0.15	0.67
Total CO_2e										1441.54	6313.93

Notes:

- Emission rates displayed above represent the max. hourly and max. annual emissions for one CAT G3516 NG compressor.
- Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
- AP-42, Chapter 3.2, Table 3.2-2 - Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines
- Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
- CO_2 equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO_2=1, GWP CH_4=25, GWP N_2O=298

Example Equations:

Max. Hourly Emission Rate **(lb/hr) =** Emission Factor **(lb/10^6 scf) ÷** Heating Value of Natural Gas **(Btu/scf)** x Boiler Rating (**MMBtu/hr) x Catalyst Reuction (%)**

Max hourly rate **(lb/hr)** = (Fuel Consumption **[Btu/bhp-hr]** x Engine Rating **[kW] /** Heat Value [**Btu/scf]**) **x** 0.001 **x** 0.001235 **x** Emission Factor **(kg/MMBtu) x** 1.102 **x** 2000

Attachment U
Natural Gas Compressor Engine (CE-4R) G3508 TALE

Pollutant	Emission Factor	Emission Factor Units	Emission Factor Basis / Source	Engine Rating (bhp)	Engine Rating (kW)	Fuel Consumption (Btu/bhp-hr)	Heat Value of Natural Gas (Btu/scf)	Annual Operating Hours	Catalyst Reduction (%)	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOCs	0.38	g/bhp-hr	Vendor Guarantee	670.0	499.6	7,656	1,030	8,760	45%	0.31	1.35
Formaldehyde	0.25	g/bhp-hr	Vendor Guarantee	670.0	499.6	7,656	1,030	8,760	90%	0.04	0.16
n-Hexane	1.11E-03	lb/MMBtu	AP-42 Chapter 3.1	669.0	498.9	7,656	1,030	8,760	0%	<0.01	0.02
Benzene	4.40E-04	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
Toluene	4.08E-04	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
Ethylbenzene	3.97E-05	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
Xylene	1.84E-04	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
CO	2.14	g/bhp-hr	Vendor Guarantee	670.0	499.6	7,656	1,030	8,760	93%	0.22	0.97
NO_x	2.00	g/bhp-hr	Vendor Guarantee	670.0	499.6	7,656	1,030	8,760	0%	2.95	12.94
$PM_{Filterable}$	7.71E-05	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
$PM_{Condensable}$	9.91E-03	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	0.05	0.22
PM_{Total}	9.99E-03	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	0.05	0.22
SO_2	5.88E-04	lb/MMBtu	AP-42 Chapter 3.2	670.0	499.6	7,656	1,030	8,760	0%	<0.01	0.01
CO_2	53.06	kg CO_2 / MMBtu	40 CFR Subpart C	670.0	499.6	7,656	1,030	8,760	0%	719.26	3150.35
CH_4	0.001	kg CH_4 / MMBtu	40 CFR Subpart C	670.0	499.6	7,656	1,030	8,760	0%	0.01	0.06
N_2O	0.0001	kg N_2O / MMBtu	40 CFR Subpart C	670.0	499.6	7,656	1,030	8,760	0%	<0.01	<0.01
Total HAPs										0.05	0.21
Total CO_2e										720.00	3153.61

Notes:

- Emission rates displayed above represent the max. hourly and max. annual emissions for one CAT G3508 NG compressor.
- Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
- AP-42, Chapter 3.2, Table 3.2-3 - Uncontrolled Emission Factors for 4-Stroke lean Burn Engines
- Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
- CO_2 equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO_2=1, GWP CH_4=25, GWP N_2O=298

Example Equations:

Max. Hourly Emission Rate **(lb/hr) =** Emission Factor **(lb/10^6 scf) ÷** Heating Value of Natural Gas **(Btu/scf)** x Boiler Rating (**MMBtu/hr) x catalyst reduction (%)**

Max hourly rate **(lb/hr)** = (Fuel Consumption **[Btu/bhp-hr]** x Engine Rating **[kW] /** Heat Value [**Btu/scf]**) **x** 0.001 **x** 0.001235 **x** Emission Factor **(kg/MMBtu) x** 1.102 **x** 2000

Attachment U

RSV-4

Regenerator Overhead Vent RSV-4

Pollutant	Max Hourly Uncontrolled Emissions (lb/hr)	Max Annual Uncontrolled Emissions (tons/yr)
VOC's	0.44	1.92
HAPs	0.37	1.60
Benzene	0.04	0.15
Toluene	0.07	0.29
Xylenes	0.15	0.67
n-Hexane	<0.01	<0.01
Methane	4.13	18.07
CO_2e	103.14	451.74

Data from GRI-GLYCalc 4.0

Attachment U
Dehy Reboiler RBV-4

Pollutant	Emission Factor	Emission Factor Units	Emission Factor Basis / Source	Boiler Rating (MMBtu/hr)	Heat Value of Natural Gas (Btu/scf)	Annual Operating Hours	Max. Hourly Emissions. (lb/hr)	Max. Annual Emissions. (tpy)
VOCs	5.5	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	0.02
Hexane	1.8	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
Formaldehyde	0.075	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
Benzene	0.0021	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
Toluene	0.0034	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
Pb	0.0005	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
CO	84	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	0.08	0.36
NO_x	100	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	0.10	0.43
$PM_{Filterable}$	1.9	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
$PM_{Condensable}$	5.7	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	0.02
PM_{Total}	7.6	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	0.03
SO_2	0.6	$lb/10^6$ scf	AP-42 Chapter 1.4	1.00	1,030	8,760	<0.01	<0.01
CO_2	53.06	kg CO_2 / MMBtu	40CFR98 Subpart C	1.00	1,030	8,760	116.98	512.36
CH_4	0.001	kg CH_4 / MMBtu	40CFR98 Subpart C	1.00	1,030	8,760	<0.01	<0.01
N_2O	0.0001	kg N_2O / MMBtu	40CFR98 Subpart C	1.00	1,030	8,760	<0.01	<0.01
Total HAPs							<0.01	<0.01
Total CO_2e							117.10	512.89

Notes:

- Emission rates displayed above represent the max. hourly and max. annual emissions for one dehydrator reboiler.
- Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
- AP-42, Chapter 1.4 references are from the July 1998 revision.
- Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.

- CO_2 equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO_2=1, GWP CH_4=25, GWP N_2O=298

Example Equations:

Max. Hourly Emission Rate **(lb/hr) =** Emission Factor **($lb/10^6$ scf)** ÷ Heating Value of Natural Gas **(Btu/scf)** x Boiler Rating (**MMBtu/hr)**

Max hourly rate **(lb/hr)** = Emission Factor **(kg CO_2/MMBtu) x** Boiler Rating **(MMBtu/hr) x** 2.20462 **(lb/kg)**

Attachment U
RSV-5
Regenerator Overhead Vent RSV-5

Pollutant	Max Hourly Uncontrolled Emissions (lb/hr)	Max Annual Uncontrolled Emissions (tons/yr)
VOC's	0.10	0.43
HAPs	0.08	0.36
Benzene	<0.01	0.03
Toluene	0.01	0.06
Xylenes	0.03	0.15
n-Hexane	<0.01	<0.01
Methane	0.92	4.02
CO_2e	22.92	100.39

Data from GRI-GLYCalc 4.0

Attachment U
Dehy Reboiler RBV-5

Pollutant	Emission Factor	Emission Factor Units	Emission Factor Basis / Source	Boiler Rating (MMBtu/hr)	Heat Value of Natural Gas (Btu/scf)	Annual Operating Hours	Max. Hourly Emissions. (lb/hr)	Max. Annual Emissions. (tpy)
VOCs	5.5	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
Hexane	1.8	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
Formaldehyde	0.075	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
Benzene	0.0021	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
Toluene	0.0034	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
Pb	0.0005	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
CO	84	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	0.02	0.07
NO_x	100	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	0.02	0.09
$PM_{Filterable}$	1.9	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
$PM_{Condensable}$	5.7	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
PM_{Total}	7.6	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
SO_2	0.6	lb/10^6 scf	AP-42 Chapter 1.4	0.20	1,030	8,760	<0.01	<0.01
CO_2	53.06	kg CO_2 / MMBtu	40CFR98 Subpart C	0.20	1,030	8,760	23.40	102.47
CH_4	0.001	kg CH_4 / MMBtu	40CFR98 Subpart C	0.20	1,030	8,760	<0.01	<0.01
N_2O	0.0001	kg N_2O / MMBtu	40CFR98 Subpart C	0.20	1,030	8,760	<0.01	<0.01
Total HAPs							<0.01	<0.01
Total CO_2e							23.42	102.58

Notes:

- Emission rates displayed above represent the max. hourly and max. annual emissions for one dehydrator reboiler.
- Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
- AP-42, Chapter 1.4 references are from the July 1998 revision.
- Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
- CO_2 equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO_2=1, GWP CH_4=25, GWP N_2O=298

Example Equations:

Max. Hourly Emission Rate **(lb/hr) =** Emission Factor **(lb/10^6 scf)** ÷ Heating Value of Natural Gas **(Btu/scf)** x Boiler Rating (**MMBtu/hr)**

Max hourly rate **(lb/hr)** = Emission Factor **(kg CO_2/MMBtu) x** Boiler Rating **(MMBtu/hr) x** 2.20462 **(lb/kg)**

Attachment U - Emission Calculations
Produced Water Tanks T-2 and T-3

Pollutant	Max. Hourly Emissions using ProMax (lb/hr)	Max. Annual Emissions using ProMax (tons/yr)
VOCs	<0.01	0.02
Total HAPs	<0.01	<0.01
Hexane	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Ethylbenzene	<0.01	<0.01
Xylene	<0.01	<0.01
CO_2	0.03	0.13
CH_4	0.32	1.39
Total CO_2e	7.99	34.99

Notes:

-Emission rates for Produced Water Tanks S10-S11 were calculated using ProMax software. ProMax output sheets for the Comet CS are attached.

-CO_2 equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO_2=1, GWP CH_4=25, GWP N_2O=298

-For emission calculation purposes, the total throughput for tanks T-1 and T-2 is modeled as being received through a single tank. The throughput value represents the total throughput for both 100-barrel tanks. Therefore, emission rates represent a total from all produced fluids tanks located at the compressor station. Actual throughput for each tank will vary based on operations.

-Arsenal Midstream will operate the Comet CS Site in Taylor county where the produced hydrocarbon condensate is expected to be minimal. A representative analysis was used in order to find a conservative esitmate of emissions from condensate. Arsenal will collect and analyze a pressurized tank liquid sample within 30 days of production start up.

Attachment U - Emission Calculations
Liquids Unloading (LO-1)

Pollutant	Max. Hourly Emissions using ProMax (lb/hr)	Max. Annual Emissions using ProMax (tons/yr)
VOCs	<0.01	<0.01
Total HAPs	<0.01	<0.01
Hexane	<0.01	<0.01
Benzene	<0.01	<0.01
Toluene	<0.01	<0.01
Ethylbenzene	<0.01	<0.01
Xylene	<0.01	<0.01
CO_2	<0.01	<0.01
CH_4	<0.01	<0.01
Total CO_2e	0.01	0.06

Notes:

-Emission rates for Liquids Unloading was calculated using ProMax software. ProMax output sheets for the Comet CS are attached.

-CO_2 equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1

Attachment U - Emissions Calculations
Pigging Operations

Type (Launch or Receiving)	Latitude Decimal Degrees	Longitude Decimal Degrees	Chamber Length (Ft.)	Chamber Diam. (Ft .)	Volume of Chamber (ft3)	PSIG of Chamber	Volume of Pressurized Gas (ft3)
Receiving	39.306	-80.107	11	1	8.64	540	326.00

Temp. of Chamber (R®)	Molecular Weight of gas mixture (lb/lb-mole)	Compressibility Factor	Pressurized Density (lb/ft3)	Atmospheric Density (lb/ft3)	Delta Density (lb/ft3)	Amount Gas Vented (lbs) Per Event
539.67	16.49	0.99793	1.58313001	0.04195423	1.54117578	13.3148029

# of Events	# of Purges Per Event	Total Amount of Gas Vented (lbs)
52	1	692.3697508

Methane/Ethane Weight Fraction	Total VOC Weight Fraction	Total CO2 Weight Fraction	Tons of Total Amount of Gas Vented	Tons of CH4/C2H6	Tons of VOC	Tons of CO2
0.9874	0.0017	0.0084	0.3462	0.3418	0.00	0.00

Example Calc

Volume of Pressurized Gas (ft3)= (Volume of Chamber (ft3) x (PSIG of Chamber 14.7)) / 14.7
Pressurized Density (lb/ft3) = (Moecular Weight (lb/lb-mole) x (PSIG of Chamber + 14.7)) / Compressibility Factor x 10.73 x Temp of Chamber (R))
Atmospheric Density (lb/ft3) = (14.7 x Molecular Weight (lb/lb-mole)) / (10.73 x Temp of Chamber (R) x Compressibility Factor)
Amount of gas vented (lbs) = Delta Density (lb/ft3) x Volume of chamber (ft3)
Total Gas vented (lbs) = Number of events x Number of purges per event x Amount of gas vented (lbs)
Tons of Total Gas Vented = Amount of gas vented (lbs) / 2000
Tons of VOC = Tons of total gas vented x Total VOC weight frac / 2000
Tons of CO2 = Tons of total gas vented x CO2 weight frac / 2000

Attachment U - Emissions Calculations
Blowdowns

Blowdown Volume (scf)	Number of Events	Average length of event (hrs)	Average blowdown rate (scf/hr)	Amount of gas vented (scf)	Pressure of chamber (PSIG)
3,776	100	0.167	22,610.78	377,600.00	540
Temp of Gas (R)	**Molecular weight of mixture (lb/lb-mol)**	**Compressibility Factor**	**Pressurized Density (lb/ft3)**	**Atmospheric Density (lb/ft3)**	**Delta Density (lb/ft3)**
539.67	16.45	1.00	1.58	0.04	1.54
Amount of Gas vented (lbs)	**VOC wieght fraction**	**CO2 Weight fraction**	**Me/Et frac**	**Gas vented (tons)**	**Tons of CH4/C2H6**
580,438.50	0.002	0.008	0.987	290.22	286.57
Tons of VOC	**Tons of CO2**				
0.50	2.40				

