



August 29, 2016



VIA Hand Delivery

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

Re: Chesapeake Appalachia, L.L.C.
Browns Creek Compressor Station
NSR (45CSR13) Construction Permit Application

Dear Mr. Durham:

Chesapeake Appalachia, L.L.C. (Chesapeake), a subsidiary of Chesapeake Energy Corporation, submits the enclosed application for a New Source Review (NSR) construction permit in accordance with the West Virginia Air Pollution Control Act and Title 45 Series 13 (45CSR13). Chesapeake requests authorization to replace an existing exempt natural gas-fired compressor engine with a like-kind reconstructed engine that is subject to NSPS Subpart JJJJ. Other emission sources at the facility, which is currently exempt from permitting requirements, consist of one (1) grandfathered triethylene glycol (TEG) dehydration unit with reboiler, one (1) 25-bbl pipeline fluids tank, pipeline fluids loading, and fugitive emissions. Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit.

This package contains the required application forms, emissions calculations and supporting documentation. A check in the amount \$2,000 is also enclosed for the construction permit application fee, as well as the 45CSR22 fees. The public notice for the proposed project will be published in *Charleston Gazette-Mail* on August 29, 2016. Chesapeake will forward the Affidavit of Publication to your attention once it is received from the publisher.

The first part of the document
 discusses the importance of
 maintaining accurate records
 and the role of the
 auditor in this process.

The second part of the document
 describes the various methods
 used to collect and analyze data.

The third part of the document
 discusses the results of the
 study and the implications
 for future research.

The fourth part of the document
 discusses the conclusions of the
 study and the recommendations
 for further action.

Please note that due to discussion with Jerry Williams regarding this project, Chesapeake requests that he be assigned to review the enclosed permit application. We would also appreciate the opportunity to review the draft permit before it is issued. Please send a copy of the draft permit to the Chesapeake Corporate Air Permitting Group at northerndivisionairpermitting@chk.com. Should you have questions or require further information, please contact me at 304-353-5118 or by e-mail at northerndivisionairpermitting@chk.com.

Sincerely,

Chesapeake Energy Corporation



Melissa Hatfield-Atkinson, P.E.
Supervisor – Air Permitting, Northern Division

Enclosures (Original Application + Three Copies)

... ..

CHESAPEAKE APPALACHIA, L.L.C.

BROWNS CREEK COMPRESSOR STATION

NSR CONSTRUCTION PERMIT APPLICATION

**SUBMITTED TO WVDEP DIVISION OF AIR QUALITY
AUGUST 2016**

TABLE OF CONTENTS

TABLE OF CONTENTS.....	i
INTRODUCTION	
Proposed Emissions	1
WVDEP APPLICATION FOR NSR PERMIT	3
ATTACHMENT A: BUSINESS REGISTRATION CERTIFICATE.....	9
ATTACHMENT B: MAP.....	11
ATTACHMENT C: INSTALLATION/START-UP SCHEDULE.....	13
ATTACHMENT D: REGULATORY DISCUSSION	14
ATTACHMENT E: PLOT PLAN.....	18
ATTACHMENT F: PROCESS FLOW DIAGRAM	20
ATTACHMENT G: PROCESS DESCRIPTION	22
ATTACHMENT H: MATERIAL SAFETY DATA SHEETS (MSDS)	23
ATTACHMENT I: EMISSION UNITS TABLE.....	35
ATTACHMENT J: EMISSION POINTS DATA SUMMARY SHEET	37
ATTACHMENT K: FUGITIVE EMISSIONS DATA SUMMARY SHEET	42
ATTACHMENT L: EMISSION UNIT DATA SHEETS.....	46
ATTACHMENT N: SUPPORTING EMISSIONS CALCULATIONS.....	68
ATTACHMENT O: MONITORING/RECORDKEEPING/REPORTING/TESTING PLANS.....	92
ATTACHMENT P: PUBLIC NOTICE.....	93
APPENDIX A: SUPPORT DOCUMENTS	94

INTRODUCTION

Chesapeake Appalachia, L.L.C. (Chesapeake), a subsidiary of Chesapeake Energy Corporation, requests authorization to construct equipment at the Browns Creek Compressor Station in Kanawha County. This construction permit application is submitted in accordance with the West Virginia Air Pollution Control Act and Title 45 Series 13 (45CSR13). Chesapeake proposes to replace an existing exempt 225-hp Caterpillar G342 NA HCR natural gas-fired compressor engine with a like-kind engine that was reconstructed after June 12, 2006 and is thus subject to NSPS Subpart JJJJ. Other emission sources at the facility, which is currently exempt from permitting requirements, consist of one (1) grandfathered triethylene glycol (TEG) dehydration unit with reboiler, one (1) 25-bbl pipeline fluids tank, pipeline fluids loading, and fugitive emissions. Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit.

Note that the existing engine was exempt because emissions were less than Rule 13 permitting thresholds and it was not subject to a substantive federal requirement based on its date of manufacture. Also note that other storage tanks may be present on site (i.e., methanol, TEG, lube oil) but are considered de minimis sources per Table 45-13B and are not addressed further in this application.

There is another 25-bbl pipeline fluids tank operated by Chesapeake that is located within ¼ mile of Browns Creek Compressor Station but operation of the two facilities is independent of each other; therefore, they are not considered collocated and emissions have not been aggregated for permitting purposes.

Proposed Emissions

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

The rich-burn natural gas-fired compressor engine is equipped with a non-selective catalytic reduction (NSCR) catalytic converter. Potential emissions were calculated using manufacturer data when available and manufacturer control efficiencies when applicable. Pollutant emissions for which no manufacturer data was available were calculated using the latest AP-42/EPA emission factors. The manufacturer specification sheet and AP-42 emission factors are enclosed in Appendix A.

The TEG dehydration unit has a capacity of 2.0 million standard cubic feet per day (MMSCFD) and is equipped with one (1) 0.25-mmBtu/hr TEG reboiler for glycol regeneration. The unit is equipped with an electric/pneumatic glycol pump with a maximum capacity of 1.5 gallons per minute (gpm). Potential emissions from the TEG dehydration unit were based on GRI-GLYCalc™ software. GRI-GLYCalc™ Input Summary and Aggregate Calculations reports are enclosed in Appendix A.

TEG reboiler emissions were calculated using AP-42/EPA emission factors for natural gas combustion. AP-42 references are enclosed in Appendix A.

Working, breathing and flashing emissions from the pipeline fluids storage tank were calculated using an extended liquids analysis and E&P TANK V2.0 software. The Calculation Report is enclosed in Appendix A.

Pipeline fluids truck loading emissions were calculated using AP-42 Section 5.2-4 Equation 1 for Petroleum Liquid Loading Losses and the physical properties of Gasoline RVP 11 from EPA TANKS 4.0.9d data. Emission factor references are included in Appendix A.

Fugitive emissions for the facility are based on calculation methodologies presented in EPA-453/R-95-017, Protocol for Equipment Leak Emissions Estimates and a representative extended gas analysis. Emission factor references are included in Appendix A.

Chesapeake Appalachia, L.L.C.
Browns Creek Compressor Station
August 2016

WVDEP APPLICATION FOR NSR PERMIT



WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY

601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

**APPLICATION FOR NSR PERMIT
AND
TITLE V PERMIT REVISION
(OPTIONAL)**

PLEASE CHECK ALL THAT APPLY TO NSR (45CSR13) (IF KNOWN):

- CONSTRUCTION MODIFICATION RELOCATION
 CLASS I ADMINISTRATIVE UPDATE TEMPORARY
 CLASS II ADMINISTRATIVE UPDATE AFTER-THE-FACT

PLEASE CHECK TYPE OF 45CSR30 (TITLE V) REVISION (IF ANY):

- ADMINISTRATIVE AMENDMENT MINOR MODIFICATION
 SIGNIFICANT MODIFICATION

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS ATTACHMENT S TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant (as registered with the WV Secretary of State's Office):
Chesapeake Appalachia, L.L.C.

2. Federal Employer ID No. (FEIN):
20-3774650

3. Name of facility (if different from above):
Browns Creek Compressor Station

4. The applicant is the:
 OWNER OPERATOR BOTH

5A. Applicant's mailing address:
**P.O. Box 18496
Oklahoma City, OK 73154-0496**

5B. Facility's present physical address:
On Rt 60 (near top of Coal Mountain) between St. Albans and Hurricane, turn onto Browns Creek Road (Rt 1), stay on main road, travel approximately 1.3 miles to a right turn onto a gravel road, then travel approximately 0.2 mile to compressor station on left.

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? YES NO
- If YES, provide a copy of the **Certificate of Incorporation/Organization/Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A**.
- If NO, provide a copy of the **Certificate of Authority/Authority of L.L.C./Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A**.

7. If applicant is a subsidiary corporation, please provide the name of parent corporation: **Chesapeake Energy Corporation**

8. Does the applicant own, lease, have an option to buy or otherwise have control of the *proposed site*? YES NO
- If YES, please explain: **Chesapeake owns the land on which the site is constructed.**
- If NO, you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.):
Natural Gas Compressor Station

10. North American Industry Classification System (NAICS) code for the facility:
211111



11A. DAQ Plant ID No. (for existing facilities only):	11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only):	
<i>All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.</i>		
<p>12A.</p> <ul style="list-style-type: none"> - For Modifications, Administrative Updates or Temporary permits at an existing facility, please provide directions to the <i>present location</i> of the facility from the nearest state road; - For Construction or Relocation permits, please provide directions to the <i>proposed new site location</i> from the nearest state road. Include a MAP as Attachment B. <p>On Rt 60 (near top of Coal Mountain) between St. Albans and Hurricane, turn onto Browns Creek Road (Rt 1), stay on main road, travel approximately 1.3 miles to a right turn onto a gravel road, then travel approximately 0.2 mile to compressor station on left.</p>		
12.B. New site address (if applicable): N/A	12C. Nearest city or town: St. Albans	12D. County: Kanawha
12.E. UTM Northing (KM): 4,248.528	12F. UTM Easting (KM): 421.183	12G. UTM Zone: 17S
<p>13. Briefly describe the proposed change(s) at the facility: Operations proposes to replace an existing exempt engine with a like-kind replacement engine that has been reconstructed and is thus subject to NSPS Subpart JJJJ requirements. Existing dehydration unit and reboiler were installed in 1973 and are considered grandfathered equipment. Other emission sources include an existing 25-bbl pipeline fluids tank, pipeline fluids truck loading, and fugitive emissions. Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit.</p>		
<p>14A. Provide the date of anticipated installation or change: 12/15/2016</p> <ul style="list-style-type: none"> - If this is an After-The-Fact permit application, provide the date upon which the proposed change did happen: / / 		<p>14B. Date of anticipated Start-Up if a permit is granted: 12/15/2016</p>
<p>14C. Provide a Schedule of the planned Installation of/Change to and Start-Up of each of the units proposed in this permit application as Attachment C (if more than one unit is involved).</p>		
<p>15. Provide maximum projected Operating Schedule of activity/activities outlined in this application: Facility: Hours Per Day 24 Days Per Week 7 Weeks Per Year 52</p>		
<p>16. Is demolition or physical renovation at an existing facility involved? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p>		
<p>17. Risk Management Plans. If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your Risk Management Plan (RMP) to U. S. EPA Region III.</p>		
<p>18. Regulatory Discussion. List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (<i>if known</i>). A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance (<i>if known</i>). Provide this information as Attachment D.</p>		
<p>Section II. Additional attachments and supporting documents.</p>		
<p>19. Include a check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR22 and 45CSR13).</p>		
<p>20. Include a Table of Contents as the first page of your application package.</p>		

21. Provide a **Plot Plan**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to *Plot Plan Guidance*) .

– Indicate the location of the nearest occupied structure (e.g. church, school, business, residence). **<300 feet**

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F**.

23. Provide a **Process Description** as **Attachment G**.

– Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H**.

– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I**.

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J**.

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K**.

28. Check all applicable **Emissions Unit Data Sheets** listed below:

<input checked="" type="checkbox"/> Bulk Liquid Transfer Operations	<input type="checkbox"/> Haul Road Emissions	<input type="checkbox"/> Quarry
<input checked="" type="checkbox"/> Chemical Processes	<input type="checkbox"/> Hot Mix Asphalt Plant	<input type="checkbox"/> Solid Materials Sizing, Handling and Storage Facilities
<input type="checkbox"/> Concrete Batch Plant	<input type="checkbox"/> Incinerator	<input checked="" type="checkbox"/> Storage Tanks
<input type="checkbox"/> Grey Iron and Steel Foundry	<input type="checkbox"/> Indirect Heat Exchanger	

General Emission Unit, specify: Compressor Engine, TEG Dehydration Unit

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L**.

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

<input type="checkbox"/> Absorption Systems	<input type="checkbox"/> Baghouse	<input type="checkbox"/> Flare
<input type="checkbox"/> Adsorption Systems	<input type="checkbox"/> Condenser	<input type="checkbox"/> Mechanical Collector
<input type="checkbox"/> Afterburner	<input type="checkbox"/> Electrostatic Precipitator	<input type="checkbox"/> Wet Collecting System

Other Collectors, specify

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M**.

30. Provide all **Supporting Emissions Calculations** as **Attachment N**, or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O**.

➤ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and *Example Legal Advertisement* for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33. **Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

YES NO

➤ If YES, identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's *"Precautionary Notice – Claims of Confidentiality"* guidance found in the *General Instructions* as **Attachment Q**.

Section III. Certification of Information

34. Authority/Delegation of Authority. Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Authority of Corporation or Other Business Entity | <input type="checkbox"/> Authority of Partnership |
| <input type="checkbox"/> Authority of Governmental Agency | <input type="checkbox"/> Authority of Limited Partnership |

Submit completed and signed **Authority Form** as **Attachment R**.

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

35A. Certification of Information. To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned **Responsible Official** / **Authorized Representative**, hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

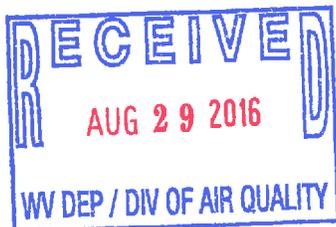
SIGNATURE  DATE: 8.24.16
(Please use blue ink) (Please use blue ink)

35B. Printed name of signee: Kevin Hill		35C. Title: Vice President
35D. E-mail: <u>Kevin.Hill@chk.com</u>	36E. Phone: 405-935-8000	36F. FAX: 405-849-2176
36A. Printed name of contact person (if different from above): Melissa Hatfield Atkinson, P.E.		36B. Title: Supervisor – Air Permitting, Northern Division
36C. E-mail: <u>northerndivisionairpermitting@chk.com</u>	36D. Phone: 304-353-5118	36E. FAX: 304-353-5231

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

- | | |
|--|--|
| <input checked="" type="checkbox"/> Attachment A: Business Certificate | <input checked="" type="checkbox"/> Attachment K: Fugitive Emissions Data Summary Sheet |
| <input checked="" type="checkbox"/> Attachment B: Map(s) | <input checked="" type="checkbox"/> Attachment L: Emissions Unit Data Sheet(s) |
| <input checked="" type="checkbox"/> Attachment C: Installation and Start Up Schedule | <input type="checkbox"/> Attachment M: Air Pollution Control Device Sheet(s) |
| <input checked="" type="checkbox"/> Attachment D: Regulatory Discussion | <input checked="" type="checkbox"/> Attachment N: Supporting Emissions Calculations |
| <input checked="" type="checkbox"/> Attachment E: Plot Plan | <input checked="" type="checkbox"/> Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans |
| <input checked="" type="checkbox"/> Attachment F: Detailed Process Flow Diagram(s) | <input type="checkbox"/> Attachment P: Public Notice |
| <input checked="" type="checkbox"/> Attachment G: Process Description | <input type="checkbox"/> Attachment Q: Business Confidential Claims |
| <input checked="" type="checkbox"/> Attachment H: Material Safety Data Sheets (MSDS) | <input type="checkbox"/> Attachment R: Authority Forms |
| <input checked="" type="checkbox"/> Attachment I: Emission Units Table | <input type="checkbox"/> Attachment S: Title V Permit Revision Information |
| <input checked="" type="checkbox"/> Attachment J: Emission Points Data Summary Sheet | <input checked="" type="checkbox"/> Application Fee |

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.



THE UNIVERSITY OF CHICAGO
LIBRARY
1100 EAST 58TH STREET
CHICAGO, ILL. 60637
U.S.A.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

- Forward 1 copy of the application to the Title V Permitting Group and:
- For Title V Administrative Amendments:
 - NSR permit writer should notify Title V permit writer of draft permit,
- For Title V Minor Modifications:
 - Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,
 - NSR permit writer should notify Title V permit writer of draft permit.
- For Title V Significant Modifications processed in parallel with NSR Permit revision:
 - NSR permit writer should notify a Title V permit writer of draft permit,
 - Public notice should reference both 45CSR13 and Title V permits,
 - EPA has 45 day review period of a draft permit.

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

Chesapeake Appalachia, L.L.C.
Browns Creek Compressor Station
August 2016

ATTACHMENT A: BUSINESS REGISTRATION CERTIFICATE

**WEST VIRGINIA
STATE TAX DEPARTMENT
BUSINESS REGISTRATION
CERTIFICATE**

ISSUED TO:
**CHESAPEAKE APPALACHIA L L C
6100 N WESTERN AVE
OKLAHOMA CITY, OK 73118-1044**

BUSINESS REGISTRATION ACCOUNT NUMBER: 1010-8420

This certificate is issued on: **06/27/2011**

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

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

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

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

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

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

atL006 v.4
L0791837824

ATTACHMENT B: MAP



Browns Creek Compressor Station
 Figure 1: Area Map
 Kanawha County, WV
 August 2016

ATTACHMENT C: INSTALLATION/START-UP SCHEDULE

Installation and start-up of the replacement engine is expected to commence on or about December 15, 2016 but is contingent upon the permit issuance date.

ATTACHMENT D: REGULATORY DISCUSSION

STATE

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

Potential emissions associated with the proposed project are greater than the minor source construction permit thresholds of 6 pounds per hour (pph) AND 10 tons per year (tpy) of any regulated air pollutant OR 144 pounds per day (ppd) of any regulated air pollutant OR 2 pph OR 5 tpy of aggregated hazardous air pollutants (HAP) OR 45 CSR 27 toxic air pollutant (TAP) (10% increase if above BAT triggers or increase to Best Available Technology (BAT) triggers) OR subject to applicable Standard or Rule.

45 CSR 22 - AIR QUALITY MANAGEMENT FEE PROGRAM:

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

45 CSR 30 - REQUIREMENTS FOR OPERATING PERMITS:

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

FEDERAL

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

The affected facility to which this Subpart applies is each storage vessel with a capacity greater than or equal to 75 cubic meters (m³) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. The 25-bbl tank at this facility was constructed after the effective date of this Subpart but is less than 75 m³ (which equals approximately 471 bbl); therefore, this Subpart does not apply.

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

This Subpart sets standards for natural gas processing plants, which are defined as any site engaged in the extraction of natural gas liquids from field gas, fractionation of natural gas liquids, or both. The facility is not a natural gas processing plant; therefore, this Subpart is not applicable.

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

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

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

The proposed 225-hp, four-stroke, rich-burn natural gas-fired flash gas compressor engine was reconstructed after the June 12, 2006 effective date; therefore, it is subject to this Subpart. Chesapeake will comply with all applicable requirements.

