



July 8, 2016

Reference No. 082715

Ms. Beverly McKeone  
Division of Air Quality  
WV Department of Environmental Protection  
601 57th Street, SE  
Charleston, West Virginia 25304

Dear Ms. Beverly McKeone:

**Re: General Permit Registration G70-C Modification Application  
Alvadore Well Pad  
Antero Resources Corporation**

GHD Services Inc. (GHD) would like to submit this General Permit Modification application that we prepared on behalf of Antero Resources Corporation for an oil and gas facility identified as Alvadore Well Pad.

A General Permit Registration Modification is requested due to the following planned operational changes:

1. Increase in production.
2. Addition of two Cimarron enclosed combustors
3. Addition of two condensate tanks
4. Addition of 8 line heaters.

Please refer to Table 14 in Attachment S - Emissions Calculations for the summary of changes in emissions of regulated air pollutants that will result from the above operational changes.

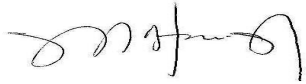
Enclosed are the following documents:

- Original copy of the G70-C General Permit Modification Application.
- Two CD copies of the G70-C General Permit Modification Application.
- The application fee with check no. 449975 in the amount of \$1,500.00.

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

Sincerely,

GHD Services Inc.

A handwritten signature in black ink, appearing to read 'Manuel Bautista', written in a cursive style.

Manuel Bautista

MB/ma/256

Encl.

cc: Barry Schatz, Antero Resources Corporation  
Elizabeth McLaughlin, Antero Resources Corporation



## General Permit G70-C Modification Application

Increase in production and the addition of eight line heaters, two condensate tanks, and two Cimarron enclosed combustors.

Alvadore Well Pad

Antero Resources Corporation

GHD Services Inc.  
6320 Rothway Suite 100 Houston Texas 77040  
082715 | Report No 256 | July 2016

## Table of Contents

### G70-C General Permit Modification

Attachment A	Single Source Determination Form
Attachment B	Siting Criteria Waiver – Not Applicable
Attachment C	Current Business Certificate
Attachment D	Process Flow Diagram
Attachment E	Process Description
Attachment F	Plot Plan
Attachment G	Area Map
Attachment H	G70-C Section Applicability Form
Attachment I	Emission Units/ERD Table
Attachment J	Fugitive Emissions Summary Sheet
Attachment K	Gas Well Affected Facility Data Sheet
Attachment L	Storage Vessels Data Sheet
Attachment M	Natural Gas Fired Fuel Burning Units Data Sheet
Attachment N	Internal Combustion Engine Data Sheet
Attachment O	Tanker Truck Loading Data Sheet
Attachment P	Glycol Dehydration Unit Sheet(s) – Not Applicable
Attachment Q	Pneumatic Controllers Data Sheet – Not Applicable
Attachment R	Air Pollution Control Device/ Emissions Reduction Devices Sheet
Attachment S	Emission Calculations
Attachment T	Facility-wide Emissions Summary Sheets
Attachment U	Class I Legal Advertisement



west virginia department of environmental protection

Division of Air Quality  
601 57<sup>th</sup> Street SE  
Charleston, WV 25 4  
Phone (304) 926-0475  
Fax (304) 926-0479  
www.dep.wv.gov

### G70-C GENERAL PERMIT REGISTRATION APPLICATION

PREVENTION AND CONTROL OF AIR POLLUTION IN REGARD TO THE CONSTRUCTION, MODIFICATION, RELOCATION, ADMINISTRATIVE UPDATE AND OPERATION OF NATURAL GAS PRODUCTION FACILITIES LOCATED AT THE WELL SITE

- CONSTRUCTION
- MODIFICATION
- RELOCATION
- CLASS I ADMINISTRATIVE UPDATE
- CLASS II ADMINISTRATIVE UPDATE

#### SECTION 1. GENERAL INFORMATION

Name of Applicant (as registered with the WV Secretary of State's Office): Antero Resources Corporation

Federal Employer ID No. (FEIN): 80-0162034

Applicant's Mailing Address: 1615 Wynkoop Street

City: Denver

State: CO

ZIP Code: 80202

Facility Name: Alvadore Well Pad

Operating Site Physical Address: 142 Rocket Dr.

