



**CONESTOGA-ROVERS  
& ASSOCIATES**

6320 Rothway, Suite 100, Houston, Texas 77040  
Telephone: (713) 734-3090 Fax: (713) 734-3391  
[www.CRAworld.com](http://www.CRAworld.com)

March 13, 2015

Reference No. 082715

Mr. Jay Fedczak  
Assistant Director for Permitting  
Division of Air Quality  
WV Department of Environmental Protection  
601 57<sup>th</sup> Street, SE  
Charleston, West Virginia 25304

Dear Mr. Jay Fedczak:

Re: New Source Review Permit Application 45CSR13  
Pearl Jean Well pad  
Antero Resources Corporation

Conestoga-Rovers & Associates (CRA) would like to submit this 45CSR13 New Source Review permit application that we prepared on behalf of Antero Resources Corporation for an oil and gas facility identified as Pearl Jean Well pad.

A G70A permit has been previously issued to the Pearl Jean Well pad. A permit revision is requested due to the following operational changes: 1) removal of a 24 HP Kubota engine; 2) change of GPUs from 1.5 to 1.0 MMBTU/hr; 3) change of enclosed combustor from Cimarron to Abutec; and 4) addition of diesel engines from a nearby Fresh Water Impoundment (FWI) pond. The FWI operates independently; however, we are voluntarily aggregating its emissions whose water pumps are driven by two diesel engines. Since a G70A permit does not allow diesel engines, we are submitting a 45CSR13 permit application.

Enclosed are the following documents:

- Original copy of the 45CSR 13 New Source Review Permit Application
- Two CD copies of the 45CSR13 New Source Review Permit Application
- The application fee with check no. 398080 in the amount of \$2,000.00

Please let us know if you have any questions or require additional information.

Sincerely,

CONESTOGA-ROVERS & ASSOCIATES

Manuel Bautista

Encl.

cc: Barry Schatz, Antero Resources Corporation

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Equal  
Employment Opportunity  
Employer

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## **New Source Review Air Permit Application 45CSR13**

(Convert G70A to 45CSR 13 - removal of Kubota engine; reduce GPU from 1.5 to 1.0 MMBtu/hr; replace combustor with Abutech; added a Fresh Water Impoundment)

### **Pearl Jean Well Pad**

Prepared for: Antero Resources Corporation

### **Conestoga-Rovers & Associates**

6320 Rothway, Suite 100  
Houston, Texas 77040

March 2015 • 082715 • Report No. 156

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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

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>Antero Resources Corporation</b>		2. Federal Employer ID No. (FEIN): 80-0162034	
3. Name of facility (if different from above): Pearl Jean Well Pad		4. The applicant is the: <input type="checkbox"/> OWNER <input type="checkbox"/> OPERATOR <input checked="" type="checkbox"/> BOTH	
5A. Applicant's mailing address: 1615 Wynkoop St. Denver, CO, 80202		5B. Facility's present physical address: 19 Antioch Rd Salem, WV 26426	
6. <b>West Virginia Business Registration.</b> Is the applicant a resident of the State of West Virginia? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO – 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: N/A			
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"/> YES <input type="checkbox"/> NO – If <b>YES</b> , please explain:    Antero is leasing the mineral rights for this site – 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.): Oil and Natural Gas Production Facility		10. North American Industry Classification System (NAICS) code for the facility: 211111	
11A. DAQ Plant ID No. (for existing facilities only): 017-001100		11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only): N/A	

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

<p>12A.</p> <ul style="list-style-type: none"> <li>For <b>Modifications, Administrative Updates or Temporary permits</b> at an existing facility, please provide directions to the <i>present location</i> of the facility from the nearest state road;</li> <li>For <b>Construction or Relocation permits</b>, please provide directions to the <i>proposed new site location</i> from the nearest state road. Include a <b>MAP as Attachment B</b>.</li> </ul> <p>At the intersection of Co Rte 50/22 and Co Rte 50/30, turn left to Co Rte 20/22 for 0.22 miles. Turn right on US-50E and go for 3.1 miles. Turn left on Antioch Road and go for 255 ft. Entrance to the facility will be on the left.</p>		
<p>12.B. New site address (if applicable): 19 Antioch Rd Salem, WV 26426</p>	<p>12C. Nearest city or town: Smithburg</p>	<p>12D. County: Doddridge</p>
<p>12.E. UTM Northing (KM): 4348.4714</p>	<p>12F. UTM Easting (KM): 528.2034</p>	<p>12G. UTM Zone: 17 N</p>
<p>13. Briefly describe the proposed change(s) at the facility: Removal of Kubota engine, change in GPU heater rating from 1.5 to 1.0 MMBTU/hr, and change in Flare from Cimarron to Abutec, and addition of diesel engines for a fresh water impoundment (FWI).</p>		
<p>14A. Provide the date of anticipated installation or change: Upon the issuance of permit</p> <ul style="list-style-type: none"> <li>If this is an <b>After-The-Fact</b> permit application, provide the date upon which the proposed change did happen:     /     /</li> </ul>		<p>14B. Date of anticipated Start-Up if a permit is granted: Upon the issuance of permit</p>
<p>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).</p>		
<p>15. Provide maximum projected <b>Operating Schedule</b> of activity/activities outlined in this application: Hours Per Day 24     Days Per Week 7     Weeks Per Year 52</p>		
<p>16. Is demolition or physical renovation at an existing facility involved?   <input type="checkbox"/> <b>YES</b>     <input checked="" type="checkbox"/> <b>NO</b></p>		
<p>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.</p>		
<p>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 Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance (<i>if known</i>). Provide this information as <b>Attachment D</b>.</p>		
<p><b>Section II. Additional attachments and supporting documents.</b></p>		
<p>19. Include a check payable to WVDEP – Division of Air Quality with the appropriate <b>application fee</b> (per 45CSR22 and 45CSR13).</p>		
<p>20. Include a <b>Table of Contents</b> as the first page of your application package.</p>		
<p>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>) .</p> <ul style="list-style-type: none"> <li>Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).</li> </ul>		
<p>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>.</p>		
<p>23. Provide a <b>Process Description</b> as <b>Attachment G</b>.</p> <ul style="list-style-type: none"> <li>Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).</li> </ul>		
<p><b>All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.</b></p>		
<p>24. Provide <b>Material Safety Data Sheets (MSDS)</b> for all materials processed, used or produced as <b>Attachment H</b>.</p> <ul style="list-style-type: none"> <li>For chemical processes, provide a MSDS for each compound emitted to the air.</li> </ul>		

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> .
28. Check all applicable <b>Emissions Unit Data Sheets</b> listed below: <input checked="" type="checkbox"/> Bulk Liquid Transfer Operations <input checked="" 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 checked="" type="checkbox"/> Storage Tanks <input type="checkbox"/> Grey Iron and Steel Foundry <input type="checkbox"/> Indirect Heat Exchanger <input type="checkbox"/> General Emission Unit, specify
Fill out and provide the <b>Emissions Unit Data Sheet(s)</b> as <b>Attachment L</b> .
29. Check all applicable <b>Air Pollution Control Device Sheets</b> listed below: <input type="checkbox"/> Absorption Systems <input type="checkbox"/> Baghouse <input checked="" 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 <input type="checkbox"/> Other Collectors, specify
Fill out and provide the <b>Air Pollution Control Device Sheet(s)</b> as <b>Attachment M</b> .
30. Provide all <b>Supporting Emissions Calculations</b> as <b>Attachment N</b> , or attach the calculations directly to the forms listed in Items 28 through 31.
31. <b>Monitoring, Recordkeeping, Reporting and Testing Plans.</b> 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 <b>Attachment O</b> . ➤ 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. <b>Public Notice.</b> At the time that the application is submitted, place a <b>Class I Legal Advertisement</b> 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 <b>Example Legal Advertisement</b> for details). Please submit the <b>Affidavit of Publication</b> as <b>Attachment P</b> immediately upon receipt.
33. <b>Business Confidentiality Claims.</b> Does this application include confidential information (per 45CSR31)? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO ➤ If <b>YES</b> , 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 " <b>Precautionary Notice – Claims of Confidentiality</b> " guidance found in the <b>General Instructions</b> as <b>Attachment Q</b> .
<b>Section III. Certification of Information</b>
34. <b>Authority/Delegation of Authority.</b> Only required when someone other than the responsible official signs the application. Check applicable <b>Authority Form</b> below: <input checked="" type="checkbox"/> Authority of Corporation or Other Business Entity <input type="checkbox"/> Authority of Partnership <input type="checkbox"/> Authority of Governmental Agency <input type="checkbox"/> Authority of Limited Partnership Submit completed and signed <b>Authority Form</b> as <b>Attachment R</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>

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

**Certification of Truth, Accuracy, and Completeness**

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

**Compliance Certification**

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

SIGNATURE Barry Schatz DATE: 3-13-2015  
(Please use blue ink) (Please use blue ink)

35B. Printed name of signee: Barry Schatz		35C. Title: Sr. Environmental and Regulatory Manager
35D. E-mail: bschatz@anteroresources.com	36E. Phone: (303)357-7276	36F. FAX: (303) 357-7315
36A. Printed name of contact person (if different from above):		36B. Title:
36C. E-mail:	36D. Phone:	36E. FAX:

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

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

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

**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

## Current Business Certificate



# State of West Virginia



## Certificate

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

### ANTERO RESOURCES CORPORATION

a corporation formed under the laws of Delaware, which is authorized to transact business in West Virginia by a Certificate of Authority has filed in my office as required by the provisions of the West Virginia Code, a copy of an amendment to its Articles of Incorporation authenticated by the proper office of the state or country of its incorporation and was found to conform to law.

Therefore, I issue this

### CERTIFICATE OF AMENDMENT TO CERTIFICATE OF AUTHORITY



*Given under my hand and the  
Great Seal of the State of  
West Virginia on this day of  
June 10, 2013*

*Natalie E. Tennant*

Secretary of State

FILED

JUN 10 2013

Natalie E. Tennant  
Secretary of State  
1900 Kanawha Blvd E  
Bldg 1, Suite 157-K  
Charleston, WV 25305



Penney Barker, Manager  
IN THE OFFICE OF Corporations Division  
SECRETARY OF STATE Tel: (304)558-8000  
Fax: (304)558-8381

Website: [www.wvsos.com](http://www.wvsos.com)  
E-mail: [business@wvsos.com](mailto:business@wvsos.com)

**APPLICATION FOR  
AMENDED CERTIFICATE  
OF AUTHORITY**

Office Hours: Monday – Friday  
8:30 a.m. – 5:00 p.m. ET

**FILE ONE ORIGINAL**  
(Two if you want a filed  
stamped copy returned to you)  
**FEE: \$25.00**

\*\*\*\* In accordance with the provisions of the West Virginia Code, the undersigned corporation hereby \*\*\*\*  
applies for an Amended Certificate of Authority and submits the following statement:

- Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
- Date Certificate of Authority was issued in West Virginia: 6/25/2008
- Corporate name has been changed to: Antero Resources Corporation  
(Attach one **Certified Copy of Name Change** as filed in home State of Incorporation.)
- Name the corporation elects to use in WV: Antero Resources Corporation  
(due to home state name not being available)
- Other amendments: \_\_\_\_\_  
(attach additional pages if necessary)
- Name and phone number of contact person. (This is optional, however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)  
Alvyn A. Schopp (303) 367-7310  
Contact Name Phone Number
- Signature information (See below **\*Important Legal Notice Regarding Signature**):  
Print Name of Signer: Alvyn A. Schopp Title/Capacity: Authorized Person  
Signature:  Date: June 10, 2013

**\*Important Legal Notice Regarding Signature:** Per West Virginia Code §31D-1-129. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor and, upon conviction thereof, shall be fined not more than one thousand dollars or confined in the county or regional jail not more than one year, or both.

# Delaware

PAGE 1

*The First State*

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "ANTERO RESOURCES APPALACHIAN CORPORATION", CHANGING ITS NAME FROM "ANTERO RESOURCES APPALACHIAN CORPORATION" TO "ANTERO RESOURCES CORPORATION", FILED IN THIS OFFICE ON THE TENTH DAY OF JUNE, A.D. 2013, AT 9:37 O'CLOCK A.M.

A FILED COPY OF THIS CERTIFICATE HAS BEEN FORWARDED TO THE NEW CASTLE COUNTY RECORDER OF DEEDS.

4520810 8100

130754186



You may verify this certificate online  
at [corp.delaware.gov/authver.shtml](http://corp.delaware.gov/authver.shtml)

  
Jeffrey W. Bullock, Secretary of State  
AUTHENTICATION: 0496546

DATE: 06-10-13

AMENDMENT TO THE  
AMENDED AND RESTATED  
CERTIFICATE OF INCORPORATION  
OF  
ANTERO RESOURCES APPALACHIAN CORPORATION

Antero Resources Appalachian Corporation (the "Corporation"), a corporation organized and existing under the laws of the State of Delaware, hereby certifies as follows:

1. The original Certificate of Incorporation of the Corporation was filed under the name Antero Resources Barnett Corporation with the filing of the original Certificate of Incorporation of the Corporation with the Secretary of State of the State of Delaware on March 18, 2008.

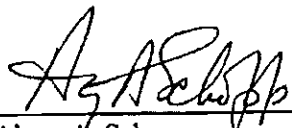
2. This Amendment to the Amended and Restated Certificate of Incorporation has been duly adopted and approved in accordance with Sections 242 of the General Corporation Law of the State of Delaware.

3. Article FIRST of the Amended and Restated Certificate of Incorporation is hereby amended to read in its entirety as follows:

FIRST. The name of the Corporation is Antero Resources Corporation.

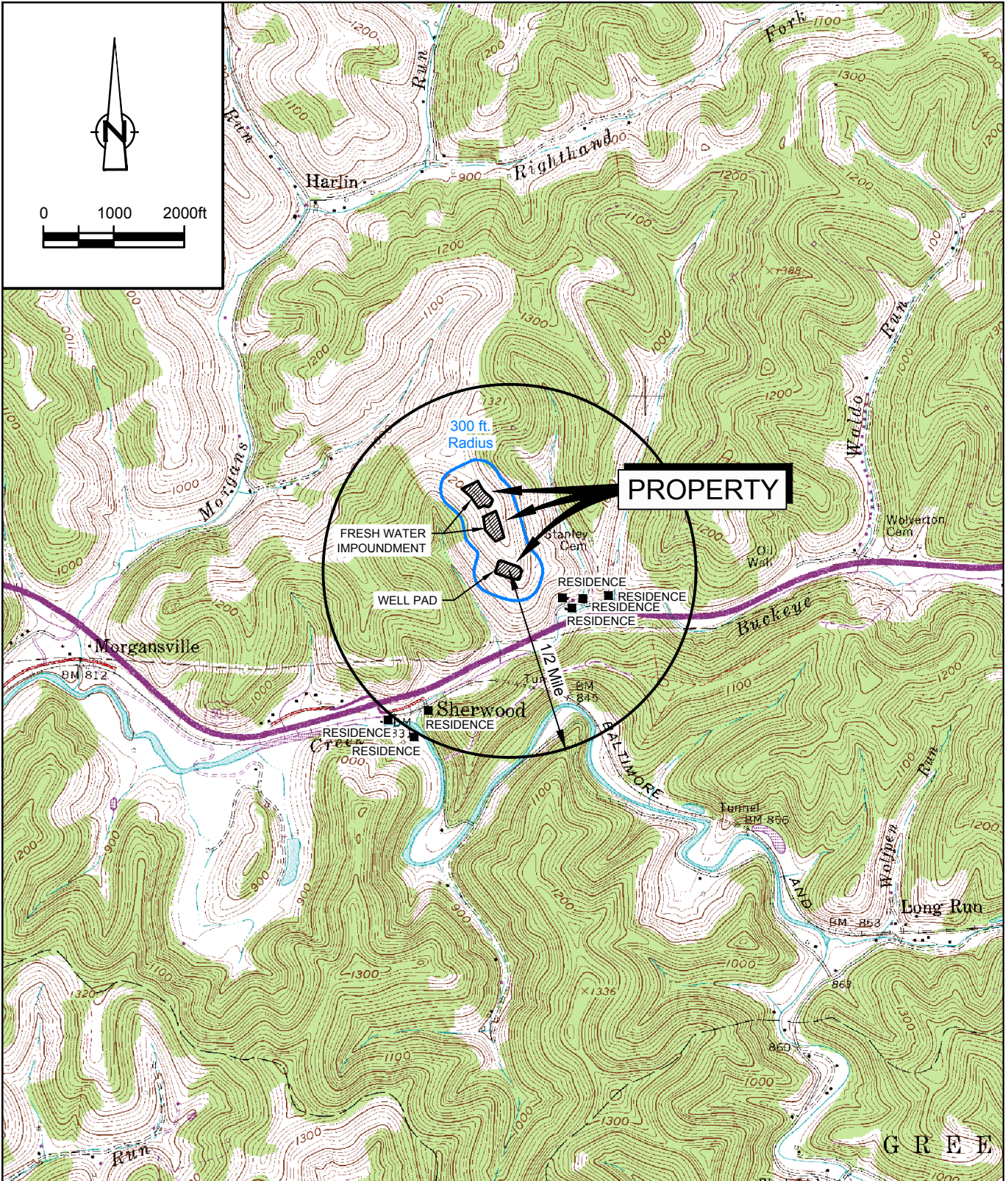
IN WITNESS WHEREOF, the Corporation has caused this Certificate of Amendment to be executed by its duly authorized officer on the 10th day of June, 2013.

ANTERO RESOURCES APPALACHIAN CORPORATION

By:   
Name: Alwyn A. Schopp  
Title: Vice President of Accounting &  
Administration / Treasurer

# Attachment B

## Site Location Map



SOURCE: USGS QUADRANGLE MAP;  
SMITHBURG, WEST VIRGINIA

SITE COORDINATES: LAT: 39.285147, LONG: -80.672978 NAD 83  
SITE ELEVATION: 1141 ft AMSL



Attachment B  
AREA MAP  
PEARL JEAN WELL PAD  
ANTERO RESOURCES  
*Doddridge County, West Virginia*

# Attachment C

## Installation and Start-up Schedule

**Attachment C****Installation and Start-up Schedule  
Pearl Jean Well Pad  
Antero Resources Corporation  
Doddridge County, West Virginia**

<b>Proposed Changes</b>	<b>Date</b>
Remove 24 HP Kubota Engine	9/21/2014
Change GPU from 1.5 to 1.0 MMBtu/hr	9/21/2014
Replace enclosed combustor with Abutec	1/26/2014
FWI engines	Upon issuance of permit
Startup	Upon installation



# Attachment D

## Regulatory Discussions

## Attachment D

**Regulatory Requirements  
Pearl Jean Well Pad  
Antero Resources Corporation  
Doddridge County, West Virginia**

Below are the applicable State and Federal regulations. Each emission source and corresponding air pollutant emissions were evaluated to determine regulatory applicability.

### **STATE REGULATORY APPLICABILITY**

#### **45CSR2 (To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers)**

The purpose of 45CSR2 (To Prevent and Control Particulate Air Pollution from Combustion of Indirect Heat Exchangers) is to establish emission limitations for smoke and particulate matter which are discharged from fuel burning units.

45CSR2 defines fuel burning unit as any furnace, boiler apparatus, device, mechanism, stack or structure used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer. Indirect heat exchangers are devices that combust any fuel and produce steam or heats water or any heat transfer medium. 45CSR2.10(a), (b) and (c) provide the three categories of fuel burning units for the purpose of this rule. The Facility's gas production unit heaters, (H001-008) do not belong to any of the three categories and therefore are not subject to this rule. Also, the gas production unit heaters will only be using natural gas, not liquid fuel, and will not result in any significant particulate matters emissions.

#### **45CSR6 (To Prevent and Control Air Pollution from Combustion of Refuse)**

The purpose of this rule is to prevent and control air pollution from combustion of refuse.

The Facility has one (1) enclosed combustor on site. The vapor combustor, which meets the definition of an Incinerator under Section 4, is subject to the emission standards for incinerators. The vapor combustor will comply with the general control device requirements of 40 CGR 60.18. The facility will demonstrate compliance with emission limits by maintaining records of gas flow to the vapor combustor and the hours of operation. The facility will also monitor the flame of the vapor combustor and record any malfunctions that may cause no flame to be present during operation.

**45CSR10 (To Prevent and Control Air Pollution from the Emission of Sulfur Oxides)**

45CSR10 establishes emission limitations for SO<sub>2</sub> emission which are discharged from stacks of fuel burning units. Fuel burning units less than 10 MMBtu/hr are exempt.

The gas production unit heaters at this facility, H001-008 are process heaters which are not classified as fuel burning units under 45CSR10 (refer to definitions in Section 2). These are therefore exempt from compliance with Section 3 of this rule.

The vapor combustor at this facility, EC001, is also exempt from compliance with Section 5 of this rule. This section only applies to process gas streams that contain hydrogen sulfide in a concentration greater than 50 grains per 100 cubic feet of gas. The process gas stream from the Facility has zero H<sub>2</sub>S concentration.

**45CSR13 (Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits, and Procedures for Evaluation)**

45CSR13 applies to this source due to the fact that the Facility has a “stationary source”, the vapor combustor, as defined in 45CSR13 Section 2.24.a which is any building, structure, facility, installation, or emission unit or combination thereof which is subject to any substantive requirement of an emission control rule promulgated by the Secretary. Antero Resources has published the required Class I legal advertisement notifying the public of their permit application, and paid the appropriate application fee (construction).

Pearl Jean potential to emit, with the vapor combustor, will not exceed the major source threshold of 100 TPY of any air pollutant and 10 TPY of any hazardous air pollutant (HAP) or 25 TPY of any combination of HAPs. Pearl Jean calculation of potential to emit included all of the emission sources that belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under the control of the same person. The nearest emission source that belongs to the same industrial grouping and under the control of the same person but not located on contiguous or adjacent property is the Lockhart Heirs Pad. This pad operates independently and is approximately 3,440 feet southeast of the Facility. A fresh water impoundment (FWI) which supplies water to multiple nearby well pads is located adjacent to the Pearl Jean well pad. Although this FWI operates independently from the well pad, emissions from the diesel engines were included in the well pad’s potential to emit.

## **FEDERAL REGULATORY APPLICABILITY**

### **40 CFR §60 New Source Performance Standards**

40 CFR §60 NSPS may apply to the Site if there are affected stationary sources constructed after the date of publication of the applicable parts of this standard.

#### **Subpart A General Provisions**

This subpart contains requirements for control devices such as combustors and is therefore applicable. The Site is subject to the requirements of this subpart, specifically the requirement to obtain a permit for the facility emission sources (§60.1), notification and recordkeeping (§60.7), performance tests (§60.8), design and operation of a flare (§60.18), and reporting of excess emissions (§60.19).

#### **Subpart K Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978**

The tanks at this site will be built after July 23, 1984; therefore this rule does not apply.

#### **Subpart Ka Volatile Organic Liquid Storage Vessels (including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984**

The tanks at this site were built after July 23, 1984; therefore this rule does not apply.

#### **Subpart Kb Volatile Organic Liquid Storage Vessels (including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984**

This subpart applies to storage vessels constructed after July 23, 1984 with a capacity greater than 75 m<sup>3</sup>. However for petroleum and condensate liquids which have a storage capacity less than 1,590 m<sup>3</sup> (420,000 gallons or 10,000 bbl) that were used prior to custody transfer are exempt from this regulation under §60.110b(d)(4).

There will be eight (8) and two (2) 400-bbl fixed roof atmospheric tanks storing condensate and produced water, respectively. These tanks are not required to comply with this subpart since they are less than the 10,000 bbl exemption and are used for storage prior to custody transfer.

#### **Subpart KKK Equipment Leaks of Volatile Organic Compounds from Onshore Natural Gas Processing Plants**

This subpart applies to facilities involved in onshore natural gas processing plants. The site is not considered a natural gas processing plant; therefore this rule does not apply.

**Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines)**

This subpart applies to stationary compression ignition (CI) internal combustion engines (ICE) specified in 40 CFR 60.4200(a)(2) through (a)(4). The Facility has two stationary ICE (FWIENG001 and FWIENG002) with maximum engine power of 600 HP (447.8 kW) and a displacement of 13.5 L. These are subject to 40 CFR 60.4204 (b), which covers stationary CI ICE with a displacement of less than 30 liters. The manufacturer has submitted these engines to EPA for certificate of conformity with the emission standards. The actual EPA emission test results were used in determining emissions from the diesel engines. The Facility will comply with the requirements specified in 40 CFR 60.4211 as applicable.

**Subpart OOOO Crude Oil and Natural Gas Production, Transmission and Distribution**

This subpart establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO<sub>2</sub>) emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011. The site will demonstrate continuous compliance, if applicable, with the standards for all affected facilities as follows: 1) comply with the reporting and recordkeeping requirement in 40 CFR 60.5420 for each gas well; 2) determine the VOC emissions for each storage tanks and minimize emissions using good engineering practices, 3) operate and maintain an enclosed combustor with a destruction efficiency of 98% to reduce VOC emissions from the storage vessels by 95% or greater, 4) demonstrate initial compliance with standards that apply to storage vessels affected facilities as required by 40 CFR 50.5410, 5) demonstrate continuous compliance with standards that apply to storage tanks as required by 40 CFR 60.5415, and 6) comply with the notification, recordkeeping, and reporting requirements under 40 CFR 60.5420. Based on enclosed combustor's efficiency of 98%, the annual emissions from each storage tank will be less than 6 TPY.

**40 CFR §61 National Emissions Standards for Hazardous Air Pollutants**

40 CFR §61 applies to each of the following sources that are intended to operate in volatile hazardous air pollutant (VHAP) service: pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, valves, connectors, surge control vessels, bottoms receivers, and control devices.

The site will not handle a fluid that is at least 10 percent by weight a VHAP, therefore this section does not apply.

**40 CFR §63 National Emission Standards for Hazardous Air Pollutants for Source Categories**

40 CFR §63 may apply to the site since it has the potential to emit hazardous air pollutants (HAP) and may be subject to a standard, limitation, prohibition, or other federally enforceable requirement of this part.

**Subpart A General Provisions**

The site HAP emissions are less than 25 tpy for total HAPs and less than 10 tpy for any single HAP, therefore the site is not a major source of HAPs. There are HAP emissions from the site and is therefore considered an area source of HAPs.

A copy of this applicability determination will be kept as specified in 40 CFR §63.10(b)(3) pertaining to recordkeeping.

**Subpart HH National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities**

This subpart applies to oil and gas production facilities located at area sources and major sources of HAP emissions. For area sources of HAP emissions, the rule applies to triethylene glycol (TEG) dehydration units for which controls are required at certain trigger levels. The site is not a major source of HAPS and does not operate a dehydration unit; therefore this section does not apply.

**Subpart HHH National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities**

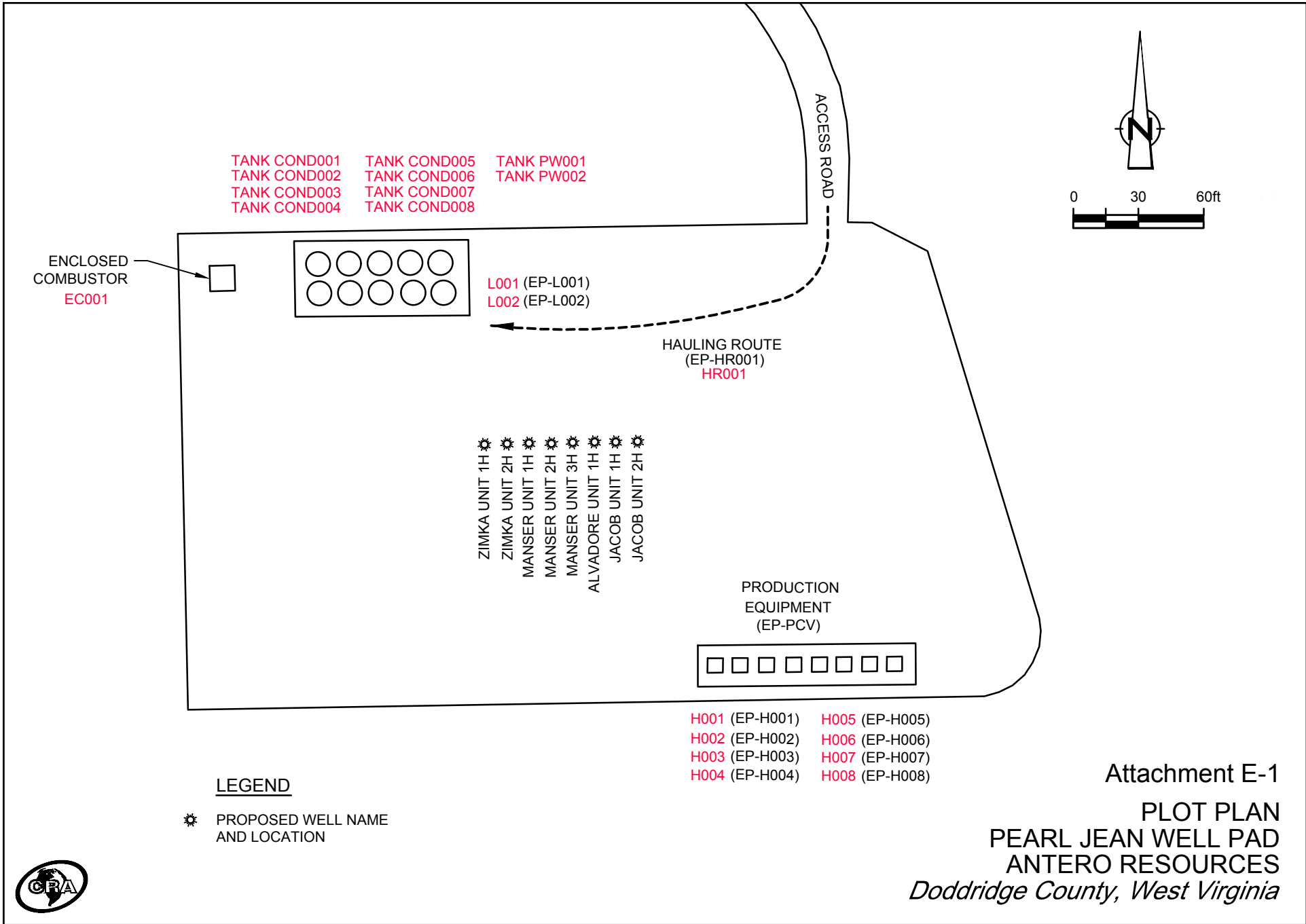
This subpart applies to owners and operators of natural gas transmission and storage facilities that transport or store natural gas prior to entering the pipeline and that are major sources of hazardous air pollutants (HAP) emissions. The site is not a natural gas transmission and storage facility, therefore this section does not apply.

**Subpart ZZZZ National Emission Standard for Reciprocating Ignition Internal Combustion Engines)**

This subpart establishes emission standards for hazardous air pollutants (HAPs) emitted from stationary internal combustion engines located at major and area sources of HAP emissions. The two engines in the Facility (FWIENG001 and FWIENG002) are subject to the area source requirements. However, since these engines are already subject to 40 CFR 60 Subpart IIII, no further requirements apply to these engines under this subpart. The Facility will demonstrate compliance through 40 CFR 60 Subpart IIII.

