



Williams Ohio Valley Midstream LLC  
Park Place Corporate Center 2  
2000 Commerce Drive  
Pittsburgh, PA 15275  
(412) 787-7300  
(412) 787-6002 fax

October 12, 2015  
**(Via Federal Express)**

Beverly McKeone  
New Source Review Program Manager  
Division of Air Quality  
West Virginia Department of Environmental Protection  
601 57th Street SE  
Charleston, WV 25304-2345

**Subject: Application for 45CSR13 NSR Modification Permit  
Williams Ohio Valley Midstream LLC  
GRENAIER DEHYDRATION STATION  
Wetzel County, West Virginia**

Dear Ms. McKeone,

Williams Ohio Valley Midstream LLC (OVM) is submitting an Application for 45CSR13 New Source Review (NSR) Modification Permit for the existing (though currently exempt) Grenadier Dehydration Station, located at 24751 Mountaineer Hwy (WV-07) near Littleton, West Virginia.

This application for 45CSR13 NSR Modification Permit has been prepared and submitted to provide for the following equipment and operations at the subject facility:

- One (1) Modified 65.0 MMscfd Triethylene Glycol (TEG) Dehydrator 01 comprised of:
  - One (1) Flash Tank w/  $\geq$  50% Off-Gas Recycle DFT-01/1E
  - One (1) Regenerator/Still Vent DSV-01/2E
  - One (1) 1.50 MMBtu/hr Natural Gas-Fired Reboiler RBV-01/3E
- One (1) New 100.0 MMscfd TEG Dehydrator 02 comprised of:
  - One (1) Flash Tank w/  $\geq$  50% Off-Gas Recycle DFT-02/4E
  - One (1) Regenerator/Still Vent w/ 95% BTEX Skid (BTEX-01) DSV-02/5E
  - One (1) 2.0 MMBtu/hr Natural Gas-Fired Reboiler RBV-02/6E
- Piping and Equipment Fugitives – Gas FUG/1F

The applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 instead of the 100.0 MMscfd Dehydrator 02 shown above:

- One (1) New 50.0 MMscfd TEG Dehydrator 02 ALTERNATIVE comprised of:
  - One (1) Flash Tank w/  $\geq$  50% Off-Gas Recycle DFT-02alt/4Ealt
  - One (1) Regenerator/Still Vent DSV-02alt/5Ealt
  - One (1) 1.00 MMBtu/hr Natural Gas-Fired Reboiler RBV-02alt/6Ealt

Beverly McKeone  
WVDEP – Division of Air Quality  
October 12, 2015  
Page 02 of 02

The facility continues to qualify as a Minor Source under Non-Attainment New Source Review (NNSR), Prevention of Significant Deterioration (PSD), and Title V Operating Permits. The facility is also an Area Source for Hazardous Air Pollutants (HAP) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.

If you have any questions concerning this submittal or need additional information, please contact me at (412) 787-4259 or [Danell.Zawaski@Williams.com](mailto:Danell.Zawaski@Williams.com).

Sincerely,



R. Danell Zawaski, P.E.  
Environmental Specialist

Enclosures:

Application for NSR Modification Permit  
Attachments A through S  
Check for Application Fee

**APPLICATION FOR  
45CSR13 NEW SOURCE REVIEW  
MODIFICATION PERMIT**

*For the:*

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Wetzel County, West Virginia

*Submitted to:*



**WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF AIR QUALITY**

*Submitted by:*



**Williams Ohio Valley Midstream LLC**  
Park Place Corporate Center 2  
2000 Commerce Drive  
Pittsburgh, PA 15275

*Prepared by:*



**EcoLogic Environmental Consultants, LLC**  
864 Windsor Court  
Santa Barbara, CA 93111

**October 2015**

**APPLICATION FOR  
45CSR13 NEW SOURCE REVIEW  
MODIFICATION PERMIT**

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Wetzel County, West Virginia

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**APPLICATION FEE**

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**APPLICATION FOR  
45CSR13 NEW SOURCE REVIEW  
MODIFICATION PERMIT**

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- **SECTION I.     General**
  - **SECTION II.    Additional Attachments and Supporting Documents**
  - **SECTION III.   Certification of Information**
-



WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**DIVISION OF AIR QUALITY**  
 601 57<sup>th</sup> Street, SE  
 Charleston, WV 25304  
 (304) 926-0475  
[www.dep.wv.gov/daq](http://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**     **NOT APPLICABLE**

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): <b>WILLIAMS OHIO VALLEY MIDSTREAM LLC (OVM)</b>	2. Federal Employer ID No. (FEIN): <b>27-0856707</b>
3. Name of facility (if different from above): <b>GRENADIER DEHYDRATION STATION</b>	4. The applicant is the: <input type="checkbox"/> <b>OWNER</b> <input type="checkbox"/> <b>OPERATOR</b> <input checked="" type="checkbox"/> <b>BOTH</b>
5A. Applicant's mailing address: <b>PARK PLACE CORPORATE CENTER 2 2000 COMMERCE DRIVE PITTSBURGH, PA 15275</b>	5B. Facility's present physical address: <b>24751 MOUNTAINEER HWY (WV-07) LITTLETON, WETZEL COUNTY, WV 26581</b>
6. <b>West Virginia Business Registration.</b> Is the applicant a resident of the State of West Virginia? <input type="checkbox"/> <b>YES</b> <input checked="" type="checkbox"/> <b>NO</b> – If <b>YES</b> , provide a copy of the <b>Certificate of Incorporation/Organization/Limited Partnership</b> (one page) including any name change amendments or other Business Registration Certificate as <b>Attachment A</b> . – If <b>NO</b> , provide a copy of the <b>Certificate of Authority/Authority of L.L.C./Registration</b> (one page) including any name change amendments or other Business Certificate as <b>Attachment A</b> .	
7. If applicant is a subsidiary corporation, please provide the name of parent corporation: <b>THE WILLIAMS COMPANIES, INC.</b>	
8. Does the applicant own, lease, have an option to buy, or otherwise have control of the <i>proposed site</i> ? <input checked="" type="checkbox"/> <b>YES</b> <input type="checkbox"/> <b>NO</b> – If <b>YES</b> , please explain: <b>APPLICANT LEASES THE PROPERTY</b> – If <b>NO</b> , you are not eligible for a permit for this source.	
9. Type of plant or facility (stationary source) to be <b>constructed, modified, relocated, administratively updated</b> or <b>temporarily permitted</b> (e.g., coal preparation plant, primary crusher, etc.): <b>1389 - OIL AND GAS FIELD SERVICES, N.E.C.</b>	10. North American Industry Classification System (NAICS) code for the facility: <b>213112 - SUPPORT ACTIVITIES FOR OIL AND GAS OPERATIONS</b>
11A. DAQ Plant ID No. (existing facilities): <b>103-00075</b>	11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (existing facilities): <b>NA – CURRENTLY PERMIT EXEMPT</b>
12A. Directions to the facility: – For <b>Modifications, Administrative Updates</b> or <b>Temporary permits</b> at an existing facility, please provide directions to the <i>present location</i> of the facility from the nearest state road; – For <b>Construction</b> or <b>Relocation permits</b> , please provide directions to the <i>proposed new site location</i> from the nearest state road. Include a <b>MAP</b> as <b>Attachment B</b> . <b>FROM LITTLETON: A. HEAD NORTHWEST ON US-250 (HORNET HWY) ~ 1.1 MILES; B. TURN LEFT ONTO SUGAR RUN RD ~ 4.5 MILES; C. TURN RIGHT ONTO WV-07 ~ 1.0 MI; D. ENTRANCE TO SITE IS ON THE RIGHT.</b>	
<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>	

12.B. New site address (if applicable): <b>SEE ABOVE</b>	12C. Nearest city or town: <b>LITTLETON</b>	12D. County: <b>WETZEL</b>
12.E. UTM Northing (KM): <b>4,389.40 KM NORTHING</b>	12F. UTM Easting (KM): <b>539.80 KM EASTING</b>	12G. UTM Zone: <b>17S</b>
13. Briefly describe the proposed change(s) at the facility: <b>THIS APPLICATION FOR 45CSR13 NSR MODIFICATION PERMIT HAS BEEN PREPARED AND SUBMITTED TO PROVIDE FOR THE FOLLOWING EQUIPMENT AND OPERATIONS AT THE SUBJECT FACILITY:</b> <ul style="list-style-type: none"> <li>• <b>ONE (1) 65.0 MMSCFD TRIETHYLENE GLYCOL (TEG) DEHYDRATOR 01 COMPRISED OF:</b> <ul style="list-style-type: none"> <li>- <b>ONE (1) FLASH TANK W/ ≥ 50% OFF-GAS RECYCLE</b> <span style="float: right;"><b>DFT-01/1E</b></span></li> <li>- <b>ONE (1) REGENERATOR/STILL VENT</b> <span style="float: right;"><b>DSV-01/2E</b></span></li> <li>- <b>ONE (1) 1.50 MMBTU/HR NATURAL GAS-FIRED REBOILER</b> <span style="float: right;"><b>RBV-01/3E</b></span></li> </ul> </li> <li>• <b>ONE (1) 100.0 MMSCFD TRIETHYLENE GLYCOL (TEG) DEHYDRATOR 02 COMPRISED OF:</b> <ul style="list-style-type: none"> <li>- <b>ONE (1) FLASH TANK W/ ≥ 50% OFF-GAS RECYCLE</b> <span style="float: right;"><b>DFT-02/4E</b></span></li> <li>- <b>ONE (1) REGENERATOR/STILL VENT W/ NEW ≥ 95% BTEX SKID</b> <span style="float: right;"><b>DSV-02/5E</b></span></li> <li>- <b>ONE (1) 2.00 MMBTU/HR NATURAL GAS-FIRED REBOILER</b> <span style="float: right;"><b>RBV-02/6E</b></span></li> </ul> </li> <li>• <b>PIPING AND EQUIPMENT FUGITIVES</b> <span style="float: right;"><b>FUG/1F</b></span></li> </ul>		
14A. Provide the date of anticipated installation or change: <b>~2 MONTHS AFTER PERMIT</b> – If this is an <b>After-The-Fact</b> permit application, provide the date upon which the proposed change did happen: <b>NA</b>	14B. Date of anticipated Start-Up if a permit is granted: <b>NA</b>	
14C. Provide a <b>Schedule</b> of the planned <b>Installation of/Change</b> to and <b>Start-Up</b> of each of the units proposed in this permit application as <b>Attachment C</b> (if more than one unit is involved).		
15. Provide maximum projected <b>Operating Schedule</b> of activity/activities outlined in this application: Hours Per Day: <b>24</b> Days Per Week: <b>7</b> Weeks Per Year: <b>52</b>		
16. Is demolition or physical renovation at an existing facility involved? <input type="checkbox"/> <b>YES</b> <input checked="" type="checkbox"/> <b>NO</b>		
17. <b>Risk Management Plans.</b> If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see <a href="http://www.epa.gov/ceppo">www.epa.gov/ceppo</a> ), submit your <b>Risk Management Plan (RMP)</b> to U.S. EPA Region III.		
18. <b>Regulatory Discussion.</b> 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 <b>Attachment S</b> of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance ( <i>if known</i> ). Provide this information as <b>Attachment D</b> .		

### **Section II. Additional attachments and supporting documents.**

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate <b>application fee</b> (per 45CSR22 and 45CSR13).
20. Include a <b>Table of Contents</b> as the first page of your application package.
21. Provide a <b>Plot Plan</b> , 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 <b>Attachment E</b> (Refer to <b>Plot Plan Guidance</b> ). – Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).
22. Provide a <b>Detailed Process Flow Diagram(s)</b> showing each proposed or modified emissions unit, emission point and control device as <b>Attachment F</b> .
23. Provide a <b>Process Description</b> as <b>Attachment G</b> . – Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).
24. Provide <b>Material Safety Data Sheets (MSDS)</b> for all materials processed, used or produced as <b>Attachment H</b> . – For chemical processes, provide a MSDS for each compound emitted to the air.
25. Fill out the <b>Emission Units Table</b> and provide it as <b>Attachment I</b> .
26. Fill out the <b>Emission Points Data Summary Sheet (Table 1 and Table 2)</b> and provide it as <b>Attachment J</b> .
27. Fill out the <b>Fugitive Emissions Data Summary Sheet</b> and provide it as <b>Attachment K</b> .
<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>

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

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Bulk Liquid Transfer        | <input type="checkbox"/> Haul Road Emissions     | <input type="checkbox"/> Quarry  |
| <input 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 type="checkbox"/> Storage Tanks   |
| <input type="checkbox"/> Grey Iron and Steel Foundry | <input type="checkbox"/> Indirect Heat Exchanger |  |

**General Emission Unit, specify:**

- **NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEETS**
- **FUGITIVE LEAK SOURCES (FUG/1F)**

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: **BTEX SKID (BTEX-01) – CONTROL FOR DSV-02/5E**

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: **NA**

- |  |   |
|--|---|
| <input 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.*

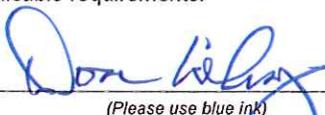
**35A. Certification of Information.** To certify this permit application, a Responsible Official (45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

**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:   
(Please use blue ink)

DATE: 9/23/2015  
(Please use blue ink)

35B. Printed name of signee: <b>DON WICBURG</b>	35C. Title: <b>VICE PRESIDENT AND GENERAL MANAGER</b>	
35D. E-mail: <b>DON.WICBURG@WILLIAMS.COM</b>	36E. Phone: <b>(304) 843-3158</b>	36F. FAX: <b>(304) 843-3131</b>
36A. Printed name of contact person: <b>R. DANELL ZAWASKI, P.E.</b>	36B. Title: <b>ENVIRONMENTAL SPECIALIST</b>	
36C. E-mail: <b>DANELL.ZAWASKI@WILLIAMS.COM</b>	36D. Phone: <b>(412) 787-4259</b>	36E. FAX: <b>(412) 787-6002</b>

**PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:**

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

**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.*

## **ATTACHMENT A**

### **Business Certificate**

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“6. **West Virginia Business Registration.** 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.”

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- **Certificate of Amendment to the Certificate of Authority**
    - From: CAIMAN EASTERN MIDSTREAM, LLC
    - To: WILLIAMS OHIO VALLEY MIDSTREAM LLC
    - Date: May 15, 2012
  
  - **Certificate of Authority of a Foreign Limited Liability Company**
    - To: CAIMAN EASTERN MIDSTREAM, LLC
    - Date: September 11, 2009
-

# State of West Virginia



## Certificate

*I, Natalie E. Tennant, Secretary of State of the  
State of West Virginia, hereby certify that*

the attached true and exact copy of the Articles of Amendment to the Articles of Organization of

**CAIMAN EASTERN MIDSTREAM, LLC**

are filed in my office, signed and verified, as required by the provisions of West Virginia Code §31B-2-204 and conform to law. Therefore, I issue this

### **CERTIFICATE OF AMENDMENT TO THE CERTIFICATE OF AUTHORITY**

changing the name of the limited liability company to

**WILLIAMS OHIO VALLEY MIDSTREAM LLC**



*Given under my hand and the  
Great Seal of the State of  
West Virginia on this day of  
May 15, 2012*

*Natalie E. Tennant*

*Secretary of State*

# State of West Virginia



## Certificate

*I, Natalie E. Tennant, Secretary of State of the State of West Virginia, hereby certify that*

**CAIMAN EASTERN MIDSTREAM, LLC**

Control Number: 99GIS

a limited liability company, organized under the laws of the State of Texas has filed its "Application for Certificate of Authority" in my office according to the provisions of West Virginia Code §31B-10-1002. I hereby declare the organization to be registered as a foreign limited liability company from its effective date of September 11, 2009, until a certificate of cancellation is filed with our office.

Therefore, I hereby issue this

### **CERTIFICATE OF AUTHORITY OF A FOREIGN LIMITED LIABILITY COMPANY**

to the limited liability company authorizing it to transact business in West Virginia

*Given under my hand and the  
Great Seal of the State of  
West Virginia on this day of  
September 11, 2009*



*Natalie E. Tennant*

Secretary of State

## ATTACHMENT B

### Map(s)

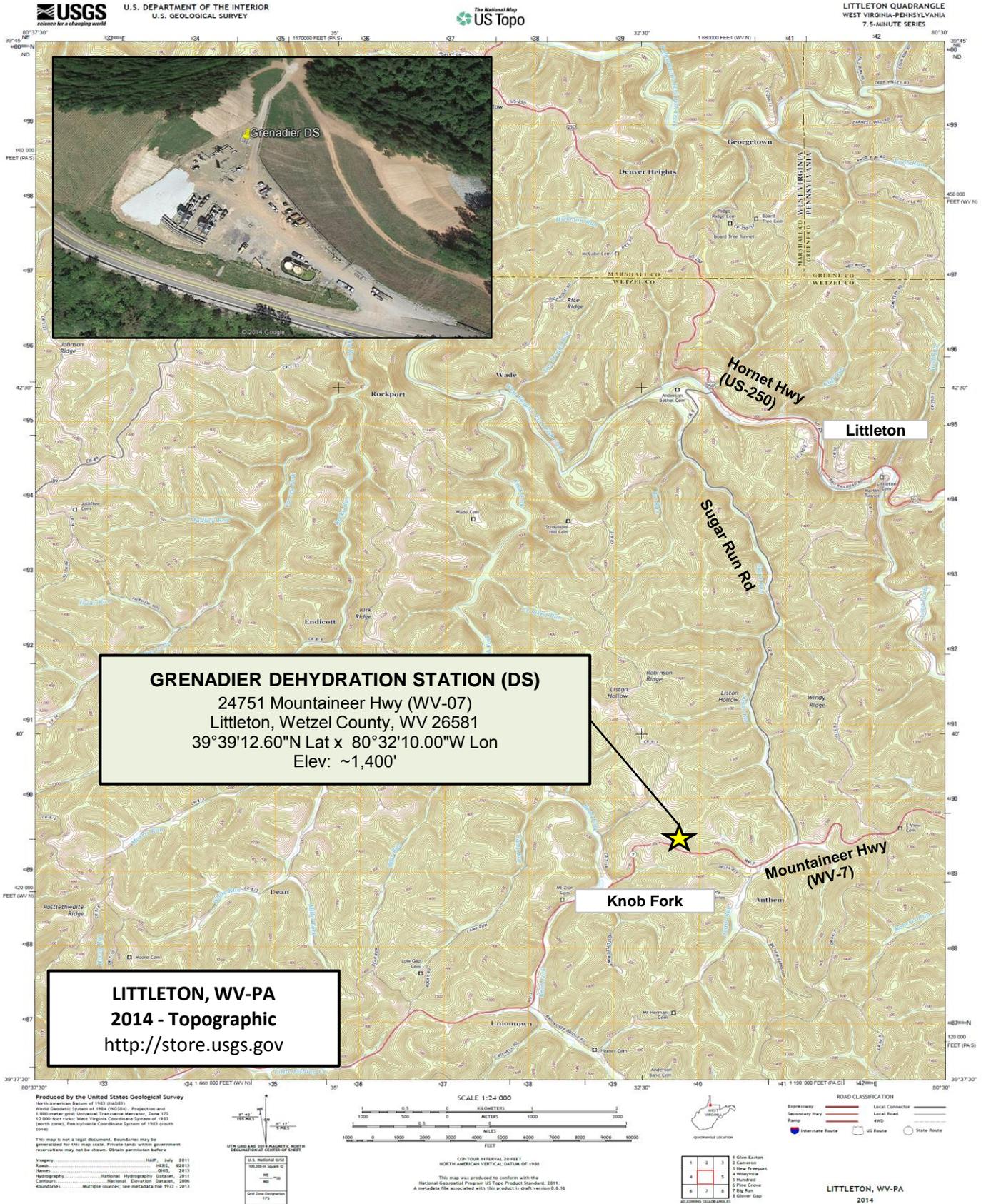
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“12A. For **Modifications, Administrative Updates** or **Temporary** permits at an existing facility, please provide directions to the present location of the facility from the nearest state road. Include a MAP as Attachment B.”

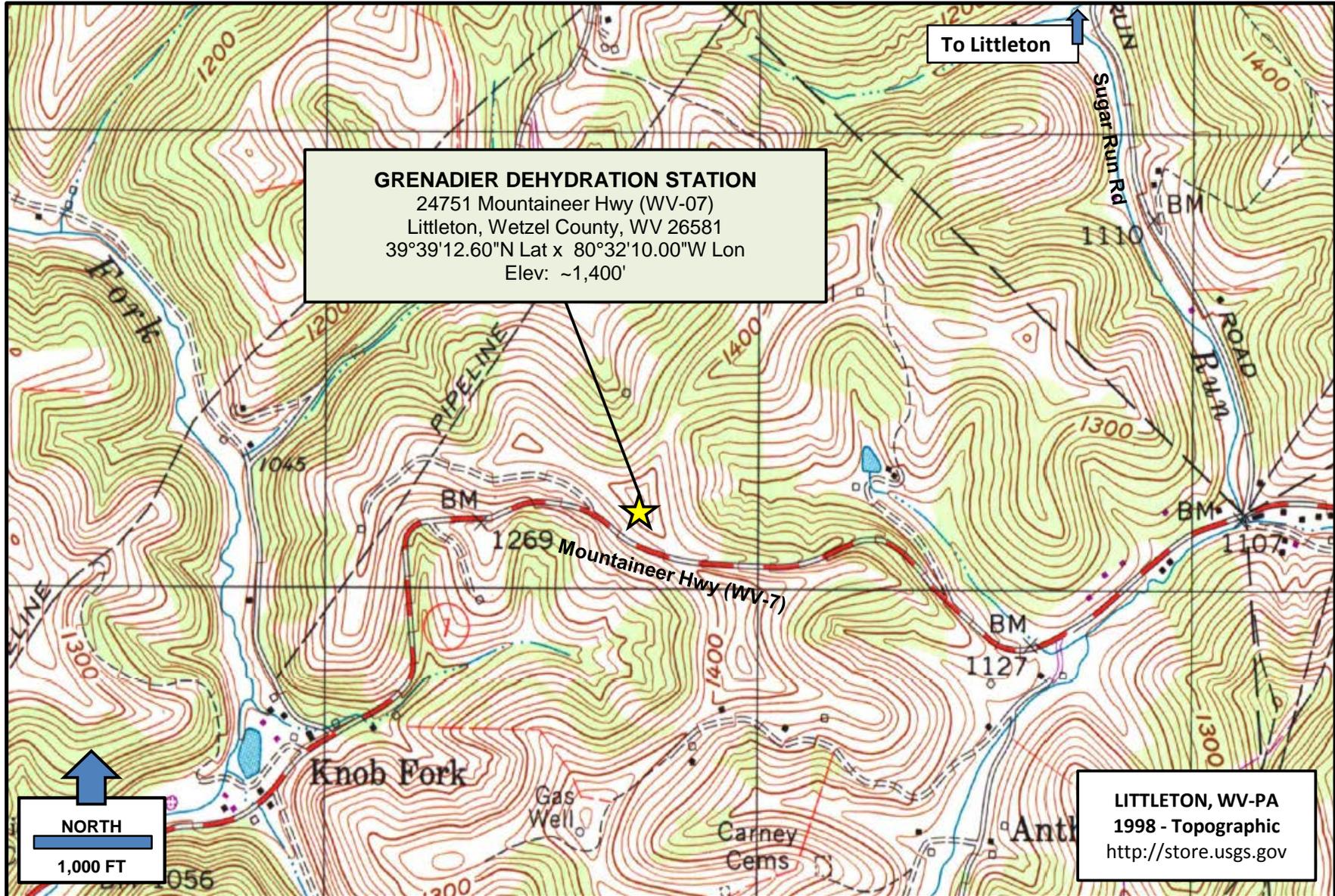
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- **Address:**  
24751 Mountaineer Hwy (WV-07)  
Littleton, Wetzel County, WV 26581
  - **Latitude and Longitude:**  
39°39'12.6" North x -80°32'03.0" West  
(39.6535° North x -80.5361° West)
  - **UTM:**  
4,389.40 km Northing x 539.80 km Easting x Zone 17S
  - **Elevation:**  
~1,400'
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit



Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit  
**Attachment Bb - Map(s)**  
**TOPOGRAPHIC MAP**



**ATTACHMENT C**  
**Installation and Start-Up Schedule**

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“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.”

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The OVM Grenadier Dehydration Station is an existing operation. The facility modifications are scheduled to be implemented w/in two (2) months following receipt of the NSR Modification Permit.

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## **ATTACHMENT D**

### **Regulatory Discussion**

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“18. **Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (if known). Discuss applicability and proposed demonstration(s) of compliance (if known). Provide this information as Attachment D.”

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- **Regulatory Discussion**
    - A. Applicability of New Source Review (NSR) Regulations
    - B. Applicability of Federal Regulations
    - C. Applicability of Source Aggregation
    - D. Applicability of State Regulations
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit

**Attachment D**  
**REGULATORY DISCUSSION**

A. Applicability of New Source Review (NSR) Regulations

The following New Source Review (NSR) regulations are potentially applicable to natural gas production facilities. Applicability to the subject facility has been determined as follows:

**1. Prevention of Significant Deterioration (PSD)** [Not Applicable]

This rule does not apply. The facility is a “PSD Minor Source” for each regulated pollutant, as follows:

- NOx: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- CO: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- VOC: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- SO<sub>2</sub>: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy
- PM<sub>10/2.5</sub>: PSD Natural Minor Source with Pre-Controlled PTE < 250 tpy

**2. Non-Attainment New Source Review (NNSR)** [Not Applicable]

This rule does not apply. The facility location is designated as either “Maintenance” or “Attainment/Unclassified” for all criteria pollutants.

**3. Major Source of Hazardous Air Pollutants (HAPs)** [Not Applicable]

This rule does not apply. The facility qualifies as a “HAP Area Source” as follows:

- Each HAP: HAP Area Source with Pre-Controlled Individual HAP PTE < 10 tpy
- Total HAPs: HAP Area Source with Pre-Controlled Total of All HAPs PTE < 25 tpy

**4. Title V Operating Permit (TVOP)** [Not Applicable]

This rule does not apply. The facility qualifies as a “Title V Minor Source” as follows:

- NOx: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- CO: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- VOC: Title V Synthetic Minor Source with Controlled PTE < 100 tpy
- SO<sub>2</sub>: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- PM<sub>10/2.5</sub>: Title V Natural Minor Source with Pre-Controlled PTE < 100 tpy
- Each HAP: Title V Natural Minor Source with Pre-Controlled PTE < 10 tpy
- Total HAPs: Title V Natural Minor Source with Pre-Controlled PTE < 25 tpy

## B. Applicability of Federal Regulations

The following federal regulations are potentially applicable to natural gas production facilities. Applicability to the facility has been determined as follows:

### 1. **NSPS A, General Provisions**

40CFR§60.1-§60.19

[Not Applicable]

This rule does not apply as there are no equipment subject to NSPS regulations.

### 2. **NSPS Dc, Steam Generating Units**

40CFR§60.40c-§60.48c

[Not Applicable]

This rule does not apply because there is no steam generating unit at the facility with a maximum design heat input capacity  $\geq 10$  MMBtu/hr and  $\leq 100$  MMBtu/hr (§60.40c(a)).

### 3. **NSPS Kb, Volatile Organic Liquid Storage Vessels**

40CFR§60.110b-§60.117b

[Not Applicable]

This rule does not apply because there is no tank used to store volatile organic liquids (VOL) with a design capacity  $\geq 75$  m<sup>3</sup> (19,815 gal, 471.8 bbl) (§60.110b(a)).

### 4. **NSPS GG, Stationary Gas Turbines**

40CFR§60.330-§60.335

[Not Applicable]

This rule does not apply because there is no stationary gas turbine at the facility (§60.330).

### 5. **NSPS KKK, Leaks from Natural Gas Processing Plants**

40CFR§60.630-§60.636

[Not Applicable]

This rule does not apply because the facility is not a natural gas processing plant (§60.630(b)).

### 6. **NSPS LLL, Onshore Natural Gas Processing: SO<sub>2</sub> Emissions**

40CFR§60.640-§60.648

[Not Applicable]

This rule does not apply because there is no gas sweetening operation at the facility (§60.640(a)).

### 7. **NSPS IIII, Compression Ignition Reciprocating Internal Combustion Engines**

40CFR§60.4200-§60.4219

[Not Applicable]

This rule does not apply because there is no stationary compression ignition engine at the facility (§60.4200(a)).

- 8. NSPS JJJJ, Stationary Spark Ignition (SI) Internal Combustion Engines (ICE)**  
40CFR§60.4230-§60.4248 [Not Applicable]
- This rule does not apply because there are no stationary spark ignition internal combustion engines at the subject facility.
- 9. NSPS KKKK, Stationary Combustion Turbines**  
40CFR§60.4300-§60.4420 [Not Applicable]
- This rule does not apply because there is no stationary combustion turbine at the facility (§60.4300).
- 10. NSPS OOOO, Crude Oil and Natural Gas Production**  
40CFR§60.5360-§60.5430 [Not Applicable]
- This rule does not apply to the pneumatic controllers because they are located between the wellhead and point of custody transfer, are not located at a natural gas processing plant, and their bleed rate is  $\leq 6$  scfh (§60.5365(d)(i)).
- Further, this rule does not apply because there are no reciprocating compressor or storage vessel at the subject facility.
- 11. NESHAP A, General Provisions**  
40CFR§63.1-§63.16 [Applicable]
- This rule does apply to the Dehydrators (DEHY-01 and -02) because they are each subject to NESHAP Subpart HH. Requirements include notification and recordkeeping.
- 12. NESHAP HH, Oil and Natural Gas Production Facilities**  
40CFR§63.760-§63.779 [Applicable]
- This rule does apply to the Dehydrators (DEHY-01 and -02). However, because each dehydrator has a benzene PTE  $< 0.9$  megagrams per year, they are exempt from all requirements except to maintain records of actual annual average benzene emissions to demonstrate continuing exemption status (§63.764(e)(1)).
- This rule does not apply to storage vessels (tanks), compressors, or ancillary equipment because the facility is an area source of HAP emissions (§63.760(b)(2)). In no case does this rule apply to engines or turbines.
- 13. NESHAP HHH, Natural Gas Transmission and Storage Facilities**  
40CFR§63.1270-§63.1289 [Not Applicable]
- This rule does not apply because the facility is not a natural gas transmission or storage facility transporting or storing natural gas prior to local distribution (§63.1270(a)).
- 14. NESHAP YYYY, Stationary Combustion Turbines**  
40CFR§63.6080-§63.6175 [Not Applicable]
- This rule does not apply because there is no stationary gas turbine at the facility (§63.6080).

**15. NESHAP ZZZZ, Stationary Reciprocating Internal Combustion Engines (RICE)**  
40CFR§63.6580-§63.6675 [Not Applicable]

This rule does not apply because there are no stationary engines at the subject facility.

**16. NESHAP DDDDD, Industrial, Commercial, and Institutional Boilers and Process Heaters – Major Sources**  
40CFR§63.7480 – §63.7575 [Not Applicable]

This rule does not apply because the facility is not a major source of HAP (§63.7485).

**17. NESHAP JJJJJ, Industrial, Commercial, and Institutional Boilers and Process Heaters – Area Sources**  
40CFR§63.11193 – §63.11237 [Not Applicable]

This rule does not apply because gas-fired boilers are not subject to the requirements of this subpart (§63.11195(e)). Specifically, “boiler” is defined as an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the form of steam and/or hot water.

**18. Chemical Accident Prevention Provisions**  
40CFR§68.1-§68.220 [Not Applicable]

This rule does not apply because the facility does not store more than a threshold quantity of a regulated substance in a process (§68.115).

**19. Compliance Assurance Monitoring (CAM)**  
40CFR§64.1-§64.10 [Not Applicable]

This rule does not apply. Although there are pollutant specific emission units subject to an emissions limitation and a control device is used to achieve compliance, the potential pre-control emissions do not exceed 100 tpy.

**20. Mandatory Greenhouse Gases (GHG) Reporting**  
40CFR§98.1-§98.9 [Not Applicable]

This rule does not apply. The facility is not subject to a listed source category and the aggregate maximum heat input capacity is < 30 MMBtu/hr from all stationary fuel combustion sources combined (§98.2(a)).

**C. Applicability of Source Aggregation**

For New Source Review (NSR) and Title V permitting, the three-part regulatory criteria to determine whether emissions from two or more facilities should be aggregated and treated as a single source is whether the activities:

- i) Belong to the same industrial grouping; and
- ii) Are located on one or more contiguous or adjacent properties; and
- iii) Are under control of the same person (or persons under common control).

### **i) Same Industrial Grouping**

The subject facility shares the same two-digit major SIC code of 13 as the upstream gas production wells and other Williams' facilities.

### **ii) Contiguous or Adjacent**

The determination of whether two or more facilities are "contiguous" or "adjacent" is made on a case-by-case basis. This determination is proximity based, and it is important to focus on this criterion and whether two contiguous or adjacent facilities, considered as a single source, meet the common sense notion of a plant. The functional interrelationship of the two or more facilities is not a relevant inquiry in determining whether the facilities are "contiguous" or "adjacent."

Neither West Virginia nor federal regulations define the terms "contiguous" or "adjacent." It is clear, however, that the determination of whether two or more facilities are "contiguous" or "adjacent" is based on the plain meaning of the terms "adjacent" and "contiguous", which consider the physical distance between the facilities. The term contiguous is defined in the dictionary as being in actual contact; touching along a boundary or at a point. The term "adjacent" is defined in the dictionary as not distant, nearby, having a common endpoint or border.

The closest Williams-owned facility to the subject facility is the Victory Dehydration Station, located approximately 7.8 miles to the northwest. The Victory Dehydration Station does not meet the common sense definition of being "contiguous" with or "adjacent" to the subject facility.

The subject facility dehydrates gas produced from an upstream production well located in northern West Virginia. The subject facility is located on a parcel that is directly adjacent to a pre-existing upstream production wellpad operated by Grenadier Energy Partners.

The location of the subject facility was chosen because of suitable characteristics for construction and operation, such as the availability of a reasonably flat grade and accessibility for large trucks and equipment. Williams' business model is to construct scalable capacity that contemplates additional production from multiple operators and the initial configuration is merely a foundation for additional opportunities in the area. The subject facility does not need to be located in the immediate vicinity of the upstream wells in order to operate properly. Had suitable land been available elsewhere, the subject facility could have been located farther from the upstream wells and could theoretically be moved farther from the wells without affecting operations. Therefore, despite the fact that the subject facility is located in close proximity to one or many upstream production sources, aggregation of the subject facility with upstream wells does not meet the common sense notion of a plant.

### **iii) Common Control**

Williams OVM operates under its parent company The Williams Companies, Inc. (Williams) and is the sole operator of the subject facility. The closest Williams-operated facility to the subject facility is the Victory Dehydration Station, located approximately 7.8 miles to the northwest. The Victory Dehydration Station is not "contiguous" with or "adjacent" to the subject facility.

The production wells, including the Grenadier Energy Partners wellpad, that send natural gas to the subject facility are owned and operated by other companies, which are unaffiliated with Williams. Williams has no ownership stake in the Grenadier Energy Partners wellpad or in any production well or company in West Virginia that may send natural gas to the subject facility.

Furthermore, neither Williams OVM, nor Williams, exercise operational control over any equipment owned or operated by any natural gas producer upstream of the subject facility. All employees at the subject facility are under the exclusive direction of Williams and are not under the control of any other entity. Similarly, Williams has no authority over employees of the production wells. These companies operate wholly independent of one another. No employees are expected to shuttle back and forth between the subject facility and any production well.

At this time, contracts are in place for the subject facility to process natural gas produced from multiple upstream production wells located throughout the region. As future commercial opportunities are identified, the subject facility will potentially receive gas from other producers. Williams will not have ownership or control of any future wellhead facilities. The producers are, and will be responsible for, any decisions to produce or shut-in wellhead facilities and have no control over the equipment installed, owned, and operated by Williams. Similarly, Williams cannot control the installation or operation of any equipment located at a well site that may be considered an air contamination source.

For the reason above, it is clear that Williams does not have common control of any production wells, including the Grenadier Energy Partners well.

### **Summary**

The subject facility and the upstream production wells should not be aggregated and treated as a single source of emissions because the subject facility is not under common control with any of the upstream wells. Additionally, the subject facility and the upstream production wells, considered together, do not meet the common sense notion of a plant because the subject facility is expected to service multiple production wells and because the location of the facility was selected for reasons unrelated to the location of the production wells. Accordingly, the subject facility should not be aggregated with the upstream wells in determining major source or PSD status

#### D. Applicability of State Regulations

The following State regulations are potentially applicable to natural gas production facilities. Applicability to the facility has been determined as follows:

**1. Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers**

45CSR2

[Applicable]

This rule does apply, however, because the dehydrator reboilers (RBV-01 thru -03) each have a maximum design heat input (MDHI) rating < 10 MMBtu/hr, the only requirement is to limit visible emissions to < 10% opacity during normal operations (§45-02-3.1). The reboilers combust only natural gas which inherently conforms to the visible emission standards.

**2. Prevent and Control the Discharge of Air Pollutants into the Open Air which Causes or Contributes to an Objectionable Odor or Odors**

45CSR4

[Applicable]

This rule does apply and states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable. No odors have been deemed objectionable.

**3. Control of Air Pollution from Combustion of Refuse**

45CSR6

[Not Applicable]

This rule does not apply because there is no refuse combustion performed at the facility.

**4. Prevent and Control Air Pollution from the Emission of Sulfur Oxides**

45CSR10

[Not Applicable]

This rule does not apply because each "fuel burning unit" at the facility has a Maximum Design Heat Input (MDHI) rating < 10 MMBtu/hr.

**5. 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**

45CSR13

[Applicable]

This rule does apply. Williams OVM is applying for a 45CSR13 New Source Review Modification Permit and has published the required Class I legal advertisement notifying the public of this application to modify the existing permit.

**6. Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants**

45CSR14

[Not Applicable]

The rule does not apply because the facility is not a major source of air pollutants.

- 7. Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60**  
45CSR16 [Not Applicable]  
This rule does not apply because the facility is not subject to any New Source Performance Standard (NSPS).
- 8. Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment**  
45CSR19 [Not Applicable]  
This rule does not apply because the facility is a minor (or “deferred”) source of all regulated pollutants.
- 9. Requirements for Operating Permits**  
45CSR30 [Not Applicable]  
This rule does not apply because the facility is a minor (or “deferred”) source of all regulated pollutants.
- 10. Air Quality Management Fees Program**  
45CSR22 [Applicable]  
This rule does apply. It establishes a program to collect fees for certificates to operate and for permits to construct, modify or relocate sources of air pollution.
- 11. Prevent and Control Emissions of Toxic Air Pollutants**  
45CSR27 [Not Applicable]  
This rule does not apply because equipment used in the production and distribution of petroleum products is exempt, provided that the product contains no more than 5% benzene by weight (§45-22-2.4).
- 12. Air Pollution Emissions Banking and Trading**  
45CSR28 [Not Applicable]  
This rule does not apply. The facility does not choose to participate in the voluntarily statewide air pollutant emissions trading program.
- 13. Emission Statements for VOC and NOX**  
45CSR29 [Not Applicable]  
This rule does not apply because the subject facility is not located in Putnam, Kanawha, Cabell, Wayne, Wood, or Greenbrier Counties (§45-29-1).

**14. Requirements for Operating Permits**

45CSR30

[Not Applicable]

This rule does not apply because the subject facility is a non-major “deferred” source of all regulated pollutants.

Pursuant to the authority granted in West Virginia 45CSR§30-3.2 and 45CSR§30A-3.1, the DAQ is extending the deferral, which was set to expire December 15, 2000, of non-major sources subject to West Virginia 45CSR30 (Title V Program) from the obligation to submit an operating permit application.

**15. Emission Standards for Hazardous Air Pollutants (HAP)**

45CSR34

[Not Applicable]

This rule does not apply because the provisions under Subpart HH of 40 CFR Part 63 which apply to non-major area sources of hazardous air pollutants are excluded.