City: Greenwood

Zip Code: 26415

County: Doddridge

Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):

Latitude: 39.27347

Longitude: -80.88265

SIC Code: 1311

DAQ Facility ID No. (For existing facilities)

NAICS Code: 211111

017-00117

#### CERTIFICATION OF INFORMATION

This G70-C General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of the Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. **Any administratively incomplete or improperly signed or unsigned G70-C Registration Application will be returned to the applicant. Furthermore, if the G70-C forms are not utilized, the application will be returned to the applicant. No substitution of forms is allowed.**

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

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

Responsible Official Signature: \_\_\_\_\_

Name and Title:

Phone:

Fax:

Email:

Date:

If applicable:

Authorized Representative Signature: Barry Schatz  
Name and Title: Barry Schatz/ Senior Environmental & Regulatory Manager Phone: 303-357-7276 Fax: 303-357-7315

Email: bschatz@anteroresources.com Date: 7/8/2016

If applicable:

Environmental Contact

Name and Title:

Phone:

Fax:

Email:

Date:

**OPERATING SITE INFORMATION**

Briefly describe the proposed new operation and/or any change(s) to the facility: Increase in production and the addition of 8 line heaters, 2 condensate tanks, and 2 Cimarron enclosed combustors.

Directions to the facility: From Clarksburg, Get on US-50 W in North Urban from Traders Ave, S Chestnut St and Broadus Ave. Head to US-50 in Pine for approximately 33 miles, turn right onto U.S 50E/Sunnyside Rd for approximately 0.3 mi, then turn right onto Old US 50E/Sunnyside Rd and continue for 0.3 miles. Turn right onto Duckworth Rd and continue for 453ft. Turn left onto Collins Hollow Rd and continue for 0.1 mile. Turn right onto Co Rte. 36/6 and continue for 449ft. Turn left onto Old U.S 50 W/Sunnyside Rd for 0.3 mile. Turn left at the first cross street onto US-50E for 0.3 mile. Haul road entrance for Alvadore Pad will be on the right.

**ATTACHMENTS AND SUPPORTING DOCUMENTS**

**I have enclosed the following required documents:**

Check payable to WVDEP – Division of Air Quality with the appropriate application fee (per 45CSR13 and 45CSR22).

- Check attached to front of application.
- I wish to pay by electronic transfer. Contact for payment (incl. name and email address):
- I wish to pay by credit card. Contact for payment (incl. name and email address):
  
- \$500 (Construction, Modification, and Relocation)                       \$300 (Class II Administrative Update)
- \$1,000 NSPS fee for 40 CFR60, Subpart IIII, JJJJ and/or OOOO <sup>1</sup>
- \$2,500 NESHAP fee for 40 CFR63, Subpart ZZZZ and/or HH <sup>2</sup>

<sup>1</sup> Only one NSPS fee will apply.  
<sup>2</sup> Only one NESHAP fee will apply. The Subpart ZZZZ NESHAP fee will be waived for new engines that satisfy requirements by complying with NSPS, Subparts IIII and/or JJJJ.  
*NSPS and NESHAP fees apply to new construction or if the source is being modified.*

- Responsible Official or Authorized Representative Signature (if applicable)
- Single Source Determination Form (**must be completed in its entirety**) – Attachment A
- Siting Criteria Waiver (if applicable) – Attachment B                       Current Business Certificate – Attachment C
- Process Flow Diagram – Attachment D                                       Process Description – Attachment E
- Plot Plan – Attachment F     Area Map – Attachment G
- G70-C Section Applicability Form – Attachment H                       Emission Units/ERD Table – Attachment I
- Fugitive Emissions Summary Sheet – Attachment J
- Gas Well Affected Facility Data Sheet (if applicable) – Attachment K
- Storage Vessel(s) Data Sheet (include gas sample data, USEPA Tanks, simulation software (e.g. ProMax, E&P Tanks, HYSYS, etc.), etc. where applicable) – Attachment L
- Natural Gas Fired Fuel Burning Unit(s) Data Sheet (GPU's, Heater Treaters, In-Line Heaters if applicable) – Attachment M
- Internal Combustion Engine Data Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment N
- Tanker Truck Loading Data Sheet (if applicable) – Attachment O
- Glycol Dehydration Unit Data Sheet(s) (include wet gas analysis, GRI- GLYCalc™ input and output reports and information on reboiler if applicable) – Attachment P
- Pneumatic Controllers Data Sheet – Attachment Q
- Air Pollution Control Device/Emission Reduction Device(s) Sheet(s) (include manufacturer performance data sheet(s) if applicable) – Attachment R
- Emission Calculations (please be specific and include all calculation methodologies used) – Attachment S
- Facility-wide Emission Summary Sheet(s) – Attachment T
- Class I Legal Advertisement – Attachment U
- One (1) paper copy and two (2) copies of CD or DVD with pdf copy of application and attachments

GHD SERVICES INC.