# Attachment E

## Plot Plan



**LEGEND**

⚙️ PROPOSED WELL NAME AND LOCATION

H001 (EP-H001) H005 (EP-H005)  
H002 (EP-H002) H006 (EP-H006)  
H003 (EP-H003) H007 (EP-H007)  
H004 (EP-H004) H008 (EP-H008)

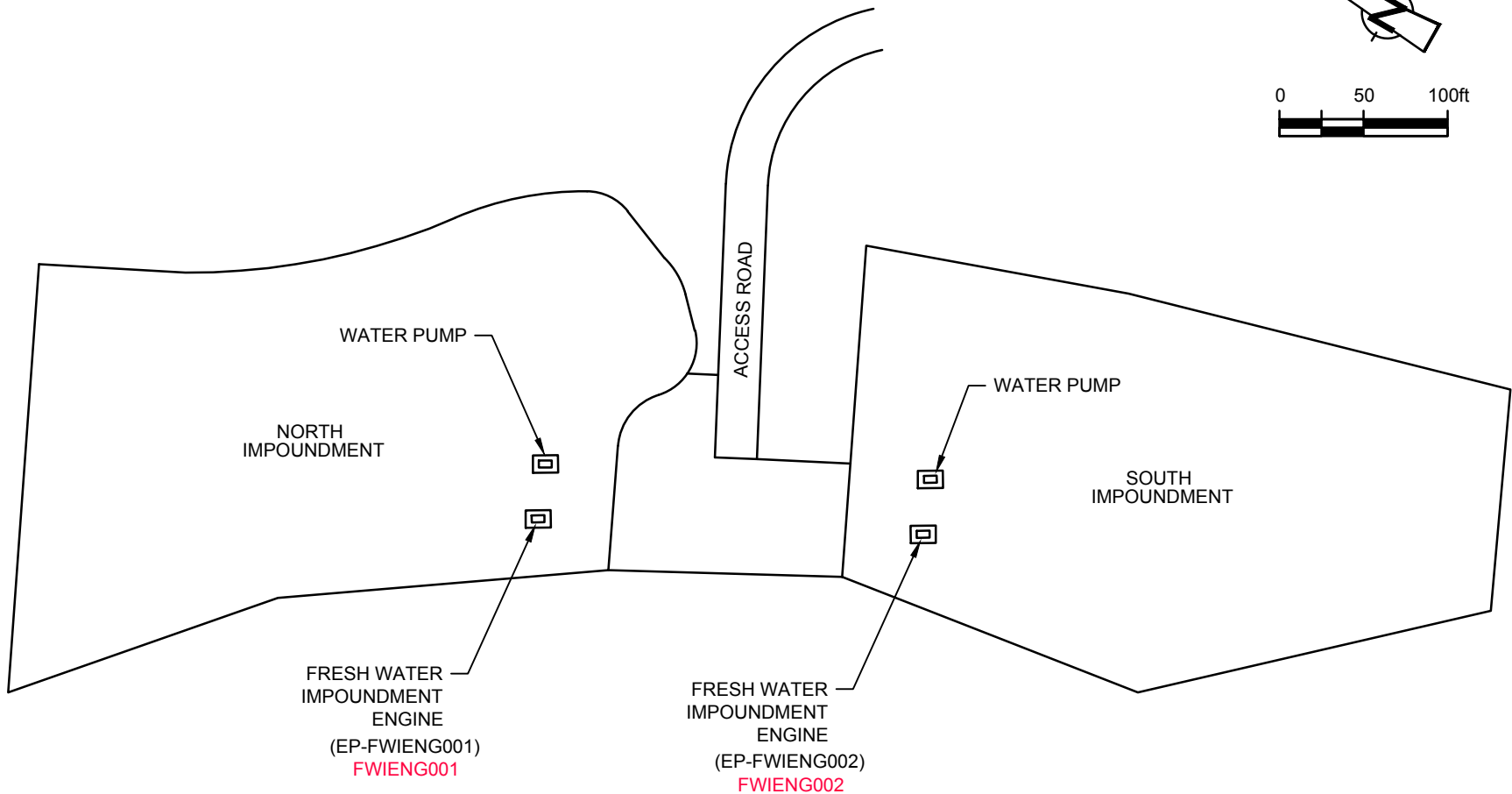
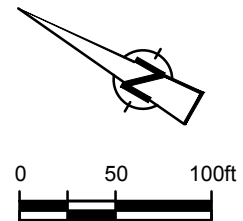
Attachment E-1

PLOT PLAN  
PEARL JEAN WELL PAD  
ANTERO RESOURCES

*Doddridge County, West Virginia*







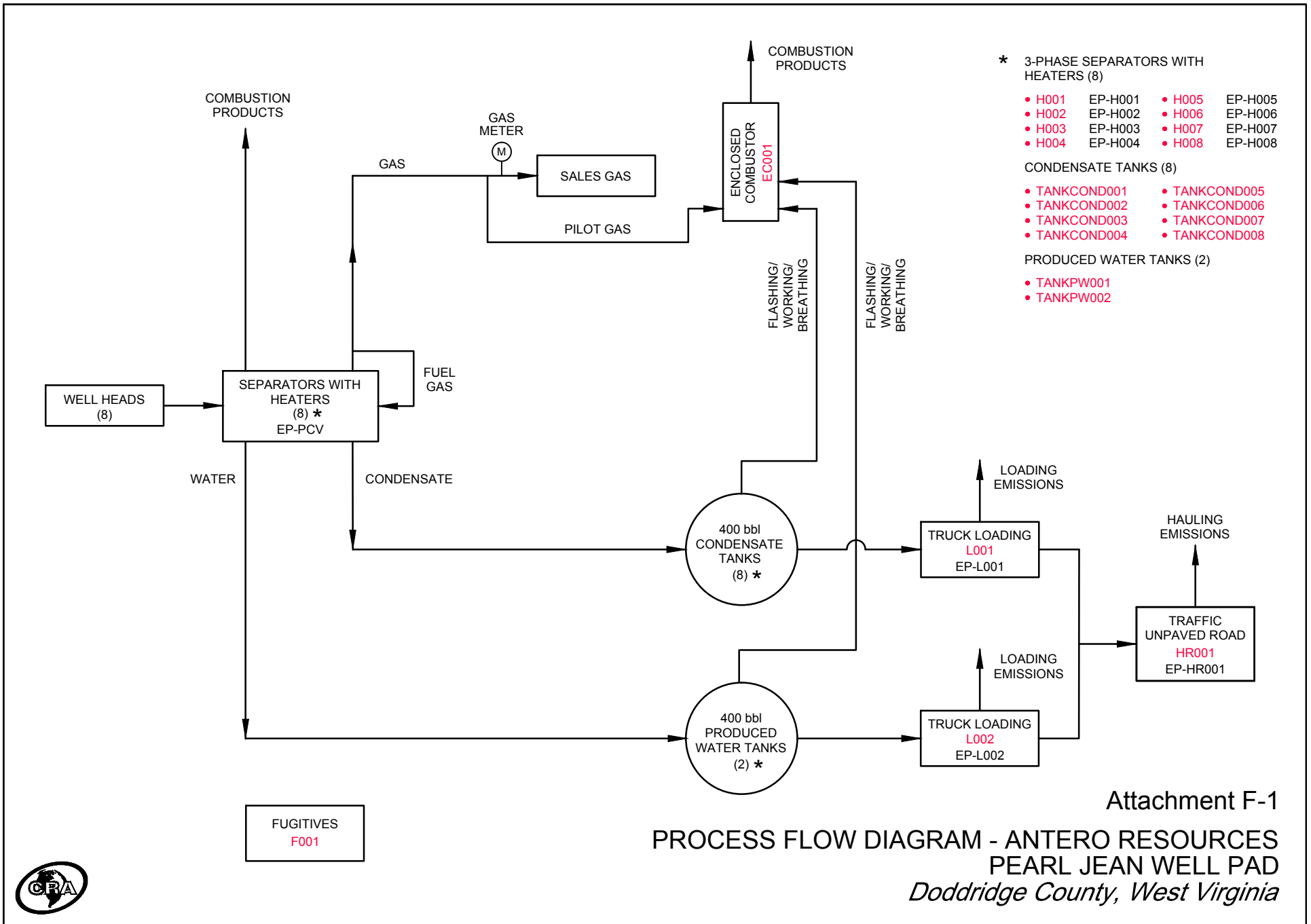
Attachment E-2

PLOT PLAN - FRESH WATER IMPOUNDMENTS  
PEARL JEAN FWI  
ANTERO RESOURCES  
*Doddridge County, West Virginia*



# Attachment F

## Process Flow Diagram

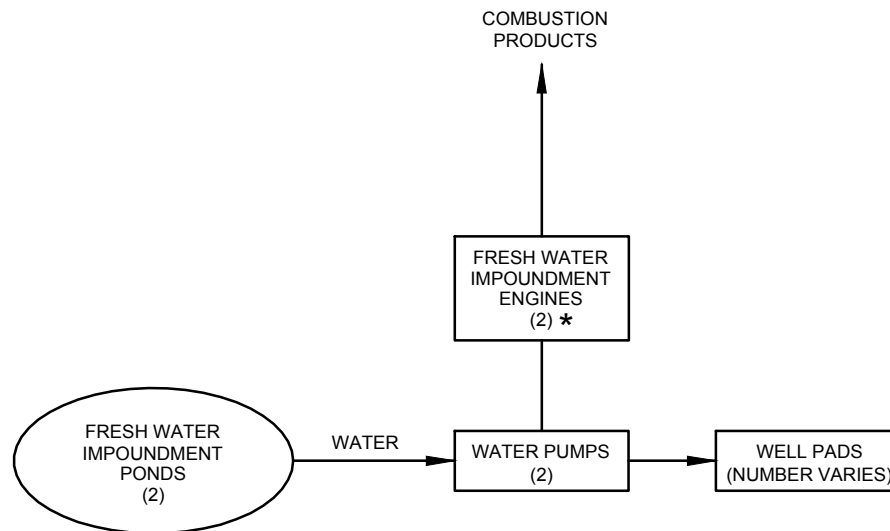


Attachment F-1

**PROCESS FLOW DIAGRAM - ANTERO RESOURCES  
PEARL JEAN WELL PAD  
Doddridge County, West Virginia**



- \* FRESH WATER IMPOUNDMENT ENGINES (2)
- FWIENG001 EP-FWIEGN001
- FWIENG002 EP-FWIEGN002



Attachment F-2  
 PROCESS FLOW DIAGRAM - ANTERO RESOURCES  
 PEARL JEAN FWI  
*Doddridge County, West Virginia*



# Attachment G

## Process Description

## Attachment G

### Process Description

#### Pearl Jean Well Pad

#### Antero Resources Corporation Doddridge County, West Virginia

A mixture of condensate and entrained gas from the wells enters the Facility through a number of low pressure separators where the gas phase is separated from the liquid phase. Gas Processing Units (GPU) heaters (H001-H008) are used in conjunction with the separators to help separate the gas from the liquid phases. These heaters are fueled by a slip stream of the separated gas. The separated gas from the low pressure separators is then metered and sent to the sales gas pipeline. The separated condensate and water from the separators flow to their respective storage tanks (TANKCOND001-008 and TANKPW001-002).

The Facility has eight (8) tanks (TANKCOND001-008) on site to store condensate and two (2) tanks (TANKPW001-002) to store produced water prior to removal from the site. Flashing, working, and breathing losses from the tanks are routed to the enclosed combustor (EC001) to control the emissions. The enclosed combustor that will be used to control emissions is designed to achieve a VOC destruction efficiency of 98 percent.

Condensate and produced water are transported off site on an as needed basis via tanker truck. Truck loading connections are in place to pump condensate (L001) and produced water (L002) from the storage tanks into tanker trucks. Emissions from the loading operations are vented to the atmosphere.

Emissions from the Facility's emission sources were calculated using the gas and extended analysis of the condensate from Moore No. 1H, one of the wells in the Moore Pad. This extended analysis is considered representative of the materials from Pearl Jean, being in the same Marcellus rock formation.

Pearl Jean calculation of potential to emit included all of the emission sources that belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under the control of the same person. The nearest emission source that belongs to the same industrial grouping and under the control of the same person but not located on contiguous or adjacent property is the Powell Pad. This operates independently and is approximately 1.2 miles southwest of the Facility. Although a nearby fresh water impoundment (FWI) pond operates independently providing water requirements of other nearby well pads, the emissions from the FWI were included in the potential to emit.

## **Attachment G**

### **Process Description**

#### **Pearl Jean Fresh Water Impoundment**

#### **Antero Resources Corporation**

#### **Doddridge County, West Virginia**

The Fresh Water Impoundment (FWI) collects and stores water for use in the nearby natural gas and oil production facilities. The FWI has two diesel engines (FWIENG001) that drive the water pumps. The pumps feed water into the water impoundment and then out into the water distribution system supplying water requirements of various natural gas and oil production facilities.

The air contaminants from the FWI are the products of diesel combustion from the engines (NO<sub>x</sub>, CO, SO<sub>2</sub>, VOC) and particulate matter (PM) emissions from unpaved roads when service vehicles enter the site. The air contaminants are released into the atmosphere. The engines use off the road low sulfur diesel fuel oil. The potential to emit was calculated using actual emissions for NO<sub>x</sub>, CO, and PM from certification tests conducted by EPA for diesel engine at the FWI. The certification emission test results were obtained from the EPA website. Other air contaminants such as SO<sub>2</sub>, VOC and HAPs were calculated using AP-42 emission factors for non-road diesel engines. The engines that drive the water pumps operate only as needed based on water requirement of the well pads; however, for purposes of determining potential to emit, the total of 8760 hours per year was used in the calculation. Calculations are in Table 13 of Attachment N. The road emission calculations are in Table 12 of Attachment N.

The FWI operates independently serving multiple nearby natural gas and oil production facilities.

# Attachment H

## Material Safety Data Sheets



**Attachment H****Description of Material Safety Data Sheets (MSDS)****Pearl Jean Well Pad****Antero Resources Corporation****Doddridge County, West Virginia**

Three generic Material Safety Data Sheets (MSDS), and analysis of the condensate and produced water of a similar well with the same formation are provided. Antero Resources Corporation has developed its own MSDS for these materials.

1. **Natural Gas:** The MSDS for natural gas reflects pipeline quality odorized gas. This is essentially the same as the material delivered to the metering and downstream gathering lines from the Antero well pad.
2. **Condensate:** Condensate is the hydrocarbon liquid that has been separated from raw natural gas through the well pad gas production unit. The liquid is often characterized as having a gasoline-like odor and consistency.
3. **Produced Water:** Produced water is primarily groundwater with residual trace hydrocarbons that has been withdrawn from the ground during the gas extraction process and then separated from the natural gas and condensate in the gas production units.

A low sulfur diesel fuel is used by the Fresh Water Impoundment engines. Copy of MSDS is not included in the attachment.



# SAFETY DATA SHEET

**Material Name:** Dry Field Natural Gas

**US GHS**

**SYNONYMS:** CNG, Natural Gas, Methane.

**\*\*\* Section 1 – PRODUCT AND COMPANY IDENTIFICATION \*\*\***

**PRODUCT NAME:** Dry Field Natural Gas      **EMERGENCY PHONE:** (800) 878-1373

**PRODUCT CODES:** CAS Reg. No. 68410-63-9      **AFTER HOURS:** (800) 878-1373

**PRODUCER:** Antero Resources

**ADDRESS:** 1615 Wynkoop Street      **CHEMTREC PHONE:** (800) 424-9300  
Denver, Colorado 80202

**\*\*\* Section 2 – HAZARDS IDENTIFICATION \*\*\***

**GHS Classification:**

Flammable Gas – Category 1.

Gases Under Pressure – Gas.

Specific Target Organ Systemic Toxicity (STOT) – Single Exposure Category 2.

**GHS LABEL ELEMENTS**

**Symbol(s)**



**Signal Word**

Danger

**Hazard Statements**

Extremely flammable gas.

Contains gas under pressure, may explode if heated.

May cause damage to central nervous and respiratory systems.

**Precautionary Statements**

**Prevention**

Keep away from heat/sparks/open flames/hot surfaces. No smoking.

Do not breathe fume/gas/mist/vapors/spray.

Wash thoroughly after handling.

Do not eat, drink or smoke when using this product.

# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

## **Response**

Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

If exposed to gas, or concerned about possible exposure: Call a POISON CENTER or doctor/physician.

## **Storage**

Protect from sunlight. Store in a well-ventilated place.

Store in a secure area.

## **Disposal**

Dispose of contents/containers in accordance with local/regional/national/international regulations.

### **\*\*\* Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS \*\*\***

<b>CAS #</b>	<b>Component</b>	<b>Percent</b>
74-82-8	Methane	95.01
78-84-0	Ethane	3.99
74-98-6	Propane	0.32
106-97-8	Butanes	0.07
109-66-0	Pentanes	0.02
110-54-3	Hexanes	0.01
7727-37-9	Nitrogen	0.35
124-38-9	Carbon Dioxide	0.19
7782-44-7	Oxygen	0.03

Because natural gas is a natural product, composition can vary greatly.

### **\*\*\* Section 4 – FIRST AID MEASURES \*\*\***

#### **First Aid: Eyes**

In case of freeze burn, cover eyes to protect from light. Flush eyes with running water for at least fifteen (15) minutes. Following flushing, seek medical attention.

#### **First Aid: Skin**

Remove contaminated clothing. In case of blistering, frostbite or freeze burns, seek immediate medical attention.

# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

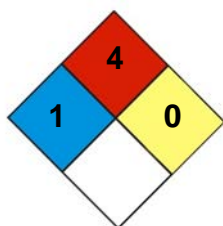
## **First Aid: Ingestion**

Risk of ingestion is extremely low. However, if oral exposure occurs, seek immediate medical assistance.

## **First Aid: Inhalation**

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

### **\*\*\* Section 5 – FIRE FIGHTING MEASURES \*\*\***



## **NFPA 704 Hazard Class**

Health: **1** Flammability: **4** Instability: **0** (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

## **General Fire Hazards**

See Section 9 for Flammability Properties.

Forms a flammable mixture with air. If released, the resulting vapors will disperse with the prevailing wind. If a source of ignition is present where the vapor exists at a 5 – 15% concentration in air, the vapor will burn along the flame front toward the source of the fuel.

## **Hazardous Combustion Products**

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

## **Extinguishing Media**

Any extinguisher suitable for Class B fires, dry chemical, fire fighting foam, CO<sub>2</sub>, and other gaseous agents. However, fire should not be extinguished unless flow of gas can be immediately stopped.

## **Unsuitable Extinguishing Media**

None.

## **Fire Fighting Equipment / Instructions**

Gas fires should not be extinguished unless flow of gas can be immediately stopped. Shut off gas source and allow gas to burn out. If spill or leak has not ignited, determine

# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

if water spray may assist in dispersing gas or vapor to protect personnel attempting to stop leak. Use water to cool equipment, surfaces and piping exposed to fire and excessive heat. For large fire, the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Isolate area, particularly around piping. Let the fire burn unless leak can be stopped. Concentrate fire-fighting efforts on objects / materials ignited by the initial fire. Withdraw immediately in the event of a rising sound from a venting safety device.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH-approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

## **\*\*\* Section 6 – ACCIDENTAL RELEASE MEASURES \*\*\***

### **Recovery and Neutralization**

Stop the source of the release, if safe to do so.

### **Materials and Methods for Clean-Up**

Consider the use of water spray to disperse gas vapors. Do not use water spray to direct gas vapors toward sewer or drainage systems. Isolate the area until gas has dispersed. Ventilate and gas test area before entering.

### **Emergency Measures**

Evacuate nonessential personnel and secure all ignition sources. No road flares, smoking or flames in hazard area. Consider wind direction. Stay upwind and uphill, if possible. Vapor cloud may be white, but color will dissipate as cloud disperses. Fire and explosion hazard is still present.

### **Personal Precautions and Protective Equipment**

Cooling effect of expanding gas from leak may present frostbite / freeze burn hazard. Wear flame retardant (FR) clothing around un-ignited leak. Wear fire protective clothing around an active fire.

### **Environmental Precautions**

Do not flush gas vapors toward sewer or drainage systems.

### **Prevention of Secondary Hazards**

None.

# SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

## \*\*\* Section 7 – HANDLING AND STORAGE \*\*\*

### Handling Procedures

Keep away from flame, sparks and excessive temperatures. Bond and ground containers. Use only in well ventilated areas.

### Storage Procedures

Natural gas will be contained in the pipeline. Keep away from flame, sparks, excessive temperatures and open flames. Empty pipeline segments may contain explosive residues from natural gas liquids. Do not cut, heat, weld or expose containers to sources of ignition sections of pipeline unless the sections have been purged of natural gas residues.

### Incompatibilities

Keep away from strong oxidizers, ignition sources and heat.

## \*\*\* Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION \*\*\*

### Component Exposure Limits

#### Methane (74-82-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

#### Ethane (74-84-0)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

#### Propane (74-98-6)

ACGIH: 2500 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

#### Butane (106-97-8)

ACGIH: 800 ppm TWA (listed under Aliphatic hydrocarbon gases : Alkane C1-4)

#### Pentanes (109-66-0)

ACGIH: 600 ppm TWA (listed under Pentane, all isomers)

#### Hexanes (110-54-3)

ACGIH: 50 ppm TWA (listed under n-Hexane)

# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

**Nitrogen (7727-37-9)**

Simple Asphyxiant

**Carbon Dioxide (124-38-9)**

ACGIH: 5000 ppm TWA (listed under Carbon Dioxide)

**Oxygen (7782-44-7)**

N/A – Necessary for life

**Engineering Measures**

Use adequate ventilation to keep gas and vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified / controlled areas.

**Personal Protective Equipment: Respiratory**

Use a NIOSH approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential for uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere. CAUTION: Flammability limits (i.e., explosion hazard should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection.

**Personal Protective Equipment: Hands**

Use cold-impervious, insulating flame-retardant (FR) gloves where contact with pressurized gas may occur.

**Personal Protective Equipment: Eyes**

Where there is a possibility of pressurized gas contact, wear splash-proof safety goggles and faceshield.

**Personal Protective Equipment: Skin and Body**

Where contact with pressurized gas may occur, wear flame-retardant (FR) and a faceshield.

**\*\*\* Section 9 – PHYSICAL AND CHEMICAL PROPERTIES \*\*\***

<b>Appearance:</b> Colorless	<b>Odor:</b> Odorless to slight petroleum odor
<b>Physical State:</b> Gas	<b>pH:</b> ND
<b>Vapor Pressure:</b> 40 atm @ -187°F (-86°C)	<b>Vapor Density:</b> 0.6
<b>Boiling Point:</b> -259°F (-162°C)	<b>Melting Point:</b> ND
<b>Solubility (H2O):</b> 3.5%	<b>Specific Gravity:</b> 0.4 @ -263°F (-164°C)

# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

<b>Evaporation Rate:</b> ND	<b>VOC:</b> ND
<b>Octanol / H<sub>2</sub>O Coeff.:</b> ND	<b>Flash Point:</b> Flammable Gas
<b>Flash Point Method:</b> N/A	
<b>Lower Flammability Limit:</b> 3.8 – 6.5	<b>Upper Flammability Limit:</b> 13-17
<b>(LFL):</b>	<b>(UFL):</b>
<b>Auto Ignition:</b> 900-1170°F (482-632°C)	<b>Burning Rate:</b> ND

## \*\*\* Section 10 – CHEMICAL STABILITY & REACTIVITY INFORMATION \*\*\*

### Chemical Stability

This is a stable material.

### Hazardous Reaction Potential

Will not occur.

### Conditions to Avoid

Keep away from strong oxidizers, ignition sources and heat.

### Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

## \*\*\* Section 11 – TOXICOLOGICAL INFORMATION \*\*\*

### Acute Toxicity

#### A: General Product Information

Methane and ethane, the main components of natural gas, are considered practically inert in terms of physiological effects. At high concentrations these materials act as simple asphyxiants and may cause death due to lack of oxygen.

#### B. Component Analysis – LD50/LC50

##### Methane (74-82-8)

Inhalation LC50 Mouse 326 g/m<sup>3</sup> 2h

##### Ethane (74-84-0)

Inhalation LC50 Rat 658 mg/l 4h

##### Propane (74-98-6)

Inhalation LC50 Rat 658 mg/l 4h



# SAFETY DATA SHEET

**Material Name: Dry Field Natural Gas**

**US GHS**

**Butanes (106-97-8)**

Inhalation LC50 Rat 658 g/m<sup>3</sup> 4h

**Pentanes (109-66-0)**

Inhalation LD50 Rat 364 g/m<sup>3</sup> 4h

**Hexanes (110-54-3)**

Inhalation LC50 Rat > 20 mg/l 4h

**Nitrogen (7727-37-9)**

Simple Asphyxiant

**Carbon Dioxide (124-38-9)**

Inhalation LC50 Human 100,000 ppm 1minute

**Oxygen (7782-44-7)**

N/A – Necessary for life

**Potential Health Effects: Skin Corrosion Property / Stimulativeness**

This product is not reported to have any skin sensitization effects.

**Generative Cell Mutagenicity**

This product is not reported to have any mutagenic effects.

**Carcinogenicity**

**A: General Product Information**

This product is not reported to have any carcinogenic effects.

**B: Component Carcinogenicity**

None of this product's components are listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

**Reproductive Toxicity**

This product is not reported to have any reproductive toxicity effects.

**Specified Target Organ General Toxicity: Single Exposure**

This product may cause damage to the heart.

**Specified Target Organ General Toxicity: Repeated Exposure**

This product is not reported to have any specific target organ repeat effects.

**Aspiration Respiratory Organs Hazard**

This product is not reported to have any aspiration hazard effects.

# SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

## \*\*\* Section 12 – ECOLOGICAL INFORMATION \*\*\*

### Ecotoxicity

#### A: General Product Information

Keep gas and vapors out of sewers, drainage areas, and waterways. Report spills and releases, as applicable under Federal and State regulations.

#### B: Component Analysis – Ecotoxicity – Aquatic Toxicity

No ecotoxicity data are available for this product's components.

### Persistence / Degradability

No information available.

### Bioaccumulation

No information available.

### Mobility in Soil

No information available.

## \*\*\* Section 13 – DISPOSAL CONSIDERATIONS \*\*\*

### Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment Recommendations.

### Disposal of Contaminated Containers or Packaging

Dispose of contents / container in accordance with local / regional / national / international regulations.

## \*\*\* Section 14 – TRANSPORTATION INFORMATION \*\*\*

### DOT Information

**Shipping Name:** Natural Gas, Compressed

**UN #:** 1971 **Hazard Class:** 2.1

Placard:



# SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

## \*\*\* Section 15 – REGULATORY INFORMATION \*\*\*

### Regulatory Information

#### Component Analysis

None of this products components are listed under SARA Section 302 (40 CFR 355 Appendix A).

n-hexane is listed under SARA Section 313 (40 CFR 372.65). However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

n-hexane is listed under CERCLA (40 CFR 302.4). However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

#### SARA Section 311/312 – Hazard Classes

<u>Acute Health</u>	<u>Chronic Health</u>	<u>Fire</u>	<u>Sudden Release of Pressure</u>	<u>Reactive</u>
---	---	X	X	---

#### SARA Section 313 – Supplier Notification

This product contains one chemical (n-Hexane) that is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-know act (EPCRA) of 1986 and of 40 CFR 372. However the concentration of this component is approximately 0.01 % in compressed natural gas and is therefore far under the reporting threshold for the chemical.

### State Regulations

#### Component Analysis – State

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

Component	CAS	CA	MA	MN	NJ	PA	RI
Methane	74-82-8	No	No	Yes	Yes	Yes	No
Ethane	78-84-0	No	No	Yes	Yes	Yes	No
Propane	74-98-6	No	No	Yes	Yes	Yes	Yes
Butane	106-97-8	Yes	No	Yes	Yes	Yes	Yes
Pentanes	109-66-0	Yes	No	Yes	Yes	Yes	Yes
Hexanes	110-54-3	Yes	Yes	Yes	Yes	Yes	Yes
Nitrogen	7727-37-9	No	No	No	No	No	No
Carbon Dioxide	124-38-9	Yes	No	Yes	Yes	Yes	Yes
Oxygen	7782-44-7	No	No	No	No	No	No

# SAFETY DATA SHEET

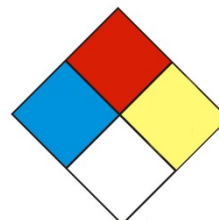
Material Name: Dry Field Natural Gas

US GHS

**\*\*\* Section 16 – OTHER INFORMATION \*\*\***

**NFPA® Hazard Rating**

Health 1  
Fire 4  
Reactivity 0



**HMIS® Hazard Rating**

Health 1 Moderate  
Fire 4 Severe  
Physical 0 Minimal  
\* Chronic

**Key/Legend**

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NJTSR = New Jersey Trade Secret Registry.

**Literature References**

None

**Other Information**

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

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

**Date of Preparation: January 30, 2014**

**Date of Last Revision: March 4, 2014**

End of Sheet

**Material Name: Natural Gas Condensate**

**US GHS**

**SYNONYMS: Drips; Condensate; Field Condensate; Gas Well Condensate; High Pressure Inlet Liquids; Lease Condensate; Natural Gas Liquids; Pipeline Liquids**

**\*\*\* Section 1 – PRODUCT AND COMPANY IDENTIFICATION \*\*\***

<b>PRODUCT NAME:</b>	<b>Natural Gas Condensate</b>	<b>EMERGENCY PHONE:</b>	<b>(800) 878-1373</b>
<b>PRODUCT CODES:</b>	<b>64741-47-5</b>	<b>AFTER HOURS:</b>	<b>(800) 878-1373</b>
<b>PRODUCER:</b>	<b>Antero Resources</b>		
<b>ADDRESS:</b>	<b>1615 Wynkoop Street Denver, Colorado 80202</b>	<b>CHEMTREC PHONE:</b>	<b>(800) 424-9300</b>

**\*\*\* Section 2 – HAZARDS IDENTIFICATION \*\*\***

**GHS Classification:**

Flammable Liquids – Category 2.  
Acute Toxicity Inhalation – Category 3  
Germ Cell Mutagenicity – Category 1B  
Carcinogenicity – Category 1A  
Specific Target Organ Systemic Toxicity (STOT) – Single Exposure Category 3  
Specific Target Organ Systemic Toxicity (STOT) – Repeat Exposure Category 1  
Aspiration Toxicity – Category 1  
Toxic to the Aquatic Environment Acute – Category 3

**GHS LABEL ELEMENTS**

**Symbol(s)**



**Signal Word**

Danger

# SAFETY DATA SHEET

**Material Name: Natural Gas Condensate**

**US GHS**

## **Hazard Statements**

Highly flammable liquid and vapor.

Toxic if inhaled.

May cause genetic defects.

May cause cancer.

May cause respiratory irritation.

May cause drowsiness or dizziness.