## ATTACHMENT E

### Plot Plan

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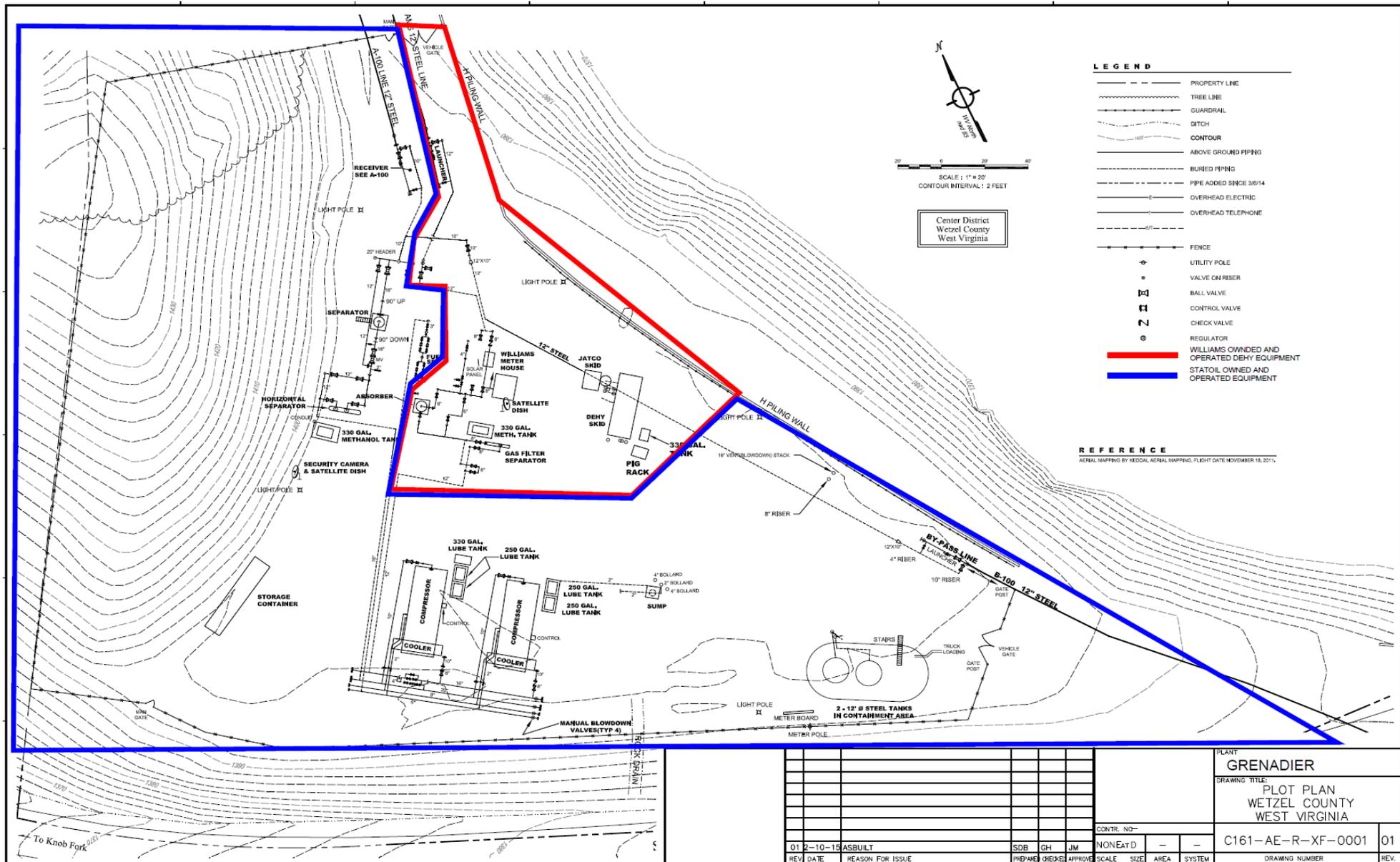
“21. Provide a **Plot Plan**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as Attachment E.”

---

- Plot Plan – Grenadier Dehydration Station
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment E - Plot Plan(s)**

**PLOT PLAN**



PLANT <b>GRENADIER</b>									
DRAWING TITLE PLOT PLAN WETZEL COUNTY WEST VIRGINIA									
								CONTR. NO- C161-AE-R-XF-0001	
								01	
01 2-10-13 ASSULT		SDB GH JM		NON EXT		- -		DRAWING NUMBER	
REV DATE		REASON FOR ISSUE		SCALE		SIZE		SYSTEM	

**ATTACHMENT F**  
**Detailed Process Flow Diagram(s) (PFD)**

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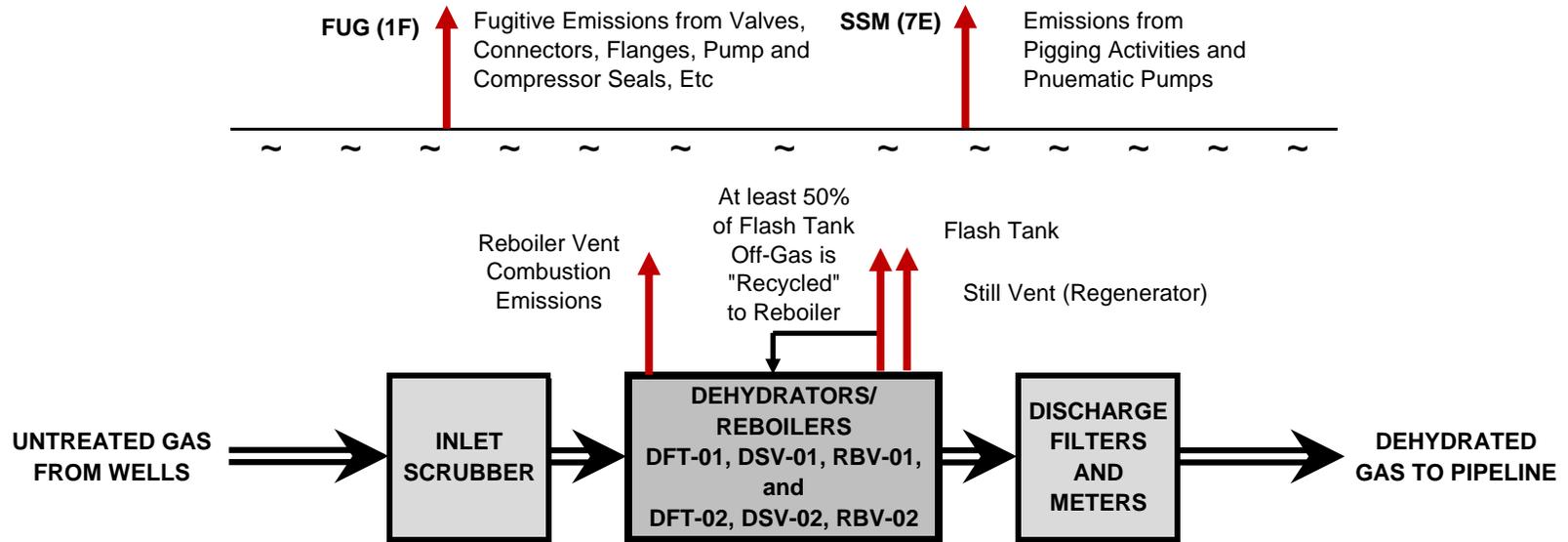
“22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as Attachment F.”

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- Process Flow Diagram (PFD) – Grenadier Dehydration Station
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment F - Process Flow Diagram(s)**

**PROCESS FLOW DIAGRAM (PFD)**



<u>Unit No.</u>	<u>Company ID - Description</u>
DFT-01 (1E)	65.0 MMscfd Dehydrator 01 - Flash Tank
DSV-01 (2E)	65.0 MMscfd Dehydrator 01 - Still Vent
RBV-01 (3E)	1.50 MMBtu/hr Reboiler 01
DFT-02 (4E)	100.0 MMscfd Dehydrator 02 - Flash Tank
DSV-02 (5E)	100.0 MMscfd Dehydrator 02 - Still Vent
RBV-02 (6E)	2.00 MMBtu/hr Reboiler 02
SSM (7E)	Pigging/Pneumatic Pump Emissions
DFT-02alt (4Ealt)	50.0 MMscfd Dehydrator 02 ALTERNATIVE - Flash Tank
DSV-02alt (5Ealt)	50.0 MMscfd Dehydrator 02 ALTERNATIVE - Still Vent
RBV-02alt (6Ealt)	1.00 MMBtu/hr Reboiler 02 ALTERNATIVE
FUG (1F)	Process Piping Fugitives

## **ATTACHMENT G**

### **Process Description**

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“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). “

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- **Process Description**
    - A. Project Overview
    - B. Triethylene Glycol (TEG) Dehydrators
    - C. Triethylene Glycol (TEG) Reboilers
    - D. Piping and Equipment Fugitive Emissions
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 Modification Permit

**Attachment G**  
**PROCESS DESCRIPTION**

A. Project Overview

Williams Ohio Valley Midstream LLC owns and operates the existing Grenadier Dehydration Station located at 24751 Mountaineer Hwy, approximately 3.3 miles south-southwest of Littleton, in Wetzel County (See Appendix B – Site Location Maps). The facility receives natural gas from local production wells then dehydrates the gas for delivery to a gathering pipeline.

This application for 45CSR13 NSR Modification Permit has been prepared and submitted to provide for the following equipment and operations at the subject facility:

- One (1) Modified 65.0 MMscfd Triethylene Glycol (TEG) Dehydrator 01 comprised of:
  - One (1) Flash Tank w/  $\geq 50\%$  Off-Gas Recycle DFT-01/1E
  - One (1) Regenerator/Still Vent DSV-01/2E
  - One (1) 1.50 MMBtu/hr Natural Gas-Fired Reboiler RBV-01/3E
- One (1) New 100.0 MMscfd TEG Dehydrator 02 comprised of:
  - One (1) Flash Tank w/  $\geq 50\%$  Off-Gas Recycle DFT-02/4E
  - One (1) Regenerator/Still Vent w/ 95% BTEX Skid (BTEX-01) DSV-02/5E
  - One (1) 2.0 MMBtu/hr Natural Gas-Fired Reboiler RBV-02/6E
- Pigging Activities SSM/7E
- Piping and Equipment Fugitives – Gas FUG/1F

The applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 instead of the 100.0 MMscfd Dehydrator 02 shown above:

- One (1) New 50.0 MMscfd TEG Dehydrator 02 ALTERNATIVE comprised of:
  - One (1) Flash Tank w/  $\geq 50\%$  Off-Gas Recycle DFT-02alt/4Ealt
  - One (1) Regenerator/Still Vent DSV-02alt/5Ealt
  - One (1) 1.00 MMBtu/hr Natural Gas-Fired Reboiler RBV-02alt/6Ealt

B. Dehydrator

Two (2) dehydrators will be utilized at the facility. Each dehydrator is comprised of a contactor/absorber tower (no vented emissions), a flash tank, and a regenerator/still.

The dehydrators are used to remove water vapor from the inlet wet gas stream to meet pipeline specifications. In the dehydration process, the wet inlet gas stream flows through an absorber tower where the gas is contacted with lean glycol. The lean glycol absorbs the water in the gas stream and becomes rich glycol, laden with water and trace amounts of hydrocarbons.

The rich glycol is then sent to the flash tank where the pressure is reduced, thus liberating the lighter hydrocarbons (primarily methane, but also significant quantities of VOCs). A minimum of 50% of the flash tank off-gas is recycled as fuel in the reboilers.

Following the flash tank, the rich glycol is then routed to the regenerator/still where it is boiled to drive off the water vapor and any remaining hydrocarbons. Once boiled, the glycol is returned to a lean state and used again in the process.

The off-gases from the 100 MMscfd regenerator/still (DSV-02/5E) pass through a BTEX skid/condenser (BTEX-01) to remove the VOC/HAP prior to discharge to the atmosphere. The manufacturer of the BTEX skid guarantees a minimum of 95% VOC removal efficiency.

C. Reboiler

Reboilers are utilized to supply heat for the regenerator/stills. The reboilers are fueled by primarily by the flash tank off-gas, with supplemental natural gas as requisite.

D. Maintenance Emissions

Pigging is routinely conducted to clear pipelines. Associated with pigging events is a small amount of natural gas released to atmosphere when the pig traps are opened to the atmosphere. Pneumatic pumps used to inject methanol and other chemicals into flow lines are powered by pressurized natural gas. As part of normal operation, these devices vent the natural gas to the atmosphere.

E. Piping and Equipment Fugitive Emissions

Piping and process equipment generate leaks from different component types (connectors, valves, pumps, etc.) in gas-vapor service.

# ATTACHMENT H

## Material Safety Data Sheets (MSDS) (And Representative Gas Analysis)

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“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.”

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- **NATURAL GAS**
    - Inlet Natural Gas – Certificate of Analysis
    - Extended Gas Analysis Summary
  
  - **MATERIAL SAFETY DATA SHEETS (MSDS):**
    - Wellhead Natural Gas
    - Triethylene Glycol (TEG)
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment H - Gas Analysis**

**Inlet Natural Gas - Certificate of Analysis**

**Gas Analytical Services**  
 BOSSIER CITY, LA  
 318-226-7237

Good  
 LELAP Certification #  
 04049

<b>Customer</b>	: 2259 - WILLIAMS	<b>Date Sampled</b>	: 06/17/2015
<b>Station ID</b>	: 52032-50	<b>Date Analyzed</b>	: 06/29/2015
<b>Cylinder ID</b>	: w70	<b>Effective Date</b>	: 07/01/2015
<b>Producer</b>	: ENVIRONMENTAL	<b>Cyl Pressure</b>	: 851
<b>Lease</b>	: GRENADIER	<b>Temp</b>	: 97
<b>Area</b>	: 503 - OVM-ENVIRONMENTAL	<b>Cylinder Type</b>	: Spot
<b>State</b>	: WV	<b>Sample By</b>	: C

<u>COMPONENT</u>	<u>MOL%</u>	<u>GPM@14.73(PSIA)</u>
Oxygen	0.0000	0.000
Nitrogen	0.2809	0.000
Methane	88.7219	0.000
Carbon-Dioxide	0.1674	0.000
Ethane	8.9834	2.408
Propane	1.4015	0.387
Iso-Butane	0.1573	0.052
Normal-Butane	0.1895	0.060
Iso-Pentane	0.0441	0.016
Normal-Pentane	0.0237	0.009
2,2-Dimethylbutane	0.0026	0.001
2,3-Dimethylbutane/CycloC5	0.0023	0.001
2-methylpentane	0.0067	0.003
3-methylpentane	0.0045	0.002
Normal-Hexane	0.0043	0.002
2,2-Dimethylpentane	0.0004	0.000
Methylcyclopentane	0.0010	0.000
BENZENE	0.0003	0.000
3,3-Dimethylpentane	0.0003	0.000
CYCLOHEXANE	0.0008	0.000
2-Methylhexane	0.0019	0.001
2,3-Dimethylpentane	0.0006	0.000
3-Methylhexane	0.0014	0.001
1,t2-DMCYC5 / 2,2,4-TMC5	0.0000	0.000
1,t3-Dimethylcyclopentane	0.0000	0.000
N-Heptane	0.0009	0.000
METHYLCYCLOHEXANE	0.0011	0.001
2,5-Dimethylhexane	0.0000	0.000
2,3-Dimethylhexane	0.0000	0.000
TOLUENE	0.0004	0.000
2-Methylheptane	0.0002	0.000
4-Methylheptane	0.0000	0.000
3-Methylheptane	0.0002	0.000
1,t4-Dimethylcyclohexane	0.0001	0.000
N-OCTANE / 1,T2-DMCYC6	0.0001	0.000
1,t3-DMCYC6/1,C4-DMCYC6/1,C2,C3-TMCYC5	0.0000	0.000
2,4,4 TMC6	0.0000	0.000
2,6-Dimethylheptane / 1,C2-DMCYC6	0.0000	0.000
Ethylcyclohexane	0.0000	0.000
ETHYLBENZENE	0.0000	0.000
M-XYLENE	0.0000	0.000
P-XYLENE	0.0000	0.000
O-XYLENE	0.0000	0.000
NONANE	0.0000	0.000
N-DECANE	0.0000	0.000
N-UNDECANE	0.0002	0.000
<b>TOTAL</b>	<b>100.0000</b>	<b>2.944</b>

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment H - Gas Analysis**

**Extended Gas Analysis Summary**

Gas Analysis for Grenadier CRP - Sampled 06/17/15

Compound	CAS	Formula	Molecular Weight (MW)	Mole % (M% = V%)	Mole Fraction (M%/Sum-M%)	Weighted Sum (MW*MF)	Weight % (WS/Sum-WS)	lb/MMscf (WS/UGC#)
Water	109-86-4	H2O	18.02	---	---	---	---	---
Carbon Monoxide	630-08-0	CO	28.01	---	---	---	---	---
Nitrogen	7727-37-9	N2	28.01	<b>0.2809</b>	0.00281	0.0787	0.4376	<b>207.36</b>
Oxygen	7782-44-7	O2	32.00	---	---	---	---	---
Hydrogen Sulfide	2148-87-8	H2S	34.09	---	---	---	---	---
Carbon Dioxide	124-38-9	CO2	44.01	<b>0.1674</b>	0.00167	0.0737	0.4097	<b>194.14</b>
Methane*	75-82-8	CH4	16.04	<b>88.7219</b>	0.88722	14.2332	79.1491	<b>37,506.80</b>
Ethane*	74-84-0	C2H6	30.07	<b>8.9834</b>	0.08983	2.7012	15.0212	<b>7,118.17</b>
Propane**	74-98-6	C3H8	44.10	<b>1.4015</b>	0.01401	0.6180	3.4366	<b>1,628.53</b>
i-Butane**	75-28-5	C4H10	58.12	<b>0.1573</b>	0.00157	0.0914	0.5084	<b>240.92</b>
n-Butane**	106-97-8	C4H10	58.12	<b>0.1895</b>	0.001895	0.1101	0.6125	<b>290.24</b>
Cyclopentane**	287-92-3	C5H10	70.10	---	---	---	---	---
i-Pentane**	78-78-4	C5H12	72.15	<b>0.0441</b>	0.000441	0.0318	0.1769	<b>83.84</b>
n-Pentane**	109-66-0	C5H12	72.15	<b>0.0237</b>	0.000237	0.0171	0.0951	<b>45.06</b>
Cyclohexane**	110-82-7	C6H12	84.16	<b>0.0018</b>	0.000018	0.0015	0.0084	<b>3.99</b>
Other Hexanes**	110-54-3	C6H14	86.18	<b>0.0161</b>	0.000161	0.0139	0.0772	<b>36.56</b>
Methylcyclohexanes**	varies	C7H14	98.19	<b>0.0011</b>	0.000011	0.0011	0.0060	<b>2.85</b>
Heptanes**	varies	C7H16	100.20	<b>0.0055</b>	0.000055	0.0055	0.0306	<b>14.52</b>
C8+ Heavies**	varies	C8+	130.00 est	<b>0.0008</b>	0.000008	0.0010	0.0058	<b>2.74</b>
Benzene***	71-43-2	C6H6	78.11	<b>0.0003</b>	0.000003	0.0002	0.0013	<b>0.62</b>
Ethylbenzene***	100-41-4	C8H10	106.17	<b>5.0E-05</b>	5.0E-07	0.0001	0.0003	<b>0.14</b>
n-Hexane***	110-54-3	C6H14	86.18	<b>0.0043</b>	0.000043	0.0037	0.0206	<b>9.76</b>
Toluene***	108-88-3	C7H8	92.14	<b>0.0004</b>	0.000004	0.0004	0.0020	<b>0.97</b>
2,2,4-Trimethylpentane**	540-84-1	C8H18	114.23	<b>5.0E-05</b>	5.0E-07	0.0001	0.0003	<b>0.15</b>
Xylenes***	1330-20-7	C8H10	106.17	<b>5.0E-05</b>	5.0E-07	0.0001	0.0003	<b>0.14</b>

<b>Total:</b>	<b>100.00</b>	<b>1.0000</b>	<b>17.98</b>	<b>100.00</b>	<b>47,388</b>
<b>THC:</b>	<b>99.55</b>	<b>0.9955</b>	<b>17.83</b>	<b>99.15</b>	<b>46,986</b>
<b>Total CH4:</b>	<b>88.72</b>	<b>0.8872</b>	<b>14.23</b>	<b>79.15</b>	<b>37,507</b>
<b>Total VOC:</b>	<b>1.85</b>	<b>0.0185</b>	<b>0.90</b>	<b>4.98</b>	<b>2,361</b>
<b>Total HAP:</b>	<b>0.005</b>	<b>0.0001</b>	<b>0.00</b>	<b>0.02</b>	<b>12</b>

\* = Hydrocarbon (HC)      \*\* = also Volatile Organic Compound (EPA-VOC)      \*\*\* = also Hazardous Air Pollutant (EPA-HAP)  
 #UGC (Universal Gas Constant) = 379.482 scf/lb-mol @ 60 °F and 14.696 psia.      Pound "X"/scf = M% of "X" \* MW of "X" / UGC

To be conservative, the following "worst-case" values were assumed:

Compound	CAS	Formula	Representative Gas Analysis			Assumed "Worst-Case" Assumption (120%)		
			Mole %	Wgt %	lb/MMscf	Mole %	Wgt %	lb/MMscf
Nitrogen	7727-37-9	N2	0.2809	0.4376	207.36	0.000	0.000	0.00
Carbon Dioxide	124-38-9	CO2	0.1674	0.4097	194.14	0.201	0.492	232.97
Methane*	75-82-8	CH4	88.7219	79.1491	37,506.80	100.00	93.53	42,275.00
Ethane*	74-98-6	C2H6	8.9834	15.0212	7,118.17	0.000	0.000	0.00
VOC**	Various	C3 thru C10+	1.8466	4.9824	2,361.05	2.216	5.979	2,833.26
Benzene***	71-43-2	C6H6	0.0003	0.0013	0.62	0.0004	0.002	0.74
Ethylbenzene***	100-41-4	C8H10	0.0001	0.0003	0.14	0.0001	0.000	0.17
n-Hexane***	110-54-3	C6H14	0.0043	0.0206	9.76	0.0052	0.025	11.72
Toluene***	108-88-3	C7H8	0.0004	0.0020	0.97	0.0005	0.002	1.17
2,2,4-Trimethylpentane**	540-84-1	C8H18	0.0001	0.0003	0.15	0.0001	0.000	0.18
Xylenes***	1330-20-7	C8H10	0.0001	0.0003	0.14	0.0001	0.000	0.17
Total HAP***	Various	C6 thru C8	0.0052	0.0249	11.78	0.0062	0.030	14.14



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Revision Date: 10/02/2013

Version: 1.0

### SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY

#### Product Identifier

**Product Form:** Mixture

**Product Name:** Wellhead Natural Gas

**Synonyms:** Wellhead Gas, Raw Gas, Methane, Residue Gas, Natural Gas Sweet, Marsh Gas, Fuel Gas, Petroleum Gas.

#### Intended Use of the Product

**Use of the Substance/Mixture:** Fuel.

#### Name, Address, and Telephone of the Responsible Party

##### Company

Williams, Inc.

One Williams Center

Tulsa, OK 74172, US

T 800-688-7507

[enterprise@williams.com](mailto:enterprise@williams.com)

#### Emergency Telephone Number

**Emergency number** : 800-424-9300

### SECTION 2: HAZARDS IDENTIFICATION

#### Classification of the Substance or Mixture

##### Classification (GHS-US)

Simple Asphy

Flam. Gas 1 H220

Compressed gas H280

#### Label Elements

##### GHS-US Labeling

##### Hazard Pictograms (GHS-US)



##### Signal Word (GHS-US)

: Danger

##### Hazard Statements (GHS-US)

: H220 - Extremely flammable gas  
H280 - Contains gas under pressure; may explode if heated  
May displace oxygen and cause rapid suffocation

##### Precautionary Statements (GHS-US)

: P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking.  
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  
P381 - Eliminate all ignition sources if safe to do so.  
P403 - Store in a well-ventilated place.  
P410+P403 - Protect from sunlight. Store in a well-ventilated place.

#### Other Hazards

**Other Hazards Not Contributing to the Classification:** Contains hydrogen sulfide. Hydrogen sulfide is a highly flammable, explosive gas under certain conditions, is a toxic gas, and may be fatal. Gas can accumulate in the headspace of closed containers, use caution when opening sealed containers. Heating the product or containers can cause thermal decomposition of the product and release hydrogen sulfide. Exposure may aggravate those with pre existing eye, skin, or respiratory conditions.

**Unknown Acute Toxicity (GHS-US)** Not available

### SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

#### Mixture

Name	Product identifier	% (w/w)	Classification (GHS-US)
Methane	(CAS No) 74-82-8	> 75	Simple Asphy

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			Flam. Gas 1, H220 Liquefied gas, H280
Ethane	(CAS No) 74-84-0	< 20	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Propane	(CAS No) 74-98-6	< 10	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Carbon dioxide	(CAS No) 124-38-9	< 10	Simple Asphy Compressed gas, H280
Butane	(CAS No) 106-97-8	< 5	Simple Asphy Flam. Gas 1, H220 Liquefied gas, H280
Nitrogen	(CAS No) 7727-37-9	< 5	Simple Asphy Compressed gas, H280
Hydrogen sulfide	(CAS No) 7783-06-4	<= 0.0004	Flam. Gas 1, H220 Liquefied gas, H280 Acute Tox. 2 (Inhalation:gas), H330 Aquatic Acute 1, H400

Full text of H-phrases: see section 16

### SECTION 4: FIRST AID MEASURES

#### Description of First Aid Measures

**General:** Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible). If frostbite or freezing occurs, immediately flush with plenty of lukewarm water to GENTLY warm the affected area. Do not use hot water. Do not rub affected area. Get immediate medical attention.

**Inhalation:** When symptoms occur: go into open air and ventilate suspected area. Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER/doctor/physician if you feel unwell

**Skin Contact:** Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation persists. Thaw frosted parts with lukewarm water. Do not rub affected area.

**Eye Contact:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation persists

**Ingestion:** Rinse mouth. Do NOT induce vomiting. Get immediate medical attention.

#### Most Important Symptoms and Effects Both Acute and Delayed

**General:** May cause frostbite on contact with the liquid. Butane is an asphyxiant. Lack of oxygen can be fatal

**Inhalation:** Gas can be toxic as a simple asphyxiant by displacing oxygen from the air. Asphyxia by lack of oxygen: risk of death. May cause drowsiness or dizziness

**Skin Contact:** Contact with the liquid may cause cold burns/frostbite

**Eye Contact:** This gas is non-irritating; but direct contact with liquefied/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns

**Ingestion:** Ingestion is not considered a potential route of exposure. Non-irritating; but solid and liquid forms of this material and pressurized gas may cause freeze burns.

**Chronic Symptoms:** Contains a small amount of Hydrogen Sulfide, symptoms of overexposure are headaches, dizziness, nausea, coughing, respiratory irritation, eye irritation, skin irritation, pain in the nose, and loss of consciousness. Heating of the product may release higher amounts of Hydrogen Sulfide (H<sub>2</sub>S).

#### Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention.

### SECTION 5: FIREFIGHTING MEASURES

#### Extinguishing Media

**Suitable Extinguishing Media:** Foam, dry chemical, carbon dioxide, water spray, fog

**Unsuitable Extinguishing Media:** Do not use a heavy water stream. Use of heavy stream of water may spread fire

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### Special Hazards Arising From the Substance or Mixture

**Fire Hazard:** Extremely flammable gas

**Explosion Hazard:** May form flammable/explosive vapor-air mixture. Heating may cause an explosion. Heat may build pressure, rupturing closed containers, spreading fire and increasing risk of burns and injuries.

**Reactivity:** Hazardous reactions will not occur under normal conditions.

### Advice for Firefighters

**Precautionary Measures Fire:** Exercise caution when fighting any chemical fire

**Firefighting Instructions:** Leaking gas fire: Do not extinguish, unless leak can be stopped safely. In case of leaking gas fire, eliminate all ignition sources if safe to do so. Use water spray or fog for cooling exposed containers. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

**Protection During Firefighting:** Do not enter fire area without proper protective equipment, including respiratory protection.

**Hazardous Combustion Products:** Carbon oxides (CO, CO<sub>2</sub>). Hydrocarbon, sulfur dioxide (SO<sub>2</sub>), and Hydrogen sulfide (H<sub>2</sub>S) fatal and irritating gases

**Other information:** Do not allow run-off from fire fighting to enter drains or water courses

### Reference to Other Sections

Refer to section 9 for flammability properties.

## **SECTION 6: ACCIDENTAL RELEASE MEASURES**

### Personal Precautions, Protective Equipment and Emergency Procedures

**General Measures:** Use special care to avoid static electric charges. Eliminate every possible source of ignition. Keep away from heat/sparks/open flames/hot surfaces - No smoking. Avoid breathing (dust, vapor, mist, gas). Use only outdoors or in a well-ventilated area. Ruptured cylinders may rocket. Do not allow product to spread into the environment

#### For Non-Emergency Personnel

**Protective Equipment:** Use appropriate personal protection equipment (PPE).

**Emergency Procedures:** Evacuate unnecessary personnel.

#### For Emergency Personnel

**Protective Equipment:** Equip cleanup crew with proper protection.

**Emergency Procedures:** Ventilate area.

### Environmental Precautions

Prevent entry to sewers and public waters. Avoid release to the environment

### Methods and Material for Containment and Cleaning Up

**For Containment:** Notify authorities if liquid enters sewers or public waters. Use only non-sparking tools

**Methods for Cleaning Up:** Clear up spills immediately and dispose of waste safely. Isolate area until gas has dispersed. Use water spray to disperse vapors. For water based spills contact appropriate authorities and abide by local regulations for hydrocarbon spills into waterways. Contact competent authorities after a spill

### Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection.

## **SECTION 7: HANDLING AND STORAGE**

### Precautions for Safe Handling

**Additional Hazards When Processed:** Handle empty containers with care because residual vapors are flammable. Extremely flammable gas. Do not pressurize, cut, or weld containers. Do not puncture or incinerate container. Liquid gas can cause frost-type burns. If stored under heat for extended periods or significantly agitated, this material might evolve or release hydrogen sulfide, a toxic, flammable gas, which can raise and widen this material's actual flammability limits and significantly lower its auto-ignition temperature. Hydrogen sulfide can be fatal.

**Hygiene Measures:** Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work. Do not eat, drink or smoke when using this product

**Technical Measures:** Proper grounding procedures to avoid static electricity should be followed. Comply with applicable regulations.

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**Storage Conditions:** Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep in fireproof place. Store in a well-ventilated place. Keep container tightly closed. Keep/Store away from extremely high or low temperatures, ignition sources, direct sunlight, incompatible materials. Store in original container.

**Incompatible Materials:** strong acids, Strong bases, Strong oxidizers, chlorine, Halogenated compounds

**Conditions for Safe Storage, Including Any Incompatibilities** Not available

### Specific End Use(s)

Fuel.

## SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

### Control Parameters

<b>Hydrogen sulfide (7783-06-4)</b>		
USA ACGIH	ACGIH TWA (ppm)	1 ppm
USA ACGIH	ACGIH STEL (ppm)	5 ppm
USA OSHA	OSHA PEL (Ceiling) (ppm)	20 ppm
USA NIOSH	NIOSH REL (ceiling) (mg/m <sup>3</sup> )	15 mg/m <sup>3</sup>
USA NIOSH	NIOSH REL (ceiling) (ppm)	10 ppm
USA IDLH	US IDLH (ppm)	100 ppm
Alberta	OEL Ceiling (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Alberta	OEL Ceiling (ppm)	15 ppm
Alberta	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Alberta	OEL TWA (ppm)	10 ppm
British Columbia	OEL Ceiling (ppm)	10 ppm
Manitoba	OEL STEL (ppm)	5 ppm
Manitoba	OEL TWA (ppm)	1 ppm
New Brunswick	OEL STEL (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
New Brunswick	OEL STEL (ppm)	15 ppm
New Brunswick	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
New Brunswick	OEL TWA (ppm)	10 ppm
Newfoundland & Labrador	OEL STEL (ppm)	5 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1 ppm
Nova Scotia	OEL STEL (ppm)	5 ppm
Nova Scotia	OEL TWA (ppm)	1 ppm
Nunavut	OEL Ceiling (mg/m <sup>3</sup> )	28 mg/m <sup>3</sup>
Nunavut	OEL Ceiling (ppm)	20 ppm
Nunavut	OEL STEL (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Nunavut	OEL STEL (ppm)	15 ppm
Nunavut	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Nunavut	OEL TWA (ppm)	10 ppm
Northwest Territories	OEL Ceiling (mg/m <sup>3</sup> )	28 mg/m <sup>3</sup>
Northwest Territories	OEL Ceiling (ppm)	20 ppm
Northwest Territories	OEL STEL (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Northwest Territories	OEL STEL (ppm)	15 ppm
Northwest Territories	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Northwest Territories	OEL TWA (ppm)	10 ppm
Ontario	OEL STEL (ppm)	15 ppm
Ontario	OEL TWA (ppm)	10 ppm
Prince Edward Island	OEL STEL (ppm)	5 ppm
Prince Edward Island	OEL TWA (ppm)	1 ppm
Québec	VECD (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Québec	VECD (ppm)	15 ppm

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Québec	VEMP (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Québec	VEMP (ppm)	10 ppm
Saskatchewan	OEL STEL (ppm)	15 ppm
Saskatchewan	OEL TWA (ppm)	10 ppm
Yukon	OEL STEL (mg/m <sup>3</sup> )	27 mg/m <sup>3</sup>
Yukon	OEL STEL (ppm)	15 ppm
Yukon	OEL TWA (mg/m <sup>3</sup> )	15 mg/m <sup>3</sup>
Yukon	OEL TWA (ppm)	10 ppm

### Propane (74-98-6)

USA ACGIH	ACGIH TWA (ppm)	1000 ppm
USA OSHA	OSHA PEL (TWA) (mg/m <sup>3</sup> )	1800 mg/m <sup>3</sup>
USA OSHA	OSHA PEL (TWA) (ppm)	1000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m <sup>3</sup> )	1800 mg/m <sup>3</sup>
USA NIOSH	NIOSH REL (TWA) (ppm)	1000 ppm
USA IDLH	US IDLH (ppm)	2100 ppm (10% LEL)
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Québec	VEMP (mg/m <sup>3</sup> )	1800 mg/m <sup>3</sup>
Québec	VEMP (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm

### Butane (106-97-8)

USA ACGIH	ACGIH TWA (ppm)	1000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m <sup>3</sup> )	1900 mg/m <sup>3</sup>
USA NIOSH	NIOSH REL (TWA) (ppm)	800 ppm
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL STEL (ppm)	750 ppm
British Columbia	OEL TWA (ppm)	600 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
New Brunswick	OEL TWA (mg/m <sup>3</sup> )	1900 mg/m <sup>3</sup>
New Brunswick	OEL TWA (ppm)	800 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Nunavut	OEL STEL (mg/m <sup>3</sup> )	2576 mg/m <sup>3</sup>
Nunavut	OEL STEL (ppm)	1000 ppm
Nunavut	OEL TWA (mg/m <sup>3</sup> )	1901 mg/m <sup>3</sup>
Nunavut	OEL TWA (ppm)	800 ppm
Northwest Territories	OEL STEL (mg/m <sup>3</sup> )	2576 mg/m <sup>3</sup>
Northwest Territories	OEL STEL (ppm)	1000 ppm
Northwest Territories	OEL TWA (mg/m <sup>3</sup> )	1901 mg/m <sup>3</sup>
Northwest Territories	OEL TWA (ppm)	800 ppm
Ontario	OEL TWA (ppm)	800 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Québec	VEMP (mg/m <sup>3</sup> )	1900 mg/m <sup>3</sup>

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Québec	VEMP (ppm)	800 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm
Yukon	OEL STEL (mg/m <sup>3</sup> )	1600 mg/m <sup>3</sup>
Yukon	OEL STEL (ppm)	750 ppm
Yukon	OEL TWA (mg/m <sup>3</sup> )	1400 mg/m <sup>3</sup>
Yukon	OEL TWA (ppm)	600 ppm
<b>Carbon dioxide (124-38-9)</b>		
USA ACGIH	ACGIH TWA (ppm)	5000 ppm
USA ACGIH	ACGIH STEL (ppm)	30000 ppm
USA OSHA	OSHA PEL (TWA) (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
USA OSHA	OSHA PEL (TWA) (ppm)	5000 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
USA NIOSH	NIOSH REL (TWA) (ppm)	5000 ppm
USA NIOSH	NIOSH REL (STEL) (mg/m <sup>3</sup> )	54000 mg/m <sup>3</sup>
USA NIOSH	NIOSH REL (STEL) (ppm)	30000 ppm
USA IDLH	US IDLH (ppm)	40000 ppm
Alberta	OEL STEL (mg/m <sup>3</sup> )	54000 mg/m <sup>3</sup>
Alberta	OEL STEL (ppm)	30000 ppm
Alberta	OEL TWA (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
Alberta	OEL TWA (ppm)	5000 ppm
British Columbia	OEL STEL (ppm)	15000 ppm
British Columbia	OEL TWA (ppm)	5000 ppm
Manitoba	OEL STEL (ppm)	30000 ppm
Manitoba	OEL TWA (ppm)	5000 ppm
New Brunswick	OEL STEL (mg/m <sup>3</sup> )	54000 mg/m <sup>3</sup>
New Brunswick	OEL STEL (ppm)	30000 ppm
New Brunswick	OEL TWA (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
New Brunswick	OEL TWA (ppm)	5000 ppm
Newfoundland & Labrador	OEL STEL (ppm)	30000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	5000 ppm
Nova Scotia	OEL STEL (ppm)	30000 ppm
Nova Scotia	OEL TWA (ppm)	5000 ppm
Nunavut	OEL STEL (mg/m <sup>3</sup> )	27000 mg/m <sup>3</sup>
Nunavut	OEL STEL (ppm)	15000 ppm
Nunavut	OEL TWA (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
Nunavut	OEL TWA (ppm)	5000 ppm
Northwest Territories	OEL STEL (mg/m <sup>3</sup> )	27000 mg/m <sup>3</sup>
Northwest Territories	OEL STEL (ppm)	15000 ppm
Northwest Territories	OEL TWA (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
Northwest Territories	OEL TWA (ppm)	5000 ppm
Ontario	OEL STEL (ppm)	30000 ppm
Ontario	OEL TWA (ppm)	5000 ppm
Prince Edward Island	OEL STEL (ppm)	30000 ppm
Prince Edward Island	OEL TWA (ppm)	5000 ppm
Québec	VECD (mg/m <sup>3</sup> )	54000 mg/m <sup>3</sup>
Québec	VECD (ppm)	30000 ppm
Québec	VEMP (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
Québec	VEMP (ppm)	5000 ppm
Saskatchewan	OEL STEL (ppm)	30000 ppm

# Wellhead Natural Gas

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Saskatchewan	OEL TWA (ppm)	5000 ppm
Yukon	OEL STEL (mg/m <sup>3</sup> )	27000 mg/m <sup>3</sup>
Yukon	OEL STEL (ppm)	15000 ppm
Yukon	OEL TWA (mg/m <sup>3</sup> )	9000 mg/m <sup>3</sup>
Yukon	OEL TWA (ppm)	5000 ppm
<b>Nitrogen (7727-37-9)</b>		
<b>Methane (74-82-8)</b>		
USA ACGIH	ACGIH TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm
<b>Ethane (74-84-0)</b>		
USA ACGIH	ACGIH TWA (ppm)	1000 ppm
Alberta	OEL TWA (ppm)	1000 ppm
British Columbia	OEL TWA (ppm)	1000 ppm
Manitoba	OEL TWA (ppm)	1000 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1000 ppm
Nova Scotia	OEL TWA (ppm)	1000 ppm
Ontario	OEL TWA (ppm)	1000 ppm
Prince Edward Island	OEL TWA (ppm)	1000 ppm
Saskatchewan	OEL STEL (ppm)	1250 ppm
Saskatchewan	OEL TWA (ppm)	1000 ppm

### Exposure Controls

**Appropriate Engineering Controls:** Gas detectors should be used when flammable gases/vapours may be released. Ensure adequate ventilation, especially in confined areas. Proper grounding procedures to avoid static electricity should be followed. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use explosion-proof equipment

**Personal Protective Equipment:** Protective goggles. Protective clothing. Respiratory protection of the dependent type. Insulated gloves



**Materials for Protective Clothing:** Chemically resistant materials and fabrics. Wear fire/flammable resistant/retardant clothing

**Hand Protection:** Wear chemically resistant protective gloves. Insulated gloves

**Eye Protection:** Chemical goggles or face shield.

**Skin and Body Protection:** Not available

**Respiratory Protection:** Use a NIOSH-approved self-contained breathing apparatus whenever exposure may exceed established Occupational Exposure Limits.