PLEASE DETACH AND RETAIN FOR YOUR RECORDS

INVOICE NUMBER	DATE	VOUCHER NO.	AMOUNT
----------------	------	-------------	--------

Account Number:  
CR61716

6/17/2016

40WVDEPAQ

401010377

449975

1,500.00

TOTAL: 1,500.00

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

**GHD SERVICES 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

6/17/2016

NO. 449975

PAY

\*\*\*\*\*1,500

DOLLARS AND

\*\*\*\*\*00

CENTS

\$ \*\*\*\*\*1,500.00

TO THE  
ORDER  
OF

**West Virginia Dept of Environmental**

Protection - Division Air Quality  
601 57th Street SE  
Charleston, WV 25304 US

GHD SERVICES INC.

AUTHORIZED SIGNATURES

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

⑈449975⑈ ⑆221370632⑆ 61000000 118910⑈

**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 A**

## **Single Source Determination Form**

## ATTACHMENT A - SINGLE SOURCE DETERMINATION FORM

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

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

Is there a facility owned by or associated with the natural gas industry located within one (1) mile of the proposed facility? Yes  No

*If Yes, please complete the questionnaire on the following page (Attachment A).*

Please provide a source aggregation analysis for the proposed facility below:

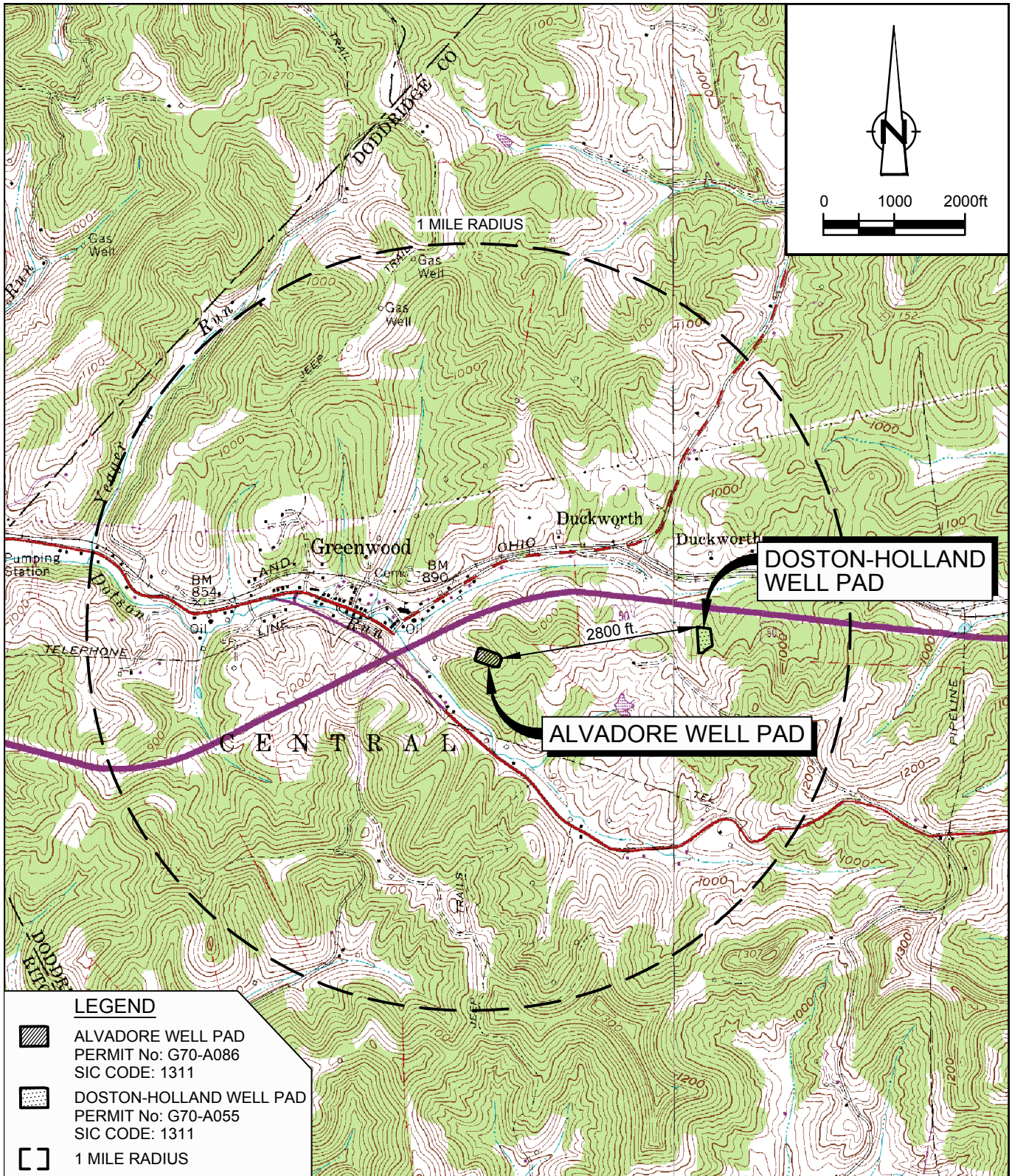
The Alvadore Well Pad calculation of potential to emit included all the emissions sources that belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under the control of the same person. The nearest emission source that belongs to the same industrial grouping and under the control of the same person but not located on contiguous or adjacent property is the Doston-Holland Well Pad. This operates independently and is approximately 0.53 mile east of the facility.