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

The emission sources affected by this Subpart include well completions, pneumatic controllers, equipment leaks from natural gas processing plants, sweetening units at natural gas processing plants, reciprocating compressors, centrifugal compressors and storage vessels which are constructed, modified or reconstructed after August 23, 2011. The emission sources at this facility were manufactured prior to the effective date of this Subpart and are not subject.

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

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

There is no well at this location and the facility is not subject to the well completion requirements of this Subpart. There is no centrifugal compressor using wet gas seals at this facility. The

pneumatic controllers at this facility were manufactured prior to the effective date of this Subpart and are not subject. The storage vessels at this facility were manufactured prior to the effective date of this Subpart and have potential emissions less than six (6) tons per year (tpy) volatile organic compounds (VOC) and are therefore not subject to this Subpart. No horsepower capacity has been added to this compressor station since September 18, 2015 and it is not subject to the fugitive source requirements of this Subpart. The pneumatic pumps at this facility are located at a compressor station and are not subject to the control requirements of this Subpart.

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

The site is a minor (area) source of hazardous air pollutants. Even though the TEG dehydration unit at this facility is considered an affected source, it will be exempt from the requirements of § 63.764(d)(2) since the actual annual average flowrate of natural gas is less than 85 thousand standard cubic meters per day (3.0-MMSCFD), as determined by the procedures specified in § 63.772(b)(1). However, the facility must maintain records of the de minimis determination as required in § 63.774(d)(1).

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

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

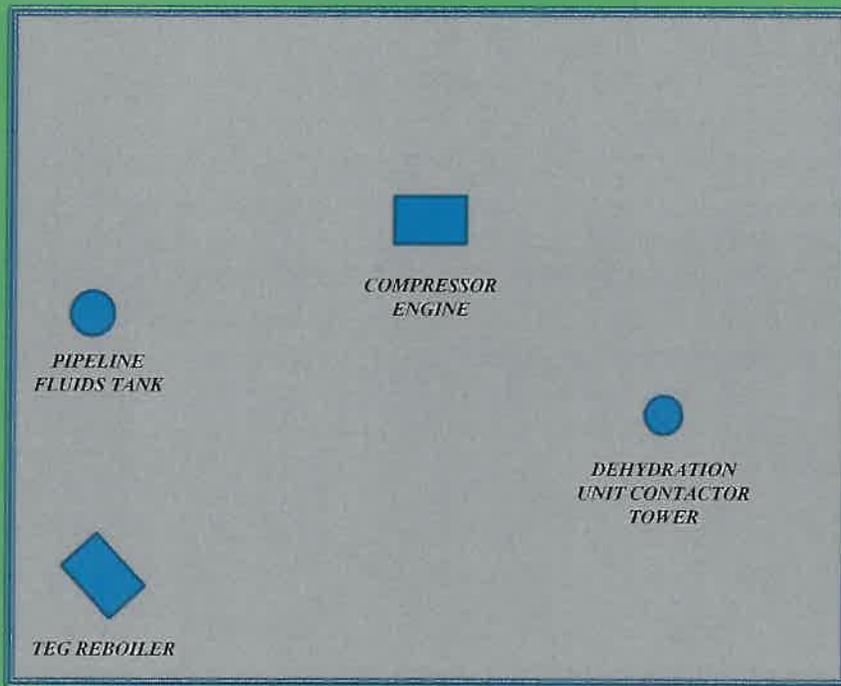
40 CFR PART 63 SUBPART ZZZZ - NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR SOURCE CATEGORIES FROM STATIONARY RECIPROCATING INTERNAL COMBUSTION ENGINES - AREA SOURCE:

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

area sources and existing RICE (constructed or reconstructed before June 12, 2006) with a site rating of less than or equal to 500 HP at major sources.

Owners and operators of new or reconstructed engines at area sources must meet the requirements of Subpart ZZZZ by complying with either 40 CFR Part 60 Subpart IIII (for CI engines) or 40 CFR Part 60 Subpart JJJJ (for SI engines). Based on emission calculations, this facility is a minor source of HAP. The proposed 225-hp, four-stroke, rich-burn natural gas-fired flash gas compressor engine was reconstructed after the June 12, 2006 and will meet the requirements of this Subpart by compliance with Subpart JJJJ. No further requirements apply for under this Subpart.

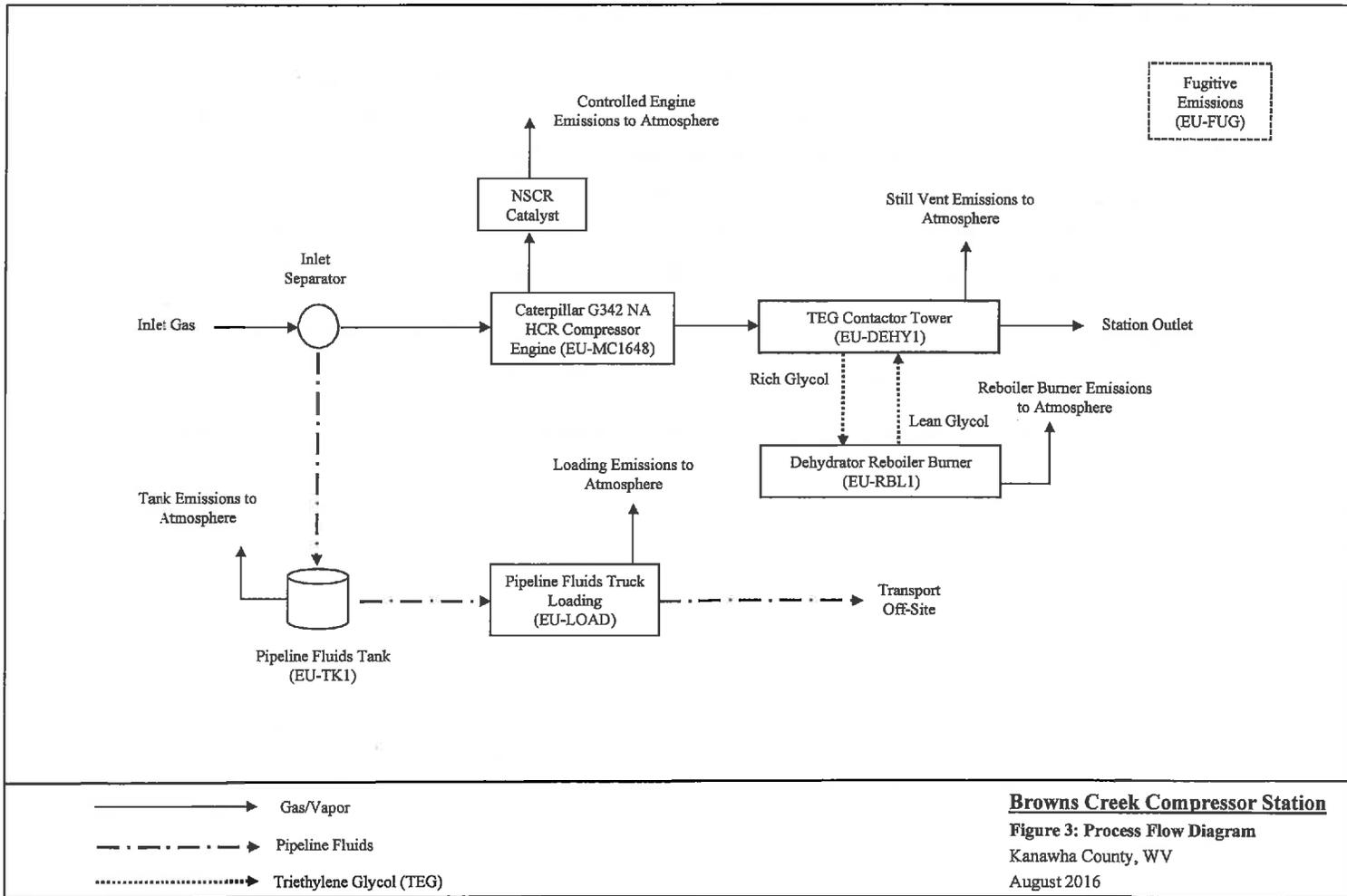
ATTACHMENT E: PLOT PLAN



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

Browns Creek Compressor Station
Figure 2: Simple Plot Plan
Kanawha County, WV
August 2016

ATTACHMENT F: PROCESS FLOW DIAGRAM



ATTACHMENT G: PROCESS DESCRIPTION

A description of the facility process is as follows: The natural gas inlet stream from surrounding area wells enters the facility through a separator that separates the inlet stream into two streams: natural gas and pipeline fluids (hydrocarbons/water). Inlet gas is compressed via a reciprocating compressor. After the inlet gas passes through the compressor, it goes through the dehydration process before exiting the facility via a sales pipeline.

A TEG dehydration unit is used to remove water from the gas. The unit is comprised of both a glycol contactor skid and a glycol regeneration skid. In the dehydration process, gas passes through a contactor vessel where water is absorbed by the glycol. The "rich" glycol containing water goes to the glycol reboiler where heat is used to remove the water and regenerate the glycol. The heat is supplied by a natural gas-fired reboiler that exhausts to the atmosphere. Overhead still column emissions from the glycol regeneration skid are emitted to atmosphere.

Pipeline fluids are stored onsite in an atmospheric storage tank that vents to atmosphere and are transported offsite via truck. Fugitive emissions from component leaks also occur.

A process flow diagram reflecting facility operations is shown in Figure 3, located in Attachment F.

ATTACHMENT H: MATERIAL SAFETY DATA SHEETS (MSDS)



Material Safety Data Sheet

Material Name: Natural Gas

Health	1
Flammability	4
Reactivity	0
PPE	

*** Section 1 - Chemical Product and Company Identification ***

Product name: Natural Gas
Synonyms: Wellhead Gas; Petroleum Gas; Fuel Gas; Methane; Marsh Gas
Chemical Family: Petroleum Hydrocarbon
Formula: Gas mixture, primarily methane

Supplier: Chesapeake Energy Corporation and its subsidiaries
6100 N. Western Avenue
Oklahoma City, OK 73118

Other Information: Phone: 405-848-8000 Fax: 405-753-5468
Emergency Phone Number: Chemtrec – 800-424-9300

*** Section 2 - Hazards Identification ***

Emergency Overview

Flammable gas, simple asphyxiant, freeze burns can occur from liquid natural gas. Keep away from heat, sparks, flames, static electricity, or other sources of ignition.

Potential Health Effects: Eyes

Natural gas is generally non-irritating to the eyes. Liquid or expanding gas can cause severe freeze burns to the eye and surrounding tissue. Pressurized gas can cause mechanical injury to the eye.

Potential Health Effects: Skin

None for gas; liquid or expanding gas can cause severe freeze burns on the skin.

Potential Health Effects: Ingestion

This material is a gas under normal atmospheric conditions and ingestion is unlikely.

Potential Health Effects: Inhalation

Drowsiness, excitation, or mild narcosis is produced at elevated concentrations and is an asphyxiant when the oxygen concentration falls below 18% at sea level.

HMIS Ratings: Health: 1 Fire: 4 HMIS Reactivity 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

*** Section 3 - Composition / Information on Ingredients ***

CAS #	Component	Percent Ranges
8006-14-2	Natural Gas	100
74-82-8	Methane	>90
74-84-0	Ethane	<5
74-98-6	Propane	<1
Mixture	C4-C6 Aliphatic Hydrocarbons	Trace amounts

This product may contain small amounts of heavier hydrocarbons. Components of this product are normally within the ranges listed above; however, depending on the geographical source, gas composition may vary.

*** Section 4 - First Aid Measures ***

First Aid: Eyes

Move away from exposure to vapors and into fresh air. If liquefied gas contacts the eye, flush with large amounts of tepid water for at least 15 minutes. Seek medical attention.

First Aid: Skin

Treat burned or frostbitten skin by immersing the affected area in tepid water. When sensation has returned to the frostbitten skin, keep the skin warm, dry, and clean. For burns, lay bulky, dry sterile bandages over affected area and seek prompt medical attention.

First Aid: Ingestion

Not considered likely since the product is a gas under normal conditions.

Material Safety Data Sheet

Material Name: Natural Gas

First Aid: Inhalation

If conditions are safe to do so, remove affected person to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration or cardiopulmonary resuscitation (CPR). Seek immediate medical attention.

*** Section 5 - Fire Fighting Measures ***

General Fire Hazards

See Section 9 for Flammability Properties.

This gas is extremely flammable and forms flammable mixtures with air. It will burn in the open or be explosive in confined spaces. Its vapors are lighter than air and will disperse. A hazard of re-ignition or explosion exists if flame is extinguished without stopping the flow of gas.

Hazardous Combustion Products

Combustion may yield carbon monoxide and/or carbon dioxide.

Extinguishing Media

Stop the gas flow if it can be done without risk. Dry chemical, carbon dioxide, or halon. Water can be used to cool the fire but may not extinguish the fire.

Fire Fighting Equipment/Instructions

Evacuate the area upwind of the source. If a leak or spill has not ignited, water spray can be used to disperse gas and to protect persons attempting to stop the leak. In the case of a fire, control the fire until the gas supply can be shut off. If the gas source cannot be shut off immediately, equipment and surfaces exposed to the fire should be cooled with water to prevent overheating and explosions. Firefighters should wear self-contained breathing apparatus and full protective clothing.

NFPA Ratings: Health: 1 Fire: 4 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

*** Section 6 - Accidental Release Measures ***

Containment Procedures

Flammable Gas – Eliminate All Sources of Ignition. Stop release/spill if it can be done with minimal risk. Keep all sources of ignition and hot metal surfaces away from release/spill. The use of explosion-proof equipment is recommended.

Evacuation Procedures

Notify persons down wind of the release/spill, isolate the immediate hazard area and keep unauthorized personnel out. Contact fire authorities and appropriate state/local agencies.

Special Procedures

Eliminate sources of heat or ignition including internal combustion engines and power tools. Stay up wind and away from the release/spill. Wear appropriate protective equipment including respiratory protection as conditions warrant.

*** Section 7 - Handling and Storage ***

Store and use natural gas cylinders and tanks in well ventilated areas, away from direct sunlight and sources of ignition. Keep away from heat, sparks, open flames, and other sources of ignition. Rapid escape of gas may generate static charge. Electrically ground and bond all lines and equipment used with natural gas. Use only explosion-proof or intrinsically safe electrical equipment where product is stored or handled. Keep away from incompatible agents and from cylinders of oxygen.

*** Section 8 - Exposure Controls / Personal Protection ***

A: Component Exposure Limits

Natural Gas (8006-14-2)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

Methane (74-82-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

Material Safety Data Sheet

Material Name: Natural Gas

Ethane (74-84-0)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

Propane (74-98-6)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases alkane C1-C4)

OSHA: 1000 ppm TWA; 1800 mg/m³ TWA

NIOSH: 1000 ppm TWA; 1800 mg/m³ TWA

Engineering Controls

Local or general exhaust is required if used in an enclosed area in order to keep concentrations below the lower explosive limit.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Eye protection should be worn to safeguard against potential eye contact, irritation, or injury.

Personal Protective Equipment: Skin

Protect skin from contact. Impervious clothing should be worn as needed.

Personal Protective Equipment: Respiratory

Use approved respiratory protective equipment in the event of oxygen deficiency, when the product produces vapors that exceed permissible limits or when excessive vapors are generated. Self-contained breathing apparatus should be used for fire fighting.

Personal Protective Equipment: General

Do not smoke in areas where this product is stored or handled. A source of clean water should be available in the work area for flushing eyes and skin. Use explosion-proof equipment suitable for hazardous locations.

***** Section 9 - Physical & Chemical Properties *****

Appearance:	Colorless	Odor:	Odorless to slight hydrocarbon
Physical State:	Gas	pH:	Neutral
Vapor Pressure:	>760 @ 25°C	Vapor Density:	0.6 (estimate)
Boiling Point:	-258 to -43°F	Melting Point:	NA
Solubility (H2O):	Slight	Specific Gravity:	0.55 (estimate)
Evaporation Rate:	Gas under normal conditions	VOC:	100%
Octanol/H2O Coeff.:	NA	Flash Point:	Flammable gas
Flash Point Method:	NA	Upper Flammability Limit (UFL):	15.0
		Lower Flammability Limit (LFL):	4.0
		Burning Rate:	Flammable gas
		Auto Ignition:	900 – 1170 °F

Properties of this material will vary with actual composition.

***** Section 10 - Chemical Stability & Reactivity Information *****

Chemical Stability

This material is stable under normal conditions of use.

Chemical Stability: Conditions to Avoid

Sources of heat or ignition.

Incompatibility

Strong oxidizers such as nitrates, chlorates, peroxides.

Hazardous Decomposition

Combustion produces carbon monoxide and carbon dioxide.

Possibility of Hazardous Reactions

Will not occur.

Material Safety Data Sheet

Material Name: Natural Gas

*** Section 11 - Toxicological Information ***

Acute Dose Effects

Component Analysis - LD50/LC50

Natural gas (8006-14-2)
Inhalation LC50 Rat: 658 mg/L/4H

Methane (74-82-8)
Inhalation LC50 Mouse: 326 g/m³/2H

Ethane (74-84-0)
Inhalation LC50 Rat: 658 mg/L/4H

Propane (74-98-6)
Inhalation LC50 Rat: 658 mg/L/4H

The major components of natural gas act as simple asphyxiant gases without significant potential for systemic toxicity. At high concentrations this material acts as an asphyxiant by diluting and displacing oxygen. Extremely high concentrations of this material can produce unconsciousness followed by death. Symptoms of persons exposed to oxygen deficient atmospheres include headache, dizziness, incoordination, cyanosis and narcosis.

*** Section 12 - Ecological Information ***

There is no information available on the ecotoxicological effects of petroleum gases. Because of their high volatility, these gases are unlikely to cause ground or water pollution. Petroleum gases released into the environment will rapidly disperse into the atmosphere and undergo photochemical degradation.

*** Section 13 - Disposal Considerations ***

This product as produced is not specifically listed as an EPA RCRA hazardous waste according to federal regulations (40 CFR 261). However, when discarded or disposed of in containers, it may meet the criteria of an "ignitable" waste. It is the responsibility of the user to determine if disposal material is hazardous according to federal, state and local regulations.

*** Section 14 - Transportation Information ***

US DOT Information

Shipping Name: Natural Gas, Compressed
UN/NA #: 1271 **Hazard Class:** 2.1 **Packing Group:** Not applicable

Depending on the product's properties the shipper may elect to classify the material differently. Refer to 49 CFR 172 for further information and descriptions.