**Thermal Hazard Protection:** Wear suitable protective clothing.

**Other Information:** When using, do not eat, drink or smoke.

## SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

### Information on Basic Physical and Chemical Properties

**Physical State** : Gas

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<b>Appearance</b>	: Clear, Colorless gas
<b>Odor</b>	: Contains Ethyl Mercaptan for leak detection, which has a skunk-like odor, odorless.
<b>Odor Threshold</b>	: Not available
<b>pH</b>	: Not available
<b>Relative Evaporation Rate (butylacetate=1)</b>	: Not available
<b>Melting Point</b>	: Not available
<b>Freezing Point</b>	: Not available
<b>Boiling Point</b>	: -157 °C (-250.6°F)
<b>Flash Point</b>	: -187 °C (-304.6°F)
<b>Auto-ignition Temperature</b>	: > 288 °C (>550.4°F)
<b>Decomposition Temperature</b>	: Not available
<b>Flammability (solid, gas)</b>	: Extremely flammable gas
<b>Lower Flammable Limit</b>	: 3 %
<b>Upper Flammable Limit</b>	: 17 %
<b>Vapor Pressure</b>	: 40 mm Hg @25°C (77°F)
<b>Relative Vapor Density at 20 °C</b>	: 0.6
<b>Relative Density</b>	: Not available
<b>Specific Gravity</b>	: Not available
<b>Solubility</b>	: Not available
<b>Log Pow</b>	: Not available
<b>Log Kow</b>	: Not available
<b>Viscosity, Kinematic</b>	: Not available
<b>Viscosity, Dynamic</b>	: Not available
<b>Explosion Data – Sensitivity to Mechanical Impact</b>	: Not available
<b>Explosion Data – Sensitivity to Static Discharge</b>	: Not available

### SECTION 10: STABILITY AND REACTIVITY

**Reactivity:** Hazardous reactions will not occur under normal conditions.

**Chemical Stability:** Extremely flammable gas. Stable at standard temperature and pressure.

**Possibility of Hazardous Reactions:** Hazardous polymerization will not occur.

**Conditions to Avoid:** Direct sunlight. Extremely high or low temperatures. Open flame. Overheating. Heat. Sparks. Incompatible materials. Avoid ignition sources

**Incompatible Materials:** Strong acids. Strong bases. Strong oxidizers. Halogenated compounds. Chlorine

**Hazardous Decomposition Products:** Carbon oxides (CO, CO<sub>2</sub>). hydrocarbons. Sulfur dioxide and hydrogen sulfide are fatal and irritating gases.

### SECTION 11: TOXICOLOGICAL INFORMATION

#### Information on Toxicological Effects - Product

**Acute Toxicity** : Not classified

**LD50 and LC50 Data** Not available

**Skin Corrosion/Irritation:** Not classified

**Serious Eye Damage/Irritation:** Not classified

**Respiratory or Skin Sensitization:** Not classified

**Germ Cell Mutagenicity:** Not classified

**Teratogenicity:** Not available

**Carcinogenicity:** Not classified

**Specific Target Organ Toxicity (Repeated Exposure):** Not classified

**Reproductive Toxicity:** Not classified

**Specific Target Organ Toxicity (Single Exposure):** Not classified

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**Aspiration Hazard:** Not classified

**Symptoms/Injuries After Inhalation:** Gas can be toxic as a simple asphyxiant by displacing oxygen from the air. Asphyxia by lack of oxygen: risk of death. May cause drowsiness or dizziness.

**Symptoms/Injuries After Skin Contact:** Contact with the liquid may cause cold burns/frostbite.

**Symptoms/Injuries After Eye Contact:** This gas is non-irritating; but direct contact with liquefied/pressurized gas or frost particles may produce severe and possibly permanent eye damage from freeze burns.

**Symptoms/Injuries After Ingestion:** Ingestion is not considered a potential route of exposure. Non-irritating; but solid and liquid forms of this material and pressurized gas may cause freeze burns.

### Information on Toxicological Effects - Ingredient(s)

#### LD50 and LC50 Data

<b>Hydrogen sulfide (7783-06-4)</b>	
LC50 Inhalation Rat (mg/l)	0.99 mg/l (Exposure time: 1 h)
ATE (gases)	100.000 ppmV/4h
<b>Propane (74-98-6)</b>	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)
<b>Butane (106-97-8)</b>	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)
<b>Ethane (74-84-0)</b>	
LC50 Inhalation Rat (mg/l)	658 mg/l (Exposure time: 4 h)

## SECTION 12: ECOLOGICAL INFORMATION

### Toxicity

<b>Wellhead Natural Gas (CAS Mixture)</b>	
LC50 Fish 1	0.002 mg/l (Exposure time: 96 h - Species: Coregonus clupeaformis)
<b>Hydrogen sulfide (7783-06-4)</b>	
LC50 Fish 1	0.0448 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [flow-through])
EC50 Daphnia 1	0.022 mg/l (Exposure time: 96 h - Species: Gammarus pseudolimnaeus)
LC 50 Fish 2	0.016 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])

### Persistence and Degradability

<b>Wellhead Natural Gas</b>	
Persistence and Degradability	Not established.

### Bioaccumulative Potential

<b>Wellhead Natural Gas</b>	
Bioaccumulative Potential	Not established.
<b>Hydrogen sulfide (7783-06-4)</b>	
BCF fish 1	(no bioaccumulation expected)
Log Pow	0.45 (at 25 °C)
<b>Propane (74-98-6)</b>	
Log Pow	2.3
<b>Butane (106-97-8)</b>	
Log Pow	2.89
<b>Carbon dioxide (124-38-9)</b>	
BCF fish 1	(no bioaccumulation)
Log Pow	0.83
<b>Ethane (74-84-0)</b>	
Log Pow	<= 2.8

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**Mobility in Soil** Not available

### **Other Adverse Effects**

**Other adverse effects:** Can cause frost damage to vegetation. Has photochemical ozone creation potential.

**Other Information:** Avoid release to the environment.

## **SECTION 13: DISPOSAL CONSIDERATIONS**

**Waste Disposal Recommendations:** Dispose of waste material in accordance with all local, regional, national, provincial, territorial and international regulations.

**Additional Information:** Handle empty containers with care because residual vapors are flammable. Empty gas cylinders should be returned to the vendor for recycling or refilling.

## **SECTION 14: TRANSPORT INFORMATION**

In Accordance With ICAO/IATA/DOT/TDG

### **UN Number**

UN-No.(DOT): 1971

DOT NA no.: UN1971

### **UN Proper Shipping Name**

DOT Proper Shipping Name : Natural gas, compressed  
(with high methane content)

Hazard Labels (DOT) : 2.1 - Flammable gases



DOT Packaging Exceptions (49 CFR 173.xxx) : 306

DOT Packaging Non Bulk (49 CFR 173.xxx) : 302

DOT Packaging Bulk (49 CFR 173.xxx) : 302

### **Additional Information**

Emergency Response Guide (ERG) Number : 115

### **Transport by sea**

DOT Vessel Stowage Location : E - The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length, but is prohibited from carriage on passenger vessels in which the limiting number of passengers is exceeded.

DOT Vessel Stowage Other : 40 - Stow "clear of living quarters"

### **Air transport**

DOT Quantity Limitations Passenger Aircraft/Rail (49 CFR 173.27) : Forbidden

DOT Quantity Limitations Cargo Aircraft Only (49 CFR 175.75) : 150 kg

## **SECTION 15: REGULATORY INFORMATION**

### **US Federal Regulations**

<b>Wellhead Natural Gas</b>	
<b>SARA Section 311/312 Hazard Classes</b>	Fire hazard Immediate (acute) health hazard Sudden release of pressure hazard
<b>Hydrogen sulfide (7783-06-4)</b>	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 302 (Specific toxic chemical listings) Listed on SARA Section 313 (Specific toxic chemical listings)	
<b>SARA Section 302 Threshold Planning Quantity (TPQ)</b>	500
<b>SARA Section 313 - Emission Reporting</b>	1.0 %

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### Propane (74-98-6)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### Butane (106-97-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### Carbon dioxide (124-38-9)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### Nitrogen (7727-37-9)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### Methane (74-82-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### Ethane (74-84-0)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

## US State Regulations

### Hydrogen sulfide (7783-06-4)

U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Acute  
 U.S. - California - SCAQMD - Toxic Air Contaminants - Non-Cancer Chronic  
 U.S. - California - Toxic Air Contaminant List (AB 1807, AB 2728)  
 U.S. - Colorado - Hazardous Wastes - Discarded Chemical Products, Off-Specification Species, Container and Spill Residues  
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)  
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)  
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Toxic Endpoints  
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities  
 U.S. - Hawaii - Occupational Exposure Limits - STELs  
 U.S. - Hawaii - Occupational Exposure Limits - TWAs  
 U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations  
 U.S. - Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)  
 U.S. - Idaho - Occupational Exposure Limits - Acceptable Maximum Peak Above the Ceiling Concentration for an 8-Hour Shift  
 U.S. - Idaho - Occupational Exposure Limits - Ceilings  
 U.S. - Idaho - Occupational Exposure Limits - TWAs  
 U.S. - Louisiana - Reportable Quantity List for Pollutants  
 U.S. - Maine - Air Pollutants - Hazardous Air Pollutants  
 U.S. - Massachusetts - Allowable Ambient Limits (AALs)  
 U.S. - Massachusetts - Allowable Threshold Concentrations (ATCs)  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Massachusetts - Threshold Effects Exposure Limits (TEELs)  
 U.S. - Michigan - Occupational Exposure Limits - STELs  
 U.S. - Michigan - Occupational Exposure Limits - TWAs  
 U.S. - Michigan - Polluting Materials List  
 U.S. - Michigan - Process Safety Management Highly Hazardous Chemicals  
 U.S. - Minnesota - Chemicals of High Concern  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - Minnesota - Permissible Exposure Limits - STELs  
 U.S. - Minnesota - Permissible Exposure Limits - TWAs

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U.S. - Montana - Ambient Air Quality Standards  
 U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour  
 U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual  
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances  
 U.S. - New Jersey - Environmental Hazardous Substances List  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New Jersey - Special Health Hazards Substances List  
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)  
 U.S. - New Mexico - Air Quality - Ambient Air Quality Standards  
 U.S. - New York - Occupational Exposure Limits - TWAs  
 U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances  
 U.S. - North Carolina - Control of Toxic Air Pollutants  
 U.S. - North Dakota - Ambient Air Quality Standards - Maximum Permissible Concentrations  
 U.S. - North Dakota - Hazardous Wastes - Discarded Chemical Products, Off-Specification Species, Container and Spill Residues  
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities  
 U.S. - Ohio - Extremely Hazardous Substances - Threshold Quantities  
 U.S. - Oregon - Permissible Exposure Limits - Ceilings  
 U.S. - Oregon - Permissible Exposure Limits - STELs  
 U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 1-Hour  
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 24-Hour  
 U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - Annual  
 U.S. - South Carolina - Toxic Air Pollutants - Maximum Allowable Concentrations  
 U.S. - South Carolina - Toxic Air Pollutants - Pollutant Categories  
 U.S. - Tennessee - Occupational Exposure Limits - STELs  
 U.S. - Tennessee - Occupational Exposure Limits - TWAs  
 U.S. - Texas - Drinking Water Standards - Secondary Constituent Levels (SCLs)  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Vermont - Hazardous Waste - Hazardous Constituents  
 U.S. - Vermont - Permissible Exposure Limits - STELs  
 U.S. - Vermont - Permissible Exposure Limits - TWAs  
 U.S. - Virginia - Water Quality Standards - Chronic Freshwater Aquatic Life  
 U.S. - Virginia - Water Quality Standards - Chronic Saltwater Aquatic Life  
 U.S. - Washington - Dangerous Waste - Dangerous Waste Constituents List  
 U.S. - Washington - Dangerous Waste - Discarded Chemical Products List  
 U.S. - Washington - Permissible Exposure Limits - STELs  
 U.S. - Washington - Permissible Exposure Limits - TWAs  
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 25 Feet to Less Than 40 Feet  
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 40 Feet to Less Than 75 Feet  
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 75 Feet or Greater  
 U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights Less Than 25 Feet  
 U.S. - Wyoming - Process Safety Management - Highly Hazardous Chemicals  
 U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Fresh Water  
 U.S. - Alaska - Water Quality Standards - Chronic Aquatic Life Criteria for Marine Water

### Propane (74-98-6)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)  
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)  
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities  
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities

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U.S. - Hawaii - Occupational Exposure Limits - TWAs  
 U.S. - Idaho - Occupational Exposure Limits - TWAs  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Michigan - Occupational Exposure Limits - TWAs  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - Minnesota - Permissible Exposure Limits - TWAs  
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances  
 U.S. - New Jersey - Environmental Hazardous Substances List  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New Jersey - Special Health Hazards Substances List  
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)  
 U.S. - New York - Occupational Exposure Limits - TWAs  
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities  
 U.S. - Oregon - Permissible Exposure Limits - TWAs  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Tennessee - Occupational Exposure Limits - TWAs  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Vermont - Permissible Exposure Limits - TWAs  
 U.S. - Washington - Permissible Exposure Limits - STELs  
 U.S. - Washington - Permissible Exposure Limits - TWAs

### Butane (106-97-8)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)  
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)  
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities  
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities  
 U.S. - Hawaii - Occupational Exposure Limits - TWAs  
 U.S. - Maine - Chemicals of High Concern  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Michigan - Occupational Exposure Limits - TWAs  
 U.S. - Minnesota - Chemicals of High Concern  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - Minnesota - Permissible Exposure Limits - TWAs  
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances  
 U.S. - New Jersey - Environmental Hazardous Substances List  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New Jersey - Special Health Hazards Substances List  
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)  
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities  
 U.S. - Oregon - Permissible Exposure Limits - TWAs  
 U.S. - Pennsylvania - RTK (Right to Know) List

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U.S. - Tennessee - Occupational Exposure Limits - TWAs  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Vermont - Permissible Exposure Limits - TWAs  
 U.S. - Washington - Permissible Exposure Limits - STELS  
 U.S. - Washington - Permissible Exposure Limits - TWAs

### Carbon dioxide (124-38-9)

U.S. - Hawaii - Occupational Exposure Limits - STELS  
 U.S. - Hawaii - Occupational Exposure Limits - TWAs  
 U.S. - Idaho - Occupational Exposure Limits - TWAs  
 U.S. - Maine - Air Pollutants - Greenhouse Gases (GHG)  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements  
 U.S. - Michigan - Occupational Exposure Limits - STELS  
 U.S. - Michigan - Occupational Exposure Limits - TWAs  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - Minnesota - Permissible Exposure Limits - STELS  
 U.S. - Minnesota - Permissible Exposure Limits - TWAs  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New York - Occupational Exposure Limits - TWAs  
 U.S. - Oregon - Permissible Exposure Limits - TWAs  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Tennessee - Occupational Exposure Limits - STELS  
 U.S. - Tennessee - Occupational Exposure Limits - TWAs  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Vermont - Permissible Exposure Limits - STELS  
 U.S. - Vermont - Permissible Exposure Limits - TWAs  
 U.S. - Washington - Permissible Exposure Limits - STELS  
 U.S. - Washington - Permissible Exposure Limits - TWAs

### Nitrogen (7727-37-9)

U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

### Methane (74-82-8)

U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities  
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities  
 U.S. - Delaware - Volatile Organic Compounds Exempt from Requirements  
 U.S. - Maine - Air Pollutants - Greenhouse Gases (GHG)  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements

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U.S. - Minnesota - Hazardous Substance List  
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances  
 U.S. - New Jersey - Environmental Hazardous Substances List  
 U.S. - New Jersey - Excluded Volatile Organic Compounds  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New Jersey - Special Health Hazards Substances List  
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)  
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities  
 U.S. - Oregon - Permissible Exposure Limits - TWAs  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

### Ethane (74-84-0)

U.S. - Connecticut - Hazardous Air Pollutants - HLVs (30 min)  
 U.S. - Connecticut - Hazardous Air Pollutants - HLVs (8 hr)  
 U.S. - Delaware - Accidental Release Prevention Regulations - Sufficient Quantities  
 U.S. - Delaware - Accidental Release Prevention Regulations - Threshold Quantities  
 U.S. - Delaware - Pollutant Discharge Requirements - Reportable Quantities  
 U.S. - Delaware - Volatile Organic Compounds Exempt from Requirements  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1  
 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2  
 U.S. - Massachusetts - Right To Know List  
 U.S. - Massachusetts - Volatile Organic Compounds Exempt From Requirements  
 U.S. - Minnesota - Hazardous Substance List  
 U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances  
 U.S. - New Jersey - Environmental Hazardous Substances List  
 U.S. - New Jersey - Excluded Volatile Organic Compounds  
 U.S. - New Jersey - Right to Know Hazardous Substance List  
 U.S. - New Jersey - Special Health Hazards Substances List  
 U.S. - New Jersey - TCPA - Extraordinarily Hazardous Substances (EHS)  
 U.S. - Ohio - Accidental Release Prevention - Threshold Quantities  
 U.S. - Oregon - Permissible Exposure Limits - TWAs  
 U.S. - Pennsylvania - RTK (Right to Know) List  
 U.S. - Texas - Effects Screening Levels - Long Term  
 U.S. - Texas - Effects Screening Levels - Short Term  
 U.S. - Washington - Permissible Exposure Limits - Simple Asphyxiants

### Canadian Regulations

#### Wellhead Natural Gas

WHMIS Classification	Class B Division 1 - Flammable Gas Class A - Compressed Gas
----------------------	--



#### Hydrogen sulfide (7783-06-4)

Listed on the Canadian DSL (Domestic Substances List) inventory.  
 Listed on the Canadian Ingredient Disclosure List

# Wellhead Natural Gas

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects
----------------------	---

### Propane (74-98-6)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

### Butane (106-97-8)

Listed on the Canadian DSL (Domestic Substances List) inventory.

Listed on the Canadian Ingredient Disclosure List

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

### Carbon dioxide (124-38-9)

Listed on the Canadian DSL (Domestic Substances List) inventory.

Listed on the Canadian Ingredient Disclosure List

WHMIS Classification	Class A - Compressed Gas
----------------------	--------------------------

### Nitrogen (7727-37-9)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas
----------------------	--------------------------

### Methane (74-82-8)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

### Ethane (74-84-0)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas
----------------------	--

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by CPR.

## SECTION 16: OTHER INFORMATION

**Revision date** : 10/02/2013

**Other Information** : This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200

### GHS Full Text Phrases:

Acute Tox. 2 (Inhalation:gas)	Acute toxicity (inhalation:gas) Category 2
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Compressed gas	Gases under pressure Compressed gas
Flam. Gas 1	Flammable gases Category 1
Liquefied gas	Gases under pressure Liquefied gas
Simple Asphy	Simple Asphyxiant
H220	Extremely flammable gas
H280	Contains gas under pressure; may explode if heated
H330	Fatal if inhaled
H400	Very toxic to aquatic life

### Party Responsible for the Preparation of This Document

# Wellhead Natural Gas

## Safety Data Sheet

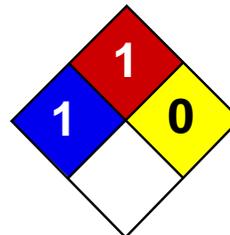
according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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Williams, Inc.  
One Williams Center  
Tulsa, OK 74172, US  
800-688-7507

*This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product*

North America GHS US 2012 & WHMIS



Health	1
Fire	1
Reactivity	0
Personal Protection	J

## Material Safety Data Sheet

### Triethylene glycol MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Triethylene glycol

**Catalog Codes:** SLT2644

**CAS#:** 112-27-6

**RTECS:** YE4550000

**TSCA:** TSCA 8(b) inventory: Triethylene glycol

**CI#:** Not available.

**Synonym:** 2,2'-[1,2-Ethanediy]bis(oxy)]bisethanol

**Chemical Formula:** C<sub>6</sub>H<sub>14</sub>O<sub>4</sub>

**Contact Information:**

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

#### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Triethylene glycol	112-27-6	100

**Toxicological Data on Ingredients:** Triethylene glycol: ORAL (LD50): Acute: 17000 mg/kg [Rat].

#### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Very hazardous in case of eye contact (irritant), of ingestion. Slightly hazardous in case of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

**Potential Chronic Health Effects:**

Very hazardous in case of eye contact (irritant). Slightly hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system. Repeated or prolonged exposure to the substance can produce target organs damage.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

**Skin Contact:** No known effect on skin contact, rinse with water for a few minutes.

**Serious Skin Contact:** Not available.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** 371°C (699.8°F)

**Flash Points:** CLOSED CUP: 177°C (350.6°F). OPEN CUP: 165.5°C (329.9°F).

**Flammable Limits:** LOWER: 0.9% UPPER: 9.2%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

## Section 7: Handling and Storage

**Precautions:**

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes. If ingested, seek medical advice immediately and show the container or the label.

**Storage:**

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:** Splash goggles. Lab coat.

### Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:** Not available.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Hygroscopic liquid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 150.18 g/mole

**Color:** Colorless.

**pH (1% soln/water):** Not available.

**Boiling Point:** 285°C (545°F)

**Melting Point:** -5°C (23°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.1274 (Water = 1)

**Vapor Pressure:** Not available.

**Vapor Density:** 5.17 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water.

**Solubility:** Easily soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

### Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Ingestion.

**Toxicity to Animals:** Acute oral toxicity (LD50): 17000 mg/kg [Rat].

**Chronic Effects on Humans:** The substance is toxic to kidneys, the nervous system.

**Other Toxic Effects on Humans:**

Very hazardous in case of ingestion. Slightly hazardous in case of inhalation.

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:** Not available.

### Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information

**DOT Classification:** Not a DOT controlled material (United States).

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

### Section 15: Other Regulatory Information

**Federal and State Regulations:**

Pennsylvania RTK: Triethylene glycol TSCA 8(b) inventory: Triethylene glycol

**Other Regulations:** OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

**Other Classifications:**

**WHMIS (Canada):** Not controlled under WHMIS (Canada).

**DSCL (EEC):** R41- Risk of serious damage to eyes.

**HMIS (U.S.A.):**

**Health Hazard:** 1

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** j

**National Fire Protection Association (U.S.A.):**

**Health:** 1

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Not applicable. Lab coat. Not applicable. Splash goggles.

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:31 PM

**Last Updated:** 05/21/2013 12:00 PM

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.*

**ATTACHMENT I**  
**Emission Units Table**

---

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

---

- **Emissions Unit Table**
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit

**Attachment I**

**EMISSION UNITS TABLE**

(Include all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status.)

Emission Unit ID <sup>1</sup>	Emission Point ID <sup>2</sup>	Emission Unit Description	Year Installed/Modified	Design Capacity	Type <sup>3</sup> and Date of Change	Control Device <sup>4</sup>
DFT-01	1E	Flash Tank 01	2013/tbd	65.0 MMscfd	Modified	na
DSV-01	2E	Still Vent (Regenerator) 01	2013/tbd		Modified	na
RBV-01	3E	Reboiler 01	2013/tbd	1.50 MMBtu/hr	Modified	na
DFT-02	4E	Flash Tank 02	tbd/---	100.0 MMscfd	New	na
DSV-02	5E	Still Vent (Regenerator) 02	tbd/---		New	BTEX-01
RBV-02	6E	Reboiler 02	tbd/---	2.00 MMBtu/hr	New	na
SSM	7E	Pigging and Pneumatic Pumps	2013/tbd	na	Modified	na
FUG	1F	Process Piping Fugitives - Gas	2013/tbd	1,001 fittings	Modified	na
<b>Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:</b>						
DFT-02alt	4Ealt	Flash Tank 02alt	tbd/---	50.0 MMscfd	New	na
DSV-02alt	5Ealt	Still Vent (Regenerator) 02alt	tbd/---		New	na
RBV-02alt	6Ealt	Reboiler 02alt	tbd/---	1.00 MMBtu/hr	New	na

<sup>1</sup> For Emission Units (or Sources) use the following numbering system: 1S, 2S, 3S, ... or other appropriate designation.  
<sup>2</sup> For Emission Points use the following numbering system: 1E, 2E, 3E, ... or other appropriate designation.  
<sup>3</sup> New, modification, removal, etc.  
<sup>4</sup> For Control Devices use the following numbering system: 1C, 2C, 3C, ... or other appropriate designation.

## ATTACHMENT J

### Emission Points Data Summary Sheet

---

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

---

- **Table 1 – Emissions Data**
    - 65.0 MMscfd Dehydrator Flash Tank 01
    - 65.0 MMscfd Dehydrator Still Vent (Regenerator) 01
    - 1.50 MMBtu/hr Dehydrator Reboiler 01
    - 100.0 MMscfd Dehydrator Flash Tank 02
    - 100.0 MMscfd Dehydrator Still Vent (Regenerator) 02
    - 2.00 MMBtu/hr Dehydrator Reboiler 02
    - Pigging / Pneumatic Pumps
    - 50.0 MMscfd Dehydrator Flash Tank 02 ALTERNATIVE
    - 50.0 MMscfd Dehydrator Still Vent 02 ALTERNATIVE
    - 1.00 MMBtu/hr Dehydrator Reboiler 02 ALTERNATIVE
    - FACILITY-WIDE SUMMARY
  
  - **Table 2 – Release Parameter Data**
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Flash Tank 01**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
DFT-01 (1E)	Upward Vertical	DFT-01 (1E)	DFT-01 (1E)	na	na	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	6.68	29.27	6.68	29.27	Gas	GLYCalc	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	0.01	0.06	0.01	0.06	Gas	GLYCalc	
								Ethylbenzene	2.3E-03	0.01	2.3E-03	0.01	Gas	GLYCalc	
								HCHO	---	---	---	---	Gas	GLYCalc	
								n-Hexane	0.04	0.17	0.04	0.17	Gas	GLYCalc	
								Methanol	---	---	---	---	Gas	---	
								Toluene	0.02	0.09	0.02	0.09	Gas	GLYCalc	
								2,2,4-TMP	4.8E-05	2.2E-03	4.8E-05	2.2E-03	Gas	GLYCalc	
								Xylenes	2.3E-03	0.01	2.3E-03	0.01	Gas	GLYCalc	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	0.08	0.35	0.08	0.35	Gas	Sum	
								CO	---	---	---	---	Gas	---	
								CH4	76	333	76	333	Gas	GLYCalc	
								N2O	---	---	---	---	Gas	---	
CO2e	1,903	8,334	1,903	8,334	Gas	Wgt Sum									

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Still Vent 01**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )							
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr										
DSV-01 (2E)	Upward Vertical	DSV-01 (2E)	DSV-01 (2E)	na	na	C	8,760	<b>65.0 MMscfd Dehydrator Still Vent (Regenerator) 01</b>								NOX	---	---	---	---	Gas	---
								CO	---	---	---	---	---	---	---	---	---	Gas	---			
								VOC	1.55	6.78	1.55	6.78	---	---	---	---	---	Gas	GLYCalc			
								SO2	---	---	---	---	---	---	---	---	---	Gas	---			
								PM10/2.5	---	---	---	---	---	---	---	---	Solid/Gas	---				
								Benzene	0.13	0.59	0.13	0.59	---	---	---	---	---	Gas	GLYCalc			
								Ethylbenzene	0.05	0.24	0.05	0.24	---	---	---	---	---	Gas	GLYCalc			
								HCHO	---	---	---	---	---	---	---	---	---	Gas	GLYCalc			
								n-Hexane	0.02	0.07	0.02	0.07	---	---	---	---	---	Gas	GLYCalc			
								Methanol	---	---	---	---	---	---	---	---	---	Gas	---			
								Toluene	0.31	1.35	0.31	1.35	---	---	---	---	---	Gas	GLYCalc			
								2,2,4-TMP	2.4E-04	8.4E-04	2.4E-04	8.4E-04	---	---	---	---	---	Gas	GLYCalc			
								Xylenes	0.08	0.34	0.08	0.34	---	---	---	---	---	Gas	GLYCalc			
								Other HAP	---	---	---	---	---	---	---	---	---	Gas	---			
								Total HAP	0.59	2.58	0.59	2.58	---	---	---	---	---	Gas	Sum			
								CO	---	---	---	---	---	---	---	---	---	Gas	---			
								CH4	1.00	4.36	1.00	4.36	---	---	---	---	---	Gas	GLYCalc			
								N2O	---	---	---	---	---	---	---	---	---	Gas	---			
CO2e	25	109	25	109	---	---	---	---	---	Gas	Wgt Sum											

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Reboiler 01**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )							
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr										
RBV-01 (3E)	Upward Vertical	RBV-01 (3E)	RBV-01 (3E)	na	na	C	8,760	NOX	0.15	0.64	0.15	0.64	Gas	AP-42								
								<b>1.50 MMBtu/hr Dehydrator Reboiler 01</b>							CO	0.12	0.54	0.12	0.54	Gas	AP-42	
								VOC	0.01	0.04	0.01	0.04	Gas	AP-42								
								SO2	8.8E-04	3.9E-03	8.8E-04	3.9E-03	Gas	AP-42								
								PM10/2.5	0.01	0.05	0.01	0.05	Solid/Gas	AP-42								
								Benzene	3.1E-06	1.4E-05	3.1E-06	1.4E-05	Gas	AP-42								
								Ethylbenzene	---	---	---	---	Gas	---								
								HCHO	1.1E-04	4.8E-04	1.1E-04	4.8E-04	Gas	AP-42								
								n-Hexane	2.6E-03	0.01	2.6E-03	0.01	Gas	AP-42								
								Methanol	---	---	---	---	Gas	---								
								Toluene	5.0E-06	2.2E-05	5.0E-06	2.2E-05	Gas	AP-42								
								2,2,4-TMP	---	---	---	---	Gas	---								
								Xylenes	---	---	---	---	Gas	---								
								Other HAP	2.8E-06	1.2E-05	2.8E-06	1.2E-05	Gas	AP-42								
								Total HAP	2.8E-03	0.01	2.8E-03	0.01	Gas	Sum								
								CO	176.47	772.94	176.47	772.94	Gas	AP-42								
								CH4	3.4E-03	0.01	3.4E-03	0.01	Gas	AP-42								
								N2O	3.2E-03	0.01	3.2E-03	0.01	Gas	AP-42								
CO2e	178	778	178	778	Gas	Wgt Sum																

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Flash Tank 02**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
DFT-02 (4E)	Upward Vertical	DFT-02 (4E)	DFT-02 (4E)	na	na	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	13.33	58.39	13.33	58.39	Gas	GLYCalc	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	0.03	0.12	0.03	0.12	Gas	GLYCalc	
								Ethylbenzene	4.4E-03	0.02	4.4E-03	0.02	Gas	GLYCalc	
								HCHO	---	---	---	---	Gas	GLYCalc	
								n-Hexane	0.08	0.35	0.08	0.35	Gas	GLYCalc	
								Methanol	---	---	---	---	Gas	---	
								Toluene	0.04	0.18	0.04	0.18	Gas	GLYCalc	
								2,2,4-TMP	9.6E-04	4.3E-03	9.6E-04	4.3E-03	Gas	GLYCalc	
								Xylenes	4.3E-03	0.02	4.3E-03	0.02	Gas	GLYCalc	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	0.16	0.69	0.16	0.69	Gas	Sum	
								CO	---	---	---	---	Gas	---	
								CH4	151.58	663.91	151.58	663.91	Gas	GLYCalc	
N2O	---	---	---	---	Gas	---									
CO2e	3,789	16,598	3,789	16,598	Gas	Wgt Sum									

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Still Vent 02**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
DSV-02 (5E)	Upward Vertical	DSV-02 (5E)	DSV-02 (5E)	BTEX-01	Condenser	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	3.11	13.62	0.16	0.68	Gas	GLYCalc	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	0.27	1.17	0.01	0.06	Gas	GLYCalc	
								Ethylbenzene	0.11	0.47	0.01	0.02	Gas	GLYCalc	
								HCHO	---	---	---	---	Gas	GLYCalc	
								n-Hexane	0.03	0.13	1.5E-03	0.01	Gas	GLYCalc	
								Methanol	---	---	---	---	Gas	---	
								Toluene	0.61	2.67	0.03	0.13	Gas	GLYCalc	
								2,2,4-TMP	3.6E-04	1.7E-03	1.8E-05	8.4E-05	Gas	GLYCalc	
								Xylenes	0.15	0.65	0.01	0.03	Gas	GLYCalc	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	1.16	5.10	0.06	0.25	Gas	Sum	
								CO	---	---	---	---	Gas	---	
								CH4	2.02	8.84	0.10	0.44	Gas	GLYCalc	
N2O	---	---	---	---	Gas	---									
CO2e	50	221	3	11	Gas	Wgt Sum									

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Reboiler 02**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )								
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr											
RBV-02 (6E)	Upward Vertical	RBV-02 (6E)	RBV-02 (6E)	na	na	C	8,760	NOX	0.20	0.86	0.20	0.86	Gas	AP-42									
								<b>2.00 MMBtu/hr Dehydrator Reboiler 02</b>								CO	0.16	0.72	0.16	0.72	Gas	AP-42	
								VOC	0.01	0.05	0.01	0.05	Gas	AP-42									
								SO2	1.2E-03	0.01	1.2E-03	0.01	Gas	AP-42									
								PM10/2.5	0.01	0.07	0.01	0.07	Solid/Gas	AP-42									
								Benzene	4.1E-06	1.8E-05	4.1E-06	1.8E-05	Gas	AP-42									
								Ethylbenzene	---	---	---	---	Gas	---									
								HCHO	1.5E-04	6.4E-04	1.5E-04	6.4E-04	Gas	AP-42									
								n-Hexane	3.5E-03	0.02	3.5E-03	0.02	Gas	AP-42									
								Methanol	---	---	---	---	Gas	---									
								Toluene	6.7E-06	2.9E-05	6.7E-06	2.9E-05	Gas	AP-42									
								2,2,4-TMP	---	---	---	---	Gas	---									
								Xylenes	---	---	---	---	Gas	---									
								Other HAP	3.7E-06	1.6E-05	3.7E-06	1.6E-05	Gas	AP-42									
								Total HAP	3.7E-03	0.02	3.7E-03	0.02	Gas	Sum									
								CO	235.29	1,030.59	235.29	1,030.59	Gas	AP-42									
								CH4	4.5E-03	0.02	4.5E-03	0.02	Gas	AP-42									
								N2O	4.3E-03	0.02	4.3E-03	0.02	Gas	AP-42									
CO2e	237	1,037	237	1,037	Gas	Wgt Sum																	

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Reboiler 02**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
SSM (7E)	Upward Vertical	SSM (7E)	SSM (7E)	na	na	I	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	---	0.72	---	0.72	Gas	EE	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	---	6.0E-04	---	6.0E-04	Gas	EE	
								Ethylbenzene	---	6.0E-04	---	6.0E-04	Gas	EE	
								HCHO	---	---	---	---	Gas	---	
								n-Hexane	---	6.0E-04	---	6.0E-04	Gas	EE	
								Methanol	---	---	---	---	Gas	---	
								Toluene	---	6.0E-04	---	6.0E-04	Gas	EE	
								2,2,4-TMP	---	6.0E-04	---	6.0E-04	Gas	EE	
								Xylenes	---	6.0E-04	---	6.0E-04	Gas	EE	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	---	3.6E-03	---	3.6E-03	Gas	EE	
								CO2	---	0.06	---	0.06	Gas	EE	
								CH4	---	10.75	---	10.75	Gas	EE	
								N2O	---	---	---	---	Gas	---	
CO2e	---	269	---	269	Gas	Wgt Sum									

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Flash Tank 02 ALTERNATIVE**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
DFT-02alt (4Ealt)	Upward Vertical	DFT-02alt (4Ealt)	DFT-02alt (4Ealt)	na	na	C	8,760	NOX	---	---	---	---	Gas	---	
								CO	---	---	---	---	Gas	---	
								VOC	6.67	29.20	6.67	29.20	Gas	GLYCalc	
								SO2	---	---	---	---	Gas	---	
								PM10/2.5	---	---	---	---	Solid/Gas	---	
								Benzene	0.01	0.06	0.01	0.06	Gas	GLYCalc	
								Ethylbenzene	2.2E-03	0.01	2.2E-03	0.01	Gas	GLYCalc	
								HCHO	---	---	---	---	Gas	GLYCalc	
								n-Hexane	0.04	0.17	0.04	0.17	Gas	GLYCalc	
								Methanol	---	---	---	---	Gas	---	
								Toluene	0.02	0.09	0.02	0.09	Gas	GLYCalc	
								2,2,4-TMP	4.8E-04	2.2E-03	4.8E-04	2.2E-03	Gas	GLYCalc	
								Xylenes	2.2E-03	0.01	2.2E-03	0.01	Gas	GLYCalc	
								Other HAP	---	---	---	---	Gas	---	
								Total HAP	0.08	0.34	0.08	0.34	Gas	Sum	
								CO	---	---	---	---	Gas	---	
								CH4	75.79	331.96	75.79	331.96	Gas	GLYCalc	
								N2O	---	---	---	---	Gas	---	
CO2e	1,895	8,299	1,895	8,299	Gas	Wgt Sum									

Continued ...