## ATTACHMENT A - SINGLE SOURCE DETERMINATION FORM




Answer each question with a detailed explanation to determine contiguous or adjacent properties which are under a common control and any support facilities. This section must be completed in its entirety.

Provide a map of contiguous or adjacent facilities (production facilities, compressor stations, dehydration facilities, etc.) which are under common control and those facilities that are not under common control but are support facilities. Please indicate the SIC code, permit number (if applicable), and the distance between facilities in question on the map.

Are the facilities owned by the same parent company or a subsidiary of the parent company? Provide the owners identity and the percentage of ownership of each facility. <b>Antero Resources has 100% ownership of each facility.</b>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Does an entity such as a corporation have decision making authority over the operation of a second entity through a contractual agreement or voting interest? Please explain.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is there a contract for service relationship between the two (2) companies or, a support/dependency relationship that exists between the two (2) companies? Please explain.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Do the facilities share common workforces, plant managers, security forces, corporate executive officers or board executives?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Will managers or other workers frequently shuttle back and forth to be involved actively at both facilities?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Do the facilities share common payroll activities, employee benefits, health plans, retirement funds, insurance coverage, or other administrative functions? Please explain.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Does one (1) facility operation support the operation of the other facility?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is one (1) facility dependent on the other? If one (1) facility shuts down, what are the limitations on the other to pursue outside business? Please explain. <b>No, these facilities operate completely independently.</b>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Are there any financial arrangements between the two (2) entities?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Are there any legal or lease agreements between the two (2) facilities?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Do the facilities share products, byproducts, equipment, or other manufacturing or air pollution control device equipment? Please explain. <b>No, these facilities operate completely independently.</b>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Do all the pollutant-emitting activities at the facilities belong to the same SIC Code? Please provide the SIC Codes. <b>1311</b>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Was the location of the new facility chosen primarily because of its proximity to the existing facility to integrate the operation of the two (2) facilities? Please explain. <b>No, these facilities operate completely independently.</b>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Will materials be routinely transferred between the two (2) facilities? Please explain the amount of transfer and how often the transfers take place and what percentages go to the various entities.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Does the facility influence production levels or compliance with environmental regulations at other facilities? Who accepts the responsibility for compliance with air quality requirements? Please explain. <b>No, these facilities operate completely independently.</b>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>



**LEGEND**

-  ALVADORE WELL PAD  
PERMIT No: G70-A086  
SIC CODE: 1311
-  DOSTON-HOLLAND WELL PAD  
PERMIT No: G70-A055  
SIC CODE: 1311
-  1 MILE RADIUS

SOURCE: USGS QUADRANGLE MAP;  
WEST UNION, WEST VIRGINIA  
PENNSBORO, WEST VIRGINIA

SITE COORDINATES: LAT: 39.27347, LONG: -80.88265



Attachment A

**SINGLE SOURCE DETERMINATION**  
**ALVADORE WELL PAD**  
**ANTERO RESOURCES**  
*Doddridge County, West Virginia*

# **Attachment B**

## **Siting Criteria Waiver**

**Attachment B**

**Siting Waiver**

**Alvadore Well Pad**

**Antero Resources Corporation**

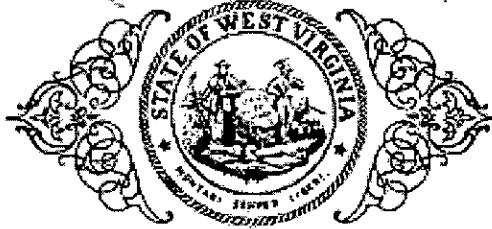
**Doddridge County, West Virginia**

A Siting Waiver form is not required because there are no occupied dwelling structures within 300 feet of Alvadore Well Pad.