Example Calc

Amount of gas vented (scf) = Blowdown volume (scf) x Number of events

Pressurized Density (lb/ft3) = (Moecular Weight (lb/lb-mole) x (PSIG of Chamber + 14.7)) / Compressibility Factor x 10.73 x Temp of Chamber (R))

Atmospheric Density (lb/ft3) = (14.7 x Molecular Weight (lb/lb-mole)) / (10.73 x Temp of Chamber (R) x Compressibility Factor)

Amount of gas vented (lbs) = Delta Density (lb/ft3) x Volume of chamber (ft3)

Total Gas vented (lbs) = Amount of gas vented (scf) x Delta Density (lb/ft3)

Tons of Total Gas Vented = Amount of gas vented (lbs) / 2000

Tons of VOC = Tons of total gas vented x Total VOC weight frac

Tons of CO2 = Tons of total gas vented x CO2 weight frac

Attachment U - Emission Calculations
Fugitive Emissions from Unpaved Haul Roads

Constant	Industrial Roads		
	PM	PM-10	PM-2.5
k (lb/VMT)	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

where

k		Patricle size multiplier[1]
s	4.8	Silt content of road surface material (%)
p	150	Number of days per year with precipitation

Item Number	Description	Number of Wheels	W Mean Vehicle Weight (tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)	PM Emissions (lbs/hr)	PM Emissions (tons/yr)	PM-10 Emissions (lbs/hr)	PM-10 Emissions (tons/yr)	PM-2.5 Emissions (lbs/hr)	PM-2.5 Emissions (tons/yr)
1	Liquids Hauling	14	30	10	1.17	1	104	NA	NA	5.01	0.26	1.28	0.07	0.13	0.01
2	Employee Vehicles	4	3	10	1.17	1	200	NA	NA	1.78	0.18	0.45	0.05	0.05	0.005
									Totals:	**6.79**	**0.44**	**1.73**	**0.11**	**0.17**	**0.01**

Notes:

[1] - Particle Size Multiplier used from AP-42 13.2.2 - Final Version 11/2006

[2] - Silt Content of Road Surface uses Sand and Gravel Processing Plant Road from AP-42 13.2.2 - Final Version 11/2006

[3] - Number of days per year with precipitation >0.01 in3 found using AP-42 13.2.2 Figure 13.2.2-1 - Final Version 11/2006

Example Calculations:

Emissions (lb/Vehicle Mile Traveled) - $E = k \times (s/12)^{a} \times (W/3)^{b}$ Equation 1a from AP-42 13.2.2 - Final Version 11/2006

Size Specific Emissions (lb/VMT) - $E_{ext} = E[(365-p)/365]$ Equation 2 from AP-42 13.2.2 - Final Version 11/2006

Attachment U
Fugitive Leaks

Default Average Component Counts for Major Onshore Natural Gas Production Equipment[1]				
Facility Equipment Type	**Valves**	**Connectors**	**Open-ended Lines**	**Pressure Relief Valves**
Wellheads	8	38	0.5	0
Separators	1	6	0	0
Meters/Piping	12	45	0	0
Compressors	12	57	0	0
In-line Heaters	14	65	2	1
Dehydrators	24	90	2	2

[1]- Table W-1B to 40CFR98 Subpart W

Well Specific Equipment Counts	
Facility Equipment Type	**Count on Site**
Wellheads	0
Separators	1
Meters/Piping	1
Compressors	5
In-line Heaters	2
Dehydrators	2

Gas Composition						
Emissions from Flaring Operations	**Propane**	**Butane**	**Pentanes**	**Hexanes+**	**CO_2**	**CH_4**
Mole %	0.06	0.00	0.00	0.00	0.31	97.12
MW	44	58	72	86.00	44.00	16.00

Fugitive Emissions														
Facility Equipment Type	**Total Count**	**Emission Rate (scf/hr/component)[2]**	**Hours of Operation**	**VOCs (lbs/hr)**	**VOCs (tons/yr)**	**Hexane (lbs/hr)**	**Hexane (tons/yr)**	**HAPs (lbs/hr)**	**HAPs (tons/yr)**	**CO_2 (lbs/hr)**	**CO_2 (tons/yr)**	**CH_4 (lbs/hr)**	**CH_4 (tons/yr)**	**Total CO_2e (lbs/hr)**	**Total CO_2e (tons/yr)**
Valves	149	0.027	8760	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Connectors	646	0.003	8760	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Open-ended Lines	8	0.061	8760	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pressure Relief Valves	6	0.040	8760	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
			Total Emissions:	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**	**0.01**	**<0.01**	**<0.01**	**<0.01**	**0.01**

[2]- Table W-1A to 40CFR98 Subpart W

Notes:
-Gas Composition data for the Comet CS was utilized

Example Equations:
Fugitive Emissions (lb/hr) = Count x Emission Rate x Hours of Operation ÷ 385.5 scf/lbmol x mol VOC's

Attachment U

Total Comet Site Wide Emission Levels

	VOCs		HAPs		CO		NO_x		PM_{Total}		$PM_{Filterable}$		$PM_{Condensable}$		SO_2		CO_2		CH_4		N_2O		CO_2e	
Emission Sources	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**
Compressor Engine (CE-1R)	0.32	1.39	0.15	0.67	0.56	2.43	1.52	6.66	0.10	0.45	<0.01	<0.01	0.10	0.45	<0.01	0.03	1440.05	6307.42	0.03	0.12	<0.01	0.01	1,441.54	6,313.93
Compressor Engine (CE-2R)	0.32	1.39	0.15	0.67	0.56	2.43	1.52	6.66	0.10	0.45	<0.01	<0.01	0.10	0.45	<0.01	0.03	1440.05	6307.42	0.03	0.12	<0.01	0.01	1,441.54	6,313.93
Compressor Engine (CE-3R)	0.32	1.39	0.15	0.67	0.56	2.43	1.52	6.66	0.10	0.45	<0.01	<0.01	0.10	0.45	<0.01	0.03	1440.05	6307.42	0.03	0.12	<0.01	0.01	1,441.54	6,313.93
Compressor Engine (CE-6R)	0.32	1.39	0.15	0.67	0.56	2.43	1.52	6.66	0.10	0.45	<0.01	<0.01	0.10	0.45	<0.01	0.03	1440.05	6307.42	0.03	0.12	<0.01	0.01	1,441.54	6,313.93
Compressor Engine (CE-4R)	0.31	1.35	0.05	0.21	0.22	0.97	2.95	12.94	0.05	0.22	<0.01	<0.01	0.05	0.22	<0.01	0.01	719.26	3150.35	0.01	0.06	<0.01	<0.01	720.00	3,153.61
Dehy Still Vent (RSV-4)	0.44	1.92	0.37	1.60	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	103.14	451.74
Dehy Reboiler (RBV-4)	<0.01	0.02	<0.01	<0.01	0.08	0.36	0.10	0.43	<0.01	0.03	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	116.98	512.36	<0.01	<0.01	<0.01	<0.01	117.10	512.89
Dehy Still Vent (RSV-5)	0.10	0.43	0.08	0.36	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22.92	100.39
Dehy Reboiler (RBV-5)	<0.01	<0.01	<0.01	<0.01	0.02	0.07	0.02	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23.40	102.47	<0.01	<0.01	<0.01	<0.01	23.42	102.58
Produced Water Tank (T-2 and T-3)	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.13	0.32	1.39	<0.01	<0.01	7.99	34.99
Truck Loading (LO-1)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.06
Pigging Fugitives	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Blowdown	0.11	0.50	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.55	2.40	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Haul Roads	--	--	--	--	--	--	--	--	6.79	0.44	1.90	0.12	--	--	--	--	--	--	--	--	--	--	--	--
Fugitives Leaks	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	<0.01	0.01	<0.01	<0.01	--	--	<0.01	<0.01
Totals	**2.12**	**9.30**	**1.11**	**4.87**	**2.54**	**11.14**	**9.16**	**40.10**	**7.26**	**2.50**	**1.91**	**0.15**	**0.46**	**2.03**	**0.03**	**0.12**	**6,619.86**	**28,994.99**	**0.44**	**1.94**	**0.01**	**0.05**	**6,760.73**	**29,611.99**

*Emissions from Tank Truck Loading Operations are routed to the vapor combustion unit. The collection efficiency of the vapors has been calculated using AP-42 methodologies. Emissions that are not collected and routed the VDU are realized at the Tank Truck Loading Operations Emission Point.

Attachment U

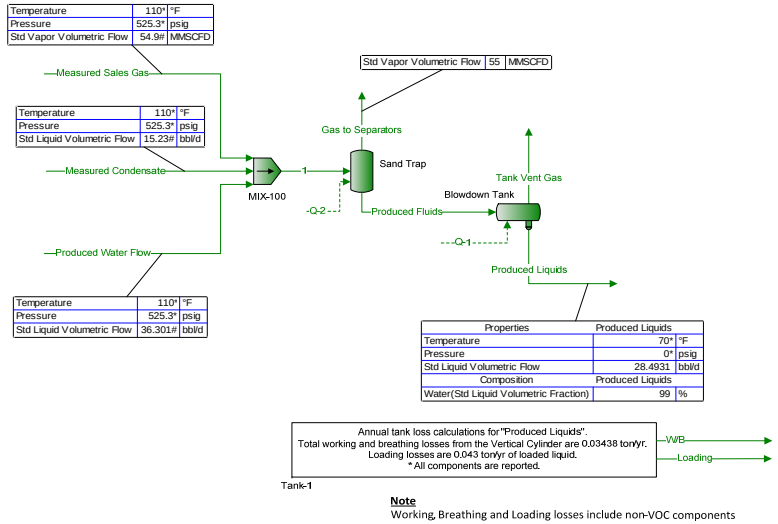
Total Comet Site Wide HAP Emission Levels

	Total HAPs		Formaldehyde		Hexane		Benzene		Toluene		Ethylbenzene		Xylene	
Emission Sources	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**	**lb/hr**	**tons/yr**
Compressor Engine (CE-1R)	0.15	0.67	0.13	0.57	0.01	0.05	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Compressor Engine (CE-2R)	0.15	0.67	0.13	0.57	0.01	0.05	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Compressor Engine (CE-3R)	0.15	0.67	0.13	0.57	0.01	0.05	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Compressor Engine (CE-6R)	0.15	0.67	0.13	0.57	0.01	0.05	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Compressor Engine (CE-4R)	0.05	0.21	0.04	0.16	<0.01	0.02	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Dehy Still Vent (RSV-4)	0.37	1.60	<0.01	<0.01	<0.01	<0.01	0.04	0.15	0.07	0.29	<0.01	<0.01	0.15	0.67
Dehy Reboiler (RBV-4)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dehy Still Vent (RSV-5)	0.08	0.36	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.01	0.06	<0.01	<0.01	0.03	0.15
Dehy Reboiler (RBV-5)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Produced Water Tank (T-2 and T-3)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tank Loading (LO-1)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pigging Fugitives	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Blowdowns	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Haul Roads	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fugitives Leaks	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Totals	**1.11**	**4.87**	**0.56**	**2.45**	**0.05**	**0.24**	**0.06**	**0.28**	**0.10**	**0.43**	**<0.01**	**<0.01**	**0.20**	**0.86**

Flowsheet1
Plant Schematic

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Arsenal – Comet Compressor Station
Produced Water Tank



Note
Working, Breathing and Loading losses include non-VOC components

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Connections

	Gas to Separators	Loading	Measured Condensate	Measured Sales Gas	Produced Fluids
From Block	Separator	--	--	--	Separator
To Block	--	--	MIX-100	MIX-100	Produced Water Tank

Stream Composition

Mole Fraction	Gas to Separators %	Loading %	Measured Condensate %	Measured Sales Gas %	Produced Fluids %
Nitrogen	0.290112	0.00314949	0 *	0.2905 *	0.000136903
Methane	96.9968	5.84269	10.674 *	97.1239 *	0.0892058
Carbon Dioxide	0.312882	4.13222	0.065 *	0.3133 *	0.00455412
Ethane	2.20751	0.403873	5.377 *	2.2091 *	0.0038004
Propane	0.064066	0.00908747	3.736 *	0.0632 *	0.00020295
Isobutane	0.000345915	6.69662E-05	1.359 *	0 *	2.14785E-06
n-Butane	0.000700986	0.000170615	2.754 *	0 *	6.12019E-06
Isopentane	0.00063835	0.000185273	2.508 *	0 *	1.10432E-05
n-Pentane	0.00057267	0.000184001	2.25 *	0 *	1.31481E-05
i-Hexane	0.00120681	0.000443321	4.742 *	0 *	6.05858E-05
n-Hexane	0.000691664	0.000265877	2.718 *	0 *	4.79204E-05
2,2,4-Trimethylpentane	4.57865E-06	1.59763E-06	0.018 *	0 *	8.20838E-07
Benzene	2.77299E-05	1.47866E-05	0.109 *	0 *	4.00907E-06
Heptane	0.00336245	0.00121693	13.22 *	0 *	0.000684061
Toluene	0.000278883	0.000102383	1.097 *	0 *	9.23124E-05
Octane	0.00396931	0.00115522	15.626 *	0 *	0.00215305
Ethylbenzene	5.07503E-05	1.56514E-05	0.2 *	0 *	4.17184E-05
o-Xylene	9.33022E-05	2.40314E-05	0.368 *	0 *	9.74368E-05
Nonane	0.00293602	0.000685299	11.599 *	0 *	0.00433072
Decane	0	0	0 *	0 *	0
Water	0.108518	89.6038	0 *	0 *	99.8138
Oxygen	0	0	0 *	0 *	0
Decanes Plus	0.00518692	0.000675309	21.58 *	0 *	0.0807623
Hexanes+	0	0	0 *	0 *	0