*** Section 15 - Regulatory Information ***

US Federal Regulations

Component Analysis

None of this products components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Natural gas	8006-14-2	No	Yes	No	No	Yes	No
Methane	74-82-8	No	Yes	Yes	Yes	Yes	Yes
Ethane	74-84-0	No	Yes	Yes	Yes	Yes	Yes
Propane	74-98-6	No	Yes	Yes	Yes	Yes	Yes

Material Safety Data Sheet

Material Name: Natural Gas

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Natural gas	8006-14-2	Yes	DSL	EINECS
Methane	74-82-8	Yes	DSL	EINECS
Ethane	74-84-0	Yes	DSL	EINECS
Propane	74-98-6	Yes	DSL	EINECS

*** Section 16 - Other Information ***

Other Information

The information presented herein has been compiled from sources considered to be dependable and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgement.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Key/Legend

NA - Not Applicable
ND - Not Determined
ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
TLV - Threshold Limit Value
PEL - Permissible Exposure Limit
RQ - Reportable Quantity
TWA - Time Weighted Average
STEL - Short Term Exposure Limit
NTP - National Toxicology Program
IARC - International Agency for Research on Cancer



Material Safety Data Sheet

Material Name: Produced Water

Health	1
Flammability	4
Reactivity	0
PPE	

***** Section 1 - Chemical Product and Company Identification *****

Product name: Produced Water - Sweet
Synonyms: Salt Water, H₂O, Oily Water, Formation Water
Chemical Family: Water
Formula: Complex mixture

Supplier: Chesapeake Energy Corporation and its subsidiaries
 6100 N. Western Avenue
 Oklahoma City, OK 73118

Other Information: Phone: 405-848-8000 Fax: 405-753-5468
Emergency Phone Number: Chemtrec – 800-424-9300

***** Section 2 - Hazards Identification *****

Emergency Overview

May cause eye, skin, respiratory and gastrointestinal tract irritation.

Potential Health Effects: Eyes

May cause eye irritation.

Potential Health Effects: Skin

Contact may cause skin irritation.

Potential Health Effects: Ingestion

Ingestion may cause irritation of the digestive tract that may result in nausea, vomiting and diarrhea.

Potential Health Effects: Inhalation

Breathing the mist and vapors may be irritating to the respiratory tract.

HMIS Ratings: Health: 1 Fire: 4 HMIS Reactivity 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

***** Section 3 - Composition / Information on Ingredients *****

Produced water is a mixture of varying amounts of water and oil produced from various exploration and production processes. Produced water may contain an upper layer of flammable liquid and vapor hydrocarbons. Produced water may include small amounts of natural gas condensate, and benzene may be present.

CAS #	Component	Percent
7732-18-5	Water	>68
Not Available	Dissolved Minerals	<32
71-43-2	Benzene	<1
8002-05-9	Petroleum distillates (naphtha)	<1

Normal composition ranges are shown. Exceptions may occur depending on the source of the produced water.

***** Section 4 - First Aid Measures *****

First Aid: Eyes

Flush eyes with clean, low-pressure water for at least 15 minutes, occasionally lifting the eyelids. If pain or redness persists after flushing, obtain medical attention. If eye is exposed to hot liquid, cover eyes with cloth and seek medical attention immediately.

First Aid: Skin

In case of hot liquid exposure, do not remove clothing or treat-wash only unburned area and seek medical attention immediately.

First Aid: Ingestion

Do not induce vomiting. Seek medical attention.

First Aid: Inhalation

Immediately remove person to area of fresh air. For respiratory distress, give oxygen, rescue breathing, or administer CPR if necessary. Obtain prompt medical attention.

Material Safety Data Sheet

Material Name: Produced Water

*** Section 5 - Fire Fighting Measures ***

General Fire Hazards

See Section 9 for Flammability Properties.

May react with strong oxidizing materials and a wide variety of chemicals. Forms explosive mixtures with air.

Hazardous Combustion Products

Not Determined.

Extinguishing Media

Dry chemical, foam, carbon dioxide, or water spray.

Fire Fighting Equipment/Instructions

Any fire would be associated with any natural gas condensate floating on the surface of the produced water.

Water may be ineffective on flames but should be used to keep fire exposed containers cool. Keep the surrounding areas cool by using water mists. Firefighters should wear self-contained breathing apparatus and full protective clothing.

NFPA Ratings: Health: 1 Fire: 4 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

*** Section 6 - Accidental Release Measures ***

Containment Procedures

Stop the source of the leak or release. Clean up releases as soon as possible, observing precautions in Personal Protection Equipment section. Contain liquid to prevent further contamination of soil and surface water.

Clean-Up Procedures

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment. Where feasible and appropriate, remove contaminated soil or flush with fresh water. Follow prescribed procedures for reporting and responding to larger releases. Advise authorities and the National Response Center (800-424-8802) if the release is to a watercourse.

Evacuation Procedures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible.

Special Procedures

Avoid excessive skin contact with the spilled material.

*** Section 7 - Handling and Storage ***

Handling Procedures

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition. Do not enter storage areas and confined spaces without adequate ventilation. Use appropriate respiratory protection if there is a potential to exceed component exposure limit(s).

*** Section 8 - Exposure Controls / Personal Protection ***

A: Component Exposure Limits

Petroleum distillates (naphtha) (8002-05-9)

OSHA: 500 ppm TWA; 2000 mg/m³ TWA

NIOSH: 350 mg/m³ TWA

1800 mg/m³ Ceiling (15 min)

Material Safety Data Sheet

Material Name: Produced Water

Benzene (71-43-2)

ACGIH: 0.5 ppm TWA
2.5 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 10 ppm TWA; 25 ppm ceiling; 50 ppm (10 min.)
NIOSH: 0.1 ppm TWA
1 ppm STEL

Engineering Controls

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Chemical goggles or face shield should be worn when handling product if the possibility of spray exists.

Personal Protective Equipment: Skin

Normal working clothes should be worn. Wash contaminated clothing prior to reuse.

Personal Protective Equipment: Respiratory

Respiratory protection is not required for normal use. At excessive concentrations, wear a NIOSH approved air purifying respirator with organic vapor cartridges.

Personal Protective Equipment: General

A source of clean water should be in the work area for flushing eyes and skin.

*** Section 9 - Physical & Chemical Properties ***

Appearance: Clear or opaque

Odor: Salty with a slight hydrocarbon odor.

Physical State: Liquid

pH: 4.9-8.5

Vapor Pressure: NA

Vapor Density: 1.2

Boiling Point: 212°F

Melting Point: ND

Solubility (H2O): Soluble

Specific Gravity: >1 @ 0°C

Freezing Point: <32°F

Evaporation Rate: ND

VOC: ND

Octanol/H2O Coeff.: ND

Flash Point: ND

Flash Point Method: ND

Lower Flammability Limit 4.0

(LFL):

Upper Flammability Limit 46.0

(UFL):

Burning Rate: ND

Auto Ignition: NA

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability

Stable under normal ambient and anticipated conditions of storage and handling.

Chemical Stability: Conditions to Avoid

Keep material away from heat, sparks, and open flames.

Incompatibility

Keep away from strong oxidizers.

Hazardous Decomposition

Not Determined.

Possibility of Hazardous Reactions

Will not occur.

Material Safety Data Sheet

Material Name: Produced Water

*** Section 11 - Toxicological Information ***

Acute Dose Effects

Component Analysis - LD50/LC50

Water (7732-18-5)

Oral LD50 Rat: >90 mL/kg

Petroleum distillates (naphtha) (8002-05-9)

Oral LD50 Rat: >4300 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg

Benzene (71-43-2)

Inhalation LC50 Rat: 13050-14380 ppm/4H; Oral LD50 Rat: 1800 mg/kg

Carcinogenicity

Component Carcinogenicity

Petroleum distillates (naphtha) (8002-05-9)

IARC: Monograph 45 [1989] (Group 3 (not classifiable))

Benzene (71-43-2)

ACGIH: A1 - Confirmed Human Carcinogen

OSHA: 10 ppm TWA; 25 ppm ceiling; 50 ppm (10 min.)

NIOSH: potential occupational carcinogen

NTP: Known Human Carcinogen (Select Carcinogen)

IARC: Supplement 7 [1987], Monograph 29 [1982] (Group 1 (carcinogenic to humans))

*** Section 12 - Ecological Information ***

Ecotoxicity

Component Analysis - Ecotoxicity - Aquatic Toxicity

Petroleum distillates (naphtha) (8002-05-9)

Test & Species

96 Hr LC50 Salmo gairdneri 258 mg/L [static]

24 Hr EC50 Daphnia magna 36 mg/L

Conditions

Benzene (71-43-2)

Test & Species

96 Hr LC50 Pimephales promelas 12.6 mg/L [flow-through]

96 Hr LC50 Oncorhynchus mykiss 5.3 mg/L [flow-through]

96 Hr LC50 Lepomis macrochirus 22 mg/L [static]

96 Hr LC50 Poecilia reticulata 28.6 mg/L [static]

72 Hr EC50 Selenastrum 29 mg/L

capricornutum

48 Hr EC50 water flea 356 mg/L [Static]

48 Hr EC50 Daphnia magna 10 mg/L

Conditions

Material Safety Data Sheet

Material Name: Produced Water

*** Section 13 - Disposal Considerations ***

This product as produced is not specifically listed as an EPA RCRA hazardous waste according to federal regulations (40 CFR 261). However, when discarded or disposed of, it may meet the criteria of a "characteristic" hazardous waste. This product could also contain benzene at low concentrations and may exhibit the characteristic of "toxicity" (D018) as determined by the toxicity characteristic leaching procedure (TCLP). This material could become a hazardous waste if mixed with or contaminated with a hazardous waste or other substance(s). It is the responsibility of the user to determine if disposal material is hazardous according to federal, state and local regulations.

*** Section 14 - Transportation Information ***

US DOT Information

Shipping Name: Not Regulated

Additional Info.: This may not apply to all shipping situations. Consult 49CFR 172 for additional information.

*** Section 15 - Regulatory Information ***

US Federal Regulations

Component Analysis

This material may contain one or more of the following chemicals identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Benzene (71-43-2)

SARA 313: 0.1 % de minimis concentration

CERCLA: 10 lb final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule); 4.54 kg final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule)

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Petroleum distillates (naphtha)	8002-05-9	No	Yes	Yes	Yes	Yes	Yes
Benzene	71-43-2	Yes	Yes	Yes	Yes	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Benzene	71-43-2	0.1 %

Additional Regulatory Information

Material Safety Data Sheet

Material Name: Produced Water

Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Water	7732-18-5	Yes	DSL	EINECS
Petroleum distillates (naphtha)	8002-05-9	Yes	DSL	EINECS
Benzene	71-43-2	Yes	DSL	EINECS

*** Section 16 - Other Information ***

Other Information

The information presented herein has been compiled from sources considered to be dependable and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgement.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Key/Legend

NA - Not Applicable
ND - Not Determined
ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
TLV - Threshold Limit Value
PEL - Permissible Exposure Limit
RQ - Reportable Quantity
TWA - Time Weighted Average
STEL - Short Term Exposure Limit
NTP - National Toxicology Program
IARC - International Agency for Research on Cancer

ATTACHMENT I: EMISSION UNITS TABLE

ATTACHMENT J: EMISSION POINTS DATA SUMMARY SHEET

**Attachment J
EMISSION POINTS DATA SUMMARY SHEET**

Table 1: Emissions Data

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (chemical processes only)		All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶	Emission Concentration ⁷ (ppmv or mg/m ³)
		ID No.	Source	ID No.	Device Type	Short Term ²	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
EP-MC1648	Upward vertical stack	EU-MC1648	Caterpillar G342 NA HCR Engine		NSCR			NOx	6.40	28.03	1.49	6.53	Gas/Vapor	O (Manufacturer Data/AP-42/EPA)	
								CO	6.80	29.77	1.98	8.67			
								VOC	0.89	3.91	0.50	2.19			
								PM ₁₀	0.03	0.13	0.03	0.13			
								SO ₂	0.01	0.04	0.01	0.04			
								Acetaldehyde	<0.01	0.02	<0.01	0.02			
								Acrolein	<0.01	0.02	<0.01	0.02			
								Benzene	<0.01	0.01	<0.01	0.01			
								Ethylbenzene	<0.01	<0.01	<0.01	<0.01			
								Formaldehyde	0.03	0.13	0.03	0.13			
								Methanol	0.01	0.04	0.01	0.04			
								Toluene	<0.01	<0.01	<0.01	<0.01			
								Xylenes	<0.01	<0.01	<0.01	<0.01			
								CO ₂	198.71	870.35	198.71	870.35			
								CH ₄	<0.01	0.01	<0.01	0.01			
								N ₂ O	<0.01	<0.01	<0.01	<0.01			
EP-DEHY1	Upward vertical stack	EU-DEHY1	Glycol Dehydrator Still Vent	N/A	N/A			VOC	9.58	41.94			Gas/Vapor	O (GRI GLYCalc)	
								Benzene	0.31	1.35					
								Toluene	0.49	2.15					
								Ethylbenzene	0.08	0.35					
								Xylenes	0.08	0.37					
								n-Hexane	0.34	1.51					
								CO ₂	<0.01	0.01					
								CH ₄	0.58	2.55					

EP-RBL1	Upward vertical stack	EU-RBL1	Glycol Dehydrator Reboiler	-	-	-	-	NOx CO VOC PM ₁₀ SO ₂ n-Hexane Formaldehyde Benzene Toluene CO ₂ CH ₄ N ₂ O	0.03 0.02 0.01 △0.01 △0.01 △0.01 △0.01 △0.01 △0.01 29.24 △0.01 △0.01	0.13 0.09 0.04 0.01 △0.01 △0.01 △0.01 △0.01 △0.01 128.07 △0.01 △0.01	-	-	Gas/Vapor	O (AP-42)	-
EP-TK1	Tank Vent	EU-TK1	25-bbl Pipeline Fluids Tank	N/A	N/A	-	-	VOC Benzene Toluene Ethylbenzene Xylenes n-Hexane	-	2.93 △0.01 △0.01 △0.01 △0.01 0.06	-	-	Gas/Vapor	O (TE&P TANK V2.0)	-
EP-LOAD	Fugitive	EU-LOAD	Pipeline Fluids Truck Loading	N/A	N/A	-	-	VOC Benzene Toluene Ethylbenzene Xylenes n-Hexane CO ₂ CH ₄	-	0.02 △0.01 △0.01 △0.01 △0.01 △0.01 △0.01 △0.01	-	-	Gas/Vapor	O (AP-42)	-
EP-FUG	Fugitive	EU-FUG	Fugitive Emissions	-	-	-	-	VOC Benzene Toluene Ethylbenzene Xylenes n-Hexane CO ₂ CH ₄	-	1.27 △0.01 0.01 △0.01 0.01 0.04 0.01 2.15	-	-	Gas/Vapor	O (EPA-453/R-95-017)	-

Note: Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit. Emissions shown for reference only.

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

- ¹ Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.
- ² Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (i.e., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).
- ³ List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS₂, VOCs, H₂S, Inorganics, Lead, Organics, O₃, NO, NO₂, SO₂, SO₃, all applicable Greenhouse Gases (including CO₂ and methane), etc. **DO NOT LIST** H₂, H₂O, N₂, O₂, and Noble Gases.
- ⁴ Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
- ⁵ Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
- ⁶ Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).
- ⁷ Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m³) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO₂, use units of ppmv (See 45CSR10).

**Attachment J
EMISSION POINTS DATA SUMMARY SHEET**

Table 2: Release Parameter Data								
Emission Point ID No. <i>(Must match Emission Units Table)</i>	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (°F)	Volumetric Flow ¹ (acfm) <i>at operating conditions</i>	Velocity (fps)	Ground Level <i>(Height above mean sea level)</i>	Stack Height ² <i>(Release height of emissions above ground level)</i>	Northing	Easting
EP-MC1648	0.7 (est.)	1,170	851	~36.85	~680	20 (est.)	4,248.528	421.183
EP-DEHY1	N/A	212	N/A	N/A	~680	N/A	4,248.528	421.183
EP-RBL1	~1.3	350 – 400	N/A	N/A	~680	N/A	4,248.528	421.183
EP-TK1	N/A	212	N/A	N/A	~680	N/A	4,248.528	421.183
EP-LOAD	N/A	Ambient	N/A	N/A	~680	N/A	4,248.528	421.183
EP-FUG	N/A	Ambient	N/A	N/A	~680	N/A	4,248.528	421.183

¹ Give at operating conditions. Include Inerts.

² Release height of emissions above ground level.

Note: Stack parameters for TEG dehydration unit and reboiler are estimated based on typical equipment configurations but may vary.

ATTACHMENT K: FUGITIVE EMISSIONS DATA SUMMARY SHEET

Attachment K

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS	
1.)	Will there be haul road activities? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.)	Will there be Storage Piles? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.)	Will there be Liquid Loading/Unloading Operations? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.)	Will there be emissions of air pollutants from Wastewater Treatment Evaporation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.)	Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.)	Will there be General Clean-up VOC Operations? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.)	Will there be any other activities that generate fugitive emissions? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."	

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS ¹	Maximum Potential Uncontrolled Emissions ²		Maximum Potential Controlled Emissions ³		Est. Method Used ⁴
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads						
Unpaved Haul Roads						
Storage Pile Emissions						
Loading/Unloading Operations – Pipeline Fluids	VOC Benzene Toluene Ethylbenzene Xylenes n-Hexane CO ₂ CH ₄	Does not apply	0.02 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01 <0.01	Does not apply	N/A	O – AP-42
Wastewater Treatment Evaporation & Operations						
Equipment Leaks	VOC Benzene Toluene Ethylbenzene Xylenes n-Hexane CO ₂ CH ₄	Does not apply	1.27 <0.01 0.01 <0.01 0.01 0.04 0.01 2.15	Does not apply	N/A	O – AP-42

General Clean-up VOC Emissions						
Other						

¹ List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS₂, VOCs, H₂S, Inorganics, Lead, Organics, O₃, NO, NO₂, SO₂, SO₃, all applicable Greenhouse Gases (including CO₂ and methane), etc. DO NOT LIST H₂, H₂O, N₂, O₂, and Noble Gases.

² Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

³ Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

⁴ Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

Note: Greenhouse Gas (GHG) emissions were calculated using EPA Mandatory Reporting Rule and 2009 API Compendium guidance. With the exception of fugitive emissions (which are calculated by mass balance), emissions calculation methodologies are intended to calculate metric tons (tonnes) for the purposes of emissions reporting to EPA. These values were converted to tons for consistency with other pollutants.

ATTACHMENT L: EMISSION UNIT DATA SHEETS

EUDS - GENERAL: COMPRESSOR ENGINE(S)

EUDS - GENERAL: DEHYDRATION UNITS

EUDS - STORAGE TANKS – CONDENSATE

EUDS - BULK LIQUID TRANSFER OPERATIONS – CONDENSATE

EUDS - CHEMICAL PROCESS (LEAK SOURCES)

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): EU-MC1648

1. Name or type and model of proposed affected source:

One (1) 225-hp Caterpillar G342 NA HCR Engine with a Non-Selective Catalytic Reduction (NSCR) Catalytic Converter (Serial Number 71B02582). Engine was manufactured on 9/23/1977 but was reconstructed after 6/12/2006 and is thus subject to NSPS Subpart JJJJ emissions limitations.

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

Emissions provided in Question 8. The unit will operate a maximum of 8,760 hours per year.

4. Name(s) and maximum amount of proposed material(s) produced per hour:

Emissions provided in Question 8.

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

Emissions from the combustion of natural gas.

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

Natural gas is used for fuel (Estimated maximum fuel use of 7,550 Btu per horsepower-hour for 8,760 hours per year at maximum horsepower rating, which equals 16.44 million cubic feet per year at 905 Btu per standard cubic foot). Actual fuel heating value may vary.

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

Gas analyses attached.

(c) Theoretical combustion air requirement (ACF/unit of fuel):

@ °F and psia.

(d) Percent excess air:

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

Spark-ignited.

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

Not applicable.

(g) Proposed maximum design heat input: 1.70 × 10⁶ BTU/hr.