May cause damage to organs (liver, kidneys, blood, nervous system, and skin) through prolonged or repeated exposure.

May be fatal if swallowed and enters airways.

Harmful to aquatic life.

## **Precautionary Statements**

### **Prevention**

Keep away from heat/sparks/open flames/hot surfaces. No smoking.

Keep container tightly closed.

Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting equipment.

Use only non-sparking tools.

Take precautionary measures against static discharge.

Wear protective gloves/protective clothing/eye protection/face protection.

Do not breathe gas/mist/vapors/spray.

Do not handle until all safety precautions have been read and understood.

Wash thoroughly after handling.

Do not eat, drink or smoke when using this product.

Use only outdoors or in a well-ventilated area.

Avoid release to the environment.

### **Response**

If on SKIN (or hair): Wash with plenty of soap and water. Remove / Take off all contaminated clothing immediately. Rinse skin with water/shower.

If INHALED: Remove victim to fresh air and keep comfortable for breathing. Call a poison center/doctor if the victim feels unwell.

If SWALLOWED: Immediately call a poison center or doctor / physician. Do not induce vomiting.

If exposed or concerned: Get medical advice/attention.

In case of fire: Use water spray, fog or fire-fighting foam.

### **Storage**

Store in a well-ventilated place. Keep cool.

Store in a secure area.

# SAFETY DATA SHEET

**Material Name: Natural Gas Condensate**

**US GHS**

## **Disposal**

Dispose of contents/containers in accordance with local/regional/national/international regulations.

### **\*\*\* Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS \*\*\***

<b>CAS #</b>	<b>Component</b>	<b>Percent</b>
111-65-9	Octanes	25 - 95
142-82-5	Heptanes	25 - 95
110-54-3	Hexanes as n-Hexane	25 - 95
109-66-0	Pentanes as n-Pentane	5 - 70
106-97-8	N-butane	0 - 45
74-98-6	Propane	0 - 15
78-84-0	Ethane	0 - 5
71-43-2	Benzene	< 1
108-88-3	Toluene	< 1
1330-20-7	m-,o-,p-Xylene	< 1

Because natural gas condensate is a natural product, composition can vary greatly.

### **\*\*\* Section 4 – FIRST AID MEASURES \*\*\***

#### **First Aid: Eyes**

Flush eyes with clean running water for at least fifteen (15) minutes. Following flushing, seek medical attention.

#### **First Aid: Skin**

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops. Wash contaminated clothing before reuse.

#### **First Aid: Ingestion (swallowing)**

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean the victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

# SAFETY DATA SHEET

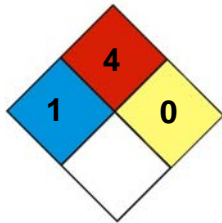
**Material Name: Natural Gas Condensate**

**US GHS**

## **First Aid: Inhalation (breathing)**

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

### **\*\*\* Section 5 – FIRE FIGHTING MEASURES \*\*\***



## **NFPA 704 Hazard Class**

**Health: 1 Flammability: 4 Instability: 0** (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

## **General Fire Hazards**

See Section 9 for Flammability Properties.

Extremely flammable. Vapors may be ignited rapidly when exposed to heat, spark, open flame, or other source of ignition (e.g., static electricity, pilot lights, mechanical / electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Flammable vapors can burn in the open or explode in confined spaces. Vapors are heavier than air, and may travel distances to an ignition source and flash back. Runoff to sewer systems may cause fire or explosion.

## **Hazardous Combustion Products**

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

## **Extinguishing Media**

**SMALL FIRES:** Any extinguisher suitable for Class B fires, dry chemical, firefighting foam, water spray, carbon dioxide (CO<sub>2</sub>), or other gaseous extinguishing agents. Use caution when applying CO<sub>2</sub> in confined spaces.

**LARGE FIRES:** Water spray, fog or fire-fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

## **Unsuitable Extinguishing Media**

None



# SAFETY DATA SHEET

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## **Fire Fighting Equipment / Instructions**

Small fires in the beginning stage may typically be extinguished using handheld portable fire extinguishers and other firefighting equipment. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied firefighting foam.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full face piece and full protective clothing.

<b>*** Section 6 – ACCIDENTAL RELEASE MEASURES ***</b>
--

## **Recovery and Neutralization**

Contain and stop the source of the spill, if safe to do so.

## **Materials and Methods for Clean-Up**

Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken.

## **Emergency Measures**

Evacuate nonessential personnel and secure all ignition sources. No road flares, smoking or flames in hazard area. Consider wind direction. Stay upwind and uphill, if possible. Vapor cloud may be white, but color will dissipate as cloud disperses. Fire and explosion hazard is still present.

## **Personal Precautions and Protective Equipment**

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8). Extremely flammable. Spillages of liquid product will create a fire hazard and may form an explosive atmosphere. Keep all sources of

# SAFETY DATA SHEET

**Material Name: Natural Gas Condensate**

**US GHS**

ignition and hot metal surfaces away from spill/release if safe to do so.

The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons downwind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

## **Environmental Precautions**

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of firefighting foam may be useful in certain situations to reduce vapors. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

## **Prevention of Secondary Hazards**

None

<b>*** Section 7 – HANDLING AND STORAGE ***</b>
---

## **Handling Procedures**

Keep away from flame, sparks and excessive temperatures. Bond and ground containers. Use non-sparking tools. Use only outdoors or in well ventilated areas. Wear protective gloves / clothing and eye / face protection. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

## **Storage Procedures**

Store only in approved containers. Bond and ground containers. Keep away from flame, sparks, excessive temperatures and open flames. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

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## **Incompatibilities**

Keep away from strong oxidizers, ignition sources and heat.

<b>*** Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION ***</b>
--

## **Component Exposure Limits**

### **Octanes (111-65-9)**

ACGIH: 300 ppm TWA (listed under Octane, all isomers)

### **Heptanes (142-82-5)**

ACGIH: 400 ppm TWA (listed under n-Heptane)

### **n-Hexane (110-54-3)**

ACGIH: 20 ppm TWA (listed under n-Hexane)

### **n-Pentane (109-66-0)**

ACGIH: 600 ppm TWA (listed under Pentane, all isomers)

### **n-Butane (106-97-8)**

ACGIH: 600 ppm TWA (listed under n-Butane)

### **Propane (74-98-6)**

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

### **Ethane (74-84-0)**

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

### **Benzene (71-43-2)**

ACGIH: 0.5 ppm (TWA); NIOSH: 0.1 ppm (TWA); OSHA 1 ppm (TWA)

### **Toluene (108-88-3)**

ACGIH: 20 ppm TWA (listed under Toluene)

### **m-, o-, p-Xylene (1330-20-7)**

ACGIH: 100 ppm TWA (listed under Xylene o, m & p isomers)

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## **Engineering Measures**

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified / controlled areas.

## **Personal Protective Equipment: Respiratory**

Use a NIOSH-approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential for uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere (oxygen content less than 19.5 percent). A respiratory program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant the use of a respirator.

If benzene concentrations equal or exceed applicable exposure limits, OSHA requirements for personal protective equipment, exposure monitoring, and training may apply (29 CFR 1910.1028 – Benzene).

CAUTION: Flammability limits (i.e., explosion hazard should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection.

## **Personal Protective Equipment: Hands**

Gloves constructed of nitrile or neoprene are recommended.

## **Personal Protective Equipment: Eyes**

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying. Eye protection that meets or exceeds ANSI Z.87.1 is recommended. Depending on conditions of use, a face shield may be necessary.

## **Personal Protective Equipment: Skin and Body**

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

## **Hygiene Measures**

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use gasoline or solvents (naphtha, kerosene, etc.) for washing this product from

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exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

## \*\*\* Section 9 – PHYSICAL AND CHEMICAL PROPERTIES \*\*\*

<b>Appearance:</b>	Colorless to straw yellow	<b>Odor:</b>	Aromatic, Gasoline;
<b>Physical State:</b>	Liquid	<b>pH:</b>	ND
<b>Vapor Pressure:</b>	110 – 200 psia (Reid VP) @ 100°F/37.8°C	<b>Vapor Density (air = 1):</b>	> 1
<b>Boiling Point:</b>	Approx. 85 - 437°F (39 – 200°C)	<b>Melting Point:</b>	ND
<b>Solubility (H2O):</b>	Insoluble to slightly soluble	<b>Specific Gravity:</b>	AP 0.62-0.76 (varies)
<b>Evaporation Rate:</b>	High	<b>VOC:</b>	ND
<b>Octanol / H2O Coeff.:</b>	ND	<b>Flash Point:</b>	-40°F -40°C
<b>Flash Point Method:</b>	Tag Closed Cup (TCC)		
<b>Lower Flammability Limit: (LFL):</b>	ND (NFPA Gasoline 1.4)	<b>Upper Flammability Limit: (UFL):</b>	ND (NFPA Gasoline 7.6)
<b>Auto Ignition:</b>	AP 480°F (250°C)	<b>Burning Rate:</b>	ND

## \*\*\* Section 10 – CHEMICAL STABILITY & REACTIVITY INFORMATION \*\*\*

### Chemical Stability

This is a stable material.

### Hazardous Reaction Potential

Will not occur.

### Conditions to Avoid

Keep away from ignition sources and high temperatures.

### Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

# SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

*** Section 11 – TOXICOLOGICAL INFORMATION ***
--

## Acute Toxicity

### A: General Product Information

Harmful if swallowed.

### B. Component Analysis – LD50/LC50

#### Octanes (111-65-9)

Inhalation LC50 rat = 118,000 mg/m<sup>3</sup> / 4H

#### Heptanes (142-82-5)

Inhalation LC50 rat = 103,000 mg/m<sup>3</sup> / 4H

#### Hexanes as n-Hexane (110-53-3)

Inhalation LC50 rat = 48,000 ppm / 4H

#### Pentanes as n-Pentane (109-66-0)

Inhalation LC50 rat = 364,000 mg/m<sup>3</sup> / 4H

#### Butanes as n-Butane (106-97-8)

Inhalation LC50 rat 658,000 mg/l / 4H

#### Propane (74-98-6)

Inhalation LC50 Rat > 800,000 ppm / 0.25H

#### Ethane (74-84-0)

Inhalation LC50 Rat 658,000 mg/l / 4H

#### Benzene (71-43-2)

Inhalation LC50 Rat 44,700 mg/m<sup>3</sup> /

#### Toluene (108-88-3)

Inhalation LD50 Rat 12/5 mg/l / 4H

#### m-, o-, p-Xylene (1330-20-7)

Inhalation LC50 Rat 5000 ppm / 4H

### Potential Health Effects: Skin Corrosion Property / Stimulativeness

May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

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**Potential Health Effects: Eye Critical Damage / Stimulativeness**

Contact with eyes may cause moderate irritation.

**Potential Health Effects: Ingestion (swallowing)**

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

**Potential Health Effects: Inhalation (breathing)**

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

**Respiratory Organs Sensitization / Skin Sensitization**

This product is not reported to have any skin sensitization effects.

**Generative Cell Mutagenicity**

May cause genetic defects. Some crude oils and crude oil fractions have been positive in mutagenicity studies.

**Carcinogenicity**

**A: General Product Information**

May cause cancer.

This product contains benzene, although at very low concentrations. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

Exposure to light hydrocarbons in the same boiling range as this product have been associated in animal studies with effects to the central nervous system, peripheral nervous system, liver, and kidneys. The significance of these animal models to predict similar human response is uncertain. Observing good work practices and personal hygiene procedures (Sections 7 and 8) can minimize potential risks to humans.

**B: Component Carcinogenicity**

**Benzene (71-43-2)**

ACGIH:	A1 - Confirmed Human Carcinogen
OSHA:	5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA
NIOSH:	potential occupational carcinogen
NTP:	Known Human Carcinogen (Select Carcinogen)

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IARC: Monograph 100F [in preparation]; Supplement 7 [1987]; Monograph 29 [1982] (Group 1 (carcinogenic to humans))

## Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

## Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

## Specified Target Organ General Toxicity: Repeated Exposure

May cause damage to organs (liver, kidneys, blood, nervous system and skin) through prolonged or repeated exposure.

## Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

## \* \* \* Section 12 – ECOLOGICAL INFORMATION \* \* \*

## Ecotoxicity

### A: General Product Information

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable under Federal and State regulations.

### B: Component Analysis – Ecotoxicity – Aquatic Toxicity

#### Benzene (71-43-2)

Test and Species	Conditions
96 Hr LC50 Pimephales promelas	10.7-14.7 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	5.3 mg/L [flow-through]
96 Hr LC50 Lepomis macrochirus	22.49 mg/L [static]
96 Hr LC50 Poecilia reticulata	28.6 mg/L [static]
96 Hr LC50 Pimephales promelas	22330-41160 µg/L [static]
96 Hr LC50 Lepomis macrochirus	70000-142000 µg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	29 mg/L
48 Hr EC50 Daphnia magna	8.76 - 15.6 mg/L [static]
48 Hr EC50 Daphnia magna	10 mg/L



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## **Natural Gas condensates (68919-39-1)**

<b>Test and Species</b>	<b>Conditions</b>
96 Hr LC50 Alburnus alburnus	119 mg/L [static]
96 Hr LC50 Cyprinodon variegatus	82 mg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	56 mg/L
24 Hr EC50 Daphnia magna	170 mg/L

### **Persistence / Degradability**

No information available

### **Bioaccumulation**

No information available

### **Mobility in Soil**

No information available

<b>*** Section 13 – DISPOSAL CONSIDERATIONS ***</b>
---

### **Waste Disposal Instructions**

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment Recommendations.

### **Disposal of Contaminated Containers or Packaging**

Recover or recycle if possible. It is the responsibility of the generator to determine the toxicity and physical properties of the material generated so as to properly classify the waste and ensure disposal methods comply with applicable regulations.

This material, if discarded should be fully characterized for ignitability (D001), reactivity (D003) and benzene (D018) prior to disposal (40 CFR261). Use which results in chemical or physical change or contamination may subject it to regulation as a hazardous waste. Along with properly characterizing all waste materials, consult state and local regulations regarding the proper disposal of this material. Do not dispose of by draining onto the ground. This will result in soil and groundwater contamination. Waste arising from spillage or tank cleaning should be disposed of in accordance with applicable regulations.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate could be considered a RCRA hazardous waste and must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a qualified drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

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## \*\*\* Section 14 – TRANSPORTATION INFORMATION \*\*\*

### DOT Information

**Shipping Name:** Petroleum Products, n.o.s. (condensate)

**UN #:** 1268 **Hazard Class:** 3

**Additional Info.:** Dependent on the product's properties, the shipper may also elect to classify as Gasoline UN1203 or Petroleum Crude Oil UN1267 - reference 49 CFR 172.101 for further description (e.g., packing group determination).

Placard:



## \*\*\* Section 15 – REGULATORY INFORMATION \*\*\*

### Regulatory Information

#### Component Analysis

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

#### Benzene (71-43-2)

SARA 313: 0.1% de minimis concentration

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

#### SARA Section 311/312 – Hazard Classes

<u>Acute Health</u>	<u>Chronic Health</u>	<u>Fire</u>	<u>Sudden Release of Pressure</u>	<u>Reactive</u>
X	X	X	--	--

#### SARA SECTION 313 – SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

# SAFETY DATA SHEET

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<b>INGREDIENT NAME (CAS NUMBER)</b>	<b>CONCENTRATION PERCENT BY WEIGHT</b>
Benzene (71-43-2)	<0.1 to 2

## Canadian Regulatory Information

<b>DSL/NDSL Inventory</b>	This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the Regulations.
<b>Workplace Hazardous Materials Information System</b>	B2 - Flammable Liquid D1A – Material Causing Immediate and Serious Toxic Effects - Very Toxic Material D2A: Material Causing Other Toxic Effects Very Toxic D2B - Material Causing Other Toxic Effects - Toxic Material

## European Union Regulatory Information

<b>Labeling</b>	Product is dangerous as defined by the European Union Dangerous Substances / Preparations Directives. Contains: Low Boiling Point Naphtha
<b>Symbol</b>	<b>F+</b> Extremely Flammable <b>T</b> Toxic <b>N</b> Dangerous for the Environment
<b>Risk Phrases</b>	R12-45-38-65-67-51/53 Extremely flammable. May cause cancer. Irritating to skin. Harmful: may cause lung damage if swallowed. Vapors may cause drowsiness and dizziness. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
<b>Safety Phrases</b>	S16-53-45-2-23-24-29-43-62 Keep away from sources of ignition – No smoking. Avoid exposure – obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Keep out of reach of children. Do not breathe vapor. Avoid contact with skin. Do not empty into drains. In case of fire use foam/dry powder/CO2. If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

# SAFETY DATA SHEET

**Material Name: Natural Gas Condensate**

**US GHS**

**State Regulations**

**Component Analysis – State**

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

Component	CAS	CA	MA	MN	NJ	PA	RI
Octanes	111-65-9	Yes	No	Yes	Yes	Yes	Yes
Heptanes	142-82-5	Yes	No	Yes	Yes	Yes	Yes
n-Hexane	110-54-3	Yes	Yes	Yes	Yes	Yes	Yes
n-Pentane	109-66-0	Yes	No	Yes	Yes	Yes	Yes
n-Butane	106-97-8	Yes	No	Yes	Yes	Yes	Yes
Propane	74-98-6	No	No	Yes	Yes	Yes	Yes
Ethane	78-84-0	No	No	Yes	Yes	Yes	No
Benzene	71-43-2	Yes	Yes	Yes	Yes	Yes	Yes
Toluene	108-88-3	Yes	Yes	Yes	Yes	Yes	Yes
m-, o-, p-Xylene	1330-20-7	Yes	Yes	Yes	Yes	Yes	Yes

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

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

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

**Component Analysis – WHMIS IDL**

The following components are identified under the Canadian Hazardous Products Act

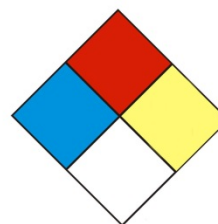
Ingredient Disclosure List:

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

**\*\*\* Section 16 – OTHER INFORMATION \*\*\***

**NFPA® Hazard Rating**

Health 1  
Fire 4  
Reactivity 0



**HMIS® Hazard Rating**

Health 1 Slight  
Fire 4 Severe  
Physical 0 Minimal  
\* Chronic

# SAFETY DATA SHEET

**Material Name: Natural Gas Condensate**

**US GHS**

## **Key/Legend**

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NJTSR = New Jersey Trade Secret Registry.

## **Literature References**

None

## **Other Information**

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

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

**Date of Preparation: January 29, 2014**

**Date of Last Revision: March 4, 2014**

End of Sheet



## SAFETY DATA SHEET

**Material Name:** Produced Water

**US GHS**

**SYNONYMS:** Produced Brine Water, Brine, Brine Water, Formation Water

**\*\*\* Section 1 – PRODUCT AND COMPANY IDENTIFICATION \*\*\***

**PRODUCT NAME:** Produced Water

**EMERGENCY PHONE:** (800) 878-1373

**PRODUCT CODES:** Mixture

**AFTER HOURS:** (800) 878-1373

**PRODUCER:** Antero Resources

**ADDRESS:** 1615 Wynkoop Street  
Denver, Colorado 80202

**CHEMTREC PHONE:** (800) 424-9300

**\*\*\* Section 2 – HAZARDS IDENTIFICATION \*\*\***

**GHS Classification:**

Eye Irritant – Category 2A.

**GHS LABEL ELEMENTS**

**Symbol(s)**



**Signal Word**

Warning

**Hazard Statements**

Causes serious eye irritation

**Precautionary Statements**

**Prevention**

Wear protective gloves/protective clothing/eye protection/face protection.

**Response**

If on SKIN (or hair): Rinse skin with water / shower. Remove / Take off all contaminated clothing immediately.

# SAFETY DATA SHEET

**Material Name: Produced Water**

**US GHS**

If in EYES: Rinse cautiously with water for at least fifteen (15) minutes. Remove Contact Lenses, if present and easy to do. Continue rinsing.

If EYE irritation persists, get medical advice / attention.

## **Storage**

Store in a secure area.

## **Disposal**

Dispose of contents/containers in accordance with regulations.

### **\*\*\* Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS \*\*\***

<b>CAS #</b>	<b>Component</b>	<b>Percent</b>
7732-18-5	Water	80
7647-14-5	Sodium Chloride	20

Because brine water is a natural product, composition can vary greatly.

### **\*\*\* Section 4 – FIRST AID MEASURES \*\*\***

#### **First Aid: Eyes**

Flush eyes with clean running water for at least fifteen (15) minutes. If irritation or redness develops from exposure, following flushing, seek medical attention.

#### **First Aid: Skin**

First aid is not required, normally. However, it is a good practice to wash any chemical from the skin.

#### **First Aid: Ingestion (Swallowing)**

First aid is not required, normally. If spontaneous vomiting occurs, lean the victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. If symptoms develop, seek medical attention.

#### **First Aid: Inhalation (Breathing)**

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

# SAFETY DATA SHEET

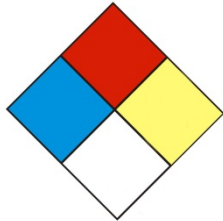
Material Name: Produced Water

US GHS

## Most important symptoms and effects

None known or anticipated.

### \*\*\* Section 5 – FIRE FIGHTING MEASURES \*\*\*



## NFPA 704 Hazard Class

**Health: 1 Flammability: 0 Instability: 0** (0=Minimal, 1=Slight, 2=Moderate, 3=Serious, 4=Severe)

## General Fire Hazards

No fire hazards are expected.

## General Fire Hazards

No unusual fire or explosion hazards are expected. If container is not properly cooled, it can rupture in the heat of a fire.

## Extinguishing Media

The material is non-flammable. Use extinguishing agent suitable for the type of surrounding fire.

## Unsuitable Extinguishing Media

None

## Fire Fighting Equipment / Instructions

Small fires in the beginning stage may typically be extinguished using handheld portable fire extinguishers and other firefighting equipment. Isolate area around container involved in fire and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from the immediate hazard area if it can be done safely. Cool equipment exposed to fire with water, if it can be done safely.

## Hazardous Combustion Products

None Anticipated. See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits



# SAFETY DATA SHEET

Material Name: Produced Water

US GHS

<b>*** Section 6 – ACCIDENTAL RELEASE MEASURES ***</b>
--

## Recovery and Neutralization

Contain and stop the source of the spill, if safe to do so.

## Materials and Methods for Clean-Up

Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios of this material. However, local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

## Emergency Measures

The material is not considered hazardous. Nevertheless, evacuate nonessential personnel and secure the area. Stay upwind and uphill, if possible.

## Personal Precautions and Protective Equipment

Stay upwind and away from the spill/release. Avoid direct contact with the material. For large spillages, notify persons downstream of the spill/release. Isolate the immediate hazard area and keep unauthorized personnel out. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

## Environmental Precautions

Protect bodies of water by diking or absorbents, if possible. Do not flush down sewer or drainage systems. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If a spill occurs on water, notify appropriate authorities and advise shipping of any hazard.

## Prevention of Secondary Hazards

None

# SAFETY DATA SHEET

Material Name: Produced Water

US GHS

## \*\*\* Section 7 – HANDLING AND STORAGE \*\*\*

### Handling Procedures

Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29 CFR 1910.146. Do not wear contaminated clothing or shoes.

### Storage Procedures

Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well ventilated areas. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

### Incompatibilities

Keep away from excessive heat to prevent rupture of container.

## \*\*\* Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION \*\*\*

### Component Exposure Limits

#### Water (7732-18-5)

ACGIH: Not listed

#### Sodium Chloride (7647-14-5)

ACGIH: Not listed

### Engineering Measures

If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

### Personal Protective Equipment: Respiratory

Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR

# SAFETY DATA SHEET

**Material Name: Produced Water**

**US GHS**

1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

## **Personal Protective Equipment: Skin and Hands**

The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals.

## **Personal Protective Equipment: Eyes**

Safety glasses or goggles that meet or exceed ANSI Z-87.1 are recommended where there is a possibility of splashing or spraying.

## **Hygiene Measures**

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove contaminated clothing and launder before reuse.

<b>*** Section 9 – PHYSICAL AND CHEMICAL PROPERTIES ***</b>
---

<b>Appearance:</b>	Clear to Brown	<b>Odor:</b>	Salty
<b>Physical State:</b>	Liquid	<b>pH:</b>	ND
<b>Vapor Pressure:</b>	< 0.36 psia @ 70°F / 21.1°C	<b>Vapor Density:</b>	> 1
<b>Boiling Point:</b>	212°F / 100°C	<b>Melting Point:</b>	2.4°F / -16.5°C
<b>Solubility (H2O):</b>	Complete	<b>Specific Gravity:</b>	1.1 @ 68°F / 20°C
<b>Evaporation Rate:</b>	Variable	<b>VOC:</b>	ND
<b>Octanol / H2O Coeff.:</b>	ND	<b>Flash Point:</b>	ND
<b>Flash Point Method:</b>	ND	<b>Upper Flammability Limit:</b>	ND
<b>Lower Flammability Limit: (LFL):</b>	ND	<b>(UFL):</b>	
<b>Auto Ignition:</b>	ND	<b>Burning Rate:</b>	ND

# SAFETY DATA SHEET

Material Name: Produced Water

US GHS

## \*\*\* Section 10 – CHEMICAL STABILITY & REACTIVITY INFORMATION \*\*\*

### Chemical Stability

This is a stable material.

### Hazardous Reaction Potential

Will react with alkali and alkaline metals to form flammable hydrogen gas.

### Conditions to Avoid

Avoid contact with alkali metals (lithium, sodium, potassium), alkaline metals (beryllium, magnesium, calcium, strontium, and barium), and metallic hydrides like lithium aluminum hydride.

### Hazardous Decomposition Products

Not anticipated under normal conditions of use.

### Hazardous Polymerization

Not known to occur.

## \*\*\* Section 11 – TOXICOLOGICAL INFORMATION \*\*\*

### Acute Toxicity

#### A: General Product Information

Unlikely to be harmful.

#### B. Component Analysis – D50/LC50

##### Water (7732-18-5)

Oral LD50 Rat 90 g/kg

##### Sodium Chloride (7647-14-5)

Oral LD50 Rat 3 g/kg

### Potential Health Effects: Skin Corrosion Property / Stimulativeness

May cause skin irritation with prolonged or repeated contact. Not expected to be a skin sensitizer.

### Potential Health Effects: Eye Critical Damage / Stimulativeness

Contact with eyes may cause moderate irritation.

# SAFETY DATA SHEET

**Material Name: Produced Water**

**US GHS**

**Potential Health Effects: Ingestion**

Ingestion may result in nausea, vomiting, diarrhea, abdominal cramps, and dehydration (thirst).

**Potential Health Effects: Inhalation**

No information available on the mixture. However, none of the components have been classified for respiratory sensitization (or are below the concentration threshold for classification).

**Generative Cell Mutagenicity**

Not expected to cause genetic effects.

**Carcinogenicity**

**General Product Information**

Not expected to cause cancer. This substance is not listed as a carcinogen by IARC, NTP or OSHA.

**Reproductive Toxicity**

This product is not reported to have any reproductive toxicity effects.

**Specified Target Organ General Toxicity: Single Exposure**

This product is not reported to have any specific target organ general toxicity single exposure effects.

**Specified Target Organ General Toxicity: Repeated Exposure**

This product is not reported to have any specific target organ general toxicity multiple exposure effects.

**Aspiration Respiratory Organs Hazard**

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

<b>*** Section 12 – ECOLOGICAL INFORMATION ***</b>
--

**Ecotoxicity**

**A: General Product Information**

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable under Federal and State regulations.

# SAFETY DATA SHEET

**Material Name: Produced Water**

**US GHS**

**Persistence / Degradability**

No information available

**Bioaccumulation**

No information available

**Mobility in Soil**

No information available

**\*\*\* Section 13 – DISPOSAL CONSIDERATIONS \*\*\***

**Waste Disposal Instructions**

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment Recommendations.

**Disposal of Contaminated Containers or Packaging**

Recover or recycle if possible. It is the responsibility of the generator to determine the toxicity and physical properties of the material generated so as to properly classify the waste and ensure disposal methods comply with applicable regulations.

This material, if discarded as produced, is not a RCRA "listed" hazardous waste, and is not believed to exhibit characteristics of hazardous waste. Consult state and local regulations regarding the proper disposal of this material. Do not dispose of brine water by draining onto the ground. This will result in soil and groundwater contamination. Waste arising from spillage or tank cleaning should be disposed of in accordance with applicable regulations.

Container contents should be completely used and containers should be emptied prior to discard. Container rinsate should not be considered a RCRA hazardous waste but must be disposed of with care and in full compliance with federal, state and local regulations. Larger empty containers, such as drums, should be returned to the distributor or to a qualified drum reconditioner. To assure proper disposal of smaller empty containers, consult with state and local regulations and disposal authorities.

**\*\*\* Section 14 – TRANSPORTATION INFORMATION \*\*\***

**DOT Information**

**Shipping Description:** Not Regulated

**UN #:** Not Regulated

# SAFETY DATA SHEET

Material Name: Produced Water

US GHS

## \*\*\* Section 15 – REGULATORY INFORMATION \*\*\*

### **CERCLA/SARA – Section 302 Extremely Hazardous Substances and TPQs (in pounds):**

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372,

### **CERCLA/SARA – Section 313 and 40 CFR 372):**

This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

### **EPA (CERCLA) Reportable Quantity (in pounds):**

This material does not contain any chemicals with CERCLA Reportable Quantities.

### **State Regulations**

#### **Component Analysis**

The following components appear on one or more of the following state hazardous substances list.

### **California Proposition 65:**

This material does not contain any chemicals that are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

### **National Chemical Inventories:**

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.

**U.S. Export control classification Number:** EAR99.

## \*\*\* Section 16 – OTHER INFORMATION \*\*\*

### **NFPA® Hazard Rating**

Health 1  
Fire 0  
Reactivity 0

### **HMIS® Hazard Rating**

Health 1 Slight  
Fire 0 Minimal  
Physical 0 Minimal

# SAFETY DATA SHEET

**Material Name: Produced Water**

**US GHS**

## **Key/Legend**

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NJTSR = New Jersey Trade Secret Registry.