**GRENADIER DEHYDRATION STATION**

Application for 45CSR13 NSR Modification Permit

**Attachment J - Emission Points Data Summary Sheet**

**Dehydrator Still Vent 02 ALTERNATIVE**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )		
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr					
DSV-02alt (5Ealt)	Upward Vertical	<b>50.0 MMscfd Dehydrator Still Vent 02 ALTERNATIVE</b>						C	8,760	NOX	---	---	---	---	Gas	---	
		CO	---	---	---	---	Gas			---							
		VOC	1.56	6.81	1.56	6.81	Gas			GLYCalc							
		SO2	---	---	---	---	Gas			---							
		PM10/2.5	---	---	---	---	Solid/Gas			---							
		Benzene	0.13	0.59	0.13	0.59	Gas			GLYCalc							
		Ethylbenzene	0.05	0.24	0.05	0.24	Gas			GLYCalc							
		HCHO	---	---	---	---	Gas			GLYCalc							
		n-Hexane	0.02	0.07	1.5E-02	0.07	Gas			GLYCalc							
		Methanol	---	---	---	---	Gas			---							
		Toluene	0.30	1.33	0.30	1.33	Gas			GLYCalc							
		2,2,4-TMP	2.4E-04	8.4E-04	2.4E-04	8.4E-04	Gas			GLYCalc							
		Xylenes	0.07	0.33	0.07	0.33	Gas			GLYCalc							
		Other HAP	---	---	---	---	Gas			---							
		Total HAP	0.58	2.55	0.58	2.55	Gas			Sum							
		CO	---	---	---	---	Gas			---							
		CH4	1.01	4.34	1.01	4.34	Gas			GLYCalc							
		N2O	---	---	---	---	Gas			---							
CO2e	25	108	25	108	Gas	Wgt Sum											

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Reboiler 02 - ALTERNATIVE**

**Table 1: Emissions Data**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )			
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr						
RBV-02alt (6Ealt)	Upward Vertical	RBV-02alt (6Ealt)	RBV-02alt (6Ealt)	na	na	C	8,760	<b>1.00 MMBtu/hr Dehydrator Reboiler 02 ALTERNATIVE</b>										
								NOX	0.10	0.43	0.10	0.43	Gas	AP-42				
								CO	0.08	0.36	0.08	0.36	Gas	AP-42				
								VOC	0.01	0.02	0.01	0.02	Gas	AP-42				
								SO2	5.9E-04	2.6E-03	5.9E-04	2.6E-03	Gas	AP-42				
								PM10/2.5	0.01	0.03	0.01	0.03	Solid/Gas	AP-42				
								Benzene	2.1E-06	9.0E-06	2.1E-06	9.0E-06	Gas	AP-42				
								Ethylbenzene	---	---	---	---	Gas	---				
								HCHO	7.4E-05	3.2E-04	7.4E-05	3.2E-04	Gas	AP-42				
								n-Hexane	1.8E-03	0.01	1.8E-03	0.01	Gas	AP-42				
								Methanol	---	---	---	---	Gas	---				
								Toluene	3.3E-06	1.5E-05	3.3E-06	1.5E-05	Gas	AP-42				
								2,2,4-TMP	---	---	---	---	Gas	---				
								Xylenes	---	---	---	---	Gas	---				
								Other HAP	1.9E-06	8.2E-06	1.9E-06	8.2E-06	Gas	AP-42				
								Total HAP	1.8E-03	0.01	1.8E-03	0.01	Gas	Sum				
								CO	117.65	515.29	117.65	515.29	Gas	AP-42				
								CH4	2.3E-03	0.01	2.3E-03	0.01	Gas	AP-42				
N2O	2.2E-03	0.01	2.2E-03	0.01	Gas	AP-42												
CO2e	118	518	118	518	Gas	Wgt Sum												

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**FACILITY-WIDE SUMMARY**

**Table 1: Emissions Data - Continued**

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type <sup>1</sup>	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 <sup>3</sup> (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used <sup>6</sup>	Emission Concentration <sup>7</sup> (ppmv or mg/m <sup>3</sup> )
		ID No.	Source	ID No.	Device Type	Short Term <sup>2</sup>	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
na	na	na	na	na	na	C	8,760	NOX	0.34	1.50	0.34	1.50	Gas	Sum	
								CO	0.29	1.26	0.29	1.26	Gas	Sum	
								Point - VOC	24.69	108.87	21.74	95.93	Gas	Sum	
								Fugitive - VOC	0.17	0.73	0.17	0.73	Gas	Sum	
								Total - VOC	24.86	110	21.90	96.66	Gas	Sum	
								SO2	2.1E-03	0.01	2.1E-03	0.01	Gas	Sum	
								PM10/2.5	0.03	0.11	0.03	0.11	Solid/Gas	Sum	
								Benzene	0.44	1.94	0.19	0.83	Gas	Sum	
								Ethylbenzene	0.17	0.74	0.07	0.29	Gas	Sum	
								HCHO	2.6E-04	1.1E-03	2.6E-04	1.1E-03	Gas	Sum	
								n-Hexane	0.17	0.75	0.14	0.62	Gas	Sum	
								Methanol	---	---	---	---	Gas	---	
								Toluene	0.98	4.29	0.40	1.76	Gas	Sum	
								2,2,4-TMP	1.7E-03	0.01	1.4E-03	0.01	Gas	Sum	
								Xylenes	0.23	1.02	0.09	0.40	Gas	Sum	
								Other HAP	6.5E-06	2.9E-05	6.5E-06	2.9E-05	Gas	Sum	
								Total HAP	2.00	8.75	0.89	3.91	Gas	Sum	
								CO2	411.78	1,803.65	411.78	1,803.65	Gas	Sum	
CH4	233.32	1,033	231.40	1,024	Gas	Sum									
N2O	0.01	0.03	0.01	0.03	Gas	Sum									
CO2e	6,247	27,631	6,199	27,421	Gas	Sum									

Continued ...

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment J - Emission Points Data Summary Sheet**

**Table 1 Notes**

Criteria Pollutants	
Pollutant	CAS
NO2	10102-44-0
CO	630-08-0
VOC	varies
Propane	74-98-6
i-Butane	75-28-5
n-Butane	106-97-8
SO2	7446-09-5
PM10/2.5	varies

Hazardous Air Pollutants (HAPs)	
Pollutant	CAS
Benzene	71-43-2
Ethylbenzene	100-41-4
Formaldehyde	50-00-0
n-Hexane	110-54-3
Methanol	67-56-1
Toluene	108-88-3
2,2,4-TMP	540-84-1
Xylenes	1330-20-7
Other HAP	varies
Total HAP	na

Greenhouse Gas (GHG) Pollutants	
Pollutant	CAS
CO2	124-38-9
CH4	74-82-8
N2O	10024-97-2
CO2e	na

**Table 1: Notes**

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 (ie., 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 K

## Fugitive Emissions Data Summary Sheet

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

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- **Application Forms Checklist**
  - **Fugitive Emissions Summary**
  - **Leak Source Data Sheet**
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit

**Attachment K - Fugitive Emissions**

**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 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?

Yes       No

If Yes, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.

2.) Will there be Storage Piles?

Yes       No

If Yes, then complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.

3.) Will there be Liquid Loading/Unloading Operations?

Yes       No

If Yes, then complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.

4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation?

Yes       No

If Yes, then 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.)?

Yes       No

If Yes, then complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.

6.) Will there be General Clean-up VOC Operations?

Yes       No

If Yes, then complete the GENERAL EMISSIONS UNIT DATA SHEET.

7.) Will there be any other activities that generate fugitive emissions?

Yes       No

If Yes, then 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."

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment K - Fugitive Emissions**

**FUGITIVE EMISSIONS DATA SUMMARY SHEET - Continued**

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 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.

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS <sup>1</sup>	Maximum Potential Pre-Controlled Emissions <sup>2</sup>		Maximum Potential Controlled Emissions <sup>3</sup>		Est. Method Used <sup>4</sup>
		lb/hr	ton/yr	lb/hr	ton/yr	
Paved Haul Roads	na	---	---	---	---	---
Unpaved Haul Roads	na	---	---	---	---	---
Storage Pile Emissions	na	---	---	---	---	---
Loading/Unloading Operations	na	---	---	---	---	---
Wastewater Treatment	na	---	---	---	---	---
Equipment Leaks (FUG (1F))	<b>VOC</b>	<b>0.17</b>	<b>0.73</b>	<b>0.17</b>	<b>0.73</b>	<b>AP-42</b>
	<b>Benzene</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>Ethylbenzene</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>n-Hexane</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>Toluene</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>2,2,4-TMP</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>Xylenes</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>AP-42</b>
	<b>Total HAP</b>	<b>8.3E-04</b>	<b>3.6E-03</b>	<b>8.3E-04</b>	<b>3.6E-03</b>	<b>Sum</b>
	<b>CO2</b>	<b>0.01</b>	<b>0.06</b>	<b>0.01</b>	<b>0.06</b>	<b>AP-42</b>
	<b>CH4</b>	<b>2.60</b>	<b>11.41</b>	<b>2.60</b>	<b>11.41</b>	<b>AP-42</b>
	<b>N2O</b>	---	---	---	---	---
<b>CO2e</b>	<b>65</b>	<b>285</b>	<b>65</b>	<b>285</b>	<b>Wgt Sum</b>	
General Clean-up VOC Emissions	na	---	---	---	---	---
Other	na	---	---	---	---	---

<sup>1</sup> List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS<sub>2</sub>, VOCs, H<sub>2</sub>S, Inorganics, Lead, Organics, O<sub>3</sub>, NO, NO<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, all applicable Greenhouse Gases, etc. DO NOT LIST H<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>, O<sub>2</sub>, and Noble Gases.

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

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

<sup>4</sup> 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).

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment K - Fugitive Emissions**

**DESCRIPTION OF FUGITIVE EMISSIONS**

Source Category	Pollutant	Number of Source Components <sup>1</sup>	Number of Components Monitored by Frequency <sup>2</sup>	Average Time to Repair (Days) <sup>3</sup>	Estimated Annual Emission Rate (lb/yr) <sup>4</sup>
Pumps <sup>5</sup>	Light Liquid VOC <sup>6,7</sup>				
	Heavy Liquid VOC <sup>8</sup>				
	Non-VOC <sup>9</sup>				
Valves <sup>10</sup>	Gas VOC				
	Light Liquid VOC				
	Heavy Liquid VOC				
	Non-VOC				
Safety Relief Valves <sup>11</sup>	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Open Ended Lines <sup>12</sup>	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Sampling Connections <sup>13</sup>	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Compressors	Gas VOC				
	Non-VOC				
Flanges / Connectors	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
Other*	Gas VOC				
	Light Liquid VOC				
	Non-VOC				
<b>TOTAL (lb/yr)</b>					<b>1,459</b>
<b>TOTAL (tpy)</b>					<b>0.73</b>

**This Facility is NOT Subject to Leak Detection and Repair (LDAR) Regulations. Please Reference the Fugitive Emissions Summary Data Sheet .**

\*Other components include compressor seals, relief valves, diaphragms, drains, meters, etc.

**Attachment K**  
**DESCRIPTION OF FUGITIVE EMISSIONS - Continued**

**Notes for Leak Source Data Sheet**

1. For VOC sources include components on streams and equipment that contain greater than 10% 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 visual or soap-bubble leak detection ppm. Do not include monitoring by methods. "M/Q(M)/Q/SA/A/0" 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; EPA - emission factors established by EPA (cite document used);  
EE - engineering estimate; 0 - other method, such as in-house emission factor (specify).
5. Do not include in the equipment count seal-less 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, H<sub>2</sub>S, mineral acids, NO, SO, etc. DO NOT LIST H, H<sub>2</sub>O, N, O, 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 L**  
**Emissions Unit Data Sheet(s)**

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“28. Fill out the **Emissions Unit Data Sheet(s)** as Attachment L.”

---

- **NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**
    - Glycol Dehydration Unit 01 – 65.0 MMscfd GRI-GLYCalc
      - Data Sheet
      - 40 CFR Part 63; Subpart HH & HHH Registration Form
    - Glycol Dehydration Unit 02 – 100.0 MMscfd GRI-GLYCalc
      - Data Sheet
      - 40 CFR Part 63; Subpart HH & HHH Registration Form
    - Glycol Dehydration Unit 02 ALTERNATIVE – 50.0 MMscfd GRI-GLYCalc
      - Data Sheet
      - 40 CFR Part 63; Subpart HH & HHH Registration Form
  
  - **STORAGE TANK DATA SHEET**
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

General Glycol Dehydration Unit Data		Manufacturer and Model		tbd --- DSV-01			
				Max Dry Gas Flow Rate (MMscf/day)		65.0	
				Design Heat Input (MMBtu/hr) - HHV		1.50	
				Design Type (DEG or TEG)		TEG	
				Source Status <sup>2</sup>		MS	
				Date Installed/Modified/Removed <sup>3</sup>		2013/TBD/---	
				Regenerator Still Vent APCD <sup>4</sup>		NA	
				Fuel HV (Btu/scf) - HHV		1,020	
				H <sub>2</sub> S Content (gr/100 scf)		0.2	
				Operation (hrs/yr)		8,760	
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr		
DEHY-01 (1E/2E)	Dehydrator 01 (Flash Tank and Still Vent (Regenerator))	GRI-GLYCalc	VOC	8.23	36.05		
		GRI-GLYCalc	Benzene	0.15	0.65		
		GRI-GLYCalc	Ethylbenzene	0.06	0.25		
		GRI-GLYCalc	n-Hexane	0.05	0.24		
		GRI-GLYCalc	Toluene	0.33	1.44		
		GRI-GLYCalc	2,2,4-TMP	2.9E-04	3.0E-03		
		GRI-GLYCalc	Xylenes	0.08	0.35		
		Sum	Tot HAP	0.67	2.93		
		GRI-GLYCalc	CH <sub>4</sub>	77.11	337.74		
		Weighted Sum	CO <sub>2</sub> e	1,928	8,443		
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr		
RBV-01 (3E)	Reboiler 01	AP	NOX	0.15	0.64		
		AP	CO	0.12	0.54		
		AP	VOC	8.3E-03	0.04		
		AP	SO <sub>2</sub>	8.8E-04	3.9E-03		
		AP	PM <sub>10/2.5</sub>	0.01	0.05		
		AP	Benzene	3.1E-06	1.4E-05		
		AP	HCHO	1.1E-04	4.8E-04		
		AP	n-Hexane	2.6E-03	0.01		
		AP	Toluene	5.0E-06	2.19E-05		
		AP	Other HAP	2.8E-06	1.22E-05		
		Sum	Total HAP	2.8E-03	0.01		
		AP	CO <sub>2</sub>	176.47	772.94		
		AP	CH <sub>4</sub>	3.4E-03	0.01		
		AP	N <sub>2</sub> O	3.2E-03	0.01		
Weighted Sum	CO <sub>2</sub> e	178	778				



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**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**40 CFR Part 63; Subpart HH & HHH Registration Form - DSV-01 - Cont**

**Please attach the following required dehydration unit information:**

1. System map indicating the chain of custody information. See Page 43 of this document for an example of a gas flow schematic. It is not intended that the applicant provide this level of detail for all sources. The level of detail that is necessary is to establish where the custody transfer points are located. This can be accomplished by submitting a process flow diagram indicating custody transfer points and the natural gas flow. However, the DAQ reserves the right to request more detailed information in order to make the necessary decisions.
2. Extended gas analysis from the Wet Gas Stream, including mole percent of C1-C8, benzene, ethylbenzene, toluene, xylene and n-hexane, using Gas Processors Association (GPA) 2286 (or similar). A sample should be taken from the inlet gas line, downstream from any inlet separator, and using a manifold to remove entrained liquids from the sample and a probe to collect the sample from the center of the gas line. GPA standard 2166 reference method or a modified version of EPA Method TO-14, (or similar) should be used.
3. GRI-GLYCalc Ver. 3.0 aggregate report based on maximum Lean Glycol circulation rate and maximum throughput.
4. Detailed calculations of gas or hydrocarbon flow rate.

**Section C: Facility NESHAPS Subpart HH/HHH status**

- Subject to Subpart HH -- However, EXEMPT because the facility is an area source of HAP emissions and the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere is < 0.90 megagram per year (1.0 tpy); see 40CFR§63.764(e)(1)(ii).

Affected facility status: \_\_\_\_\_  
 (choose only one)

- Subject to Subpart HHH

Not Subject  
 Because:

- < 10/25 TPY
- Affected facility exclusively handles black oil.
- Facility-wide actual annual average NG throughput is < 650 thousand scf/day and facility-wide actual annual average hydrocarbon liquid is < 250 bpd.
- No affected source is present.

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

General Glycol Dehydration Unit Data		Manufacturer and Model		tbd --- DSV-02	
		Max Dry Gas Flow Rate (MMscf/day)		100.0	
		Design Heat Input (MMBtu/hr) - HHV		2.00	
		Design Type (DEG or TEG)		TEG	
		Source Status <sup>2</sup>		NS	
		Date Installed/Modified/Removed <sup>3</sup>		tbd/---/---	
		Regenerator Still Vent APCD <sup>4</sup>		CD	
		Fuel HV (Btu/scf) - HHV		1,020	
		H <sub>2</sub> S Content (gr/100 scf)		0.2	
		Operation (hrs/yr)		8,760	
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr
DEHY-02 (4E/5E)	Dehydrator 02 (Flash Tank and Still Vent (Regenerator))	GRI-GLYCalc	VOC	13.49	59.08
		GRI-GLYCalc	Benzene	0.04	0.18
		GRI-GLYCalc	Ethylbenzene	0.01	0.04
		GRI-GLYCalc	n-Hexane	0.08	0.35
		GRI-GLYCalc	Toluene	0.07	0.31
		GRI-GLYCalc	2,2,4-TMP	9.8E-04	4.4E-03
		GRI-GLYCalc	Xylenes	0.01	0.05
		Sum	Tot HAP	0.22	0.94
		GRI-GLYCalc	CH <sub>4</sub>	151.68	664.35
		Weighted Sum	CO <sub>2</sub> e	3,792	16,609
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr
RBV-02 (6E)	Reboiler 02	AP	NOX	0.20	0.86
		AP	CO	0.16	0.72
		AP	VOC	1.1E-02	0.05
		AP	SO <sub>2</sub>	1.2E-03	5.2E-03
		AP	PM <sub>10/2.5</sub>	0.01	0.07
		AP	Benzene	4.1E-06	1.8E-05
		AP	HCHO	1.5E-04	6.4E-04
		AP	n-Hexane	3.5E-03	0.02
		AP	Toluene	6.7E-06	2.92E-05
		AP	Other HAP	3.7E-06	1.63E-05
		Sum	Total HAP	3.7E-03	0.02
		AP	CO <sub>2</sub>	235.29	1,030.59
		AP	CH <sub>4</sub>	4.5E-03	0.02
		AP	N <sub>2</sub> O	4.3E-03	0.02
Weighted Sum	CO <sub>2</sub> e	237	1,037		



Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**40 CFR Part 63; Subpart HH & HHH Registration Form - DSV-02 - Cont**

Please attach the following required dehydration unit information:

1. System map indicating the chain of custody information. See Page 43 of this document for an example of a gas flow schematic. It is not intended that the applicant provide this level of detail for all sources. The level of detail that is necessary is to establish where the custody transfer points are located. This can be accomplished by submitting a process flow diagram indicating custody transfer points and the natural gas flow. However, the DAQ reserves the right to request more detailed information in order to make the necessary decisions.
2. Extended gas analysis from the Wet Gas Stream, including mole percent of C1-C8, benzene, ethylbenzene, toluene, xylene and n-hexane, using Gas Processors Association (GPA) 2286 (or similar). A sample should be taken from the inlet gas line, downstream from any inlet separator, and using a manifold to remove entrained liquids from the sample and a probe to collect the sample from the center of the gas line. GPA standard 2166 reference method or a modified version of EPA Method TO-14, (or similar) should be used.
3. GRI-GLYCalc Ver. 3.0 aggregate report based on maximum Lean Glycol circulation rate and maximum throughput.
4. Detailed calculations of gas or hydrocarbon flow rate.

**Section C: Facility NESHAPS Subpart HH/HHH status**

- Subject to Subpart HH -- However, EXEMPT because the facility is an area source of HAP emissions and the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere is < 0.90 megagram per year (1.0 tpy); see 40CFR§63.764(e)(1)(ii).

Affected facility status:  
(choose only one)

- Subject to Subpart HHH

Not Subject  
Because:

- < 10/25 TPY
- Affected facility exclusively handles black oil.
- Facility-wide actual annual average NG throughput is < 650 thousand scf/day and facility-wide actual annual average hydrocarbon liquid is < 250 bpd.
- No affected source is present.

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

General Glycol Dehydration Unit Data		Manufacturer and Model		tbd --- DSV-02alt	
		Max Dry Gas Flow Rate (MMscf/day)		50.0	
		Design Heat Input (MMBtu/hr) - HHV		1.00	
		Design Type (DEG or TEG)		TEG	
		Source Status <sup>2</sup>		NS-ALTERNATIVE	
		Date Installed/Modified/Removed <sup>3</sup>		tbd/---/---	
		Regenerator Still Vent APCD <sup>4</sup>		NA	
		Fuel HV (Btu/scf) - HHV		1,020	
		H <sub>2</sub> S Content (gr/100 scf)		0.2	
		Operation (hrs/yr)		8,760	
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr
DEHY-02alt (4Ealt/5Ealt)	Dehydrator 02alt (Flash Tank and Still Vent (Regenerator))	GRI-GLYCalc	VOC	8.22	36.01
		GRI-GLYCalc	Benzene	0.15	0.64
		GRI-GLYCalc	Ethylbenzene	0.06	0.25
		GRI-GLYCalc	n-Hexane	0.05	0.24
		GRI-GLYCalc	Toluene	0.32	1.42
		GRI-GLYCalc	2,2,4-TMP	7.2E-04	3.0E-03
		GRI-GLYCalc	Xylenes	0.08	0.34
		Sum	Tot HAP	0.66	2.89
		GRI-GLYCalc	CH <sub>4</sub>	76.80	336.37
		Weighted Sum	CO <sub>2</sub> e	1,920	8,407
Source ID # <sup>1</sup>	Vent	Reference <sup>5</sup>	PTE <sup>6</sup>	lbs/hr	tons/yr
RBV-02alt (6Ealt)	Reboiler 02alt	AP	NOX	0.10	0.43
		AP	CO	0.08	0.36
		AP	VOC	5.6E-03	0.02
		AP	SO <sub>2</sub>	5.9E-04	2.6E-03
		AP	PM <sub>10/2.5</sub>	0.01	0.03
		AP	Benzene	2.1E-06	9.0E-06
		AP	HCHO	7.4E-05	3.2E-04
		AP	n-Hexane	1.8E-03	0.01
		AP	Toluene	3.3E-06	1.46E-05
		AP	Other HAP	1.9E-06	8.15E-06
		Sum	Total HAP	1.8E-03	0.01
		AP	CO <sub>2</sub>	117.65	515.29
		AP	CH <sub>4</sub>	2.3E-03	0.01
		AP	N <sub>2</sub> O	2.2E-03	0.01
Weighted Sum	CO <sub>2</sub> e	118	518		



Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment L - Emission Unit Data Sheet**

**40 CFR Part 63; Subpart HH & HHH Registration Form - DSV-02alt - Cont**

**Please attach the following required dehydration unit information:**

1. System map indicating the chain of custody information. See Page 43 of this document for an example of a gas flow schematic. It is not intended that the applicant provide this level of detail for all sources. The level of detail that is necessary is to establish where the custody transfer points are located. This can be accomplished by submitting a process flow diagram indicating custody transfer points and the natural gas flow. However, the DAQ reserves the right to request more detailed information in order to make the necessary decisions.
2. Extended gas analysis from the Wet Gas Stream, including mole percent of C1-C8, benzene, ethylbenzene, toluene, xylene and n-hexane, using Gas Processors Association (GPA) 2286 (or similar). A sample should be taken from the inlet gas line, downstream from any inlet separator, and using a manifold to remove entrained liquids from the sample and a probe to collect the sample from the center of the gas line. GPA standard 2166 reference method or a modified version of EPA Method TO-14, (or similar) should be used.
3. GRI-GLYCalc Ver. 3.0 aggregate report based on maximum Lean Glycol circulation rate and maximum throughput.
4. Detailed calculations of gas or hydrocarbon flow rate.

**Section C: Facility NESHAPS Subpart HH/HHH status**

- Subject to Subpart HH -- However, EXEMPT because the facility is an area source of HAP emissions and the actual average emissions of benzene from the glycol dehydration unit process vent to the atmosphere is < 0.90 megagram per year (1.0 tpy); see 40CFR§63.764(e)(1)(ii).

Affected facility status: \_\_\_\_\_  
 (choose only one)

- Subject to Subpart HHH

Not Subject  
 Because:

- < 10/25 TPY
- Affected facility exclusively handles black oil.
- Facility-wide actual annual average NG throughput is < 650 thousand scf/day and facility-wide actual annual average hydrocarbon liquid is < 250 bpd.
- No affected source is present.

Williams Ohio Valley Midstream LLC (OVM)  
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**Attachment L - Emission Unit Data Sheet**

**NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**  
**(Continued)**

Notes to **NATURAL GAS GLYCOL DEHYDRATION UNIT DATA SHEET**

1. Enter the appropriate Source Identification Numbers for the glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent. The glycol dehydration unit Reboiler Vent and glycol Regenerator Still Vent should be designated RBV-1 and RSV-1, respectively. If the compressor station incorporates multiple glycol dehydration units, a Glycol Dehydration Unit Data Sheet shall be completed for each, using Source Identification #s RBV-2 and RSV-2, RBV-3 and RSV-3, etc.

2. Enter the Source Status using the following codes:

- NS = Construction of New Source
- ES = Existing Source
- MS = Modification of Existing Source
- RS = Removal of Source

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

4. Enter the Air Pollution Control Device (APCD) type designation using the following codes:

- NA = None
- CD = Condenser
- FL = Flare
- CC = Condenser/Combustion Combination
- TO = Thermal Oxidizer

5. Enter the Potential Emissions Data Reference designation using the following codes:

- MD = Manufacturer's Data
- AP = AP-42
- GR = GRI-GLYCalcTM
- OT = Other (please list): \_\_\_\_\_

6. Enter the Reboiler Vent and glycol Regenerator Still Vent Potential to Emit (PTE) for the listed regulated pollutants in lbs per hour and tons per year. The glycol Regenerator Still Vent potential emissions may be determined using the most recent version of the thermodynamic software model GRI-GLYCalcTM (Radian International LLC & Gas Research Institute). Attach all referenced Potential Emissions Data (or calculations) and the GRI-GLYCalc Aggregate Calculations Report to this Glycol Dehydration Unit Data Sheet(s). This PTE data shall be incorporated in the Emissions Summary Sheet.

**Include a copy of the GRI-GLYCalcTM analysis. This includes a printout of the aggregate calculations report, which shall include emissions reports, equipment reports, and stream reports.**

**\*An explanation of input parameters and examples, when using GRI-GLYCalcTM is available on our website.**



**ATTACHMENT M**  
**Air Pollution Control Device Sheet(s)**

---

“29. Fill out the **Air Pollution Control Device Sheet(s)** as Attachment M.”

---

- **Air Pollution Control Device Sheet (Condenser)**
  - **JATCO 95% BTEX Skid – Condenser for Dehydrator Still Vent 02 (DSV-02)**
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 Modification Permit

**Attachment M**  
**AIR POLLUTION CONTROL DEVICE SHEET**  
 (Condenser System)

Control Device ID No. (must match Emission Units Table): **BTEX-01**

**Equipment Information and Filter Characteristics**

1. Manufacturer: <b>JATCO</b>  Model No.	2. Method: <input type="checkbox"/> Pressure condensation <input checked="" type="checkbox"/> <b>Temperature condensation</b> <input type="checkbox"/> Surface <input type="checkbox"/> Contact <input type="checkbox"/> Other, specify
3. Control Device Name: <b>BTEX ELIMINATOR</b> <b>(Controls DSV-02/5E)</b>	
4. Provide diagram of condenser:	
5. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
6. Heat exchanger area: <span style="float: right;">ft<sup>3</sup></span>	7. Reported removal efficiency: <span style="float: right;">95%</span>
8. Coolant Used: <b>AIR</b>	9. Refrigeration capacity: Ref. <span style="float: right;">tons</span>
10. Composition of coolant:	11. Internal operating temperature: <span style="float: right;">°F</span>
12. Specific heat of coolant:  <span style="float: right;">BTU/lb.°F, at 77°F</span>	13. Temperature of condensation: <span style="float: right;">°F</span>
<b>Average Operation:</b>	<b>Maximum Operation:</b>
14. Coolant Temperature:  Inlet: <span style="float: right;">°F</span> Outlet: <span style="float: right;">°F</span>	15. Coolant Temperature:  Inlet: <span style="float: right;">°F</span> Outlet: <span style="float: right;">°F</span>
16. Gas Temperature:  Inlet: <span style="float: right;">°F</span> Outlet: <span style="float: right;">°F</span>	17. Gas Temperature:  Inlet: <span style="float: right;">°F</span> Outlet: <span style="float: right;">°F</span>
18. Gas flow rate: <span style="float: right;">ft<sup>3</sup>/min</span>	19. Gas flow rate: <span style="float: right;">ft<sup>3</sup>/min</span>
20. Coolant flow rate per condenser: Type:	21. Coolant flow rate per condenser: Type:
Water: <span style="float: right;">gal/min</span> Air: <span style="float: right;">ft<sup>3</sup>/min</span> Other: <span style="float: right;">lb/hour</span>	Water: <span style="float: right;">gal/min</span> Air: <span style="float: right;">ft<sup>3</sup>/min</span> Other: <span style="float: right;">lb/hour</span>
22. Efficiency of condenser: <span style="float: right;">%</span>	23. Efficiency of condenser: <span style="float: right;">%</span>
24. Condenser surface area: <span style="float: right;">ft<sup>2</sup></span>	25. Condenser surface area: <span style="float: right;">ft<sup>2</sup></span>

26.	Pollutant	Guaranteed Minimum Control Efficiency %	Concentration ppmv	Specific Heat BTU/lb-mol °F	Heat of Vaporation BTU/lb-mol
A	VOC	95%			
B					
C					
D					
E					
F					
G					
Total Concentration in ppmv					

**Emission Gas (Vapor) Stream**

27. Before Condenser	28. After Condenser
Inlet vapor flow rate:           ft <sup>3</sup> /min	Inlet vapor flow rate:           ft <sup>3</sup> /min
Influent vapor temperature:       °F	Influent vapor temperature:       °F
Effluent vapor temperature:       °F	Effluent vapor temperature:       °F

29. Pollutant	INLET			OUTLET		
	Vapor Pressure	Condensation Temperature	Rate lb/hr	Rate lb/hr	Vapor Pressure	Condensation Temperature
A						
B						
C						
D						
E						
F						
G						

Total of the POLLUTANT lb/hr

30. Moisture content:           %

31. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

32. Describe the collection material disposal system:

33. Have you included **Condenser Control Device** in the Emissions Points Data Summary Sheet?

**34. 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:

REPORTING:

TESTING:

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 or air control device.

RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.

REPORTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.

TESTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.

**35. Manufacturer's Guaranteed Capture Efficiency for each air pollutant.**

NA

**36. Manufacturer's Guaranteed Control Efficiency for each air pollutant.**

95%

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

## JATCO Vertical Panel Air Cooled Heat Exchangers



Full stainless steel condenser with stainless steel skid base, using stainless steel aluminum wound 1" 1.0 fin tubes. A multi-pass tube construction with each pass draining to the lower liquid line, that is connected to a JATCO automatic blowcase. Units can be configured in series to increase cooling capacity.

### Specifications:

<b>Test pressure:</b>	20 psi
<b>Operating pressure:</b>	1 psi
<b>Max operating temp:</b>	225° F
<b>Max Condenser Vapor Outlet Temp:</b>	10° F Approach to Ambient Temp.
<b>Headers:</b>	304 Stainless Steel
<b>Fin Tube Description:</b>	1" x 16 ga x SA249 TP316 Aluminum L-Foot
<b>Fin Tube Length:</b>	6' 0"
<b>Fin Dimension:</b>	.015" x 2.5"

<b>Model #</b>	<b>No. of Passes</b>	<b>Max H<sub>2</sub>O Removed</b>	<b># of Tubes</b>	<b>Maximum Regen Compatibility</b>
System I	3	834 lbs./D	8	125,000 BTU/HR
System II	5	2,500 lbs./D	16	375,000 BTU/HR
System III	7	3,334 lbs./D	24	500,000 BTU/HR

## JATCO BTEX Eliminator Guarantee

The system operation of the JATCO BTEX “Eliminator” is able to achieve stack test results in **excess of 95% destruction efficiency** by routing the pre-condensed still column vapors to the main burner and inducing the low pressure V.O.C.s into the primary air inlet of the original burner using our patented JATCO compound injector burner assembly. When re-boiler temperature is reached, a valve stops the V.O.C. flow to the main burner and opens to route the V.O.C.s to the exhaust stack, through the igniter (to be installed with unit). The igniter consists of a stainless steel nipple with a nickel alloy wire coil. As the main burner is on its firing cycle, the exhaust gases keep this coil red hot by cumulating heat in the fire tube. After the main burner shuts off, and V.O.C.s are routed to the exhaust stack, the coil will ignite or flash the vapor for a period until there is free air oxygen dilution. The actual stack testing will show burner/on burner/off cycles and concentrations. It is also a note that general operation of standard glycol re-boiler dehydration, when the burner is on is when you achieve the flash/flux around the fire tube and when it shuts off the V.O.C output from the still column diminishes rapidly.

JATCO Environmental Inc. stands behind all of the testing performed on our BTEX Systems Units and will purchase any unit back that does not perform to these standards.



### BTEX Eliminator Shell & Tube System

The Shell and Tube Eliminator System is a counter flow stainless steel tube and bundle heat exchanger condensing system used to capture and recycle BTEX and VOC vapors from the dehydrator still column. [\(more\)](#)

---

### Recent blog entries

Dec 10, 2010, posted by Admin

[Guess who got in on the blogging game???](#)

Nov 30, 1999, posted by

[WE WILL BE AT THE DUG SHOW](#)

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# ATTACHMENT N

## Supporting Emissions Calculations

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“30. Provide all **Supporting Emissions Calculations** as Attachment N.”

---

- **Emission Summary Spreadsheets**
    - Controlled Emissions – Criteria Pollutants
    - Controlled Emissions – Hazardous Air Pollutants (HAP)
    - Greenhouse Gas (GHG) Emissions
    - PRE-Controlled Emissions – Criteria Pollutants
    - PRE-Controlled Emissions – Hazardous Air Pollutants (HAP)
  - **Unit-Specific Emission Spreadsheets**
    - Dehydrator 01 (Still Vent and Flash Tank) – 65.0 MMscfd
    - Dehydrator 01 (Summary) – 65.0 MMscfd
    - Reboiler 01 – 1.50 MMBtu/hr
    - Dehydrator 02 (Still Vent and Flash Tank) – 100.0 MMscfd
    - Dehydrator 02 (Summary) – 100.0 MMscfd
    - Reboiler 02 – 2.00 MMBtu/hr
    - Pigging / Pneumatic Pumps
    - Dehydrator 02 ALTERNATIVE (Still Vent and Flash Tank) – 50.0 MMscfd
    - Dehydrator 02 ALTERNATIVE (Summary) – 50.0 MMscfd
    - Reboiler 02 ALTERNATIVE – 1.00 MMBtu/hr
  - **Fugitive Emissions**
    - Piping and Equipment Fugitives - Gas
  - **AP-42 and GHG Emission Factors**
  - **GRI-GLYCalc Model Runs**
    - Dehydrator 01 (Still Vent and Flash Tank) – 65.0 MMscfd
    - Dehydrator 02 (Still Vent and Flash Tank) – 100.0 MMscfd
    - Dehydrator 02 ALTERNATIVE (Still Vent and Flash Tank) – 50.0 MMscfd
-

Williams Ohio Valley Midstream LLC (OVM)  
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**Attachment N - Supporting Emissions Calculations**  
**Controlled Emissions - Criteria Pollutants**

Unit ID	Point ID	Control ID	Description	Design Capacity	NOx		CO		VOC		SOx		PM10/2.5	
					lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
DFT-01	1E	na	Flash Tank 01	65.0 MMscfd	---	---	---	---	6.68	29.27	---	---	---	---
DSV-01	2E	na	Still Vent (Regenerator) 01		---	---	---	---	1.55	6.78	---	---	---	---
RBV-01	3E	na	Reboiler 01	1.50 MMBtu/hr	0.15	0.64	0.12	0.54	0.01	0.04	8.8E-04	3.9E-03	0.01	0.05
DFT-02	4E	na	Flash Tank 02	100.0 MMscfd	---	---	---	---	13.33	58.39	---	---	---	---
DSV-02	5E	BTEX-01	Still Vent (Regenerator) 02		---	---	---	---	0.16	0.68	---	---	---	---
RBV-02	6E	na	Reboiler 02	2.00 MMBtu/hr	0.20	0.86	0.16	0.72	0.01	0.05	1.2E-03	0.01	0.01	0.07
SSM	7E	na	Pigging and Pneumatic Pumps	na	---	---	---	---	---	0.72	---	---	---	---
<b>TOTAL POINT SOURCE PTE:</b>					<b>0.34</b>	<b>1.50</b>	<b>0.29</b>	<b>1.26</b>	<b>21.74</b>	<b>95.93</b>	<b>2.1E-03</b>	<b>0.01</b>	<b>0.03</b>	<b>0.11</b>
<b>WV-DEP Permit Threshold:</b>					6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy	
<b>Title V Permit Threshold:</b>					---	100	---	100	---	100	---	100	---	100

FUG	1F	na	Process Piping Fugitives - Gas	1,001 fittings	---	---	---	---	0.17	0.73	---	---	---	---
<b>TOTAL FUGITIVE SOURCE PTE:</b>					---	---	---	---	<b>0.17</b>	<b>0.73</b>	---	---	---	---

<b>TOTAL PTE:</b>					<b>0.34</b>	<b>1.50</b>	<b>0.29</b>	<b>1.26</b>	<b>21.90</b>	<b>96.66</b>	<b>2.1E-03</b>	<b>0.01</b>	<b>0.03</b>	<b>0.11</b>
-------------------	--	--	--	--	-------------	-------------	-------------	-------------	--------------	--------------	----------------	-------------	-------------	-------------

- Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr.  
 2 - VOC is volatile organic compounds, as defined by EPA, and includes HCHO (formaldehyde).  
 3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.  
 4 - Fugitive criteria pollutant emissions are not considered in major source determinations (45CSR30 Section 2.26.b.)

**IMPORTANT:**

**5 - Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:**

DFT-02alt	4Ealt	na	Flash Tank 02alt	50.0 MMscfd	---	---	---	---	6.67	29.20	---	---	---	---
DSV-02alt	5Ealt	na	Still Vent (Regenerator) 02alt		---	---	---	---	1.56	6.81	---	---	---	---
RBV-02alt	6Ealt	na	Reboiler 02alt	1.00 MMBtu/hr	0.10	0.43	0.08	0.36	0.01	0.02	5.9E-04	2.6E-03	0.01	0.03
<b>ALTERNATIVE POINT SOURCE PTE:</b>					<b>0.25</b>	<b>1.07</b>	<b>0.21</b>	<b>0.90</b>	<b>16.46</b>	<b>72.84</b>	<b>1.5E-03</b>	<b>0.01</b>	<b>0.02</b>	<b>0.08</b>
<b>ALTERNATIVE TOTAL PTE:</b>					<b>0.25</b>	<b>1.07</b>	<b>0.21</b>	<b>0.90</b>	<b>16.63</b>	<b>73.57</b>	<b>1.5E-03</b>	<b>0.01</b>	<b>0.02</b>	<b>0.08</b>

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**Attachment N - Supporting Emissions Calculations**

**Controlled Emissions - Hazardous Air Pollutants (HAP)**

Unit ID	Point ID	Benzene		Ethylbenzene		Formaldehyde		n-Hexane		Methanol		Toluene		2,2,4-TMP		Xylenes		Other HAP		Total HAP	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
DFT-01	1E	0.01	0.06	2.3E-03	0.01	---	---	0.04	0.17	---	---	0.02	0.09	4.8E-05	2.2E-03	2.3E-03	0.01	---	---	0.08	0.35
DSV-01	2E	0.13	0.59	0.05	0.24	---	---	0.02	0.07	---	---	0.31	1.35	2.4E-04	8.4E-04	0.08	0.34	---	---	0.59	2.58
RBV-01	3E	3.1E-06	1.4E-05	---	---	1.1E-04	4.8E-04	2.6E-03	0.01	---	---	5.0E-06	2.2E-05	---	---	---	---	2.8E-06	1.2E-05	2.8E-03	0.01
DFT-02	4E	0.03	0.12	4.4E-03	0.02	---	---	0.08	0.35	---	---	0.04	0.18	9.6E-04	4.3E-03	4.3E-03	0.02	---	---	0.16	0.69
DSV-02	5E	0.01	0.06	0.01	0.02	---	---	1.5E-03	0.01	---	---	0.03	0.13	1.8E-05	8.4E-05	0.01	0.03	---	---	0.06	0.25
RBV-02	6E	4.1E-06	1.8E-05	---	---	1.5E-04	6.4E-04	3.5E-03	0.02	---	---	6.7E-06	2.9E-05	---	---	---	---	3.7E-06	1.6E-05	3.7E-03	0.02
SSM	7E	---	6.0E-04	---	6.0E-04	---	---	---	6.0E-04	---	---	---	6.0E-04	---	6.0E-04	---	6.0E-04	---	---	---	3.6E-03
FUG	1F	1.4E-04	6.1E-04	1.4E-04	6.1E-04	---	---	1.4E-04	6.1E-04	---	---	1.4E-04	6.1E-04	1.4E-04	6.1E-04	1.4E-04	6.1E-04	---	---	8.3E-04	3.6E-03

<b>TOTAL PTE:</b>	<b>0.19</b>	<b>0.83</b>	<b>0.07</b>	<b>0.29</b>	<b>2.6E-04</b>	<b>1.1E-03</b>	<b>0.14</b>	<b>0.62</b>	<b>---</b>	<b>---</b>	<b>0.40</b>	<b>1.76</b>	<b>1.4E-03</b>	<b>0.01</b>	<b>0.09</b>	<b>0.40</b>	<b>6.5E-06</b>	<b>2.9E-05</b>	<b>0.89</b>	<b>3.91</b>
<b>WV-DEP:</b>	2 lb/hr	<u>OR</u> 0.5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 0.5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy
<b>Title V:</b>	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	25

Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr.