Molar Flow	Gas to Separators lbmol/h	Loading lbmol/h	Measured Condensate lbmol/h	Measured Sales Gas lbmol/h	Produced Fluids lbmol/h
Nitrogen	17.5195	1.6247E-08	0 *	17.5196 *	3.13347E-05
Methane	5857.52	3.01401E-05	0.164075 *	5857.38 *	0.0204176
Carbon Dioxide	18.8946	2.13165E-05	0.000999147 *	18.8946 *	0.00104236
Ethane	133.309	2.08342E-06	0.0826525 *	133.227 *	0.000869844
Propane	3.86887	4.68787E-08	0.0574279 *	3.81149 *	4.64517E-05
Isobutane	0.0208894	3.45452E-10	0.0208899 *	0 *	4.91604E-07
n-Butane	0.0423317	8.80136E-10	0.0423331 *	0 *	1.4008E-06
Isopentane	0.0385492	9.55749E-10	0.0385517 *	0 *	2.5276E-06
n-Pentane	0.0345828	9.4919E-10	0.0345859 *	0 *	3.00938E-06
i-Hexane	0.0728777	2.28692E-09	0.0728916 *	0 *	1.3867E-05
n-Hexane	0.0417687	1.37156E-09	0.0417797 *	0 *	1.09681E-05
2,2,4-Trimethylpentane	0.000276499	8.24155E-12	0.000276687 *	0 *	1.87875E-07
Benzene	0.00167457	7.62782E-11	0.00167549 *	0 *	9.17605E-07
Heptane	0.203055	6.27766E-09	0.203211 *	0 *	0.000156569
Toluene	0.0168414	5.28153E-10	0.0168625 *	0 *	2.11287E-05
Octane	0.239702	5.95934E-09	0.240195 *	0 *	0.000492795
Ethylbenzene	0.00306475	8.07394E-11	0.0030743 *	0 *	9.5486E-06
o-Xylene	0.00563441	1.23968E-10	0.00565671 *	0 *	2.23015E-05
Nonane	0.177303	3.53519E-09	0.178294 *	0 *	0.000991224
Decane	0	0	0 *	0 *	0
Water	6.55326	0.000462231	0 *	0 *	22.8456
Oxygen	0	0	0 *	0 *	0
Decanes Plus	0.313232	3.48365E-09	0.331717 *	0 *	0.0184851

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Molar Flow	Gas to Separators lbmol/h	Loading lbmol/h	Measured Condensate lbmol/h	Measured Sales Gas lbmol/h	Produced Fluids lbmol/h
Hexanes+	0	0	0 *	0 *	0

Mass Fraction	Gas to Separators %	Loading %	Measured Condensate %	Measured Sales Gas %	Produced Fluids %
Nitrogen	0.492103	0.00463619	0 *	0.493431 *	0.00021142
Methane	94.2221	4.92537	1.71125 *	94.4739 *	0.0788918
Carbon Dioxide	0.833779	9.55619	0.0285875 *	0.83603 *	0.0110489
Ethane	4.01926	0.638145	1.61576 *	4.02763 *	0.00629965
Propane	0.17106	0.0210569	1.64634 *	0.168977 *	0.000493347
Isobutane	0.00121741	0.000204528	0.789365 *	0 *	6.88197E-06
n-Butane	0.00246704	0.000521092	1.59964 *	0 *	1.96099E-05
Isopentane	0.00278877	0.000702418	1.80831 *	0 *	4.39231E-05
n-Pentane	0.00250183	0.000697598	1.62229 *	0 *	5.22951E-05
i-Hexane	0.00629718	0.0020075	4.08377 *	0 *	0.000287821
n-Hexane	0.00360913	0.00120398	2.34072 *	0 *	0.000227652
2,2,4-Trimethylpentane	3.16691E-05	9.58973E-06	0.0205477 *	0 *	5.16892E-06
Benzene	0.000131156	6.06933E-05	0.0850863 *	0 *	1.72635E-05
Heptane	0.0204012	0.00640762	13.238 *	0 *	0.00377867
Toluene	0.00155592	0.000495705	1.0101 *	0 *	0.000468887
Octane	0.0274546	0.00693419	17.8377 *	0 *	0.013558
Ethylbenzene	0.000326245	8.73152E-05	0.212191 *	0 *	0.000244161
o-Xylene	0.000599788	0.000134065	0.390432 *	0 *	0.000570259
Nonane	0.0228012	0.0046186	14.8666 *	0 *	0.0306198
Decane	0	0	0 *	0 *	0
Water	0.118377	84.8247	0 *	0 *	99.1287
Oxygen	0	0	0 *	0 *	0
Decanes Plus	0.0511082	0.0057745	35.0933 *	0 *	0.724492
Hexanes+	0	0	0 *	0 *	0

Mass Flow	Gas to Separators lb/h	Loading lb/h	Measured Condensate lb/h	Measured Sales Gas lb/h	Produced Fluids lb/h
Nitrogen	490.782	4.55133E-07	0 *	490.783 *	0.000877791
Methane	93969.1	0.000483522	2.63217 *	93966.8 *	0.327549
Carbon Dioxide	831.54	0.000938128	0.043972 *	831.542 *	0.0458737
Ethane	4008.47	6.26464E-05	2.48528 *	4006.01 *	0.0261554
Propane	170.6	2.06714E-06	2.53232 *	168.07 *	0.00204832
Isobutane	1.21414	2.00784E-08	1.21416 *	0 *	2.85731E-05
n-Butane	2.46041	5.11554E-08	2.46049 *	0 *	8.14178E-05
Isopentane	2.78128	6.89561E-08	2.78146 *	0 *	0.000182363
n-Pentane	2.49511	6.84829E-08	2.49533 *	0 *	0.000217123
i-Hexane	6.28027	1.97076E-07	6.28146 *	0 *	0.001195
n-Hexane	3.59944	1.18194E-07	3.60038 *	0 *	0.000945182
2,2,4-Trimethylpentane	0.0315841	9.4142E-10	0.0316055 *	0 *	2.14607E-05
Benzene	0.130804	5.95823E-09	0.130876 *	0 *	7.16758E-05
Heptane	20.3465	6.29034E-07	20.3621 *	0 *	0.0156886
Toluene	1.55174	4.86632E-08	1.55369 *	0 *	0.00194676
Octane	27.3808	6.80727E-07	27.4371 *	0 *	0.0562912
Ethylbenzene	0.325369	8.5717E-09	0.326383 *	0 *	0.00101373
o-Xylene	0.598177	1.31611E-08	0.600544 *	0 *	0.00236764
Nonane	22.74	4.53406E-07	22.8671 *	0 *	0.12713
Decane	0	0	0 *	0 *	0
Water	118.059	0.00832721	0 *	0 *	411.57
Oxygen	0	0	0 *	0 *	0
Decanes Plus	50.9709	5.66881E-07	53.9789 *	0 *	3.008
Hexanes+	0	0	0 *	0 *	0

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Stream Properties

Property	Units	Gas to Separators	Loading	Measured Condensate	Measured Sales Gas	Produced Fluids
Temperature	°F	80 *	72.1381	110 *	110 *	80
Pressure	psia	540	0.436193	540 *	540 *	540
Mole Fraction Vapor	%	100	100	0	100	0
Mole Fraction Light Liquid	%	0	0	100	0	0.104691
Mole Fraction Heavy Liquid	%	0	0	0	0	99.8953
Molecular Weight	lb/lbmol	16.5149	19.0303	100.065	16.4924	18.1398
Mass Density	lb/ft^3	1.6646	0.00145505	42.8595	1.55018	62.0044
Molar Flow	lbmol/h	6038.88	0.000515861	1.53715	6030.83	22.8882
Mass Flow	lb/h	99731.4	0.00981696	153.815	99463.2	415.188
Vapor Volumetric Flow	ft^3/h	59913.2	6.74681	3.58883	64162.4	6.69609
Liquid Volumetric Flow	gpm	7469.7	0.841161	0.447438	7999.47	0.834838
Std Vapor Volumetric Flow	MMSCFD	54.9998	4.69826E-06	0.0139998	54.9265 *	0.208457
Std Liquid Volumetric Flow	sgpm	653.505	2.25342E-05	0.444096 *	652.835	0.833419
Compressibility		0.925057	0.999602	0.206226	0.939746	0.0272779
Specific Gravity		0.570214	0.657063	0.687193	0.569439	0.994155
API Gravity				67.0788		10.3956
Enthalpy	Btu/h	-1.98556E+08	-52.73	-135535	-1.96006E+08	-2.80896E+06
Mass Enthalpy	Btu/lb	-1990.91	-5371.31	-881.156	-1970.64	-6765.51
Mass Cp	Btu/(lb*°F)	0.585803	0.428815	0.526872	0.587838	0.977162
Ideal Gas CpCv Ratio		1.29882	1.32176	1.05157	1.29158	1.32296
Dynamic Viscosity	cP	0.0118662	0.0105296	0.350309	0.0123289	0.87981
Kinematic Viscosity	cSt	0.445021	451.766	0.51025	0.496504	0.885819
Thermal Conductivity	Btu/(h*ft*°F)	0.0212234	0.0123256	0.0663715	0.0224082	0.347588
Surface Tension	lbf/ft			0.00104169		0.00491694 ?
Net Ideal Gas Heating Value	Btu/ft^3	920.505	60.1697	5056.69	920.475	7.86602
Net Liquid Heating Value	Btu/lb	21143.3	292.726	19022.3	21172.8	-887.185
Gross Ideal Gas Heating Value	Btu/ft^3	1021.68	111.776	5439.14	1021.64	58.6584
Gross Liquid Heating Value	Btu/lb	23468.1	1321.81	20472.7	23500.5	175.391

Remarks

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Connections

	Produced Liquids	Produced Water Flow	Tank Vent Gas	W/B	1
From Block	Produced Water Tank	--	Produced Water Tank	--	MIX-100
To Block	--	MIX-100	--	--	Separator

Stream Composition

Mole Fraction	Produced Liquids %	Produced Water Flow %	Tank Vent Gas %	W/B %	1 %
Nitrogen	1.90479E-06	0 *	0.140694	0.00314949	0.289017
Methane	0.00261237	0 *	90.2487	5.84269	96.6309
Carbon Dioxide	0.00162187	0 *	3.05756	4.13222	0.311718
Ethane	0.000239369	0 *	3.71148	0.403873	2.19919
Propane	2.4682E-05	0 *	0.185812	0.00908747	0.0638248
Isobutane	5.10334E-07	0 *	0.00170709	6.69662E-05	0.000344617
n-Butane	1.90907E-06	0 *	0.00439066	0.000170615	0.000698362
Isopentane	5.72481E-06	0 *	0.00554847	0.000185273	0.000635981
n-Pentane	7.75151E-06	0 *	0.00563201	0.000184001	0.000570557
i-Hexane	4.71927E-05	0 *	0.0140053	0.000443321	0.00120248
n-Hexane	4.01748E-05	0 *	0.00811243	0.000265877	0.000689233
2,2,4-Trimethylpentane	7.73279E-07	0 *	5.03387E-05	1.59763E-06	4.56446E-06
Benzene	3.65317E-06	0 *	0.000374563	1.47866E-05	2.76403E-05
Heptane	0.000649444	0 *	0.0367265	0.00121693	0.00335234
Toluene	8.91165E-05	0 *	0.00341988	0.000102383	0.000278178
Octane	0.00211879	0 *	0.0378235	0.00115522	0.00396246
Ethylbenzene	4.12593E-05	0 *	0.000519706	1.56514E-05	5.07162E-05
o-Xylene	9.6629E-05	0 *	0.00093843	2.40314E-05	9.33178E-05
Nonane	0.0043126	0 *	0.0231918	0.000685299	0.00294129
Decane	0	0 *	0	0	0
Water	99.9073	100 *	2.48427	89.6038	0.484988
Oxygen	0	0 *	0	0	0
Decanes Plus	0.080812	0 *	0.0290893	0.000675309	0.00547228
Hexanes+	0	0 *	0	0	0

Molar Flow	Produced Liquids lbmol/h	Produced Water Flow lbmol/h	Tank Vent Gas lbmol/h	W/B lbmol/h	1 lbmol/h
Nitrogen	4.35553E-07	0 *	3.08991E-05	1.29903E-08	17.5196
Methane	0.000597351	0 *	0.0198203	2.40987E-05	5857.54
Carbon Dioxide	0.000370861	0 *	0.000671497	1.70437E-05	18.8956
Ethane	5.47348E-05	0 *	0.000815109	1.66581E-06	133.31
Propane	5.64385E-06	0 *	4.08079E-05	3.7482E-08	3.86891
Isobutane	1.16694E-07	0 *	3.74909E-07	2.76208E-10	0.0208899
n-Butane	4.36533E-07	0 *	9.6427E-07	7.03716E-10	0.0423331
Isopentane	1.30905E-06	0 *	1.21855E-06	7.64173E-10	0.0385517
n-Pentane	1.77248E-06	0 *	1.23689E-06	7.58929E-10	0.0345859
i-Hexane	1.07912E-05	0 *	3.07581E-06	1.82851E-09	0.0728916
n-Hexane	9.18649E-06	0 *	1.78164E-06	1.09663E-09	0.0417797
2,2,4-Trimethylpentane	1.7682E-07	0 *	1.10553E-08	6.58957E-12	0.000276687
Benzene	8.35344E-07	0 *	8.22611E-08	6.09886E-11	0.00167549
Heptane	0.000148504	0 *	8.06583E-06	5.01933E-09	0.203211
Toluene	2.03776E-05	0 *	7.51069E-07	4.22287E-10	0.0168625
Octane	0.000484488	0 *	8.30675E-06	4.76482E-09	0.240195
Ethylbenzene	9.43446E-06	0 *	1.14137E-07	6.45555E-11	0.0030743
o-Xylene	2.20955E-05	0 *	2.06097E-07	9.91195E-11	0.00565671
Nonane	0.000986131	0 *	5.09336E-06	2.82658E-09	0.178294
Decane	0	0 *	0	0	0
Water	22.8451	29.3989 *	0.000545593	0.000369578	29.3989
Oxygen	0	0 *	0	0	0
Decanes Plus	0.0184787	0 *	6.38855E-06	2.78537E-09	0.331717