## **Literature References**

None

## **Other Information**

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

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

**Date of Preparation: January 28, 2014**

**Date of Last Revision: March 4, 2014**

End of Sheet



# Attachment I

## Emission Units Table

### Attachment I: Emission Units Data Sheet

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

Emission Unit ID1	Emission Point ID2	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type3 and Date of Change	Control Device 4
H001, H002, H003, H004, H005, H006, H007, H008	EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008	Gas Production Unit Heater	NEW	1 MMBtu/hr (each)	Modification	N/A
F001	F001	Fugitives	2014	0	Existing	N/A
TANKCOND001-08	EC001	Condensate Tank	2014	400 bbl each	Existing	EC001
TANKPW001-002	EC001	PW Tank	2014	400 bbl each	Existing	EC001
L001	EP-L001	Loading (Condensate)	2014	200BBL capacity (each)	Existing	N/A
L002	EP-L002	Loading (Water)	2014	200BBL capacity (each)	Existing	N/A
HR001	EP-HR001	Haul Truck	2014	40 ton capacity	Existing	N/A
EC001	EC001	Enclosed Combustor	NEW	138 scf/min	NEW	N/A
PCV	EP-PCV	Pneumatic CV	2014	6.6 scf/day/PCV	Existing	N/A
ENG001	EP-ENG001	Compressor Engine	2014	24 HP	Removal	N/A
FWIENG001	EP-FWIENG001	Freshwater Inpoundment Engine	2015	600 HP	New	N/A
FWIENG002	EP-FWIENG002	Freshwater Inpoundment Engine	2015	600 HP	New	N/A

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

# Attachment J

## Emission Points Data Summary Sheet

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

Table 1: Emissions Data												
Emission Point ID No. <i>(Must match Emission Units Table &amp; Plot Plan)</i>	Emission Point Type <sup>1</sup>	Emission Unit Vented Through This Point <i>(Must match Emission Units Table &amp; Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table &amp; Plot Plan)</i>		All Regulated Pollutants - Chemical Name/CAS <sub>3</sub> <i>(Speciate VOCs &amp; HAPS)</i>	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used <sup>6</sup>
		ID No.	Source	ID No.	Device Type		lb/hr	ton/yr	lb/hr	ton/yr		
EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008	Vertical Stack	H001, H002, H003, H004, H005, H006, H007, H008	Gas Production Unit Heater	N/A		CO (630080)	0.54	2.36	0.54	2.36	Gas/Vapor /Solid (for PM)	MB AP-42
						NOx (10102439)	0.64	2.81	0.64	2.81		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	774.39	3391.81	774.39	3391.81		
						PM, PM10, PM2.5	0.05	0.21	0.05	0.21		
						Hexane (110543)	0.01	0.05	0.01	0.05		
						Total VOCs	0.04	0.15	0.04	0.15		
F001	n/a	F001	Fugitives	N/A		Benzene (71432)	0.01	0.03	0.01	0.03	Gas/Vapor	MB
						Toluene (108883)	0.02	0.09	0.02	0.09		
						Ethyl benzene (100414)	0.02	0.08	0.02	0.08		
						Hexane (110543)	0.25	1.08	0.25	1.08		
						o,m,p-xylenes (95476,108383,106423)	0.05	0.23	0.05	0.23		
						CO2 Equivalent CO2 (124389), CH4	64.94	284.44	64.94	284.44		
						VOCs	3.01	13.17	3.01	13.17		
						TAPs (benzene)	0.01	0.03	0.01	0.03		
EP-L001, EP-L002	n/a	L001, L002	Loading (Condensate), Loading (Water)	N/A		VOCs	3.59	0.07	3.59	0.07	Gas/Vapor	MB
						hexane (110543)	0.05	0.00	0.05	0.00		
						CO2 Equivalent CO2 (124389), CH4	4.09	0.27	4.09	0.27		
						benzene (71432)	0.00	0.00	0.00	0.00		
						TAPs (benzene)	0.00	0.00	0.00	0.00		
EP-HR001	n/a	HR001	Haul Truck	N/A		PM, PM10, PM2.5	2.09	0.34	1.04	0.17	Solid	MB

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

Table 1: Emissions Data												
Emission Point ID No. <i>(Must match Emission Units Table &amp; Plot Plan)</i>	Emission Point Type <sup>1</sup>	Emission Unit Vented Through This Point <i>(Must match Emission Units Table &amp; Plot Plan)</i>		Air Pollution Control Device <i>(Must match Emission Units Table &amp; Plot Plan)</i>		All Regulated Pollutants - Chemical Name/CAS <sup>3</sup> <i>(Speciate VOCs &amp; HAPS)</i>	Maximum Potential Uncontrolled Emissions <sup>4</sup>		Maximum Potential Controlled Emissions <sup>5</sup>		Emission Form or Phase <i>(At exit conditions, Solid, Liquid or Gas/Vapor)</i>	Est. Method Used <sup>6</sup>
		ID No.	Source	ID No.	Device Type		lb/hr	ton/yr	lb/hr	ton/yr		
EC001	n/a	TANKCOND001-08 and TANKPW001-002and EC001	Condensate Tank and PW Tank and Enclosed Combustor	N/A	Enclosed Combustor	CO (630080)	0.00	0.00	0.03	0.13	Gas/Vapor/ Solid (for PM)	MB
						NOx (10102439)	0.00	0.00	0.03	0.15		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4	92.84	406.63	107.93	472.72		
						Toluene (108883)	0.01	0.05	0.00	0.00		
						ethyl benzene (100414)	0.01	0.03	0.00	0.00		
						hexane (110543)	4.26	18.68	0.09	0.37		
						o,m,p-xylenes (95476,108383,106423)	0.02	0.08	0.00	0.00		
						VOCs	25.07	109.82	0.50	2.20		
EP-PCV	valve	PCV	Pneumatic CV	N/A		hexane (110543)	0.01	0.04	0.01	0.04	Gas/Vapor	MB
						CO2 Equivalent CO2 (124389), CH4	5.42	23.74	5.42	23.74		
						VOCs	0.07	0.30	0.07	0.30		
EP-FWIENG001, EP-FWIENG002	n/a	FWIENG001, FWIENG002	Freshwater Inpoundment Engine	N/A		CO (630080)	1.18	5.19	1.18	5.19	Gas/Vapor/ Solid (for PM)	MB AP-42
						NOx (10102439)	6.53	28.62	6.53	28.62		
						CO2 Equivalent	1380.00	6044.39	1380.00	6044.39		
						PM,PM10, PM2.5	0.20	0.86	0.20	0.86		
						Acetaldehyde (75070)	0.01	0.03	0.01	0.03		
						Benzene (71432)	0.01	0.04	0.01	0.04		
						Formaldehyde (50000)	0.01	0.05	0.01	0.05		
						Total VOCs	3.02	13.21	3.02	13.21		
						Total SO <sub>2</sub>	2.46	10.78	2.46	10.78		

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.

- Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.
- 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).
- 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 (including CO<sub>2</sub> and methane), etc. **DO NOT LIST** H<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>, O<sub>2</sub>, and Noble Gases.
- 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).
- 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/20minute batch).
- 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).
- 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/m<sup>3</sup>) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO<sub>2</sub>, use units of ppmv (See 45CSR10).

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

Table 2: Release Parameter Data								
Emission Point ID No. <i>(Must match Emission Units Table)</i>	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (oF)	Volumetric Flow 1	Velocity (fps)	Ground Level <i>(Height above mean sea level)</i>	Stack Height 2 <i>(Release height of emissions above ground level)</i>	Northing	Easting
EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008	0.96	71	90	2.0723	1220	13	4348.47	528.20
F001	N/A	N/A	N/A	N/A	1220	varies from 4 to 8	4348.47	528.20
EP-L001, EP-L002	N/A	N/A	N/A	N/A	1220	N/A	4348.47	528.20
EP-HR001	N/A	N/A	N/A	N/A	1220	N/A	4348.47	528.20
EC001	3.92	900	5.59	0.008	1220	20	4348.47	528.20
EP-PCV	N/A	N/A	N/A	N/A	1220	N/A	4348.47	528.20
EP-FWIENG001, EP-FWIENG002	N/A	N/A	N/A	N/A	1220	N/A	4348.47	528.20

<sup>1</sup> Give at operating conditions. Include inerts.

<sup>2</sup> Release height of emissions above ground level.

# Attachment K

## Fugitive Emissions Data Summary Sheet

## Attachment K

### Description of Fugitive Emissions Pearl Jean Well Pad Antero Resources Corporation Doddridge County, West Virginia

Sources of fugitive emissions include loading operations, haul road emissions, equipment leaks, and pneumatic control valves. Fugitive emissions were calculated using AP-42 factors. Routine equipment leaks are assumed to be occurring continuously throughout the year. Loading operations and haul road emissions only occur when tanker trucks are onsite. The fugitives emissions summary is also located in Attachment O.

#### Equipment Leaks

Equipment include valves, flanges, and connectors installed in various process equipment such as gas production unit heaters, compressor, pipelines, and separators. Emissions are assumed to be occurring throughout the year. Detailed calculations are shown on Table 4.

#### Pneumatic Control Valves

Pneumatic control valves are part of the gas production unit heaters. These are intermittent low bleed valves and their emissions are assumed to be occurring throughout the year. Detailed calculations are shown on Table 5.

#### Loading Operations

Loading emissions occur when condensate and produced water are transferred out of the well site via tanker trucks. Fugitive emissions were estimated using AP-42 loading loss formula,  $L = 12.46 * SPM/T$ , and Bryan & Engineering (BR&E) software known as Promax. Detailed calculations are shown in Table 8.

#### Haul Road Emissions

Haul road emissions are emitted when tanker trucks or service vehicles enter the Facility. The Facility is flat and unpaved. Detailed calculations are shown on Table 12.



## Attachment K

### FUGITIVE EMISSIONS DATA SUMMARY SHEET

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

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

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

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS <sup>1</sup>	Maximum Potential Uncontrolled 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	
Haul Road/Road Dust Emissions Paved Haul Roads						
Unpaved Haul Roads						
Storage Pile Emissions						
Loading/Unloading Operations						
Wastewater Treatment Evaporation & Operations						
Equipment Leaks		Does not apply		Does not apply		
General Clean-up VOC Emissions						
Other						

<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 (including CO<sub>2</sub> and methane), 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 minutes (e.g. 5 lb VOC/20 minute 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 minutes (e.g. 5 lb VOC/20 minute 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).

**Attachment K  
Fugitive Emissions Data Summary Sheet**

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS 1	Maximum Potential Uncontrolled Emissions 2		Maximum Potential Controlled Emissions 3		Est. Method Used 4
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	n/a					
Unpaved Haul Roads	PM, PM10, PM2.5	2.0856	0.3365	1.0428	0.1683	MB
Loading/Unloading Operations	VOCs	3.5911	0.0659	3.5911	0.0659	MB
	toluene (108883)	0.0002	0.0000	0.0002	0.0000	
	ethyl benzene (100414)	0.0003	0.0000	0.0003	0.0000	
	hexane (110543)	0.0508	0.0009	0.0508	0.0009	
	o,m,p-xylenes (95476,108383,106423)	0.0008	0.0000	0.0008	0.0000	
	CO2 Equivalent CO2 (124389), CH4	4.0905	0.2694	4.0905	0.2694	
	benzene (71432)	0.0000	0.0000	0.0000	0.0000	
	TAPs (benzene)	0.0000	0.0000	0.0000	0.0000	
Equipment Leaks (Components)	Benzene (71432)	Does not apply	0.0279	Does not apply	0.0279	MB
	Toluene (108883)		0.0868		0.0868	
	Ethyl benzene (100414)		0.0803		0.0803	
	Hexane (110543)		1.0790		1.0790	
	o,m,p-xylenes (95476,108383,106423)		0.2303		0.2303	
	CO2 Equivalent CO2 (124389), CH4		284.4389		284.4389	
	VOCs		13.1658		13.1658	
	TAPs (benzene)		0.0279		0.0279	
Equipment Leaks (PCVs)	toluene (108883)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MB
	ethyl benzene (100414)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	hexane (110543)	0.0082	0.0358	0.0082	0.0358	
	o,m,p-xylenes (95476,108383,106423)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	CO2 Equivalent CO2 (124389), CH4	5.4196	23.7380	5.4196	23.7380	
	VOCs	0.0687	0.3009	0.0687	0.3009	
	TAPs (benzene)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

1 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 (including CO<sub>2</sub> and methane), etc. DO NOT LIST H<sub>2</sub>, H<sub>2</sub>O, N<sub>2</sub>, O<sub>2</sub>, and Noble Gases.

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

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

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

# Attachment L

## Emission Unit Data Sheets

**Attachment L**

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

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

Identification Number (as assigned on <i>Equipment List Form</i> ):		EP-L001, EP-L002			
1. Loading Area Name:		CONDENSATE & PRODUCED WATER			
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): Tank Trucks					
3. Loading Rack or Transfer Point Data: Tanks to Hauling Trucks					
Number of pumps	2				
Number of liquids loaded	2				
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	2				
4. Does ballasting of marine vessels occur at this loading area? Does not apply					
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point: For hire tank trucks are used and are cleaned at the operator's dispatch terminal. These trucks are in dedicated service and cleaned only prior to repair or leak tests. Cleaning materials include water, steam, detergent, and solvents which are applied using hand held pressurized spray nozzles.					
6. Are cargo vessels pressure tested for leaks at this or any other location? Yes					
7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):					
Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.	
hours/day	5	5	5	5	
days/week	2	2	2	2	
weeks/quarter	13	13	13	13	
8. Bulk Liquid Data ( <i>add pages as necessary</i> ):					
Pump ID No.	P1	P2			
Liquid Name	CONDENSATE	Produced Water			
Max. daily throughput (1000 gal/day)	1.008	12.096			
Max. annual throughput (1000 gal/yr)	367.92	4,415.04			
Loading Method <sup>1</sup>	BF	BF			
Max. Fill Rate (gal/min)	168.00	168.00			
Average Fill Time (min/loading)	50.00	50.00			
Max. Bulk Liquid Temperature (°F)	72.10	72.10			
True Vapor Pressure <sup>2</sup>	0.84	0.45			
Cargo Vessel Condition <sup>3</sup>	U	U			
Control Equipment or Method <sup>4</sup>	None	None			
Minimum control efficiency (%)	0.00	0.00			

**Attachment L**

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

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

Maximum Emission Rate	Loading (lb/hr)	5.07	1.16				
	Annual (lb/yr)	0.09	0.25				
Estimation Method s		Promax	Promax				
1 BF = Bottom Fill    SP = Splash Fill    SUB = Submerged Fill							
2 At maximum bulk liquid temperature: 72.1F							
3 B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)							
4 List as many as apply (complete and submit appropriate <i>Air Pollution Control Device Sheets</i> ): CA = Carbon Adsorption VB = Dedicated Vapor Balance (closed system) ECD = Enclosed Combustion Device F = Flare TO = Thermal Oxidation or Incineration							
5 EPA = EPA Emission Factor as stated in AP-42 MB = Material Balance							
TM = Test Measurement based upon test data submittal MB, Efs							
<b>9. Proposed Monitoring, Recordkeeping, Reporting, and Testing</b> 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			
1) Visual inspection to ensure that loading connections from storage tanks to trucks are leak-free.				1) Maintain records of condensate transferred from storage tanks. 2) Maintain records of produced water transferred from storage tanks.			
REPORTING				TESTING			
N/A				N/A			
<b>MONITORING.</b> PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.							
<b>RECORDKEEPING.</b> PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.							
<b>REPORTING.</b> PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.							
<b>TESTING.</b> PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.							
10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty							
N/A							

### Attachment L: Leak Source Data Sheet

Source Category	Pollutant	Number of Source Components (1)	Number of Components Monitored by Frequency <sup>2</sup>	Average Time to Repair (days) (3)	Estimated Annual Emission Rate (lb/yr) (4)
Pumps (5)	light liquid VOC <sup>(6,7)</sup>				
	heavy liquid VOC <sup>8</sup>				
	Non-VOC <sup>9</sup>				
Valves (10)	Gas VOC	400		First attempt within 5 days of detection and final repair within 15 days	6,624.61
	Light Liquid VOC	416		First attempt within 5 days of detection and final repair within 15 days	19,210.33
	Heavy Liquid VOC	--			--
	Non-VOC	--			--
Safety Relief Valves (11)	Gas VOC	See Valves		First attempt within 5 days of detection and final repair within 15 days	see Valves
	Non VOC	See Valves		First attempt within 5 days of detection and final repair within 15 days	see Valves
Open-ended Lines (12)	VOC				
	Non-VOC				
Sampling Connections (13)	VOC				
	Non-VOC				
Compressors	VOC				
	Non-VOC				
Flanges	VOC	104		First attempt within 5 days of detection and final repair within 15 days	149.27
	Non-VOC			First attempt within 5 days of detection and final repair within 15 days	632.40
Other	VOC	472		First attempt within 5 days of detection and final repair within 15 days	347.42
	Non-VOC				1,471.85

**Attachment L**

**EMISSIONS UNIT DATA SHEET STORAGE TANKS (CONDENSATE)**

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

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

**I. GENERAL INFORMATION (required)**

1. Bulk Storage Area Name	COND TANK	2. Tank Name:	TANKCOND001-08
3. Tank Equipment Identification No. (as assigned on <i>Equipment List Form</i> )	TANKCOND001-08	4. Emission Point Identification No. (as assigned on <i>Equipment List Form</i> )	EC001
5. Date of Commencement of Construction (for existing tanks): 2014			
6. Type of change			
N/A			
7. Description of Tank Modification (if applicable)			
7A. Does the tank have more than one mode of operation? (e.g. Is there more than one product stored in the tank?)			
No			
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).			
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.):			

**II. TANK INFORMATION (required)**

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 400bbbls			
9A. Tank Internal Diameter (ft): 12		9B. Tank Internal Height (or Length) (ft): 20	
10A. Maximum Liquid Height (ft): 18		10B. Average Liquid Height (ft): 10	
11A. Maximum Vapor Space Height (ft): 18		11B. Average Vapor Space Height (ft): 10	
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights.: 400bbbls			
13A. Maximum annual throughput (gal/yr): 367,920		13B. Maximum daily throughput (gal/day): 1,008	
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 3			
15. Maximum tank fill rate (gal/min) 168.00			
16. Tank fill method Splash Fill			
17. Complete 17A and 17B for Variable Vapor Space Tank Systems Does Not Apply			
17A. Volume Expansion Capacity of System (gal)		17B. Number of transfers into system per year	
18. Type of tank (check all that apply):			
<input checked="" type="checkbox"/> Fixed Roof <input checked="" type="checkbox"/> vertical <input type="checkbox"/> horizontal <input checked="" type="checkbox"/> flat roof <input type="checkbox"/> cone roof <input type="checkbox"/> dome roof			
<input type="checkbox"/> other (describe)			
External Floating Roof <input type="checkbox"/> pontoon roof <input type="checkbox"/> double deck roof			
Domed External (or Covered) Floating Roof			
Internal Floating Roof <input type="checkbox"/> vertical column support <input type="checkbox"/> self-supporting			
Variable Vapor Space <input type="checkbox"/> lifter roof <input type="checkbox"/> diaphragm			
Pressurized <input type="checkbox"/> spherical <input type="checkbox"/> cylindrical			
Underground			
Other (describe)			



**Attachment L**  
**EMISSIONS UNIT DATA SHEET STORAGE TANKS (CONDENSATE)**

**III. TANK CONSTRUCTION & OPERATION INFORMATION** (optional if providing TANKS Summary Sheets)

19. Tank Shell Construction: Other (describe): steel		
20A. Shell Color: Green	20B. Roof Color: Green	20C. Year Last Painted 2014
21. Shell Condition (if metal and unlined): No Rust      Light Rust      Dense Rust      Not applicable		
22A. Is the tank heated?                      NO		
22B. If YES, provide the operating temperature (°F)		
22C. If YES, please describe how heat is provided to tank.		
23. Operating Pressure Range (psig): 0 psig, atmospheric		
24. Complete the following section for <b>Vertical Fixed Roof Tanks</b>		
24A. For dome roof, provide roof radius (ft)		
24B. For cone roof, provide slope (ft/ft)		
25. Complete the following section for <b>Floating Roof Tanks</b>		Does Not Apply
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type:      Metallic (Mechanical) Shoe Seal      Liquid Mounted Resilient Seal (check one)                      Vapor Mounted Resilient Seal                      Other (describe):		
25C. Is the Floating Roof equipped with a Secondary Seal?      YES      NO		
25D. If YES, how is the secondary seal mounted? (check one)      Shoe      Rim      Other (describe):		
25E. Is the Floating Roof equipped with a weather shield?      YES      NO		
25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED:      UNBOLTED COVER, GASKETED:      UNBOLTED COVER, UNGASKETED:		
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:      UNBOLTED COVER, GASKETED:      UNBOLTED COVER, UNGASKETED:		
COLUMN WELL		
BUILT-UP COLUMN –                      BUILT-UP COLUMN –                      PIPE COLUMN – FLEXIBLE		
SLIDING COVER, GASKETED:                      SLIDING COVER, UNGASKETED:                      FABRIC SLEEVE SEAL:		
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED:      PIPE COLUMN – SLIDING COVER, UNGASKETED:		
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED:                      SLIDING COVER, UNGASKETED:		
ROOF LEG OR HANGER WELL		
WEIGHTED      MECHANICAL ACTUATION, GASKETED:		
WEIGHTED      MECHANICAL ACTUATION, UNGASKETED:		
SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)		
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED:      WEIGHTED MECHANICAL ACTUATION, UNGASKETED:		
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED:      WEIGHTED MECHANICAL ACTUATION, UNGASKETED:		
DECK DRAIN (3-INCH DIAMETER)		
OPEN:                      90% CLOSED:		
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		
26. Complete the following section for Internal Floating Roof Tanks		Does Not Apply
26A. Deck Type:      Bolted      Welded		
26B. For Bolted decks, provide deck construction:		

**Attachment L**  
**EMISSIONS UNIT DATA SHEET STORAGE TANKS (CONDENSATE)**

26C. Deck seam: Continuous sheet construction 5 feet wide Continuous sheet construction 6 feet wide Continuous sheet construction 7 feet wide Continuous sheet construction 5 × 7.5 feet wide Continuous sheet construction 5 × 12 feet wide Other (describe)			
26D. Deck seam length (ft)		26E. Area of deck (ft <sup>2</sup> )	
For column supported tanks: 26F. Number of columns:		26G. Diameter of each column:	
<b>IV. SITE INFORMATION</b> (optional if providing TANKS Summary Sheets)			
27. Provide the city and state on which the data in this section are based.: Charleston, WV			
28. Daily Average Ambient Temperature (°F): 55.3			
29. Annual Average Maximum Temperature (°F): 65.9 75.94			
30. Annual Average Minimum Temperature (°F): 44.6 65.9			
31. Average Wind Speed (miles/hr): 18.5mph			
32. Annual Average Solar Insulation Factor (BTU/(ft <sup>2</sup> -day)) 1030.236			
33. Atmospheric Pressure (psia): 14.8 (based off local conditions, could not find annual)			
<b>V. LIQUID INFORMATION</b> (optional if providing TANKS Summary Sheets)			
34. Average daily temperature range of bulk liquid:			
34A. Minimum (°F): 39.5		34B. Maximum (°F) 63.8	
35. Average operating pressure range of tank: atmosphere			
35A. Minimum (psig) 0		35B. Maximum (psig) 0	
36A. Minimum Liquid Surface Temperature (°F) 39.5		36B. Corresponding Vapor Pressure (psia) 0.3705	
37A. Average Liquid Surface Temperature (°F) 51.7		37B. Corresponding Vapor Pressure (psia) 0.5092	
38A. Maximum Liquid Surface Temperature (°F) 63.8		38B. Corresponding Vapor Pressure (psia) 0.6879	
39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
39A. Material Name or Composition		Condensate	
39B. CAS Number		mix of HC	
39C. Liquid Density (lb/gal)		5.98	
39D. Liquid Molecular Weight (lb/lb-mole)		111.40	
39E. Vapor Molecular Weight (lb/lb-mole)		42.61	
Maximum Vapor Pressure		0.8389	
39F. True (psia)			
39G. Reid (psia)		1.65	
Months Storage per Year		year round	
39H. From			
39I. To			

**Attachment L**

**EMISSIONS UNIT DATA SHEET STORAGE TANKS (CONDENSATE)**

**VI. EMISSIONS AND CONTROL DEVICE DATA** (required)

40. Emission Control Devices (check as many as apply): Other <sup>1</sup> (describe): Flare Combustor <sup>1</sup> Complete appropriate Air Pollution Control Device Sheet.					
41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).					
<b>Material Name &amp; CAS No.</b>	<b>Breathing Loss (lb/hr)</b>	<b>Working Loss</b>		<b>Annual Loss (lb/yr)</b>	<b><sup>1</sup> Estimation Method</b>
<i>Please see Table 6 and 7</i>					

<sup>1</sup> EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

Remember to attach emissions calculations, including TANKS Summary Sheets if applicable.

**Attachment L**

**EMISSIONS UNIT DATA SHEET STORAGE TANKS (PRODUCED WATER)**

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

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

**I. GENERAL INFORMATION (required)**

1. Bulk Storage Area Name: PWTANK	2. Tank Name: TANKPW001-002
3. Tank Equipment Identification No. (as assigned on <i>Equipment List Form</i> ) TANKPW001-002	4. Emission Point Identification No. (as assigned on <i>Equipment List Form</i> ) EC001
5. Date of Commencement of Construction (for existing tanks): 2014	
6. Type of change N/A	
7. Description of Tank Modification (if applicable)	
7A. Does the tank have more than one mode of operation? (e.g. Is there more than one product stored in the tank?) No	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.):	

**II. TANK INFORMATION (required)**

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 400bbls	
9A. Tank Internal Diameter (ft): 12	9B. Tank Internal Height (or Length) (ft): 20
10A. Maximum Liquid Height (ft): 18	10B. Average Liquid Height (ft): 10
11A. Maximum Vapor Space Height (ft): 18	11B. Average Vapor Space Height (ft): 10
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights.: 400	
13A. Maximum annual throughput (gal/yr): 4,415,040	13B. Maximum daily throughput (gal/day): 12,096
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 132	
15. Maximum tank fill rate (gal/min) 168.00	
16. Tank fill method Splash Fill	
17. Complete 17A and 17B for Variable Vapor Space Tank Systems Does Not Apply	
17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year
18. Type of tank (check all that apply): <input checked="" type="checkbox"/> Fixed Roof <input checked="" type="checkbox"/> vertical <input type="checkbox"/> horizontal <input checked="" type="checkbox"/> flat roof <input type="checkbox"/> cone roof <input type="checkbox"/> dome roof <input type="checkbox"/> other (describe) External Floating Roof <input type="checkbox"/> pontoon roof <input type="checkbox"/> double deck roof Domed External (or Covered) Floating Roof Internal Floating Roof <input type="checkbox"/> vertical column support <input type="checkbox"/> self-supporting Variable Vapor Space <input type="checkbox"/> lifter roof <input type="checkbox"/> diaphragm Pressurized <input type="checkbox"/> spherical <input type="checkbox"/> cylindrical Underground Other (describe)	

**Attachment L**  
**EMISSIONS UNIT DATA SHEET STORAGE TANKS (PRODUCED WATER)**

<b>III. TANK CONSTRUCTION &amp; OPERATION INFORMATION</b> (optional if providing TANKS Summary Sheets)		
19. Tank Shell Construction: Other (describe): steel		
20A. Shell Color: Green	20B. Roof Color: Green	20C. Year Last Painted 2014
21. Shell Condition (if metal and unlined): No Rust		
22A. Is the tank heated? NO		
22B. If YES, provide the operating temperature (°F)		
22C. If YES, please describe how heat is provided to tank.		
23. Operating Pressure Range (psig): Opsig, atmospheric		
24. Complete the following section for <b>Vertical Fixed Roof Tanks</b>		
24A. For dome roof, provide roof radius (ft)		
24B. For cone roof, provide slope (ft/ft):		
25. Complete the following section for <b>Floating Roof Tanks</b>		Does Not Apply
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type: Metallic (Mechanical) Shoe Seal Liquid Mounted Resilient Seal (check one) Vapor Mounted Resilient Seal Other (describe):		
25C. Is the Floating Roof equipped with a Secondary Seal? YES NO		
25D. If YES, how is the secondary seal mounted? (check one) Shoe Rim Other (describe):		
25E. Is the Floating Roof equipped with a weather shield? YES NO		
25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED: UNBOLTED COVER, GASKETED: UNBOLTED COVER, UNGASKETED:		
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED: UNBOLTED COVER, GASKETED: UNBOLTED COVER, UNGASKETED:		
COLUMN WELL		
BUILT-UP COLUMN – BUILT-UP COLUMN – PIPE COLUMN – FLEXIBLE		
SLIDING COVER, GASKETED: SLIDING COVER, UNGASKETED: FABRIC SLEEVE SEAL:		
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED: PIPE COLUMN – SLIDING COVER, UNGASKETED:		
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED: SLIDING COVER, UNGASKETED:		
ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:		
WEIGHTED MECHANICAL ACTUATION, UNGASKETED:		
SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)		
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED: WEIGHTED MECHANICAL ACTUATION, UNGASKETED:		
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED: WEIGHTED MECHANICAL ACTUATION, UNGASKETED:		
DECK DRAIN (3-INCH DIAMETER)		
OPEN: 90% CLOSED:		
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		
26. Complete the following section for Internal Floating Roof Tanks		Does Not Apply
26A. Deck Type: Bolted Welded		
26B. For Bolted decks, provide deck construction:		

**Attachment L**  
**EMISSIONS UNIT DATA SHEET STORAGE TANKS (PRODUCED WATER)**

26C. Deck seam: Continuous sheet construction 5 feet wide Continuous sheet construction 6 feet wide Continuous sheet construction 7 feet wide Continuous sheet construction 5 × 7.5 feet wide Continuous sheet construction 5 × 12 feet wide Other (describe)	
26D. Deck seam length (ft)	26E. Area of deck (ft <sup>2</sup> )
For column supported tanks: 26F. Number of columns:	26G. Diameter of each column:

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

27. Provide the city and state on which the data in this section are based.: Charleston, WV	
28. Daily Average Ambient Temperature (°F):	55.3
29. Annual Average Maximum Temperature (°F):	75.94
30. Annual Average Minimum Temperature (°F):	65.9
31. Average Wind Speed (miles/hr):	18.5mph
32. Annual Average Solar Insolation Factor (BTU/(ft <sup>2</sup> -day))	1030.236
33. Atmospheric Pressure (psia):	14.8

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

34. Average daily temperature range of bulk liquid: 51.7			
34A. Minimum (°F):	39.5	34B. Maximum (°F):	63.8
35. Average operating pressure range of tank: atmosphere		atmosphere	
35A. Minimum (psig):	0	35B. Maximum (psig):	0
36A. Minimum Liquid Surface Temperature (°F):	39.5	36B. Corresponding Vapor Pressure (psia):	0.1834
37A. Average Liquid Surface Temperature (°F):	51.7	37B. Corresponding Vapor Pressure (psia):	0.2592
38A. Maximum Liquid Surface Temperature (°F)	63.8	38B. Corresponding Vapor Pressure (psia):	0.3594
39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
39A. Material Name or Composition	Produced Water		
39B. CAS Number	mix of HC and water		
39C. Liquid Density (lb/gal)	8.33		
39D. Liquid Molecular Weight (lb/lb-mole)	18.0156		
39E. Vapor Molecular Weight (lb/lb-mole)	18.4214		
Maximum Vapor Pressure	0.4460		
39F. True (psia)			
39G. Reid (psia)	1.022		
Months Storage per Year	year round		

**Attachment L**

**EMISSIONS UNIT DATA SHEET STORAGE TANKS (PRODUCED WATER)**

**VI. EMISSIONS AND CONTROL DEVICE DATA (required)**

40. Emission Control Devices (check as many as apply): Other <sup>1</sup> (describe): Flare Combustor <sup>1</sup> Complete appropriate Air Pollution Control Device Sheet.					
41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).					
Material Name & CAS No.	Breathing Loss (lb/hr)	Working Loss Amount   Units		Annual Loss (lb/yr)	<sup>1</sup> Estimation Method
<i>Please See Table 6 and 7</i>					

<sup>1</sup> EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

Remember to attach emissions calculations, including TANKS Summary Sheets if applicable.