**IMPORTANT:**

**2 - Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:**

DFT-02alt	4Ealt	0.01	0.06	2.2E-03	0.01	---	---	0.04	0.17	---	---	0.02	0.09	4.8E-04	2.2E-03	2.2E-03	0.01	---	---	0.08	0.34
DSV-02alt	5Ealt	0.13	0.59	0.05	0.24	---	---	0.02	0.07	---	---	0.30	1.33	2.4E-04	8.4E-04	0.07	0.33	---	---	0.58	2.55
RBV-02alt	6Ealt	2.1E-06	9.0E-06	---	---	7.4E-05	3.2E-04	1.8E-03	0.01	---	---	3.3E-06	1.5E-05	---	---	---	---	1.9E-06	8.2E-06	1.8E-03	0.01
<b>ALTERNATIVE:</b>		<b>0.30</b>	<b>1.29</b>	<b>0.11</b>	<b>0.50</b>	<b>1.8E-04</b>	<b>8.1E-04</b>	<b>0.11</b>	<b>0.50</b>	<b>---</b>	<b>---</b>	<b>0.65</b>	<b>2.87</b>	<b>0.00</b>	<b>0.01</b>	<b>0.16</b>	<b>0.68</b>	<b>4.7E-06</b>	<b>2.0E-05</b>	<b>1.33</b>	<b>5.85</b>

Williams Ohio Valley Midstream LLC (OVM)  
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**Attachment N - Supporting Emissions Calculations**

**Greenhouse Gas (GHG) Emissions**

Unit ID	Point ID	Control ID	Description	Heat Input MMBtu/hr (HHV)	Hours of Operation hr/yr	kg/MMBtu: 53.06		kg/MMBtu: 1.00E-03		kg/MMBtu: 1.00E-04		TOTAL CO2e tpy
						GWP: CO2 tpy	CO2e tpy	GWP: CH4 tpy	CO2e tpy	GWP: N2O tpy	CO2e tpy	
DFT-01	1E	na	Flash Tank 01	---	8,760	---	---	333.38	8,334.46	---	---	8,334
DSV-01	2E	na	Still Vent (Regenerator) 01	---	8,760	---	---	4.36	108.99	---	---	109
RBV-01	3E	na	Reboiler 01	1.50	8,760	772.94	772.94	0.01	0.37	0.01	4.22	778
DFT-02	4E	na	Flash Tank 02	---	8,760	---	---	663.91	16,597.83	---	---	16,598
DSV-02	5E	BTEX-01	Still Vent (Regenerator) 02	---	8,760	---	---	0.44	11.04	---	---	11
RBV-02	6E	na	Reboiler 02	2.00	8,760	1,030.59	1,030.59	0.02	0.49	0.02	5.63	1,037
SSM	7E	na	Pigging and Pneumatic Pumps	---	8,760	0.06	0.06	10.75	268.81	---	---	269
FUG	1F	na	Process Piping Fugitives - Gas	---	8,760	0.06	0.06	11.41	285.24	---	---	285

<b>TOTAL FACILITY-WIDE PTE:</b>	<b>1,804</b>	- OR -	<b>1,024</b>	- OR -	<b>0.03</b>	- AND -	<b>27,421</b>
<b>WV-DEP Threshold:</b>	na		na		na		na
<b>Title V Permit Threshold:</b>	na		na		na		na

- Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr.  
 2 - Dehydrator CH4 emissions are based on "Worst Case" GRI-GLYCalc Model Output.  
 3 - Fugitive CH4 emissions are based on EPA Fugitive Emission Factors for Oil and Gas Production Operations.  
 4 - All other GHG emissions are based on default values in 40CFR98, Subpart C, Table C-1.  
 5 - CO2e is aggregated Greenhouse Gas (GHG), comprised of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), as adjusted for Global Warming Potential (GWP).  
 6 - WV-DEP and Title V Permit Major Source Thresholds are applicable only if other regulated air pollutants exceed the corresponding Thresholds.

**IMPORTANT:**

**7 - Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:**

DFT-02alt	4Ealt	na	Flash Tank 02alt	---	8,760	---	---	332	8,299	---	---	8,299
DSV-02alt	5Ealt	na	Still Vent (Regenerator) 02alt	---	8,760	---	---	4.34	108	---	---	108
RBV-02alt	6Ealt	na	Reboiler 02alt	1.00	8,760	515	515	0.01	0.2	0.01	2.8	518
<b>ALTERNATIVE FACILITY-WIDE PTE:</b>						<b>1,288</b>		<b>696</b>		<b>0.02</b>		<b>18,701</b>

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**PRE-Controlled Emissions - Criteria Pollutants**

Unit ID	Point ID	Control ID	Description	Design Capacity	NOx		CO		VOC		SOx		PM10/2.5	
					lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
DFT-01	1E	na	Flash Tank 01	65.0 MMscfd	---	---	---	---	6.68	29.27	---	---	---	---
DST-02	2E	na	Still Vent (Regenerator) 01		---	---	---	---	1.55	6.78	---	---	---	---
RBV-01	3E	na	Reboiler 01	1.50 MMBtu/hr	0.15	0.64	0.12	0.54	0.01	0.04	8.8E-04	3.9E-03	0.01	0.05
DFT-02	4E	na	Flash Tank 02	100.0 MMscfd	---	---	---	---	13.33	58.39	---	---	---	---
DSV-02	5E	BTEX-01	Still Vent (Regenerator) 02		---	---	---	---	3.11	13.62	---	---	---	---
RBV-02	6E	na	Reboiler 02	2.00 MMBtu/hr	0.20	0.86	0.16	0.54	0.01	0.05	1.2E-03	0.01	0.01	0.07
SSM	7E	na	Pigging and Pneumatic Pumps	na	---	---	---	---	---	0.72	---	---	---	---
<b>TOTAL POINT SOURCE PTE:</b>					<b>0.34</b>	<b>1.50</b>	<b>0.29</b>	<b>1.08</b>	<b>24.69</b>	<b>108.87</b>	<b>2.1E-03</b>	<b>0.01</b>	<b>0.03</b>	<b>0.11</b>
<b>WV-DEP Permit Threshold:</b>					6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy		6 lb/hr <u>AND</u> 10 tpy	
<b>Title V Permit Threshold:</b>					---	100	---	100	---	100	---	100	---	100

<b>FUG</b>	<b>1F</b>	<b>na</b>	<b>Process Piping Fugitives - Gas</b>	<b>1,001 fittings</b>	---	---	---	---	<b>0.17</b>	<b>0.73</b>	---	---	---	---
<b>TOTAL FUGITIVE SOURCE PTE:</b>					---	---	---	---	<b>0.17</b>	<b>0.73</b>	---	---	---	---

<b>TOTAL PTE:</b>					<b>0.34</b>	<b>1.50</b>	<b>0.29</b>	<b>1.08</b>	<b>24.86</b>	<b>109.60</b>	<b>2.1E-03</b>	<b>0.01</b>	<b>0.03</b>	<b>0.11</b>
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- Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr.  
 2 - VOC is volatile organic compounds, as defined by EPA, and includes HCHO (formaldehyde).  
 3 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.  
 4 - Fugitive criteria pollutant emissions are not considered in major source determinations (45CSR30 Section 2.26.b.)

**IMPORTANT:**

**5 - Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:**

DFT-02alt	4Ealt	na	Flash Tank 02alt	50.0 MMscfd	---	---	---	---	6.67	29.20	---	---	---	---
DSV-02alt	5Ealt	na	Still Vent (Regenerator) 02alt		---	---	---	---	1.56	6.81	---	---	---	---
RBV-02alt	6Ealt	na	Reboiler 02alt	1.00 MMBtu/hr	0.10	0.43	0.08	0.36	0.01	0.02	5.9E-04	2.6E-03	0.01	0.03
<b>TOTAL POINT SOURCE PTE:</b>					<b>0.25</b>	<b>1.07</b>	<b>0.21</b>	<b>0.90</b>	<b>16.46</b>	<b>72.84</b>	<b>1.5E-03</b>	<b>0.01</b>	<b>0.02</b>	<b>0.08</b>
<b>TOTAL PTE:</b>					<b>0.25</b>	<b>1.07</b>	<b>0.21</b>	<b>0.90</b>	<b>16.63</b>	<b>73.57</b>	<b>1.5E-03</b>	<b>0.01</b>	<b>0.02</b>	<b>0.08</b>

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**Attachment N - Supporting Emissions Calculations**

**PRE-Controlled Emissions - Hazardous Air Pollutants (HAP)**

Unit ID	Point ID	Benzene		Ethylbenzene		HCHO (HAP)		n-Hexane		Methanol		Toluene		2,2,4-TMP		Xylenes		Other HAP		Total HAP	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
DFT-01	1E	0.01	0.06	2.3E-03	0.01	---	---	0.04	0.17	---	---	0.02	0.09	4.8E-05	2.2E-03	2.3E-03	0.01	---	---	0.08	0.35
DSV-01	2E	0.13	0.59	0.05	0.24	---	---	0.02	0.07	---	---	0.31	1.35	2.4E-04	8.4E-04	0.08	0.34	---	---	0.59	2.58
RBV-01	3E	3.1E-06	1.4E-05	---	---	1.1E-04	4.8E-04	2.6E-03	0.01	---	---	5.0E-06	2.2E-05	---	---	---	---	2.8E-06	1.2E-05	2.8E-03	0.01
DFT-02	4E	0.03	0.12	4.4E-03	0.02	---	---	0.08	0.35	---	---	0.04	0.18	9.6E-04	4.3E-03	4.3E-03	0.02	---	---	0.16	0.69
DSV-02	5E	0.27	1.17	0.11	0.47	---	---	0.03	0.13	---	---	0.61	2.67	3.6E-04	1.7E-03	0.15	0.65	---	---	2.02	8.84
RBV-02	6E	4.1E-06	1.8E-05	---	---	1.5E-04	6.4E-04	3.5E-03	0.02	---	---	6.7E-06	2.9E-05	---	---	---	---	3.7E-06	1.6E-05	3.7E-03	0.02
SSM	7E	---	6.0E-04	---	6.0E-04	---	---	---	6.0E-04	---	---	---	6.0E-04	---	6.0E-04	---	6.0E-04	---	---	---	3.6E-03
FUG	1F	1.4E-04	6.1E-04	1.4E-04	6.1E-04	---	---	1.4E-04	6.1E-04	---	---	1.4E-04	6.1E-04	1.4E-04	6.1E-04	1.4E-04	6.1E-04	---	---	8.3E-04	3.6E-03

<b>TOTAL PTE:</b>	<b>0.44</b>	<b>1.94</b>	<b>0.17</b>	<b>0.74</b>	<b>2.6E-04</b>	<b>1.1E-03</b>	<b>0.17</b>	<b>0.75</b>	<b>---</b>	<b>---</b>	<b>0.98</b>	<b>4.29</b>	<b>1.7E-03</b>	<b>0.01</b>	<b>0.23</b>	<b>1.02</b>	<b>6.5E-06</b>	<b>2.9E-05</b>	<b>2.85</b>	<b>12.49</b>
<b>WV-DEP:</b>	2 lb/hr	<u>OR</u> 0.5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 0.5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy	2 lb/hr	<u>OR</u> 5 tpy
<b>Title V:</b>	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	10	---	25

Notes: 1 - Emissions are based on operation at 100% of rated load for 8,760 hrs/yr.

**IMPORTANT:**

**2 - Applicant requests an ALTERNATIVE OPERATING SCENARIO w/ a 50.0 MMscfd Dehydrator 02 INSTEAD OF the 100.00 MMscfd Dehydrator 02 shown above:**

DFT-02alt	4Ealt	0.01	36.05	2.3E-03	0.01	---	---	0.04	0.17	---	---	0.02	0.09	4.8E-05	2.2E-03	2.3E-03	0.01	---	---	0.08	0.35
DSV-02alt	5Ealt	0.13	0.59	0.05	0.24	---	---	0.02	0.07	---	---	0.31	1.35	2.4E-04	8.4E-04	0.08	0.34	---	---	0.59	2.58
RBV-02alt	6Ealt	3.1E-06	1.4E-05	---	---	1.1E-04	4.8E-04	2.6E-03	0.01	---	---	5.0E-06	2.2E-05	---	---	---	---	2.8E-06	1.2E-05	2.8E-03	0.01
<b>TOTAL PTE:</b>		<b>0.30</b>	<b>37.28</b>	<b>0.11</b>	<b>0.50</b>	<b>2.2E-04</b>	<b>9.7E-04</b>	<b>0.11</b>	<b>0.50</b>	<b>---</b>	<b>---</b>	<b>0.66</b>	<b>2.88</b>	<b>0.00</b>	<b>0.01</b>	<b>0.16</b>	<b>0.70</b>	<b>5.6E-06</b>	<b>2.4E-05</b>	<b>1.34</b>	<b>5.89</b>

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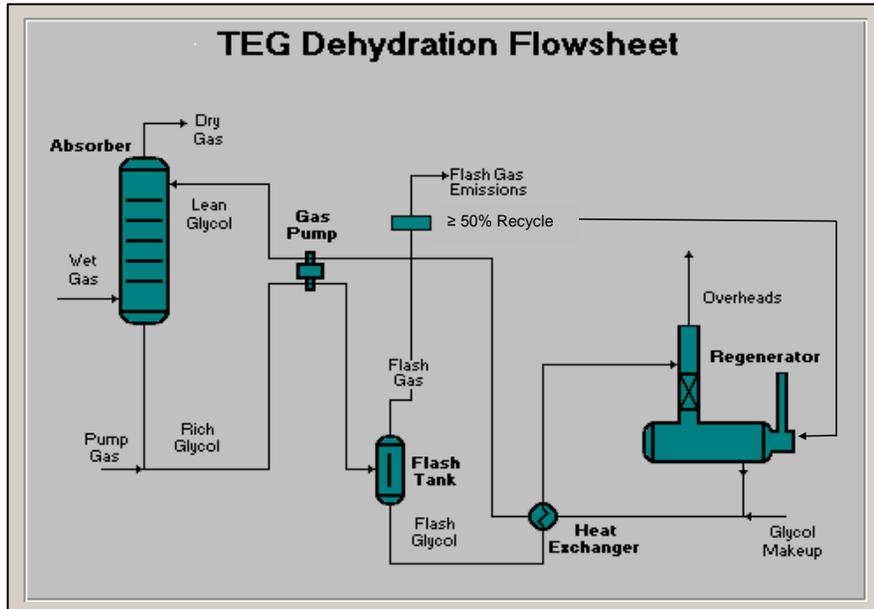
**Dehydrator 01 (Flash Tank and Still Vent) – 65.0 MMscfd**

Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Estimated Pre-Controlled Emissions		120% Worst-Case Pre-Controlled Emissions		Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy		%	lb/hr
DFT-01 (1E)	Dehy 01 (DFT-01)  Flash Tank (A minimum of 50% of the Flash Tank Off-Gas is Recycled as Fuel in the Reboiler)	Flow Rate 65.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	5.57	24.39	6.68	29.27	---	6.68	29.27
			GRI-GLYCalc 4.0	Benzene	0.01	0.05	0.01	0.06	---	0.01	0.06
			GRI-GLYCalc 4.0	Ethylbenzene	1.9E-03	0.01	2.3E-03	0.01	---	2.3E-03	0.01
			GRI-GLYCalc 4.0	n-Hexane	0.03	0.14	0.04	0.17	---	0.04	0.17
			GRI-GLYCalc 4.0	Toluene	0.02	0.08	0.02	0.09	---	0.02	0.09
			GRI-GLYCalc 4.0	2,2,4-TMP	4.0E-05	1.8E-03	4.8E-05	2.2E-03	---	4.8E-05	2.2E-03
			GRI-GLYCalc 4.0	Xylenes	1.9E-03	0.01	2.3E-03	0.01	---	2.3E-03	0.01
			GRI-GLYCalc 4.0	Tot HAP	0.07	0.29	0.08	0.35	---	0.08	0.35
			GRI-GLYCalc 4.0	CH4	63.43	277.82	76.11	333.38	---	76.11	333.38
			40CFR98 - Table A-1	CO2e	1,586	6,945	1,903	8,334	---	1,903	8,334
DSV-01 (2E)	Dehy 01 (DSV-01)  Still Vent (aka Regenerator)	Flow Rate 65.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	1.29	5.65	1.55	6.78	---	1.55	6.78
			GRI-GLYCalc 4.0	Benzene	0.11	0.49	0.13	0.59	---	0.13	0.59
			GRI-GLYCalc 4.0	Ethylbenzene	0.05	0.20	0.05	0.24	---	5.5E-02	0.24
			GRI-GLYCalc 4.0	n-Hexane	0.01	0.05	0.02	0.07	---	1.5E-02	0.07
			GRI-GLYCalc 4.0	Toluene	0.26	1.12	0.31	1.35	---	0.31	1.35
			GRI-GLYCalc 4.0	2,2,4-TMP	2.0E-04	7.0E-04	2.4E-04	8.4E-04	---	2.4E-04	8.4E-04
			GRI-GLYCalc 4.0	Xylenes	0.06	0.28	0.08	0.34	---	7.7E-02	0.34
			GRI-GLYCalc 4.0	Tot HAP	0.49	2.15	0.59	2.58	---	0.59	2.58
			GRI-GLYCalc 4.0	CH4	0.83	3.63	1.00	4.36	---	1.00	4.36
			40CFR98 - Table A-1	CO2e	21	91	25	109	---	25	109
DEHY 01 (Sum of DSV and DFT)	Dehy 01 (Total)  Total Dehydrator Emissions	Flow Rate 65.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	6.86	30.04	8.23	36.05	---	8.23	36.05
			GRI-GLYCalc 4.0	Benzene	0.12	0.54	0.15	0.65	---	0.15	0.65
			GRI-GLYCalc 4.0	Ethylbenzene	0.05	0.21	0.06	0.25	---	0.06	0.25
			GRI-GLYCalc 4.0	n-Hexane	0.05	0.20	0.05	0.24	---	0.05	0.24
			GRI-GLYCalc 4.0	Toluene	0.27	1.20	0.33	1.44	---	0.33	1.44
			GRI-GLYCalc 4.0	2,2,4-TMP	2.4E-04	0.00	2.9E-04	3.0E-03	---	2.9E-04	3.0E-03
			GRI-GLYCalc 4.0	Xylenes	0.07	0.29	0.08	0.35	---	0.08	0.35
			GRI-GLYCalc 4.0	Tot HAP	0.56	2.44	0.67	2.93	---	0.67	2.93
			GRI-GLYCalc 4.0	CH4	64.26	281.45	77.11	337.74	---	77.11	337.74
			40CFR98 - Table A-1	CO2e	1,606	7,036	1,928	8,443	---	1,928	8,443

- Notes:
- 1 - Used GRI-GLYCalc V4.0 to calculate combined regenerator vent/flash gas emissions.
  - 2 - Total HAP includes n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), and other components.
  - 3 - A 20% contingency has been added to the GRI-GLYCalc results to account for potential future changes in gas quality.

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**Attachment N - Supporting Emissions Calculations**  
**Dehydrator 01 (Summary) – 65.0 MMscfd**

Unit ID	Description	Reference	Pollutant	GRI-GLYCalc Results		W/ 20% Margin		Control Eff %	Controlled Emissions	
				lb/hr	tpy	lb/hr	tpy		lb/hr	tpy
DEHY-01 (1E/2E)	Dehydrator 01  (Sum of Flash Tank and Still Vent (aka Regenerator) Emissions)	---	NOX	---	---	---	---	---	---	---
		---	CO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	VOC	6.86	30.04	8.23	36.05	---	8.23	36.05
		---	SO2	---	---	---	---	---	---	---
		---	PM10/2.5	---	---	---	---	---	---	---
	65.0 MMscfd	GRI-GLYCalc 4.0	Benzene	0.12	0.54	0.15	0.65	---	0.15	0.65
		GRI-GLYCalc 4.0	Ethylbenzene	0.05	0.21	0.06	0.25	---	0.06	0.25
		---	HCHO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	n-Hexane	0.05	0.20	0.05	0.24	---	0.05	0.24
		---	Methanol	---	---	---	---	---	---	---
	8,760 Hr/yr	GRI-GLYCalc 4.0	Toluene	0.27	1.20	0.33	1.44	---	0.33	1.44
		GRI-GLYCalc 4.0	2,2,4-TMP	2.4E-04	2.5E-03	2.9E-04	3.0E-03	---	2.9E-04	3.0E-03
		GRI-GLYCalc 4.0	Xylenes	0.07	0.29	0.08	0.35	---	0.08	0.35
		---	Other HAP	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Total HAP	0.56	2.44	0.67	2.93	---	0.67	2.93
	23,725 MMscf/yr 2.71 MMscf/hr NESHAP HH - Exempt	---	CO2	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	CH4	64.26	281.45	77.11	337.74	---	77.11	337.74
		---	N2O	---	---	---	---	---	---	---
		40CFR98 - Table A-1	CO2e	1,606	7,036	1,928	8,443	---	1,928	8,443



**\*Dehydrator Operating Parameters**  
 (See Attachments L - GRI-GLYCalc Model and H - Extended Gas Analysis)

Dry Gas Flow Rate:	65.0 MMscfd	Extended Gas Analysis:	06/17/15
Wet Gas Temperature:	90 oF	Flash Tank Temperature:	150 oF
Wet Gas Pressure:	1,100 psig	Flash Tank Pressure:	50 psig
Wet Gas Water Content:	Saturated	Flash Tank Off-Gas:	50% Recycle
Dry Gas Water Content:	7.0 lb H2O/MMscf	Stripping Gas:	na
Lean Glycol Water Content:	1.5 wt% H2O	Stripping Gas Flow Rate:	na
Glycol Pump Type:	Gas Injection	Regen Overhead Control:	na
Glycol Pump Model:	Kimray 45015 PV	Condenser Temperature:	na
Lean Glycol Circulation Rate:	7.50 gpm	Condenser Pressure:	na

**Additional GRI-GLYCalc 4.0 Model Results:**

Flash Tank Off-Gas Flow:	3,490 scfh	Wet Gas Water Content:	0.086 Vol%
Regen Overhead Stream:	2,220 scfh	Dry Gas Water Content:	0.005 Vol%
Lean Glycol Recirc Ratio:	4.3 gal/lb-H2O	Rich Glycol Water Content:	3.730 wt%

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**Reboiler 01 – 1.50 MMBtu/hr**

Unit ID	Description	Reference	Pollutant	Emission Factor		Pre-Controlled		Control %	Controlled	
				lb/MMscf	lb/MMBtu	lb/hr	tpy		lb/hr	tpy
RBV-01 (3E)	Reboiler 01	EPA AP-42 Table 1.4-2	NOX	100.00	0.10	0.15	0.64	na	0.15	0.64
		EPA AP-42 Table 1.4-2	CO	84.00	0.08	0.12	0.54	na	0.12	0.54
		EPA AP-42 Table 1.4-2	VOC	5.68	0.01	0.01	0.04	na	0.01	0.04
		EPA AP-42 Table 1.4-2	SO2	0.60	5.88E-04	8.8E-04	3.9E-03	na	8.8E-04	3.9E-03
		EPA AP-42 Table 1.4-2	PM10/2.5	7.60	0.01	0.01	0.05	na	0.01	0.05
	1.50 MMBtu/hr	EPA AP-42 Table 1.4-3	Benzene	2.1E-03	2.06E-06	3.1E-06	1.4E-05	na	3.1E-06	1.4E-05
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	---	---	---	---	---
	8,760 hr/yr	EPA AP-42 Table 1.4-3	HCHO	0.08	7.35E-05	1.1E-04	4.8E-04	na	1.1E-04	4.8E-04
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	2.6E-03	0.01	na	2.6E-03	0.01
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	Methanol	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Toluene	3.4E-03	3.33E-06	5.0E-06	2.2E-05	---	5.0E-06	2.2E-05
		EPA AP-42 Table 1.4-3	2,2,4-TMP	---	---	---	---	na	---	---
		EPA AP-42 Table 1.4-3	Xylenes	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Other HAP	1.9E-03	1.86E-06	2.8E-06	1.2E-05	na	2.8E-06	1.2E-05
		EPA AP-42 Table 1.4-3	Total HAP	1.88	1.85E-03	2.8E-03	0.01	na	2.8E-03	0.01
		EPA AP-42 Table 1.4-2	CO2	120,000	117.65	176.47	772.94	na	176.47	772.94
	1,471 scf/hr 35.29 Mscfd 12.88 MMscf/yr	EPA AP-42 Table 1.4-2	CH4	2.30	2.25E-03	3.4E-03	0.01	na	3.4E-03	0.01
EPA AP-42 Table 1.4-2		N2O	2.20	2.16E-03	3.2E-03	0.01	na	3.2E-03	0.01	
40CFR98 - Table A-1		CO2e	120,713	118	178	778	na	178	778	

- Notes:
- 1 - The combustion emission factors are based on a default fuel heat content of 1,020 Btu/scf (HHV).
  - 2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
  - 3 - Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment N - Supporting Emissions Calculations**

**Dehydrator 02 (Flash Tank and Still Vent) – 100.0 MMscfd**

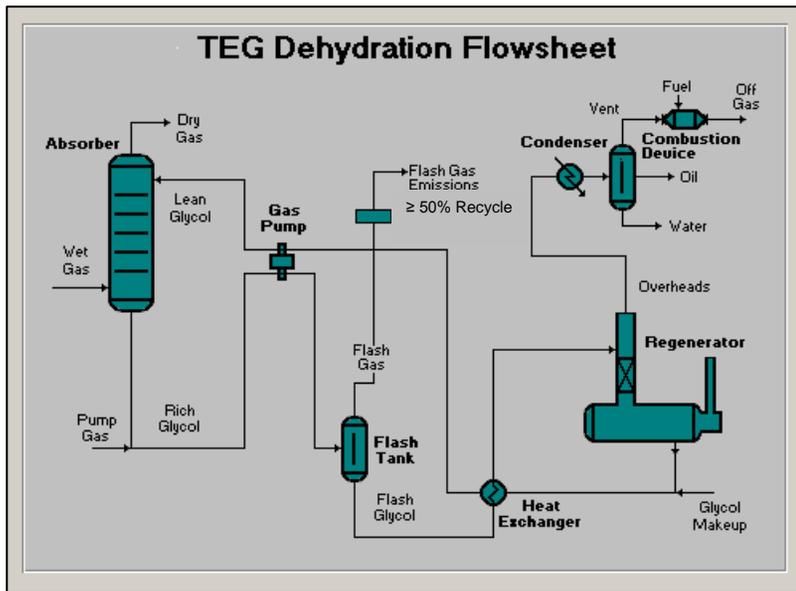
Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Estimated Pre-Controlled Emissions		120% Worst-Case Pre-Controlled Emissions		Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy		%	lb/hr
DFT-02 (4E)	Dehy 02 (DFT-02)  Flash Tank (A minimum of 50% of the Flash Tank Off-Gas is Recycled as Fuel in the Reboiler)	Flow Rate 100.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	11.11	48.66	13.33	58.39	---	13.33	58.39
			GRI-GLYCalc 4.0	Benzene	0.02	0.10	0.03	0.12	---	0.03	0.12
			GRI-GLYCalc 4.0	Ethylbenzene	3.7E-03	0.02	4.4E-03	0.02	---	4.4E-03	0.02
			GRI-GLYCalc 4.0	n-Hexane	0.07	0.29	0.08	0.35	---	0.08	0.35
			GRI-GLYCalc 4.0	Toluene	0.03	0.15	0.04	0.18	---	0.04	0.18
			GRI-GLYCalc 4.0	2,2,4-TMP	8.0E-04	3.6E-03	9.6E-04	4.3E-03	---	9.6E-04	4.3E-03
			GRI-GLYCalc 4.0	Xylenes	3.6E-03	0.02	4.320E-03	0.02	---	4.3E-03	0.02
			GRI-GLYCalc 4.0	Tot HAP	0.13	0.57	0.16	0.69	---	0.16	0.69
			GRI-GLYCalc 4.0	CH4	126.32	553.26	151.58	663.91	---	151.58	663.91
40CFR98 - Table A-1	CO2e	3,158	13,832	3,789	16,598	---	3,789	16,598			
DSV-02 (5E)	Dehy 02 (DSV-02)  Still Vent (aka Regenerator) (Controlled w/ JATCO 95% BTEX Skid)	Flow Rate 100.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	2.59	11.35	3.11	13.62	95%	0.16	0.68
			GRI-GLYCalc 4.0	Benzene	0.22	0.98	0.27	1.17	95%	0.01	0.06
			GRI-GLYCalc 4.0	Ethylbenzene	0.09	0.39	0.11	0.47	95%	0.01	0.02
			GRI-GLYCalc 4.0	n-Hexane	0.03	0.11	0.03	0.13	95%	1.5E-03	0.01
			GRI-GLYCalc 4.0	Toluene	0.51	2.22	0.61	2.67	95%	0.03	0.13
			GRI-GLYCalc 4.0	2,2,4-TMP	3.0E-04	1.4E-03	3.6E-04	1.7E-03	95%	1.8E-05	8.4E-05
			GRI-GLYCalc 4.0	Xylenes	0.12	0.54	0.15	0.65	95%	0.01	0.03
			GRI-GLYCalc 4.0	Tot HAP	0.97	4.25	1.16	5.10	95%	0.06	0.25
			GRI-GLYCalc 4.0	CH4	1.68	7.36	2.02	8.84	95%	0.10	0.44
40CFR98 - Table A-1	CO2e	42	184	50	221	95%	3	11			
DEHY 02 (Sum of DSV and DFT)	Dehy 02 (Total)  Total Dehydrator Emissions	Flow Rate 100.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	13.70	60.02	16.44	72.02	18%	13.49	59.08
			GRI-GLYCalc 4.0	Benzene	0.24	1.07	0.29	1.29	86%	0.04	0.18
			GRI-GLYCalc 4.0	Ethylbenzene	0.09	0.41	0.11	0.49	91%	0.01	0.04
			GRI-GLYCalc 4.0	n-Hexane	0.09	0.40	0.11	0.48	27%	0.08	0.35
			GRI-GLYCalc 4.0	Toluene	0.54	2.37	0.65	2.85	89%	0.07	0.31
			GRI-GLYCalc 4.0	2,2,4-TMP	1.1E-03	0.01	1.3E-03	0.01	27%	9.8E-04	0.00
			GRI-GLYCalc 4.0	Xylenes	0.13	0.56	0.15	0.67	92%	0.01	0.05
			GRI-GLYCalc 4.0	Tot HAP	1.10	4.82	1.32	5.78	84%	0.22	0.94
			GRI-GLYCalc 4.0	CH4	128.00	560.62	153.60	672.75	1%	151.68	664.35
40CFR98 - Table A-1	CO2e	3,200	14,016	3,840	16,819	1%	3,792	16,609			

- Notes:
- 1 - Used GRI-GLYCalc V4.0 to calculate combined regenerator vent/flash gas emissions.
  - 2 - Total HAP includes n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), and other components.
  - 3 - A 20% contingency has been added to the GRI-GLYCalc results to account for potential future changes in gas quality.

Williams Ohio Valley Midstream LLC (OVM)  
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**Attachment N - Supporting Emissions Calculations**

**Dehydrator 02 (Summary) – 100.0 MMscfd**

Unit ID	Description	Reference	Pollutant	GRI-GLYCalc Results		W/ 20% Margin		Control Eff %	Controlled Emissions	
				lb/hr	tpy	lb/hr	tpy		lb/hr	tpy
DEHY-02 (4E/5E)	Dehydrator 02  (Sum of Flash Tank and Still Vent (aka Regenerator) Emissions) (Controlled w/ JATCO 95% BTEX Skid)	---	NOX	---	---	---	---	---	---	---
		---	CO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	VOC	13.70	60.02	16.44	72.02	18.0%	13.49	59.08
		---	SO2	---	---	---	---	---	---	---
		---	PM10/2.5	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Benzene	0.24	1.07	0.29	1.29	86.3%	0.04	0.18
		GRI-GLYCalc 4.0	Ethylbenzene	0.09	0.41	0.11	0.49	91.3%	0.01	0.04
		100.0 MMscfd	HCHO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	n-Hexane	0.09	0.40	0.11	0.48	26.6%	0.08	0.35
		8,760 Hr/yr	Methanol	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Toluene	0.54	2.37	0.65	2.85	89.0%	0.07	0.31
		GRI-GLYCalc 4.0	2,2,4-TMP	1.1E-03	0.01	1.3E-03	0.01	26.6%	9.8E-04	4.4E-03
		GRI-GLYCalc 4.0	Xylenes	0.13	0.56	0.15	0.67	92.3%	0.01	0.05
		36,500 MMscf/yr 4.17 MMscf/hr NESHAP HH - Exempt	Other HAP	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Total HAP	1.10	4.82	1.32	5.78	83.7%	0.22	0.94
	---	CO2	---	---	---	---	---	---	---	
	GRI-GLYCalc 4.0	CH4	128.00	560.62	154	673	1.2%	152	664	
	---	N2O	---	---	---	---	---	---	---	
40CFR98 - Table A-1	CO2e	3,200	14,016	3,840	16,819	1.2%	3,792	16,609		



**\*Dehydrator Operating Parameters  
 (See Attachments L - GRI-GLYCalc Model  
 and H - Extended Gas Analysis)**

Dry Gas Flow Rate:	100.0 MMscfd	Extended Gas Analysis:	06/17/15
Wet Gas Temperature:	90 oF	Flash Tank Temperature:	150 oF
Wet Gas Pressure:	1,100 psig	Flash Tank Pressure:	50 psig
Wet Gas Water Content:	Saturated	Flash Tank Off-Gas:	50% Recycle
Dry Gas Water Content:	7.0 lb H2O/MMscf	Stripping Gas:	na
Lean Glycol Water Content:	1.5 wt% H2O	Stripping Gas Flow Rate:	na
Glycol Pump Type:	Gas Injection	Regen Overhead Control:	95% BTEX Skid
Glycol Pump Model:	2xKimray 45015 PV	Condenser Temperature:	150 oF
Lean Glycol Circulation Rate:	15.00 gpm	Condenser Pressure:	14 psia

**Additional GRI-GLYCalc 4.0 Model Results:**

Flash Tank Off-Gas Flow:	6,950 scfh	Wet Gas Water Content:	0.086 Vol%
Regen Overhead Stream:	3,450 scfh	Dry Gas Water Content:	0.004 Vol%
Lean Glycol Recirc Ratio:	5.6 gal/lb-H2O	Rich Glycol Water Content:	3.230 wt%

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**Attachment N - Supporting Emissions Calculations**

**Reboiler 02 – 2.00 MMBtu/hr**

Unit ID	Description	Reference	Pollutant	Emission Factor		Pre-Controlled		Control %	Controlled	
				lb/MMscf	lb/MMBtu	lb/hr	tpy		lb/hr	tpy
RBV-2 (6E)	Reboiler 02	EPA AP-42 Table 1.4-2	NOX	100.00	0.10	0.20	0.86	na	0.20	0.86
		EPA AP-42 Table 1.4-2	CO	84.00	0.08	0.16	0.72	na	0.16	0.72
		EPA AP-42 Table 1.4-2	VOC	5.68	0.01	0.01	0.05	na	0.01	0.05
		EPA AP-42 Table 1.4-2	SO2	0.60	5.88E-04	1.2E-03	0.01	na	1.2E-03	0.01
		EPA AP-42 Table 1.4-2	PM10/2.5	7.60	0.01	0.01	0.07	na	0.01	0.07
	2.00 MMBtu/hr (HHV)	EPA AP-42 Table 1.4-3	Benzene	2.1E-03	2.06E-06	4.1E-06	1.8E-05	na	4.1E-06	1.8E-05
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	---	---	---	---	---
	8,760 hr/yr	EPA AP-42 Table 1.4-3	HCHO	0.08	7.35E-05	1.5E-04	6.4E-04	na	1.5E-04	6.4E-04
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	3.5E-03	0.02	na	3.5E-03	0.02
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	Methanol	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Toluene	3.4E-03	3.33E-06	6.7E-06	2.9E-05	---	6.7E-06	2.9E-05
		EPA AP-42 Table 1.4-3	2,2,4-TMP	---	---	---	---	na	---	---
		EPA AP-42 Table 1.4-3	Xylenes	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Other HAP	1.9E-03	1.86E-06	3.7E-06	1.6E-05	na	3.7E-06	1.6E-05
		EPA AP-42 Table 1.4-3	Total HAP	1.88	1.85E-03	3.7E-03	0.02	na	3.7E-03	0.02
		EPA AP-42 Table 1.4-2	CO2	120,000	117.65	235.29	1,030.59	na	235.29	1,030.59
	1,961 scf/hr 47.06 Mscfd 17.18 MMscf/yr	EPA AP-42 Table 1.4-2	CH4	2.30	2.25E-03	4.5E-03	0.02	na	4.5E-03	0.02
EPA AP-42 Table 1.4-2		N2O	2.20	2.16E-03	4.3E-03	0.02	na	4.3E-03	0.02	
40CFR98 - Table A-1		CO2e	120,713	118	237	1,037	na	237	1,037	

- Notes:
- 1 - The combustion emission factors are based on a default fuel heat content of 1,020 Btu/scf (HHV).
  - 2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
  - 3 - Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

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**Attachment N - Supporting Emissions Calculations**

**Startup, Shutdown and Maintenance (includes Pigging Emissions (SSM))**

Unit ID	Description	No of Units	a. Vented Gas Volume		b. Blowdown (BD) Gas Volume		Frequency of Occurrence	
			scf/hr/unit	scf/yr/unit	scf/SSM	scf/Event	Events/unit/wk	Events/unit/yr
SSM	Pigging	1	na	na	na	3,061	1	52
	Pneumatic Pumps	3	13.30	116,508	na	na	na	na

Unit ID	Description	Total Gas Vented MMscf/yr	VOC	Hex,BTEX,TMP	Total HAP	CO2	CH4	CO2e
			2,833 lb/MMscf tpy	2.36 lb/MMscf tpy	14.14 lb/MMscf tpy	233 lb/MMscf tpy	42,275 lb/MMscf tpy	1,057,108 lb/MMscf tpy
SSM	Pigging	0.16	0.23	1.9E-04	1.1E-03	0.02	3	84
	Pneumatic Pumps	0.35	0.50	4.1E-04	2.5E-03	0.04	7	185

<b>0.72</b>	<b>6.0E-04</b>	<b>3.6E-03</b>	<b>0.06</b>	<b>11</b>	<b>269</b>
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- Notes: 1 - SSM Emissions include gas vented to the atmosphere from pigging events.  
 2 - To be conservative, the following gas characteristics were assumed:

Pollutant	Representative Gas Analysis	Worst-Case Assumption
CO2	194 lb/MMscf	233 lb/MMscf
CH4	37,507 lb/MMscf	42,275 lb/MMscf
VOC	2,361 lb/MMscf	2,833 lb/MMscf
n-Hex, BTEX, 2,2,4-TMP (ea)	Varies lb/MMscf	2.36 lb/MMscf
Total HAP	11.78 lb/MMscf	14.14 lb/MMscf

- 3 - This estimate of SSM emissions is sufficient to account for other infrequent and (often) de-minimis emissions from various activities at the facility that are not necessarily associated with pigging events.  
 4 - Pigging calculations based on 52 events per year and 3,061 scf/event (assuming 50 scf of gas blowdown at 900 psig).  
 5 - It is conservatively assumed that each pneumatic pump vents gas to the atmosphere for 8,760 hours per year.  
 6 - The pneumatic pump vented gas volume is from Table W-1A to Subpart W of Part 98—Default Whole Gas Emission Factors for Onshore Petroleum and Natural Gas Production

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 Application for 45CSR13 NSR Modification Permit  
**Attachment N - Supporting Emissions Calculations**