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Molar Flow	Produced Liquids lbmol/h	Produced Water Flow lbmol/h	Tank Vent Gas lbmol/h	W/B lbmol/h	1 lbmol/h
Hexanes+	0	0 *	0	0	0

Mass Fraction	Produced Liquids %	Produced Water Flow %	Tank Vent Gas %	W/B %	1 %
Nitrogen	2.9415E-06	0 *	0.222656	0.00463619	0.490064
Methane	0.00231027	0 *	81.7906	4.92537	93.8318
Carbon Dioxide	0.00393478	0 *	7.60174	9.55619	0.830368
Ethane	0.000396776	0 *	6.30461	0.638145	4.00263
Propane	5.99975E-05	0 *	0.462873	0.0210569	0.170352
Isobutane	1.63514E-06	0 *	0.0056052	0.000204528	0.00121239
n-Butane	6.11677E-06	0 *	0.0144166	0.000521092	0.00245689
Isopentane	2.27692E-05	0 *	0.0226149	0.000702418	0.00277739
n-Pentane	3.083E-05	0 *	0.0229554	0.000697598	0.00249167
i-Hexane	0.00022419	0 *	0.0681814	0.0020075	0.00627226
n-Hexane	0.000190851	0 *	0.0394935	0.00120398	0.00359511
2,2,4-Trimethylpentane	4.86932E-06	0 *	0.000324839	9.58973E-06	3.15593E-05
Benzene	1.57306E-05	0 *	0.00165285	6.06933E-05	0.000130684
Heptane	0.00358736	0 *	0.207897	0.00640762	0.0203323
Toluene	0.000452643	0 *	0.017801	0.000495705	0.00155141
Octane	0.013342	0 *	0.244078	0.00693419	0.0273969
Ethylbenzene	0.000241469	0 *	0.00311696	8.73152E-05	0.000325905
o-Xylene	0.000565518	0 *	0.00562827	0.000134065	0.000599665
Nonane	0.030491	0 *	0.168036	0.0046186	0.0228336
Decane	0	0 *	0	0	0
Water	99.2192	100 *	2.52832	84.8247	0.528853
Oxygen	0	0 *	0	0	0
Decanes Plus	0.72492	0 *	0.267413	0.0057745	0.0538999
Hexanes+	0	0 *	0	0	0

Mass Flow	Produced Liquids lb/h	Produced Water Flow lb/h	Tank Vent Gas lb/h	W/B lb/h	1 lb/h
Nitrogen	1.22013E-05	0 *	0.00086559	3.63903E-07	490.783
Methane	0.00958298	0 *	0.317966	0.000386602	93969.4
Carbon Dioxide	0.0163214	0 *	0.0295522	0.000750084	831.586
Ethane	0.00164582	0 *	0.0245096	5.00892E-05	4008.5
Propane	0.000248869	0 *	0.00179945	1.65279E-06	170.602
Isobutane	6.78253E-06	0 *	2.17906E-05	1.60538E-08	1.21416
n-Butane	2.53723E-05	0 *	5.60455E-05	4.09015E-08	2.46049
Isopentane	9.44464E-05	0 *	8.79167E-05	5.51341E-08	2.78146
n-Pentane	0.000127882	0 *	8.92405E-05	5.47558E-08	2.49533
i-Hexane	0.000929936	0 *	0.000265059	1.57573E-07	6.28146
n-Hexane	0.000791649	0 *	0.000153533	9.45028E-08	3.60038
2,2,4-Trimethylpentane	2.01979E-05	0 *	1.26283E-06	7.52717E-10	0.0316055
Benzene	6.52503E-05	0 *	6.42556E-06	4.76393E-09	0.130876
Heptane	0.0148803	0 *	0.000808212	5.02947E-07	20.3621
Toluene	0.00187756	0 *	6.92023E-05	3.89089E-08	1.55369
Octane	0.0553424	0 *	0.000948867	5.44278E-07	27.4371
Ethylbenzene	0.00100161	0 *	1.21174E-05	6.85354E-09	0.326383
o-Xylene	0.00234576	0 *	2.18803E-05	1.0523E-08	0.600544
Nonane	0.126476	0 *	0.00065325	3.62523E-07	22.8671
Decane	0	0 *	0	0	0
Water	411.56	529.629 *	0.00982901	0.00665806	529.629
Oxygen	0	0 *	0	0	0
Decanes Plus	3.00696	0 *	0.00103958	4.53252E-07	53.9789
Hexanes+	0	0 *	0	0	0

Process Streams Report
All Streams
Tabulated by Total Phase

Client Name:	Arsenal - Comet Compressor Station
Location:	
Flowsheet:	Flowsheet1
Job:	Produced Water Tank

Stream Properties

Property	Units	Produced Liquids	Produced Water Flow	Tank Vent Gas	W/B	1
Temperature	°F	70 *	110 *	70	72.1381	105.294
Pressure	psia	14.6959 *	540 *	14.6959	0.436193	540
Mole Fraction Vapor	%	0	0	100	100	99.7486
Mole Fraction Light Liquid	%	0.088776	100	0	0	0.251419
Mole Fraction Heavy Liquid	%	99.9112	0	0	0	0
Molecular Weight	lb/lbmol	18.1402	18.0153	17.7014	19.0303	16.521
Mass Density	lb/ft^3	62.1448	61.8492	0.045883	0.00145505	1.57351
Molar Flow	lbmol/h	22.8663	29.3989	0.0219619	0.000412459	6061.77
Mass Flow	lb/h	414.799	529.629	0.388756	0.00784919	100147
Vapor Volumetric Flow	ft^3/h	6.67471	8.56323	8.47278	5.39444	63645.2
Liquid Volumetric Flow	gpm	0.832172	1.06762	1.05635	0.672554	7934.98
Std Vapor Volumetric Flow	MMSCFD	0.208257	0.267754	0.00020002	3.75651E-06	55.2083
Std Liquid Volumetric Flow	sgpm	0.831049	1.05877 *	0.00237031	1.80173E-05	654.338
Compressibility		0.000754686	0.0257285	0.997438	0.999602	0.935138
Specific Gravity		0.996406	0.991665	0.611182	0.657063	
API Gravity		10.3061	9.93525			
Enthalpy	Btu/h	-2.8127E+06	-3.59481E+06	-841.91	-42.1605	-1.99736E+08
Mass Enthalpy	Btu/lb	-6780.88	-6787.42	-2165.65	-5371.31	-1994.44
Mass Cp	Btu/(lb*°F)	0.978145	0.979951	0.493137	0.428815	0.58805
Ideal Gas CpCv Ratio		1.32351	1.32394	1.29568	1.32176	1.29258
Dynamic Viscosity	cP	0.99829	0.635123	0.0111767	0.0105296	
Kinematic Viscosity	cSt	1.00284	0.641066	15.2069	451.766	
Thermal Conductivity	Btu/(h*ft*°F)	0.344283	0.363956	0.0183609	0.0123256	
Surface Tension	lbf/ft	0.00500044 ?	0.00473609			
Net Ideal Gas Heating Value	Btu/ft^3	7.01412	0	894.841	60.1697	917.059
Net Liquid Heating Value	Btu/lb	-905.954	-1059.76	19139.3	292.726	21051.9
Gross Ideal Gas Heating Value	Btu/ft^3	57.7605	50.3101	993.583	111.776	1018.05
Gross Liquid Heating Value	Btu/lb	155.634	0	21256.1	1321.81	23371.6

Remarks

Energy Stream Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Energy Streams

Energy Stream	Energy Rate	Power	From Block	To Block
Q-1	-4587.09 Btu/h	-1.80279 hp	--	Produced Water Tank
Q-2	-1.62887E+06 Btu/h	-640.17 hp	--	Separator

Remarks

Blocks
Produced Water Tank

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		Modified: 12:02 PM, 7/26/2017
Flowsheet:	Flowsheet1	Status: Solved 9:59 AM, 8/17/2017

Connections

Stream	Connection Type	Other Block	Stream	Connection Type	Other Block
Produced Fluids	Inlet	Separator	Tank Vent Gas	Vapor Outlet	
Produced Liquids	Heavy Liquid Outlet		Q-1	Energy	

Block Parameters

Pressure Drop	525.304	psi	Main Liquid Phase	Light Liquid	
Mole Fraction Vapor	0.0959527	%	Heat Duty	-4587.09	Btu/h
Mole Fraction Light Liquid	0.0886908	%	Heat Release Curve Type	Plug Flow	
Mole Fraction Heavy Liquid	99.8154	%	Heat Release Curve Increments	10	

Remarks

Blocks
MIX-100
Mixer/Splitter Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank	
Location:		Modified: 11:59 AM, 6/20/2017	
Flowsheet:	Flowsheet1	Status: Solved 9:59 AM, 8/17/2017	

Connections

Stream	Connection Type	Other Block	Stream	Connection Type	Other Block
Produced Water Flow	Inlet		Measured Condensate	Inlet	
Measured Sales Gas	Inlet		1	Outlet	Separator

Block Parameters

Pressure Drop	0 psi	Fraction to PStream 1	100 %

Remarks

Blocks
Separator
Separator Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		Modified: 12:21 PM, 6/20/2017
Flowsheet:	Flowsheet1	Status: Solved 9:59 AM, 8/17/2017

Connections

Stream	Connection Type	Other Block	Stream	Connection Type	Other Block
1	Inlet	MIX-100	Gas to Separators	Vapor Outlet	
Produced Fluids	Light Liquid Outlet	Produced Water Tank	Q-2	Energy	

Block Parameters

* Pressure Drop	0	psi	Main Liquid Phase	Light Liquid	
Mole Fraction Vapor	99.6224	%	Heat Duty	-1.62887E+06	Btu/h
Mole Fraction Light Liquid	0.000395297	%	Heat Release Curve Type	Plug Flow	
Mole Fraction Heavy Liquid	0.377188	%	Heat Release Curve Increments	10	

Remarks

Flowsheet Environment
Environment1

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		
Flowsheet:	Flowsheet1	

Environment Settings

Number of Poynting Intervals	0	Phase Tolerance	1 %
Gibbs Excess Model Evaluation Temperature	77 °F	Emulsion Enabled	False
Freeze Out Temperature Threshold Difference	10 °F		

Components

Component Name	Henry's Law Component	Phase Initiator	Component Name	Henry's Law Component	Phase Initiator
Nitrogen	False	False	Benzene	False	False
Methane	False	False	Heptane	False	False
Carbon Dioxide	False	False	Toluene	False	False
Ethane	False	False	Octane	False	False
Propane	False	False	Ethylbenzene	False	False
Isobutane	False	False	o-Xylene	False	False
n-Butane	False	False	Nonane	False	False
Isopentane	False	False	Decane	False	False
n-Pentane	False	False	Water	False	True
i-Hexane	False	False	Oxygen	False	False
n-Hexane	False	False	Decanes Plus	False	False
2,2,4-Trimethylpentane	False	False	Hexanes+	False	False

Physical Property Method Sets

Liquid Molar Volume	COSTALD	Overall Package	Peng-Robinson
Stability Calculation	Peng-Robinson	Vapor Package	Peng-Robinson
Light Liquid Package	Peng-Robinson	Heavy Liquid Package	Peng-Robinson

Remarks

Environments Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

Project-Wide Constants

Atmospheric Pressure	14.6959 psia	Ideal Gas Reference Pressure	14.6959 psia
Ideal Gas Reference Temperature	60 °F	Ideal Gas Reference Volume	379.484 ft^3/lbmol
Liquid Reference Temperature	60 °F		

Environment [Environment1]

Environment Settings

Number of Poynting Intervals	0	Phase Tolerance	1 %
Gibbs Excess Model Evaluation Temperature	77 °F	Emulsion Enabled	False
Freeze Out Temperature Threshold Difference	10 °F		

Components

Component Name	Henry's Law Component	Phase Initiator	Component Name	Henry's Law Component	Phase Initiator
Nitrogen	False	False	Benzene	False	False
Methane	False	False	Heptane	False	False
Carbon Dioxide	False	False	Toluene	False	False
Ethane	False	False	Octane	False	False
Propane	False	False	Ethylbenzene	False	False
Isobutane	False	False	o-Xylene	False	False
n-Butane	False	False	Nonane	False	False
Isopentane	False	False	Decane	False	False
n-Pentane	False	False	Water	False	True
i-Hexane	False	False	Oxygen	False	False
n-Hexane	False	False	Decanes Plus	False	False
2,2,4-Trimethylpentane	False	False	Hexanes+	False	False

Physical Property Method Sets

Liquid Molar Volume	COSTALD	Overall Package	Peng-Robinson
Stability Calculation	Peng-Robinson	Vapor Package	Peng-Robinson
Light Liquid Package	Peng-Robinson	Heavy Liquid Package	Peng-Robinson

Remarks

Single Oil Report
Decanes Plus

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

Properties

	Volume Average Boiling Point	399.878 °F		Low Temperature Viscosity	1.05288 cP
*	Molecular Weight	162.726 lb/lbmol		Temperature of High T Viscosity	210 °F
*	Specific Gravity	0.788		High Temperature Viscosity	0.503332 cP
	API Gravity	48.0685		Watson K	12.066
	Critical Temperature	720.653 °F		ASTM D86 10-90% Slope	0 °F/%
	Critical Pressure	307.278 psia		ASTM D93 Flash Point	157.716 °F
	Critical Volume	10.2876 ft^3/lbmol	?	Pour Point	-12.6777 °F
	Acentric Factor	0.527304		Paraffinic Fraction	51.9393 %
	Carbon to Hydrogen Ratio	6.00643		Naphthenic Fraction	27.7089 %
	Refractive Index	1.43922		Aromatic Fraction	20.3518 %
	Temperature of Low T Viscosity	100 °F		Ideal Gas Heat Capacity	57.9027 Btu/(lbmol*°F)

Warnings

ProMax:ProMax!Project!Oils!Decanes Plus!Properties!Pour Point

Warning: Pour Point calculation: The value of 0.788 for Specific Gravity should be between 0.8 and 1.