7. Projected operating schedule:

Hours/Day	24	Days/Week	7	Weeks/Year	52
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8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@	1,170	°F and	Atmospheric	psia
a. NO _x	6.40	lb/hr		grains/ACF
b. SO ₂	0.01	lb/hr		grains/ACF
c. CO	6.80	lb/hr		grains/ACF
d. PM ₁₀	0.03	lb/hr		grains/ACF
e. Hydrocarbons		lb/hr		grains/ACF
f. VOCs	0.89	lb/hr		grains/ACF
g. Pb		lb/hr		grains/ACF
h. Specify other(s)				
PM Total	0.03	lb/hr		grains/ACF
Total HAPs	0.05	lb/hr		grains/ACF
		lb/hr		grains/ACF

Note: Speciated HAPs and Greenhouse Gases presented in Attachment J.

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
 Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

<p>MONITORING</p> <p>In accordance with 40 CFR Part 60 NSPS Subpart JJJJ requirements</p>	<p>RECORDKEEPING</p> <p>In accordance with 40 CFR Part 60 NSPS Subpart JJJJ requirements</p>
<p>REPORTING</p> <p>In accordance with 40 CFR Part 60 NSPS Subpart JJJJ requirements</p>	<p>TESTING</p> <p>In accordance with 40 CFR Part 60 NSPS Subpart JJJJ requirements</p>

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

As shown on attached catalyst manufacturer specification sheet.

**Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL**

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): EU-DEHY1

<p>1. Name or type and model of proposed affected source:</p> <p>Triethylene glycol (TEG) dehydration unit.</p> <p><i>Note: Information provided for reference only. Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit.</i></p>
<p>2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.</p>
<p>3. Name(s) and maximum amount of proposed process material(s) charged per hour:</p> <p>Emissions provided in Question 8. Unit will process a maximum of 2.0 million standard cubic feet of natural gas per day.</p>
<p>4. Name(s) and maximum amount of proposed material(s) produced per hour:</p> <p>Emissions provided in Question 8.</p>
<p>5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:</p> <p>Emissions from the still column are formed by boiling off water and absorbed hydrocarbons from triethylene glycol. Emissions from the reboiler are from combustion of natural gas.</p>

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:				
@	212	°F and	14.7	psia
a.	NO _x	0.03	lb/hr	grains/ACF
b.	SO ₂	<0.01	lb/hr	grains/ACF
c.	CO	0.02	lb/hr	grains/ACF
d.	PM ₁₀	<0.01	lb/hr	grains/ACF
e.	Hydrocarbons		lb/hr	grains/ACF
f.	VOCs	9.59*	lb/hr	grains/ACF
g.	Pb	N/A	lb/hr	grains/ACF
h.	Specify other(s)			
	Total HAPs	1.30*	lb/hr	grains/ACF
	<i>*Dehy (EP-DEHY1) + reboiler (EP-RBL1) emissions.</i>		lb/hr	grains/ACF
	<i>Note: Speciated HAPs and Greenhouse Gases presented in Attachment J.</i>		lb/hr	grains/ACF
			lb/hr	grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
 Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

<p>MONITORING</p> <p>In accordance with MACT HH requirements, the facility shall determine the actual flow rate of natural gas to the dehydration unit to document the de minimis determination as required by §63.772 (1)(i) or § 63.772 (1)(ii).</p>	<p>RECORDKEEPING</p> <p>In accordance with MACT HH requirements, the facility must maintain records of the de minimis determination as required by §63.774(d)(1).</p>
<p>REPORTING</p> <p>None Proposed</p>	<p>TESTING</p> <p>None Proposed</p>

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

Not applicable

Attachment L EMISSIONS UNIT DATA SHEET STORAGE TANKS

Provide the following information for each new or modified bulk liquid storage tank as shown on the *Equipment List Form* and other parts of this application. A tank is considered modified if the material to be stored in the tank is different from the existing stored liquid.

IF USING US EPA'S TANKS EMISSION ESTIMATION PROGRAM (AVAILABLE AT www.epa.gov/tnn/tanks.html), APPLICANT MAY ATTACH THE SUMMARY SHEETS IN LIEU OF COMPLETING SECTIONS III, IV, & V OF THIS FORM. HOWEVER, SECTIONS I, II, AND VI OF THIS FORM MUST BE COMPLETED. US EPA'S AP-42, SECTION 7.1, "ORGANIC LIQUID STORAGE TANKS," MAY ALSO BE USED TO ESTIMATE VOC AND HAP EMISSIONS (<http://www.epa.gov/tnn/chief/>).

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name Pipeline Fluids Storage	2. Tank Name One (1) 25-bbl Pipeline Fluids Storage Tank
3. Tank Equipment Identification No. (as assigned on <i>Equipment List Form</i>) EU-TANK1	4. Emission Point Identification No. (as assigned on <i>Equipment List Form</i>) EP-TANK1
5. Date of Commencement of Construction (for existing tanks) 2008	
6. Type of change <input type="checkbox"/> New Construction <input type="checkbox"/> New Stored Material <input checked="" type="checkbox"/> Other Tank Modification	
7. Description of Tank Modification (if applicable) Updated potential emissions	
7A. Does the tank have more than one mode of operation? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (e.g. Is there more than one product stored in the tank?)	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.): Not applicable	

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. <div style="text-align: center;">25 barrels</div>	
9A. Tank Internal Diameter (ft) <div style="text-align: center;">6</div>	9B. Tank Internal Height (or Length) (ft) <div style="text-align: center;">5</div>
10A. Maximum Liquid Height (ft) <div style="text-align: center;">5</div>	10B. Average Liquid Height (ft) <div style="text-align: center;">2.5</div>
11A. Maximum Vapor Space Height (ft) <div style="text-align: center;">5</div>	11B. Average Vapor Space Height (ft) <div style="text-align: center;">2.5</div>
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights. <div style="text-align: center;">1,057.54 gallons (per EPA TANKS 4.0.9d)</div>	

13A. Maximum annual throughput (gal/yr) 10,080	13B. Maximum daily throughput (gal/day) 27.62 *Rolling daily throughput total not to exceed maximum annual throughput.
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume) 9.53 (per EPA TANKS 4.0.9d)	
15. Maximum tank fill rate (gal/min) Unknown	
16. Tank fill method <input type="checkbox"/> Submerged <input checked="" type="checkbox"/> Splash <input type="checkbox"/> Bottom Loading	
17. Complete 17A and 17B for Variable Vapor Space Tank Systems <input checked="" type="checkbox"/> Does Not Apply	
17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year
18. Type of tank (check all that apply): <input checked="" type="checkbox"/> Fixed Roof <input checked="" type="checkbox"/> vertical <input type="checkbox"/> horizontal <input type="checkbox"/> flat roof <input checked="" type="checkbox"/> cone roof <input type="checkbox"/> dome roof <input type="checkbox"/> other (describe) <input type="checkbox"/> External Floating Roof <input type="checkbox"/> pontoon roof <input type="checkbox"/> double deck roof <input type="checkbox"/> Domed External (or Covered) Floating Roof <input type="checkbox"/> Internal Floating Roof <input type="checkbox"/> vertical column support <input type="checkbox"/> self-supporting <input type="checkbox"/> Variable Vapor Space <input type="checkbox"/> lifter roof <input type="checkbox"/> diaphragm <input type="checkbox"/> Pressurized <input type="checkbox"/> spherical <input type="checkbox"/> cylindrical <input type="checkbox"/> Underground <input type="checkbox"/> Other (describe)	

III. TANK CONSTRUCTION & OPERATION INFORMATION (optional if providing TANKS Summary Sheets)
Refer to enclosed E&P TANK V2.0 Calculation Report

19. Tank Shell Construction: <input type="checkbox"/> Riveted <input type="checkbox"/> Gunite lined <input type="checkbox"/> Epoxy-coated rivets <input type="checkbox"/> Other (describe)		
20A. Shell Color	20B. Roof Color	20C. Year Last Painted
21. Shell Condition (if metal and unlined): <input type="checkbox"/> No Rust <input type="checkbox"/> Light Rust <input type="checkbox"/> Dense Rust <input type="checkbox"/> Not applicable		
22A. Is the tank heated? <input type="checkbox"/> YES <input type="checkbox"/> NO		
22B. If YES, provide the operating temperature (°F)		
22C. If YES, please describe how heat is provided to tank.		
23. Operating Pressure Range (psig):		
24. Complete the following section for Vertical Fixed Roof Tanks		<input type="checkbox"/> Does Not Apply
24A. For dome roof, provide roof radius (ft)		
24B. For cone roof, provide slope (ft/ft)		
25. Complete the following section for Floating Roof Tanks		<input type="checkbox"/> Does Not Apply
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type: <input type="checkbox"/> Metallic (Mechanical) Shoe Seal <input type="checkbox"/> Liquid Mounted Resilient Seal (check one) <input type="checkbox"/> Vapor Mounted Resilient Seal <input type="checkbox"/> Other (describe):		
25C. Is the Floating Roof equipped with a Secondary Seal? <input type="checkbox"/> YES <input type="checkbox"/> NO		

25D. If YES, how is the secondary seal mounted? (check one) <input type="checkbox"/> Shoe <input type="checkbox"/> Rim <input type="checkbox"/> Other (describe):		
25E. Is the Floating Roof equipped with a weather shield? <input type="checkbox"/> YES <input type="checkbox"/> NO		
25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
COLUMN WELL		
BUILT-UP COLUMN – SLIDING COVER, GASKETED:	BUILT-UP COLUMN – SLIDING COVER, UNGASKETED:	PIPE COLUMN – FLEXIBLE FABRIC SLEEVE SEAL:
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED:	PIPE COLUMN – SLIDING COVER, UNGASKETED:	
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED:	SLIDING COVER, UNGASKETED:	
ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
DECK DRAIN (3-INCH DIAMETER)		
OPEN:	90% CLOSED:	
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		

26. Complete the following section for Internal Floating Roof Tanks <input type="checkbox"/> Does Not Apply	
26A. Deck Type: <input type="checkbox"/> Bolted <input type="checkbox"/> Welded	
26B. For Bolted decks, provide deck construction:	
26C. Deck seam: <input type="checkbox"/> Continuous sheet construction 5 feet wide <input type="checkbox"/> Continuous sheet construction 6 feet wide <input type="checkbox"/> Continuous sheet construction 7 feet wide <input type="checkbox"/> Continuous sheet construction 5 × 7.5 feet wide <input type="checkbox"/> Continuous sheet construction 5 × 12 feet wide <input type="checkbox"/> Other (describe)	
26D. Deck seam length (ft)	26E. Area of deck (ft ²)
For column supported tanks:	26G. Diameter of each column:
26F. Number of columns:	

IV. SITE INFORMATION (optional if providing TANKS Summary Sheets)

27. Provide the city and state on which the data in this section are based. Refer to enclosed E&P TANK V2.0 Calculation Report
28. Daily Average Ambient Temperature (°F)
29. Annual Average Maximum Temperature (°F)
30. Annual Average Minimum Temperature (°F)
31. Average Wind Speed (miles/hr)
32. Annual Average Solar Insulation Factor (BTU/(ft ² ·day))
33. Atmospheric Pressure (psia)

V. LIQUID INFORMATION (optional if providing TANKS Summary Sheets)

34. Average daily temperature range of bulk liquid: Refer to enclosed E&P TANK V2.0 Calculation Report			
34A. Minimum (°F)	34B. Maximum (°F)		
35. Average operating pressure range of tank:			
35A. Minimum (psig)	35B. Maximum (psig)		
36A. Minimum Liquid Surface Temperature (°F)	36B. Corresponding Vapor Pressure (psia)		
37A. Average Liquid Surface Temperature (°F)	37B. Corresponding Vapor Pressure (psia)		
38A. Maximum Liquid Surface Temperature (°F)	38B. Corresponding Vapor Pressure (psia)		
39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
39A. Material Name or Composition			
39B. CAS Number			
39C. Liquid Density (lb/gal)			
39D. Liquid Molecular Weight (lb/lb-mole)			
39E. Vapor Molecular Weight (lb/lb-mole)			

Maximum Vapor Pressure 39F. True (psia)			
39G. Reid (psia)			
Months Storage per Year 39H. From			
39I. To			

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply): Does Not Apply

Carbon Adsorption¹

Condenser¹

Conservation Vent (psig)

Vacuum Setting Pressure Setting

Emergency Relief Valve (psig)

Inert Gas Blanket of

Insulation of Tank with

Liquid Absorption (scrubber)¹

Refrigeration of Tank

Rupture Disc (psig)

Vent to Incinerator¹

Other¹ (describe):

¹ Complete appropriate Air Pollution Control Device Sheet.

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

Material Name & CAS No.	Breathing Loss (lb/hr)	Working Loss		Annual Loss (lb/yr)	Estimation Method ¹
		Amount	Units		
Refer to Attachment N Emissions Calculations and enclosed E&P TANK V2.0 Calculation Report.					

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 if applicable.

**Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS**

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on <i>Equipment List Form</i>): EU-LOAD	
1. Loading Area Name: Pipeline Fluids Truck Loading	
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): <input type="checkbox"/> Drums <input type="checkbox"/> Marine Vessels <input type="checkbox"/> Rail Tank Cars <input checked="" type="checkbox"/> Tank Trucks	
3. Loading Rack or Transfer Point Data:	
Number of pumps	One (1)
Number of liquids loaded	One (1)
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	One (1)
4. Does ballasting of marine vessels occur at this loading area? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Does not apply	
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point: Point is kept clear. Scotchies are provided. Lines kept in good working order and tested periodically.	
6. Are cargo vessels pressure tested for leaks at this or any other location? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If YES, describe: Vessel pressure tested in accordance with DOT requirements, if applicable.	

7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):				
Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day	24	24	24	24
days/week	5	5	5	5
weeks/quarter	13	13	13	13

8. Bulk Liquid Data (add pages as necessary):		
Pump ID No.	N/A	
Liquid Name	Pipeline Fluids	
Max. daily throughput (1000 gal/day)	~0.02762	
Max. annual throughput (1000 gal/yr)	10.08	
Loading Method ¹	SUB	
Max. Fill Rate (gal/min)	125	
Average Fill Time (min/loading)	~60	
Max. Bulk Liquid Temperature (°F)	55	
True Vapor Pressure ²	5.9954	
Cargo Vessel Condition ³	U	
Control Equipment or Method ⁴	None	
Minimum control efficiency (%)	N/A	
Maximum Emission Rate	Loading (lb/hr)	26.18
	Annual (lb/yr)	40 (based on 0.02 tons/year)
Estimation Method ⁵	EPA	

¹ BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill
² At maximum bulk liquid temperature
³ B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)
⁴ List as many as apply (complete and submit appropriate <i>Air Pollution Control Device Sheets</i>): CA = Carbon Adsorption LOA = Lean Oil Adsorption CO = Condensation SC = Scrubber (Absorption) CRA = Compressor-Refrigeration-Absorption TO = Thermal Oxidation or Incineration CRC = Compression-Refrigeration-Condensation VB = Dedicated Vapor Balance (closed system) O = other (describe)
⁵ EPA = EPA Emission Factor as stated in AP-42 MB = Material Balance TM = Test Measurement based upon test data submittal O = other (describe)

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing

Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING None Proposed	RECORDKEEPING None Proposed
REPORTING None Proposed	TESTING None Proposed

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty
Not applicable

**Attachment L
EMISSIONS UNIT DATA SHEET
CHEMICAL PROCESS**

For chemical processes please fill out this sheet and all supplementary forms (see below) that apply. Please check all supplementary forms that have been completed.

- Emergency Vent Summary Sheet*
- Leak Sources Data Sheet*
- Toxicology Data Sheet*
- Reactor Data Sheet*
- Distillation Column Data Sheet*

1. Chemical process area name and equipment ID number (as shown in *Equipment List Form*)
Components in natural gas and light liquid service (EU-FUG)

2. Standard Industrial Classification Codes (SICs) for process(es)
1311

3. List raw materials and attach MSDSs
Natural gas and condensate

4. List Products and Maximum Production and attach MSDSs

Description and CAS Number	Maximum Hourly (lb/hr)	Maximum Annual (ton/year)
Not applicable		

5. Complete the *Emergency Vent Summary Sheet* for all emergency relief devices.

6. Complete the *Leak Source Data Sheet* and describe below or attach to application the leak detection or maintenance program to minimize fugitive emissions. Include detection instruments, calibration gases or methods, planned inspection frequency, and record-keeping, and similar pertinent information. If subject to a rule requirement (e.g. 40CFR60, Subpart VV), please list those here.

The facility is not a natural gas processing plant (SIC 1321) and is therefore not subject to New Source Performance Standards (NSPS) Subpart KKK or Subpart OOOO/OOOOa requirements for a leak detection and repair (LDAR) monitoring program. No horsepower capacity has been added to this compressor station since September 18, 2015; therefore, it is not subject to the fugitive source requirements of Subpart OOOOa.

7. Clearly describe below or attach to application Accident Procedures to be followed in the event of an accidental spill or release.

In the event of an accidental spill or release, personnel will be protected, emergency response personnel will be notified and immediate steps to stop the spill or release will be implemented.

8A. Complete the *Toxicology Data Sheet* or attach to application a toxicology report (an up-to-date material safety data sheets (MSDS) may be used) outlining the currently known acute and chronic health effects of each compound or chemical entity emitted to the air. If these compounds have already been listed in Item 3, then a duplicate MSDS sheet is not required. Include data such as the OSHA time weighted average (TWA) or mutagenicity, teratogenicity, irritation, and other known or suspected effects should be addressed. Indicate where these are unknown, and provide references.

8B. Describe any health effects testing or epidemiological studies on these compounds that are being or may be conducted by the company or required under TSCA, RCRA or other federal regulations. Discuss the persistence in the environment of any emission (e.g. pesticides, etc.).

9. **Waste Products** - Waste products status: (If source is subject to RCRA or 45CSR25, please contact the Hazardous Waste Section of WVDEP, OAQ at (304) 926-3647.)

9A. Types and amounts of wastes to be disposed:

9B. Method of disposal and location of waste disposal facilities:
 Carrier: _____ Phone: _____

9C. Check here if approved USEPA/State Hazardous Waste Landfill will be used

10. Maximum and Projected Typical Operating Schedule for process or project as a whole (circle appropriate units).

circle units:	(hrs/day) (hr/batch)	(days), (batches/day), (batches/week)	(days/yr), (weeks/year)
10A. Maximum			
10B. Typical			

11. Complete a *Reactor Data Sheet* for each reactor in this chemical process.

12. Complete a *Distillation Column Data Sheet* for each distillation column in this chemical process.

13. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
 Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
None Proposed	None Proposed
REPORTING	TESTING
None Proposed	None Proposed

MONITORING. Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment operation or air pollution control device.
RECORDKEEPING. Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING. Please describe the proposed frequency of reporting of the recordkeeping.
TESTING. Please describe any proposed emissions testing for this process equipment or air pollution control device.

14. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

Not applicable

LEAK SOURCE DATA SHEET

Source Category	Pollutant	Number of Source Components ¹	Number of Components Monitored by Frequency ²	Average Time to Repair (days) ³	Estimated Annual Emission Rate (lb/yr) ⁴
Pumps ⁵	light liquid VOC ^{6,7}	0	N/A	N/A	0
	heavy liquid VOC ⁸				
	Non-VOC ⁹				
Valves ¹⁰	Gas VOC	43	N/A	N/A	820
	Light Liquid VOC	18	N/A	N/A	840
	Heavy Liquid VOC				
	Non-VOC				
Safety Relief Valves ¹¹	Gas VOC	7	N/A	N/A	260
	Non VOC				
Open-ended Lines ¹²	VOC	3	N/A	N/A	20
	Non-VOC				
Sampling Connections ¹³	VOC				
	Non-VOC				
Compressors	VOC	3	N/A	N/A	120
	Non-VOC				
Flanges	VOC	193 (Gas), 66 (LL)	N/A	N/A	320 (Gas), 140 (LL)
	Non-VOC				
Other	VOC	0	N/A	N/A	0
	Non-VOC				

¹⁻¹³ See notes on the following page.

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

Notes for Leak Source Data Sheet

1. For VOC sources include components on streams and equipment that contain greater than 10% w/w VOC, including feed streams, reaction/separation facilities, and product/by-product delivery lines. Do not include certain leakless equipment as defined below by category.
2. By monitoring frequency, give the number of sources routinely monitored for leaks, using a portable detection device that measures concentration in ppm. Do not include monitoring by visual or soap-bubble leak detection methods. "M/Q(M)/Q/SA/A/O" means the time period between inspections as follows:

Monthly/Quarterly, with Monthly follow-up of repaired leakers/Quarterly/Semi-annual/Annually/Other (specify time period)

If source category is not monitored, a single zero in the space will suffice. For example, if 50 gas-service valves are monitored quarterly, with monthly follow-up of those repaired, 75 are monitored semi-annually, and 50 are checked bimonthly (alternate months), with non checked at any other frequency, you would put in the category "valves, gas service:" 0/50/0/75/0/50 (bimonthly).

3. Give the average number of days, after a leak is discovered, that an attempt will be made to repair the leak.
4. Note the method used: MB - material balance; EE - engineering estimate; EPA - emission factors established by EPA (cite document used); O - other method, such as in-house emission factor (specify).
5. Do not include in the equipment count sealless pumps (canned motor or diaphragm) or those with enclosed venting to a control device. (Emissions from vented equipment should be included in the estimates given in the Emission Points Data Sheet.)
6. Volatile organic compounds (VOC) means the term as defined in 40 CFR §51.100 (s).
7. A light liquid is defined as a fluid with vapor pressure equal to or greater than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if 20% w/w or more of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a light liquid.
8. A heavy liquid is defined as a fluid with a vapor pressure less than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if less than 20% w/w of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a heavy liquid.
9. LIST CO, H₂S, mineral acids, NO, NO₂, SO₃, etc. DO NOT LIST CO₂, H₂, H₂O, N₂, O₂, and Noble Gases.
10. Include all process valves whether in-line or on an open-ended line such as sample, drain and purge valves. Do not include safety-relief valves, or leakless valves such as check, diaphragm, and bellows seal valves.
11. Do not include a safety-relief valve if there is a rupture disk in place upstream of the valve, or if the valve vents to a control device.
12. Open-ended lines include purge, drain and vent lines. Do not include sampling connections, or lines sealed by plugs, caps, blinds or second valves.
13. Do not include closed-purge sampling connections.

ATTACHMENT N: SUPPORTING EMISSIONS CALCULATIONS

EXAMPLE CALCULATIONS

g/hp-hr Emission Factors:

Emission Factor (g/hp-hr) * Engine Rating (hp) * 1 lb/453.6 g = lb/hr

lb/mmBtu Emission Factors:

Emission Factor (lb/mmBtu) * Engine Rating (hp) * Fuel Use (Btu/hp-hr) * 1 mmBtu/1000000 Btu = lb/hr

lb/mmscf Emission Factors:

Emission Factor (lb/mmscf) * Heater Rating (mmBtu/hr) * 1/Fuel Heating Value (Btu/scf) = lb/hr

kg/mmBtu Emission Factors:

Emission Factor (kg/mmBtu) * Engine Rating (hp) * Fuel Use (Btu/hp-hr) * 2.20462 lb/kg * 1 mmBtu/1000000 Btu = lb/hr

Emission Factor (kg/mmBtu) * Heater Rating (mmBtu/hr) * 2.20462 lb/kg = lb/hr

Fugitives:

TOC Emission Factor (lb/hr/source) * Number of Sources * VOC wt% = lb/hr VOC

Tons per Year (TPY) Conversion:

lb/hr * Hours/Year * 1 ton/2000 lb = TPY

Tonnes/Year * 1.10231131 = TPY

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Summary of Criteria Air Pollutant Emissions

Equipment	Unit ID	NOx		CO		Total VOC ¹		SO ₂		PM Total	
		lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
225-hp Caterpillar G342 NA HCR Engine w/ NSCR	EU-MC1648	1.49	6.53	1.98	8.67	0.50	2.19	0.01	0.04	0.03	0.13
25-bbl Pipeline Fluids Tank	EU-TK1	-	-	-	-	0.67	2.93	-	-	-	-
Pipeline Fluids Truck Loading	EU-LOAD	-	-	-	-	-	0.02	-	-	-	-
Fugitive Emissions	EU-FUG	-	-	-	-	0.29	1.27	-	-	-	-
Total Emissions to be Permitted =		1.49	6.53	1.98	8.67	1.46	6.41	0.01	0.04	0.03	0.13

Grandfathered Equipment - For Reference Only²

Equipment	Unit ID	NOx		CO		Total VOC ¹		SO ₂		PM Total	
		lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
2.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	-	-	9.58	41.94	-	-	-	-
0.25-mmBtu/hr TEG Reboiler	EU-RBL1	0.03	0.13	0.02	0.09	0.01	0.04	<0.01	<0.01	<0.01	0.01
Total Grandfathered Emissions =		0.03	0.13	0.02	0.09	9.59	41.98	<0.01	<0.01	<0.01	0.01

Sitewide Potential Emissions =		1.52	6.66	2.00	8.76	11.05	48.39	0.01	0.04	0.03	0.14
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Notes:

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

² Chesapeake requests that the grandfathered TEG dehydration unit and reboiler be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Summary of Hazardous Air Pollutants

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAPs
225-hp Caterpillar G342 NA HCR Engine w/ NSCR	EU-MC1648	<0.01	<0.01	<0.01	<0.01	0.03	0.01	-	<0.01	<0.01	0.05
25-bbl Pipeline Fluids Tank	EU-TK1	-	-	<0.01	<0.01	-	-	0.01	<0.01	<0.01	0.02
Pipeline Fluids Truck Loading	EU-LOAD	-	-	-	-	-	-	-	-	-	-
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.01	<0.01	<0.01	0.01
Total Emissions to be Permitted =		<0.01	<0.01	<0.01	<0.01	0.03	0.01	0.02	<0.01	<0.01	0.08

Grandfathered Equipment - For Reference Only

Equipment	Unit ID	Estimated Emissions (lb/hr)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAPs
2.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	0.31	0.08	-	-	0.34	0.49	0.08	1.30
0.25-mmBtu/hr TEG Reboiler	EU-RBL1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Total Grandfathered Emissions =		-	-	0.31	0.08	<0.01	-	0.34	0.49	0.08	1.30
Sitewide Potential Emissions =		<0.01	<0.01	0.31	0.08	0.03	0.01	0.36	0.49	0.08	1.38

Continued on Next Page

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Summary of Hazardous Air Pollutants (Continued)

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAPs
225-hp Caterpillar G342 NA HCR Engine w/ NSCR	EU-MC1648	0.02	0.02	0.01	-	0.13	0.04	-	<0.01	<0.01	0.22
25-bbl Pipeline Fluids Tank	EU-TK1	-	-	<0.01	<0.01	-	-	0.06	<0.01	<0.01	0.07
Pipeline Fluids Truck Loading	EU-LOAD	-	-	-	-	-	-	-	-	-	-
Fugitive Emissions	EU-FUG	-	-	<0.01	<0.01	-	-	0.04	0.01	0.01	0.06
Total Emissions to be Permitted =		0.02	0.02	0.02	<0.01	0.13	0.04	0.10	0.01	0.01	0.34

Grandfathered Equipment - For Reference Only

Equipment	Unit ID	Estimated Emissions (TPY)									
		Acetalde- hyde	Acrolein	Benzene	Ethyl- benzene	Formalde- hyde	Methanol	n-Hexane	Toluene	Xylenes	Total HAPs
2.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	-	1.35	0.35	-	-	1.51	2.15	0.37	5.73
0.25-mmBlu/hr TEG Reboiler	EU-RBL1	-	-	<0.01	-	<0.01	-	<0.01	<0.01	-	<0.01
Total Grandfathered Emissions =		-	-	1.35	0.35	<0.01	-	1.51	2.15	0.37	6.73
Sitewide Potential Emissions =		0.02	0.02	1.37	0.35	0.13	0.04	1.61	2.16	0.38	6.08

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Summary of Greenhouse Gas Emissions - Metric Tons per Year (Tonnes)

Equipment	Unit ID	Carbon Dioxide (CO ₂)		Methane (CH ₄)		Methane (CH ₄) as CO ₂ eq.		Nitrous Oxide (N ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ eq.		Total CO ₂ + CO ₂ eq. ¹	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
225-hp Caterpillar G342 NA HCR Engine w/ NSCR	EU-MC1646	198.71	789.57	<0.01	0.01	0.09	0.36	<0.01	<0.01	0.11	0.44	198.81	790.37
25-bbl Pipeline Fluids Tank	EU-TK1	<0.01	<0.01	0.11	0.44	2.75	10.93	-	-	-	-	2.78	11.05
Pipeline Fluids Truck Loading	EU-LOAD	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-
Fugitive Emissions	EU-FUG	<0.01	0.01	0.46	1.85	12.25	48.67	-	-	-	-	12.25	48.68
Total Emissions to be Permitted =		198.71	789.68	0.60	2.40	16.09	69.97	<0.01	<0.01	0.11	0.44	213.94	850.10

Grandfathered Equipment - For Reference Only

Equipment	Unit ID	Carbon Dioxide (CO ₂)		Methane (CH ₄)		Methane (CH ₄) as CO ₂ eq.		Nitrous Oxide (N ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ eq.		Total CO ₂ + CO ₂ eq. ¹	
		lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr	lb/hr	tonnes/yr
2.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	<0.01	0.01	0.58	2.31	14.58	57.93	-	-	-	-	14.58	57.94
0.25-mmBtu/hr TEG Reboiler	EU-RBL1	29.24	116.18	<0.01	<0.01	0.01	0.04	<0.01	<0.01	0.02	0.08	29.27	116.30
Total Grandfathered Emissions =		29.24	116.19	0.68	2.31	14.69	57.97	<0.01	<0.01	0.02	0.08	43.85	174.24
Sitewide Potential Emissions =		227.96	906.77	1.38	4.71	29.68	117.94	<0.01	<0.01	0.13	0.62	267.79	1,024.34

Notes:
¹ CO₂ Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO₂ = 1, CH₄ = 25, N₂O = 298

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Summary of Greenhouse Gas Emissions - Short Tons per Year (Tons)

Equipment	Unit ID	Carbon Dioxide (CO ₂)		Methane (CH ₄)		Methane (CH ₄) as CO ₂ eq		Nitrous Oxide (N ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ eq		Total CO ₂ + CO ₂ eq ¹	
		lb/hr	tons/yr ²	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr
225-hp Caterpillar G342 NA HCR Engine w/ NSCR	EU-MC1948	198.71	870.35	<0.01	0.01	0.09	0.40	<0.01	<0.01	0.11	0.49	198.91	871.24
25-bbl Pipeline Fluids Tank	EU-TK1	<0.01	<0.01	0.11	0.48	2.75	12.05	-	-	-	-	2.78	12.18
Pipeline Fluids Truck Loading	EU-LOAD	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-
Fugitive Emissions	EU-FUG	<0.01	0.01	0.49	2.15	12.25	53.66	-	-	-	-	12.25	53.67
Total Emissions to be Permitted =		199.71	870.37	0.60	2.64	15.09	66.10	<0.01	<0.01	0.11	0.49	213.84	837.08

Grandfathered Equipment - For Reference Only

Equipment	Unit ID	Carbon Dioxide (CO ₂)		Methane (CH ₄)		Methane (CH ₄) as CO ₂ eq		Nitrous Oxide (N ₂ O)		Nitrous Oxide (N ₂ O) as CO ₂ eq		Total CO ₂ + CO ₂ eq ¹	
		lb/hr	tons/yr ²	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr ²	lb/hr	tons/yr	lb/hr	tons/yr
2.0-MMSCFD TEG Dehydration Unit	EU-DEHY1	-	0.01	0.58	2.55	14.58	63.86	-	-	-	-	14.58	63.87
0.25-mmBbl/hr TEG Reboiler	EU-RBL1	29.24	128.07	<0.01	<0.01	0.01	0.04	<0.01	<0.01	0.02	0.08	29.27	128.20
Total Grandfathered Emissions =		29.24	128.08	0.58	2.55	14.59	63.90	<0.01	<0.01	0.02	0.08	43.85	182.07
Sitewide Potential Emissions =		227.95	998.45	1.15	5.19	29.68	130.00	<0.01	<0.01	0.13	0.58	257.79	1,129.15

Notes:

¹ CO₂ Equivalent = Pollutant times GWP multiplier. 40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO₂ = 1, CH₄ = 25, N₂O = 298

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

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Engine Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	<u>EU-MC1648</u>
Make:	Caterpillar
Model:	G342 NA HCR
Design Class:	4S-RB
Controls:	NSCR
Horsepower (hp):	225
Fuel Use (Btu/hp-hr):	7,550
Fuel Use (scfh):	1,877
Annual Fuel Use (mmscf):	16.44
Fuel Use (mmBtu/hr):	1.70
Exhaust Flow (acfm):	851
Exhaust Temp (°F):	1,170
Operating Hours:	8,760
Fuel Heating Value (Btu/scf):	905

Uncontrolled Manufacturer Emission Factors¹

NOx (g/hp-hr):	12.90
CO (g/hp-hr):	13.70
HC/VOC (g/hp-hr):	1.80

Controlled Manufacturer Emission Factors²

NOx (g/hp-hr):	3.00
CO (g/hp-hr):	4.00
HC/VOC (g/hp-hr):	1.00

Uncontrolled Criteria Air Pollutant Emissions

Unit ID: **EU-MC1648**

Pollutant	lb/hr	TPY
NOx	6.40	28.03
CO	6.80	29.77
VOC	0.89	3.91
SO ₂ ³	0.01	0.04
PM _{10/2.5}	0.02	0.09
PM _{COND}	0.02	0.09
PM _{TOT}	0.03	0.13

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Engine Emissions Calculations - Criteria Air Pollutants (Continued)

Proposed Criteria Air Pollutant Emissions

Unit ID: EU-MC1648

Pollutant	lb/hr	TPY
NO _x	1.49	6.53
CO	1.98	8.67
VOC	0.50	2.19
SO ₂ ³	0.01	0.04
PM _{10/2.5}	0.02	0.09
PM _{COND}	0.02	0.09
PM _{TOT}	0.03	0.13

AP-42 Table 3.2 (7/00) Emission Factors (lb/mmBtu)⁴

Pollutant	3.2-3 (7/00)
PM _{10/2.5}	9.50E-03
PM _{COND}	9.91E-03
PM _{TOT}	1.94E-02

Notes:

¹ Uncontrolled emission factors based on engine manufacturer data. Total Hydrocarbon (THC) factor used as conservative estimate of VOC.

² Post-catalyst emission factors based on NSPS Subpart JJJJ limits for reconstructed engines.

³ SO₂: Mass balance assuming fuel sulfur content of 1 grain/100 scf.

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

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Engine Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID: **EU-MC1648**
 Make: Caterpillar
 Model: G342 NA HCR
 Design Class: 4S-RB
 Controls: NSCR
 Horsepower (hp): 225
 Fuel Use (Btu/hp-hr): 7,550
 Fuel Use (scfh): 1,877
 Annual Fuel Use (mmscf): 16.44
 Fuel Use (mmBtu/hr): 1.70
 Exhaust Flow (acfm): 851
 Exhaust Temp (°F): 1,170
 Operating Hours: 8,760

Unit ID: **EU-MC1648**

Pollutant	lb/hr	TPY
Acetaldehyde	<0.01	0.02
Acrolein	<0.01	0.02
Benzene	<0.01	0.01
Ethylbenzene	<0.01	<0.01
Formaldehyde	0.03	0.13
Methanol	0.01	0.04
Toluene	<0.01	<0.01
Xylenes	<0.01	<0.01
Total HAPs =	0.05	0.22

AP-42 Table 3.2 (7/00) Emission Factors (lb/mmBtu)¹

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

Notes:

¹ For conservative estimate, no catalyst reduction taken for any HAP.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Engine Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	<u>EU-MC1648</u>
Make:	Caterpillar
Model:	G342 NA HCR
Design Class:	4S-RB
Controls:	NSCR
Horsepower (hp):	225
Fuel Use (Btu/hp-hr):	7,550
Fuel Use (scfh):	1,877
Annual Fuel Use (mmscf):	16.44
Fuel Use (mmBtu/hr):	1.70
Exhaust Flow (acfm):	851
Exhaust Temp (°F):	1,170
Operating Hours:	8,760

Unit ID: **EU-MC1648**

Pollutant	lb/hr	tonnes/yr
CO ₂	198.71	789.57
CH ₄	<0.01	0.01
N ₂ O	<0.01	<0.01
CH ₄ as CO ₂ e	0.09	0.36
N ₂ O as CO ₂ e	0.11	0.44
Total CO₂ + CO₂e =	198.91	790.37

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

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

Notes:

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

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

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

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Glycol Dehydration Unit Emissions - Criteria and Hazardous Air Pollutants

Equipment Information

<u>Parameter</u>		<u>Units</u>	<u>Value</u>
Unit ID	-		EU-DEHY1
Maximum Throughput		MMSCFD	2.00
Operating Hours		Hours/Year	8,760
Wet Gas Temperature		°F	50
Wet Gas Pressure		psig	210
Lean Glycol Flow Rate		gpm	1.50

Proposed Emissions¹

Unit ID: EU-DEHY1

<u>Pollutant</u>	<u>lb/hr</u>	<u>TPY</u>
2, 2, 4-Trimethylpentane	<0.01	0.01
n-Hexane	0.34	1.51
Benzene	0.31	1.35
Toluene	0.49	2.15
Ethylbenzene	0.08	0.35
Xylenes	0.08	0.37
Total HAPs =	1.30	5.74
Total VOCs =	9.58	41.94

GRI-GLYCalc Results - For Reference Only

<u>Pollutant</u>	<u>lb/hr</u>	<u>TPY</u>
2, 2, 4-Trimethylpentane	0.0025	0.0108
n-Hexane	0.3442	1.5076
Benzene	0.3071	1.3452
Toluene	0.4920	2.1548
Ethylbenzene	0.0803	0.3518
Xylenes	0.0849	0.3718
Total HAPs =	1.3110	5.7420
Total VOCs =	9.5758	41.9419

Notes:

¹ GRI-GLYCalc Reports in Appendix A. Results rounded to two decimal places, which may result in some discrepancy between lb/hr and TPY conversion.