# **Attachment C**

## **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)

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

**APPLICATION FOR  
AMENDED CERTIFICATE  
OF AUTHORITY**

**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)

6. 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

7. 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.

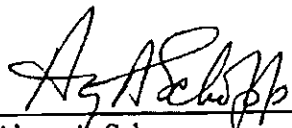
2. This Amendment to the Amended and Restated Certificate of Incorporation has been duly adopted and approved in accordance with Sections 242 of the General Corporation Law of the State of Delaware.

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.

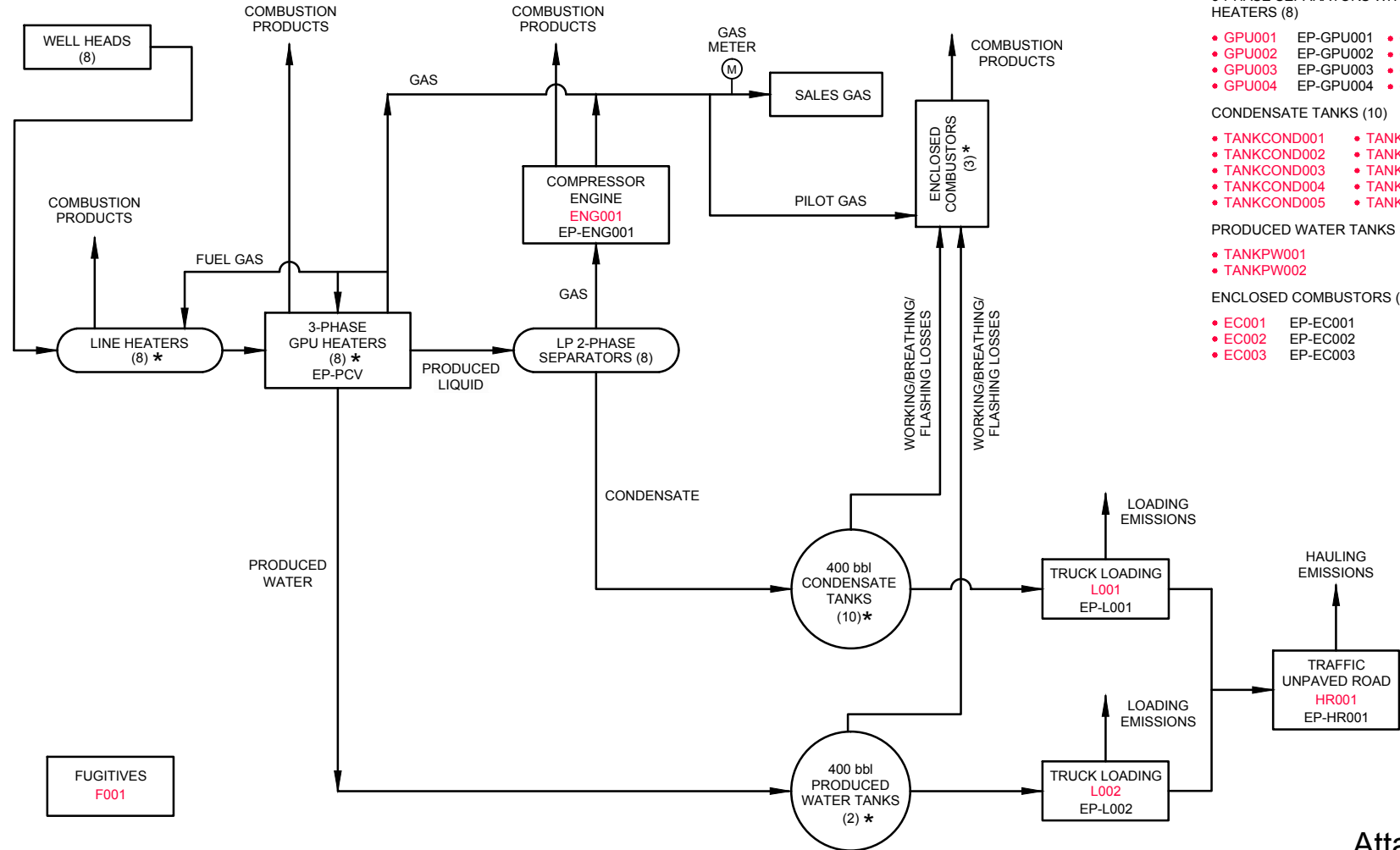
IN WITNESS WHEREOF, the Corporation has caused this Certificate of Amendment to be executed by its duly authorized officer on the 10th day of June, 2013.