Remarks

Single Oil Report
Hexanes+

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

Properties

	Volume Average Boiling Point	-173.182 °F		Low Temperature Viscosity	3.0532E+30 cP
*	Molecular Weight	16.662 lb/lbmol		Temperature of High T Viscosity	210 °F
*	Specific Gravity	0.5763		High Temperature Viscosity	1370.85 cP
	API Gravity	114.032		Watson K	11.439
	Critical Temperature	-2.89417 °F		ASTM D86 10-90% Slope	0 °F/%
	Critical Pressure	1116.36 psia	?	ASTM D93 Flash Point	-237.696 °F
	Critical Volume	1.64547 ft^3/lbmol	?	Pour Point	2.40106E+29 °F
	Acentric Factor	0.333018	?	Paraffinic Fraction	100 %
?	Carbon to Hydrogen Ratio	8.6229	?	Naphthenic Fraction	0 %
?	Refractive Index	1.31682	?	Aromatic Fraction	0 %
	Temperature of Low T Viscosity	100 °F	?	Ideal Gas Heat Capacity	5.55252 Btu/(lbmol*°F)

Warnings

ProMax:ProMax!Project!Oils!Hexanes+!Properties!Carbon to Hydrogen Ratio
Warning: Carbon to Hydrogen Ratio calculation: The value of -173.182 °F for Volume Average Boiling Point should be between 80 °F and 650 °F.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Refractive Index
Warning: Refractive Index calculation: The value of -173.182 °F for Volume Average Boiling Point should be between 80 °F and 1500 °F.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!ASTM D93 Flash Point
Warning: ASTM D93 Flash Point calculation: The value of -173.182 °F for Volume Average Boiling Point should be between 150 °F and 850 °F.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Pour Point
Warning: Pour Point calculation: The value of -173.182 °F for Volume Average Boiling Point should be between 340.33 °F and 1040.33 °F.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Paraffinic Fraction
Warning: Paraffinic Fraction calculation: The value of 16.662 lb/lbmol for Molecular Weight should be between 70 lb/lbmol and 600 lb/lbmol.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Naphthenic Fraction
Warning: Naphthenic Fraction calculation: The value of 16.662 lb/lbmol for Molecular Weight should be between 70 lb/lbmol and 600 lb/lbmol.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Aromatic Fraction
Warning: Aromatic Fraction calculation: The value of 16.662 lb/lbmol for Molecular Weight should be between 70 lb/lbmol and 600 lb/lbmol.
ProMax:ProMax!Project!Oils!Hexanes+!Properties!Ideal Gas Heat Capacity
Warning: Ideal Gas Heat Capacity calculation: The value of 0.5763 for Specific Gravity should be between 0.662763 and 1.07605.
ProMax:ProMax!Project!Oils!Hexanes+
Warning: The value of 0.5763 for Specific Gravity should be between 0.662763 and 1.07605.

Remarks

Calculator Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

Condensate Produced

Source Code

Residual Error (for CV1) = Water_frac - 99

Calculated Variable [CV1]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Measured Condensate!Phases!Total!Properties!Std Liquid Volumetric Flow
Value	15.2262
Unit	

Measured Variable [Water_frac]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Produced Liquids!Phases!Total!Composition!Std Liquid Volumetric Fraction!Water
Value	99
Unit	

Solver Properties

Status: Solved

Error	4.09861E-05		Algorithm	Default
Calculated Value	0.444096	sgpm	Iterations	20
Lower Bound		sgpm	Max Iterations	20
Upper Bound		sgpm	Weighting	1
Step Size		sgpm	Solver Active	Active
Is Minimizer	False		* Skip Dependency Check	True

Remarks

Produced Water

Source Code

Residual Error (for CV1) = Water_flow - 28.4931

Calculated Variable [CV1]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Produced Water Flow!Phases!Total!Properties!Std Liquid Volumetric Flow
Value	36.3006
Unit	

Measured Variable [Water_flow]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Produced Liquids!Phases!Total!Properties!Std Liquid Volumetric Flow
Value	28.4931
Unit	

Solver Properties

Status: Solved

Error	-1.09742E-06		Algorithm	Default
Calculated Value	1.05877	sgpm	Iterations	20
Lower Bound		sgpm	Max Iterations	20
Upper Bound		sgpm	Weighting	1
Step Size		sgpm	Solver Active	Active
Is Minimizer	False		* Skip Dependency Check	True

Remarks

Calculator Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

SG Flow

Source Code

Residual Error (for CV1) = SGflow-55

Calculated Variable [CV1]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Measured Sales Gas!Phases!Total!Properties!Std Vapor Volumetric Flow
Value	54926.5
Unit	

Measured Variable [SGflow]

Source Moniker	ProMax:ProMax!Project!Flowsheets!Flowsheet1!PStreams!Gas to Separators!Phases!Total!Properties!Std Vapor Volumetric Flow
Value	54.9998
Unit	

Solver Properties

Status: Solved

Error	-0.000205125		Iterations	1
Calculated Value	54.9265	MMSCFD	Max Iterations	20
Lower Bound		MMSCFD	Weighting	1
Upper Bound		MMSCFD	Priority	0
Step Size		MMSCFD	Solver Active	Active
Is Minimizer	False		Group	
Algorithm	Default		Skip Dependency Check	False

Remarks

User Value Sets Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

Tank-1

User Value [BlockReady]

* Parameter	1		Upper Bound		
Lower Bound			* Enforce Bounds	False	

User Value [ShellLength]

* Parameter	12	ft	Upper Bound		ft
Lower Bound		ft	* Enforce Bounds	False	

User Value [ShellDiam]

* Parameter	12	ft	Upper Bound		ft
Lower Bound		ft	* Enforce Bounds	False	

User Value [BreatherVP]

* Parameter	0.03	psig	Upper Bound		psig
Lower Bound		psig	* Enforce Bounds	False	

User Value [BreatherVacP]

* Parameter	-0.03	psig	Upper Bound		psig
Lower Bound		psig	* Enforce Bounds	False	

User Value [DomeRadius]

* Parameter	0	ft	Upper Bound		ft
Lower Bound		ft	* Enforce Bounds	False	

User Value [OpPress]

* Parameter	0	psig	Upper Bound		psig
Lower Bound		psig	* Enforce Bounds	False	

User Value [AvgPercentLiq]

* Parameter	50	%	Upper Bound		%
Lower Bound		%	* Enforce Bounds	False	

User Value [MaxPercentLiq]

* Parameter	90	%	Upper Bound		%
Lower Bound		%	* Enforce Bounds	False	

User Value [AnnNetTP]

* Parameter	28.495	bbl/day	Upper Bound		bbl/day
Lower Bound		bbl/day	* Enforce Bounds	False	

User Value [OREff]

* Parameter	0	%	Upper Bound		%
Lower Bound		%	* Enforce Bounds	False	

User Value [MaxAvgT]

* Parameter	59.8833	°F	Upper Bound		°F
Lower Bound		°F	* Enforce Bounds	False	

User Value [MinAvgT]

* Parameter	40.7333	°F	Upper Bound		°F
Lower Bound		°F	* Enforce Bounds	False	

User Value [BulkLiqT]

* Parameter	54.6483	°F	Upper Bound		°F
Lower Bound		°F	* Enforce Bounds	False	

User Value Sets Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

User Value [AvgP]

* Parameter	14.1085	psia	Upper Bound	psia
Lower Bound		psia	* Enforce Bounds	False

User Value [Therml]

* Parameter	1202.96	Btu/ft^2/day	Upper Bound	Btu/ft^2/day
Lower Bound		Btu/ft^2/day	* Enforce Bounds	False

User Value [AvgWindSpeed]

* Parameter	9.075	mi/h	Upper Bound	mi/h
Lower Bound		mi/h	* Enforce Bounds	False

User Value [MaxHourlyLoadingRate]

* Parameter	4.36	gpm	Upper Bound	gpm
Lower Bound		gpm	* Enforce Bounds	False

User Value [EntrainedOilFrac]

* Parameter	1	%	Upper Bound	%
Lower Bound		%	* Enforce Bounds	False

User Value [TurnoverRate]

* Parameter	47.8033		Upper Bound	
Lower Bound			* Enforce Bounds	False

User Value [LLossSatFactor]

* Parameter	1.45		Upper Bound	
Lower Bound			* Enforce Bounds	False

User Value [AtmPressure]

* Parameter	14.1085	psia	Upper Bound	psia
Lower Bound		psia	* Enforce Bounds	False

User Value [TVP]

* Parameter	0.29824	psia	Upper Bound	psia
Lower Bound		psia	* Enforce Bounds	False

User Value [MaxVP]

* Parameter	0.423479	psia	Upper Bound	psia
Lower Bound		psia	* Enforce Bounds	False

User Value [MinVP]

* Parameter	0.208702	psia	Upper Bound	psia
Lower Bound		psia	* Enforce Bounds	False

User Value [AvgLiqSurfaceT]

* Parameter	61.1967	°F	Upper Bound	°F
Lower Bound		°F	* Enforce Bounds	False

User Value [MaxLiqSurfaceT]

* Parameter	72.1381	°F	Upper Bound	°F
Lower Bound		°F	* Enforce Bounds	False

User Value [TotalLosses]

* Parameter	0.0343795	ton/yr	Upper Bound	ton/yr

User Value Sets Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

User Value [TotalLosses]

Lower Bound	ton/yr	* Enforce Bounds	False

User Value [WorkingLosses]

* Parameter	0.0234419 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [StandingLosses]

* Parameter	0.0109375 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [RimSealLosses]

* Parameter	0 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [WithdrawalLoss]

* Parameter	0 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [LoadingLosses]

* Parameter	0.0429983 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [MaxHourlyLoadingLoss]

* Parameter	0.0515001 lb/hr	Upper Bound	lb/hr
Lower Bound	lb/hr	* Enforce Bounds	False

User Value [PStar]

Parameter		Upper Bound	
Lower Bound		* Enforce Bounds	False

User Value [AllCTotalLosses]

* Parameter	0.0343795 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [AllCLoadingLosses]

* Parameter	0.0429983 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [AllCMaxHLoadingLoss]

* Parameter	0.0515001 lb/hr	Upper Bound	lb/hr
Lower Bound	lb/hr	* Enforce Bounds	False

User Value [AllCFlashingLosses]

* Parameter	0 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [DeckFittingLosses]

* Parameter	0 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value [DeckSeamLosses]

* Parameter	0 ton/yr	Upper Bound	ton/yr
Lower Bound	ton/yr	* Enforce Bounds	False

User Value Sets Report

Client Name:	Arsenal - Comet Compressor Station	Job: Produced Water Tank
Location:		

User Value [FlashingLosses]

* Parameter	0	ton/yr	Upper Bound	ton/yr
Lower Bound		ton/yr	* Enforce Bounds	False

User Value [TotalResidual]

* Parameter	1816.78	ton/yr	Upper Bound	ton/yr
Lower Bound		ton/yr	* Enforce Bounds	False

User Value [GasMoleWeight]

* Parameter	0.0190303	kg/mol	Upper Bound	kg/mol
Lower Bound		kg/mol	* Enforce Bounds	False

User Value [VapReportableFrac]

* Parameter	100	%	Upper Bound	%
Lower Bound		%	* Enforce Bounds	False

User Value [LiqReportableFrac]

* Parameter	100	%	Upper Bound	%
Lower Bound		%	* Enforce Bounds	False

User Value [FlashReportableFrac]

* Parameter	0	%	Upper Bound	%
Lower Bound		%	* Enforce Bounds	False

Remarks

This User Value Set was programmatically generated. GUID={8F6700DA-E196-4418-8000-F476C212C378}

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Comet 10 mmSCF
File Name: P:\Projects\0419542 Arsenal G35-D Compressor Station.GM\Comet Compressor Station\2017 Update\Calculations\GLY-CALC\10 mmSCF.ddf
Date: August 16, 2017

DESCRIPTION:

Description:

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.9168	22.003	4.0155
Ethane	0.1453	3.487	0.6363
Propane	0.0121	0.290	0.0530
Isobutane	<0.0001	0.001	0.0002
n-Butane	0.0001	0.001	0.0002
Isopentane	0.0001	0.002	0.0003
n-Pentane	0.0001	0.002	0.0004
n-Hexane	0.0002	0.005	0.0009
Heptanes	0.0005	0.012	0.0022
Benzene	0.0078	0.187	0.0341
Toluene	0.0145	0.349	0.0636
Ethylbenzene	0.0248	0.594	0.1084
Xylenes	0.0341	0.819	0.1495
C8+ Heavies	0.0033	0.080	0.0146
Total Emissions	1.1597	27.832	5.0793
Total Hydrocarbon Emissions	1.1597	27.832	5.0793
Total VOC Emissions	0.0976	2.343	0.4275
Total HAP Emissions	0.0814	1.954	0.3566
Total BTEX Emissions	0.0812	1.949	0.3556

EQUIPMENT REPORTS:

ABSORBER

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

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	3.73 lbs. H2O/MMSCF
Temperature:	80.0 deg. F
Pressure:	540.0 psig
Dry Gas Flow Rate:	10.0000 MMSCF/day