Note: Chesapeake requests that the grandfathered TEG dehydration unit be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Glycol Dehydration Unit Emissions - Greenhouse Gas Emissions

Proposed Emissions^{1,2}

Unit ID: EU-DEHY1

Pollutant	lb/hr	tons/yr
CO ₂ =	<0.01	0.01
CH ₄ =	0.58	2.55
CH ₄ as CO ₂ e =	14.58	63.86
Total CO₂ + CO₂e =	14.58	63.87

GRI-GLYCalc Results - For Reference Only

Pollutant	lb/hr	tons/yr
CO ₂ =	0.0016	0.0071
Input CH ₄ from GLYCalc =	0.5832	2.5542
CH ₄ as CO ₂ e =	14.5800	63.8550
Total CO₂ + CO₂e =	14.5816	63.8621

Notes:

¹ Proposed CH₄ emissions based on GRI-GLYCalc results. Proposed CO₂ emissions calculated using mass balance based on CH₄ and CO₂ mol% in the gas sample.

² Example CO₂ Calculation (Exhibit 5.1: API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry, August 2009):

CO₂ = tonnes CH₄ * tonne mole CH₄/16 tonne CH₄ * tonne mole gas/tonne mole CH₄ * tonne mole CO₂/tonne mole gas * 44 tonne CO₂/tonne mole CO₂

CH ₄ mol% from gas analysis =	76.9432
CO ₂ mol% from gas analysis =	0.0774

Note: Chesapeake requests that the grandfathered TEG dehydration unit be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Glycol Reboiler Emissions Calculations - Criteria Air Pollutants

Equipment Information

Unit ID:	<u>EU-RBL1</u>
Description:	TEG Reboiler
Burner Design (mmBtu/hr):	0.25
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	2.42
Annual Operating Hours:	8,760

Proposed Emissions^{1, 2}

Unit ID: EU-RBL1

Pollutant	lb/hr	TPY
NOx	0.03	0.13
CO	0.02	0.09
VOC	0.01	0.04
SO ₂	<0.01	<0.01
PM _{10/2.5}	<0.01	0.01
PM _{COND}	<0.01	0.01
PM _{TOT}	<0.01	0.01

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

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

Notes:

¹ All pollutants except SO₂: AP-42 Tables 1.4-1, -2 (7/98).

² SO₂: Mass balance assuming fuel sulfur content of 1 grain/100 scf.

Note: Chesapeake requests that the grandfathered reboiler be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Glycol Reboiler Emissions Calculations - Hazardous Air Pollutants

Equipment Information

Unit ID:	<u>EU-RBL1</u>
Description:	TEG Reboiler
Burner Design (mmBtu/hr):	0.25
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	2.42
Annual Operating Hours:	8,760

Proposed Emissions¹

Unit ID: **EU-RBL1**

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

AP-42 Emission Factors (lb/mmscf)

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

Notes:

¹ AP-42 Tables 1.4-3 (7/98).

Note: Chesapeake requests that the grandfathered reboiler be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Glycol Reboiler Emissions Calculations - Greenhouse Gases

Equipment Information

Unit ID:	<u>EU-RBL1</u>
Description:	TEG Reboiler
Burner Design (mmBtu/hr):	0.25
Fuel HHV (Btu/scf):	905
Annual Fuel Use (mmscf):	2.42
Annual Operating Hours:	8,760

Greenhouse Gas (GHG) Emissions¹

Unit ID: EU-RBL1

Pollutant	lb/hr	tonnes/yr
CO ₂	29.24	116.18
CH ₄	<0.01	<0.01
N ₂ O	<0.01	<0.01
CH ₄ as CO ₂ e	0.01	0.04
N ₂ O as CO ₂ e	0.02	0.08
Total CO₂ + CO₂e	29.27	116.30

CO₂e = CO₂ equivalent (Pollutant times GWP multiplier)

40 CFR 98 Table A-1, Global Warming Potential (GWP) multiplier (100-Year Time Horizon): CO₂ = 1, CH₄ = 25, N₂O = 298

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

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

Notes:

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

Note: Chesapeake requests that the grandfathered reboiler be excluded from the permit.

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Storage Tank Emissions

Tank Information

Unit ID:	<u>EU-TK1</u>
Contents:	Pipeline Fluids
Capacity (bbl):	25
Capacity (gal):	1,050
Total Throughput (bbl/yr):	240
Total Throughput (gal/yr):	10,080
Working/Breathing Losses (VOC TPY):	0.34
Flashing Losses (VOC TPY):	2.59

E&P TANK V2.0 Results¹

Pollutant	lb/hr	TPY
Carbon Dioxide	0.001	0.005
Nitrogen	0.002	0.009
Methane	0.111	0.484
Ethane	0.104	0.455
Propane	0.191	0.836
i-Butane	0.134	0.588
i-Butane	0.126	0.553
i-Pentane	0.104	0.457
n-Pentane	0.044	0.193
Hexanes	0.033	0.143
Heptanes	0.015	0.066
Octanes	0.005	0.021
Nonanes	0.001	0.004
Decanes+	0.000	0.000
Benzene	0.001	0.004
Toluene	0.001	0.003
Ethylbenzene	0.000	0.000
Xylenes	0.000	0.001
n-Hexane	0.014	0.060
2,2,4-Trimethylpentane	0.000	0.000
Total =	0.89	3.88
Total HAP =	0.02	0.09
Total VOC =	0.67	2.93
Total CO₂e =	2.78	12.18

Notes:

¹ Flashing losses calculated using Gas-to-Oil ratio and Flash Gas Analysis obtained from E&P TANK results; remaining emissions estimated working/breathing losses. E&P TANK V2.0 Calculation Report in Appendix A.

Chesapeake Appalachia, L.L.C.
Browns Creek Compressor Station
Storage Tank Emissions - E&P TANK V2.0 Gas-to-Oil Ratio Results

The following equation calculates total flash emissions, E_{TOT} . The total flash emissions includes non-VOC and VOC components:

$$E_{TOT} = (Q)(R_g)(MW_{TV}) * (\text{lb-mole}/379.4 \text{ scf})(365 \text{ days/year})(1 \text{ ton}/2000 \text{ lb})$$

Where:

3.53 E_{TOT} = total stock tank flash emissions, ton/year

287.11 R_g = measured gas-oil ratio, scf/bbl

0.66 Q = production, bbl/day

38.90 MW_{TV} = stock tank gas molecular weight, lb/lb-mole

73.264% X_{VOC} = weight fraction of VOC in stock tank gas

Given total emissions, E_{TOT} , the following equation calculates VOC emissions, E_{VOC} :

2.59 $E_{VOC} = E_{TOT} * X_{VOC}$

Where:

E_{VOC} = VOC flash emissions, ton/year

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	scf/yr	lb/hr	TPY
Hydrogen Sulfide	34.082	0.0000%	0.000	0.0000%	0.0000%	0.00	0.00	0.00
Carbon Dioxide	44.010	0.1194%	0.053	0.1351%	0.0000%	0.23	<0.01	<0.01
Nitrogen	28.013	0.3763%	0.105	0.2710%	0.0000%	0.71	<0.01	0.01
Oxygen	31.999	0.0000%	0.000	0.0000%	0.0000%	0.00	0.00	0.00
Methane	16.042	34.7691%	5.578	14.3403%	14.3988%	65.64	0.12	0.51
Ethane	30.069	15.8939%	4.779	12.2873%	12.3374%	30.01	0.10	0.44
Propane	44.096	17.1306%	7.554	19.4213%	19.5005%	32.34	0.16	0.69
i-Butane	58.122	9.8124%	5.703	14.6630%	14.7228%	18.52	0.12	0.52
n-Butane	58.122	9.4102%	5.489	14.0620%	14.1193%	17.77	0.11	0.50
i-Pentane	72.149	6.3777%	4.601	11.8304%	11.8787%	12.04	0.10	0.42
n-Pentane	72.149	2.6955%	1.945	5.0001%	5.0205%	5.09	0.04	0.18
n-Hexane	86.175	0.6969%	0.601	1.5440%	1.5503%	1.32	0.01	0.05
Other Hexanes	86.175	1.7100%	1.474	3.7886%	3.8041%	3.23	0.03	0.13
Heptanes (as n-Heptane)	100.202	0.6869%	0.688	1.7696%	1.7768%	1.30	0.01	0.08
Benzene	78.114	0.0496%	0.039	0.0996%	0.1000%	0.09	<0.01	<0.01
Toluene	92.141	0.0351%	0.032	0.0832%	0.0835%	0.07	<0.01	<0.01
Ethylbenzene	106.167	0.0017%	0.002	0.0046%	0.0047%	0.00	<0.01	<0.01
Xylenes	106.167	0.0114%	0.012	0.0311%	0.0312%	0.02	<0.01	<0.01
Octanes (as n-Octane)	114.229	0.1882%	0.215	0.5527%	0.5550%	0.36	<0.01	0.02
2,2,4-Trimethylpentane	114.230	0.0000%	0.000	0.0000%	0.0000%	0.00	0.00	0.00
Nonanes (as n-Nonane)	128.255	0.0352%	0.045	0.1161%	0.1165%	0.07	<0.01	<0.01
Decanes+ (as n-Decane)	142.282	0.0000%	0.000	0.0000%	0.0000%	0.00	0.00	0.00
TOTAL =		100.0000%	38.895	100.0000%	100.0000%	188.78	0.81	3.55
TOTAL HC =			38.737	TOTAL VOC =	73.264%	92.21	0.59	2.59
				TOTAL HAP =	1.770%	1.50	0.01	0.06

1) E&P TANK V2.0 Calculation Report - Flash Gas Composition

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Truck Loading Emissions - Criteria and Hazardous Air Pollutants

Loading Information

Unit ID:	EU-LOAD
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
Saturation Factor:	0.6
Em. Factor (lb/1000 gal): ¹	3.49
Throughput (1000 gal):	10.1
Average Fill Rate (gal/hr):	7,500

5.9954	= P, True vapor pressure of liquid loaded (max. psia) ²
40.13	= M, Molecular weight of vapor (lb/lb-mol) ³
55	= T, Temperature of bulk liquid loaded (average °F) ²
515	= T, Temperature of bulk liquid loaded (°F + 460 = °R)

Loading Emissions⁴

Pollutant	Max. lb/hr	Avg. lb/hr	TPY
VOC =	26.18	<0.01	0.02
n-Hexane	1.29	<0.01	<0.01
Benzene	0.09	<0.01	<0.01
Toluene	0.28	<0.01	<0.01
Ethylbenzene	0.05	<0.01	<0.01
Xylenes	0.39	<0.01	<0.01
Total HAPs⁵ =	2.10	<0.01	<0.01

Notes:

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

² AP-42 Section 7.1 - Properties of Selected Petroleum Liquids correlation with information obtained from TANKS 4.0.9d using RVP 11 properties.

³ E&P TANK V2.0 Calculation Report in Appendix A.

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

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

**Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Truck Loading Emissions - Greenhouse Gases**

Loading Information

Unit ID:	<u>EU-LOAD</u>
Fill Method:	Submerged
Type of Service:	Dedicated
Mode of Operation:	Normal
TOC Em. Factor (tonne/10 ⁶ gal): ¹	0.91
Throughput (10 ⁶ gal):	0.0101
Average Fill Rate (gal/hr):	7,500

CH ₄ wt% from analysis =	1.6088%
CO ₂ wt% from analysis =	0.0157%

Loading Emissions^{2,3}

Pollutant	Max. lb/hr	Avg. lb/hr	tonnes/yr
CH ₄	0.24	<0.01	<0.01
CH ₄ as CO ₂ e	6.05	<0.01	<0.01
CO ₂	<0.01	<0.01	<0.01
Total CO₂ + CO₂e =	6.05	<0.01	<0.01

API Compendium Table 5-12

Loading Type	Emission Factor (tonne TOC/10 ⁶ gal)
Rail/Truck - Submerged Loading - Dedicated Normal Service	0.91

Notes:

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

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

³ CO₂e = CO₂ equivalent (Pollutant times GWP multiplier):

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

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Fugitive Emissions Calculations - Criteria and Hazardous Air Pollutants and Greenhouse Gases

Equipment Information

Source Type/Service	Number of Sources ¹	Em. Factor (lb/hr/source) ²	Control Efficiency	TOC lb/hr	TOC TPY	VOC Wt %
Valves - Gas	43	9.92E-03	0.00%	0.43	1.88	21.71%
Flanges - Gas	193	8.60E-04	0.00%	0.17	0.74	21.71%
Compressor Seals - Gas	3	1.94E-02	0.00%	0.06	0.26	21.71%
Relief Valves - Gas	7	1.94E-02	0.00%	0.14	0.61	21.71%
Open-Ended Lines - Gas	3	4.41E-03	0.00%	0.01	0.04	21.71%
Total TOC (Gas Components) =				0.81	3.53	-
Valves - Light Oil	18	5.51E-03	0.00%	0.10	0.44	96.88%
Flanges - Light Oil	66	2.43E-04	0.00%	0.02	0.09	96.88%
Pump Seals - Light Oil	0	2.87E-02	0.00%	0.00	0.00	96.88%
Other - Light Oil	0	1.65E-02	0.00%	0.00	0.00	96.88%
Total TOC (Liquid Components) =				0.12	0.53	-

VOC and Greenhouse Gas Emissions

Source Type/Service	VOC		CH ₄		CO ₂	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
Valves - Gas	0.09	0.41	0.26	1.14	<0.01	<0.01
Flanges - Gas	0.04	0.16	0.10	0.45	<0.01	<0.01
Compressor Seals - Gas	0.01	0.06	0.04	0.16	<0.01	<0.01
Relief Valves - Gas	0.03	0.13	0.08	0.37	<0.01	<0.01
Open-Ended Lines - Gas	<0.01	0.01	0.01	0.03	<0.01	<0.01
Components in Gas Service =	0.17	0.77	0.49	2.15	<0.01	0.01
Valves - Light Oil	0.10	0.42	<0.01	0.01	<0.01	<0.01
Flanges - Light Oil	0.02	0.07	<0.01	<0.01	<0.01	<0.01
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00
Components in Liquid Service =	0.12	0.51	<0.01	0.01	<0.01	<0.01
Total (Gas + Liquid Components) =	0.29	1.27	0.49	2.16	<0.01	0.01

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Fugitive Emissions Calculations (Continued)

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

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Flanges - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Components In Gas Service =	<0.01						
Valves - Light Oil	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Flanges - Light Oil	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	<0.01
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components In Liquid Service =	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Total (Gas + Liquid Components) =	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01

Hazardous Air Pollutant (HAP) Emissions (TPY)

Source Type/Service	n-Hexane	Benzene	Toluene	Ethylbenzene	Xylenes	2,2,4-Tri.	Total
Valves - Gas	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Flanges - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Compressor Seals - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Relief Valves - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Open-Ended Lines - Gas	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Components In Gas Service =	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Valves - Light Oil	0.02	<0.01	<0.01	<0.01	0.01	0.00	0.03
Flanges - Light Oil	<0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.01
Pump Seals - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other - Light Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Components In Liquid Service =	0.02	<0.01	0.01	<0.01	0.01	0.00	0.04
Total (Gas + Liquid Components) =	0.04	<0.01	0.01	<0.01	0.01	<0.01	0.06

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Fugitive Emissions Calculations (Continued)

Typical Component Count per Equipment Type based on Representative Facility³

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

Equipment Type	WH	GPU	HT	LPT	COMP	OT	TT-O
Number of Each Type at Facility =	0	0	0	0	1	1	1

Estimated Component Count per Dehydration Unit⁴

Source Type/Service	DEHY	REB
Valves - Gas	24	14
Flanges - Gas	90	65
Relief Valves - Gas	2	2
Open-Ended Lines - Gas	2	1

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Fugitive Emissions Calculations (Continued)

Speciated Gas Analysis⁵

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.0000%	0.0000	0.0000%	-	0.00	0.00
Carbon Dioxide	44.010	0.0774%	0.0341	0.1617%	-	<0.01	0.01
Nitrogen	28.013	2.1214%	0.5943	2.8206%	-	0.02	0.10
Methane	16.042	76.9432%	12.3432	58.5848%	60.3857%	0.49	2.13
Ethane	30.069	12.1703%	3.6595	17.3691%	17.9030%	0.15	0.63
Propane	44.096	5.8132%	2.5634	12.1666%	12.5406%	0.10	0.44
i-Butane	58.122	0.4952%	0.2878	1.3661%	1.4081%	0.01	0.05
n-Butane	58.122	1.4401%	0.8370	3.9727%	4.0949%	0.03	0.14
i-Pentane	72.149	0.2790%	0.2013	0.9554%	0.9848%	0.01	0.03
n-Pentane	72.149	0.2939%	0.2120	1.0064%	1.0374%	0.01	0.04
n-Hexane	86.175	0.0800%	0.0689	0.3272%	0.3373%	<0.01	0.01
Other Hexanes	86.175	0.1394%	0.1201	0.5702%	0.5877%	<0.01	0.02
Heptanes (as n-Heptane)	100.202	0.0767%	0.0769	0.3648%	0.3760%	<0.01	0.01
Benzene	78.114	0.0031%	0.0024	0.0115%	0.0118%	<0.01	<0.01
Toluene	92.141	0.0033%	0.0030	0.0144%	0.0149%	<0.01	<0.01
Ethylbenzene	106.167	0.0004%	0.0004	0.0020%	0.0021%	<0.01	<0.01
Xylenes	106.167	0.0004%	0.0004	0.0020%	0.0021%	<0.01	<0.01
2,2,4-Trimethylpentane	114.230	0.0004%	0.0005	0.0022%	0.0022%	<0.01	<0.01
Octanes (as n-Octane)	114.229	0.0477%	0.0545	0.2586%	0.2666%	<0.01	0.01
Nonanes (as n-Nonane)	128.255	0.0055%	0.0071	0.0335%	0.0345%	<0.01	<0.01
Decanes (as n-Decane)	142.282	0.0015%	0.0021	0.0101%	0.0104%	<0.01	<0.01
TOTAL =		100.0000%	21.07	100.0000%	100.0000%	0.83	3.64
		TOTAL HC =	20.44	TOTAL VOC =	21.71%	0.17	0.77
				TOTAL HAP =	0.37%	<0.01	0.01

Chesapeake Appalachia, L.L.C.
 Browns Creek Compressor Station
 Fugitive Emissions Calculations (Continued)

Speciated Liquids Analysis⁶

Component	Molecular Weight	Mole %	Equiv. Wt. Basis	Weight %	HC Weight %	lb/hr	TPY
Hydrogen Sulfide	34.082	0.0000%	0.000	0.0000%	-	0.00	0.00
Carbon Dioxide	44.010	0.0300%	0.013	0.0157%	-	<0.01	<0.01
Nitrogen	28.013	0.0900%	0.025	0.0300%	-	<0.01	<0.01
Methane	16.042	8.4300%	1.352	1.6081%	1.6088%	<0.01	0.01
Ethane	30.069	4.2300%	1.272	1.5124%	1.5131%	<0.01	0.01
Propane	44.096	5.9100%	2.606	3.0988%	3.1003%	<0.01	0.02
i-Butane	58.122	5.1700%	3.005	3.5731%	3.5747%	<0.01	0.02
n-Butane	58.122	6.2200%	3.615	4.2988%	4.3007%	0.01	0.02
i-Pentane	72.149	8.9100%	6.428	7.6440%	7.6475%	0.01	0.04
n-Pentane	72.149	4.9700%	3.586	4.2638%	4.2658%	0.01	0.02
n-Hexane	86.175	4.8000%	4.136	4.9185%	4.9208%	0.01	0.03
Other Hexanes	86.175	9.1100%	7.851	9.3350%	9.3392%	0.01	0.05
Heptanes (as n-Heptane)	100.202	11.3400%	11.363	13.5115%	13.5177%	0.02	0.07
Benzene	78.114	0.3700%	0.289	0.3437%	0.3438%	<0.01	<0.01
Toluene	92.141	0.9800%	0.903	1.0737%	1.0742%	<0.01	0.01
Ethylbenzene	106.167	0.1500%	0.159	0.1894%	0.1894%	<0.01	<0.01
Xylenes	106.167	1.1900%	1.263	1.5023%	1.5030%	<0.01	0.01
2,2,4-Trimethylpentane	114.230	0.0000%	0.000	0.0000%	0.0000%	0.00	0.00
Octanes (as n-Octane)	114.229	10.3900%	11.868	14.1126%	14.1190%	0.02	0.07
Nonanes (as n-Nonane)	128.255	5.9600%	7.644	9.0894%	9.0935%	0.01	0.05
Decanes (as n-Decane)	142.282	11.7500%	16.718	19.8793%	19.8884%	0.02	0.11
TOTAL =		100.0000%	84.10	100.0000%	100.0000%	0.12	0.53
		TOTAL HC =	84.06	TOTAL VOC =	96.88%	0.12	0.51
				TOTAL HAP =	8.03%	0.01	0.04

Notes:

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

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

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

⁴ Average Component Count, EPA-600/R-96-080h.