**Dehydrator 02 (ALTERNATIVE) (Flash Tank and Still Vent) – 50.0 MMscfd**

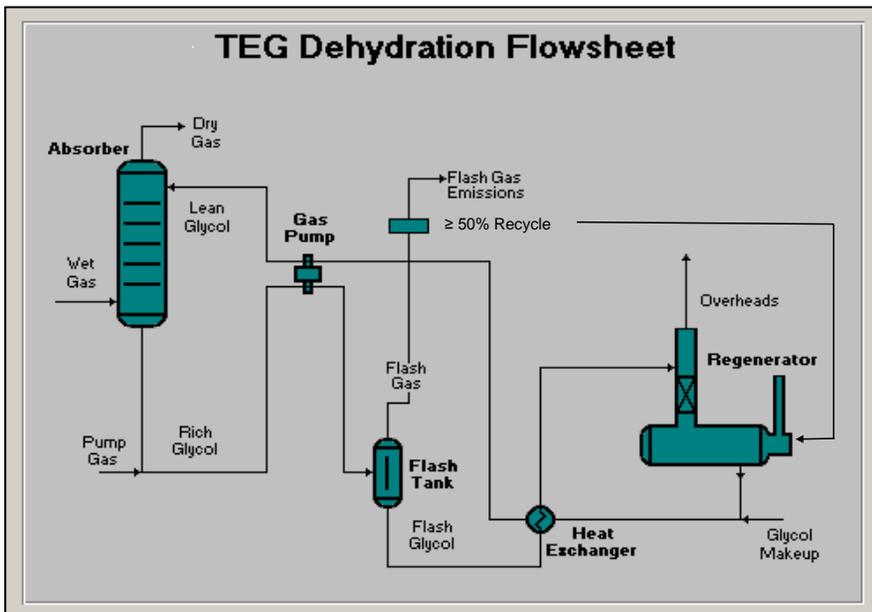
Unit ID	Description	Capacity	Reference	Pollutant	GRI-GLYCalc Estimated Pre-Controlled Emissions		120% Worst-Case Pre-Controlled Emissions		Control Efficiency	Controlled Emissions	
					lb/hr	tpy	lb/hr	tpy		%	lb/hr
DFT-02alt (4Ealt)	Dehy 02alt (DFT-02alt)  Flash Tank (A minimum of 50% of the Flash Tank Off-Gas is Recycled as Fuel in the Reboiler)	Flow Rate 50.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	5.56	24.33	6.67	29.20	---	6.67	29.20
			GRI-GLYCalc 4.0	Benzene	0.01	0.05	0.01	0.06	---	0.01	0.06
			GRI-GLYCalc 4.0	Ethylbenzene	1.8E-03	0.01	2.2E-03	0.01	---	2.2E-03	0.01
			GRI-GLYCalc 4.0	n-Hexane	0.03	0.14	0.04	0.17	---	0.04	0.17
			GRI-GLYCalc 4.0	Toluene	0.02	0.08	0.02	0.09	---	0.02	0.09
			GRI-GLYCalc 4.0	2,2,4-TMP	4.0E-04	1.8E-03	4.8E-04	2.2E-03	---	4.8E-04	2.2E-03
			GRI-GLYCalc 4.0	Xylenes	1.8E-03	0.01	2.2E-03	0.01	---	2.2E-03	0.01
			GRI-GLYCalc 4.0	Tot HAP	0.07	0.29	0.08	0.34	---	0.08	0.34
			GRI-GLYCalc 4.0	CH4	63.16	276.63	75.79	331.96	---	75.79	331.96
			40CFR98 - Table A-1	CO2e	1,579	6,916	1,895	8,299	---	1,895	8,299
DSV-02alt (5Ealt)	Dehy 02alt (DSV-02alt)  Still Vent (aka Regenerator)	Flow Rate 50.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	1.30	5.68	1.56	6.81	---	1.56	6.81
			GRI-GLYCalc 4.0	Benzene	0.11	0.49	0.13	0.59	---	0.13	0.59
			GRI-GLYCalc 4.0	Ethylbenzene	0.04	0.20	0.05	0.24	---	0.05	0.24
			GRI-GLYCalc 4.0	n-Hexane	0.01	0.06	0.02	0.07	---	0.02	0.07
			GRI-GLYCalc 4.0	Toluene	0.25	1.11	0.30	1.33	---	0.30	1.33
			GRI-GLYCalc 4.0	2,2,4-TMP	2.0E-04	7.0E-04	2.4E-04	8.4E-04	---	2.4E-04	8.4E-04
			GRI-GLYCalc 4.0	Xylenes	0.06	0.27	0.07	0.33	---	0.07	0.33
			GRI-GLYCalc 4.0	Tot HAP	0.48	2.12	0.58	2.55	---	0.58	2.55
			GRI-GLYCalc 4.0	CH4	0.84	3.61	1.01	4.34	---	1.01	4.34
			40CFR98 - Table A-1	CO2e	21	90	25	108	---	25	108
DEHY 02alt (Sum of DSV and DFT)	Dehy 02alt (Total)  Total Dehydrator Emissions	Flow Rate 50.0 MMscfd  8,760 hr/yr	GRI-GLYCalc 4.0	VOC	6.85	30.01	8.22	36.01	---	8.22	36.01
			GRI-GLYCalc 4.0	Benzene	0.12	0.54	0.15	0.64	---	0.15	0.64
			GRI-GLYCalc 4.0	Ethylbenzene	0.05	0.20	0.06	0.25	---	0.06	0.25
			GRI-GLYCalc 4.0	n-Hexane	0.05	0.20	0.05	0.24	---	0.05	0.24
			GRI-GLYCalc 4.0	Toluene	0.27	1.19	0.32	1.42	---	0.32	1.42
			GRI-GLYCalc 4.0	2,2,4-TMP	6.0E-04	0.00	7.2E-04	3.0E-03	---	7.2E-04	3.0E-03
			GRI-GLYCalc 4.0	Xylenes	0.06	0.28	0.08	0.34	---	0.08	0.34
			GRI-GLYCalc 4.0	Tot HAP	0.55	2.41	0.66	2.89	---	0.66	2.89
			GRI-GLYCalc 4.0	CH4	64.00	280.31	76.80	336.37	---	76.80	336.37
			40CFR98 - Table A-1	CO2e	1,600	7,006	1,920	8,407	---	1,920	8,407

- Notes:
- 1 - Used GRI-GLYCalc V4.0 to calculate combined regenerator vent/flash gas emissions.
  - 2 - Total HAP includes n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), and other components.
  - 3 - A 20% contingency has been added to the GRI-GLYCalc results to account for potential future changes in gas quality.

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**Attachment N - Supporting Emissions Calculations**

**Dehydrator 02 (ALTERNATIVE) (Summary) – 50.0 MMscfd**

Unit ID	Description	Reference	Pollutant	GRI-GLYCalc Results		W/ 20% Margin		Control Eff %	Controlled Emissions	
				lb/hr	tpy	lb/hr	tpy		lb/hr	tpy
DEHY-02alt (4Ealt/5Ealt)	Dehydrator 02alt  (Sum of Flash Tank and Still Vent (aka Regenerator) Emissions)	---	NOX	---	---	---	---	---	---	---
		---	CO	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	VOC	6.85	30.01	8.22	36.01	---	<b>8.22</b>	<b>36.01</b>
		---	SO2	---	---	---	---	---	---	---
		---	PM10/2.5	---	---	---	---	---	---	---
	50.0 MMscfd	GRI-GLYCalc 4.0	Benzene	0.12	0.54	0.15	0.64	---	<b>0.15</b>	<b>0.64</b>
		GRI-GLYCalc 4.0	Ethylbenzene	0.05	0.20	0.06	0.25	---	<b>0.06</b>	<b>0.25</b>
		---	HCHO	---	---	---	---	---	---	---
	8,760 Hr/yr	GRI-GLYCalc 4.0	n-Hexane	0.05	0.20	0.05	0.24	---	<b>0.05</b>	<b>0.24</b>
		---	Methanol	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Toluene	0.27	1.19	0.32	1.42	---	<b>0.32</b>	<b>1.42</b>
		GRI-GLYCalc 4.0	2,2,4-TMP	6.0E-04	2.5E-03	7.2E-04	3.0E-03	---	<b>7.2E-04</b>	<b>3.0E-03</b>
		GRI-GLYCalc 4.0	Xylenes	0.06	0.28	0.08	0.34	---	<b>0.08</b>	<b>0.34</b>
		---	Other HAP	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	Total HAP	0.55	2.41	0.66	2.89	---	<b>0.66</b>	<b>2.89</b>
	18,250 MMscf/yr 2.08 MMscf/hr NESHAP HH - Exempt	---	CO2	---	---	---	---	---	---	---
		GRI-GLYCalc 4.0	CH4	64.00	280.31	76.80	336.37	---	<b>76.80</b>	<b>336.37</b>
		---	N2O	---	---	---	---	---	---	---
40CFR98 - Table A-1		CO2e	1,600	7,006	1,920	8,407	---	<b>1,920</b>	<b>8,407</b>	



**\*Dehydrator Operating Parameters  
 (See Attachments L - GRI-GLYCalc Model  
 and H - Extended Gas Analysis)**

Dry Gas Flow Rate:	50.0 MMscfd	Extended Gas Analysis:	06/17/15
Wet Gas Temperature:	90 oF	Flash Tank Temperature:	150 oF
Wet Gas Pressure:	1,100 psig	Flash Tank Pressure:	50 psig
Wet Gas Water Content:	Saturated	Flash Tank Off-Gas:	50% Recycle
Dry Gas Water Content:	7.0 lb H2O/MMscf	Stripping Gas:	na
Lean Glycol Water Content:	1.5 wt% H2O	Stripping Gas Flow Rate:	na
Glycol Pump Type:	Gas Injection	Regen Overhead Control:	na
Glycol Pump Model:	Kimray 45015 PV	Condenser Temperature:	na
Lean Glycol Circulation Rate:	7.50 gpm	Condenser Pressure:	na

**Additional GRI-GLYCalc 4.0 Model Results:**

Flash Tank Off-Gas Flow:	3,470 scfh	Wet Gas Water Content:	0.086 Vol%
Regen Overhead Stream:	1,730 scfh	Dry Gas Water Content:	0.004 Vol%
Lean Glycol Recirc Ratio:	5.6 gal/lb-H2O	Rich Glycol Water Content:	3.230 wt%

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment N - Supporting Emissions Calculations**

**Reboiler 02 (ALTERNATIVE) – 1.00 MMBtu/hr**

Unit ID	Description	Reference	Pollutant	Emission Factor		Pre-Controlled		Control %	Controlled	
				lb/MMscf	lb/MMBtu	lb/hr	tpy		lb/hr	tpy
RBV-02alt (6Ealt)	Reboiler 02alt	EPA AP-42 Table 1.4-2	NOX	100.00	0.10	0.10	0.43	na	0.10	0.43
		EPA AP-42 Table 1.4-2	CO	84.00	0.08	0.08	0.36	na	0.08	0.36
		EPA AP-42 Table 1.4-2	VOC	5.68	0.01	0.01	0.02	na	0.01	0.02
		EPA AP-42 Table 1.4-2	SO2	0.60	5.88E-04	5.9E-04	2.6E-03	na	5.9E-04	2.6E-03
		EPA AP-42 Table 1.4-2	PM10/2.5	7.60	0.01	0.01	0.03	na	0.01	0.03
	1.00 MMBtu/hr	EPA AP-42 Table 1.4-3	Benzene	2.1E-03	2.06E-06	2.1E-06	9.0E-06	na	2.1E-06	9.0E-06
		EPA AP-42 Table 1.4-3	Ethylbenzene	---	---	---	---	---	---	---
	8,760 hr/yr	EPA AP-42 Table 1.4-3	HCHO	0.08	7.35E-05	7.4E-05	3.2E-04	na	7.4E-05	3.2E-04
		EPA AP-42 Table 1.4-3	n-Hexane	1.80	1.76E-03	1.8E-03	0.01	na	1.8E-03	0.01
	1,020 Btu/scf (HHV)	EPA AP-42 Table 1.4-3	Methanol	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Toluene	3.4E-03	3.33E-06	3.3E-06	1.5E-05	---	3.3E-06	1.5E-05
		EPA AP-42 Table 1.4-3	2,2,4-TMP	---	---	---	---	na	---	---
		EPA AP-42 Table 1.4-3	Xylenes	---	---	---	---	---	---	---
		EPA AP-42 Table 1.4-3	Other HAP	1.9E-03	1.86E-06	1.9E-06	8.2E-06	na	1.9E-06	8.2E-06
		EPA AP-42 Table 1.4-3	Total HAP	1.88	1.85E-03	1.8E-03	0.01	na	1.8E-03	0.01
		EPA AP-42 Table 1.4-2	CO2	120,000	117.65	117.65	515.29	na	117.65	515.29
	980 scf/hr	EPA AP-42 Table 1.4-2	CH4	2.30	2.25E-03	2.3E-03	0.01	na	2.3E-03	0.01
23.53 Mscfd	EPA AP-42 Table 1.4-2	N2O	2.20	2.16E-03	2.2E-03	0.01	na	2.2E-03	0.01	
8.59 MMscf/yr	40CFR98 - Table A-1	CO2e	120,713	118	118	518	na	118	518	

- Notes:
- 1 - The combustion emission factors are based on a default fuel heat content of 1,020 Btu/scf (HHV).
  - 2 - PM10/2.5 is filterable and condensable particulate matter; including PM10 and PM2.5.
  - 3 - Total HAP includes HCHO, n-hexane, BTEX (benzene, toluene, ethylbenzene, xylene), acetaldehyde, acrolein, and methanol.

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**GRENADIER DEHYDRATION STATION**  
 Application for 45CSR13 NSR Modification Permit  
**Attachment N - Supporting Emissions Calculations**

**Piping and Equipment Fugitives**

Unit ID	Description	Component (Unit) Type (Gas)	Unit Count	THC Factor lb/hr/Unit	Hydrocarbons (THC)		VOC 5.98 Wgt%		n-Hex,BTEX,TMP 5.0E-03 Wgt%		Total HAP 0.03 Wgt%		CO2 0.49 Wgt%		CH4 93.53 Wgt%		CO2e GWP = 25	
					lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
FUG (1F)	Process Piping Fugitives (Gas)	Valves	192	0.00992	1.90	8.34	0.11	0.50	9.5E-05	4.1E-04	5.7E-04	2.5E-03	0.01	0.04	1.78	7.80	45	195
		Pump Seals	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Other	15	0.01940	0.29	1.27	0.02	0.08	1.4E-05	6.3E-05	8.7E-05	3.8E-04	1.4E-03	0.01	0.27	1.19	7	30
		Connectors	387	0.00044	0.17	0.75	0.01	0.04	8.5E-06	3.7E-05	5.1E-05	2.2E-04	8.4E-04	3.7E-03	0.16	0.70	4	17
		Flanges	387	0.00086	0.33	1.46	0.02	0.09	1.7E-05	7.2E-05	9.9E-05	4.3E-04	1.6E-03	0.01	0.31	1.36	8	34
		Open-ended	20	0.00441	0.09	0.38	0.01	0.02	4.3E-06	1.9E-05	2.6E-05	1.1E-04	4.2E-04	1.9E-03	0.08	0.35	2	9

<b>1,001</b>	<b>2.79</b>	<b>12.20</b>	<b>0.17</b>	<b>0.73</b>	<b>1.4E-04</b>	<b>6.1E-04</b>	<b>8.3E-04</b>	<b>3.6E-03</b>	<b>0.01</b>	<b>0.06</b>	<b>2.60</b>	<b>11.41</b>	<b>65</b>	<b>285</b>
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- Notes: 1 - Assumed 8,760 hours per year of fugitive emissions.  
 2 - Gas emissions calculated using EPA Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017, Nov 1995.

- 5 - Unit counts are based on the following data:  
 1 Meter/Piping, 3 Heaters (Reboilers), and 3 Dehydrators --- Also 150% safety multiplier.

	Gas	
	kg/hr	lb/hr
Valves	4.50E-03	0.00992
Pump Seals	na	na
Others	8.80E-03	0.01940
Connectors	2.00E-04	0.00044
Flanges	3.90E-04	0.00086
Open-Ended Lines	2.00E-03	0.00441

- 3 - "Other" components include compressor seals, relief valves, diaphragms, drains, meters, etc.  
 4 - To be conservative, the following gas characteristics were assumed:

Pollutant	Gas	
	Analysis	Estimated
Carbon Dioxide	0.41 Wgt%	0.49 Wgt%
Methane	79.15 Wgt%	93.53 Wgt%
VOC	4.98 Wgt%	5.98 Wgt%
n-Hex, BTEX, TMP-ea	4.1E-03 Wgt%	5.0E-03 Wgt%
Total HAP	0.02 Wgt%	0.03 Wgt%

TABLE 4-7. AVERAGE COMPONENT COUNTS FOR ONSHORE PRODUCTION IN THE WESTERN U.S.

Equipment	No. of Sites	No. of Equipment	Average Component Count <sup>a</sup>				
			Valves	Connections	Open-Ended Lines	PRVs <sup>b</sup>	Compressor Seals
Gas Wellheads	17	184	11 (30%)	36 (20%)	1 (28%)	0	0
Separators	16	183	34 (44%)	106 (38%)	6 (94%)	2 (68%)	0
Meters/Piping	12	73	14 (31%)	51 (47%)	1 (113%)	1 (150%)	0
Gathering Compressors	13	61	73 (102%)	179 (51%)	3 (50%)	4 (84%)	4 (69%)
Heaters	11	77	14 (49%)	65 (70%)	2 (66%)	1 (89%)	0
Dehydrators	10	52	24 (31%)	90 (37%)	2 (69%)	2 (53%)	0

<sup>a</sup> Values in parentheses represent the 90% confidence interval.

<sup>b</sup> Pressure relief valves.

Example: Valves = (1\*14 Meters + 3\*14 Heaters + 3\*24 Dehydrators)\*150% Margin = 192 Units  
 Also split Connections equally between Connectors and Flanges:  
 Connectors = Flanges = (1\*51 Meters + 3\*65 Heaters + 3\*90 Dehydrators)\*150%/2 = 387 Units

Potentially Applicable  
**AP-42 and GHG EMISSION FACTORS**  
(Preferentially use test data or vendor data where available)

Pollutant		GAS-FIRED ENGINE			GAS-FIRED TURBINE		
		AP-42 Table 3.2-1; 3.2-2; 3.2-3 07/00			AP-42 Table 3.1-1; 3.1-2a; 3.1-3 04/00		
		2SLB lb/MMBtu	4SLB lb/MMBtu	4SRB lb/MMBtu	Uncontrolled lb/MMBtu	Water Injection lb/MMBtu	Lean Pre-Mix# lb/MMBtu
CRITERIA	NOX (≥ 90% Load)	3.17E+00	4.08E+00	2.21E+00	3.20E-01	1.30E-01	9.90E-02
	CO (≥ 90% Load)	3.86E-01	3.17E-01	3.72E+00	8.20E-02	3.00E-02	1.50E-02
	THC (TOC)	1.64E+00	1.47E+00	3.58E-01	1.10E-02	1.10E-02	1.10E-02
	NMHC (THC-CH4)	1.90E-01	2.20E-01	1.28E-01	2.40E-03	2.40E-03	2.40E-03
	NMNEHC (NMHC-C2H6)	1.19E-01	1.15E-01	5.76E-02	2.10E-03	2.10E-03	2.10E-03
	VOC	1.20E-01	1.18E-01	2.96E-02	2.10E-03	2.10E-03	2.10E-03
	SO2*** (2,000 gr-S/MMscf)	5.88E-04	5.88E-04	5.88E-04	3.40E-03	3.40E-03	3.40E-03
	PM10/2.5 (Filter+Cond)	4.83E-02	9.99E-03	1.94E-02	6.60E-03	6.60E-03	6.60E-03
HAPS	Benzene	1.94E-03	4.40E-04	1.58E-03	1.20E-05	1.20E-05	9.10E-07
	Ethylbenzene	1.08E-04	3.97E-05	2.48E-05	3.20E-05	3.20E-05	3.20E-05
	Formaldehyde (HCHO)	5.52E-02	5.28E-02	2.05E-02	7.10E-04	7.10E-04	2.00E-05
	n-Hexane	4.45E-04	1.11E-03	---	---	---	---
	Methanol (MeOH)	2.48E-03	2.50E-03	3.06E-03	---	---	---
	Toluene	9.63E-04	4.08E-04	5.58E-04	1.30E-04	1.30E-04	1.30E-04
	TMP, 2,2,4- (i-Octane)	8.46E-04	2.50E-04	---	---	---	---
	Xylenes	2.68E-04	1.84E-04	1.95E-04	6.40E-05	6.40E-05	6.40E-05
	Other HAPs	1.72E-02	1.44E-02	6.36E-03	1.06E-04	1.06E-04	1.06E-04
GHG	CO2**** (GWP=1)	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02	1.17E+02
	CH4 (GWP=25)	1.45E+00	1.25E+00	2.30E-01	8.60E-03	8.60E-03	8.60E-03
	N2O (GWP=298)	2.20E-04	2.20E-04	2.20E-04	3.00E-03	3.00E-03	3.00E-03
	CO2e	1.53E+02	1.48E+02	1.23E+02	1.18E+02	1.18E+02	1.18E+02

(#Lean Pre-Mix - aka: Dry Low Emissions (DLE or DLN) and SoLoNOx)

Pollutant		GAS-FIRED EXTERNAL COMBUSTION			FLARE	DIESEL ENGINE
		AP-42 Table 1.4-1; 1.4-2; 1.4-3 (<100 MMBtu/hr) 07/98			13.5-1 04/15	3.3-1; 3.3-2 10/96
		Uncontrolled lb/MMBtu	LoNOx Burners lb/MMBtu	Flue Gas Recirc lb/MMBtu	Combustion lb/MMBtu	Uncontrolled lb/MMBtu
CRITERIA	NOX	9.80E-02	4.90E-02	3.14E-02	6.80E-02	4.41E+00
	CO	8.24E-02	8.24E-02	8.24E-02	3.10E-01	9.50E-01
	THC (TOC)	1.08E-02	1.08E-02	1.08E-02	≥98%	3.60E-01
	NMHC (THC-CH4)	8.53E-03	8.53E-03	8.53E-03	Destruction and Removal Efficiency	3.53E-01
	NMNEHC (NMHC-C2H6)	5.49E-03	5.49E-03	5.49E-03		3.50E-01
	VOC (NMNEHC+HCHO)	5.56E-03	5.56E-03	5.56E-03	5.882E-04	3.60E-01
	SO2 (2,000 gr-S/MMscf)	5.88E-04	5.88E-04	5.88E-04	7.451E-03	2.90E-01
	PM10/2.5 (Filter+Condense)	7.45E-03	7.45E-03	7.45E-03		3.10E-01
HAPS	Benzene	2.06E-06	2.06E-06	2.06E-06	≥98% Destruction and Removal Efficiency	9.33E-04
	Ethylbenzene	---	---	---		---
	HCHO (Formaldehyde)	7.35E-05	7.35E-05	7.35E-05		1.18E-03
	n-Hexane	1.76E-03	1.76E-03	1.76E-03		---
	Methanol (MeOH)	---	---	---		---
	Toluene	3.33E-06	3.33E-06	3.33E-06		4.09E-04
	2,2,4-TMP (i-Octane)	---	---	---		---
	Xylenes	---	---	---		2.85E-04
Other HAPs	1.86E-06	1.86E-06	1.86E-06	1.05E-03		
GHG	CO2 (GWP=1)	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.64E+02
	CH4 (GWP=25)	2.25E-03	2.25E-03	2.25E-03	98% DRE	6.61E-03
	N2O (GWP=298)	2.16E-03	6.27E-04	6.27E-04	2.16E-03	1.32E-03
	CO2e	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.65E+02

40 CFR 98 - DEFAULT EMISSION FACTORS				
Fuel Type	Table C-1 to Subpart C of Part 98	Table C-2 to Subpart C of Part 98		
	Default HHV	Carbon Dioxide lb CO2/MMBtu	Methane lb CH4/MMBtu	Nitrous Oxide lb N2O/MMBtu
Fuel Oil No. 2 (Diesel)	0.138 MMBtu/gal	163.05	6.61E-03	1.32E-03
Propane	0.091 MMBtu/gal	138.60	6.61E-03	1.32E-03
Natural Gas	1,026 Btu/scf	116.98	2.20E-03	2.20E-04

**Conversion Factors**  
<http://www.onlineconversion.com/>

- 1.0 lb = 453.592 g
- 1.0 kg = 2.205 lb
- 1.0 hp = 2,544.433 Btu/hr
- 1.0 hp = 745.700 Watt
- 1.0 kW = 3,412.142 Btu/hr
- 1.0 kW-hr = 1.340 hp-hr
- 1.0 cf = 7.481 gal
- 1.0 gal H2O = 8.338 lb
- 1.0 cf H2O = 62.371 gal
- 1.0 m = 3.281 ft
- 1.0 km = 0.621 mi
- 1.0 acre = 43,560.174 ft2
- 1.0 °F = (°C\*9/5)+32
- 1.0 °R = °F+459.67
- 1.0 % = 10,000 ppm
- UGC (stp) = 379.48 scf/lb-mol

Global Warming Potential (100 Yr) (GWP)		
Table A-1 to Subpart A of Part 98		
CO2	CH4*	N2O#
1.00	25.00	298.00

#Revised by EPA on 11/29/13

\*Converted Ext Comb Emission Factors to lb/MMBtu by dividing lb/MMscf by AP-42 default HHV of 1,020 Btu/scf.

\*\*Converted GHG Emission Factors to lb/MMBtu by multiplying kg/MMBtu by 2.2046 lb/kg.

\*\*\*Assumes 100% conversion of fuel sulfur to SOX (2,000 gr/MMscf).

\*\*\*\*Assumes 99.5% conversion of fuel carbon to CO2 for natural gas.

## GRI-GLYCalc VERSION 4.0 - EMISSIONS SUMMARY

Case Name: Grenadier DS - 65 MMscfd DEHY-01

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-La - Grenadier DS - NSR-Mod - 65 MMscfd Dehy-01 - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.8294	19.906	3.6329
Ethane	0.6073	14.575	2.6600
Propane	0.3228	7.747	1.4139
Isobutane	0.0746	1.790	0.3266
n-Butane	0.1269	3.046	0.5559
Isopentane	0.0382	0.917	0.1673
n-Pentane	0.0281	0.675	0.1233
n-Hexane	0.0125	0.300	0.0548
Cyclohexane	0.0435	1.045	0.1907
Other Hexanes	0.0318	0.762	0.1391
Heptanes	0.0452	1.085	0.1980
Methylcyclohexane	0.0353	0.847	0.1545
2,2,4-Trimethylpentane	0.0002	0.004	0.0007
Benzene	0.1120	2.688	0.4905
Toluene	0.2566	6.158	1.1238
Ethylbenzene	0.0455	1.093	0.1995
Xylenes	0.0642	1.542	0.2813
C8+ Heavies	0.0523	1.255	0.2290
Total Emissions	2.7264	65.433	11.9415
Total Hydrocarbon Emissions	2.7264	65.433	11.9415
Total VOC Emissions	1.2896	30.951	5.6486
Total HAP Emissions	0.4910	11.784	2.1505
Total BTEX Emissions	0.4783	11.480	2.0951

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.4281	1522.276	277.8153
Ethane	14.3169	343.605	62.7079
Propane	3.5867	86.082	15.7099
Isobutane	0.5764	13.833	2.5246
n-Butane	0.7664	18.394	3.3570
Isopentane	0.2130	5.112	0.9330
n-Pentane	0.1275	3.060	0.5584
n-Hexane	0.0330	0.791	0.1444
Cyclohexane	0.0300	0.721	0.1315
Other Hexanes	0.1102	2.644	0.4826
Heptanes	0.0614	1.473	0.2688
Methylcyclohexane	0.0196	0.471	0.0859
2,2,4-Trimethylpentane	0.0004	0.010	0.0018
Benzene	0.0114	0.274	0.0500
Toluene	0.0177	0.426	0.0777
Ethylbenzene	0.0019	0.046	0.0084
Xylenes	0.0019	0.045	0.0083
C8+ Heavies	0.0109	0.261	0.0476

	lbs/hr	lbs/day	tons/yr
Total Emissions	83.3134	1999.523	364.9129
Total Hydrocarbon Emissions	83.3134	1999.523	364.9129
Total VOC Emissions	5.5684	133.642	24.3897
Total HAP Emissions	0.0663	1.592	0.2905
Total BTEX Emissions	0.0329	0.791	0.1443

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.8563	3044.551	555.6306
Ethane	28.6337	687.210	125.4158
Propane	7.1735	172.163	31.4198
Isobutane	1.1528	27.666	5.0491
n-Butane	1.5329	36.789	6.7139
Isopentane	0.4260	10.224	1.8660
n-Pentane	0.2550	6.120	1.1169
n-Hexane	0.0659	1.582	0.2888
Cyclohexane	0.0600	1.441	0.2630
Other Hexanes	0.2203	5.288	0.9651
Heptanes	0.1227	2.945	0.5375
Methylcyclohexane	0.0392	0.942	0.1719
2,2,4-Trimethylpentane	0.0008	0.020	0.0036
Benzene	0.0228	0.548	0.1000
Toluene	0.0355	0.851	0.1553
Ethylbenzene	0.0038	0.092	0.0167
Xylenes	0.0038	0.091	0.0165
C8+ Heavies	0.0218	0.522	0.0953
Total Emissions	166.6269	3999.045	729.8257
Total Hydrocarbon Emissions	166.6269	3999.045	729.8257
Total VOC Emissions	11.1368	267.284	48.7794
Total HAP Emissions	0.1326	3.183	0.5810
Total BTEX Emissions	0.0659	1.581	0.2886

## COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	64.2576	1542.182	281.4482
Ethane	14.9242	358.180	65.3679
Propane	3.9095	93.829	17.1238
Isobutane	0.6510	15.623	2.8512
n-Butane	0.8933	21.440	3.9128
Isopentane	0.2512	6.029	1.1002
n-Pentane	0.1556	3.735	0.6817
n-Hexane	0.0455	1.091	0.1991
Cyclohexane	0.0736	1.765	0.3222
Other Hexanes	0.1419	3.406	0.6216
Heptanes	0.1066	2.557	0.4667
Methylcyclohexane	0.0549	1.317	0.2404
2,2,4-Trimethylpentane	0.0006	0.014	0.0025
Benzene	0.1234	2.962	0.5405
Toluene	0.2743	6.584	1.2015
Ethylbenzene	0.0474	1.139	0.2078
Xylenes	0.0661	1.587	0.2896
C8+ Heavies	0.0632	1.516	0.2767

-----	-----	-----	-----
Total Emissions	86.0398	2064.956	376.8544
Total Hydrocarbon Emissions	86.0398	2064.956	376.8544
Total VOC Emissions	6.8581	164.594	30.0383
Total HAP Emissions	0.5573	13.376	2.4410
Total BTEX Emissions	0.5113	12.271	2.2394

## GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Grenadier DS - 65 MMscfd DEHY-01

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-La - Grenadier DS - NSR-Mod - 65 MMscfd Dehy-01 - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## DESCRIPTION:

-----

Description: 90 oF, 1100 psig  
 Gas Drive Pump @ 7.5 gpm  
 50% Flash Tank Recycle  
 No Emission Controls

Annual Hours of Operation: 8760.0 hours/yr

## WET GAS:

-----

Temperature: 90.00 deg. F  
 Pressure: 1100.00 psig  
 Wet Gas Water Content: Saturated

Component	Conc. (vol %)
-----	-----
Carbon Dioxide	0.1674
Nitrogen	0.2809
Methane	88.7219
Ethane	8.9834
Propane	1.4015
Isobutane	0.1573
n-Butane	0.1895
Isopentane	0.0441
n-Pentane	0.0237
n-Hexane	0.0043
Cyclohexane	0.0018
Other Hexanes	0.0161
Heptanes	0.0055
Methylcyclohexane	0.0011
2,2,4-Trimethylpentane	0.0000
Benzene	0.0003
Toluene	0.0004
Ethylbenzene	0.0000
Xylenes	0.0000
C8+ Heavies	0.0008

## DRY GAS:

-----

Flow Rate: 65.0 MMSCF/day  
 Water Content: 7.0 lbs. H2O/MMSCF

## LEAN GLYCOL:

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

PUMP:

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

FLASH TANK:

---

Flash Control: Combustion device  
Flash Control Efficiency: 50.00 %  
Temperature: 150.0 deg. F  
Pressure: 50.0 psig

## GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Grenadier DS - 65 MMscfd DEHY-01

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-La - Grenadier DS - NSR-Mod - 65 MMscfd Dehy-01 - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## DESCRIPTION:

Description: 90 oF, 1100 psig  
 Gas Drive Pump @ 7.5 gpm  
 50% Flash Tank Recycle  
 No Emission Controls

Annual Hours of Operation: 8760.0 hours/yr

## EMISSIONS REPORTS:

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.8294	19.906	3.6329
Ethane	0.6073	14.575	2.6600
Propane	0.3228	7.747	1.4139
Isobutane	0.0746	1.790	0.3266
n-Butane	0.1269	3.046	0.5559
Isopentane	0.0382	0.917	0.1673
n-Pentane	0.0281	0.675	0.1233
n-Hexane	0.0125	0.300	0.0548
Cyclohexane	0.0435	1.045	0.1907
Other Hexanes	0.0318	0.762	0.1391
Heptanes	0.0452	1.085	0.1980
Methylcyclohexane	0.0353	0.847	0.1545
2,2,4-Trimethylpentane	0.0002	0.004	0.0007
Benzene	0.1120	2.688	0.4905
Toluene	0.2566	6.158	1.1238
Ethylbenzene	0.0455	1.093	0.1995
Xylenes	0.0642	1.542	0.2813
C8+ Heavies	0.0523	1.255	0.2290
<b>Total Emissions</b>	<b>2.7264</b>	<b>65.433</b>	<b>11.9415</b>
<b>Total Hydrocarbon Emissions</b>	<b>2.7264</b>	<b>65.433</b>	<b>11.9415</b>
<b>Total VOC Emissions</b>	<b>1.2896</b>	<b>30.951</b>	<b>5.6486</b>
<b>Total HAP Emissions</b>	<b>0.4910</b>	<b>11.784</b>	<b>2.1505</b>
<b>Total BTEX Emissions</b>	<b>0.4783</b>	<b>11.480</b>	<b>2.0951</b>

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.4281	1522.276	277.8153
Ethane	14.3169	343.605	62.7079
Propane	3.5867	86.082	15.7099
Isobutane	0.5764	13.833	2.5246
n-Butane	0.7664	18.394	3.3570
Isopentane	0.2130	5.112	0.9330

Page: 2

n-Pentane	0.1275	3.060	0.5584
n-Hexane	0.0330	0.791	0.1444
Cyclohexane	0.0300	0.721	0.1315
Other Hexanes	0.1102	2.644	0.4826
Heptanes	0.0614	1.473	0.2688
Methylcyclohexane	0.0196	0.471	0.0859
2,2,4-Trimethylpentane	0.0004	0.010	0.0018
Benzene	0.0114	0.274	0.0500
Toluene	0.0177	0.426	0.0777
Ethylbenzene	0.0019	0.046	0.0084
Xylenes	0.0019	0.045	0.0083
C8+ Heavies	0.0109	0.261	0.0476
-----			
Total Emissions	83.3134	1999.523	364.9129
Total Hydrocarbon Emissions	83.3134	1999.523	364.9129
Total VOC Emissions	5.5684	133.642	24.3897
Total HAP Emissions	0.0663	1.592	0.2905
Total BTEX Emissions	0.0329	0.791	0.1443

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.8563	3044.551	555.6306
Ethane	28.6337	687.210	125.4158
Propane	7.1735	172.163	31.4198
Isobutane	1.1528	27.666	5.0491
n-Butane	1.5329	36.789	6.7139
Isopentane	0.4260	10.224	1.8660
n-Pentane	0.2550	6.120	1.1169
n-Hexane	0.0659	1.582	0.2888
Cyclohexane	0.0600	1.441	0.2630
Other Hexanes	0.2203	5.288	0.9651
Heptanes	0.1227	2.945	0.5375
Methylcyclohexane	0.0392	0.942	0.1719
2,2,4-Trimethylpentane	0.0008	0.020	0.0036
Benzene	0.0228	0.548	0.1000
Toluene	0.0355	0.851	0.1553
Ethylbenzene	0.0038	0.092	0.0167
Xylenes	0.0038	0.091	0.0165
C8+ Heavies	0.0218	0.522	0.0953
-----			
Total Emissions	166.6269	3999.045	729.8257
Total Hydrocarbon Emissions	166.6269	3999.045	729.8257
Total VOC Emissions	11.1368	267.284	48.7794
Total HAP Emissions	0.1326	3.183	0.5810
Total BTEX Emissions	0.0659	1.581	0.2886

## COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	64.2576	1542.182	281.4482
Ethane	14.9242	358.180	65.3679
Propane	3.9095	93.829	17.1238
Isobutane	0.6510	15.623	2.8512
n-Butane	0.8933	21.440	3.9128
Isopentane	0.2512	6.029	1.1002

n-Pentane	0.1556	3.735	0.6817
n-Hexane	0.0455	1.091	0.1991
Cyclohexane	0.0736	1.765	0.3222
Other Hexanes	0.1419	3.406	0.6216
Heptanes	0.1066	2.557	0.4667
Methylcyclohexane	0.0549	1.317	0.2404
2,2,4-Trimethylpentane	0.0006	0.014	0.0025
Benzene	0.1234	2.962	0.5405
Toluene	0.2743	6.584	1.2015
Ethylbenzene	0.0474	1.139	0.2078
Xylenes	0.0661	1.587	0.2896
C8+ Heavies	0.0632	1.516	0.2767
-----			
Total Emissions	86.0398	2064.956	376.8544
Total Hydrocarbon Emissions	86.0398	2064.956	376.8544
Total VOC Emissions	6.8581	164.594	30.0383
Total HAP Emissions	0.5573	13.376	2.4410
Total BTEX Emissions	0.5113	12.271	2.2394

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
-----			
Methane	559.2635	281.4482	49.68
Ethane	128.0758	65.3679	48.96
Propane	32.8337	17.1238	47.85
Isobutane	5.3757	2.8512	46.96
n-Butane	7.2698	3.9128	46.18
Isopentane	2.0332	1.1002	45.89
n-Pentane	1.2401	0.6817	45.03
n-Hexane	0.3435	0.1991	42.03
Cyclohexane	0.4537	0.3222	28.99
Other Hexanes	1.1042	0.6216	43.70
Heptanes	0.7355	0.4667	36.54
Methylcyclohexane	0.3264	0.2404	26.33
2,2,4-Trimethylpentane	0.0043	0.0025	42.16
Benzene	0.5905	0.5405	8.47
Toluene	1.2792	1.2015	6.07
Ethylbenzene	0.2162	0.2078	3.87
Xylenes	0.2979	0.2896	2.77
C8+ Heavies	0.3243	0.2767	14.69
-----			
Total Emissions	741.7673	376.8544	49.20
Total Hydrocarbon Emissions	741.7673	376.8544	49.20
Total VOC Emissions	54.4280	30.0383	44.81
Total HAP Emissions	2.7315	2.4410	10.63
Total BTEX Emissions	2.3837	2.2394	6.05

EQUIPMENT REPORTS:

-----  
 ABSORBER  
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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: 2.34 lbs. H2O/MMSCF

Temperature: 90.0 deg. F  
 Pressure: 1100.0 psig  
 Dry Gas Flow Rate: 65.0000 MMSCF/day  
 Glycol Losses with Dry Gas: 0.8970 lb/hr  
 Wet Gas Water Content: Saturated  
 Calculated Wet Gas Water Content: 40.82 lbs. H2O/MMSCF  
 Calculated Lean Glycol Recirc. Ratio: 4.32 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	5.73%	94.27%
Carbon Dioxide	99.82%	0.18%
Nitrogen	99.98%	0.02%
Methane	99.99%	0.01%
Ethane	99.96%	0.04%
Propane	99.94%	0.06%
Isobutane	99.92%	0.08%
n-Butane	99.90%	0.10%
Isopentane	99.91%	0.09%
n-Pentane	99.88%	0.12%
n-Hexane	99.82%	0.18%
Cyclohexane	99.15%	0.85%
Other Hexanes	99.86%	0.14%
Heptanes	99.69%	0.31%
Methylcyclohexane	99.15%	0.85%
2,2,4-Trimethylpentane	99.87%	0.13%
Benzene	92.05%	7.95%
Toluene	89.01%	10.99%
Ethylbenzene	87.09%	12.91%
Xylenes	82.16%	17.84%
C8+ Heavies	99.35%	0.65%