## Attachment L: Natural Gas Fired Fuel Burning Units Emission Data Sheet

Complete the information on this data for each Gas Producing Unit(s), Heater Treater(s), and in-line heater(s) at the production pad. Reboiler information should be entered on the Glycol Dehydration Emission Unit Data Sheet.

Emission Unit ID # <sup>1</sup>	Emission Point ID# <sup>2</sup>	Emission Unit Description (Manufacturer / Model #)	Year Installed/ Modified	Type <sup>3</sup> and Date of Change	Control Device <sup>4</sup>	Design Heat Input (mmBtu/hr) <sup>5</sup>	Fuel Heating Value (Btu/scf) <sup>6</sup>
H001	EP-H001	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H002	EP-H002	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H003	EP-H003	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H004	EP-H004	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H005	EP-H005	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H006	EP-H006	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H007	EP-H007	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
H008	EP-H008	Gas Production Unit Heater	NEW	NA	--	1.00	1,247.06
ENG001	EP-ENG001	Engine (Kubota DG972-E2)	2014	Removal	--	--	1,247.06
EC001	EC001	Enclosed Combustor (Abutec-200)	NEW	NA	EC001	18.4	1,247.06

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

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

<sup>3</sup> New, modification, removal.

<sup>4</sup> Complete appropriate air pollution control device sheet for any control device.

<sup>5</sup> Enter design heat input capacity in mmBtu/hr.

<sup>6</sup> Enter the fuel heating value in Btu/standard cubic foot.



## Attachment L: Diesel Burning Units Emission Data Sheet

*Complete the information on this data for each Diesel Engine and Diesel fueled equipment*

Emission Unit ID # <sup>1</sup>	Emission Point ID# <sup>2</sup>	Emission Unit Description (Manufacturer / Model #)	Year Installed/ Modified	Type <sup>3</sup> and Date of Change	Control Device <sup>4</sup>	Design Capacity
FWIENG001	EP-FWIENG001	Freshwater Inpoundment Engine	2015	New	--	600 HP
FWIENG002	EP-FWIENG002	Freshwater Inpoundment Engine	2015	New	--	600 HP

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

<sup>2</sup> Enter the appropriate Emission Point identification numbers for each fuel burning unit located at the production pad.

<sup>3</sup> New, modification, removal.

<sup>4</sup> Complete appropriate air pollution control device sheet for any control device.

<sup>5</sup> Enter design heat input capacity in mmBtu/hr.

## Attachment L

### FUGITIVE EMISSIONS FROM UNPAVED HAULROADS

*UNPAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)*

PM-10

k =	Particle size multiplier		0.80	0.36					
s =	Silt content of road surface material (%)		5.1	5.1					
p =	Number of days per year with precipitation >0.01 in.		150	150					
Item Number	Description	Number of Wheels	Mean Vehicle Weight (tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1	Tanker Trucks Condensate	10	40	10	0.25	1.0	44	N/A	50
2	Tanker Trucks PW	10	40	10	0.25	1.0	526	N/A	50
3	Well Pad Pick Up Truck	4	3	10	0.21	1.0	730	N/A	50
4	FWI Pick Up Truck	4	3	10	0.30	1.0	730	N/A	50
5									
6									
7									
8									

**Source:** AP-42 Fifth Edition – 13.2.2 Unpaved Roads

$E = k \times 5.9 \times (s \div 12) \times (S \div 30) \times (W \div 3)0.7 \times (w \div 4)0.5 \times ((365 - p) \div 365) =$  lb/Vehicle Mile Traveled (VMT) Where:

PM

PM-10

k =	Particle size multiplier		0.80	0.36
s =	Silt content of road surface material (%)		5.1	5.1
S =	Mean vehicle speed (mph)		10	10
W =	Mean vehicle weight (tons)		21	21
w =	Mean number of wheels per vehicle		7	7
p =	Number of days per year with precipitation >0.01 in.		150	150

For lb/hr:  $[lb \div VMT] \times [VMT \div trip] \times [Trips \div Hour] =$  lb/hr

For TPY:  $[lb \div VMT] \times [VMT \div trip] \times [Trips \div Hour] \times [Ton \div 2000 lb] =$  Tons/year

#### SUMMARY OF UNPAVED HAULROAD EMISSIONS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1	0.9544	0.0210	0.4772	0.0105	0.4295	0.0094	0.2147	0.0047
2	0.9544	0.2510	0.4772	0.1255	0.4295	0.1130	0.2147	0.0565
3	0.0728	0.0266	0.0364	0.0133	0.0328	0.0120	0.0164	0.0060
4	0.1040	0.0380	0.0520	0.0190	0.0468	0.0171	0.0234	0.0085
5								
6								
7								
8								
TOTALS	2.0856	0.3365	1.0428	0.1683	0.9385	0.1514	0.4693	0.0757

**Attachment L**

**EMISSIONS UNIT DATA SHEET CHEMICAL PROCESS  
EMERGENCY VENT SUMMARY SHEET**

List below all emergency relief devices, rupture disks, safety relief valves, and similar openings that will vent only under abnormal conditions.

Emission Point ID <sub>1</sub>	Relief Vents (type) & Set Pressure (psig)	Name of Chemical(s) or Pollutants Controlled	Worst Case Emission per Release Event (lbs/lb)
EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008	3 per heater	CO (630080)	0.54
		NOx (10102439)	0.64
		Pb (7439-92-1)	0.00
		CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	774.39
		SO2 (7446095)	0.0038
		PM, PM10, PM2.5	0.0488
		Benzene (71432)	1.35E-05
		Toluene (108883)	2.18E-05
		Hexane (110543)	0.0115
		Formaldehyde (50000)	0.0005
		2-Methylnaphthalene (91576)	1.54E-07
		Dichlorobenzene (95501)	7.70E-06
		Fluoranthene (206440)	1.92E-08
		Fluorene (86737)	1.80E-08
		Naphthalene (91203)	3.91E-06
		Phenanthrene (85018)	1.09E-07
		Total VOCs	0.0353
N/A -- Separator vents	2 valves per separator	N2	330.93
		CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	744450.38
		H2S	0.00
		methane	29771.85
		ethane	10206.64
		propane	4746.93
		Isobutane	791.64
		n-butane	1658.20
		Isopentane	656.41
		n-pentane	516.07
		2-methylpentane	9.92
		3-methylpentane	7.11
		Hexane (110543)	1146.48
		methylcyclopentane	3.75
		Benzene (71432)	1.05
		2-methylhexane	12.71
		3-methylhexane	10.51
		heptane	22.60
		methylcyclohexane	14.45
		Toluene (108883)	3.26
		Octane	56.53
		Ethylbenzene (100414)	3.02
		m-xylene (108383)	4.03
		o-xylene (95476)	4.62
		Nonane	34.83
		C10+	93.36
		HAPs	1162.45
Total VOCs	9797.48		

**Attachment L**

**EMISSIONS UNIT DATA SHEET CHEMICAL PROCESS  
EMERGENCY VENT SUMMARY SHEET**

List below all emergency relief devices, rupture disks, safety relief valves, and similar openings that will vent only under abnormal conditions.

Emission Point ID <sup>1</sup>	Relief Vents (type) & Set Pressure (psig)	Name of Chemical(s) or Pollutants Controlled	Worst Case Emission per Release Event (lbs/lb)
N/A -- Tank vents	1 enardo valve per two (400bbbls) tank	Propane	7.96
		Isobutane	2.19
		n-Butane	5.36
		Isopentane	2.60
		n-Pentane	2.13
		2-Methylpentane	0.04
		3-Methylpentane	0.03
		Hexane (110543)	4.26
		Methylcyclopentane	0.02
		Benzene (71432)	0.00
		2-Methylhexane	0.04
		3-Methylhexane	0.04
		Heptane	0.08
		Methylcyclohexane	0.05
		Toluene (108883)	0.01
		Octane	0.15
		Ethylbenzene (100414)	0.01
		m-xylene (108383)	0.01
		o-xylene (95476)	0.01
		Nonane	0.05
C10+	0.01		
CO2e	92.84		
HAPs	4.31		
Total VOCs	25.07		

All routine vents (non-emergency) should be listed on the *Emission Points Data Summary Sheet*.

<sup>1</sup> Indicate the emission point, if any, to which source equipment normally vents. Do not assign emission point ID numbers to each emergency relief vent or device.

<sup>2</sup> List all emergency relief devices next to the piece of equipment from which they control releases.

# **Attachment M**

## **Air Pollution Control Device**

**Attachment M**  
**Air Pollution Control Device Sheet**  
**(COMBUSTOR SYSTEM)**

Control Device ID No. (must match Emission Units Table):

EC001

**Equipment Information**

1. Manufacturer: Model No. Abutech-200		2. Method: Enclosed Combustor	
3. 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.			
4. Method of system used: Non-assisted			
5. Maximum capacity of flare:  200,000 scfd		6. Dimensions of stack: Diameter: 3.92 ft. Height: 20 ft.	
7. Estimated combustion efficiency: (Waste gas destruction efficiency) Estimated: 98 % Minimum guaranteed: 98 %		8. Fuel used in burners: Natural Gas	
9. Number of burners: 1 Rating: 18.4 MMBTU/hr		11. Describe method of controlling flame: Uncontrolled - The vapor combustor is non-assisted - Pilot flame is monitored with a flare rectification system	
10. Will preheat be used? No			
12. Flare height: 20ft		14. Natural gas flow rate to flare pilot flame per pilot light: 12.6scf/hr	
13. Flare tip inside diameter: 3.92 ft			
15. Number of pilot lights: Total : 1		16. Will automatic re-ignition be used? Yes	
17. If automatic re-ignition will be used, describe the method: Based on monitoring system			
18. Is pilot flame equipped with a monitor? Yes If yes, what type? thermocouple			
19. Hours of unit operation per year: 8760			

**Steam Injection**

20. Will steam injection be used? No		21. Steam pressure Expected: PSIG Minimum	
22. Total Steam flow rate: LB/hr		23. Temperature: °F	
24. Velocity ft/sec		25. Number of jet streams	
26. Diameter of steam jets: in		27. Design basis for steam injected: LB steam/LB hydrocarbon	
28. How will steam flow be controlled if steam injection is used?			

Design Maximum:

**Characteristics of the Waste Gas Stream to be Burned**

3

29. Name	Quantity <sup>3</sup> Grains of H <sub>2</sub> S/100 ft	Quantity (scf/hr)	Source of Material
TANKCOND001-08	0	302.1399	Condensate vapor
TANKPW001-002	0	33.5112	Condensate vapor
30. Estimate total combustible to flare: (Maximum mass flow rate of waste gas)		335.6511 scf/hr	
31. Estimated total flow rate to flare including materials to be burned, carrier gases, auxiliary fuel, etc.:		348.2511 scf/hr	
32. Give composition of carrier gases: please see Tables 6 and 7 of Attachment N			
33. Temperature of emission stream: 900°F Heating value of emission stream: 2005.87 Btu/ft <sup>3</sup> Mean molecular weight of emission stream: MW = 42.61 lb/lb-mole		34. Identify and describe all auxiliary fuels to be burned. Natural gas 1221 Btu/ft <sup>3</sup>	

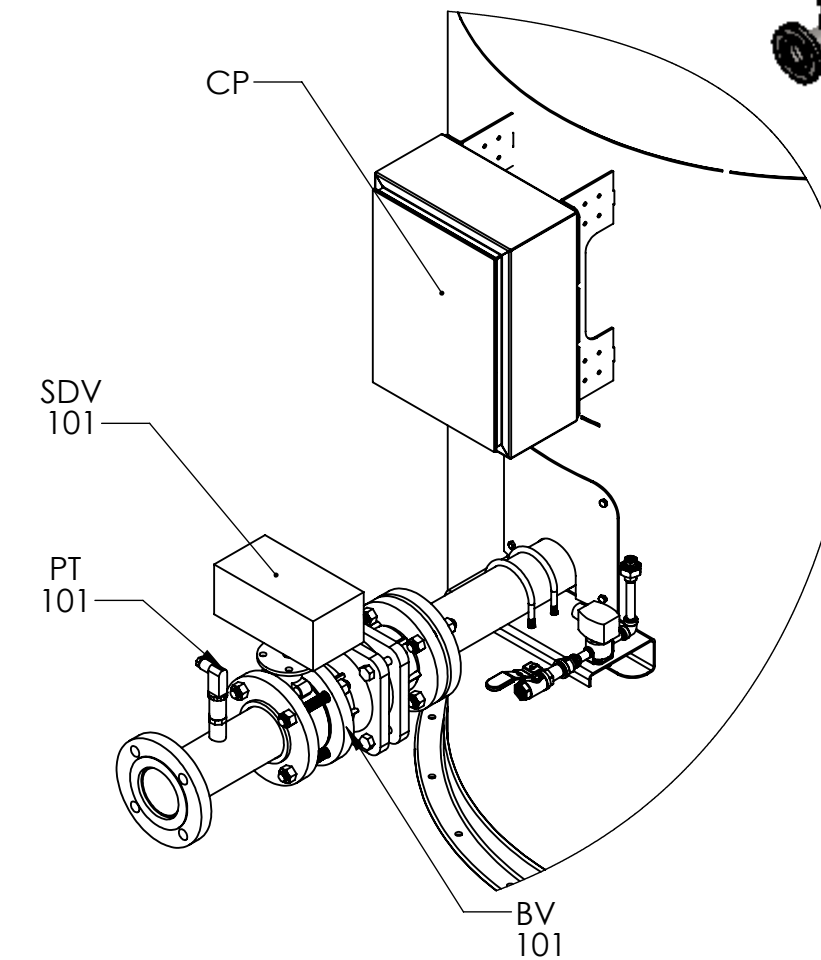
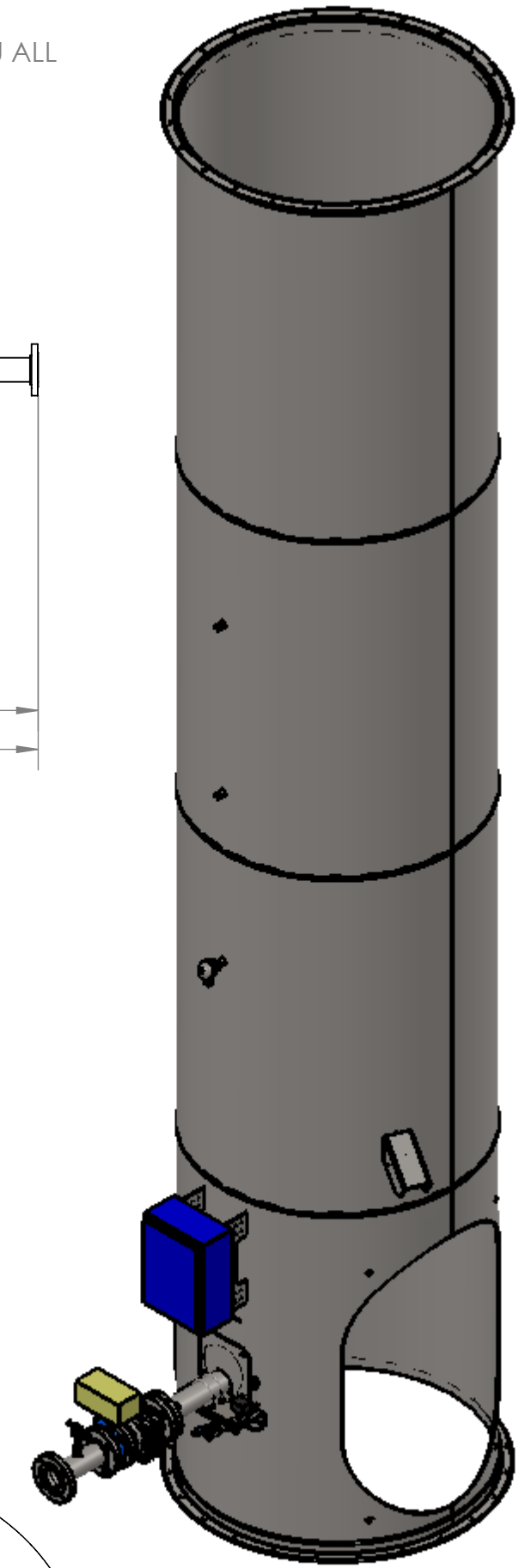
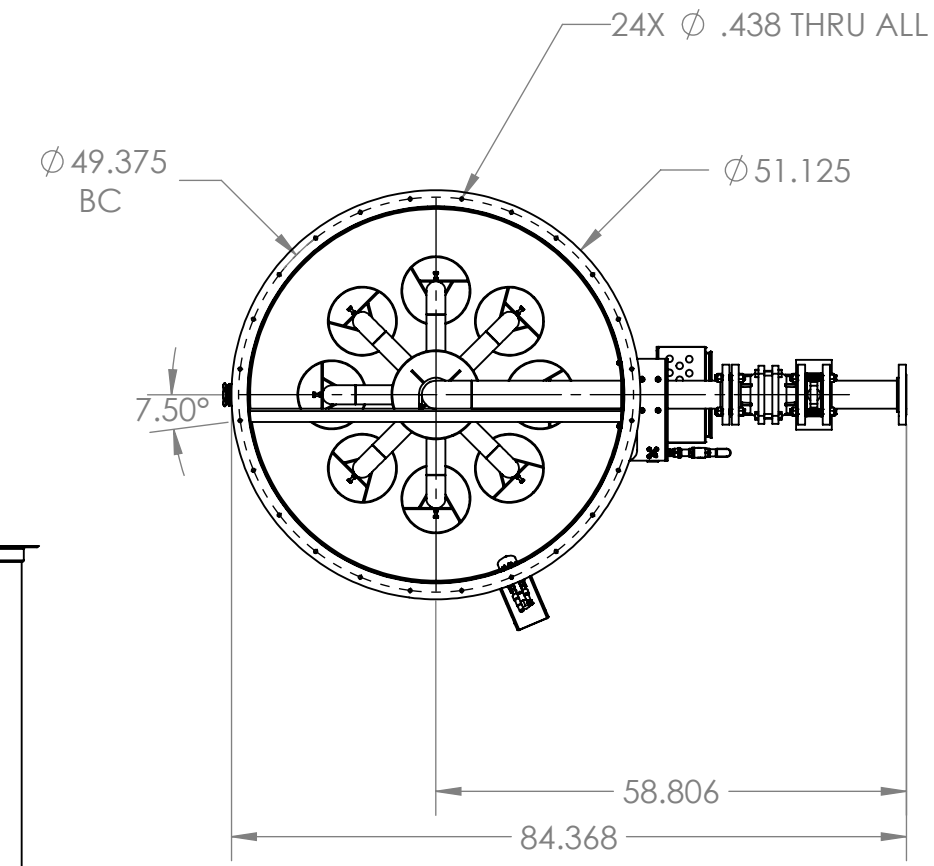
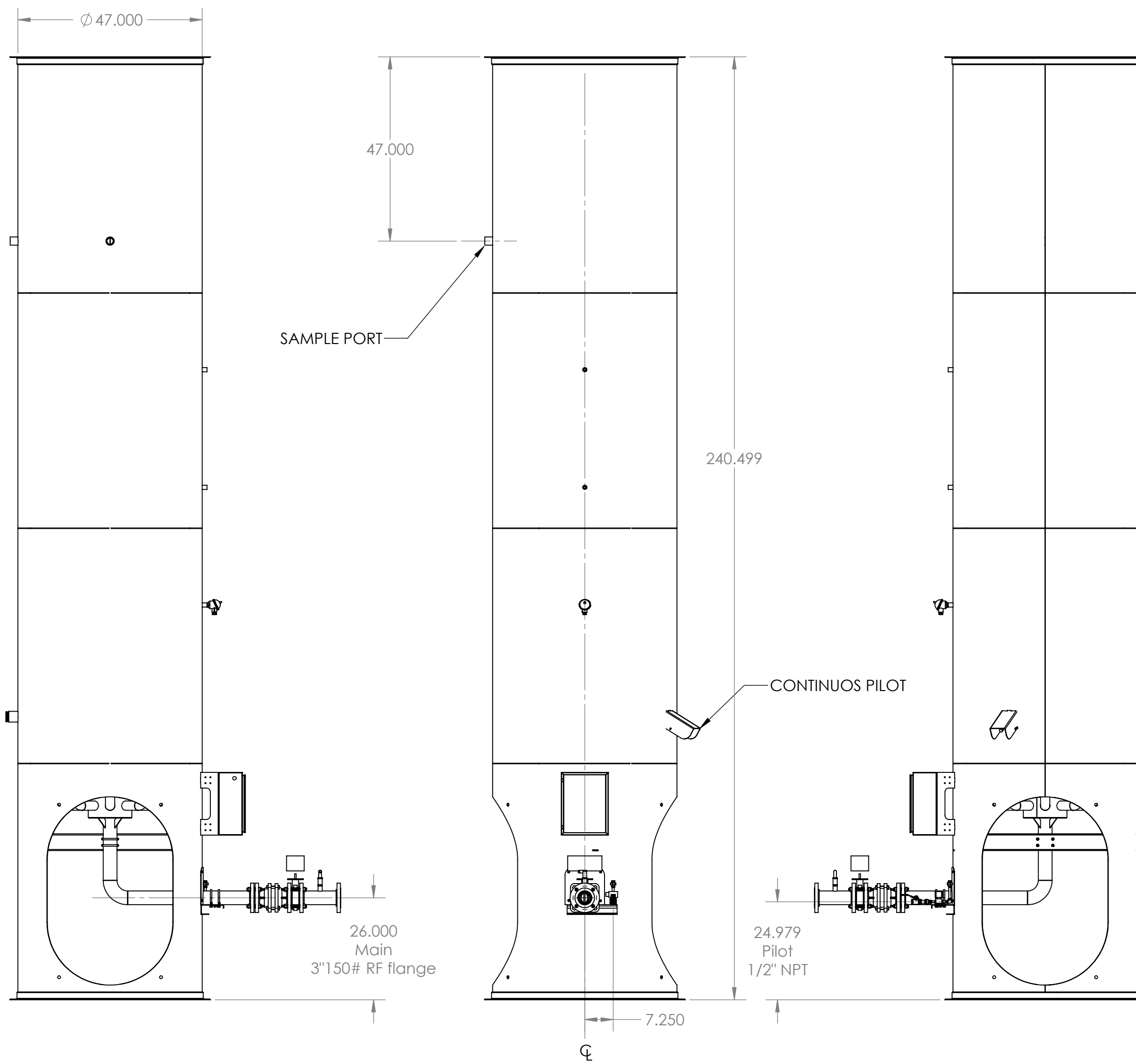
**Attachment M**  
**Air Pollution Control Device Sheet**  
**(COMBUSTOR SYSTEM)**

Control Device ID No. (must match Emission Units Table): EC001

35. Temperature of flare gas: 900 °F	36. Flare gas flow rate: 5.59 ascf/min
37. Flare gas heat content: 2005.87 Btu/ft3	38. Flare gas exit velocity: 0.08 scf/min
39. Maximum rate during emergency for one major piece of equipment or process unit: 131 35.55 lbs/hr	
40. Maximum rate during emergency for one major piece of equipment or process unit: 2300	
41. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification): n/a	
42. Describe the collection material disposal system: Daily or as needed, manually drain fuel gas scrubber and the Drip Pot into approved container and dispose/collect per guidelines.	
43. Have you included <i>Flare Control Device</i> in the Emissions Points Data Summary Sheet? YES	
<b>44. Proposed Monitoring, Recordkeeping, Reporting, and Testing</b> 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.	
<b>MONITORING:</b> 1) Report any period when visible emissions exceeded 5 minutes during any two-hour period. 2) Monitor the presence of pilot flame at all times with the Flame rectification system, a thermocouple equivalent. 3) Monitor visible emissions from the vapor combustor. 4) Monitor throughput to the vapor combustor.	<b>RECORDKEEPING:</b> 1) Record the times and duration of periods when the pilot flame was not present. 2) Records of throughput to the vapor combustor. 3) Records of vapor combustor malfunction or shutdown which resulted in excess emissions. 4) Records of vapor combustor inspection and maintenance activities conducted.
<b>REPORTING:</b> 1) Report any period when visible emissions exceeded 5 minutes during any two-hour period.	<b>TESTING:</b> N/A
<b>MONITORING:</b> 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. <b>RECORDKEEPING:</b> Please describe the proposed recordkeeping that will accompany the monitoring. <b>REPORTING:</b> Please describe any proposed emissions testing for this process equipment on air pollution control device. <b>TESTING:</b> Please describe any proposed emissions testing for this process equipment on air pollution control device.	
45. Manufacturer's Guaranteed Capture Efficiency for each air pollutant.	
NA	
46. Manufacturer's Guaranteed Control Efficiency for each air pollutant.	
98%	
47. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.	
Burner inspection and cleaning is recommended on a semi-annual schedule. With burner assembly removed from ECD, verify that all jets are clean and in good working order (replace any jets that are plugged, destroyed or missing).	

# General Arrangement Drawing

NOTE: This drawing is intended for your review and approval of the general arrangement for project ABUTEC 200. Some dimensions are subject to change during the final engineering phase of this project. "As Built" drawings will be provided at engineering completion.



PROPRIETARY AND CONFIDENTIAL

ALL IDEAS, DESIGNS, ARRANGMENTS, AND PLANS INDICATED OR REPRESENTED BY THIS DRAWING ARE OWNED BY ABUTEC LLC, AND WERE CREATED, DEVELOPED, AND DEVELOPED FOR USE ON AND IN CONNECTION WITH THE SPECIFIED PROJECT. NONE SUCH IDEAS, DESIGNS, ARRANGMENTS OR PLANS SHALL BE USED BY OR DISCLOSED TO AN PERSON, FIRM, OR CORPORATION FOR ANY PURPOSE WHATSOEVER WITHOUT THE WRITTEN PERMISSION OF ABUTEC LLC.

MATERIAL		UNLESS OTHERWISE SPECIFIED:		
DIMENSIONS ARE IN INCHES		TOLERANCES:		
FRACTIONAL ±		ANGULAR: MACH ± BEND ±		
TWO PLACE DECIMAL ±		THREE PLACE DECIMAL ±		
DRAWN	J. PHILLIPS	SIZE	DWG. NO.	REV
CHECKED	S. EGAN	<b>B</b>	ABUTEC-200 GAD	
ENG APPR.	HVP	SCALE: 1:24	WEIGHT: 1690.48	SHEET 1 OF 1





# Attachment N

## Supporting Emission Calculations

**Table 1**

**Facility Information  
Pearl Jean Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

**Oil and Gas Site General Information**

<b>Administrative Information</b>	
Company Name	Antero Resources Corporation
Facility/Well Name	Pearl Jean Well Pad
Nearest City/Town	Smithburg
API Number/SIC Code	1311
Latitude/Longitude	39.285147, -80.672978
County	Doddridge County

<b>Technical Information</b>	
Max Condensate Site Throughput (bbl/day):	24
Max Produced Water Site Throughput (bbl/day):	288
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	Yes

<b>Equipment/Processes at Site</b>	
<b>Equipment/Process Types</b>	<b>How many for this site?</b>
Fugitives	8
Turbines	0
Diesel Engines	2
Gas Processing Unit Heaters	8
Condensate Tanks	8
Produced Water Tanks	2
Miscellaneous Tanks	0
Loading Jobs	2
Glycol Units	0
Amine Units	0
Enclosed Combustor-Vapor Combustion Control Device	1

Table 2

**Uncontrolled/Controlled Emissions Summary**  
**Pearl Jean Well Pad**  
**Doddridge County, West Virginia**  
**Antero Resources Corporation**

Emission Source	VOC		NO <sub>x</sub>		CO <sub>2e</sub>		CO		SO <sub>2</sub>		PM <sub>2.5</sub>		PM <sub>10</sub>		Lead		Total HAPs		Benzene		Xylenes		Formaldehyde		
	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	
<b>UNCONTROLLED (Fugitives, Storage Tanks, Gas Production Unit Heaters)</b>																									
Fugitive Emissions (Component Count, PCV and Hauling) <sup>1</sup>	3.0746	13.4667			70.360	308.18							0.9385	0.1514			0.3516	1.5400	0.0064	0.0279	5.26E-02	2.30E-01			
Flashing, Working and Breathing (F/W/B) Losses <sup>2</sup>	25.07	109.8			92.8	406.6											4.306	18.858	0.0042	0.0185	0.0190	0.0832			
Engine Emissions <sup>3</sup>	3.0169	13.2141	6.5349	28.6229	1,380.00	6,044.39	1.1846	5.1884	2.4604	10.7764			0.1974	0.8647			0.0372	0.1628	0.0092	0.0401	0.0028	0.0122	0.0116	0.0507	
Gas Production Unit Heaters <sup>4</sup>	0.0353	0.1545	0.6415	2.8098	774.39	3,391.81	0.5389	2.3602	0.0038	0.0169	0.0488	0.2135	0.0488	0.2135	3.21E-06	1.40E-05	0.0121	0.0529	1.35E-05	5.90E-05			0.0005	0.0021	
<b>TOTALS:</b>	<b>31.1997</b>	<b>136.6548</b>	<b>7.1764</b>	<b>31.4327</b>	<b>2317.5814</b>	<b>10151.0064</b>	<b>1.7234</b>	<b>7.5487</b>	<b>2.4642</b>	<b>10.7932</b>	<b>0.0488</b>	<b>0.2135</b>	<b>1.1847</b>	<b>1.2297</b>	<b>3.21E-06</b>	<b>1.40E-05</b>	<b>4.7064</b>	<b>20.6140</b>	<b>0.0198</b>	<b>0.0865</b>	<b>0.0744</b>	<b>0.3257</b>	<b>0.0121</b>	<b>0.0528</b>	
<b>UNCONTROLLED (Truck Loading Emissions)</b>																									
Truck Loading Emissions <sup>5</sup>	3.591	0.066			4.091	0.269											0.0522	0.0010	3.94E-05	7.81E-07	0.0008	0.0000			
<b>CONTROLLED EMISSIONS</b>																									
Enclosed Combustor Emissions (from F/W/B losses) <sup>6</sup>	0.5015	2.1967	0.0348	0.1525	107.9270	472.7201	0.0293	0.1281	7.56E-06	3.31E-05	0.0020	0.0087	0.0026	0.0116	1.74E-07	7.63E-07	0.0861	0.3773	8.45E-05	3.70E-04	0.0004	0.0017	9.45E-07	4.14E-06	
Controlled Fugitive Emissions from Hauling													0.4693	0.0757											
<b>TOTALS:</b>	<b>0.5015</b>	<b>2.1967</b>	<b>0.0348</b>	<b>0.1525</b>	<b>107.9270</b>	<b>472.7201</b>	<b>0.0293</b>	<b>0.1281</b>	<b>7.56E-06</b>	<b>3.31E-05</b>	<b>0.0020</b>	<b>0.0087</b>	<b>0.4719</b>	<b>0.0873</b>	<b>1.74E-07</b>	<b>7.63E-07</b>	<b>0.0861</b>	<b>0.3773</b>	<b>0.0001</b>	<b>0.0004</b>	<b>0.0004</b>	<b>0.0017</b>	<b>9.45E-07</b>	<b>4.14E-06</b>	
<b>POTENTIAL TO EMIT<sup>7</sup></b>	<b>6.6283</b>	<b>29.0979</b>	<b>7.2112</b>	<b>31.5852</b>	<b>2332.6701</b>	<b>10217.3642</b>	<b>1.7527</b>	<b>7.6768</b>	<b>2.4642</b>	<b>10.7933</b>	<b>0.0507</b>	<b>0.2222</b>	<b>0.7181</b>	<b>1.1656</b>	<b>3.38E-06</b>	<b>1.48E-05</b>	<b>0.4870</b>	<b>2.1339</b>	<b>0.0156</b>	<b>0.0684</b>	<b>0.0557</b>	<b>0.2442</b>	<b>0.0121</b>	<b>0.0528</b>	
<b>Enter any notes here:</b>	<p>1 - See Tables 4 and 5 for fugitive emission calculations; Table 12 for PM emissions from hauling.</p> <p>2 - See Tables 6 and 7 for tanks emission calculations</p> <p>3 - See Table 13 for Fresh Water Impoundment (FWI) engines emission calculations</p> <p>4 - See Table 9 for gas production unit heater emission calculations</p> <p>5 - The maximum emission was calculated based on tank truck capacity of 200 barrels and actual fill rate of 50 minutes per tank truck. At a production rate of 24 barrels per day, VOC emissions would be 3.5911 pounds per hour. Average hourly VOC emissions from truck loading is 0.015 pound per hour.</p> <p>6 - See Table 10 and 11 for enclosed combustor emission calculations.</p> <p>7 - The hourly potential to emit is the sum of emissions from gas production unit heater, engine, storage tanks, fugitives and enclosed combustor. Does not include emissions from loading (see footnote 4). The total TPY PTE is the sum of all emissions. PM 10 TPY is the sum of uncontrolled hauling and other PM10 sources.</p>																								