ANTERO RESOURCES APPALACHIAN CORPORATION

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

# **Attachment D**

## **Process Flow Diagram**



- \* LINE HEATERS (8)
  - LH001 EP-LH001
  - LH005 EP-LH005
  - LH002 EP-LH002
  - LH006 EP-LH006
  - LH003 EP-LH003
  - LH007 EP-LH007
  - LH004 EP-LH004
  - LH008 EP-LH008
- 3-PHASE SEPARATORS WITH HEATERS (8)
  - GPU001 EP-GPU001
  - GPU005 EP-GPU005
  - GPU002 EP-GPU002
  - GPU006 EP-GPU006
  - GPU003 EP-GPU003
  - GPU007 EP-GPU007
  - GPU004 EP-GPU004
  - GPU008 EP-GPU008
- CONDENSATE TANKS (10)
  - TANKCOND001
  - TANKCOND006
  - TANKCOND002
  - TANKCOND007
  - TANKCOND003
  - TANKCOND008
  - TANKCOND004
  - TANKCOND009
  - TANKCOND005
  - TANKCOND010
- PRODUCED WATER TANKS (2)
  - TANKPW001
  - TANKPW002
- ENCLOSED COMBUSTORS (3)
  - EC001 EP-EC001
  - EC002 EP-EC002
  - EC003 EP-EC003

Attachment D

PROCESS FLOW DIAGRAM - ANTERO RESOURCES  
ALVADORE WELL PAD  
Doddrige County, West Virginia



# **Attachment E**

## **Process Description**

## **Attachment E**

### **Process Description**

#### **Alvadore Well Pad**

#### **Antero Resources Corporation**

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

A mixture of condensate, water, and entrained gas from the condensate and gas wells enters the facility through a series of line heaters (LH001-008) and gas production units (GPU001-GPU008) which are 3-phase separators where the gas, condensate, and produced water are separated. The line heaters and GPUs are fueled by a slip stream of the separated gas.

The gas from the three phase separators is metered and sent to the sales gas pipeline. The water flow to the produced water storage tanks (TANKPW001-002). The condensate is then sent to two phase low pressure separators where gas is further separated. The gas is routed to the gas fueled compressor engines (ENG001), compressed, metered and sent to the sales gas line. The condensate from the two phase separators flows to the condensate storage tanks (TANKSCOND001-010). The line heaters are only used during the first several months from start of production and will be removed once production has normalized.

The facility has ten (10) tanks (TANKCOND001-010) on site to store condensate and two (2) tanks (TANKPW001-002) to store produced water prior to removal from the site. The flashing, working and breathing losses from the tanks are routed to three enclosed combustors (EC001-003) to control the emissions. The enclosed combustor(s) that will be used to control emissions are designed to achieve a VOC destruction efficiency of 98 percent.