FLASH TANK

Flash Control: Combustion device  
 Flash Control Efficiency: 50.00 %  
 Flash Temperature: 150.0 deg. F  
 Flash Pressure: 50.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.46%	0.54%
Carbon Dioxide	6.29%	93.71%
Nitrogen	0.63%	99.37%
Methane	0.65%	99.35%
Ethane	2.08%	97.92%
Propane	4.31%	95.69%
Isobutane	6.08%	93.92%
n-Butane	7.65%	92.35%
Isopentane	8.43%	91.57%
n-Pentane	10.17%	89.83%

n-Hexane	16.21%	83.79%
Cyclohexane	43.67%	56.33%
Other Hexanes	13.08%	86.92%
Heptanes	27.19%	72.81%
Methylcyclohexane	49.21%	50.79%
2,2,4-Trimethylpentane	16.36%	83.64%
Benzene	83.90%	16.10%
Toluene	88.81%	11.19%
Ethylbenzene	93.06%	6.94%
Xylenes	95.17%	4.83%
C8+ Heavies	73.69%	26.31%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	37.96%	62.04%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	2.67%	97.33%
n-Pentane	2.54%	97.46%
n-Hexane	1.92%	98.08%
Cyclohexane	6.49%	93.51%
Other Hexanes	4.28%	95.72%
Heptanes	1.36%	98.64%
Methylcyclohexane	7.22%	92.78%
2,2,4-Trimethylpentane	4.89%	95.11%
Benzene	5.88%	94.12%
Toluene	8.82%	91.18%
Ethylbenzene	11.10%	88.90%
Xylenes	13.51%	86.49%
C8+ Heavies	14.16%	85.84%

STREAM REPORTS:

WET GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 2.71e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.60e-002	1.11e+002
Carbon Dioxide	1.67e-001	5.26e+002

Nitrogen	2.81e-001	5.62e+002
Methane	8.86e+001	1.02e+005
Ethane	8.98e+000	1.93e+004
Propane	1.40e+000	4.41e+003
Isobutane	1.57e-001	6.53e+002
n-Butane	1.89e-001	7.86e+002
Isopentane	4.41e-002	2.27e+002
n-Pentane	2.37e-002	1.22e+002
n-Hexane	4.30e-003	2.65e+001
Cyclohexane	1.80e-003	1.08e+001
Other Hexanes	1.61e-002	9.91e+001
Heptanes	5.50e-003	3.93e+001
Methylcyclohexane	1.10e-003	7.71e+000
2,2,4-Trimethylpentane	5.00e-005	4.08e-001
Benzene	3.00e-004	1.67e+000
Toluene	4.00e-004	2.63e+000
Ethylbenzene	5.00e-005	3.79e-001
Xylenes	5.00e-005	3.79e-001
C8+ Heavies	7.99e-004	9.73e+000
-----		
Total Components	100.00	1.28e+005

DRY GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 2.71e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	4.93e-003	6.34e+000
Carbon Dioxide	1.67e-001	5.25e+002
Nitrogen	2.81e-001	5.62e+002
Methane	8.87e+001	1.02e+005
Ethane	8.98e+000	1.93e+004
Propane	1.40e+000	4.41e+003
Isobutane	1.57e-001	6.52e+002
n-Butane	1.89e-001	7.85e+002
Isopentane	4.41e-002	2.27e+002
n-Pentane	2.37e-002	1.22e+002
n-Hexane	4.29e-003	2.64e+001
Cyclohexane	1.78e-003	1.07e+001
Other Hexanes	1.61e-002	9.89e+001
Heptanes	5.48e-003	3.92e+001
Methylcyclohexane	1.09e-003	7.64e+000
2,2,4-Trimethylpentane	4.99e-005	4.07e-001
Benzene	2.76e-004	1.54e+000
Toluene	3.56e-004	2.34e+000
Ethylbenzene	4.35e-005	3.30e-001
Xylenes	4.11e-005	3.11e-001
C8+ Heavies	7.95e-004	9.67e+000
-----		
Total Components	100.00	1.28e+005

LEAN GLYCOL STREAM

Temperature: 90.00 deg. F

Flow Rate: 7.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	4.16e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	2.30e-012	9.71e-011
Nitrogen	2.06e-013	8.68e-012
Methane	1.07e-017	4.50e-016
Ethane	8.43e-008	3.56e-006
Propane	2.44e-009	1.03e-007
Isobutane	3.50e-010	1.48e-008
n-Butane	4.55e-010	1.92e-008
Isopentane	2.48e-005	1.05e-003
n-Pentane	1.74e-005	7.33e-004
n-Hexane	5.79e-006	2.45e-004
Cyclohexane	7.16e-005	3.02e-003
Other Hexanes	3.36e-005	1.42e-003
Heptanes	1.47e-005	6.21e-004
Methylcyclohexane	6.50e-005	2.74e-003
2,2,4-Trimethylpentane	1.86e-007	7.87e-006
Benzene	1.66e-004	7.00e-003
Toluene	5.88e-004	2.48e-002
Ethylbenzene	1.35e-004	5.69e-003
Xylenes	2.38e-004	1.00e-002
C8+ Heavies	2.04e-004	8.63e-003
Total Components	100.00	4.22e+003

## RICH GLYCOL AND PUMP GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 8.09e+000 gpm  
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.25e+001	4.16e+003
Water	3.73e+000	1.68e+002
Carbon Dioxide	3.47e-002	1.56e+000
Nitrogen	1.60e-002	7.19e-001
Methane	2.84e+000	1.28e+002
Ethane	6.50e-001	2.92e+001
Propane	1.67e-001	7.50e+000
Isobutane	2.73e-002	1.23e+000
n-Butane	3.69e-002	1.66e+000
Isopentane	1.03e-002	4.65e-001
n-Pentane	6.31e-003	2.84e-001
n-Hexane	1.75e-003	7.87e-002
Cyclohexane	2.37e-003	1.07e-001
Other Hexanes	5.64e-003	2.54e-001
Heptanes	3.75e-003	1.69e-001
Methylcyclohexane	1.72e-003	7.73e-002
2,2,4-Trimethylpentane	2.19e-005	9.83e-004
Benzene	3.15e-003	1.42e-001
Toluene	7.04e-003	3.17e-001
Ethylbenzene	1.22e-003	5.50e-002

Xylenes	1.73e-003	7.80e-002
C8+ Heavies	1.84e-003	8.27e-002
-----		
Total Components	100.00	4.50e+003

## FLASH TANK OFF GAS STREAM

-----

Temperature: 150.00 deg. F  
 Pressure: 64.70 psia  
 Flow Rate: 3.49e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	5.51e-001	9.12e-001
Carbon Dioxide	3.62e-001	1.46e+000
Nitrogen	2.77e-001	7.14e-001
Methane	8.60e+001	1.27e+002
Ethane	1.04e+001	2.86e+001
Propane	1.77e+000	7.17e+000
Isobutane	2.16e-001	1.15e+000
n-Butane	2.87e-001	1.53e+000
Isopentane	6.42e-002	4.26e-001
n-Pentane	3.84e-002	2.55e-001
n-Hexane	8.32e-003	6.59e-002
Cyclohexane	7.76e-003	6.00e-002
Other Hexanes	2.78e-002	2.20e-001
Heptanes	1.33e-002	1.23e-001
Methylcyclohexane	4.35e-003	3.92e-002
2,2,4-Trimethylpentane	7.83e-005	8.23e-004
Benzene	3.18e-003	2.28e-002
Toluene	4.19e-003	3.55e-002
Ethylbenzene	3.91e-004	3.82e-003
Xylenes	3.86e-004	3.77e-003
C8+ Heavies	1.39e-003	2.18e-002
-----		
Total Components	100.00	1.70e+002

## FLASH TANK GLYCOL STREAM

-----

Temperature: 150.00 deg. F  
 Flow Rate: 7.71e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
-----		
TEG	9.61e+001	4.16e+003
Water	3.86e+000	1.67e+002
Carbon Dioxide	2.27e-003	9.83e-002
Nitrogen	1.04e-004	4.50e-003
Methane	1.92e-002	8.29e-001
Ethane	1.40e-002	6.07e-001
Propane	7.46e-003	3.23e-001
Isobutane	1.72e-003	7.46e-002
n-Butane	2.93e-003	1.27e-001
Isopentane	9.07e-004	3.92e-002
n-Pentane	6.67e-004	2.89e-002
n-Hexane	2.95e-004	1.27e-002
Cyclohexane	1.08e-003	4.66e-002
Other Hexanes	7.66e-004	3.32e-002

Heptanes	1.06e-003	4.58e-002
Methylcyclohexane	8.78e-004	3.80e-002
2,2,4-Trimethylpentane	3.72e-006	1.61e-004
Benzene	2.75e-003	1.19e-001
Toluene	6.50e-003	2.81e-001
Ethylbenzene	1.18e-003	5.12e-002
Xylenes	1.72e-003	7.43e-002
C8+ Heavies	1.41e-003	6.09e-002
-----	-----	-----
Total Components	100.00	4.33e+003

## FLASH GAS EMISSIONS

Flow Rate: 7.50e+003 scfh  
Control Method: Combustion Device  
Control Efficiency: 50.00

Component	Conc. (vol%)	Loading (lb/hr)
-----	-----	-----
Water	5.00e+001	1.78e+002
Carbon Dioxide	2.69e+001	2.34e+002
Nitrogen	1.29e-001	7.14e-001
Methane	2.00e+001	6.34e+001
Ethane	2.41e+000	1.43e+001
Propane	4.11e-001	3.59e+000
Isobutane	5.02e-002	5.76e-001
n-Butane	6.67e-002	7.66e-001
Isopentane	1.49e-002	2.13e-001
n-Pentane	8.94e-003	1.27e-001
n-Hexane	1.93e-003	3.30e-002
Cyclohexane	1.80e-003	3.00e-002
Other Hexanes	6.47e-003	1.10e-001
Heptanes	3.10e-003	6.14e-002
Methylcyclohexane	1.01e-003	1.96e-002
2,2,4-Trimethylpentane	1.82e-005	4.11e-004
Benzene	7.39e-004	1.14e-002
Toluene	9.73e-004	1.77e-002
Ethylbenzene	9.10e-005	1.91e-003
Xylenes	8.99e-005	1.89e-003
C8+ Heavies	3.23e-004	1.09e-002
-----	-----	-----
Total Components	100.00	4.96e+002

## REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F  
Pressure: 14.70 psia  
Flow Rate: 2.22e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----	-----	-----
Water	9.84e+001	1.04e+002
Carbon Dioxide	3.82e-002	9.83e-002
Nitrogen	2.75e-003	4.50e-003
Methane	8.85e-001	8.29e-001
Ethane	3.46e-001	6.07e-001
Propane	1.25e-001	3.23e-001

Isobutane	2.20e-002	7.46e-002
n-Butane	3.74e-002	1.27e-001
Isopentane	9.06e-003	3.82e-002
n-Pentane	6.68e-003	2.81e-002
n-Hexane	2.48e-003	1.25e-002
Cyclohexane	8.85e-003	4.35e-002
Other Hexanes	6.31e-003	3.18e-002
Heptanes	7.72e-003	4.52e-002
Methylcyclohexane	6.15e-003	3.53e-002
2,2,4-Trimethylpentane	2.29e-005	1.53e-004
Benzene	2.45e-002	1.12e-001
Toluene	4.77e-002	2.57e-001
Ethylbenzene	7.34e-003	4.55e-002
Xylenes	1.04e-002	6.42e-002
C8+ Heavies	5.25e-003	5.23e-002
-----	-----	-----
Total Components	100.00	1.06e+002

## GRI-GLYCalc VERSION 4.0 - EMISSIONS SUMMARY

Case Name: Grenadier DS - 100 MMscfd DEHY-02

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lb - Grenadier DS - NSR-Mod - 100 MMscfd Dehy-02 - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0840	2.016	0.3680
Ethane	0.0625	1.499	0.2736
Propane	0.0325	0.779	0.1422
Isobutane	0.0075	0.181	0.0330
n-Butane	0.0128	0.308	0.0563
Isopentane	0.0039	0.093	0.0170
n-Pentane	0.0029	0.069	0.0125
n-Hexane	0.0013	0.031	0.0056
Cyclohexane	0.0045	0.108	0.0197
Other Hexanes	0.0032	0.078	0.0142
Heptanes	0.0047	0.112	0.0204
Methylcyclohexane	0.0036	0.087	0.0160
2,2,4-Trimethylpentane	<0.0001	<0.001	0.0001
Benzene	0.0108	0.259	0.0472
Toluene	0.0247	0.592	0.1080
Ethylbenzene	0.0044	0.105	0.0192
Xylenes	0.0060	0.145	0.0264
C8+ Heavies	0.0042	0.100	0.0183
Total Emissions	0.2734	6.562	1.1975
Total Hydrocarbon Emissions	0.2734	6.562	1.1975
Total VOC Emissions	0.1269	3.047	0.5560
Total HAP Emissions	0.0471	1.131	0.2064
Total BTEX Emissions	0.0458	1.100	0.2007

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.6810	40.345	7.3629
Ethane	1.2499	29.996	5.4744
Propane	0.6500	15.599	2.8468
Isobutane	0.1510	3.623	0.6612
n-Butane	0.2570	6.169	1.1258
Isopentane	0.0776	1.863	0.3401
n-Pentane	0.0573	1.375	0.2509
n-Hexane	0.0256	0.615	0.1122
Cyclohexane	0.0903	2.167	0.3955
Other Hexanes	0.0650	1.561	0.2848
Heptanes	0.0932	2.238	0.4084
Methylcyclohexane	0.0731	1.754	0.3202
2,2,4-Trimethylpentane	0.0003	0.008	0.0014
Benzene	0.2226	5.343	0.9750
Toluene	0.5072	12.174	2.2217
Ethylbenzene	0.0897	2.152	0.3927
Xylenes	0.1244	2.985	0.5448
C8+ Heavies	0.1078	2.587	0.4722

Total Emissions	5.5230	132.553	24.1909
Total Hydrocarbon Emissions	5.5230	132.553	24.1909
Total VOC Emissions	2.5922	62.212	11.3536
Total HAP Emissions	0.9698	23.276	4.2478
Total BTEX Emissions	0.9439	22.654	4.1343

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.3160	3031.585	553.2642
Ethane	28.5936	686.246	125.2399
Propane	7.1537	171.689	31.3332
Isobutane	1.1508	27.619	5.0405
n-Butane	1.5310	36.743	6.7056
Isopentane	0.4256	10.214	1.8641
n-Pentane	0.2549	6.117	1.1164
n-Hexane	0.0660	1.583	0.2889
Cyclohexane	0.0599	1.437	0.2623
Other Hexanes	0.2204	5.290	0.9655
Heptanes	0.1228	2.947	0.5378
Methylcyclohexane	0.0390	0.937	0.1710
2,2,4-Trimethylpentane	0.0008	0.020	0.0036
Benzene	0.0223	0.536	0.0978
Toluene	0.0343	0.823	0.1502
Ethylbenzene	0.0037	0.088	0.0160
Xylenes	0.0036	0.086	0.0157
C8+ Heavies	0.0213	0.512	0.0935
Total Emissions	166.0197	3984.472	727.1661
Total Hydrocarbon Emissions	166.0197	3984.472	727.1661
Total VOC Emissions	11.1101	266.641	48.6620
Total HAP Emissions	0.1307	3.136	0.5722
Total BTEX Emissions	0.0639	1.533	0.2797

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	252.6320	6063.169	1106.5284
Ethane	57.1872	1372.492	250.4799
Propane	14.3074	343.378	62.6665
Isobutane	2.3016	55.238	10.0810
n-Butane	3.0619	73.486	13.4112
Isopentane	0.8512	20.428	3.7281
n-Pentane	0.5098	12.234	2.2327
n-Hexane	0.1319	3.166	0.5779
Cyclohexane	0.1198	2.875	0.5246
Other Hexanes	0.4408	10.580	1.9309
Heptanes	0.2456	5.893	1.0755
Methylcyclohexane	0.0781	1.874	0.3421
2,2,4-Trimethylpentane	0.0016	0.039	0.0072
Benzene	0.0447	1.072	0.1956
Toluene	0.0686	1.646	0.3004
Ethylbenzene	0.0073	0.176	0.0321
Xylenes	0.0072	0.172	0.0313
C8+ Heavies	0.0427	1.025	0.1870

Total Emissions	332.0393	7968.944	1454.3323
Total Hydrocarbon Emissions	332.0393	7968.944	1454.3323
Total VOC Emissions	22.2201	533.282	97.3240
Total HAP Emissions	0.2613	6.271	1.1445
Total BTEX Emissions	0.1277	3.065	0.5594

## COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.4000	3033.601	553.6321
Ethane	28.6560	687.745	125.5135
Propane	7.1862	172.468	31.4755
Isobutane	1.1583	27.800	5.0735
n-Butane	1.5438	37.051	6.7618
Isopentane	0.4295	10.307	1.8811
n-Pentane	0.2577	6.186	1.1289
n-Hexane	0.0672	1.614	0.2945
Cyclohexane	0.0644	1.545	0.2820
Other Hexanes	0.2237	5.368	0.9797
Heptanes	0.1274	3.058	0.5581
Methylcyclohexane	0.0427	1.025	0.1870
2,2,4-Trimethylpentane	0.0008	0.020	0.0037
Benzene	0.0331	0.794	0.1450
Toluene	0.0590	1.415	0.2582
Ethylbenzene	0.0080	0.193	0.0352
Xylenes	0.0096	0.230	0.0421
C8+ Heavies	0.0255	0.612	0.1118
Total Emissions	166.2931	3991.034	728.3637
Total Hydrocarbon Emissions	166.2931	3991.034	728.3637
Total VOC Emissions	11.2370	269.688	49.2180
Total HAP Emissions	0.1778	4.267	0.7786
Total BTEX Emissions	0.1097	2.633	0.4804

## GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Grenadier DS - 100 MMscfd DEHY-02  
 File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lb - Grenadier DS - NSR-Mod - 100 MMscfd Dehy-02 - 08.14.15 - DRAFT.ddf  
 Date: August 14, 2015

## DESCRIPTION:

-----  
 Description: 90 oF, 1100 psig  
               Gas Drive Pump @ 15.0 gpm  
               50% Flash Tank Recycle  
               95% BTEX Skid

Annual Hours of Operation: 8760.0 hours/yr

## WET GAS:

-----  
 Temperature: 90.00 deg. F  
 Pressure: 1100.00 psig  
               Wet Gas Water Content: Saturated

Component	Conc. (vol %)
-----	-----
Carbon Dioxide	0.1674
Nitrogen	0.2809
Methane	88.7219
Ethane	8.9834
Propane	1.4015
Isobutane	0.1573
n-Butane	0.1895
Isopentane	0.0441
n-Pentane	0.0237
n-Hexane	0.0043
Cyclohexane	0.0018
Other Hexanes	0.0161
Heptanes	0.0055
Methylcyclohexane	0.0011
2,2,4-Trimethylpentane	0.0000
Benzene	0.0003
Toluene	0.0004
Ethylbenzene	0.0000
Xylenes	0.0000
C8+ Heavies	0.0008

## DRY GAS:

-----  
               Flow Rate: 100.0 MMSCF/day  
               Water Content: 7.0 lbs. H2O/MMSCF

## LEAN GLYCOL:

-----  
               Glycol Type: TEG  
               Water Content: 1.5 wt% H2O  
               Flow Rate: 15.0 gpm

PUMP:  
-----

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

FLASH TANK:  
-----

Flash Control: Combustion device  
Flash Control Efficiency: 50.00 %  
Temperature: 150.0 deg. F  
Pressure: 50.0 psig

REGENERATOR OVERHEADS CONTROL DEVICE:  
-----

Control Device: Condenser  
Temperature: 150.0 deg. F  
Pressure: 14.0 psia

Control Device: Combustion Device  
Destruction Efficiency: 95.0 %  
Excess Oxygen: 5.0 %  
Ambient Air Temperature: 50.0 deg. F

## GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Grenadier DS - 100 MMscfd DEHY-02

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lb - Grenadier DS - NSR-Mod - 100 MMscfd Dehy-02 - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## DESCRIPTION:

Description: 90 oF, 1100 psig  
 Gas Drive Pump @ 15.0 gpm  
 50% Flash Tank Recycle  
 95% BTEX Skid

Annual Hours of Operation: 8760.0 hours/yr

## EMISSIONS REPORTS:

## CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0840	2.016	0.3680
Ethane	0.0625	1.499	0.2736
Propane	0.0325	0.779	0.1422
Isobutane	0.0075	0.181	0.0330
n-Butane	0.0128	0.308	0.0563
Isopentane	0.0039	0.093	0.0170
n-Pentane	0.0029	0.069	0.0125
n-Hexane	0.0013	0.031	0.0056
Cyclohexane	0.0045	0.108	0.0197
Other Hexanes	0.0032	0.078	0.0142
Heptanes	0.0047	0.112	0.0204
Methylcyclohexane	0.0036	0.087	0.0160
2,2,4-Trimethylpentane	<0.0001	<0.001	0.0001
Benzene	0.0108	0.259	0.0472
Toluene	0.0247	0.592	0.1080
Ethylbenzene	0.0044	0.105	0.0192
Xylenes	0.0060	0.145	0.0264
C8+ Heavies	0.0042	0.100	0.0183
Total Emissions	0.2734	6.562	1.1975
Total Hydrocarbon Emissions	0.2734	6.562	1.1975
Total VOC Emissions	0.1269	3.047	0.5560
Total HAP Emissions	0.0471	1.131	0.2064
Total BTEX Emissions	0.0458	1.100	0.2007

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.6810	40.345	7.3629
Ethane	1.2499	29.996	5.4744
Propane	0.6500	15.599	2.8468
Isobutane	0.1510	3.623	0.6612
n-Butane	0.2570	6.169	1.1258
Isopentane	0.0776	1.863	0.3401

Page: 2

n-Pentane	0.0573	1.375	0.2509
n-Hexane	0.0256	0.615	0.1122
Cyclohexane	0.0903	2.167	0.3955
Other Hexanes	0.0650	1.561	0.2848
Heptanes	0.0932	2.238	0.4084
Methylcyclohexane	0.0731	1.754	0.3202
2,2,4-Trimethylpentane	0.0003	0.008	0.0014
Benzene	0.2226	5.343	0.9750
Toluene	0.5072	12.174	2.2217
Ethylbenzene	0.0897	2.152	0.3927
Xylenes	0.1244	2.985	0.5448
C8+ Heavies	0.1078	2.587	0.4722
-----			
Total Emissions	5.5230	132.553	24.1909
Total Hydrocarbon Emissions	5.5230	132.553	24.1909
Total VOC Emissions	2.5922	62.212	11.3536
Total HAP Emissions	0.9698	23.276	4.2478
Total BTEX Emissions	0.9439	22.654	4.1343

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.3160	3031.585	553.2642
Ethane	28.5936	686.246	125.2399
Propane	7.1537	171.689	31.3332
Isobutane	1.1508	27.619	5.0405
n-Butane	1.5310	36.743	6.7056
Isopentane	0.4256	10.214	1.8641
n-Pentane	0.2549	6.117	1.1164
n-Hexane	0.0660	1.583	0.2889
Cyclohexane	0.0599	1.437	0.2623
Other Hexanes	0.2204	5.290	0.9655
Heptanes	0.1228	2.947	0.5378
Methylcyclohexane	0.0390	0.937	0.1710
2,2,4-Trimethylpentane	0.0008	0.020	0.0036
Benzene	0.0223	0.536	0.0978
Toluene	0.0343	0.823	0.1502
Ethylbenzene	0.0037	0.088	0.0160
Xylenes	0.0036	0.086	0.0157
C8+ Heavies	0.0213	0.512	0.0935
-----			
Total Emissions	166.0197	3984.472	727.1661
Total Hydrocarbon Emissions	166.0197	3984.472	727.1661
Total VOC Emissions	11.1101	266.641	48.6620
Total HAP Emissions	0.1307	3.136	0.5722
Total BTEX Emissions	0.0639	1.533	0.2797

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	252.6320	6063.169	1106.5284
Ethane	57.1872	1372.492	250.4799
Propane	14.3074	343.378	62.6665
Isobutane	2.3016	55.238	10.0810
n-Butane	3.0619	73.486	13.4112
Isopentane	0.8512	20.428	3.7281

n-Pentane	0.5098	12.234	2.2327
n-Hexane	0.1319	3.166	0.5779
Cyclohexane	0.1198	2.875	0.5246
Other Hexanes	0.4408	10.580	1.9309
Heptanes	0.2456	5.893	1.0755
Methylcyclohexane	0.0781	1.874	0.3421
2,2,4-Trimethylpentane	0.0016	0.039	0.0072
Benzene	0.0447	1.072	0.1956
Toluene	0.0686	1.646	0.3004
Ethylbenzene	0.0073	0.176	0.0321
Xylenes	0.0072	0.172	0.0313
C8+ Heavies	0.0427	1.025	0.1870
-----			
Total Emissions	332.0393	7968.944	1454.3323
Total Hydrocarbon Emissions	332.0393	7968.944	1454.3323
Total VOC Emissions	22.2201	533.282	97.3240
Total HAP Emissions	0.2613	6.271	1.1445
Total BTEX Emissions	0.1277	3.065	0.5594

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.4000	3033.601	553.6321
Ethane	28.6560	687.745	125.5135
Propane	7.1862	172.468	31.4755
Isobutane	1.1583	27.800	5.0735
n-Butane	1.5438	37.051	6.7618
Isopentane	0.4295	10.307	1.8811
n-Pentane	0.2577	6.186	1.1289
n-Hexane	0.0672	1.614	0.2945
Cyclohexane	0.0644	1.545	0.2820
Other Hexanes	0.2237	5.368	0.9797
Heptanes	0.1274	3.058	0.5581
Methylcyclohexane	0.0427	1.025	0.1870
2,2,4-Trimethylpentane	0.0008	0.020	0.0037
Benzene	0.0331	0.794	0.1450
Toluene	0.0590	1.415	0.2582
Ethylbenzene	0.0080	0.193	0.0352
Xylenes	0.0096	0.230	0.0421
C8+ Heavies	0.0255	0.612	0.1118
-----			
Total Emissions	166.2931	3991.034	728.3637
Total Hydrocarbon Emissions	166.2931	3991.034	728.3637
Total VOC Emissions	11.2370	269.688	49.2180
Total HAP Emissions	0.1778	4.267	0.7786
Total BTEX Emissions	0.1097	2.633	0.4804

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	1113.8912	553.6321	50.30
Ethane	255.9542	125.5135	50.96
Propane	65.5133	31.4755	51.96
Isobutane	10.7421	5.0735	52.77

n-Butane	14.5369	6.7618	53.49
Isopentane	4.0682	1.8811	53.76
n-Pentane	2.4836	1.1289	54.55
n-Hexane	0.6900	0.2945	57.32
Cyclohexane	0.9201	0.2820	69.35
Other Hexanes	2.2157	0.9797	55.78
Heptanes	1.4839	0.5581	62.39
Methylcyclohexane	0.6623	0.1870	71.76
2,2,4-Trimethylpentane	0.0086	0.0037	57.25
Benzene	1.1706	0.1450	87.62
Toluene	2.5221	0.2582	89.76
Ethylbenzene	0.4248	0.0352	91.71
Xylenes	0.5762	0.0421	92.70
C8+ Heavies	0.6592	0.1118	83.05
-----			
Total Emissions	1478.5231	728.3637	50.74
Total Hydrocarbon Emissions	1478.5231	728.3637	50.74
Total VOC Emissions	108.6777	49.2180	54.71
Total HAP Emissions	5.3923	0.7786	85.56
Total BTEX Emissions	4.6937	0.4804	89.76

## EQUIPMENT REPORTS:

## CONDENSER AND COMBUSTION DEVICE

Condenser Outlet Temperature: 150.00 deg. F  
 Condenser Pressure: 14.00 psia  
 Condenser Duty: 2.41e-002 MM BTU/hr  
 Hydrocarbon Recovery: 0.00 bbls/day  
 Produced Water: 10.91 bbls/day  
 Ambient Temperature: 50.00 deg. F  
 Excess Oxygen: 5.00 %  
 Combustion Efficiency: 95.00 %  
 Supplemental Fuel Requirement: 2.41e-002 MM BTU/hr

Component	Emitted	Destroyed
Methane	5.00%	95.00%
Ethane	5.00%	95.00%
Propane	5.00%	95.00%
Isobutane	5.00%	95.00%
n-Butane	5.00%	95.00%
Isopentane	5.00%	95.00%
n-Pentane	5.00%	95.00%
n-Hexane	4.99%	95.01%
Cyclohexane	4.99%	95.01%
Other Hexanes	5.00%	95.00%
Heptanes	4.99%	95.01%
Methylcyclohexane	4.99%	95.01%
2,2,4-Trimethylpentane	4.99%	95.01%
Benzene	4.84%	95.16%
Toluene	4.86%	95.14%
Ethylbenzene	4.88%	95.12%
Xylenes	4.84%	95.16%
C8+ Heavies	3.87%	96.13%

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: 2.06 lbs. H2O/MMSCF

Temperature: 90.0 deg. F  
 Pressure: 1100.0 psig  
 Dry Gas Flow Rate: 100.0000 MMSCF/day  
 Glycol Losses with Dry Gas: 1.3798 lb/hr  
 Wet Gas Water Content: Saturated  
 Calculated Wet Gas Water Content: 40.82 lbs. H2O/MMSCF  
 Calculated Lean Glycol Recirc. Ratio: 5.57 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	5.04%	94.96%
Carbon Dioxide	99.76%	0.24%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.95%	0.05%
Propane	99.93%	0.07%
Isobutane	99.90%	0.10%
n-Butane	99.87%	0.13%
Isopentane	99.88%	0.12%
n-Pentane	99.84%	0.16%
n-Hexane	99.76%	0.24%
Cyclohexane	98.88%	1.12%
Other Hexanes	99.81%	0.19%
Heptanes	99.59%	0.41%
Methylcyclohexane	98.87%	1.13%
2,2,4-Trimethylpentane	99.83%	0.17%
Benzene	89.76%	10.24%
Toluene	85.92%	14.08%
Ethylbenzene	83.51%	16.49%
Xylenes	77.58%	22.42%
C8+ Heavies	99.14%	0.86%

FLASH TANK

Flash Control: Combustion device  
 Flash Control Efficiency: 50.00 %  
 Flash Temperature: 150.0 deg. F  
 Flash Pressure: 50.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.46%	0.54%
Carbon Dioxide	6.36%	93.64%
Nitrogen	0.64%	99.36%
Methane	0.66%	99.34%
Ethane	2.14%	97.86%
Propane	4.35%	95.65%

Isobutane	6.16%	93.84%
n-Butane	7.74%	92.26%
Isopentane	8.57%	91.43%
n-Pentane	10.34%	89.66%
n-Hexane	16.52%	83.48%
Cyclohexane	44.61%	55.39%
Other Hexanes	13.35%	86.65%
Heptanes	27.79%	72.21%
Methylcyclohexane	50.19%	49.81%
2,2,4-Trimethylpentane	16.79%	83.21%
Benzene	84.12%	15.88%
Toluene	89.02%	10.98%
Ethylbenzene	93.23%	6.77%
Xylenes	95.26%	4.74%
C8+ Heavies	74.60%	25.40%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	44.13%	55.87%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	2.65%	97.35%
n-Pentane	2.51%	97.49%
n-Hexane	1.89%	98.11%
Cyclohexane	6.37%	93.63%
Other Hexanes	4.23%	95.77%
Heptanes	1.33%	98.67%
Methylcyclohexane	7.09%	92.91%
2,2,4-Trimethylpentane	4.81%	95.19%
Benzene	5.87%	94.13%
Toluene	8.79%	91.21%
Ethylbenzene	11.08%	88.92%
Xylenes	13.49%	86.51%
C8+ Heavies	14.03%	85.97%

STREAM REPORTS:

WET GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 4.17e+006 scfh

Component Conc. Loading

	(vol%)	(lb/hr)
Water	8.60e-002	1.70e+002
Carbon Dioxide	1.67e-001	8.09e+002
Nitrogen	2.81e-001	8.64e+002
Methane	8.86e+001	1.56e+005
Ethane	8.98e+000	2.97e+004
Propane	1.40e+000	6.79e+003
Isobutane	1.57e-001	1.00e+003
n-Butane	1.89e-001	1.21e+003
Isopentane	4.41e-002	3.49e+002
n-Pentane	2.37e-002	1.88e+002
n-Hexane	4.30e-003	4.07e+001
Cyclohexane	1.80e-003	1.66e+001
Other Hexanes	1.61e-002	1.52e+002
Heptanes	5.50e-003	6.05e+001
Methylcyclohexane	1.10e-003	1.19e+001
2,2,4-Trimethylpentane	5.00e-005	6.27e-001
Benzene	3.00e-004	2.57e+000
Toluene	4.00e-004	4.05e+000
Ethylbenzene	5.00e-005	5.83e-001
Xylenes	5.00e-005	5.83e-001
C8+ Heavies	7.99e-004	1.50e+001
Total Components	100.00	1.98e+005

DRY GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 4.17e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	4.34e-003	8.58e+000
Carbon Dioxide	1.67e-001	8.07e+002
Nitrogen	2.81e-001	8.64e+002
Methane	8.87e+001	1.56e+005
Ethane	8.98e+000	2.97e+004
Propane	1.40e+000	6.78e+003
Isobutane	1.57e-001	1.00e+003
n-Butane	1.89e-001	1.21e+003
Isopentane	4.41e-002	3.49e+002
n-Pentane	2.37e-002	1.88e+002
n-Hexane	4.29e-003	4.06e+001
Cyclohexane	1.78e-003	1.65e+001
Other Hexanes	1.61e-002	1.52e+002
Heptanes	5.48e-003	6.03e+001
Methylcyclohexane	1.09e-003	1.17e+001
2,2,4-Trimethylpentane	4.99e-005	6.26e-001
Benzene	2.69e-004	2.31e+000
Toluene	3.44e-004	3.48e+000
Ethylbenzene	4.18e-005	4.87e-001
Xylenes	3.88e-005	4.52e-001
C8+ Heavies	7.93e-004	1.48e+001
Total Components	100.00	1.97e+005

## LEAN GLYCOL STREAM

Temperature: 90.00 deg. F  
Flow Rate: 1.50e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	8.32e+003
Water	1.50e+000	1.27e+002
Carbon Dioxide	2.31e-012	1.95e-010
Nitrogen	2.08e-013	1.76e-011
Methane	1.08e-017	9.09e-016
Ethane	8.55e-008	7.22e-006
Propane	2.45e-009	2.07e-007
Isobutane	3.53e-010	2.98e-008
n-Butane	4.58e-010	3.87e-008
Isopentane	2.50e-005	2.11e-003
n-Pentane	1.75e-005	1.48e-003
n-Hexane	5.85e-006	4.94e-004
Cyclohexane	7.28e-005	6.14e-003
Other Hexanes	3.40e-005	2.87e-003
Heptanes	1.49e-005	1.26e-003
Methylcyclohexane	6.61e-005	5.58e-003
2,2,4-Trimethylpentane	1.89e-007	1.60e-005
Benzene	1.64e-004	1.39e-002
Toluene	5.79e-004	4.89e-002
Ethylbenzene	1.32e-004	1.12e-002
Xylenes	2.30e-004	1.94e-002
C8+ Heavies	2.08e-004	1.76e-002
Total Components	100.00	8.45e+003

## RICH GLYCOL AND PUMP GAS STREAM

Temperature: 90.00 deg. F  
Pressure: 1114.70 psia  
Flow Rate: 1.61e+001 gpm  
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.29e+001	8.32e+003
Water	3.23e+000	2.89e+002
Carbon Dioxide	3.49e-002	3.12e+000
Nitrogen	1.60e-002	1.43e+000
Methane	2.84e+000	2.54e+002
Ethane	6.53e-001	5.84e+001
Propane	1.67e-001	1.50e+001
Isobutane	2.74e-002	2.45e+000
n-Butane	3.71e-002	3.32e+000
Isopentane	1.04e-002	9.31e-001
n-Pentane	6.35e-003	5.69e-001
n-Hexane	1.77e-003	1.58e-001
Cyclohexane	2.42e-003	2.16e-001
Other Hexanes	5.69e-003	5.09e-001
Heptanes	3.80e-003	3.40e-001
Methylcyclohexane	1.75e-003	1.57e-001
2,2,4-Trimethylpentane	2.21e-005	1.98e-003

Benzene	3.14e-003	2.81e-001
Toluene	6.98e-003	6.25e-001
Ethylbenzene	1.21e-003	1.08e-001
Xylenes	1.69e-003	1.51e-001
C8+ Heavies	1.88e-003	1.68e-001
-----		
Total Components	100.00	8.95e+003

FLASH TANK OFF GAS STREAM

-----  
 Temperature: 150.00 deg. F  
 Pressure: 64.70 psia  
 Flow Rate: 6.95e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	4.74e-001	1.56e+000
Carbon Dioxide	3.63e-001	2.93e+000
Nitrogen	2.78e-001	1.42e+000
Methane	8.60e+001	2.53e+002
Ethane	1.04e+001	5.72e+001
Propane	1.77e+000	1.43e+001
Isobutane	2.16e-001	2.30e+000
n-Butane	2.88e-001	3.06e+000
Isopentane	6.44e-002	8.51e-001
n-Pentane	3.86e-002	5.10e-001
n-Hexane	8.36e-003	1.32e-001
Cyclohexane	7.77e-003	1.20e-001
Other Hexanes	2.79e-002	4.41e-001
Heptanes	1.34e-002	2.46e-001
Methylcyclohexane	4.35e-003	7.81e-002
2,2,4-Trimethylpentane	7.87e-005	1.65e-003
Benzene	3.12e-003	4.47e-002
Toluene	4.07e-003	6.86e-002
Ethylbenzene	3.77e-004	7.33e-003
Xylenes	3.68e-004	7.16e-003
C8+ Heavies	1.37e-003	4.27e-002
-----		
Total Components	100.00	3.38e+002

FLASH TANK GLYCOL STREAM

-----  
 Temperature: 150.00 deg. F  
 Flow Rate: 1.53e+001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
-----		
TEG	9.66e+001	8.32e+003
Water	3.33e+000	2.87e+002
Carbon Dioxide	2.31e-003	1.99e-001
Nitrogen	1.07e-004	9.18e-003
Methane	1.95e-002	1.68e+000
Ethane	1.45e-002	1.25e+000
Propane	7.55e-003	6.50e-001
Isobutane	1.75e-003	1.51e-001
n-Butane	2.99e-003	2.57e-001
Isopentane	9.26e-004	7.98e-002

n-Pentane	6.82e-004	5.88e-002
n-Hexane	3.03e-004	2.61e-002
Cyclohexane	1.12e-003	9.64e-002
Other Hexanes	7.89e-004	6.79e-002
Heptanes	1.10e-003	9.45e-002
Methylcyclohexane	9.14e-004	7.87e-002
2,2,4-Trimethylpentane	3.86e-006	3.32e-004
Benzene	2.75e-003	2.36e-001
Toluene	6.46e-003	5.56e-001
Ethylbenzene	1.17e-003	1.01e-001
Xylenes	1.67e-003	1.44e-001
C8+ Heavies	1.46e-003	1.25e-001
-----		
Total Components	100.00	8.61e+003

FLASH GAS EMISSIONS

Flow Rate: 1.49e+004 scfh  
 Control Method: Combustion Device  
 Control Efficiency: 50.00