Glycol Losses with Dry Gas: 0.0219 lb/hr
Wet Gas Water Content: Saturated
Calculated Wet Gas Water Content: 50.86 lbs. H2O/MMSCF
Specified Lean Glycol Recirc. Ratio: 3.00 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	7.33%	92.67%
Carbon Dioxide	99.91%	0.09%
Nitrogen	99.99%	0.01%
Methane	99.99%	0.01%
Ethane	99.98%	0.02%
Propane	99.96%	0.04%
Isobutane	99.94%	0.06%
n-Butane	99.92%	0.08%
Isopentane	99.91%	0.09%
n-Pentane	99.88%	0.12%
n-Hexane	99.78%	0.22%
Heptanes	99.54%	0.46%
Benzene	90.92%	9.08%
Toluene	85.64%	14.36%
Ethylbenzene	78.77%	21.23%
Xylenes	70.72%	29.28%
C8+ Heavies	98.21%	1.79%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	28.19%	71.81%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Heptanes	0.50%	99.50%
Benzene	5.00%	95.00%
Toluene	7.91%	92.09%
Ethylbenzene	10.41%	89.59%
Xylenes	12.93%	87.07%
C8+ Heavies	12.04%	87.96%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 4.17e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.07e-001	2.12e+001
Carbon Dioxide	3.13e-001	1.51e+002
Nitrogen	2.90e-001	8.94e+001
Methane	9.70e+001	1.71e+004
Ethane	2.21e+000	7.29e+002
Propane	6.31e-002	3.06e+001
Isobutane	9.99e-005	6.38e-002
n-Butane	9.99e-005	6.38e-002
Isopentane	9.99e-005	7.92e-002
n-Pentane	9.99e-005	7.92e-002
n-Hexane	9.99e-005	9.46e-002
Heptanes	9.99e-005	1.10e-001
Benzene	9.99e-005	8.58e-002
Toluene	9.99e-005	1.01e-001
Ethylbenzene	9.99e-005	1.17e-001
Xylenes	9.99e-005	1.17e-001
C8+ Heavies	9.99e-005	1.87e-001
Total Components	100.00	1.81e+004

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 4.17e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.87e-003	1.56e+000
Carbon Dioxide	3.13e-001	1.51e+002
Nitrogen	2.90e-001	8.94e+001
Methane	9.71e+001	1.71e+004
Ethane	2.21e+000	7.29e+002
Propane	6.32e-002	3.06e+001
Isobutane	9.99e-005	6.38e-002
n-Butane	9.99e-005	6.38e-002
Isopentane	9.99e-005	7.92e-002
n-Pentane	9.99e-005	7.91e-002
n-Hexane	9.98e-005	9.44e-002
Heptanes	9.95e-005	1.10e-001
Benzene	9.09e-005	7.80e-002
Toluene	8.56e-005	8.67e-002
Ethylbenzene	7.88e-005	9.18e-002
Xylenes	7.07e-005	8.25e-002
C8+ Heavies	9.82e-005	1.84e-001
Total Components	100.00	1.81e+004

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 9.14e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	5.07e+002
Water	1.50e+000	7.72e+000
Carbon Dioxide	2.66e-012	1.37e-011
Nitrogen	9.71e-014	5.00e-013
Methane	5.99e-018	3.08e-017
Ethane	1.33e-008	6.86e-008
Propane	9.57e-011	4.92e-010
Isobutane	2.27e-013	1.17e-012
n-Butane	2.55e-013	1.31e-012
Isopentane	7.08e-008	3.64e-007
n-Pentane	9.35e-008	4.81e-007
n-Hexane	2.06e-007	1.06e-006
Heptanes	4.92e-007	2.53e-006
Benzene	7.97e-005	4.10e-004
Toluene	2.42e-004	1.25e-003
Ethylbenzene	5.59e-004	2.88e-003
Xylenes	9.84e-004	5.07e-003
C8+ Heavies	8.88e-005	4.57e-004
Total Components	100.00	5.15e+002

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 9.55e-001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.46e+001	5.07e+002
Water	5.11e+000	2.74e+001
Carbon Dioxide	2.56e-002	1.37e-001
Nitrogen	9.33e-004	5.00e-003
Methane	1.71e-001	9.17e-001
Ethane	2.71e-002	1.45e-001
Propane	2.26e-003	1.21e-002
Isobutane	7.28e-006	3.90e-005
n-Butane	9.88e-006	5.29e-005
Isopentane	1.36e-005	7.29e-005
n-Pentane	1.80e-005	9.62e-005
n-Hexane	3.96e-005	2.12e-004
Heptanes	9.46e-005	5.06e-004
Benzene	1.53e-003	8.20e-003
Toluene	2.95e-003	1.58e-002
Ethylbenzene	5.16e-003	2.76e-002
Xylenes	7.32e-003	3.92e-002
C8+ Heavies	7.09e-004	3.80e-003
Total Components	100.00	5.35e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia

Flow Rate: 4.39e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.43e+001	1.97e+001
Carbon Dioxide	2.69e-001	1.37e-001
Nitrogen	1.54e-002	5.00e-003
Methane	4.94e+000	9.17e-001
Ethane	4.17e-001	1.45e-001
Propane	2.37e-002	1.21e-002
Isobutane	5.79e-005	3.90e-005
n-Butane	7.86e-005	5.29e-005
Isopentane	8.68e-005	7.25e-005
n-Pentane	1.15e-004	9.57e-005
n-Hexane	2.11e-004	2.11e-004
Heptanes	4.34e-004	5.04e-004
Benzene	8.61e-003	7.79e-003
Toluene	1.36e-002	1.45e-002
Ethylbenzene	2.01e-002	2.48e-002
Xylenes	2.78e-002	3.41e-002
C8+ Heavies	1.69e-003	3.34e-003
Total Components	100.00	2.10e+001

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Comet 10 mmSCF
File Name: P:\Projects\0419542 Arsenal G35-D Compressor Station.GM\Comet Compressor Station\2017 Update\Calculations\GLY-CALC\10 mmSCF.ddf
Date: August 16, 2017

DESCRIPTION:

Description:

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 540.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.3133
Nitrogen	0.2905
Methane	97.1239
Ethane	2.2091
Propane	0.0632
Isobutane	0.0001
n-Butane	0.0001
Isopentane	0.0001
n-Pentane	0.0001
n-Hexane	0.0001
Heptanes	0.0001
Benzene	0.0001
Toluene	0.0001
Ethylbenzene	0.0001
Xylenes	0.0001
C8+ Heavies	0.0001

DRY GAS:

Flow Rate: 10.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Recirculation Ratio: 3.0 gal/lb H2O

PUMP:

Glycol Pump Type: Electric/Pneumatic

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Comet 45 mmSCF
File Name: P:\Projects\0419542 Arsenal G35-D Compressor Station.GM\Comet Compressor Station\2017 Update\Calculations\GLY-CALC\45 mmSCF.ddf
Date: August 16, 2017

DESCRIPTION:

Description:

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	4.1255	99.012	18.0697
Ethane	0.6537	15.690	2.8634
Propane	0.0544	1.306	0.2384
Isobutane	0.0002	0.004	0.0008
n-Butane	0.0002	0.006	0.0010
Isopentane	0.0003	0.008	0.0014
n-Pentane	0.0004	0.010	0.0019
n-Hexane	0.0009	0.023	0.0042
Heptanes	0.0023	0.054	0.0099
Benzene	0.0351	0.841	0.1536
Toluene	0.0654	1.569	0.2864
Ethylbenzene	0.1114	2.673	0.4879
Xylenes	0.1536	3.685	0.6726
C8+ Heavies	0.0150	0.361	0.0658
Total Emissions	5.2185	125.243	22.8568
Total Hydrocarbon Emissions	5.2185	125.243	22.8568
Total VOC Emissions	0.4392	10.541	1.9238
Total HAP Emissions	0.3663	8.792	1.6045
Total BTEX Emissions	0.3654	8.769	1.6004

EQUIPMENT REPORTS:

ABSORBER

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

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	3.73 lbs. H2O/MMSCF
Temperature:	80.0 deg. F
Pressure:	540.0 psig
Dry Gas Flow Rate:	45.0000 MMSCF/day

Glycol Losses with Dry Gas: 0.0984 lb/hr
Wet Gas Water Content: Saturated
Calculated Wet Gas Water Content: 50.86 lbs. H2O/MMSCF
Specified Lean Glycol Recirc. Ratio: 3.00 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	7.33%	92.67%
Carbon Dioxide	99.91%	0.09%
Nitrogen	99.99%	0.01%
Methane	99.99%	0.01%
Ethane	99.98%	0.02%
Propane	99.96%	0.04%
Isobutane	99.94%	0.06%
n-Butane	99.92%	0.08%
Isopentane	99.91%	0.09%
n-Pentane	99.88%	0.12%
n-Hexane	99.78%	0.22%
Heptanes	99.54%	0.46%
Benzene	90.92%	9.08%
Toluene	85.64%	14.36%
Ethylbenzene	78.77%	21.23%
Xylenes	70.72%	29.28%
C8+ Heavies	98.21%	1.79%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	28.19%	71.81%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Heptanes	0.50%	99.50%
Benzene	5.00%	95.00%
Toluene	7.91%	92.09%
Ethylbenzene	10.41%	89.59%
Xylenes	12.93%	87.07%
C8+ Heavies	12.04%	87.96%

STREAM REPORTS:

WET GAS STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 1.88e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.07e-001	9.55e+001
Carbon Dioxide	3.13e-001	6.81e+002
Nitrogen	2.90e-001	4.02e+002
Methane	9.70e+001	7.70e+004
Ethane	2.21e+000	3.28e+003
Propane	6.31e-002	1.38e+002
Isobutane	9.99e-005	2.87e-001
n-Butane	9.99e-005	2.87e-001
Isopentane	9.99e-005	3.57e-001
n-Pentane	9.99e-005	3.57e-001
n-Hexane	9.99e-005	4.26e-001
Heptanes	9.99e-005	4.95e-001
Benzene	9.99e-005	3.86e-001
Toluene	9.99e-005	4.55e-001
Ethylbenzene	9.99e-005	5.25e-001
Xylenes	9.99e-005	5.25e-001
C8+ Heavies	9.99e-005	8.42e-001
Total Components	100.00	8.16e+004

DRY GAS STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 1.88e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.87e-003	7.00e+000
Carbon Dioxide	3.13e-001	6.81e+002
Nitrogen	2.90e-001	4.02e+002
Methane	9.71e+001	7.70e+004
Ethane	2.21e+000	3.28e+003
Propane	6.32e-002	1.38e+002
Isobutane	9.99e-005	2.87e-001
n-Butane	9.99e-005	2.87e-001
Isopentane	9.99e-005	3.56e-001
n-Pentane	9.99e-005	3.56e-001
n-Hexane	9.98e-005	4.25e-001
Heptanes	9.95e-005	4.93e-001
Benzene	9.09e-005	3.51e-001
Toluene	8.56e-005	3.90e-001
Ethylbenzene	7.88e-005	4.13e-001
Xylenes	7.07e-005	3.71e-001
C8+ Heavies	9.82e-005	8.27e-001
Total Components	100.00	8.15e+004

LEAN GLYCOL STREAM

Temperature: 80.00 deg. F
Flow Rate: 4.11e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	2.28e+003
Water	1.50e+000	3.47e+001
Carbon Dioxide	2.66e-012	6.17e-011
Nitrogen	9.71e-014	2.25e-012
Methane	5.99e-018	1.39e-016
Ethane	1.33e-008	3.09e-007
Propane	9.57e-011	2.22e-009
Isobutane	2.27e-013	5.26e-012
n-Butane	2.55e-013	5.90e-012
Isopentane	7.08e-008	1.64e-006
n-Pentane	9.35e-008	2.17e-006
n-Hexane	2.06e-007	4.77e-006
Heptanes	4.92e-007	1.14e-005
Benzene	7.97e-005	1.85e-003
Toluene	2.42e-004	5.61e-003
Ethylbenzene	5.59e-004	1.29e-002
Xylenes	9.84e-004	2.28e-002
C8+ Heavies	8.88e-005	2.06e-003
Total Components	100.00	2.32e+003

RICH GLYCOL STREAM

Temperature: 80.00 deg. F
Pressure: 554.70 psia
Flow Rate: 4.30e+000 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.46e+001	2.28e+003
Water	5.11e+000	1.23e+002
Carbon Dioxide	2.56e-002	6.17e-001
Nitrogen	9.33e-004	2.25e-002
Methane	1.71e-001	4.13e+000
Ethane	2.71e-002	6.54e-001
Propane	2.26e-003	5.44e-002
Isobutane	7.28e-006	1.75e-004
n-Butane	9.88e-006	2.38e-004
Isopentane	1.36e-005	3.28e-004
n-Pentane	1.80e-005	4.33e-004
n-Hexane	3.96e-005	9.53e-004
Heptanes	9.46e-005	2.28e-003
Benzene	1.53e-003	3.69e-002
Toluene	2.95e-003	7.10e-002
Ethylbenzene	5.16e-003	1.24e-001
Xylenes	7.32e-003	1.76e-001
C8+ Heavies	7.09e-004	1.71e-002
Total Components	100.00	2.41e+003

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia

Flow Rate: 1.98e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.43e+001	8.85e+001
Carbon Dioxide	2.69e-001	6.17e-001
Nitrogen	1.54e-002	2.25e-002
Methane	4.94e+000	4.13e+000
Ethane	4.17e-001	6.54e-001
Propane	2.37e-002	5.44e-002
Isobutane	5.79e-005	1.75e-004
n-Butane	7.86e-005	2.38e-004
Isopentane	8.68e-005	3.26e-004
n-Pentane	1.15e-004	4.31e-004
n-Hexane	2.11e-004	9.49e-004
Heptanes	4.34e-004	2.27e-003
Benzene	8.61e-003	3.51e-002
Toluene	1.36e-002	6.54e-002
Ethylbenzene	2.01e-002	1.11e-001
Xylenes	2.78e-002	1.54e-001
C8+ Heavies	1.69e-003	1.50e-002
Total Components	100.00	9.43e+001

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Comet 45 mmSCF
File Name: P:\Projects\0419542 Arsenal G35-D Compressor Station.GM\Comet Compressor Station\2017 Update\Calculations\GLY-CALC\45 mmSCF.ddf
Date: August 16, 2017

DESCRIPTION:

Description:

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 80.00 deg. F
Pressure: 540.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.3133
Nitrogen	0.2905
Methane	97.1239
Ethane	2.2091
Propane	0.0632
Isobutane	0.0001
n-Butane	0.0001
Isopentane	0.0001
n-Pentane	0.0001
n-Hexane	0.0001
Heptanes	0.0001
Benzene	0.0001
Toluene	0.0001
Ethylbenzene	0.0001
Xylenes	0.0001
C8+ Heavies	0.0001