⁵ Browns Creek Comp Dehy-Inlet Analysis in Appendix A.

⁶ E&P TANK V2.0 Report in Appendix A.

ATTACHMENT O: MONITORING/RECORDKEEPING/REPORTING/TESTING PLANS

Except as may be noted on Emissions Unit Data Sheets, Chesapeake is not submitting any special recommendations for monitoring, recordkeeping, reporting, or testing plans other than those typically established for the emissions units proposed in this application.

ATTACHMENT P: PUBLIC NOTICE

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

AIR QUALITY PERMIT NOTICE Notice of Application

Notice is given that Chesapeake Appalachia, L.L.C. has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a New Source Review (45 CSR 13) construction permit for Browns Creek Compressor Station located in Kanawha County, West Virginia. Driving directions to the facility are: On Rt 60 (near top of Coal Mountain) between St. Albans and Hurricane, turn onto Browns Creek Road (Rt 1), stay on main road, travel approximately 1.3 miles to a right turn onto a gravel road, then travel approximately 0.2 mile to compressor station on left. Latitude/longitude coordinates are 38.381485, -81.902405.

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

Nitrogen Oxides (NOx)	6.53 tons/yr
Carbon Monoxide (CO)	8.67 tons/yr
Volatile Organic Compounds (VOC)	6.41 tons/yr
Particulate Matter (PM)	0.13 tons/yr
Sulfur Dioxide (SO ₂)	0.04 tons/yr
Acetaldehyde	0.02 tons/yr
Acrolein	0.02 tons/yr
Benzene	0.02 tons/yr
Ethylbenzene	<0.01 tons/yr
Formaldehyde	0.13 tons/yr
Methanol	0.04 tons/yr
n-Hexane	0.10 tons/yr
Toluene	0.01 tons/yr
Xylenes	0.01 tons/yr
Methane	2.64 tons/yr
Carbon Dioxide	870.37 tons/yr
Nitrous Oxide	<0.01 tons/yr
Carbon Dioxide Equivalent	937.09 tons/yr

Startup of operation is expected to occur on or about December 15, 2016, but is contingent upon the permit issuance date. 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 1227, during normal business hours.

Dated this the XXth of August 2016

By: Chesapeake Appalachia, L.L.C.
Kevin Hill
Vice President
P.O. Box 18496
Oklahoma City, OK 73154-0496

APPENDIX A: SUPPORT DOCUMENTS

ENGINE SPECIFICATION SHEET

GRI-GLYCALC REPORT(S)

E&P TANK v2.0 CALCULATION REPORT

AP-42 AND EPA EMISSION FACTORS

G342 EMISSIONS DATA

G342 EMISSIONS DATA @ STANDARD RATINGS

ENGINE	RATING (hp/rpm)	NOx	CO (gram/hp-hr)	HC	%O2	A/FR vol/vol	Tstack deg F	EXH FLOW cfm	AIR FLOW kg/hr	BSFC Btu/hp-hr
NA HCR	225/1200 stand/catalyst	12.9	13.7	1.8	0.5	9.5	1170	851	520	7550
NA HCR	200/1000 stand/catalyst	11.2	12.1	1.7	0.5	9.5	1140	803	500	7400
NA LCR	200/1200 stand/catalyst	11.4	11.5	0.8	0.5	9.5	1250	866	494	8150
NA LCR	169/1000 stand/catalyst	11.3	11.8	0.8	0.5	9.5	1170	769	470	7900
TA LCR	265/1200 stand catalyst	20.5 9.8	0.8 10.7	0.8 0.8	2.0 0.5	10.4 9.5	1058 1095	1047 1005	691 644	8000 8240
TA LCR	240/1000 stand catalyst	19.0 9.7	0.9 9.7	0.9 0.9	2.0 0.5	10.4 9.5	1020 1060	952 938	654 615	8075 8320
TA LCR	295/1200 stand	18.4	0.8	1.0	2.0	—	1090	1325	856	8083
TA HCR	295/1200 stand catalyst	15.5 9.4	1.1 9.9	0.8 1.6	2.0 0.5	10.4 9.5	1120 1160	1115 1078	705 663	7450 7675
TA LCR	255/1000 stand	17	0.9	1.1	2.0	—	1010	1050	715	7796
TA HCR	255/1000 stand catalyst	13.8 8.9	1.3 9.6	1.3 1.8	2.0 0.5	10.4 9.5	1080 1120	938 910	610 574	7500 7725



Prepared For:
Jamie Osborne
MidCon Compression, LLC

Date: July 12, 2016

APPLICATION INFORMATION

DRIVER

Make: CAT
Model: G342 NA HCR
Horsepower: 225
RPM: 1200
Compression Ratio: 10.5
Exhaust Flow Rate: 851 CFM
Exhaust Temperature: 1170 °F
Reference: N/A
Fuel: Natural Gas
Annual Operating Hours: 8760

UNCONTROLLED EMISSIONS DATA

	<u>g/bhp-hr</u>	<u>lb/hr</u>	<u>Tons/Year</u>
NO _x :	12.90	6.40	28.03
CO:	13.70	6.80	29.77
THC:	1.80	0.89	3.91
NMHC:	N/A	N/A	N/A
NMNEHC:	N/A	N/A	N/A
HCHO:	N/A	N/A	N/A
Oxygen:	0.50%		

CATALYST ELEMENT

Model: RE-1450-T
Catalyst Type: NSCR, Standard
Substrate Type: BRAZED
Element Size: Round, 14.5" x 3.5"
Element Quantity: 1

POST CATALYST EMISSIONS DATA

	<u>g/bhp-hr</u>	<u>lb/hr</u>
NO _x :	< 3.0	1.49
CO:	< 4.0	1.98
VOC:	< 1.0	0.50



2585 Heartland Dr.
Sheridan, WY 82801
Office: | Direct: +1 (307) 675.5081
rjames@emittechnologies.com

WARRANTY

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

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

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

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

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

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

Engine lubrication oil shall contain less than 0.5 v-% Sulfated Ash with a maximum allowable specific oil consumption of 0.7 g/bhp-hr. The catalyst shall be limited to a maximum ash loading of 0.022 lb/ft³. Phosphorous and zinc additives are limited to 0.03 wt%. New or Reconstructed engines must operate for a minimum of 50 hours prior to catalyst installation, otherwise the warranty is void.

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

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

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

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

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

Pollutant	Emission Factor (lb/MMBtu) ^b (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO _x ^c 90 - 105% Load	2.21 E+00	A
NO _x ^c <90% Load	2.27 E+00	C
CO ^c 90 - 105% Load	3.72 E+00	A
CO ^c <90% Load	3.51 E+00	C
CO ₂ ^d	1.10 E+02	A
SO ₂ ^e	5.88 E-04	A
TOC ^f	3.58 E-01	C
Methane ^g	2.30 E-01	C
VOC ^h	2.96 E-02	C
PM ₁₀ (filterable) ^{i,j}	9.50 E-03	E
PM _{2.5} (filterable) ^j	9.50 E-03	E
PM Condensable ^k	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane ^l	2.53 E-05	C
1,1,2-Trichloroethane ^l	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene ^l	6.63 E-04	D
1,3-Dichloropropene ^l	<1.27 E-05	E
Acetaldehyde ^{l,m}	2.79 E-03	C
Acrolein ^{l,m}	2.63 E-03	C
Benzene ^l	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride ^l	<1.77 E-05	E

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

Pollutant	Emission Factor (lb/MMBtu) ^b (fuel input)	Emission Factor Rating
Chlorobenzene ¹	<1.29 E-05	E
Chloroform ¹	<1.37 E-05	E
Ethane ⁿ	7.04 E-02	C
Ethylbenzene ¹	<2.48 E-05	E
Ethylene Dibromide ¹	<2.13 E-05	E
Formaldehyde ^{1,m}	2.05 E-02	A
Methanol ¹	3.06 E-03	D
Methylene Chloride ¹	4.12 E-05	C
Naphthalene ¹	<9.71 E-05	E
PAH ¹	1.41 E-04	D
Styrene ¹	<1.19 E-05	E
Toluene ¹	5.58 E-04	A
Vinyl Chloride ¹	<7.18 E-06	E
Xylene ¹	1.95 E-04	A

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

^b Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10⁶ scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

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

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

^d Based on 99.5% conversion of the fuel carbon to CO₂. CO₂ [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO₂,

- C = carbon content of fuel by weight (0.75), D = density of fuel, $4.1 \text{ E}+04 \text{ lb}/10^6 \text{ scf}$, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).
- ^e Based on 100% conversion of fuel sulfur to SO_2 . Assumes sulfur content in natural gas of $2,000 \text{ gr}/10^6 \text{ scf}$.
 - ^f Emission factor for TOC is based on measured emission levels from 6 source tests.
 - ^g Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.
 - ^h VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.
 - ⁱ No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.
 - ^j Considered $\leq 1 \mu\text{m}$ in aerodynamic diameter. Therefore, for filterable PM emissions, $\text{PM}_{10}(\text{filterable}) = \text{PM}_{2.5}(\text{filterable})$.
 - ^k No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.
 - ^l Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.
 - ^m For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.
 - ⁿ Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

Gas Analytical Services

Good

Charleston, WV
555-555-5555

Customer	: 8001 - Chesapeake	Date Sampled	: 09/30/2015
Station ID	: 924740	Date Analyzed	: 10/12/2015
Cylinder ID	: 0214	Effective Date	: 10/01/2015
Producer	:	Cyl Pressure	: 100
Lease	: Browns Creek Comp Dehy-Inlet	Temp	: 84
Area	: 529 - Shrewsbury	Cylinder Type	: Spot
State	:	Sample By	: T McGrady

<u>COMPONENT</u>	<u>MOL%</u>	<u>GPM@14.73(Psia)</u>
Carbon-Dioxide	0.0774	0.000
Oxygen	0.0063	0.000
Nitrogen	2.1214	0.000
Methane	76.9432	0.000
Ethane	12.1703	3.266
Propane	5.8132	1.607
Iso-Butane	0.4952	0.163
N-Butane	1.4401	0.456
Neo-Pentane	0.0077	0.003
Iso-Pentane	0.2713	0.100
N-Pentane	0.2939	0.107
N-Hexane	0.0800	0.052
N-Heptane	0.0226	0.010
N-Octane	0.0053	0.003
N-Nonane	0.0012	0.001
N-Decane	0.0004	0.000
Benzene	0.0031	0.001
Toluene	0.0033	0.001
Ethylbenzene	0.0004	0.000
O-Xylene	0.0004	0.000
C6's	0.1234	0.050
C7's	0.0705	0.029
C8's	0.0424	0.022
C9's	0.0055	0.003
C10's	0.0014	0.001
C11's	0.0001	0.000
TOTAL	100.0000	5.875

Compressibility Factor (Z) @ 14.73 @ 60 Deg. F = 0.9965

C5+ GPM : 0.26100

Ideal Gravity: 0.7274

Real Gravity: 0.7297

C5+ Mole % : 0.8957

BTU @ (PSIA)	@14.65	@14.696	@14.73	@15.025
Ideal GPM	5.819	5.838	5.851	5.968
Ideal BTU Dry	1,239.11	1,243.00	1,245.88	1,270.83
Ideal BTU Sat	1,217.42	1,221.31	1,224.19	1,249.14
Real GPM	5.840	5.858	5.872	5.990
Real BTU Dry	1,243.49	1,247.41	1,250.31	1,275.44
Real BTU Sat	1,222.23	1,226.15	1,229.04	1,254.18

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Brown's Creek dehy - PTE with 2015 analysis

File Name: C:\Users\Mary\Documents\Mary Work\Chesapeake\Browns Creek 2016 PTE.ddf

Date: August 08, 2016

DESCRIPTION:

Description: PTE based on max glycol circulation rate,
2015 analysis, and worst case operating
temperature and pressure combination using
36 months of operating data.

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 50.00 deg. F
Pressure: 210.00 psig
Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.0774
Nitrogen	2.1214
Methane	76.9432
Ethane	12.1703
Propane	5.8132
Isobutane	0.4952
n-Butane	1.4401
Isopentane	0.2790
n-Pentane	0.2939
Cyclopentane	0.0167
n-Hexane	0.0800
Cyclohexane	0.0160
Other Hexanes	0.1067
Heptanes	0.0760
Methylcyclohexane	0.0007
2,2,4-Trimethylpentane	0.0004
Benzene	0.0031
Toluene	0.0033
Ethylbenzene	0.0004
Xylenes	0.0004
C8+ Heavies	0.0563

DRY GAS:

Flow Rate: 2.0 MMSCF/day
Water Content: 7.0 lbs. H2O/MMSCF

LEAN GLYCOL:

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

PUMP:

Glycol Pump Type: Electric/Pneumatic

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Brown's Creek dehy - PTE with 2015 analysis
 File Name: C:\Users\Mary\Documents\Mary Work\Chesapeake\Browns Creek 2016 PTE.ddf
 Date: August 08, 2016

DESCRIPTION:

Description: PTE based on max glycol circulation rate,
 2015 analysis, and worst case operating
 temperature and pressure combination using
 36 months of operating data.

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.5832	13.996	2.5542
Ethane	0.7842	18.821	3.4348
Propane	1.2962	31.109	5.6774
Isobutane	0.2630	6.311	1.1518
n-Butane	1.0968	26.323	4.8039
Isopentane	0.3389	8.133	1.4843
n-Pentane	0.4876	11.702	2.1357
Cyclopentane	0.1132	2.716	0.4956
n-Hexane	0.3442	8.261	1.5076
Cyclohexane	0.2842	6.821	1.2448
Other Hexanes	0.3233	7.760	1.4163
Heptanes	0.9396	22.549	4.1153
Methylcyclohexane	0.0203	0.488	0.0891
2,2,4-Trimethylpentane	0.0025	0.059	0.0108
Benzene	0.3071	7.371	1.3452
Toluene	0.4920	11.807	2.1548
Ethylbenzene	0.0803	1.928	0.3518
Xylenes	0.0849	2.037	0.3718
C8+ Heavies	3.1018	74.444	13.5859
Total Emissions	10.9431	262.635	47.9309
Total Hydrocarbon Emissions	10.9431	262.635	47.9309
Total VOC Emissions	9.5758	229.819	41.9419
Total HAP Emissions	1.3110	31.463	5.7420
Total BTEX Emissions	0.9643	23.143	4.2236

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: 1.27 lbs. H₂O/MMSCF
 Temperature: 50.0 deg. F
 Pressure: 210.0 psig
 Dry Gas Flow Rate: 2.0000 MMSCF/day
 Glycol Losses with Dry Gas: 0.0006 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 40.69 lbs. H₂O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 27.37 gal/lb H₂O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.10%	96.90%
Carbon Dioxide	99.55%	0.45%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.90%	0.10%
Propane	99.77%	0.23%
Isobutane	99.58%	0.42%
n-Butane	99.40%	0.60%
Isopentane	99.23%	0.77%
n-Pentane	98.95%	1.05%
Cyclopentane	95.60%	4.40%
n-Hexane	97.73%	2.27%
Cyclohexane	90.40%	9.60%
Other Hexanes	98.40%	1.60%
Heptanes	94.39%	5.61%
Methylcyclohexane	86.53%	13.47%
2,2,4-Trimethylpentane	97.55%	2.45%
Benzene	42.30%	57.70%
Toluene	26.39%	73.61%
Ethylbenzene	13.95%	86.05%
Xylenes	9.07%	90.93%
C8+ Heavies	85.28%	14.72%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	79.36%	20.64%
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%
Cyclopentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	3.20%	96.80%
Other Hexanes	1.00%	99.00%
Heptanes	0.50%	99.50%

Methylcyclohexane	4.00%	96.00%
2,2,4-Trimethylpentane	1.50%	98.50%
Benzene	5.00%	95.00%
Toluene	7.90%	92.10%
Ethylbenzene	10.40%	89.60%
Xylenes	12.90%	87.10%
C8+ Heavies	12.01%	87.99%

STREAM REPORTS:

WET GAS STREAM

Temperature: 50.00 deg. F
 Pressure: 224.70 psia
 Flow Rate: 8.35e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.57e-002	3.40e+000
Carbon Dioxide	7.73e-002	7.49e+000
Nitrogen	2.12e+000	1.31e+002
Methane	7.69e+001	2.71e+003
Ethane	1.22e+001	8.04e+002
Propane	5.81e+000	5.64e+002
Isobutane	4.95e-001	6.33e+001
n-Butane	1.44e+000	1.84e+002
Isopentane	2.79e-001	4.42e+001
n-Pentane	2.94e-001	4.66e+001
Cyclopentane	1.67e-002	2.57e+000
n-Hexane	7.99e-002	1.52e+001
Cyclohexane	1.60e-002	2.96e+000
Other Hexanes	1.07e-001	2.02e+001
Heptanes	7.59e-002	1.67e+001
Methylcyclohexane	6.99e-004	1.51e-001
2,2,4-Trimethylpentane	4.00e-004	1.00e-001
Benzene	3.10e-003	5.32e-001
Toluene	3.30e-003	6.68e-001
Ethylbenzene	4.00e-004	9.34e-002
Xylenes	4.00e-004	9.34e-002
C8+ Heavies	5.63e-002	2.11e+001
Total Components	100.00	4.64e+003

DRY GAS STREAM

Temperature: 50.00 deg. F
 Pressure: 224.70 psia
 Flow Rate: 8.33e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.67e-003	1.05e-001
Carbon Dioxide	7.71e-002	7.45e+000
Nitrogen	2.12e+000	1.31e+002