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	5.00e+001	3.54e+002
Carbon Dioxide	2.69e+001	4.67e+002
Nitrogen	1.29e-001	1.42e+000
Methane	2.00e+001	1.26e+002
Ethane	2.41e+000	2.86e+001
Propane	4.12e-001	7.15e+000
Isobutane	5.03e-002	1.15e+000
n-Butane	6.69e-002	1.53e+000
Isopentane	1.50e-002	4.26e-001
n-Pentane	8.97e-003	2.55e-001
n-Hexane	1.94e-003	6.60e-002
Cyclohexane	1.81e-003	5.99e-002
Other Hexanes	6.50e-003	2.20e-001
Heptanes	3.11e-003	1.23e-001
Methylcyclohexane	1.01e-003	3.90e-002
2,2,4-Trimethylpentane	1.83e-005	8.23e-004
Benzene	7.26e-004	2.23e-002
Toluene	9.45e-004	3.43e-002
Ethylbenzene	8.76e-005	3.66e-003
Xylenes	8.56e-005	3.58e-003
C8+ Heavies	3.18e-004	2.13e-002
-----		
Total Components	100.00	9.88e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F  
 Pressure: 14.70 psia  
 Flow Rate: 3.45e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	9.79e+001	1.60e+002
Carbon Dioxide	4.97e-002	1.99e-001
Nitrogen	3.60e-003	9.18e-003

Methane	1.15e+000	1.68e+000
Ethane	4.57e-001	1.25e+000
Propane	1.62e-001	6.50e-001
Isobutane	2.86e-002	1.51e-001
n-Butane	4.86e-002	2.57e-001
Isopentane	1.18e-002	7.76e-002
n-Pentane	8.73e-003	5.73e-002
n-Hexane	3.27e-003	2.56e-002
Cyclohexane	1.18e-002	9.03e-002
Other Hexanes	8.30e-003	6.50e-002
Heptanes	1.02e-002	9.32e-002
Methylcyclohexane	8.19e-003	7.31e-002
2,2,4-Trimethylpentane	3.04e-005	3.16e-004
Benzene	3.13e-002	2.23e-001
Toluene	6.05e-002	5.07e-001
Ethylbenzene	9.29e-003	8.97e-002
Xylenes	1.29e-002	1.24e-001
C8+ Heavies	6.96e-003	1.08e-001
-----		
Total Components	100.00	1.66e+002

CONDENSER PRODUCED WATER STREAM

Temperature: 150.00 deg. F  
 Flow Rate: 3.18e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)
Water	1.00e+002	1.59e+002	999823.
Carbon Dioxide	1.11e-003	1.77e-003	11.
Nitrogen	1.65e-006	2.62e-006	0.
Methane	5.43e-004	8.64e-004	5.
Ethane	4.36e-004	6.93e-004	4.
Propane	2.76e-004	4.39e-004	3.
Isobutane	3.38e-005	5.39e-005	0.
n-Butane	7.40e-005	1.18e-004	1.
Isopentane	1.51e-005	2.41e-005	0.
n-Pentane	1.18e-005	1.88e-005	0.
n-Hexane	4.14e-006	6.58e-006	0.
Cyclohexane	7.47e-005	1.19e-004	1.
Other Hexanes	8.64e-006	1.37e-005	0.
Heptanes	8.04e-006	1.28e-005	0.
Methylcyclohexane	2.82e-005	4.49e-005	0.
2,2,4-Trimethylpentane	1.86e-008	2.97e-008	0.
Benzene	4.36e-003	6.94e-003	44.
Toluene	7.83e-003	1.25e-002	78.
Ethylbenzene	1.00e-003	1.60e-003	10.
Xylenes	1.85e-003	2.95e-003	19.
C8+ Heavies	2.86e-006	4.56e-006	0.
-----			
Total Components	100.00	1.59e+002	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 150.00 deg. F  
 Flow Rate: 6.70e-005 gpm

Component	Conc. (wt%)	Loading (lb/hr)
Water	3.12e-002	8.89e-006
Carbon Dioxide	4.13e-003	1.18e-006
Nitrogen	1.99e-005	5.66e-009
Methane	1.63e-002	4.65e-006
Ethane	6.30e-002	1.80e-005
Propane	1.43e-001	4.08e-005
Isobutane	5.97e-002	1.70e-005
n-Butane	1.31e-001	3.74e-005
Isopentane	8.46e-002	2.41e-005
n-Pentane	7.23e-002	2.06e-005
n-Hexane	7.03e-002	2.00e-005
Cyclohexane	3.69e-001	1.05e-004
Other Hexanes	1.51e-001	4.29e-005
Heptanes	6.26e-001	1.78e-004
Methylcyclohexane	5.18e-001	1.48e-004
2,2,4-Trimethylpentane	2.23e-003	6.35e-007
Benzene	8.37e-001	2.38e-004
Toluene	5.48e+000	1.56e-003
Ethylbenzene	2.10e+000	5.99e-004
Xylenes	3.49e+000	9.93e-004
C8+ Heavies	8.58e+001	2.44e-002
Total Components	100.00	2.85e-002

CONDENSER VENT STREAM

Temperature: 150.00 deg. F  
 Pressure: 14.00 psia  
 Flow Rate: 9.79e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.67e+001	1.24e+000
Carbon Dioxide	1.74e+000	1.97e-001
Nitrogen	1.27e-001	9.18e-003
Methane	4.06e+001	1.68e+000
Ethane	1.61e+001	1.25e+000
Propane	5.71e+000	6.49e-001
Isobutane	1.01e+000	1.51e-001
n-Butane	1.71e+000	2.57e-001
Isopentane	4.17e-001	7.76e-002
n-Pentane	3.08e-001	5.72e-002
n-Hexane	1.15e-001	2.56e-002
Cyclohexane	4.15e-001	9.01e-002
Other Hexanes	2.92e-001	6.50e-002
Heptanes	3.60e-001	9.30e-002
Methylcyclohexane	2.88e-001	7.29e-002
2,2,4-Trimethylpentane	1.07e-003	3.15e-004
Benzene	1.07e+000	2.15e-001
Toluene	2.07e+000	4.93e-001
Ethylbenzene	3.19e-001	8.75e-002
Xylenes	4.40e-001	1.20e-001
C8+ Heavies	1.90e-001	8.34e-002
Total Components	100.00	6.92e+000

COMBUSTION DEVICE OFF GAS STREAM

-----  
 Temperature: 1000.00 deg. F  
 Pressure: 14.70 psia  
 Flow Rate: 3.50e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Methane	5.68e+001	8.40e-002
Ethane	2.25e+001	6.25e-002
Propane	7.99e+000	3.25e-002
Isobutane	1.41e+000	7.54e-003
n-Butane	2.40e+000	1.28e-002
Isopentane	5.84e-001	3.88e-003
n-Pentane	4.31e-001	2.86e-003
n-Hexane	1.61e-001	1.28e-003
Cyclohexane	5.81e-001	4.50e-003
Other Hexanes	4.09e-001	3.25e-003
Heptanes	5.04e-001	4.65e-003
Methylcyclohexane	4.03e-001	3.65e-003
2,2,4-Trimethylpentane	1.50e-003	1.58e-005
Benzene	1.50e+000	1.08e-002
Toluene	2.91e+000	2.47e-002
Ethylbenzene	4.47e-001	4.37e-003
Xylenes	6.16e-001	6.02e-003
C8+ Heavies	2.66e-001	4.17e-003
Total Components	100.00	2.73e-001

## GRI-GLYCalc VERSION 4.0 - EMISSIONS SUMMARY

Case Name: Grenadier DS - 50 MMscfd DEHY-02alt

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lbalt - Grenadier DS - NSR-Mod - 50 MMscfd Dehy-02alt - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.8405	20.172	3.6814
Ethane	0.6249	14.998	2.7372
Propane	0.3250	7.799	1.4234
Isobutane	0.0755	1.811	0.3306
n-Butane	0.1285	3.084	0.5629
Isopentane	0.0388	0.932	0.1700
n-Pentane	0.0286	0.687	0.1254
n-Hexane	0.0128	0.307	0.0561
Cyclohexane	0.0451	1.084	0.1978
Other Hexanes	0.0325	0.780	0.1424
Heptanes	0.0466	1.119	0.2042
Methylcyclohexane	0.0365	0.877	0.1601
2,2,4-Trimethylpentane	0.0002	0.004	0.0007
Benzene	0.1113	2.671	0.4875
Toluene	0.2536	6.087	1.1108
Ethylbenzene	0.0448	1.076	0.1964
Xylenes	0.0622	1.493	0.2724
C8+ Heavies	0.0539	1.294	0.2361
Total Emissions	2.7615	66.276	12.0954
Total Hydrocarbon Emissions	2.7615	66.276	12.0954
Total VOC Emissions	1.2961	31.106	5.6768
Total HAP Emissions	0.4849	11.638	2.1239
Total BTEX Emissions	0.4719	11.327	2.0671

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.1576	1515.783	276.6304
Ethane	14.2967	343.121	62.6196
Propane	3.5768	85.844	15.6665
Isobutane	0.5754	13.809	2.5202
n-Butane	0.7655	18.371	3.3528
Isopentane	0.2128	5.107	0.9320
n-Pentane	0.1274	3.058	0.5582
n-Hexane	0.0330	0.792	0.1445
Cyclohexane	0.0299	0.719	0.1312
Other Hexanes	0.1102	2.645	0.4827
Heptanes	0.0614	1.473	0.2689
Methylcyclohexane	0.0195	0.469	0.0855
2,2,4-Trimethylpentane	0.0004	0.010	0.0018
Benzene	0.0112	0.268	0.0489
Toluene	0.0171	0.412	0.0751
Ethylbenzene	0.0018	0.044	0.0080
Xylenes	0.0018	0.043	0.0078
C8+ Heavies	0.0107	0.256	0.0467

	lbs/hr	lbs/day	tons/yr
Total Emissions	83.0093	1992.224	363.5809
Total Hydrocarbon Emissions	83.0093	1992.224	363.5809
Total VOC Emissions	5.5550	133.320	24.3309
Total HAP Emissions	0.0653	1.568	0.2861
Total BTEX Emissions	0.0319	0.766	0.1399

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.3153	3031.566	553.2609
Ethane	28.5934	686.242	125.2392
Propane	7.1537	171.688	31.3331
Isobutane	1.1508	27.619	5.0405
n-Butane	1.5309	36.743	6.7055
Isopentane	0.4256	10.214	1.8641
n-Pentane	0.2549	6.117	1.1163
n-Hexane	0.0660	1.583	0.2889
Cyclohexane	0.0599	1.437	0.2623
Other Hexanes	0.2204	5.290	0.9654
Heptanes	0.1228	2.947	0.5378
Methylcyclohexane	0.0390	0.937	0.1710
2,2,4-Trimethylpentane	0.0008	0.020	0.0036
Benzene	0.0223	0.536	0.0978
Toluene	0.0343	0.823	0.1502
Ethylbenzene	0.0037	0.088	0.0160
Xylenes	0.0036	0.086	0.0157
C8+ Heavies	0.0213	0.512	0.0935
Total Emissions	166.0187	3984.448	727.1618
Total Hydrocarbon Emissions	166.0187	3984.448	727.1618
Total VOC Emissions	11.1100	266.640	48.6617
Total HAP Emissions	0.1306	3.136	0.5722
Total BTEX Emissions	0.0639	1.533	0.2797

## COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.9981	1535.955	280.3119
Ethane	14.9216	358.119	65.3567
Propane	3.9018	93.643	17.0899
Isobutane	0.6509	15.621	2.8508
n-Butane	0.8940	21.456	3.9157
Isopentane	0.2516	6.039	1.1021
n-Pentane	0.1561	3.746	0.6836
n-Hexane	0.0458	1.099	0.2005
Cyclohexane	0.0751	1.802	0.3289
Other Hexanes	0.1427	3.425	0.6251
Heptanes	0.1080	2.592	0.4731
Methylcyclohexane	0.0561	1.346	0.2456
2,2,4-Trimethylpentane	0.0006	0.014	0.0025
Benzene	0.1225	2.939	0.5364
Toluene	0.2708	6.498	1.1860
Ethylbenzene	0.0467	1.120	0.2044
Xylenes	0.0640	1.536	0.2802
C8+ Heavies	0.0646	1.550	0.2828

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Total Emissions	85.7708	2058.500	375.6762
Total Hydrocarbon Emissions	85.7708	2058.500	375.6762
Total VOC Emissions	6.8511	164.425	30.0076
Total HAP Emissions	0.5502	13.206	2.4100
Total BTEX Emissions	0.5039	12.093	2.2070

## GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Grenadier DS - 50 MMscfd DEHY-02alt

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lbalt - Grenadier DS - NSR-Mod - 50 MMscfd Dehy-02alt - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## DESCRIPTION:

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Description: 90 oF, 1100 psig  
 Gas Drive Pump @ 7.5 gpm  
 50% Flash Tank Recycle  
 No Emission Controls

Annual Hours of Operation: 8760.0 hours/yr

## WET GAS:

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Temperature: 90.00 deg. F  
 Pressure: 1100.00 psig  
 Wet Gas Water Content: Saturated

Component	Conc. (vol %)
Carbon Dioxide	0.1674
Nitrogen	0.2809
Methane	88.7219
Ethane	8.9834
Propane	1.4015
Isobutane	0.1573
n-Butane	0.1895
Isopentane	0.0441
n-Pentane	0.0237
n-Hexane	0.0043
Cyclohexane	0.0018
Other Hexanes	0.0161
Heptanes	0.0055
Methylcyclohexane	0.0011
2,2,4-Trimethylpentane	0.0000
Benzene	0.0003
Toluene	0.0004
Ethylbenzene	0.0000
Xylenes	0.0000
C8+ Heavies	0.0008

## DRY GAS:

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Flow Rate: 50.0 MMSCF/day  
 Water Content: 7.0 lbs. H2O/MMSCF

## LEAN GLYCOL:

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

PUMP:

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

FLASH TANK:

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Flash Control: Combustion device  
Flash Control Efficiency: 50.00 %  
Temperature: 150.0 deg. F  
Pressure: 50.0 psig

## GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Grenadier DS - 50 MMscfd DEHY-02alt

File Name: C:\Users\Clyde 08.19.14\Documents\000 - EcoLogic LLC - 08.18.14\03 - OVM - Grenadier DS\10.554 - Grenadier - NSR-Mod - 07.29.15\00 - Att-Lbalt - Grenadier DS - NSR-Mod - 50 MMscfd Dehy-02alt - 08.14.15 - DRAFT.ddf

Date: August 14, 2015

## DESCRIPTION:

Description: 90 oF, 1100 psig  
 Gas Drive Pump @ 7.5 gpm  
 50% Flash Tank Recycle  
 No Emission Controls

Annual Hours of Operation: 8760.0 hours/yr

## EMISSIONS REPORTS:

## UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.8405	20.172	3.6814
Ethane	0.6249	14.998	2.7372
Propane	0.3250	7.799	1.4234
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n-Butane	0.1285	3.084	0.5629
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Heptanes	0.0466	1.119	0.2042
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2,2,4-Trimethylpentane	0.0002	0.004	0.0007
Benzene	0.1113	2.671	0.4875
Toluene	0.2536	6.087	1.1108
Ethylbenzene	0.0448	1.076	0.1964
Xylenes	0.0622	1.493	0.2724
C8+ Heavies	0.0539	1.294	0.2361
<b>Total Emissions</b>	<b>2.7615</b>	<b>66.276</b>	<b>12.0954</b>
<b>Total Hydrocarbon Emissions</b>	<b>2.7615</b>	<b>66.276</b>	<b>12.0954</b>
<b>Total VOC Emissions</b>	<b>1.2961</b>	<b>31.106</b>	<b>5.6768</b>
<b>Total HAP Emissions</b>	<b>0.4849</b>	<b>11.638</b>	<b>2.1239</b>
<b>Total BTEX Emissions</b>	<b>0.4719</b>	<b>11.327</b>	<b>2.0671</b>

## FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.1576	1515.783	276.6304
Ethane	14.2967	343.121	62.6196
Propane	3.5768	85.844	15.6665
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n-Butane	0.7655	18.371	3.3528
Isopentane	0.2128	5.107	0.9320

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n-Pentane	0.1274	3.058	0.5582
n-Hexane	0.0330	0.792	0.1445
Cyclohexane	0.0299	0.719	0.1312
Other Hexanes	0.1102	2.645	0.4827
Heptanes	0.0614	1.473	0.2689
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-----			
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Total HAP Emissions	0.0653	1.568	0.2861
Total BTEX Emissions	0.0319	0.766	0.1399

## FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	126.3153	3031.566	553.2609
Ethane	28.5934	686.242	125.2392
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n-Butane	1.5309	36.743	6.7055
Isopentane	0.4256	10.214	1.8641
n-Pentane	0.2549	6.117	1.1163
n-Hexane	0.0660	1.583	0.2889
Cyclohexane	0.0599	1.437	0.2623
Other Hexanes	0.2204	5.290	0.9654
Heptanes	0.1228	2.947	0.5378
Methylcyclohexane	0.0390	0.937	0.1710
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-----			
Total Emissions	166.0187	3984.448	727.1618
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Total HAP Emissions	0.1306	3.136	0.5722
Total BTEX Emissions	0.0639	1.533	0.2797

## COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	63.9981	1535.955	280.3119
Ethane	14.9216	358.119	65.3567
Propane	3.9018	93.643	17.0899
Isobutane	0.6509	15.621	2.8508
n-Butane	0.8940	21.456	3.9157
Isopentane	0.2516	6.039	1.1021

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n-Pentane	0.1561	3.746	0.6836
n-Hexane	0.0458	1.099	0.2005
Cyclohexane	0.0751	1.802	0.3289
Other Hexanes	0.1427	3.425	0.6251
Heptanes	0.1080	2.592	0.4731
Methylcyclohexane	0.0561	1.346	0.2456
2,2,4-Trimethylpentane	0.0006	0.014	0.0025
Benzene	0.1225	2.939	0.5364
Toluene	0.2708	6.498	1.1860
Ethylbenzene	0.0467	1.120	0.2044
Xylenes	0.0640	1.536	0.2802
C8+ Heavies	0.0646	1.550	0.2828
-----			
Total Emissions	85.7708	2058.500	375.6762
Total Hydrocarbon Emissions	85.7708	2058.500	375.6762
Total VOC Emissions	6.8511	164.425	30.0076
Total HAP Emissions	0.5502	13.206	2.4100
Total BTEX Emissions	0.5039	12.093	2.2070

## COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
-----			
Methane	556.9423	280.3119	49.67
Ethane	127.9763	65.3567	48.93
Propane	32.7565	17.0899	47.83
Isobutane	5.3710	2.8508	46.92
n-Butane	7.2684	3.9157	46.13
Isopentane	2.0341	1.1021	45.82
n-Pentane	1.2418	0.6836	44.95
n-Hexane	0.3450	0.2005	41.87
Cyclohexane	0.4601	0.3289	28.51
Other Hexanes	1.1078	0.6251	43.57
Heptanes	0.7419	0.4731	36.24
Methylcyclohexane	0.3311	0.2456	25.83
2,2,4-Trimethylpentane	0.0043	0.0025	41.94
Benzene	0.5853	0.5364	8.35
Toluene	1.2611	1.1860	5.96
Ethylbenzene	0.2124	0.2044	3.78
Xylenes	0.2881	0.2802	2.72
C8+ Heavies	0.3296	0.2828	14.18
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Total Emissions	739.2571	375.6762	49.18
Total Hydrocarbon Emissions	739.2571	375.6762	49.18
Total VOC Emissions	54.3385	30.0076	44.78
Total HAP Emissions	2.6961	2.4100	10.61
Total BTEX Emissions	2.3468	2.2070	5.96

## EQUIPMENT REPORTS:

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ABSORBER

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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: 2.06 lbs. H2O/MMSCF

Temperature: 90.0 deg. F  
 Pressure: 1100.0 psig  
 Dry Gas Flow Rate: 50.0000 MMSCF/day  
 Glycol Losses with Dry Gas: 0.6899 lb/hr  
 Wet Gas Water Content: Saturated  
 Calculated Wet Gas Water Content: 40.82 lbs. H2O/MMSCF  
 Calculated Lean Glycol Recirc. Ratio: 5.57 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	5.04%	94.96%
Carbon Dioxide	99.76%	0.24%
Nitrogen	99.98%	0.02%
Methane	99.98%	0.02%
Ethane	99.95%	0.05%
Propane	99.93%	0.07%
Isobutane	99.90%	0.10%
n-Butane	99.87%	0.13%
Isopentane	99.88%	0.12%
n-Pentane	99.84%	0.16%
n-Hexane	99.76%	0.24%
Cyclohexane	98.88%	1.12%
Other Hexanes	99.81%	0.19%
Heptanes	99.59%	0.41%
Methylcyclohexane	98.87%	1.13%
2,2,4-Trimethylpentane	99.83%	0.17%
Benzene	89.76%	10.24%
Toluene	85.92%	14.08%
Ethylbenzene	83.51%	16.49%
Xylenes	77.58%	22.42%
C8+ Heavies	99.14%	0.86%

FLASH TANK

Flash Control: Combustion device  
 Flash Control Efficiency: 50.00 %  
 Flash Temperature: 150.0 deg. F  
 Flash Pressure: 50.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.46%	0.54%
Carbon Dioxide	6.36%	93.64%
Nitrogen	0.64%	99.36%
Methane	0.66%	99.34%
Ethane	2.14%	97.86%
Propane	4.35%	95.65%
Isobutane	6.16%	93.84%
n-Butane	7.74%	92.26%
Isopentane	8.57%	91.43%
n-Pentane	10.34%	89.66%

n-Hexane	16.52%	83.48%
Cyclohexane	44.61%	55.39%
Other Hexanes	13.35%	86.65%
Heptanes	27.79%	72.21%
Methylcyclohexane	50.19%	49.81%
2,2,4-Trimethylpentane	16.79%	83.21%
Benzene	84.12%	15.88%
Toluene	89.02%	10.98%
Ethylbenzene	93.23%	6.77%
Xylenes	95.26%	4.74%
C8+ Heavies	74.60%	25.40%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	44.13%	55.87%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	2.65%	97.35%
n-Pentane	2.51%	97.49%
n-Hexane	1.89%	98.11%
Cyclohexane	6.37%	93.63%
Other Hexanes	4.23%	95.77%
Heptanes	1.33%	98.67%
Methylcyclohexane	7.09%	92.91%
2,2,4-Trimethylpentane	4.81%	95.19%
Benzene	5.87%	94.13%
Toluene	8.79%	91.21%
Ethylbenzene	11.08%	88.92%
Xylenes	13.49%	86.51%
C8+ Heavies	14.03%	85.97%

STREAM REPORTS:

WET GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 2.09e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.60e-002	8.51e+001
Carbon Dioxide	1.67e-001	4.05e+002

Nitrogen	2.81e-001	4.32e+002
Methane	8.86e+001	7.82e+004
Ethane	8.98e+000	1.48e+004
Propane	1.40e+000	3.39e+003
Isobutane	1.57e-001	5.02e+002
n-Butane	1.89e-001	6.05e+002
Isopentane	4.41e-002	1.75e+002
n-Pentane	2.37e-002	9.39e+001
n-Hexane	4.30e-003	2.04e+001
Cyclohexane	1.80e-003	8.32e+000
Other Hexanes	1.61e-002	7.62e+001
Heptanes	5.50e-003	3.03e+001
Methylcyclohexane	1.10e-003	5.93e+000
2,2,4-Trimethylpentane	5.00e-005	3.14e-001
Benzene	3.00e-004	1.29e+000
Toluene	4.00e-004	2.02e+000
Ethylbenzene	5.00e-005	2.92e-001
Xylenes	5.00e-005	2.92e-001
C8+ Heavies	7.99e-004	7.48e+000
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Total Components	100.00	9.88e+004

DRY GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 2.08e+006 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	4.34e-003	4.29e+000
Carbon Dioxide	1.67e-001	4.04e+002
Nitrogen	2.81e-001	4.32e+002
Methane	8.87e+001	7.81e+004
Ethane	8.98e+000	1.48e+004
Propane	1.40e+000	3.39e+003
Isobutane	1.57e-001	5.02e+002
n-Butane	1.89e-001	6.04e+002
Isopentane	4.41e-002	1.75e+002
n-Pentane	2.37e-002	9.38e+001
n-Hexane	4.29e-003	2.03e+001
Cyclohexane	1.78e-003	8.23e+000
Other Hexanes	1.61e-002	7.61e+001
Heptanes	5.48e-003	3.01e+001
Methylcyclohexane	1.09e-003	5.86e+000
2,2,4-Trimethylpentane	4.99e-005	3.13e-001
Benzene	2.69e-004	1.16e+000
Toluene	3.44e-004	1.74e+000
Ethylbenzene	4.18e-005	2.43e-001
Xylenes	3.88e-005	2.26e-001
C8+ Heavies	7.93e-004	7.42e+000
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Total Components	100.00	9.87e+004

LEAN GLYCOL STREAM

Temperature: 90.00 deg. F

Flow Rate: 7.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	4.16e+003
Water	1.50e+000	6.33e+001
Carbon Dioxide	2.31e-012	9.74e-011
Nitrogen	2.08e-013	8.79e-012
Methane	1.08e-017	4.55e-016
Ethane	8.55e-008	3.61e-006
Propane	2.45e-009	1.04e-007
Isobutane	3.53e-010	1.49e-008
n-Butane	4.58e-010	1.93e-008
Isopentane	2.50e-005	1.06e-003
n-Pentane	1.75e-005	7.39e-004
n-Hexane	5.85e-006	2.47e-004
Cyclohexane	7.28e-005	3.07e-003
Other Hexanes	3.40e-005	1.44e-003
Heptanes	1.49e-005	6.30e-004
Methylcyclohexane	6.61e-005	2.79e-003
2,2,4-Trimethylpentane	1.89e-007	7.99e-006
Benzene	1.64e-004	6.93e-003
Toluene	5.79e-004	2.45e-002
Ethylbenzene	1.32e-004	5.59e-003
Xylenes	2.30e-004	9.70e-003
C8+ Heavies	2.08e-004	8.80e-003
Total Components	100.00	4.22e+003

RICH GLYCOL AND PUMP GAS STREAM

Temperature: 90.00 deg. F  
 Pressure: 1114.70 psia  
 Flow Rate: 8.04e+000 gpm  
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.29e+001	4.16e+003
Water	3.23e+000	1.44e+002
Carbon Dioxide	3.49e-002	1.56e+000
Nitrogen	1.60e-002	7.16e-001
Methane	2.84e+000	1.27e+002
Ethane	6.53e-001	2.92e+001
Propane	1.67e-001	7.48e+000
Isobutane	2.74e-002	1.23e+000
n-Butane	3.71e-002	1.66e+000
Isopentane	1.04e-002	4.65e-001
n-Pentane	6.35e-003	2.84e-001
n-Hexane	1.77e-003	7.90e-002
Cyclohexane	2.42e-003	1.08e-001
Other Hexanes	5.69e-003	2.54e-001
Heptanes	3.80e-003	1.70e-001
Methylcyclohexane	1.75e-003	7.84e-002
2,2,4-Trimethylpentane	2.21e-005	9.89e-004
Benzene	3.14e-003	1.41e-001
Toluene	6.98e-003	3.12e-001
Ethylbenzene	1.21e-003	5.41e-002

Xylenes	1.69e-003	7.55e-002
C8+ Heavies	1.88e-003	8.40e-002
-----		
Total Components	100.00	4.47e+003

FLASH TANK OFF GAS STREAM

Temperature: 150.00 deg. F  
 Pressure: 64.70 psia  
 Flow Rate: 3.47e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	4.74e-001	7.81e-001
Carbon Dioxide	3.63e-001	1.46e+000
Nitrogen	2.78e-001	7.12e-001
Methane	8.60e+001	1.26e+002
Ethane	1.04e+001	2.86e+001
Propane	1.77e+000	7.15e+000
Isobutane	2.16e-001	1.15e+000
n-Butane	2.88e-001	1.53e+000
Isopentane	6.44e-002	4.26e-001
n-Pentane	3.86e-002	2.55e-001
n-Hexane	8.36e-003	6.60e-002
Cyclohexane	7.77e-003	5.99e-002
Other Hexanes	2.79e-002	2.20e-001
Heptanes	1.34e-002	1.23e-001
Methylcyclohexane	4.35e-003	3.90e-002
2,2,4-Trimethylpentane	7.87e-005	8.23e-004
Benzene	3.12e-003	2.23e-002
Toluene	4.07e-003	3.43e-002
Ethylbenzene	3.77e-004	3.66e-003
Xylenes	3.68e-004	3.58e-003
C8+ Heavies	1.37e-003	2.13e-002
-----		
Total Components	100.00	1.69e+002

FLASH TANK GLYCOL STREAM

Temperature: 150.00 deg. F  
 Flow Rate: 7.66e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
-----		
TEG	9.66e+001	4.16e+003
Water	3.33e+000	1.44e+002
Carbon Dioxide	2.31e-003	9.94e-002
Nitrogen	1.07e-004	4.59e-003
Methane	1.95e-002	8.41e-001
Ethane	1.45e-002	6.25e-001
Propane	7.55e-003	3.25e-001
Isobutane	1.75e-003	7.55e-002
n-Butane	2.99e-003	1.29e-001
Isopentane	9.26e-004	3.99e-002
n-Pentane	6.82e-004	2.94e-002
n-Hexane	3.03e-004	1.31e-002
Cyclohexane	1.12e-003	4.82e-002
Other Hexanes	7.89e-004	3.39e-002

Heptanes	1.10e-003	4.72e-002
Methylcyclohexane	9.14e-004	3.93e-002
2,2,4-Trimethylpentane	3.86e-006	1.66e-004
Benzene	2.75e-003	1.18e-001
Toluene	6.46e-003	2.78e-001
Ethylbenzene	1.17e-003	5.04e-002
Xylenes	1.67e-003	7.19e-002
C8+ Heavies	1.46e-003	6.27e-002
-----		
Total Components	100.00	4.31e+003

FLASH GAS EMISSIONS

Flow Rate: 7.47e+003 scfh  
 Control Method: Combustion Device  
 Control Efficiency: 50.00

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	5.00e+001	1.77e+002
Carbon Dioxide	2.69e+001	2.33e+002
Nitrogen	1.29e-001	7.12e-001
Methane	2.00e+001	6.32e+001
Ethane	2.41e+000	1.43e+001
Propane	4.12e-001	3.58e+000
Isobutane	5.03e-002	5.75e-001
n-Butane	6.69e-002	7.65e-001
Isopentane	1.50e-002	2.13e-001
n-Pentane	8.97e-003	1.27e-001
n-Hexane	1.94e-003	3.30e-002
Cyclohexane	1.81e-003	2.99e-002
Other Hexanes	6.50e-003	1.10e-001
Heptanes	3.11e-003	6.14e-002
Methylcyclohexane	1.01e-003	1.95e-002
2,2,4-Trimethylpentane	1.83e-005	4.11e-004
Benzene	7.26e-004	1.12e-002
Toluene	9.45e-004	1.71e-002
Ethylbenzene	8.76e-005	1.83e-003
Xylenes	8.56e-005	1.79e-003
C8+ Heavies	3.18e-004	1.07e-002
-----		
Total Components	100.00	4.94e+002

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F  
 Pressure: 14.70 psia  
 Flow Rate: 1.73e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----		
Water	9.79e+001	8.02e+001
Carbon Dioxide	4.97e-002	9.94e-002
Nitrogen	3.60e-003	4.59e-003
Methane	1.15e+000	8.41e-001
Ethane	4.57e-001	6.25e-001
Propane	1.62e-001	3.25e-001

Isobutane	2.86e-002	7.55e-002
n-Butane	4.86e-002	1.29e-001
Isopentane	1.18e-002	3.88e-002
n-Pentane	8.73e-003	2.86e-002
n-Hexane	3.27e-003	1.28e-002
Cyclohexane	1.18e-002	4.51e-002
Other Hexanes	8.30e-003	3.25e-002
Heptanes	1.02e-002	4.66e-002
Methylcyclohexane	8.19e-003	3.65e-002
2,2,4-Trimethylpentane	3.04e-005	1.58e-004
Benzene	3.13e-002	1.11e-001
Toluene	6.05e-002	2.54e-001
Ethylbenzene	9.29e-003	4.48e-002
Xylenes	1.29e-002	6.22e-002
C8+ Heavies	6.96e-003	5.39e-002
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Total Components	100.00	8.31e+001

**ATTACHMENT O**  
**Monitoring/Recordkeeping/Reporting/Testing Plans**

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“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.”

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- **Monitoring/Recordkeeping/Reporting/Testing Plans**
-

Williams Ohio Valley Midstream LLC  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit

**Attachment O**  
**MONITORING/RECORDKEEPING/REPORTING/TESTING PLANS**

Williams Ohio Valley Midstream LLC proposes the following monitoring, recordkeeping, testing and reporting requirements at the subject facility:

A. Monitoring

1. Monitor and record quantity of natural gas treated in the dehydrators.
2. Monitor inlet gas characteristics with annual sample collection and extended gas analysis.
3. Monitor dehydrator operating parameters, such as temperatures, pressures, and flow rates, as requisite to determine actual and potential emissions.

B. Recordkeeping

1. Maintain records of the amount of natural gas treated in the dehydrators.
2. Maintain records demonstrating the actual annual average benzene emissions are less than one ton per year.
3. Maintain a record of all potential to emit (PTE) calculations for the entire facility. These records shall include the dehydration units and ancillary equipment.
4. The records shall be maintained on site or in a readily available off-site location for a period of five (5) years.

C. Reporting

1. Report any deviations from the allowable emissions limitations, including visible emissions.
2. Any and all application forms, reports, or compliance certifications required by this Permit shall be certified by a responsible official.

D. Testing

Not Applicable (except for annual extended gas analysis described above).

## ATTACHMENT P

### Public Notice

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“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.”

The applicant shall cause such legal advertisement to appear a minimum of one (1) day in the newspaper most commonly read in the area where the facility exists or will be constructed. The notice must be published no earlier than five (5) working days of receipt by this office of your application. The original affidavit of publication must be received by this office no later than the last day of the public comment period.

Types and amounts of pollutants discharged must include all regulated pollutants (PM, PM10, VOC, SO2, Xylene, etc.) and their potential to emit or the permit level being sought in units of tons per year (including fugitive emissions).

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- Legal Advertisement (as shown) will be placed in a newspaper of general circulation in the area where the source is located (See 45CSR§13-8.3 thru 45CSR§13-8.5).
  - An Affidavit of Publication shall be submitted immediately upon receipt.
-

Williams Ohio Valley Midstream LLC (OVM)  
**GRENADIER DEHYDRATION STATION**  
Application for 45CSR13 NSR Modification Permit

**Attachment P - Public Notice**

**AIR QUALITY PUBLIC NOTICE**  
**Notice of Application**

Notice is given that Williams Ohio Valley Midstream LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a 45CSR13 NSR Modification Permit for an existing (but exempt) Grenadier Dehydration Station, located at 24751 Mountaineer Hwy (WV-07), Littleton, WV.

The latitude and longitude coordinates are 39.6535<sup>o</sup> North and -80.5361<sup>o</sup> West.

The applicant estimates the increase in the potential to discharge regulated air pollutants will be as follows:

- 1.26 tons of nitrogen oxides per year
- 1.06 tons of carbon monoxide per year
- 84.08 tons of volatile organic compounds per year
- 0.01 tons of sulfur dioxide per year
- 0.09 tons of particulate matter per year
- 1.90 tons of total hazardous air pollutants per year
- 24,409 tons of carbon dioxide equivalent per year

Startup of modifications are anticipated within two (2) months of authorization.

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

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

Dated this the \_\_\_\_\_ day of \_\_\_\_\_ 2015.

By: Williams Ohio Valley Midstream LLC  
Don Wicburg  
Vice President and General Manager  
100 Teletech Drive, Suite 2  
Moundsville, WV 26041

**ATTACHMENT Q**  
**Business Confidential Claims**  
**(NOT APPLICABLE)**

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also

**ATTACHMENT R**  
**Authority Forms**  
**(NOT APPLICABLE)**

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also

**ATTACHMENT S**  
**Title V Permit Revision Information**  
**(NOT APPLICABLE)**

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## APPLICATION FEE

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Include a check payable to WVDEP – Division of Air Quality.

- As per WV Rule 22 (45CSR22) filed on May 6, 1991, a **minimum fee of \$1,000** must be submitted for each 45CSR13 permit application filed with the WVDEP-DAQ.
  - **Additional charges** may apply, depending on the nature of the application as outlined in Section 3.4.b. of Regulation 22, and shown below:
    - NSPS Requirements:                 \$1,000     Not Applicable
    - NESHAP Requirements:             \$2,500     (HH-Dehydrators)
    - New Major Source:                 \$10,000    Not Applicable
    - Major Modifications:               \$5,000     Not Applicable
  - Total application fee is **\$3,500** [= \$1,000 minimum fee + \$2,500 additional charges]
-

**\*\*\*\*\* End of Application for 45CSR13 NSR Modification Permit \*\*\*\***



WILLIAMS FIELD SERVICES GROUP, INC  
 PO BOX 21218  
 TULSA, OK 74121-1218

COMPANY NUMBER: 4000

CHECK NUMBER: 4000119747

PAY DATE	SUPPLIER NO.	SUPPLIER NAME	CHECK TOTAL
11-SEP-15	526257	WV DEP - DIVISION OF AIR QUALITY	3,500.00

Invoice Date	Invoice Or Credit Memo / Invoice Description	Gross	Discount	Net
10-SEP-15	10-SEP-2015A / AIR PERMIT APPLICATION FEE FOR GREN	3,500.00	0.00	3,500.00

Supplier Support 1-866-778-2665

Page Totals	0.00	3,500.00
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VERIFY THE AUTHENTICITY OF THIS MULTI-TONE SECURITY DOCUMENT.

CHECK BACKGROUND AREA CHANGES COLOR GRADUALLY FROM TOP TO BOTTOM.



WILLIAMS FIELD SERVICES GROUP, INC  
 PO BOX 21218  
 TULSA, OK 74121-1218  
 Company Number: 4000

JPMorgan Chase Bank, N.A. 70-2322/719  
 Chicago, IL

Check Number: 4000119747

Check Date: 11-SEP-15

Three Thousand Five Hundred Dollars And Zero Cents

Pay To The Order Of:

WV DEP - DIVISION OF AIR QUALITY  
 601 57TH ST SE  
 CHARLESTON, WV 25304 United States

PAY (USD)	\$3,500.00
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*Donald R. Chappell*

Authorized Signature

⑈ 4000 1 1974 7⑈ ⑆ 07 19 23 2 26⑆

00940 1 16 7⑈

ORIGIN ID:OLA (412) 787-4197  
DANIEL ZAWASKI  
WILLIAMS  
2000 COMMERCE DRIVE  
PARK PLACE 2  
PITTSBURGH, PA 15275  
UNITED STATES US

SHIP DATE: 12OCT15  
ACTWGT: 1.00 LB  
CAD: 104269589/NET3670

BILL SENDER

TO BEVERLY MCKEONE  
WV DIV OF AIR QUALITY PERMITTING  
601 57TH STREET, SE

CHARLESTON WV 25304

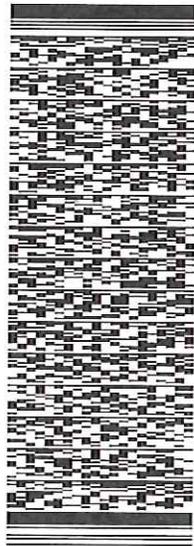
(304) 926-0499 X 1260

REF: 60000006200060394.6228.8325

PO:

DEPT:

539J3401A31D0



J153015551691uz

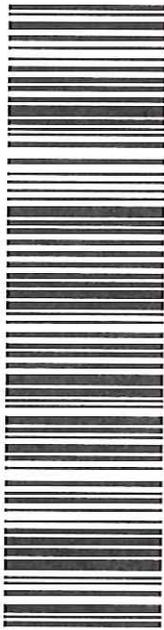
WED - 14 OCT 4:30P

\*\* 2DAY \*\*

TRK# 7747 1674 1053  
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25304  
WV-US HTS



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