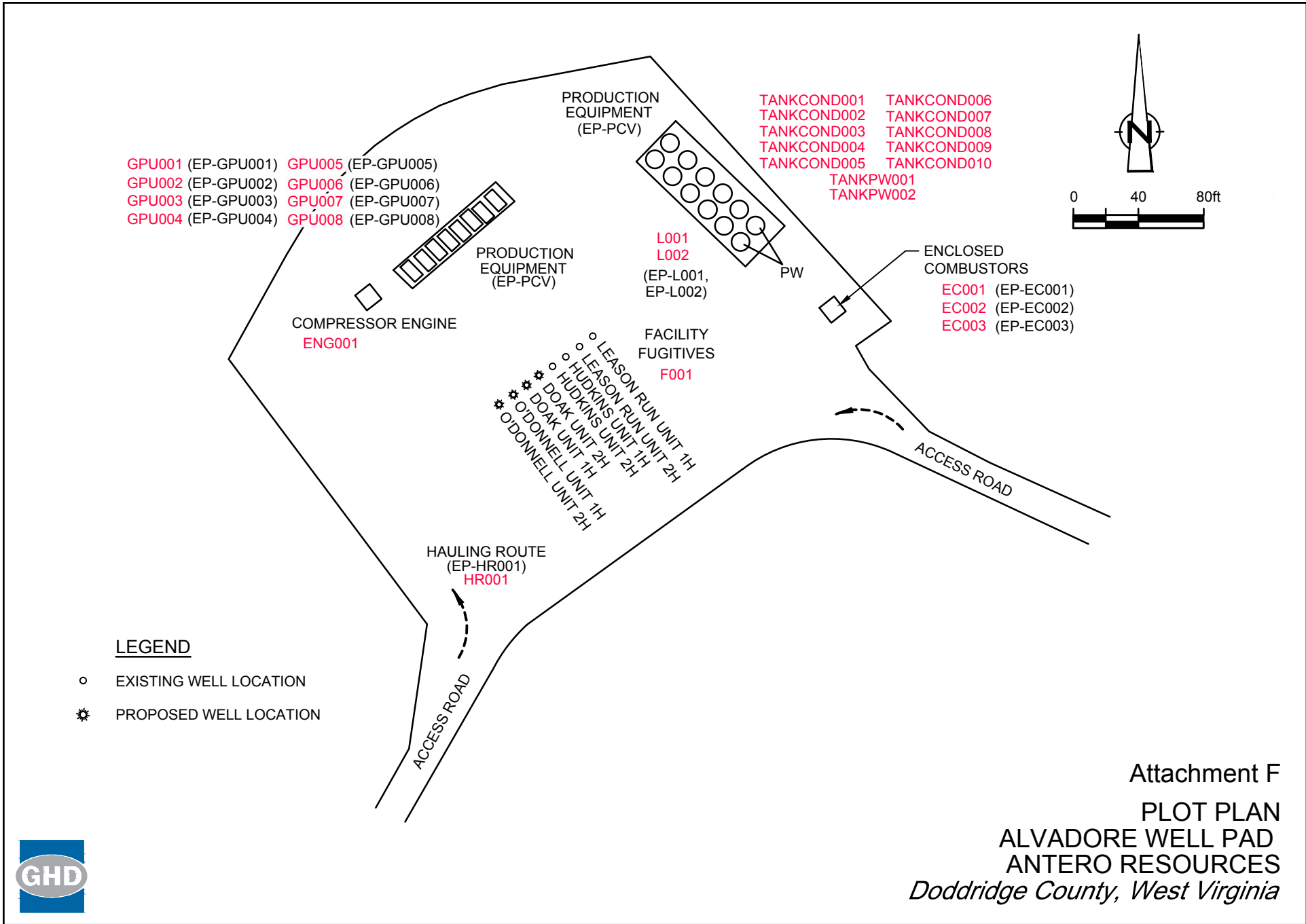
Condensate and produced water are transported off site on an as needed basis via tanker truck. Truck loading connections are in place to pump condensate (L001) and produced water (L002) from the storage tanks into tanker trucks. Emissions from the loading operations are vented to the atmosphere.

Emissions from the facility's emission sources were calculated using the extended analysis of condensate from Nero Unit 2H in the McGill Well Pad and site specific gas analysis from Leason Run Unit 1H, Alvadore Well Pad. The extended condensate analysis is considered representative of the materials from Alvadore Well Pad, being in the same Marcellus rock formation.