DRY GAS:

Flow Rate: 45.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H2O
Recirculation Ratio: 3.0 gal/lb H2O

PUMP:

Glycol Pump Type: Electric/Pneumatic

C6+ Gas Analysis Report

Gas Analytical Services

Client:	PDC Mountaineer	Date Sampled:	May 29, 2014
Site:	Garrett EQT Check	Date Reported:	Jun 2, 2014 11:28a
Field No:	9998	Collected By:	J. Dowell
Meter:		Date Effective:	May 29, 2014 12:00a
Source Laboratory:	Clarksburg (Bridgeport), WV	Sample Pressure (PSI):	540
Lab File No:	114847.CHR	Sample Temp (°F):	
Sample Type:	Spot	Field H2O (PPM):	
		Field H2S (PPM):	

Component	Mol %	Gal/MSCF
Methane	97.1239	
Ethane	2.2091	0.59
Propane	0.0632	0.02
I-Butane	< MDL	0.00
N-Butane	< MDL	0.00
I-Pentane	< MDL	0.00
N-Pentane	< MDL	0.00
Nitrogen	0.2905	
Oxygen	< MDL	
CO2	0.3133	
Hexanes+	< MDL	0.00
TOTAL	100.0000	0.60

Analytical Results at Base Conditions (Real)		
BTU/SCF (Dry):	1,025.7784	BTU/ft³
BTU/SCF (Saturated):	1,008.8030	BTU/ft³
PSIA:	14.73	PSI
Temperature (°F):	60.00	°F
Z Factor (Dry):	0.99793	
Z Factor (Saturated):	0.99758	

Analytical Results at Contract Conditions (Real)		
BTU/SCF (Dry):	1,025.7784	BTU/ft³
BTU/SCF (Saturated):	1,008.8030	BTU/ft³
PSIA:	14.7300	PSI
Temperature (°F):	60.0000	°F
Z Factor (Dry):	0.99793	
Z Factor (Saturated):	0.99758	

Calculated Specific Gravities			
Ideal Gravity:	0.5694	Real Gravity:	0.5704
Molecular Wt:	16.4925 lb/lbmol		

Gross Heating Values are Based on:
GPA 2145-09, 2172, 2261
Compressibility is Calculated using AGA-8.

Source	Date	Notes
Gas Analytical	Jun 2, 2014	results to Lenny Pierce

G3516B

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1400	FUEL:	Nat Gas
COMPRESSION RATIO:	8:1	FUEL SYSTEM:	CAT WIDE RANGE
AFTERCOOLER - STAGE 2 INLET (°F):	130		WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 1 INLET (°F):	201	FUEL PRESSURE RANGE(psig):	5.0-50.0
JACKET WATER OUTLET (°F):	210	FUEL METHANE NUMBER:	80
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL LHV (Btu/scf):	905
IGNITION SYSTEM:	ADEM3	ALTITUDE CAPABILITY AT 100°F INLET AIR TEMP. (ft):	4000
EXHAUST MANIFOLD:	DRY	APPLICATION:	Gas Compression
COMBUSTION:	Ultra Lean Burn		
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5		

RATING		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	bhp	1380	1035	691
ENGINE EFFICIENCY	(ISO 3046/1)	(2)	%	34.9	32.5	30.3
ENGINE EFFICIENCY	(NOMINAL)	(2)	%	34.2	31.9	29.7

ENGINE DATA						
FUEL CONSUMPTION	(ISO 3046/1)	(3)	Btu/bhp-hr	7300	7819	8399
FUEL CONSUMPTION	(NOMINAL)	(3)	Btu/bhp-hr	7442	7971	8562
AIR FLOW (77°F, 14.7 psia)	(WET)	(4) (5)	scfm	3126	2452	1714
AIR FLOW	(WET)	(4) (5)	lb/hr	13859	10872	7602
COMPRESSOR OUT PRESSURE			in Hg(abs)	103.7	91.7	69.4
COMPRESSOR OUT TEMPERATURE			°F	381	354	274
AFTERCOOLER AIR OUT TEMPERATURE			°F	133	133	131
INLET MAN. PRESSURE		(6)	in Hg(abs)	94.6	76.8	54.0
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(7)	°F	146	146	143
TIMING		(8)	°BTDC	30.0	28.7	24.1
EXHAUST STACK TEMPERATURE		(9)	°F	992	938	1006
EXHAUST GAS FLOW (@stack temp, 14.5 psia)	(WET)	(10) (5)	ft3/min	9124	6900	5065
EXHAUST GAS MASS FLOW	(WET)	(10) (5)	lb/hr	14377	11288	7899

EMISSIONS DATA					
NOx (as NO2)	(11)	g/bhp-hr	0.50	0.50	0.50
CO	(12)	g/bhp-hr	2.43	2.61	2.56
THC (mol. wt. of 15.84)	(12)	g/bhp-hr	4.77	5.11	5.18
NMHC (mol. wt. of 15.84)	(12)	g/bhp-hr	0.71	0.77	0.78
NMNEHC (VOCs) (mol. wt. of 15.84)	(12)(13)	g/bhp-hr	0.48	0.51	0.52
HCHO (Formaldehyde)	(12)	g/bhp-hr	0.43	0.43	0.42
CO2	(12)	g/bhp-hr	474	505	549
EXHAUST OXYGEN	(14)	% DRY	9.0	8.7	8.3
LAMBDA	(14)		1.68	1.64	1.60

ENERGY BALANCE DATA					
LHV INPUT	(15)	Btu/min	171162	137537	98551
HEAT REJECTION TO JACKET WATER (JW)	(16)(23)	Btu/min	23454	24132	20035
HEAT REJECTION TO ATMOSPHERE	(17)	Btu/min	6110	5093	4076
HEAT REJECTION TO LUBE OIL (OC)	(18)(23)	Btu/min	4449	3947	3324
HEAT REJECTION TO EXHAUST (LHV TO 77°F)	(19)	Btu/min	62411	46273	34853
HEAT REJECTION TO EXHAUST (LHV TO 350°F)	(19)	Btu/min	41610	29857	23415
HEAT REJECTION TO A/C - STAGE 1	(20)(23)	Btu/min	10041	8304	2813
HEAT REJECTION TO A/C - STAGE 2	(21)(24)	Btu/min	5357	5061	3334
PUMP POWER	(22)	Btu/min	833	833	833

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure, 500 ft. altitude.) No overload permitted at rating shown. Consult altitude curves for applications above maximum rated altitude and/or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	30	35	40	45	50	55	60	65	70	75	80	85
IGNITION TIMING	27	27	27	28	28	28	28	30	30	30	30	30
DERATION FACTOR	0.90	0.90	0.90	1	1	1	1	1	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1	1	1	1	0.96	0.92	0.87	0.83	0.79	0.75	No Rating	No Rating	No Rating
120	1	1	1	1	0.97	0.93	0.88	0.84	0.79	0.75	No Rating	No Rating	No Rating
110	1	1	1	1	0.98	0.94	0.89	0.84	0.80	0.75	No Rating	No Rating	No Rating
100	1	1	1	1	1	0.95	0.90	0.85	0.80	0.75	No Rating	No Rating	No Rating
90	1	1	1	1	1	0.97	0.91	0.86	0.80	0.75	No Rating	No Rating	No Rating
80	1	1	1	1	1	0.99	0.94	0.89	0.84	0.78	No Rating	No Rating	No Rating
70	1	1	1	1	1	1	0.95	0.90	0.85	0.80	0.75	No Rating	No Rating
60	1	1	1	1	1	1	0.95	0.90	0.85	0.80	0.75	No Rating	No Rating
50	1	1	1	1	1	1	0.95	0.90	0.85	0.80	0.75	No Rating	No Rating

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.31	1.36	1.40	1.45	1.50	1.55	1.55	1.55	1.55	1.55	No Rating	No Rating	No Rating
120	1.25	1.29	1.34	1.39	1.44	1.49	1.49	1.49	1.49	1.49	No Rating	No Rating	No Rating
110	1.18	1.23	1.28	1.32	1.37	1.42	1.42	1.42	1.42	1.42	No Rating	No Rating	No Rating
100	1.12	1.17	1.21	1.26	1.30	1.35	1.35	1.35	1.35	1.35	No Rating	No Rating	No Rating
90	1.06	1.10	1.15	1.19	1.24	1.29	1.29	1.29	1.29	1.29	No Rating	No Rating	No Rating
80	1	1.04	1.08	1.13	1.17	1.22	1.22	1.22	1.22	1.22	No Rating	No Rating	No Rating
70	1	1	1.02	1.06	1.11	1.15	1.15	1.15	1.15	1.15	1.15	No Rating	No Rating
60	1	1	1	1	1.04	1.09	1.09	1.09	1.09	1.09	1.09	No Rating	No Rating
50	1	1	1	1	1	1.02	1.02	1.02	1.02	1.02	1.02	No Rating	No Rating

ALTITUDE (FEET ABOVE SEA LEVEL)

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating	No Rating
120	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating	No Rating
110	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating	No Rating
100	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating	No Rating
90	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating	No Rating
80	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	No Rating	No Rating	No Rating
70	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating
60	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating
50	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1230	No Rating	No Rating

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:
This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar Methane Number Calculation program.

ALTITUDE DERATION FACTORS:
This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

ACTUAL ENGINE RATING:
To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).
1) Fuel Usage Guide Deration
2) 1-((1-Altitude/Temperature Deration) + (1-RPC))

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):
Aftercooler heat rejection is given for standard conditions of 77°F and 500 ft. altitude. To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See Notes 23 and 24 below for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM):
This table shows the minimum allowable engine turndown speed where the engine will maintain the Rated Speed's Torque for the given ambient conditions. For some ambient conditions, the engine is not capable of being loaded continuously from idle to the max site torque at the indicated speed.

NOTES:
1. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.
2. ISO 3046/1 engine efficiency tolerance is (+)0, (-)5% of full load % efficiency value. Nominal engine efficiency tolerance is ± 3.0% of full load % efficiency value.
3. ISO 3046/1 fuel consumption tolerance is (+)5, (-)0% of full load data. Nominal fuel consumption tolerance is ± 3.0% of full load data.
4. Undried air. Flow is a nominal value with a tolerance of ± 5 %.
5. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
6. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
7. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
8. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
9. Exhaust stack temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
10. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
11. NOx values are "Not to Exceed".
12. CO, CO2, THC, NMHC, NMNEHC, and HCHO values are "Not to Exceed" levels. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
13. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
14. Exhaust Oxygen tolerance is ± 0.5; Lambda tolerance is ± 0.05. Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
15. LHV rate tolerance is ± 3.0%.
16. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
17. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
18. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
19. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
20. Heat rejection to A/C - Stage 1 based on treated water. Tolerance is ±5% of full load data.
21. Heat rejection to A/C - Stage 2 based on treated water. Tolerance is ±5% of full load data.
22. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
23. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2) + (1AC x 1.05) + [0.9 x (1AC + 2AC) x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
24. Total Second Stage Aftercooler Circuit heat rejection is calculated as: (2AC x 1.05) + [(1AC + 2AC) x 0.1 x (ACHRF - 1) x 1.05]. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

DCL International Inc.

Mailing address: **P.O. Box 90, Concord, Ontario, Canada, L4K 1B2**
Toll free: **1-800-872-1968** *Phone:* **905-660-6450** *Fax:* **905-660-6435** *E-mail:* **info@dcl-inc.com**

To	Mark Davis	**Phone**	
	J-W Power	**Fax**	
Date	January 4, 2010	**Email**	mdavis@jwenergy.com

RE: EMISSIONS GUARANTEE

Mark,

We hereby guarantee that our QUICK-LID™ Model DC65A-12 catalytic converter described below:

Catalyst model	DC65
Catalyst coating	Oxidation (A coating)
Outside Diameter of catalyst substrate	30.75"
No. of catalyst substrates	1
Cell Density	300 cpsi

and sized for the following engine:

Engine model	CAT G3516 ULB
Power	1380 hp @ 1400 rpm
Fuel	Pipeline Quality Natural Gas

will perform as follows:

Emissions	**After Catalyst (% destruction)**
Carbon Monoxide (CO)	93%
Formaldehyde (CH_2O)	90%
Volatile Organic Compounds	80%

for a period of 1 year or 8000 hours, whichever comes first, subject to all terms and conditions contained in the attached warranty document being respected and met.

Best regards,
DCL International, Inc.