**Table 3**

**Permit Summary  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation**

Pollutant		Emissions		Threshold	Threshold Exceeded?	
		Uncontrolled	Controlled		Uncontrolled	Controlled
VOC	lbs/hr	31.1997	6.6283	6	Yes	Yes
	tons/yr	136.7207	29.0979	10	Yes	Yes
NO <sub>x</sub>	lbs/hr	7.1764	7.2112	6	Yes	Yes
	tons/yr	31.4327	31.5852	10	Yes	Yes
CO	lbs/hr	1.7234	1.7527	6		
	tons/yr	7.5487	7.6768	10		
SO <sub>2</sub>	lbs/hr	2.4642	2.4642	6		
	tons/yr	10.7932	10.7933	10	Yes	Yes
PM <sub>2.5</sub>	lbs/hr	4.88E-02	5.07E-02	6		
	tons/yr	2.14E-01	2.22E-01	10		
PM <sub>10</sub>	lbs/hr	1.1847	0.7181	6		
	tons/yr	1.2297	1.1656	10		
Lead	lbs/hr	3.21E-06	3.38E-06	6		
	tons/yr	1.40E-05	1.48E-05	10		
Total HAPs	lbs/hr	4.7064	0.4870	2	Yes	
	tons/yr	20.6149	2.1339	5	Yes	
Total TAPs	lbs/hr	0.0318	0.0277	1.14		
n-Hexane	lbs/hr	4.5299	0.3514			
	tons/yr	19.8420	1.5399			
Toluene	lbs/hr	0.0350	0.0241			
	tons/yr	0.1531	0.1054			
Ethylbenzene	lbs/hr	0.0257	0.0185			
	tons/yr	0.1124	0.0810			
Xylenes	lbs/hr	0.0744	0.0557			
	tons/yr	0.3257	0.2442			
Benzene	lbs/hr	0.0198	0.0156			
	tons/yr	0.0865	0.0684			

<b>Enter any notes here:</b>	<p>1. Emissions are based on 98% Enclosed Combustor DRE operating 100% of the time.</p> <p>2. Please see Attachment J – Emission Points Data Summary Sheet and Attachment K- Fugitive Emissions Data Summary Sheet for sitewide sources and breakdown of emission quantities.</p>
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Table 4

Fugitive Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation

VOC Type:	Condensate VOC
Emission Type:	Steady State (continuous)

Gas Weight Fraction From Analysis:	VOC frac	0.191
	Benzene frac	0.000
	Toluene	0.000
	Ethylbenzene	0.000
	Xylenes	0.000
	n-Hexane	0.023
	Methane	0.603

Gas					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
400	Valves	Gas VOC	0.004500	0.34	6,624.61
		Non VOC	0.004500	1.46	28,064.99
472	Connectors	VOC	0.000200	0.02	347.42
		Non-VOC	0.000200	0.08	1,471.85
104	Flanges	VOC	0.000390	0.01	149.27
		Non-VOC	0.000390	0.03	632.40
<b>Total VOCs:</b>				0.37	7,121.30
<b>Total THC:</b>				1.93	37,290.55

Light Liquid Weight Fraction From Analysis:	VOC frac	0.958
	Benzene frac	0.003
	Toluene	0.009
	Ethylbenzene	0.008
	Xylenes	0.023
	n-hexane	0.065
	Methane	0.014

Light Liquid					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
416	Valves	Light Liquid VOC	0.002500	1.00	19,210.33
		Light Liquid Non-VOC		0.04	832.55
<b>Total VOC:</b>				1.00	19,210.33
<b>Total THC:</b>				1.04	20,042.88

Fugitive Total Emissions			
	Annual Emissions (lb/yr)	Annual Emissions (lb/hr)	Annual Emissions (tpy)
VOC	26,331.63	3.01	13.17
Ethylbenzene		0.02	0.08
Toluene		0.02	0.09
Xylenes		0.05	0.23
n-Hexane		0.25	1.08
TAPs (Benzene)		0.01	0.03
HAPs		0.34	1.50
CO <sub>2e</sub>	568,877.82	64.94	284.44

<b>Enter Notes Here:</b>	Fugitive emissions based on an estimated component count
	Global Warming Potentials from EPA site
	<u>Reference to Emission factors used:</u>
	1. Emission factors are for oil and gas production facilities (not refineries) come from the EPA's "Protocol for Equipment Leak Emission Estimates" November 1995, EPA 4531, R-95-017, Table 2-4.
	2. Percent of speciated VOCs used in fugitive calculations are based on the total hydrocarbons, not of the total sample.

Table 5

**Pneumatic Control Valve Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation**

Number of PCVs	24
Bleed Rate (scf/day/PCV)	6.6
Total Bleed Rate (scf/day)	158.4

Component	Mol%	Molecular Weight (lb/lb-mole)	Component Flow (scf/day)	Component Moles (lb-moles)	Component Emissions		
					(lbs/day)	(lbs/hr)	(tons/year)
H2S	0	34.08	0	0.00	0.00	0.00	0.00
Nitrogen	0.4946	14.01	0.7834464	0.00	0.03	0.00	0.01
Carbon Dioxide	0.1467	44.01	0.2323728	0.00	0.03	0.00	0.00
Methane	77.6927	16.04	123.0652368	0.32	5.20	0.22	0.95
Ethane	14.1987	30.07	22.4907408	0.06	1.78	0.07	0.33
Propane	4.4938	44.1	7.1181792	0.02	0.83	0.03	0.15
Isobutane	0.5666	58.12	0.8974944	0.00	0.14	0.01	0.03
n-Butane	1.1838	58.12	1.8751392	0.00	0.29	0.01	0.05
Isopentane	0.3749	72.15	0.5938416	0.00	0.11	0.00	0.02
n-Pentane	0.2914	72.15	0.4615776	0.00	0.09	0.00	0.02
2-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
3-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
n-Hexane	0.5451	86.18	0.8634384	0.00	0.20	0.01	0.04
Methylcyclopentane	0	84.16	0	0.00	0.00	0.00	0.00
Benzene	0	78.11	0	0.00	0.00	0.00	0.00
2-Methylhexane	0	100.2	0	0.00	0.00	0.00	0.00
3-Methylhexane	0	100.2	0	0.00	0.00	0.00	0.00
Heptane	0	100.21	0	0.00	0.00	0.00	0.00
Methylcyclohexane	0	98.186	0	0.00	0.00	0.00	0.00
Toluene	0	92.14	0	0.00	0.00	0.00	0.00
Octane	0	114.23	0	0.00	0.00	0.00	0.00
Ethylbenzene	0	106.17	0	0.00	0.00	0.00	0.00
m & p-Xylene	0	106.16	0	0.00	0.00	0.00	0.00
o-Xylene	0	106.16	0	0.00	0.00	0.00	0.00
Nonane	0	128.2	0	0.00	0.00	0.00	0.00
C10+	0	174.28	0	0.00	0.00	0.00	0.00

	lb/hr	tpy
VOC Emissions	0.0687	0.3009
Benzene Emissions	0.0000	0.0000
Toluene Emissions	0.0000	0.0000
Ethylbenzene Emissions	0.0000	0.0000
Xylene Emissions	0.0000	0.0000
n-Hexane Emissions	0.0082	0.0358
HAPs Emissions	0.0082	0.0358
TAPs Emissions	0.0000	0.0000
CO <sub>2e</sub> emissions	5.4196	23.7380

<b>Enter any notes here:</b>	1. PCV bleed rate obtained from the user manual for PCV <a href="http://issuu.com/rmcprocesscontrols/docs/mizer-pilot-operation--parts---installation-manual">http://issuu.com/rmcprocesscontrols/docs/mizer-pilot-operation--parts---installation-manual</a> 2. Emissions per hour= Mol % x no. of PCV x bleed rate x MW / 379.48 / 24
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Table 6

**Uncontrolled Flashing Emissions  
Pearl Jean Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

# Hours Operational	8760
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Component	Condensate Tank Flashing Losses			Produced Water Tank Flashing Losses		
	Vapor Mass Fraction wt%	Flashing Losses		Vapor Mass Fraction wt%	Flashing Losses	
		lbs/hr	tpy		lbs/hr	tpy
Water	0.0808	0.0237	0.1040	2.6423	0.0000	0.0000
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0339	0.0100	0.0437	0.3393	0.0055	0.0243
Carbon Dioxide	0.1491	0.0438	0.1917	2.6311	0.0430	0.1884
Methane	9.0285	2.6514	11.6133	57.8153	0.9451	4.1397
Ethane	17.1837	5.0464	22.1032	21.1967	0.3465	1.5177
Propane	22.1455	6.5035	28.4855	10.3894	0.1698	0.7439
Isobutane	6.2734	1.8423	8.0694	0.5902	0.0096	0.0423
n-Butane	15.3294	4.5018	19.7180	2.5657	0.0419	0.1837
Isopentane	7.5490	2.2169	9.7102	0.6663	0.0109	0.0477
n-Pentane	6.1973	1.8200	7.9715	0.5084	0.0083	0.0364
2-Methylpentane	0.1251	0.0367	0.1609	0.0044	0.0001	0.0003
3-Methylpentane	0.0897	0.0263	0.1154	0.0083	0.0001	0.0006
n-Hexane	14.3415	4.2117	18.4473	0.3918	0.0064	0.0281
Methylcyclopentane	0.0474	0.0139	0.0610	0.0123	0.0002	0.0009
Benzene	0.0131	0.0039	0.0169	0.0202	0.0003	0.0014
2-Methylhexane	0.1442	0.0423	0.1854	0.0043	0.0001	0.0003
3-Methylhexane	0.1185	0.0348	0.1524	0.0037	0.0001	0.0003
Heptane	0.2426	0.0712	0.3120	0.0078	0.0001	0.0006
Methylcyclohexane	0.1590	0.0467	0.2046	0.0270	0.0004	0.0019
Toluene	0.0344	0.0101	0.0443	0.0489	0.0008	0.0035
Octane	0.4374	0.1284	0.5626	0.0084	0.0001	0.0006
Ethylbenzene	0.0224	0.0066	0.0288	0.0312	0.0005	0.0022
m & p-Xylene	0.0276	0.0081	0.0355	0.0381	0.0006	0.0027
o-Xylene	0.0301	0.0088	0.0387	0.0428	0.0007	0.0031
Nonane	0.1501	0.0441	0.1931	0.0044	0.0001	0.0003
C10+	0.0461	0.0136	0.0594	0.0017	0.0000	0.0001
Total VOCs	73.524	21.59	94.6	15.375	0.2513	1.1009
Total CO <sub>2e</sub>		66.33	290.5		23.67	103.7
Total TAPs (Benzene)		0.0039	0.0169		0.0003	0.0014
Toluene		0.0101	0.0443		0.0008	0.0035
Ethylbenzene		0.0066	0.0288		0.0005	0.0022
Xylenes		0.0169	0.0742		0.0013	0.0058
n-Hexane		4.212	18.447		0.0064	0.0281
Total HAPs		4.249	18.612		0.0094	0.0410
Total	100.00	29.37	128.6	100.00	1.592	6.97

<b>Enter any notes here:</b>	Vapor mass fractions and Flashing losses from Promax output
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Table 7

## Uncontrolled Working and Breathing Losses

Pearl Jean Well Pad

Doddridge County, West Virginia

Antero Resources Corporation

Condensate Tank Information	
Number of Tanks	8
Maximum Working Losses (lbs/hr)	0.4422
Maximum Breathing Losses (lbs/hr)	4.1154

	Condensate Tank W/B Losses						
	Vapor Mass Fraction wt%	Working Losses		Breathing Losses		Max W/B Losses	
		lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0018	0.0000	0.0000	0.0001	0.0003	0.0001	0.0004
Carbon Dioxide	0.1874	0.0008	0.0036	0.0077	0.0338	0.0085	0.0374
Methane	2.4566	0.0109	0.0476	0.1011	0.4428	0.1120	0.4904
Ethane	26.4930	0.1172	0.5132	1.0903	4.7755	1.2074	5.2886
Propane	28.2405	0.1249	0.5470	1.1622	5.0905	1.2871	5.6375
Isobutane	7.4320	0.0329	0.1440	0.3059	1.3396	0.3387	1.4836
n-Butane	17.9810	0.0795	0.3483	0.7400	3.2411	0.8195	3.5894
Isopentane	8.2278	0.0364	0.1594	0.3386	1.4831	0.3750	1.6425
n-Pentane	6.6470	0.0294	0.1287	0.2736	1.1982	0.3029	1.3269
2-Methylpentane	0.1293	0.0006	0.0025	0.0053	0.0233	0.0059	0.0258
3-Methylpentane	0.0924	0.0004	0.0018	0.0038	0.0167	0.0042	0.0184
n-Hexane	1.0037	0.0044	0.0194	0.0413	0.1809	0.0457	0.2004
Methylcyclopentane	0.0457	0.0002	0.0009	0.0019	0.0082	0.0021	0.0091
Benzene	0.0008	0.0000	0.0000	0.0000	0.0001	0.0000	0.0002
2-Methylhexane	0.0098	0.0000	0.0002	0.0004	0.0018	0.0004	0.0020
3-Methylhexane	0.1214	0.0005	0.0024	0.0050	0.0219	0.0055	0.0242
Heptane	0.2299	0.0010	0.0045	0.0095	0.0414	0.0105	0.0459
Methylcyclohexane	0.1490	0.0007	0.0029	0.0061	0.0269	0.0068	0.0298
Toluene	0.0044	0.0000	0.0001	0.0002	0.0008	0.0002	0.0009
Octane	0.3775	0.0017	0.0073	0.0155	0.0680	0.0172	0.0754
Ethylbenzene	0.0053	0.0000	0.0001	0.0002	0.0010	0.0002	0.0011
m & p-Xylene	0.0084	0.0000	0.0002	0.0003	0.0015	0.0004	0.0017
o-Xylene	0.0079	0.0000	0.0002	0.0003	0.0014	0.0004	0.0016
Nonane	0.1176	0.0005	0.0023	0.0048	0.0212	0.0054	0.0235
C10+	0.0296	0.0001	0.0006	0.0012	0.0053	0.0014	0.0059
Total VOCs	70.861	0.3134	1.373	2.9162	12.7730	3.2296	14.146
Total CO <sub>2e</sub>		0.2724	1.1932	2.5352	11.1042	2.8076	12.297
Total TAPs (Benzene)		0.0000	0.0000	0.0000	0.0001	0.0000	0.0002
Toluene		0.0000	0.0001	0.0002	0.0008	0.0002	0.0009
Ethylbenzene		0.0000	0.0001	0.0002	0.0010	0.0002	0.0011
Xylenes		0.0001	0.0003	0.0007	0.0029	0.0007	0.0032
n-Hexane		0.0044	0.0194	0.0413	0.1809	0.0457	0.2004
Total HAPs		0.0046	0.0200	0.0424	0.1857	0.0470	0.2057
Total	100.00	0.4422	1.9369	4.1154	18.0254	4.5576	19.962



Table 7

## Uncontrolled Working and Breathing Losses

Pearl Jean Well Pad

Doddridge County, West Virginia

Antero Resources Corporation

Produced Water Tank Information	
Number of Tanks	2
Maximum Working Losses (lbs/hr)	0.0269
Maximum Breathing Losses (lbs/hr)	0.0083

Component	Produced Water Tank W/B Losses						
	Vapor Mass Fraction wt%	Working Losses		Breathing Losses		Max W/B Losses	
		lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0067	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Carbon Dioxide	3.5216	0.0009	0.0042	0.0003	0.0013	0.0012	0.0054
Methane	3.1916	0.0009	0.0038	0.0003	0.0012	0.0011	0.0049
Ethane	1.0797	0.0003	0.0013	0.0001	0.0004	0.0004	0.0017
Propane	0.1290	0.0000	0.0002	0.0000	0.0000	0.0000	0.0002
Isobutane	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Butane	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Isopentane	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Pentane	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Methylpentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3-Methylpentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Hexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Benzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Methylhexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3-Methylhexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heptane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Toluene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Octane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
m & p-Xylene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
o-Xylene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nonane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C10+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total VOCs	0.1366	0.0000	0.0002	0.0000	0.0000	0.0000	0.0002
Total CO <sub>2e</sub>		0.0224	0.0982	0.0069	0.0302	0.0293	0.1284
Total TAPs (Benzene)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Toluene		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ethylbenzene		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Hexane		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total HAPs		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	100.00	0.0269	0.1179	0.0083	0.0362	0.0352	0.1541

Enter any notes here:	Vapor mass fractions, working losses and breathing losses from Promax output
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Table 8

**Loading Emissions**  
**Pearl Jean Well Pad**  
**Doddridge County, West Virginia**  
**Antero Resources Corporation**

Annual Loading	Oil Truck Loading	Water Truck Loading
RVP	1.65	1.0220
Annual Average Temp (F)	72.1	72.1
S (saturation factor)	0.6	0.6
P (true vapor pressure)	0.84	0.45
M (MW of vapor)	42.61	18.42
Collection Efficiency (%)	0	0
Loading Loss (lb/10 <sup>3</sup> gal)*	0.50	0.12
Maximum Throughput (gallons/hr)	10,080	10,080
Average Throughput (gallons/yr)	367,920	4,415,040
Loading Emissions (lbs/hr)	5.07	1.16
Loading Emissions (tpy)	0.09	0.25

Component	Condensate Tank Loading Losses			Produced Water Tank Loading Losses		
	Vapor Mass Fraction wt%	Loading Losses		Vapor Mass Fraction wt%	Loading Losses	
		lbs/hr	tpy		lbs/hr	tpy
H2S	0.0000	0.00	0.00	0.0000	0.00E+00	0.00E+00
Nitrogen	0.0018	0.00	0.00	0.0067	7.85E-05	1.72E-05
Carbon Dioxide	0.1874	0.01	0.00	3.5216	4.10E-02	8.98E-03
Methane	2.4566	0.12	0.00	3.1916	3.72E-02	8.14E-03
Ethane	26.4930	1.34	0.02	1.0797	1.26E-02	2.75E-03
Propane	28.2405	1.43	0.03	0.1290	1.50E-03	3.29E-04
Isobutane	7.4320	0.38	0.01	0.0009	1.07E-05	2.34E-06
n-Butane	17.9810	0.91	0.02	0.0060	6.99E-05	1.53E-05
Isopentane	8.2278	0.42	0.01	0.0004	4.55E-06	9.96E-07
n-Pentane	6.6470	0.34	0.01	0.0002	2.53E-06	5.54E-07
2-Methylpentane	0.1293	0.01	0.00	0.0000	4.16E-09	9.11E-10
3-Methylpentane	0.0924	0.00	0.00	0.0000	1.90E-08	4.17E-09
n-Hexane	1.0037	0.05	0.00	0.0000	1.44E-08	3.16E-09
Methylcyclopentane	0.0457	0.00	0.00	0.0000	6.11E-08	1.34E-08
Benzene	0.0008	0.00	0.00	0.0000	3.07E-07	6.73E-08
2-Methylhexane	0.0098	0.00	0.00	0.0000	6.65E-11	1.46E-11
3-Methylhexane	0.1214	0.01	0.00	0.0000	8.55E-10	1.87E-10
Heptane	0.2299	0.01	0.00	0.0000	1.34E-09	2.93E-10
Methylcyclohexane	0.1490	0.01	0.00	0.0000	2.86E-08	6.26E-09
Toluene	0.0044	0.00	0.00	0.0000	3.58E-07	7.84E-08
Octane	0.3775	0.02	0.00	0.0000	2.82E-10	6.17E-11
Ethylbenzene	0.0053	0.00	0.00	0.0000	1.28E-07	2.81E-08
m & p-Xylene	0.0084	0.00	0.00	0.0000	1.75E-07	3.84E-08
o-Xylene	0.0079	0.00	0.00	0.0000	2.06E-07	4.51E-08
Nonane	0.1176	0.01	0.00	0.0000	6.96E-11	1.52E-11
C10+	0.0296	0.00	0.00	0.0000	2.17E-12	4.75E-13
Total VOCs	70.8611	3.590	0.066	0.1366	1.59E-03	3.48E-04
Total CO <sub>2e</sub>		3.121	0.0569		0.9700	0.2124
Total TAPs (Benzene)		0.0000	0.0000		0.0000	0.0000
Toluene		0.0002	0.0000		0.0000	0.0000
Ethylbenzene		0.0003	0.0000		0.0000	0.0000
Xylenes		0.0008	0.0000		0.0000	0.0000
n-Hexane		0.0508	0.0009		0.0000	0.0000
Total HAPs		0.0522	0.0010		0.0000	0.0000
Total	100.0000	5.0655	0.0924	100.0000	1.1643	0.2550

**Enter any notes here**

Vapor mass fractions and loading losses from Promax output

\*Using equation  $L_L = 12.46 * \text{SPM}/T$  from AP-42, Chapter 5, Section 5.2-4

MW was obtained by Promax; RVP was taken from laboratory reports

Annual Average Temp (F) obtained from Charleston, WV (preset in Promax)

S (saturation factor) is based on submerged loading, dedicated service as it was most representative

True vapor pressure (TVP) equation from AP-42, Chapter 7, Figure 7.1-13b

Loading emissions are vented to the atmosphere.

**Table 9**

**Gas Production Unit Heater Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation**

Number of Units	8
GPU Heater Rating (MMBtu/hr)	1.00
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,247

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	0.642	2.810
CO	84	0.539	2.360
CO <sub>2</sub>	120,000	769.811	3371.770
Lead	0.0005	3.21E-06	1.40E-05
N <sub>2</sub> O	2.2	0.014	0.062
PM (Total)	7.6	0.049	0.214
SO <sub>2</sub>	0.6	0.004	0.017
TOC	11	0.071	0.309
Methane	2.3	0.015	0.065
VOC	5.5	0.035	0.155
<b>HAPS</b>			
2-Methylnaphthalene	2.40E-05	1.54E-07	6.74E-07
Benzene	2.10E-03	1.35E-05	5.90E-05
Dichlorobenzene	1.20E-03	7.70E-06	3.37E-05
Fluoranthene	3.00E-06	1.92E-08	8.43E-08
Fluorene	2.80E-06	1.80E-08	7.87E-08
Formaldehyde	7.50E-02	4.81E-04	2.11E-03
Hexane	1.80E+00	1.15E-02	5.06E-02
Naphthalene	6.10E-04	3.91E-06	1.71E-05
Phenanathrene	1.70E-05	1.09E-07	4.78E-07
Toluene	3.40E-03	2.18E-05	9.55E-05

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.035	0.155
TOTAL Uncontrolled HAPs	0.012	0.053
TOTAL Uncontrolled TAPs (Benzene)	0.000	0.000
TOTAL Uncontrolled TAPs (Formaldehyde)	0.000	0.002
TOTAL CO <sub>2e</sub> Emissions	774.39	3,391.81

<b>Enter any notes here:</b>
All Emission Factors based off AP-42 Sec 1.4 Natural Gas Combustion

Table 10

**Enclosed Combustor Emissions  
Pearl Jean Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

General Information	
Unit Name:	EC001

Pollutant	Emission Factor (lb/MMscf)
NOx	100
CO	84
PM10	7.6
PM2.5	5.7
SO <sub>2</sub>	0.6
CO <sub>2</sub>	120,000
VOC	5.5
benzene	2.10E-03
Hexane	1.80E+00
Toluene	3.40E-03
Formaldehyde	7.50E-02
N <sub>2</sub> O	2.20
Lead	5.00E-04

Constants	
Btu/MMBtu	1,000,000
scf/MMscf	1,000,000
lb/ton	2,000
H <sub>2</sub> S molecular weight	34.08
SO <sub>2</sub> molecular weight	64.06
seconds/hour	3,600
inches/ft	12

Destruction Efficiency	
VOC percent destruction efficiency (%)	98
H <sub>2</sub> S percent destruction efficiency (%)	98

Enclosed Combustor operating hours	8760
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Stream Information							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor (Enter Name of Each Stream Here)	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
Maximum Expected Hourly Volumetric Flow Rate of Stream (scf/hr)	12.6	--	261.55	32.79	40.59	0.72	348.25
Maximum Expected Annual Volumetric Flow Rate of Stream (scf/yr)	110,376.00	--	2,291,171.04	287,209.58	355,574.57	6,348.66	3,050,679.86
Heating Content (Btu/ft <sup>3</sup> )	1,247		2,192.39	1,078.40	2,192.39	1,078.40	2,005.87

Mass Flow Rates of the Vapors Sent to this Control Device, Hourly Basis (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
H <sub>2</sub> S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	21.592	0.251	3.230	0.000	25.07
Benzene	-	-	0.004	0.000	0.000	0.000	0.004
Toluene	-	-	0.010	0.001	0.000	0.000	0.011
Ethylbenzene	-	-	0.007	0.001	0.000	0.000	0.007
Xylenes	-	-	0.017	0.001	0.001	0.000	0.019
n-Hexane	-	-	4.212	0.006	0.046	0.000	4.264
HAPs	-	-	4.249	0.009	0.047	0.000	4.306
Total Mass Flow	-	-	29.367	1.592	4.558	0.035	35.552
Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)							
H <sub>2</sub> S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	94.573	1.101	14.146	0.000	109.819
Benzene	-	-	0.017	0.001	0.000	0.000	0.019
Toluene	-	-	0.044	0.004	0.001	0.000	0.049
Ethylbenzene	-	-	0.029	0.002	0.001	0.000	0.032
Xylenes	-	-	0.074	0.006	0.003	0.000	0.083
n-Hexane	-	-	18.447	0.028	0.200	0.000	18.676
HAP	-	-	18.612	0.041	0.206	0.000	18.858
Total Mass Flow	-	-	128.629	6.971	19.962	0.154	155.716

Table 10

**Enclosed Combustor Emissions  
Pearl Jean Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

Controlled Emissions							
Hourly (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.001	-	0.026	0.003	0.004	0.000	0.03
CO	0.001	-	0.022	0.003	0.003	0.000	0.03
PM2.5	0.000	-	0.001	0.000	0.000	0.000	0.00
PM10	0.000	-	0.002	0.000	0.000	0.000	0.00
H2S	0.000	-	0.000	0.000	0.000	0.000	0.00
SO <sub>2</sub>	0.000	-	0.000	0.000	0.000	0.000	0.00
CO <sub>2</sub>	1.512	-	-	-	-	-	1.51
Total VOC	0.000	-	0.432	0.005	0.065	0.000	0.50
Benzene	0.000	-	0.000	0.000	0.000	0.000	0.00
Toluene	0.000	-	0.000	0.000	0.000	0.000	0.00
Ethylbenzene	0.000	-	0.000	0.000	0.000	0.000	0.00
Xylenes	0.000	-	0.000	0.000	0.000	0.000	0.00
n-Hexane	0.000	-	0.084	0.000	0.001	0.000	0.09
HAP	0.000	-	0.085	0.000	0.001	0.000	0.09
N <sub>2</sub> O	0.000	-	0.001	0.000	0.000	0.000	0.00
Lead	0.000	-	0.000	0.000	0.000	0.000	0.00
Formaldehyde	0.000	-	-	-	-	-	0.00
Annual (tpy)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.006	-	0.115	0.014	0.018	0.000	0.15
CO	0.005	-	0.096	0.012	0.015	0.000	0.13
PM2.5	0.000	-	0.007	0.001	0.001	0.000	0.01
PM10	0.000	-	0.009	0.001	0.001	0.000	0.01
H <sub>2</sub> S	0.000	-	0.000	0.000	0.000	0.000	0.00
SO <sub>2</sub>	0.000	-	0.000	0.000	0.000	0.000	0.00
CO <sub>2</sub>	6.623	-	-	-	-	-	6.62
Total VOC	0.000	-	1.891	0.022	0.283	0.000	2.20
Benzene	0.000	-	0.000	0.000	0.000	0.000	0.00
Toluene	0.000	-	0.001	0.000	0.000	0.000	0.00
Ethylbenzene	0.000	-	0.001	0.000	0.000	0.000	0.00
Xylenes	0.000	-	0.001	0.000	0.000	0.000	0.00
n-Hexane	0.000	-	0.369	0.001	0.004	0.000	0.37
HAP	0.000	-	0.372	0.001	0.004	0.000	0.38
N <sub>2</sub> O	0.000	-	0.003	0.000	0.000	0.000	0.00
Lead	0.000	-	0.000	0.000	0.000	0.000	0.00
Formaldehyde	0.000	-	-	-	-	-	0.00

Enclosed Combustor Total Emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	0.50	2.20
NOx	3.48E-02	1.53E-01
CO	2.93E-02	1.28E-01
PM2.5	1.99E-03	8.69E-03
PM10	2.65E-03	1.16E-02
H <sub>2</sub> S	4.02E-06	1.76E-05
SO <sub>2</sub>	7.56E-06	3.31E-05
Benzene (TAPs)	8.45E-05	3.70E-04
Formaldehyde (TAPs)	9.45E-07	4.14E-06
HAPs	0.09	0.38
CO <sub>2</sub> e	107.93	472.72
N <sub>2</sub> O	7.66E-04	3.36E-03
Lead	1.74E-07	7.63E-07