Methane	7.70e+001	2.71e+003
Ethane	1.22e+001	8.04e+002
Propane	5.80e+000	5.62e+002
Isobutane	4.94e-001	6.30e+001
n-Butane	1.43e+000	1.83e+002
Isopentane	2.77e-001	4.39e+001
n-Pentane	2.91e-001	4.61e+001
Cyclopentane	1.60e-002	2.46e+000
n-Hexane	7.82e-002	1.48e+001
Cyclohexane	1.45e-002	2.68e+000
Other Hexanes	1.05e-001	1.99e+001
Heptanes	7.18e-002	1.58e+001
Methylcyclohexane	6.06e-004	1.31e-001
2,2,4-Trimethylpentane	3.91e-004	9.80e-002
Benzene	1.31e-003	2.25e-001
Toluene	8.72e-004	1.76e-001
Ethylbenzene	5.58e-005	1.30e-002
Xylenes	3.63e-005	8.47e-003
C8+ Heavies	4.81e-002	1.80e+001

Total Components	100.00	4.63e+003

LEAN GLYCOL STREAM

 Temperature: 50.00 deg. F
 Flow Rate: 1.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	8.31e+002
Water	1.50e+000	1.27e+001
Carbon Dioxide	4.02e-013	3.40e-012
Nitrogen	3.34e-013	2.82e-012
Methane	2.32e-018	1.96e-017
Ethane	4.39e-008	3.70e-007
Propane	6.25e-009	5.27e-008
Isobutane	9.35e-010	7.89e-009
n-Butane	3.22e-009	2.72e-008
Isopentane	2.02e-004	1.70e-003
n-Pentane	2.90e-004	2.45e-003
Cyclopentane	6.74e-005	5.68e-004
n-Hexane	2.05e-004	1.73e-003
Cyclohexane	1.11e-003	9.39e-003
Other Hexanes	3.87e-004	3.27e-003
Heptanes	5.59e-004	4.72e-003
Methylcyclohexane	1.00e-004	8.48e-004
2,2,4-Trimethylpentane	4.43e-006	3.74e-005
Benzene	1.92e-003	1.62e-002
Toluene	5.00e-003	4.22e-002
Ethylbenzene	1.10e-003	9.32e-003
Xylenes	1.49e-003	1.26e-002
C8+ Heavies	5.02e-002	4.23e-001

Total Components	100.00	8.44e+002

RICH GLYCOL STREAM

Temperature: 50.00 deg. F
 Pressure: 224.70 psia
 Flow Rate: 1.53e+000 gpm
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
-----	-----	-----
TEG	9.68e+001	8.31e+002
Water	1.86e+000	1.60e+001
Carbon Dioxide	3.96e-003	3.40e-002
Nitrogen	3.31e-003	2.84e-002
Methane	6.80e-002	5.83e-001
Ethane	9.14e-002	7.84e-001
Propane	1.51e-001	1.30e+000
Isobutane	3.06e-002	2.63e-001
n-Butane	1.28e-001	1.10e+000
Isopentane	3.97e-002	3.41e-001
n-Pentane	5.71e-002	4.90e-001
Cyclopentane	1.33e-002	1.14e-001
n-Hexane	4.03e-002	3.46e-001
Cyclohexane	3.42e-002	2.94e-001
Other Hexanes	3.81e-002	3.27e-001
Heptanes	1.10e-001	9.44e-001
Methylcyclohexane	2.47e-003	2.12e-002
2,2,4-Trimethylpentane	2.91e-004	2.49e-003
Benzene	3.77e-002	3.23e-001
Toluene	6.22e-002	5.34e-001
Ethylbenzene	1.04e-002	8.97e-002
Xylenes	1.14e-002	9.75e-002
C8+ Heavies	4.11e-001	3.53e+000
-----	-----	-----
Total Components	100.00	8.58e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 1.38e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----	-----	-----
Water	5.04e+001	3.29e+000
Carbon Dioxide	2.13e-001	3.40e-002
Nitrogen	2.80e-001	2.84e-002
Methane	1.00e+001	5.83e-001
Ethane	7.19e+000	7.84e-001
Propane	8.11e+000	1.30e+000
Isobutane	1.25e+000	2.63e-001
n-Butane	5.20e+000	1.10e+000
Isopentane	1.30e+000	3.39e-001
n-Pentane	1.86e+000	4.88e-001
Cyclopentane	4.45e-001	1.13e-001
n-Hexane	1.10e+000	3.44e-001
Cyclohexane	9.31e-001	2.84e-001
Other Hexanes	1.03e+000	3.23e-001
Heptanes	2.59e+000	9.40e-001
Methylcyclohexane	5.71e-002	2.03e-002
2,2,4-Trimethylpentane	5.93e-003	2.46e-003
Benzene	1.08e+000	3.07e-001

Toluene	1.47e+000	4.92e-001
Ethylbenzene	2.09e-001	8.03e-002
Xylenes	2.20e-001	8.49e-002
C8+ Heavies	5.02e+000	3.10e+000
-----	-----	-----
Total Components	100.00	1.43e+001

BROWN'S CREEK GLYCOL DEHYDRATOR MODELING INPUTS EXPLANATION:

Temperature and pressure: Modeling was based on a conservative variation of 36 months of operating to get the highest potential emissions. The previous PTE quantified was based on the design pressure of the contactor which is significantly higher than the highest typical operating pressure (720 psig versus ~ 200 psig).

Throughput: The documented design throughput of 2 mmcf/day was used for modeling purposes.

Gas analysis: An updated gas sample representative of the gas that is dehydrated at this facility was used in the modeling. The date of the analysis is 10/2015 which according to Operations should still be representative of the current gas quality.

Absorber stages: The default water content value of 7 lb H₂O/mmcf was used for modeling purposes.

Lean glycol water content: According to Glycalc's User Manual, a default water content of 1.5% can be used for modeling.

Lean glycol flowrate: A lean glycol flowrate of 1.5 gpm was used based on the information received from Cameron (formerly NATCO) that the glycol pump's maximum capacity was 1.5 gpm. Using this value gives a higher emissions result than using default recirculation ratio number of 3 gal/lb.

Pump type: Electric

Flash Tank temperature and pressure: No flash tank.

Stripping gas flow rate: Stripping gas is not utilized.

Browns Creek monthly operating data

		Temp	Pressure	Pump
2013	Jan	71	190	1.3
	Feb	70	200	1.45
	March	68	195	1.4
	April	59	197	1.3
	May	70	195	1.4
	June	78	195	1.4
	July	84	195	1.3
	Aug	75	195	1.3
	Sept	63	180	1.4
	Oct	55	185	1.4
	Nov	96	196	1.3
	Dec	75	194	1.3
2014	Jan	62	180	1.45
	Feb	58	185	1.4
	March	71	210	1.4
	April	68	208	1.46
	May	86	198	1.3
	June	84	195	0.575
	July	80	197	0.527
	Aug	88	195	0.5
	Sept	82	185	0.45
	Oct	66	190	0.54
	Nov	81	175	0.569
	Dec	81	182	0.5
2015	Jan	58	178	0.8
	Feb	62	154	0.6
	March	56	179	0.7
	April	50	180	0.7
	May	74	185	0.58
	June	70	180	0.4
	July	81	180	0.47
	Aug	68	175	0.48
	Sept	75	179	0.55
	Oct	96	198	0.4
	Nov	90	195	1
	Dec	60	195	1
		72.52778	188.75	0.961139
	min	50	154	
	max	96	210	

924740

Browns Creek

CO2	0.0774
O2	0.0063
Nitrogen	2.1214
Methane	76.9432
Ethane	12.1703
Propane	5.8132
Isobutane	0.4952
N-Butane	1.4401
Neopentane	0.0077
Isopentane	0.2713
N-Pentane	0.2939
Cyclopentane	0.0167
N-Hexane	0.08
Cyclohexane	0.016
N-Heptane	0.0226
Methylcyclohexane	0.0007
2,2,4-Trimethylpentane	0.0004
N-Octane	0.0053
Other C6's	0.1067
Other C7's	0.0534
C8+	0.051
Benzene	0.0031
Toluene	0.0033
Ethylbenzene	0.0004
Xylenes	0.0004
	100

0

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

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

^a Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10⁶ scf to kg/10⁶ m³, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from lb/10⁶ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

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

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

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

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

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

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

^a Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from lb/10⁶ scf to kg/10⁶ m³, multiply by 16. To convert from lb/10⁶ scf to lb/MMBtu, divide by 1,020. Emission Factors preceded with a less-than symbol are based on method detection limits.

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

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

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

```

*****
*   Project Setup Information   *
*****
Project File           : Untitled.Ept
Flowsheet Selection   : Oil Tank with Separator
Calculation Method    : RVP Distillation
Control Efficiency    : 100.0%
Known Separator Stream : Geographical Region
Geographical Region   : All Regions in US
Entering Air Composition : No

Filed Name            : Brown's Creek
Well ID               : Case 92 (58 API, 10 RVP, 300# LP)
Date                  : 2016.07.20
    
```

```

*****
*   Data Input                 *
*****
Separator Pressure    : 300.00 [psig]
Separator Temperature : 80.00 [F]
Ambient Pressure      : 14.70 [psia]
Ambient Temperature   : 80.00 [F]
C10+ SG               : 0.8820
C10+ MW               : 296.00
    
```

-- Low Pressure Oil -----

No.	Component	mol %
1	H2S	0.0000
2	O2	0.0000
3	CO2	0.0300
4	N2	0.0900
5	C1	8.4300
6	C2	4.2300
7	C3	5.9100
8	i-C4	5.1700
9	n-C4	6.2200
10	i-C5	8.9100
11	n-C5	4.9700
12	C6	9.1100
13	C7	11.3400
14	C8	10.3900
15	C9	5.9600
16	C10+	11.7500
17	Benzene	0.3700
18	Toluene	0.9800
19	E-Benzene	0.1500
20	Xylenes	1.1900
21	n-C6	4.8000
22	224Trimethylp	0.0000

-- Sales Oil -----

```

Production Rate       : 0.7 [bbl/day]
Days of Annual Operation : 365 [days/year]
API Gravity           : 58.0
Reid Vapor Pressure   : 10.60 [psia]
    
```

```

*****
*   Calculation Results       *
*****
    
```

-- Emission Summary -----

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]

Total HAPs	0.070	0.016
Total HC	3.870	0.884
VOCs, C2+	3.385	0.773
VOCs, C3+	2.930	0.669

Uncontrolled Recovery Info.

Vapor	200.9800	x1E-3 [MSCFD]
HC Vapor	200.0800	x1E-3 [MSCFD]
GOR	287.11	[SCF/bbl]

-- Emission Composition -----

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
1	H2S	0.000	0.000
2	O2	0.000	0.000
3	CO2	0.005	0.001
4	N2	0.009	0.002
5	C1	0.484	0.111
6	C2	0.455	0.104
7	C3	0.836	0.191
8	i-C4	0.588	0.134
9	n-C4	0.553	0.126
10	i-C5	0.457	0.104
11	n-C5	0.193	0.044
12	C6	0.143	0.033
13	C7	0.066	0.015
14	C8	0.021	0.005
15	C9	0.004	0.001
16	C10+	0.000	0.000
17	Benzene	0.004	0.001
18	Toluene	0.003	0.001
19	E-Benzene	0.000	0.000
20	Xylenes	0.001	0.000
21	n-C6	0.060	0.014
22	224Trimethylp	0.000	0.000
	Total	3.882	0.886

-- Stream Data -----

No.	Component	MW	LP Oil mol %	Flash Oil mol %	Sale Oil mol %	Flash Gas mol %	W&S Gas mol %	Total Emissions mol %
1	H2S	34.80	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.0300	0.0021	0.0000	0.1194	0.0496	0.1111
4	N2	28.01	0.0900	0.0006	0.0000	0.3763	0.0145	0.3332
5	C1	16.04	8.4300	0.2054	0.0000	34.7691	4.8646	31.2062
6	C2	30.07	4.2300	0.5879	0.0039	15.8939	13.8313	15.6481
7	C3	44.10	5.9100	2.4063	0.8494	17.1306	37.7108	19.5826
8	i-C4	58.12	5.1700	3.7204	3.2119	9.8124	15.2521	10.4605
9	n-C4	58.12	6.2200	5.2238	4.8805	9.4102	13.0089	9.8389
10	i-C5	72.15	8.9100	9.7007	9.7854	6.3777	7.7795	6.5447
11	n-C5	72.15	4.9700	5.6802	5.7866	2.6955	3.2686	2.7638
12	C6	86.16	9.1100	11.4207	11.8324	1.7100	2.0852	1.7547
13	C7	100.20	11.3400	14.6665	15.2753	0.6869	0.8605	0.7075
14	C8	114.23	10.3900	13.5756	14.1635	0.1882	0.2442	0.1949
15	C9	128.28	5.9600	7.8101	8.1523	0.0352	0.0503	0.0370
16	C10+	166.00	11.7500	15.4190	16.0990	0.0000	0.0000	0.0000
17	Benzene	78.11	0.3700	0.4701	0.4881	0.0496	0.0610	0.0509
18	Toluene	92.13	0.9800	1.2750	1.3293	0.0351	0.0448	0.0363
19	E-Benzene	106.17	0.1500	0.1963	0.2049	0.0017	0.0022	0.0017
20	Xylenes	106.17	1.1900	1.5580	1.6260	0.0114	0.0152	0.0119
21	n-C6	86.18	4.8000	6.0812	6.3116	0.6969	0.8566	0.7160
22	224Trimethylp	114.24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	MW		100.95	120.35	123.46	38.83	49.76	40.13
	Stream Mole Ratio		1.0000	0.7620	0.7299	0.2380	0.0322	0.2701
	Heating Value	[BTU/SCF]				2218.43	2811.04	2289.04
	Gas Gravity	[Gas/Air]				1.34	1.72	1.39
	Bubble Pt. @ 100F	[psia]	322.24	24.57	11.47			

RVP @ 100F	[psia]	79.39	15.92	10.57
Spec. Gravity @ 100F		0.672	0.695	0.698

TANKS 4.0 Report

Note: This report is provided for reference only in determining parameters used to calculate loading emissions. Working, breathing and flashing emissions were quantified using E&P TANK V2.0. Contents conservatively assumed RVP 11 based on E&P TANK V2.0 calculations of RVP 10.6.

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

Identification

User Identification:	Browns Creek Compressor Station
City:	Kanawha County
State:	West Virginia
Company:	Chesapeake Appalachia, L.L.C.
Type of Tank:	Vertical Fixed Roof Tank
Description:	25-bbl Pipeline Fluids Tank as RVP 11

Tank Dimensions

Shell Height (ft):	5.00
Diameter (ft):	6.00
Liquid Height (ft):	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	1,057.54
Turnovers:	9.53
Net Throughput(gal/yr):	10,080.00
Is Tank Heated (y/n):	N

Paint Characteristics

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

Roof Characteristics

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

Breather Vent Settings

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

Meteorological Data used in Emissions Calculations: Charleston, West Virginia (Avg Atmospheric Pressure = 14.25 psia)

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

Browns Creek Compressor Station - Vertical Fixed Roof Tank
Kanawha County, West Virginia

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F)			Liquid Bulk Temp (deg F)	Vapor Pressure (psia)			Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
		Avg.	Min.	Max.		Avg.	Min.	Max.					
Gasoline (RVP 11)	All	56.87	51.31	62.04	55.00	5.4092	4.8698	5.9954	65.0000			92.00	Option 4: RVP=11, ASTM Slope=3

TANKS 4.0 Report

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

Emissions Report for: Annual

Browns Creek Compressor Station - Vertical Fixed Roof Tank
Kanawha County, West Virginia

Components	Losses(lbs)		Total Emissions
	Working Loss	Breathing Loss	
Gasoline (RVP 11)	84.38	156.75	241.14

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

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

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

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

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

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

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

where:

L_L = loading loss, pounds per 1000 gallons (lb/10³ gal) of liquid loaded

S = a saturation factor (see Table 5.2-1)

P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia)
(see Figure 7.1-5, Figure 7.1-6, and Table 7.1-2)

M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Table 7.1-2)

T = temperature of bulk liquid loaded, °R (°F + 460)

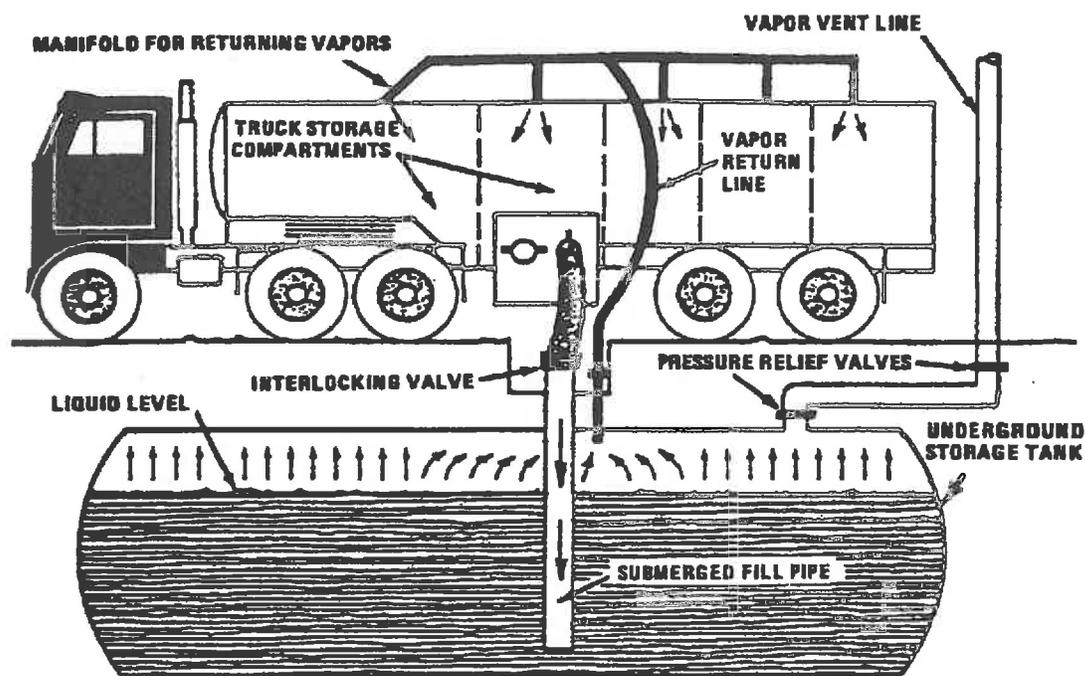


Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

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

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

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

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

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

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

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

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

TABLE 4-5. AVERAGE EQUIPMENT EMISSIONS FOR ONSHORE PRODUCTION IN THE EASTERN U.S.

Equipment Type	Component Type ^a	Component Emission Factor, ^b Mact/component-yr	Average Component Count	Average Equipment Emissions, scf/equipment-yr	90% Confidence Interval, %
Gas Wellheads	Valve	0.184	8	2,595	27
	Connection	0.024	38		
	OEL	0.42	0.5		
Separators	Valve	0.184	1	328	27
	Connection	0.024	6		
Heaters	Valve	0.184	14	5,188	43
	Connection	0.024	65		
	OEL	0.42	2		
	PRV	0.279	1		
Glycol Dehydrators	Valve	0.184	24	7,938	35
	Connection	0.024	90		
	OEL	0.42	2		
	PRV	0.279	2		
Meters/Piping	Valve	0.184	12	3,289	30
	Connection	0.024	45		
Gathering Compressors	Valve	0.184	12	4,417	6
	Connection	0.024	57		
	OEL	0.42	2		

^a OEL = Open-Ended Line; PRV = Pressure Relief Valve.

^b Total methane emission rate adjusted for average 69.6 wt. % (78.8 vol. %) methane in production.¹⁷