Tawnya VanGroningen

Tawnya VanGroningen
Account Manager
North American Industrial Catalyst Division

Quote#16-1558

335-21148-00

G3508 LE

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1400	FUEL:	Nat Gas
COMPRESSION RATIO:	8:1	FUEL SYSTEM:	HPG IMPCO
AFTERCOOLER WATER INLET (°F):	130		WITH AIR FUEL RATIO CONTROL
JACKET WATER OUTLET (°F):	210	FUEL PRESSURE RANGE(psig):	35.0-40.0
COOLING SYSTEM:	JW+OC, AC	FUEL METHANE NUMBER:	80
IGNITION SYSTEM:	ADEM3	FUEL LHV (Btu/scf):	905
EXHAUST MANIFOLD:	ASWC	ALTITUDE CAPABILITY AT 77°F INLET AIR TEMP. (ft):	3658
COMBUSTION:	Low Emission	APPLICATION:	Gas Compression
NOx EMISSION LEVEL (g/bhp-hr NOx):	2.0		

RATING		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	bhp	670	502	335
ENGINE EFFICIENCY	(ISO 3046/1)	(2)	%	33.9	32.1	29.5
ENGINE EFFICIENCY	(NOMINAL)	(2)	%	33.2	31.5	28.9

ENGINE DATA						
FUEL CONSUMPTION	(ISO 3046/1)	(3)	Btu/bhp-hr	7510	7936	8639
FUEL CONSUMPTION	(NOMINAL)	(3)	Btu/bhp-hr	7656	8090	8807
AIR FLOW (77°F, 14.7 psia)	(WET)	(4) (5)	scfm	1396	1085	783
AIR FLOW	(WET)	(4) (5)	lb/hr	6188	4811	3472
COMPRESSOR OUT PRESSURE			in Hg(abs)	77.1	75.0	59.0
COMPRESSOR OUT TEMPERATURE			°F	313	294	236
AFTERCOOLER AIR OUT TEMPERATURE			°F	131	129	130
INLET MAN. PRESSURE		(6)	in Hg(abs)	68.7	54.2	39.4
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(7)	°F	138	136	137
TIMING		(8)	°BTDC	33.0	33.0	33.0
EXHAUST STACK TEMPERATURE		(9)	°F	985	977	974
EXHAUST GAS FLOW (@stack temp, 14.5 psia)	(WET)	(10) (5)	ft3/min	4086	3163	2279
EXHAUST GAS MASS FLOW	(WET)	(10) (5)	lb/hr	6445	5014	3620

EMISSIONS DATA					
NOx (as NO2)	(11)	g/bhp-hr	2.00	2.00	2.00
CO	(12)	g/bhp-hr	1.85	1.96	2.14
THC (mol. wt. of 15.84)	(12)	g/bhp-hr	3.04	3.30	3.76
NMHC (mol. wt. of 15.84)	(12)	g/bhp-hr	0.46	0.50	0.56
NMNEHC (VOCs) (mol. wt. of 15.84)	(12)(13)	g/bhp-hr	0.30	0.33	0.38
HCHO (Formaldehyde)	(12)	g/bhp-hr	0.18	0.20	0.25
CO2	(12)	g/bhp-hr	468	489	538
EXHAUST OXYGEN	(14)	% DRY	7.9	7.6	7.2
LAMBDA	(14)		1.49	1.46	1.45

ENERGY BALANCE DATA					
LHV INPUT	(15)	Btu/min	85472	67733	49171
HEAT REJECTION TO JACKET WATER (JW)	(16)(22)	Btu/min	18204	16013	13141
HEAT REJECTION TO ATMOSPHERE	(17)	Btu/min	3188	2657	2126
HEAT REJECTION TO LUBE OIL (OC)	(18)(22)	Btu/min	2878	2532	2078
HEAT REJECTION TO EXHAUST (LHV TO 77°F)	(19)	Btu/min	27406	21203	15304
HEAT REJECTION TO EXHAUST (LHV TO 350°F)	(19)	Btu/min	18562	14270	10261
HEAT REJECTION TO AFTERCOOLER (AC)	(20)(23)	Btu/min	4555	3191	1480
PUMP POWER	(21)	Btu/min	838	838	838

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1. (Standard reference conditions of 77°F, 29.60 in Hg barometric pressure, 500 ft. altitude.) No overload permitted at rating shown. Consult altitude curves for applications above maximum rated altitude and/or temperature.

Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Tolerances specified are dependent upon fuel quality. Fuel methane number cannot vary more than ± 3.

For notes information consult page three.

FUEL USAGE GUIDE

CAT METHANE NUMBER	25	30	35	40	45	50	55	60	65	70	75	80	85	100
IGNITION TIMING	-	27	27	28	29	29	30	31	31	31	32	32	33	33
DERATION FACTOR	0	0.90	0.90	0.90	0.95	1	1	1	1	1	1	1	1	1

ALTITUDE DERATION FACTORS AT RATED SPEED

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1	1	0.96	0.92	0.88	0.84	0.80	0.76	0.73	0.70	0.67	0.64	0.61
120	1	1	0.98	0.94	0.90	0.85	0.81	0.77	0.74	0.71	0.68	0.65	0.62
110	1	1	1	0.96	0.92	0.87	0.83	0.79	0.75	0.72	0.69	0.66	0.63
100	1	1	1	0.98	0.94	0.89	0.85	0.81	0.77	0.74	0.70	0.68	0.65
90	1	1	1	1	0.96	0.91	0.87	0.83	0.79	0.75	0.72	0.69	0.66
80	1	1	1	1	0.98	0.93	0.89	0.85	0.81	0.77	0.73	0.70	0.67
70	1	1	1	1	1	0.95	0.91	0.87	0.83	0.78	0.75	0.72	0.68
60	1	1	1	1	1	0.98	0.93	0.89	0.84	0.80	0.76	0.73	0.70
50	1	1	1	1	1	1	0.95	0.91	0.87	0.82	0.78	0.74	0.71

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS (ACHRF)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.39	1.45	1.51	1.58	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62
120	1.31	1.37	1.43	1.50	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
110	1.23	1.29	1.35	1.41	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
100	1.15	1.21	1.27	1.33	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37
90	1.07	1.13	1.19	1.25	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29
80	1	1.05	1.11	1.17	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
70	1	1	1.03	1.09	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
60	1	1	1	1	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
50	1	1	1	1	1	1	1	1	1	1	1	1	1

ALTITUDE (FEET ABOVE SEA LEVEL)

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM)

INLET AIR TEMP °F	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
120	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
110	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
100	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
90	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
80	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
70	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
60	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
50	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050

ALTITUDE (FEET ABOVE SEA LEVEL)

FUEL USAGE GUIDE:
This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar Methane Number Calculation program.

ALTITUDE DERATION FACTORS:
This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

ACTUAL ENGINE RATING:
To determine the actual rating of the engine at site conditions, one must consider separately, limitations due to fuel characteristics and air system limitations. The Fuel Usage Guide deration establishes fuel limitations. The Altitude/Temperature deration factors and RPC (reference the Caterpillar Methane Program) establish air system limitations. RPC comes into play when the Altitude/Temperature deration is less than 1.0 (100%). Under this condition, add the two factors together. When the site conditions do not require an Altitude/Temperature derate (factor is 1.0), it is assumed the turbocharger has sufficient capability to overcome the low fuel relative power, and RPC is ignored. To determine the actual power available, take the lowest rating between 1) and 2).
1) Fuel Usage Guide Deration
2) 1-((1-Altitude/Temperature Deration) + (1-RPC))

AFTERCOOLER HEAT REJECTION FACTORS(ACHRF):
Aftercooler heat rejection is given for standard conditions of 77°F and 500 ft. altitude. To maintain a constant air inlet manifold temperature, as the inlet air temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor (ACHRF) to adjust for inlet air temp and altitude conditions. See Notes 22 and 23 below for application of this factor in calculating the heat exchanger sizing criteria. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail.

MINIMUM SPEED CAPABILITY AT THE RATED SPEED'S SITE TORQUE (RPM):
This table shows the minimum allowable engine turndown speed where the engine will maintain the Rated Speed's Torque for the given ambient conditions.

NOTES:
1. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.
2. ISO 3046/1 engine efficiency tolerance is (+)0, (-)5% of full load % efficiency value. Nominal engine efficiency tolerance is ± 3.0% of full load % efficiency value.
3. ISO 3046/1 fuel consumption tolerance is (+)5, (-)0% of full load data. Nominal fuel consumption tolerance is ± 3.0% of full load data.
4. Undried air. Flow is a nominal value with a tolerance of ± 5 %.
5. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
6. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.
7. Inlet manifold temperature is a nominal value with a tolerance of ± 9°F.
8. Timing indicated is for use with the minimum fuel methane number specified. Consult the appropriate fuel usage guide for timing at other methane numbers.
9. Exhaust stack temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.
10. Exhaust flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 6 %.
11. NOx values are "Not to Exceed".
12. CO, CO2, THC, NMHC, NMNEHC, and HCHO values are "Not to Exceed" levels. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
13. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
14. Exhaust Oxygen tolerance is ± 0.5; Lambda tolerance is ± 0.05. Lambda and Exhaust Oxygen level are the result of adjusting the engine to operate at the specified NOx level.
15. LHV rate tolerance is ± 3.0%.
16. Heat rejection to jacket water value displayed includes heat to jacket water alone. Value is based on treated water. Tolerance is ± 10% of full load data.
17. Heat rejection to atmosphere based on treated water. Tolerance is ± 50% of full load data.
18. Lube oil heat rate based on treated water. Tolerance is ± 20% of full load data.
19. Exhaust heat rate based on treated water. Tolerance is ± 10% of full load data.
20. Heat rejection to aftercooler based on treated water. Tolerance is ±5% of full load data.
21. Pump power includes engine driven jacket water and aftercooler water pumps. Engine brake power includes effects of pump power.
22. Total Jacket Water Circuit heat rejection is calculated as: (JW x 1.1) + (OC x 1.2). Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.
23. Total Aftercooler Circuit heat rejection is calculated as: AC x ACHRF x 1.05. Heat exchanger sizing criterion is maximum circuit heat rejection at site conditions, with applied tolerances. A cooling system safety factor may be multiplied by the total circuit heat rejection to provide additional margin.

DCL International Inc.

Mailing address: **P.O. Box 90, Concord, Ontario, Canada, L4K 1B2**
Toll free: **1-800-872-1968** *Phone:* **905-660-6450** *Fax:* **905-660-6435** *E-mail:* **info@dcl-inc.com**

To	Mark Davis	**Phone**	
	J-W Power	**Fax**	
Date	June 21st 2011	**Email**	mdavis@jwenergy.com

RE: EMISSIONS GUARANTEE

Mark,

We hereby guarantee that our QUICK-LID™ Model DC63Q-8 catalytic converter described below:

Catalyst model	DC63
Catalyst coating	Oxidation (Q coating)
Outside Diameter of catalyst substrate	20.4"
No. of catalyst substrates	1
Cell Density	300 cpsi

and sized for the following engine:

Engine model	CAT G3508 B
Power	670 hp @ 1400 rpm
Fuel	Pipeline Quality Natural Gas

will perform as follows:

Emissions	**After Catalyst (% destruction)**
Carbon Monoxide (CO)	93%
Formaldehyde (CH_2O)	90%
Volatile Organic Compounds	45%

for a period of 1 year (after invoice date) or 8000 hours, whichever comes first, subject to all terms and conditions contained in the attached warranty document being respected and met.

Best regards,
DCL International, Inc.

Tawnya VanGroningen

Tawnya VanGroningen
Account Manager
North American Industrial Catalyst Division

Quote#16-1558

335-21540-00

Attachment V

ATTACHMENT V – 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
Compressor Engine (CE-1R)	1.52	6.66	0.56	2.43	0.32	1.39	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	1,441.54	6,313.93
Compressor Engine (CE-2R)	1.52	6.66	0.56	2.43	0.32	1.39	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	1,441.54	6,313.93
Compressor Engine (CE-3R)	1.52	6.66	0.56	2.43	0.32	1.39	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	1,441.54	6,313.93
Compressor Engine (CE-6R)	1.52	6.66	0.56	2.43	0.32	1.39	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	1,441.54	6,313.93
Compressor Engine (CE-4R)	2.95	12.94	0.22	0.97	0.31	1.35	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	720.00	3,153.61
Dehy Still Vent (RSV-4)	<0.01	<0.01	<0.01	<0.01	0.44	1.92	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	103.14	451.74
Dehy Reboiler (RBV-4)	0.10	0.43	0.08	0.36	<0.01	0.02	<0.01	<0.01	<0.01	0.03	<0.01	0.03	117.10	512.89
Dehy Still Vent (RSV-5)	<0.01	<0.01	<0.01	<0.01	0.10	0.43	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22.92	100.39
Dehy Reboiler (RBV-5)	0.02	0.09	0.02	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23.42	102.58
Produced Water Tank (T-1 and T-2)	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7.99	34.99
Truck Loading (LO-1)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.06
TOTAL	9.16	40.10	2.54	11.14	2.12	9.30	0.03	0.12	0.01	0.03	0.01	0.03	6,760.72	29,611.98

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

ATTACHMENT V – 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
Compressor Engine (CE-1R)	0.13	0.57	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.05	0.15	0.67
Compressor Engine (CE-2R)	0.13	0.57	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.05	0.15	0.67
Compressor Engine (CE-3R)	0.13	0.57	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.05	0.15	0.67
Compressor Engine (CE-6R)	0.13	0.57	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.01	0.05	0.15	0.67
Compressor Engine (CE-4R)	0.04	0.16	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.05	0.21
Dehy Still Vent (RSV-4)	<0.01	<0.01	0.04	0.15	0.07	0.29	<0.01	<0.01	0.15	0.67	<0.01	<0.01	0.37	1.60
Dehy Reboiler (RBV-4)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dehy Still Vent (RSV-5)	<0.01	<0.01	<0.01	0.03	0.01	0.06	<0.01	<0.01	0.03	0.15	<0.01	<0.01	0.08	0.36
Dehy Reboiler (RBV-5)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Produced Water Tank (T-1 and T-2)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Truck Loading (LO-1)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TOTAL	0.56	2.45	0.06	0.28	0.10	0.43	<0.01	<0.01	0.20	0.86	0.05	0.24	1.11	4.87

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

Attachment W

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that Arsenal Resources, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a G35-D General Permit for a natural gas compressor stations located in Taylor County, West Virginia. The latitude and longitude coordinates are: 39.30600 and -80.10700

The applicant estimates the maximum potential to discharge the following regulated air pollutants on a facility-wide basis will be:

Particulate Matter (PM) = 2.50 tpy
Sulfur Dioxide (SO_2) = 0.12 tpy
Volatile Organic Compounds (VOC) = 9.30 tpy
Carbon Monoxide (CO) = 11.14 tpy
Nitrogen Oxides (NO_x) = 40.10 tpy
Total Hazardous Air Pollutants (HAPs) = 4.87 tpy
Formaldehyde (HCHO) = 2.45 tpy
Hexane (C_8H_{14}) = 0.24 tpy
Carbon Dioxide Equivalents (CO_2e) = 29,611.98 tpy

Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

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

Dated this the 22th day of August 2017.

By: Arsenal Resources
Meghan M.B. Yingling
Environmental Compliance Manager
6031 Wallace Road Ext. Suite 300
Wexford, PA 15090