**Enter any notes here as needed**  
1. Emission Factors from AP-42 Tables 1.4-1, 1.4-2, and 1.4.3

Table 11

Enclosed Combustor GHG Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation

Enclosed Combustor CO<sub>2</sub> and CH<sub>4</sub> Emissions

Components	Mole fraction of oil flash gas constituents <sup>a</sup>	Volume of oil flash gas sent to flare scf/year	Mole fraction of water flash gas constituents <sup>a</sup>	Volume of water flash gas sent to flare scf/year	Mole fraction of oil tank vapors constituents <sup>a</sup>	Volume of oil tank vapor sent to flare scf/year	Mole fraction of water tank vapors constituents <sup>a</sup>	Volume of water tank vapors sent to flare scf/year	Component volume of gas sent to flare scf/year	Number of carbon atoms	Combustion Efficiency	Combusted CO <sub>2</sub> Volume <sup>b</sup> scf/year	Uncombusted CO <sub>2</sub> and CH <sub>4</sub> Volume <sup>b</sup> scf/year	Volume GHGs Emitted scf/year
CO <sub>2</sub>	0.001	2,291,171	0.0119	287,210	0.0018	355,575	0.015	6,349	7,411	1	0	--	7,411	7,712,188
Methane	0.235	2,291,171	0.7195	287,210	0.0653	355,575	0.037	6,349	769,302	1	0.98	753,916	15,386	15,386
Ethane	0.239	2,291,171	0.1407	287,210	0.3754	355,575	0.007	6,349	721,370	2	0.98	1,413,886	--	
Propane	0.210	2,291,171	0.0470	287,210	0.2729	355,575	0.001	6,349	591,592	3	0.98	1,739,282	--	
i-Butane	0.045	2,291,171	0.0020	287,210	0.0545	355,575	0.000	6,349	123,355	4	0.98	483,552	--	
n-Butane	0.110	2,291,171	0.0088	287,210	0.1318	355,575	0.000	6,349	302,065	4	0.98	1,184,096	--	
Pentane	0.080	2,291,171	0.0033	287,210	0.0878	355,575	0.000	6,349	214,683	5	0.98	1,051,946	--	
Hexane	0.071	2,291,171	0.0009	287,210	0.0061	355,575	0.000	6,349	164,227	6	0.98	965,657	--	
Benzene	0.000	2,291,171	0.0001	287,210	0.0000	355,575	0.000	6,349	178	6	0.98	1,044	--	
Heptanes	0.002	2,291,171	0.0001	287,210	0.0018	355,575	0.000	6,349	6,015	7	0.98	41,265	--	
Toluene	0.000	2,291,171	0.0001	287,210	0.0000	355,575	0.000	6,349	396	7	0.98	2,715	--	
Octane	0.002	2,291,171	0.0001	287,210	0.0021	355,575	0.000	6,349	5,970	8	0.98	46,806	--	
Ethyl benzene	0.000	2,291,171	0.0001	287,210	0.0000	355,575	0.000	6,349	227	8	0.98	1,776	--	
Xylenes	0.000	2,291,171	0.0002	287,210	0.0001	355,575	0.000	6,349	587	8	0.98	4,605	--	
Nonane	0.000	2,291,171	0.0000	287,210	0.0004	355,575	0.000	6,349	1,263	9	0.98	11,138	--	
Decane plus	0.000	2,291,171	0.0000	287,210	0.0001	355,575	0.000	6,349	316	10	0.98	3,093	--	
<b>Subtotal</b>												<b>7,704,777</b>	<b>--</b>	

Pollutant	Volume Emitted scf/year	Density of GHG <sup>c</sup> lb/scf	Conversion Factor lb/ton	GWF	Emissions <sup>c</sup>	
					lbs/hr	(tons/yr)
CO <sub>2</sub>	7,712,188	0.12	2000	1	102.09	447.16
CH <sub>4</sub>	15,386	0.09	2000	25	0.16	0.72
<b>CO<sub>2</sub>e Emissions</b>					<b>106.2</b>	<b>465.06</b>

GHG Emissions Summary

Notes

a Flashing/Working/Breathing Losses from ProMax output reports

b 40 CFR 98.233 (n)(4): Eqns: W-19, W-20 and W-21

c 40 CFR 98.233(v) Eqn W-36 - density at 60F and 14.7 psia

Table 12

Haul Road Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation

	PM	PM10
Particle Size Multiplier (k)	0.8	0.36
Silt Content of Road Surface Material (s) (%)	5.1	5.1
Days per Year with Precipitation > 0.01 in (p)	150	150
Control Efficiency for Watering <sup>1</sup> (%)	50	50

Tanker Truck Trip Calculation	
Condensate Production (bbl/day)	24
PW Production (bbl/day)	288
Truck Capacity (bbl)	200

Pick Up Truck Trip Calculation	Well Pad	FWI
No of Trips Per day	2	2
Trips Per Year	730	730

	# of Wheels	Mean Vehicle Weight (W) (tons)	Mean Vehicle Speed (S) (mph)	Miles Per Trip (miles)	Maximum Trips per Hour	Maximum Trips per Year	Vehicle Miles Travelled		PM (lbs/VMT)	PM10 (lbs/VMT)
							(miles/hr)	(miles/year)		
Tanker Trucks Condensate	10	40	10	0.2500	1	44	0.2500	11.0000	3.8175	1.7179
Tanker Trucks PW	10	40	10	0.2500	1	526	0.2500	131.5000	3.8175	1.7179
Well Pad Pick Up Truck	4	3	10	0.2100	1	730	0.2100	153.3000	0.3467	0.1560
FWI Pick Up Truck	4	3	10	0.3000	1	730	0.3000	219.0000	0.3467	0.1560

	Uncontrolled Emissions						Controlled Emissions					
	PM			PM10			PM			PM10		
	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)
Tanker Trucks Condensate	0.9544	41.9928	0.0210	0.4295	18.8968	0.0094	0.4772	20.9964	0.0105	0.2147	9.4484	0.0047
Tanker Trucks PW	0.9544	502.0051	0.2510	0.4295	225.9023	0.1130	0.4772	251.0026	0.1255	0.2147	112.9512	0.0565
Well Pad Pick Up Truck	0.0728	53.1460	0.0266	0.0328	23.9157	0.0120	0.0364	26.5730	0.0133	0.0164	11.9578	0.0060
FWI Pick Up Truck	0.1040	75.9229	0.0380	0.0468	34.1653	0.0171	0.0520	37.9614	0.0190	0.0234	17.0826	0.0085
<b>Total Emissions</b>	<b>2.0856</b>	<b>673.0668</b>	<b>0.3365</b>	<b>0.9385</b>	<b>302.8801</b>	<b>0.1514</b>	<b>1.0428</b>	<b>336.5334</b>	<b>0.1683</b>	<b>0.4693</b>	<b>151.4400</b>	<b>0.0757</b>

<b>Enter any notes here:</b>	1 EPA, AP-42, Volume I, Section 13.2.2 Unpaved Roads (11/06); assume 2:1 moisture ratio Section 13.2.2 Unpaved Roads (11/06) Source: Attachment L, Fugitive Emissions from Unpaved Haul Roads, Rev 03/2007, West Virginia Department of Environmental Protection
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Table 13

Fresh Water Impoundment (FWI) Engine Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation

**FWIENG001**

Manufacturer	John Deere
Model	6135HF485
Power (hp)	600
Operating Hours/Year	8760
Fuel Consumption (gal/hr)	35.7
Heat Value (Btu/gal)	137380

**FWIENG002**

Manufacturer	John Deere
Model	6135HF485
Power (hp)	600
Operating Hours/Year	8760
Fuel Consumption (gal/hr)	35.7
Heat Value (Btu/gal)	137380

Pollutant	Emission Factors		Engine Emissions	
	g/hp-hr	lb/MMBtu	lb/hr	tpy
NOx	2.47		3.27	14.31
CO	0.45		0.59	2.59
SO2	0.93		1.23	5.39
PM	0.07		0.10	0.43
VOC	1.14		1.51	6.61
CO <sub>2e</sub>	521.63		690.00	3022.20
HAPS				
Benzene		9.33E-04	4.58E-03	2.00E-02
1,3-Butadiene		3.91E-05	1.92E-04	8.40E-04
Toluene		4.09E-04	2.01E-03	8.79E-03
Xylenes		2.85E-04	1.40E-03	6.12E-03
Formaldehyde		1.18E-03	5.79E-03	2.53E-02
Acetaldehyde		7.67E-04	3.76E-03	1.65E-02
Acrolein		9.25E-05	4.54E-04	1.99E-03
Naphthelene		8.48E-05	4.16E-04	1.82E-03

Pollutant	Emission Factors		Engine Emissions	
	g/hp-hr	lb/MMBtu	lb/hr	tpy
NOx	2.47		3.27	14.31
CO	0.45		0.59	2.59
SO2	0.93		1.23	5.39
PM	0.07		0.10	0.43
VOC	1.14		1.51	6.61
CO <sub>2e</sub>	521.63		690.00	3022.20
HAPS				
Benzene		9.33E-04	4.58E-03	2.00E-02
1,3-Butadiene		3.91E-05	1.92E-04	8.40E-04
Toluene		4.09E-04	2.01E-03	8.79E-03
Xylenes		2.85E-04	1.40E-03	6.12E-03
Formaldehyde		1.18E-03	5.79E-03	2.53E-02
Acetaldehyde		7.67E-04	3.76E-03	1.65E-02
Acrolein		9.25E-05	4.54E-04	1.99E-03
Naphthelene		8.48E-05	4.16E-04	1.82E-03

	lb/hr	tpy
TOTAL Uncontrolled VOC	3.0169	13.2141
TOTAL Uncontrolled NOx	6.5349	28.6229
TOTAL Uncontrolled HAPS	0.0372	0.1628
TOTAL Uncontrolled TAPs (Benzene)	0.0092	0.0401
TOTAL Uncontrolled TAPs (Formaldehyde)	0.0116	0.0507
TOTAL CO <sub>2e</sub> Emissions	1380.00	6044.39

**Notes:**

1. Emissions for NOx, CO, and PM are based on EPA certification actual test results (in g/kw-hr) for nonroad diesel fueled engines manufactured in 2010 (<http://www.epa.gov/otaq/certdata.htm#early-lgens>). Everything else is based on AP-42 Emission factors for diesel fueled nonroad industrial engines



**Table 14**

**Change in Regulated Air Pollutants Emissions  
 Pearl Jean Well Pad  
 Doddridge County, West Virginia  
 Antero Resources Corporation**

Pollutant	Potential Emissions <sup>1</sup>		Initial Permit Application Emissions		Change in Emissions	
	Hourly PTE (lb/hr)	Yearly PTE (tpy)	Hourly PTE (lb/hr)	Yearly PTE (tpy)	Hourly PTE (lb/hr)	Yearly PTE (tpy)
<b>PM</b>	1.2916	1.2581	1.0639	0.4696	0.2277	0.7885
<b>PM10</b>	0.7181	1.1656	0.5239	0.3975	0.1942	0.7681
<b>VOC</b>	6.6283	29.0979	3.6590	16.0923	2.9693	13.0056
<b>CO</b>	1.7527	7.6768	6.4820	28.3913	-4.7293	-20.7145
<b>NOx</b>	7.2112	31.5852	1.3129	5.7503	5.8984	25.8349
<b>SO2</b>	2.4642	10.7933	0.0059	0.0259	2.4583	10.7673
<b>Pb</b>	3.38E-06	1.48E-05	4.99E-06	2.18E-05	-1.60E-06	-7.02E-06
<b>HAPs</b>	0.4870	2.1339	0.4641	2.0335	0.0229	0.1004
<b>TAPs</b>	0.0277	0.1212	0.0125	0.0547	0.0152	0.0665

Notes: 1) Change in emissions from the removal of the Kubota engine and reduction in GPU heater rating and installation of FWI engines



Bryan Research & Engineering, Inc.

# ProMax<sup>®</sup> 3.2

with  
TSWEET<sup>®</sup> & PROSIM<sup>®</sup>

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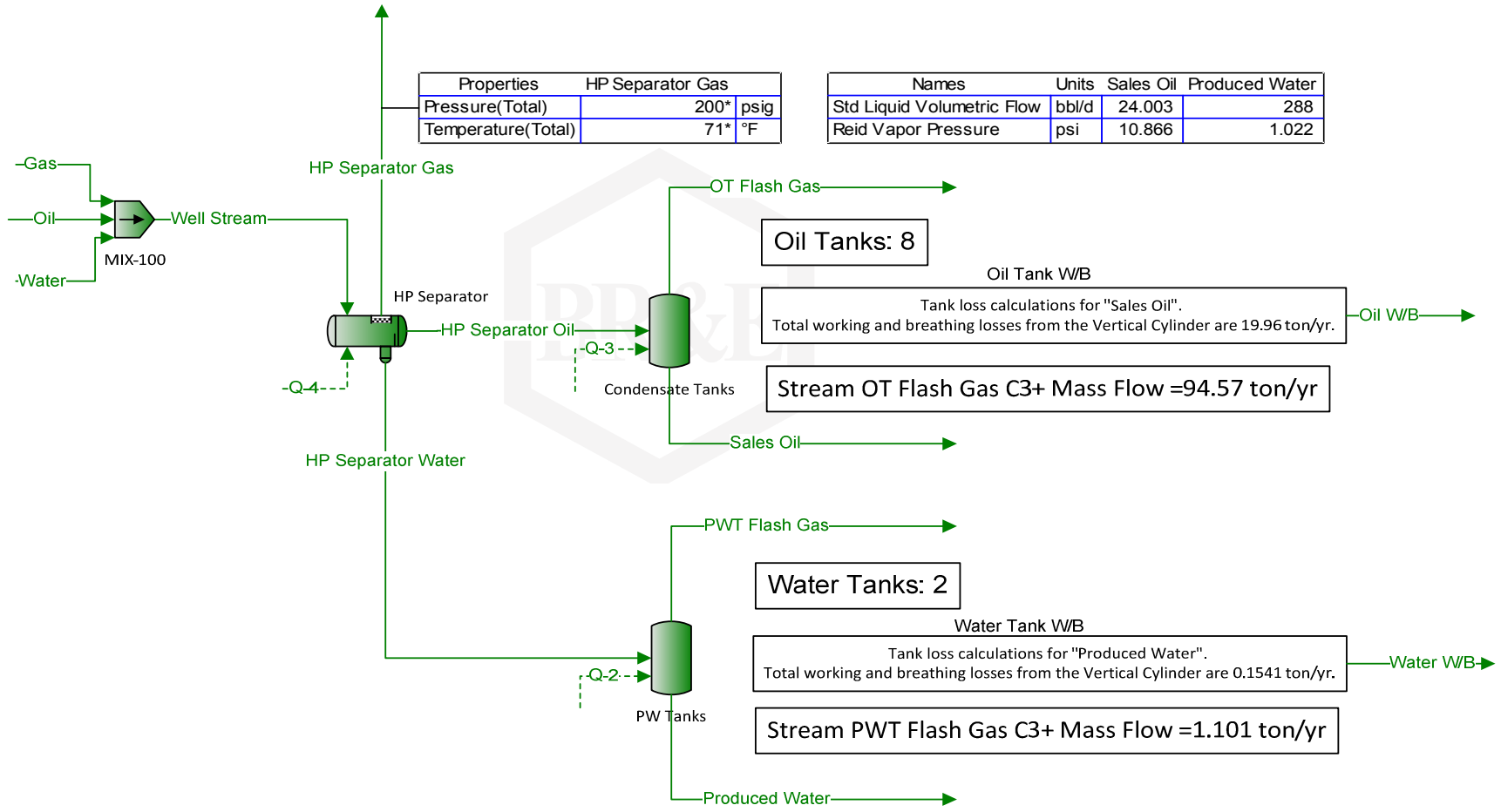
## Simulation Report

Client Name:	Antero Resources Corporation
Location:	West Virginia
Job:	Pearl Jean
Project Name:	PROMAX SCENARIO 3
File Name:	ProMax@C:\ProMax\Antero\Scenario 3\PROMAX SCENARIO 3.PMX
ProMax Version:	3.2.13330.0
Report Created:	10/22/2014 9:00

Stream HP Separator Gas C3+ Mass Flow =4.174E+04 ton/yr

Properties	HP Separator Gas
Pressure(Total)	200* psig
Temperature(Total)	71* °F

Names	Units	Sales Oil	Produced Water
Std Liquid Volumetric Flow	bb/d	24.003	288
Reid Vapor Pressure	psi	10.866	1.022



Oil Tanks: 8

Oil Tank WB  
Tank loss calculations for "Sales Oil".  
Total working and breathing losses from the Vertical Cylinder are 19.96 ton/yr.

Stream OT Flash Gas C3+ Mass Flow =94.57 ton/yr

Water Tanks: 2

Water Tank WB  
Tank loss calculations for "Produced Water".  
Total working and breathing losses from the Vertical Cylinder are 0.1541 ton/yr.

Stream PWT Flash Gas C3+ Mass Flow =1.101 ton/yr







Benzene	0.00203193	0.00194576	0.00194576	0.00194576	0.0131469	0.0131469	0	0.115875	0.0201799	0.0201799	0.00072558	2.63923E-05
2-Methylhexane	0.0246848	0.0219049	0.0219049	0.0219049	0.144166	0.144166	0	0.928303	0.00427464	0.00427464	0.00981879	5.71405E-09
3-Methylhexane	0.0204108	0.0179911	0.0179911	0.0179911	0.118487	0.118487	0	0.728720	0.00366604	0.00366604	0.121437	7.34475E-08
Heptane	0.0438841	0.0373864	0.0373864	0.0373864	0.242582	0.242582	0	1.33307	0.00780079	0.00780079	0.229841	1.14749E-07
Methylcyclohexane	0.0280462	0.0239133	0.0239133	0.0239133	0.159036	0.159036	0	0.805223	0.0270250	0.0270250	0.149041	2.45602E-06
Toluene	0.00632517	0.00517981	0.00517981	0.00517981	0.0344448	0.0344448	0	0.157768	0.0488924	0.0488924	0.00443228	3.07604E-05
Octane	0.109751	0.0702956	0.0702956	0.0702956	0.437375	0.437375	0	1.62517	0.00844421	0.00844421	0.377478	2.42019E-08
Ethylbenzene	0.000585480	0.000351904	0.000351904	0.000351904	0.0224119	0.0224119	0	0.0729432	0.0311680	0.0311680	0.00528072	1.10285E-05
m-Xylene	0.00781493	0.00436047	0.00436047	0.00436047	0.0276063	0.0276063	0	0.0885180	0.0380849	0.0380849	0.00837787	1.50443E-05
o-Xylene	0.000897207	0.00475062	0.00475062	0.00475062	0.0300647	0.0300647	0	0.0930265	0.0428147	0.0428147	0.00788962	1.76828E-05
Nonane	0.0676173	0.0249121	0.0249121	0.0249121	0.150141	0.150141	0	0.493161	0.00443063	0.00443063	0.117581	5.97879E-09
C10+	0.181262	0.00872111	0.00872111	0.00872111	0.0461411	0.0461411	0	0.265293	0.00173953	0.00173953	0.0296258	1.86409E-10

Mass Flow	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
Water	1245.59	80.0307	0	0	0.0237373	0	0	0	0	0	0.0431955	1.88477E-06	0.0323890	
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nitrogen	330.928	330.916	0	0	0.00996606	0	330.900	0.0222261	0	0.00554747	8.24798E-05	2.37198E-06		
Carbon Dioxide	154.197	154.080	0	0	0.0437728	0	154.189	0.0138728	0	0.0430129	0.00854076	0.00123895		
Methane	29771.4	29768.1	0	0	2.65144	0	29766.5	2.75323	0	0.945143	0.111963	0.00112283		
Ethane	10206.5	10200.7	0	0	5.04639	0	10196.4	2.44030	0	0.346516	1.20745	0.000379851		
Propane	4746.88	4737.71	0	0	6.50354	0	4732.45	1.71223	0	0.169841	1.28709	4.53747E-05		
Isobutane	791.636	787.938	0	0	1.84232	0	786.494	0.349042	0	0.00964793	0.338721	3.22726E-07		
n-Butane	1658.18	1647.11	0	0	4.50182	0	1643.22	0.818461	0	0.0419424	0.819503	2.11143E-06		
Isopentane	666.410	646.007	0	0	2.21694	0	645.983	0.319489	0	0.0108925	0.374992	1.37413E-07		
n-Pentane	516.071	505.278	0	0	1.81998	0	502.106	0.380318	0	0.00831098	0.302946	7.64646E-08		
2-Methylpentane	9.2066	9.44881	0	0	0.0367394	0	0	0.144299	0	7.16004E-05	0.00589425	1.25764E-10		
3-Methylpentane	7.10692	6.73269	0	0	0.0263407	0	0	0.0959634	0	0.000135151	0.00421070	5.75548E-10		
n-Hexane	1146.47	1072.93	0	0	4.21171	0	1121.85	0.294580	0	0.00640554	0.0457449	4.35734E-10		
Methylcyclopentane	3.75239	3.49820	0	0	0.0139211	0	0	0.0420753	0	0.000201749	0.00208201	1.84762E-09		
Benzene	1.04656	0.974107	0	0	0.00386090	0	0	0.0116332	0	0.000329885	3.52102E-05	9.28508E-09		
2-Methylhexane	12.7141	10.9663	0	0	0.0423376	0	0	0.0931963	0	6.98803E-05	0.000447502	2.01026E-12		
3-Methylhexane	10.5128	9.00691	0	0	0.0347964	0	0	0.0731593	0	5.99311E-05	0.00534611	2.58396E-11		
Heptane	22.6029	18.7168	0	0	0.0712396	0	0	0.133832	0	0.000127525	0.0104798	4.03697E-11		
Methylcyclohexane	14.4454	11.9718	0	0	0.0467046	0	0	0.0808398	0	0.00679272	0.000441795	8.64052E-10		
Toluene	3.25784	2.59317	0	0	0.0101155	0	0	0.0158390	0	0.000799276	0.000202006	1.08218E-08		
Octane	56.5282	35.1921	0	0	0.128445	0	0	0.163158	0	0.000138043	0.0172040	8.51449E-12		
Ethylbenzene	3.01557	1.76174	0	0	0.00658178	0	0	0.00732308	0	0.000509524	0.000240674	3.87994E-09		
m-Xylene	4.02515	2.18299	0	0	0.00810722	0	0	0.00888670	0	0.000622598	0.000381831	5.29273E-09		
o-Xylene	4.62115	2.37831	0	0	0.00882918	0	0	0.00933933	0	0.000699920	0.000359578	6.22098E-09		
Nonane	34.8270	12.4718	0	0	0.0440923	0	0	0.0495105	0	7.24304E-05	0.00535890	2.10340E-12		
C10+	93.3610	4.36606	0	0	0.0135504	0	0	0.0266339	0	2.84372E-05	0.00135023	6.55806E-14		

Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B
Phase: Vapor	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units													
Temperature	°F	168.5	71.0	71.0	71.0	75.9	75.9	200.0		200.0	75.94	75.94	75.9425	75.9425
Pressure	psig	200	200	200	200	0	0	300		300	0	0	12.0035	-14.2249
Mole Fraction Vapor	%	100	100	100	100	100	100	100		100	100	100	100	100
Mole Fraction Light Liquid	%	0	0	0	0	0	0	0		0	0	0	0	0
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0		0	0	0	0	0
Molecular Weight	lb/lbmol	20.9	20.9	20.9	20.9	41.8	41.8	20.9		29.9	20.6577	20.6577	42.6090	18.4214
Mass Density	lb/ft³	0.7	0.8	0.8	0.8	0.1	0.1	1.0		1.5	0.0530072	0.0530072	0.203700	0.00151027
Molar Flow	lbmol/h	2461.4	2393.6	0.0	0.0	0.7	0.0	2388.0		0.3	0.0791360	0.106963	0.00190980	
Mass Flow	lb/h	51506.0	50063.1	0.0	0.0	29.4	0.0	49880.0		10.0	1.63476	4.55761	0.0351810	
Vapor Volumetric Flow	MCFH	74.9	59.9	0.0	0.0	0.3	0.0	51.8		0.0	0.0308404	0.0223741	0.0232945	
Liquid Volumetric Flow	Mbb/d	320.1	256.3	0.0	0.0	1.2	0.0	221.3		0.0	0.131830	0.0956399	0.0995742	
Std Vapor Volumetric Flow	MMSCFD	22.4	21.8	0.0	0.0	0.0	0.0	21.7		0.0	0.000720741	0.000974183	1.73937E-05	
Std Liquid Volumetric Flow	Mbb/d	10.1	10.0	0.0	0.0	0.0	0.0	10.0		0.0	0.000321898	0.000654534	2.66021E-06	
Compressibility		0.969	0.944	0.944	0.944	0.985	0.985	0.964		0.916	0.996395	0.996395	0.971622	0.999551
Specific Gravity		0.723	0.722	0.722	0.722	1.444	1.444	0.721		1.034	0.713253	0.713253	1.47117	0.636040
API Gravity														
Enthalpy	MMBtu/h	-86.9	-82.6	0.0	0.0	0.0	0.0	-78.8		0.0	-0.00296714	-0.00482261	-0.00194448	
Mass Enthalpy	Btu/lb	-1688.0	-1649.8	-1649.8	-1649.8	-1084.4	-1084.4	-1579.9		-1240.0	-1815.03	-1815.03	-1058.14	-5527.08
Mass Cp	Btu/(lb**F)	0.5	0.5	0.5	0.5	0.4	0.4	0.6		0.5	0.475802	0.475802	0.411587	0.442454
Ideal Gas Cp/Cv Ratio		1.224	1.248	1.248	1.248	1.130	1.130	1.215		1.152	1.25433	1.25433	1.12964	1.32229





o-Xylene		2.1252E-05	0	6.99248E-05	0.0210773	0	0.0209942	0	0.0434613	6.33320E-05	0	0	0
Nonane		4.36305E-07	0	5.76643E-07	0.174302	0	0.173958	0	0.271159	1.19056E-08	0	0	0
C10+		7.03421E-07	0	1.80190E-07	0.549352	0	0.549268	0	0.576139	4.65173E-09	0	0	0
<b>Mass Fraction</b>		<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Water		99.9748	0.00911423	99.9574	0.00911423	0.000585314	0.000585314	100	0	99.9952	99.9952	5.64667E-07	99.9999
H2S		0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		9.37943E-05	0.00362577	0.000136534	0.00362577	2.10324E-05	2.10324E-05	0	0.00249903	4.55856E-06	4.55856E-06	2.17697E-06	2.58871E-09
Carbon Dioxide		0.00111013	0.0167507	0.00248551	0.0167507	0.00101619	0.00101619	0	0.00754600	0.00146277	0.00146277	0.00243945	5.62601E-05
Methane		0.0159978	0.975111	0.0240806	0.975111	0.0173305	0.0173305	0	0.698294	0.00159570	0.00159570	0.00913436	2.52554E-06
Ethane		0.00512453	2.01877	0.00892527	2.01877	0.215226	0.215226	0	2.11661	0.000681705	0.000681705	0.0036339	1.00131E-06
Propane		0.00159549	3.27138	0.00440962	3.27138	1.02671	1.02671	0	3.44201	0.000369136	0.000369136	2.41126	1.32773E-07
Isobutane		0.000109335	1.33582	0.000236823	1.33582	0.748601	0.748601	0	1.29265	7.29536E-06	7.29536E-06	1.59100	3.29924E-10
n-Butane		0.000568920	3.99647	0.00106765	3.99647	2.64867	2.64867	0	3.81492	6.98408E-05	6.98408E-05	5.60581	4.75665E-09
Isopentane		0.000114522	3.76215	0.000271564	3.76215	3.31178	3.31178	0	7.27511	1.24298E-05	1.24298E-05	6.58733	2.13203E-10
n-Pentane		0.000112482	3.90450	0.000207110	3.90450	3.63182	3.63182	0	3.66771	9.39009E-06	9.39009E-06	7.08903	1.17459E-10
2-Methylpentane		1.10943E-06	0.170761	1.74192E-06	0.170761	0.176191	0.176191	0	2.63485	3.85174E-08	3.85174E-08	0.332640	9.23018E-14
3-Methylpentane		1.72649E-06	0.135412	3.41251E-06	0.135412	0.140849	0.140849	0	1.88955	1.97258E-07	1.97258E-07	0.264557	1.14612E-12
n-Hexane		9.61568E-05	26.6147	0.000155131	26.6147	28.0744	28.0744	0	6.55675	2.74003E-06	2.74003E-06	3.57990	2.54589E-13
Methylcyclopentane		1.34938E-06	0.0919263	5.68341E-06	0.0919263	0.0972213	0.0972213	0	0.999983	8.84015E-07	8.84015E-07	0.168003	1.10321E-11
Benzene		2.09136E-05	0.0252388	7.99012E-05	0.0252388	0.0266769	0.0266769	0	0.279097	7.20809E-05	7.20809E-05	0.00280280	2.75961E-09
2-Methylhexane		4.77920E-07	0.632581	1.69427E-06	0.632581	0.690667	0.690667	0	3.40149	3.17923E-08	3.17923E-08	0.0809167	1.25406E-15
3-Methylhexane		4.25011E-07	0.544995	1.45428E-06	0.544995	0.595719	0.595719	0	2.81360	2.84994E-08	2.84994E-08	1.04945	1.68452E-14
Heptane		5.25812E-07	1.40645	3.09484E-06	1.40645	1.54487	1.54487	0	6.05568	6.09812E-08	6.09812E-08	2.49817	2.64976E-14
Methylcyclohexane		4.62151E-06	0.895161	1.17910E-05	0.895161	0.982707	0.982707	0	3.87146	1.28091E-06	1.28091E-06	1.61868	3.42882E-12
Toluene		5.32313E-05	0.238660	0.000163306	0.238660	0.262947	0.262947	0	0.874192	0.000144347	0.000144347	0.0597930	2.67146E-09
Octane		2.34566E-06	7.72202	3.32766E-06	7.72202	8.58837	8.58837	0	15.1910	4.35633E-08	4.35633E-08	13.0777	3.70477E-15
Ethylbenzene		2.93732E-05	0.452665	9.53221E-05	0.452665	0.503834	0.503834	0	0.810997	8.32326E-05	8.32326E-05	0.209187	8.70900E-10
m-Xylene		4.56637E-05	0.665402	0.000120661	0.665402	0.741254	0.741254	0	1.08280	0.000105290	0.000105290	0.395799	1.23073E-09
o-Xylene		7.42982E-05	0.809870	0.000176611	0.809870	0.902611	0.902611	0	1.24354	0.000160022	0.000160022	0.416027	1.95526E-09
Nonane		1.84269E-06	8.09089	1.75949E-06	8.09089	9.03527	9.03527	0	9.37293	3.63413E-08	3.63413E-08	12.5357	1.46313E-15
C10+		3.75247E-06	32.2095	6.94466E-07	32.2095	36.0347	36.0347	0	25.1547	1.79351E-08	1.79351E-08	39.8111	5.78840E-17
<b>Mass Flow</b>		<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>
Water		3036.01	0	4201.55	0.0251826	0	0.00144533	4281.60	0	4201.50	0	0	0
H2S		0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		0.00284832	0	0.00573901	0.0100180	0	5.19358E-05	0.00297243	0.000191537	0	0	0	0
Carbon Dioxide		0.00337121	0	0.104474	0.0462821	0	0.00250931	0.0279988	0.0614615	0	0	0	0
Methane		0.485818	0	1.01219	2.69423	0	0.0427946	2.59096	0.0670466	0	0	0	0
Ethane		0.155620	0	0.375160	5.57785	0	0.531463	7.85352	0.0286432	0	0	0	0
Propane		0.0484516	0	0.185351	9.03883	0	2.53529	12.7713	0.0155100	0	0	0	0
Isobutane		0.00332027	0	0.00995446	3.69086	0	1.84854	4.79626	0.000306530	0	0	0	0
n-Butane		0.0172768	0	0.0448769	11.0423	0	6.54044	14.1549	0.00293450	0	0	0	0
Isopentane		0.00347777	0	0.0114148	10.3948	0	8.17788	10.1113	0.000522262	0	0	0	0
n-Pentane		0.00341583	0	0.00870552	10.7882	0	8.96817	13.6087	0.000394544	0	0	0	0
2-Methylpentane		3.36910E-05	0	7.32188E-05	0.471813	0	0.435073	9.77640	1.61839E-06	0	0	0	0
3-Methylpentane		5.24298E-05	0	0.000143439	0.374144	0	0.347803	7.01101	8.28821E-06	0	0	0	0
n-Hexane		0.00292007	0	0.00652067	73.5366	0	69.3249	24.3283	0.000115128	0	0	0	0
Methylcyclopentane		4.09775E-05	0	0.000238893	0.253992	0	0.240071	3.71036	3.71437E-05	0	0	0	0
Benzene		0.00635098	0	0.00335852	0.0697348	0	0.0658739	1.03557	0.00302863	0	0	0	0
2-Methylhexane		1.45134E-05	0	7.12161E-05	1.74782	0	1.70548	12.6210	1.33582E-06	0	0	0	0
3-Methylhexane		1.29066E-05	0	6.11285E-05	1.50582	0	1.47103	10.4396	1.19746E-06	0	0	0	0
Heptane		1.59678E-05	0	0.000130087	3.88604	0	3.81480	22.4691	2.56225E-06	0	0	0	0
Methylcyclohexane		0.000140345	0	0.000496615	2.47333	0	2.42663	14.3647	5.38202E-05	0	0	0	0
Toluene		0.00161652	0	0.00686432	0.659418	0	0.649303	3.24362	0.00605004	0	0	0	0
Octane		7.39928E-05	0	0.000139873	21.3360	0	21.2075	56.3651	1.83011E-06	0	0	0	0
Ethylbenzene		0.000891998	0	0.0040671	1.25071	0	1.24413	3.00914	0.00349719	0	0	0	0
m-Xylene		0.00138671	0	0.00504658	1.83851	0	1.83040	4.01765	0.0042398	0	0	0	0
o-Xylene		0.00225627	0	0.00742356	2.23767	0	2.22884	4.61407	0.00673264	0	0	0	0
Nonane		5.59583E-05	0	7.39574E-05	22.3551	0	22.3111	34.7775	1.52696E-06	0	0	0	0
C10+		0.000113954	0	2.91907E-05	88.9950	0	88.9814	93.3344	7.53580E-07	0	0	0	0

Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units													
Temperature	°F	168.5	71.0	71.0	71.0	75.9	75.9		300.0	200.0	75.94	75.94	75.9425	75.9425







**FESCO, Ltd.**  
**1100 FESCO Avenue - Alice, Texas 78332**

**For:** Antero Resources Appalachian Corp.  
 1625 17th Street  
 Denver, Colorado 80202

**Sample:** Moore No. 1H (Moore Pad)  
 Separator Hydrocarbon Liquid  
 Sampled @ 200 psig & 71 °F

Date Sampled: 09/25/13

Job Number: 35844.002

**CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2186-M**

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.013	0.003	0.003
Carbon Dioxide	0.000	0.000	0.000
Methane	5.429	1.872	0.782
Ethane	5.670	3.086	1.531
Propane	4.895	2.744	1.938
Isobutane	1.346	0.896	0.702
n-Butane	3.278	2.103	1.711
2,2 Dimethylpropane	0.112	0.087	0.072
Isopentane	2.120	1.578	1.374
n-Pentane	2.192	1.617	1.420
2,2 Dimethylbutane	0.171	0.146	0.133
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.285	0.238	0.221
2 Methylpentane	1.460	1.234	1.130
3 Methylpentane	1.063	0.883	0.822
n-Hexane	2.076	1.737	1.606
Heptanes Plus	<u>69.889</u>	<u>81.775</u>	<u>86.555</u>
Totals:	100.000	100.000	100.000

**Characteristics of Heptanes Plus:**

Specific Gravity ----- 0.7602 (Water=1)  
 °API Gravity ----- 54.63 @ 60°F  
 Molecular Weight ----- 137.9  
 Vapor Volume ----- 17.49 CF/Gal  
 Weight ----- 6.33 Lbs/Gal

**Characteristics of Total Sample:**

Specific Gravity ----- 0.7182 (Water=1)  
 °API Gravity ----- 65.51 @ 60°F  
 Molecular Weight ----- 111.4  
 Vapor Volume ----- 20.47 CF/Gal  
 Weight ----- 5.98 Lbs/Gal

Base Conditions: 14.850 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: XG  
 Processor: JCdjv  
 Cylinder ID: W-1570

\_\_\_\_\_  
 David Dannhaus 361-661-7015

**TANKS DATA INPUT REPORT**

COMPONENT	Mol %	LiqVol %	Wt %
Carbon Dioxide	0.000	0.000	0.000
Nitrogen	0.013	0.003	0.003
Methane	5.429	1.872	0.782
Ethane	5.670	3.086	1.531
Propane	4.895	2.744	1.938
Isobutane	1.346	0.896	0.702
n-Butane	3.390	2.190	1.783
Isopentane	2.120	1.578	1.374
n-Pentane	2.192	1.617	1.420
Other C-6's	2.980	2.501	2.306
Heptanes	7.576	6.844	6.648
Octanes	12.065	11.665	11.797
Nonanes	8.901	9.909	10.137
Decanes Plus	37.229	50.209	54.133
Benzene	0.063	0.036	0.045
Toluene	0.549	0.374	0.454
E-Benzene	0.993	0.780	0.947
Xylenes	2.513	1.958	2.395
n-Hexane	2.076	1.737	1.606
2,2,4 Trimethylpentane	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
Totals:	100.000	100.000	100.000

**Characteristics of Total Sample:**

Specific Gravity -----	0.7182 (Water=1)
°API Gravity -----	65.51 @ 60°F
Molecular Weight-----	111.4
Vapor Volume -----	20.47 CF/Gal
Weight -----	5.98 Lbs/Gal

**Characteristics of Decanes (C10) Plus:**

Specific Gravity -----	0.7744 (Water=1)
Molecular Weight-----	162.0

**Characteristics of Atmospheric Sample:**

°API Gravity -----	58.66 @ 60°F
Reid Vapor Pressure (ASTM D-5191)-----	1.65 psi

QUALITY CONTROL CHECK			
	Sampling Conditions	Test Samples	
Cylinder Number	-----	W-1570*	----
Pressure, PSIG	200	192	----
Temperature, °F	71	70	----

\* Sample used for analysis

## TOTAL EXTENDED REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.013	0.003	0.003
Carbon Dioxide	0.000	0.000	0.000
Methane	5.429	1.872	0.782
Ethane	5.670	3.086	1.531
Propane	4.895	2.744	1.938
Isobutane	1.346	0.896	0.702
n-Butane	3.278	2.103	1.711
2,2 Dimethylpropane	0.112	0.087	0.072
Isopentane	2.120	1.578	1.374
n-Pentane	2.192	1.617	1.420
2,2 Dimethylbutane	0.171	0.146	0.133
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.285	0.238	0.221
2 Methylpentane	1.460	1.234	1.130
3 Methylpentane	1.063	0.883	0.822
n-Hexane	2.076	1.737	1.606
Methylcyclopentane	0.629	0.453	0.475
Benzene	0.063	0.036	0.045
Cyclohexane	0.496	0.344	0.375
2-Methylhexane	1.928	1.824	1.735
3-Methylhexane	1.592	1.487	1.432
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	0.623	0.570	0.555
n-Heptane	2.308	2.167	2.076
Methylcyclohexane	2.198	1.798	1.938
Toluene	0.549	0.374	0.454
Other C-8's	7.225	7.113	7.150
n-Octane	2.641	2.754	2.709
E-Benzene	0.993	0.780	0.947
M & P Xylenes	0.843	0.666	0.804
O-Xylene	1.670	1.292	1.591
Other C-9's	6.223	6.843	7.054
n-Nonane	2.678	3.066	3.083
Other C-10's	8.998	10.873	11.414
n-decane	2.504	3.128	3.199
Undecanes(11)	9.521	11.804	12.566
Dodecanes(12)	6.162	8.252	8.907
Tridecanes(13)	3.969	5.699	6.237
Tetradecanes(14)	2.330	3.584	3.976
Pentadecanes(15)	1.359	2.238	2.513
Hexadecanes(16)	0.796	1.402	1.587
Heptadecanes(17)	0.538	1.001	1.144
Octadecanes(18)	0.366	0.717	0.825
Nonadecanes(19)	0.238	0.486	0.562
Eicosanes(20)	0.164	0.348	0.405
Heneicosanes(21)	0.099	0.222	0.259
Docosanes(22)	0.065	0.150	0.177
Tricosanes(23)	0.049	0.118	0.139
Tetracosanes(24)	0.031	0.078	0.093
Pentacosanes(25)	0.013	0.033	0.040
Hexacosanes(26)	0.009	0.023	0.027
Heptacosanes(27)	0.006	0.015	0.019
Octacosanes(28)	0.005	0.015	0.018
Nonacosanes(29)	0.003	0.010	0.012
Triacotanes(30)	0.001	0.003	0.004
Hentriacotanes Plus(31+)	<u>0.002</u>	<u>0.008</u>	<u>0.010</u>
Total	100.000	100.000	100.000



**FESCO, Ltd.**  
**1100 Fesco Avenue - Alice, Texas 78332**

**For:** Antero Resources Appalachian Corp.  
 1625 17th Street  
 Denver, Colorado 80202

**Date Sampled:** 09/25/13

**Date Analyzed:** 10/02/13

**Sample:** Moore No. 1H

**Job Number:** J35844

<b>FLASH LIBERATION OF HYDROCARBON LIQUID</b>		
	<b>Separator HC Liquid</b>	<b>Stock Tank</b>
Pressure, psig	200	0
Temperature, °F	71	70
Gas Oil Ratio (1)	-----	139
Gas Specific Gravity (2)	-----	1.149
Separator Volume Factor (3)	1.0837	1.000

<b>STOCK TANK FLUID PROPERTIES</b>	
Shrinkage Recovery Factor (4)	0.9228
Oil API Gravity at 60 °F	58.66
Reid Vapor Pressure, psi (5)	1.65

<b>Quality Control Check</b>			
	<b>Sampling Conditions</b>	<b>Test Samples</b>	
Cylinder No.	-----	W-1570*	----
Pressure, psig	200	192	----
Temperature, °F	71	70	----

(1) - Scf of flashed vapor per barrel of stock tank oil

(2) - Air = 1.000

(3) - Separator volume / Stock tank volume

(4) - Fraction of first stage separator liquid

(5) - Absolute pressure at 100 deg F

Analyst: \_\_\_\_\_ M. G.

\* Sample used for flash study

**Base Conditions: 14.85 PSI & 60 °F**

Certified: FESCO, Ltd. - Alice, Texas

\_\_\_\_\_  
 David Dannhaus 361-661-7015



**FESCO, Ltd.**  
**1100 Fesco Ave. - Alice, Texas 78332**

**For:** Antero Resources Appalachian Corp.  
 1625 17th Street  
 Denver, Colorado 80202

**Sample:** Moore No. 1H (Moore Pad)  
 Gas Evolved from Hydrocarbon Liquid Flashed  
 From 200 psig & 71 °F to 0 psig & 70 °F

Date Sampled: 09/25/13

Job Number: 35844.001

**CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT**

<b>COMPONENT</b>	<b>MOL%</b>	<b>GPM</b>
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.054	
Carbon Dioxide	0.117	
Methane	35.770	
Ethane	31.071	8.375
Propane	18.617	5.169
Isobutane	3.229	1.065
n-Butane	5.838	1.855
2-2 Dimethylpropane	0.101	0.039
Isopentane	1.708	0.630
n-Pentane	1.353	0.494
Hexanes	1.101	0.457
Heptanes Plus	<u>1.041</u>	<u>0.471</u>
Totals	100.000	18.556

**Computed Real Characteristics Of Heptanes Plus:**

Specific Gravity ----- 3.643 (Air=1)  
 Molecular Weight ----- 104.45  
 Gross Heating Value ----- 5573 BTU/CF

**Computed Real Characteristics Of Total Sample:**

Specific Gravity ----- 1.149 (Air=1)  
 Compressibility (Z) ----- 0.9899  
 Molecular Weight ----- 32.94  
 Gross Heating Value  
 Dry Basis ----- 1951 BTU/CF  
 Saturated Basis ----- 1918 BTU/CF

\*Hydrogen Sulfide tested in laboratory by: Stained Tube Method (GPA 2377)

Results: 0.063 Gr/100 CF, 1.0 PPMV or 0.0001 Mol %

Base Conditions: 14.850 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR  
 Processor: ANB  
 Cylinder ID: FL# 15 S

David Dannhaus 361-661-7015

**CHROMATOGRAPH EXTENDED ANALYSIS  
TOTAL REPORT**

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.054		0.046
Carbon Dioxide	0.117		0.156
Methane	35.770		17.417
Ethane	31.071	8.375	28.359
Propane	18.617	5.169	24.919
Isobutane	3.229	1.065	5.697
n-Butane	5.838	1.855	10.300
2,2 Dimethylpropane	0.101	0.039	0.221
Isopentane	1.708	0.630	3.741
n-Pentane	1.353	0.494	2.963
2,2 Dimethylbutane	0.063	0.027	0.165
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.081	0.033	0.212
2 Methylpentane	0.363	0.152	0.950
3 Methylpentane	0.229	0.094	0.599
n-Hexane	0.365	0.151	0.955
Methylcyclopentane	0.034	0.012	0.087
Benzene	0.010	0.003	0.024
Cyclohexane	0.050	0.017	0.128
2-Methylhexane	0.110	0.052	0.335
3-Methylhexane	0.110	0.050	0.335
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.119	0.052	0.358
n-Heptane	0.120	0.056	0.365
Methylcyclohexane	0.101	0.041	0.301
Toluene	0.023	0.008	0.064
Other C8's	0.177	0.083	0.592
n-Octane	0.039	0.020	0.135
Ethylbenzene	0.002	0.001	0.006
M & P Xylenes	0.014	0.005	0.045
O-Xylene	0.002	0.001	0.006
Other C9's	0.074	0.038	0.284
n-Nonane	0.015	0.009	0.058
Other C10's	0.031	0.018	0.133
n-Decane	0.004	0.002	0.017
Undecanes (11)	<u>0.006</u>	<u>0.004</u>	<u>0.027</u>
Totals	100.000	18.556	100.000

**Computed Real Characteristics Of Total Sample:**

Specific Gravity -----	1.149	(Air=1)
Compressibility (Z) -----	0.9899	
Molecular Weight -----	32.94	
Gross Heating Value		
Dry Basis -----	1951	BTU/CF
Saturated Basis -----	1918	BTU/CF

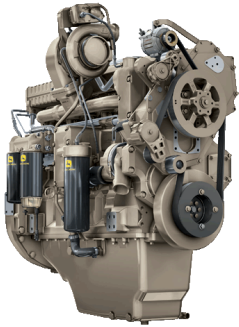
**Antero Resources  
Moore Unit 1H - Moore Pad**

Tag Name	Value	Units	Timestamp
Accumulated Gas Flow	1154650	MCF	12/3/2013 10:05
Casing Pressure	287.85	PSIA	12/3/2013 10:05
Current Day Gas Flow	422.39	MCF	12/3/2013 10:05
Differential Pressure	13.27	inH2O	12/3/2013 10:05
Flow Rate	4797.37	MCF Per Day	12/3/2013 10:05
Pressure	203.88	PSIA	12/3/2013 10:05
Previous Day Energy	5930.91	MBTU	12/3/2013 10:05
Previous Day Gas Flow	4755.91	MCF	12/3/2013 10:05
Temperature	69.77	F	12/3/2013 10:05
Tubing Pressure	287.85	PSIA	12/3/2013 10:05
Daily AP	12.9	PSIA	12/3/2013 9:00
Daily DP	206.96	inH2O	12/3/2013 9:00
Daily Energy	5930.91	MBTU	12/3/2013 9:00
Daily Flow	4755.91	MCF	12/3/2013 9:00
Daily Tf	68.31	F	12/3/2013 9:00
Hourly AP	197.13	PSIA	12/3/2013 11:00
Hourly DP	13.86	Inches	12/3/2013 11:00
Hourly Energy	250.4	MBTU	12/3/2013 11:00
Hourly Flow Time	3600	Seconds	12/3/2013 11:00
Hourly Tf	69.4	F	12/3/2013 11:00
Hourly Volume	200.8	MCF	12/3/2013 11:00
Audited Accumulated Gas Volume		MCF	
Audited Casing Pressure	293	PSI	11/30/2013 9:00
Audited Gas Volume	4772.87	MCF	11/30/2013 9:00
Audited Oil Volume	0	Barrels	11/30/2013 9:00
Audited Tubing Pressure	293	PSI	11/30/2013 9:00
Audited Water Volume	0	Barrels	11/30/2013 9:00
Argon	0	%	12/3/2013 10:05
BTU	1247.06	BTU	12/3/2013 10:05
CO2	0.1467	%	12/3/2013 10:05
Carbon Monoxide	0	%	12/3/2013 10:05
Decane	0	%	12/3/2013 10:05
Ethane	14.1987	%	12/3/2013 10:05
Helium	0	%	12/3/2013 10:05
Heptane	0	%	12/3/2013 10:05
Hexane	0.5451	%	12/3/2013 10:05
Hydrogen	0	%	12/3/2013 10:05
Hydrogen Sulfide	0	%	12/3/2013 10:05
Iso-Butane	0.5666	%	12/3/2013 10:05
Iso-Pentane	0.3749	%	12/3/2013 10:05
Methane	77.6927	%	12/3/2013 10:05
N2	0.4946	%	12/3/2013 10:05
N-Butane	1.1838	%	12/3/2013 10:05
Nonane	0	%	12/3/2013 10:05
N-Pentane	0.2914	%	12/3/2013 10:05
Octane	0	%	12/3/2013 10:05
Oxygen	0.0117	%	12/3/2013 10:05
Plate Size	3.75	Inches	12/3/2013 10:05
Propane	4.4938	%	12/3/2013 10:05
SPG	0.7248		12/3/2013 10:05
Water	0	%	12/3/2013 10:05

# PowerTech Plus

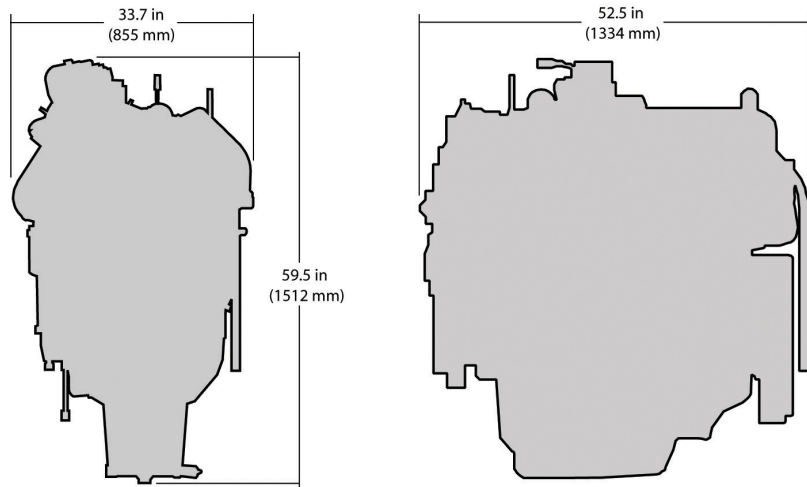
## 6135H Diesel Engine

Industrial Engine Specifications



6135H shown

### Dimensions



### Certifications

- CARB
- EPA Tier 3
- EU Stage III A

### General data

Model	6135HF485
Number of cylinders	6
Displacement - L (cu in)	13.5 (824)
Bore and Stroke-- mm (in)	132 x 165 (5.20 x 6.50)
Compression Ratio	16.0:1
Engine Type	In-line, 4-Cycle

Aspiration	Turbocharged and air-to-air aftercooled
Length - mm (in)	1334 (52.5)
Width - mm (in)	855 (33.7)
Height-- mm (in)	1512 (59.5)
Weight, dry-- kg (lb)	1493 (3291)

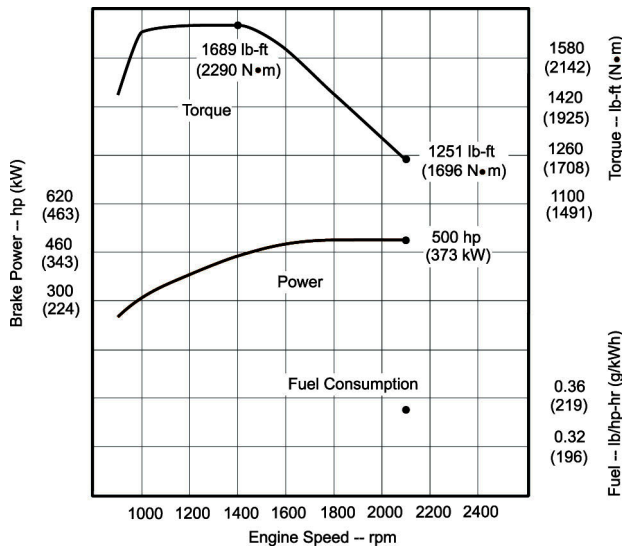
Intermittent BHP is the power rating for variable speed and load applications where full power is required intermittently.

Heavy duty - see application ratings/definitions, engine performance curves.

Continuous BHP is the power rating for applications operating under a constant load and speed for long periods of time.

Power output is within + or - 5% at standard SAE J 1995 and ISO 3 046.

## Performance curve



## Performance data

Intermittent rated speed	373 kW (500 hp) @ 2100 rpm
Peak power	373 kW (500 hp) @ 2100 rpm
Power bulge %	0% @ NA rpm
Peak torque	2290 N.m (1689 ft-lb) @ 1400 rpm
Torque rise %	35% @ 1400 rpm

## Features and benefits

### 4-Valve Cylinder Head

- The 4-valve cylinder head provides excellent airflow resulting in greater low-speed torque and better transient response. Cross flow design

### Electronic Unit Injector (EUI) and Engine Control Unit (ECU)

- The EUI fuel system provides variable common-rail pressure, multiple injections, and higher injection pressures, up to 2000 bar (29,000 psi). It also controls fuel injection timing and provides precise control for start, duration, and end of injection

### Cooled Exhaust Gas Recirculation (EGR)

- EGR cools and mixes measured amounts of cooled exhaust gas with incoming fresh air to lower peak combustion temperatures, thereby reducing NOx

### Variable Geometry Turbocharger (VGT)

- Varies exhaust pressure based on load and speed to insure proper EGR flow; greater low-speed torque, quicker transient response, higher peak torque, and best-in-class fuel economy.

### Air-to-Air Aftercooled

- This is the most efficient method of cooling intake air to help reduce engine emissions while maintaining low-speed torque, transient response time, and peak torque. It enables an engine to meet emissions regulations with better fuel economy and the lowest installed costs

### Compact Size

- Horsepower/displacement ratio is best-in-class
- Lower installed cost
- Mounting points are the same as Tier 2/Stage II engine models

### Engine Performance

- Multiple rated speeds to further reduce noise and improve fuel economy
- New higher peak torque ratings
- Better transient response time
- Greater levels of low speed torque
- Higher levels of power bulge

### John Deere Electronic Engine Controls

- Electronic engine controls monitor critical engine functions, providing warning and/or shutdown to prevent costly engine repairs and eliminate the need for add-on governing components all lowering total installed costs. Snapshot diagnostic data that can be retrieved using commonly available diagnostic service tools
- Controls utilize new common wiring interface connector for vehicles or a available OEM instrumentation packages; new solid conduit and "T" connectors to reduce wiring stress and provide greater durability and improved appearance
- Factory-installed, engine mounted ECU or remote-mounted ECU comes with wiring harness and associated components. Industry-standard SAE J1939 interface communicates with other vehicle systems, eliminating redundant sensors and reducing vehicle installed cost

### Additional Features

- Gear-driven auxiliary drives; 500-hour oil change; self-adjusting poly-vee fan drive; R.H. and L.H. engine-mounted fuel filters; single-piece low friction piston; optional rear PTO; low-pressure fuel system with "auto-prime" feature; directed top-liner cooling

**John Deere Power Systems**  
3801 W. Ridgeway Ave.  
PO Box 5100  
Waterloo, IA 50704-5100  
Phone: 1-800-533-6446  
Fax: 319.292.5075

**John Deere Power Systems**  
**Usine de Saran**  
La Foulonnerie - B.P. 11.13  
45401 Fleury les Aubrais Cedex  
France  
Phone: 33.2.38.82.61.19  
Fax: 33.2.38.82.60.00

*All values at rated speed and power with standard options unless otherwise noted. Specifications and design subject to change without notice.*

# Attachment O

## Monitoring/Recordkeeping/Reporting/Testing Plans

**Attachment O****Proposed Monitoring, Recordkeeping, Reporting, and Testing  
Pearl Jean Well Pad  
Antero Resources Corporation  
Doddridge County, West Virginia**

The Facility will perform the following to demonstrate compliance with emission limits and operating parameters:

1. Monitor and maintain records of natural gas usage for the heaters
2. Monitor the presence of the vapor combustor pilot flame with a thermocouple or equivalent.
3. Monitor opacity from the heaters and enclosed combustor
4. Monitor and maintain records of condensate and produced water transferred from storage tanks.
5. Monitor engine setting adjustments to ensure these are consistent with manufacturer's instructions.
6. Maintain records of hours of operations of the engines.
7. Maintain records of maintenance performed on engines.
8. Documentation from manufacturer that engine is certified to meet emission standards

These records will be maintained on site or in a readily available off-site location for a period of 5 years.

# Attachment P

## Public Notice



**Attachment P**

**Air Quality Permit Notice  
Notice of Application  
Pearl Jean Well Pad  
Antero Resources Corporation  
Doddridge County, West Virginia**

Notice is given that Antero Resources Corporation has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a NSR Permit 45CSR13 for an Oil and Natural Gas facility located at 19 Antioch Rd, Salem, WV 26426.

The latitude and longitude coordinates are: 39.285147 degrees N and -80.672978 degrees W

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

Pollutants	TOTALS (tpy):
VOC	29.0980
NO <sub>x</sub>	31.5852
CO <sub>2e</sub>	10217.4
CO	7.6768
SO <sub>2</sub>	10.7933
PM <sub>2.5</sub>	0.2222
PM <sub>10</sub>	1.1656
Lead	1.48E-05
Total HAPs	2.1339
Benzene	0.0684
Formaldehyde	0.0528
Xylenes	0.2442

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

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1227, during normal business hours.

Dated this the \_\_ day of \_\_\_\_\_, 2015

By: Antero Resources Corporation  
Barry Schatz  
Senior Environmental & Regulatory Manager  
1615 Wynkoop Street  
Denver, CO 80202

# Attachment R

## Authority Forms

**Attachment R  
AUTHORITY OF CORPORATION  
OR OTHER BUSINESS ENTITY (DOMESTIC OR FOREIGN)**

TO: The West Virginia Department of Environmental Protection,  
Division of Air Quality

DATE: January 23, 2015

ATTN.: Director

Corporation's / other business entity's Federal Employer I.D. Number 80-0162034

The undersigned hereby files with the West Virginia Department of Environmental Protection, Division of Air Quality, a permit application and hereby certifies that the said name is a trade name which is used in the conduct of an incorporated business or other business entity.

Further, the corporation or the business entity certifies as follows:

(1) Barry Schatz (is/are) the authorized representative(s) and in that capacity may represent the interest of the corporation or the business entity and may obligate and legally bind the corporation or the business entity.

(2) The corporation or the business entity is authorized to do business in the State of West Virginia.

(3) If the corporation or the business entity changes its authorized representative(s), the corporation or the business entity shall notify the Director of the West Virginia Department of Environmental Protection, Division of Air Quality, immediately upon such change.



\_\_\_\_\_  
President or Other Authorized Officer  
(Vice President, Secretary, Treasurer or other  
official in charge of a principal business function of  
the corporation or the business entity)

(If not the President, then the corporation or the business entity must submit certified minutes or bylaws stating legal authority of other authorized officer to bind the corporation or the business entity).

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
Name of Corporation or business entity

# Attachment

## Application Fee

Conestoga-Rovers & Associates, Inc.

▼ PLEASE DETACH AND RETAIN FOR YOUR RECORDS ▼

INVOICE NUMBER	DATE	VOUCHER NO.	AMOUNT
Account Number: CR21215	2/12/2015	40WVDEPAQ 400936171	398080 2,000.00
<b>TOTAL:</b>			<b>2,000.00</b>

THIS DOCUMENT IS PROTECTED BY A MICRO-PRINT SIGNATURE LINE, FLUORESCENT PAPER FIBERS, A WATERMARKED BACKER, AND IS REACTIVE TO CHEMICAL ALTERATION

**Conestoga-Rovers & Associates, Inc.**  
 2055 NIAGARA FALLS BLVD, SUITE 3  
 NIAGARA FALLS, NY 14304

**M&T BANK**  
 MANUFACTURERS AND TRADERS TRUST COMPANY  
 Commercial Banking  
 Main Office, Ithaca, NY 14850  
 50-7063-2213

2/13/2015 NO. 398080

PAY \*\*\*\*\*2,000 DOLLARS AND \*\*\*\*\*00 CENTS \$ \*\*\*\*\*2,000.00

TO THE  
ORDER  
OF

WV Dept. of Environmental Protectio  
 Division Air Quality  
 601 57th Street SE  
 Charleston,, WV 25304 US

Conestoga-Rovers & Associates, Inc.  
  
  
 AUTHORIZED SIGNATURES

WARNING: THIS DOCUMENT IS VOID IF ACCOUNT NUMBER DOES NOT APPEAR ON THE REVERSE SIDE IN RED

⑈ 398080⑈ ⑆ 221370632⑆ 51000000118910⑈