# **Attachment F**

## **Plot Plan**



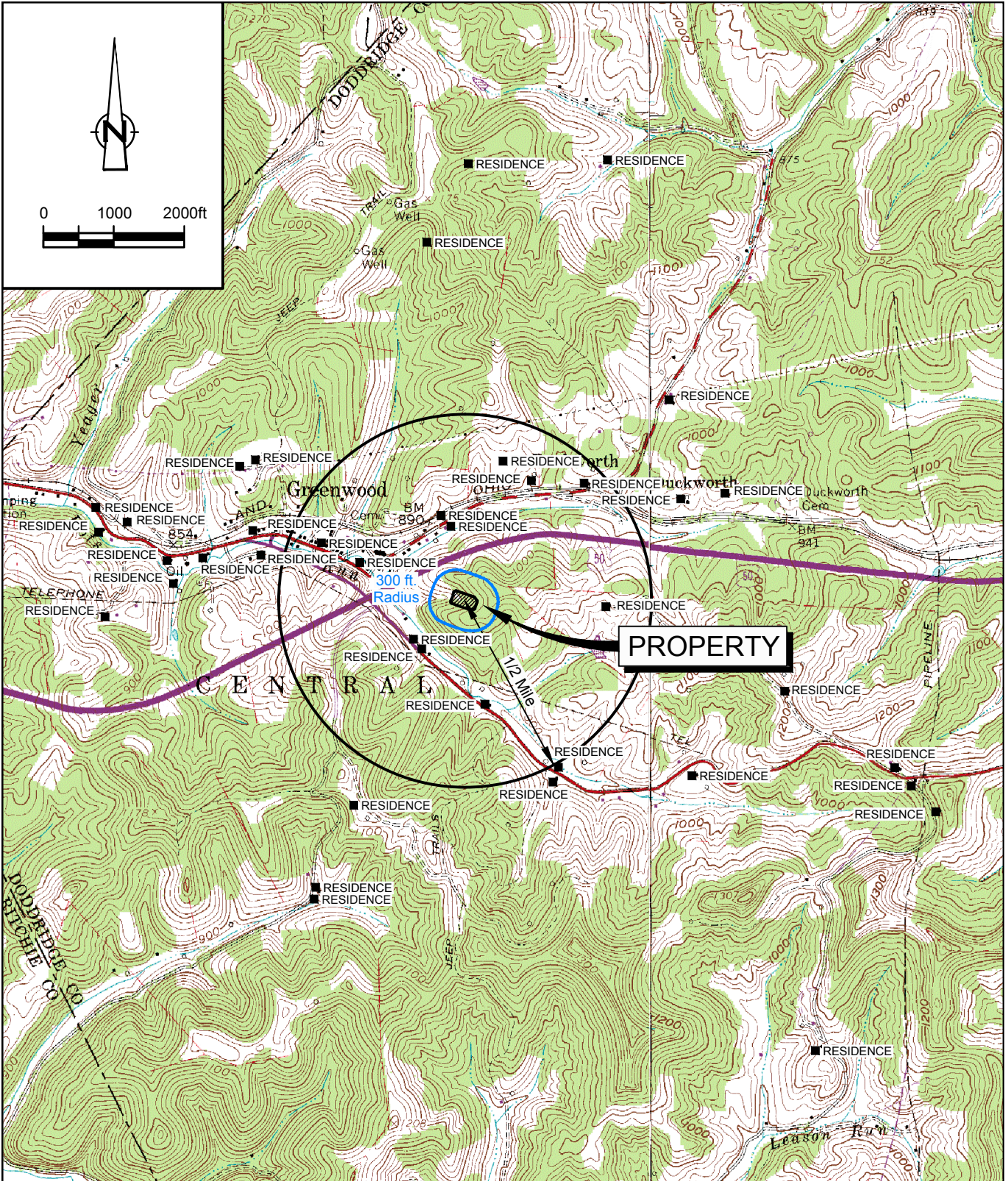


Attachment F  
 PLOT PLAN  
 ALVADORE WELL PAD  
 ANTERO RESOURCES  
 Doddridge County, West Virginia



# **Attachment G**

## **Area Map**



SOURCE: USGS QUADRANGLE MAP;  
 WEST UNION, WEST VIRGINIA  
 PENNSBORO, WEST VIRGINIA  
 SITE COORDINATES: LAT: 39.27347, LONG: -80.88265 NAD 83  
 SITE ELEVATION: 1055 ft AMSL



Attachment G  
 AREA MAP  
 ALVADORE WELL PAD  
 ANTERO RESOURCES  
*Doddridge County, West Virginia*

# **Attachment H**

## **G70-C Section Applicability Form**

**ATTACHMENT H – G70-C SECTION APPLICABILITY FORM**

**General Permit G70-C Registration<sup>1</sup>  
Section Applicability Form**

General Permit G70-C was developed to allow qualified applicants to seek registration for a variety of sources. These sources include gas well affected facilities, storage vessels, gas production units, in-line heaters, heater treaters, glycol dehydration units and associated reboilers, pneumatic controllers, centrifugal compressors, reciprocating compressors, reciprocating internal combustion engines (RICEs), tank truck loading, fugitive emissions, completion combustion devices, flares, enclosed combustion devices, and vapor recovery systems. All registered facilities will be subject to Sections 1.0, 2.0, 3.0, and 4.0.

General Permit G70-C allows the registrant to choose which sections of the permit they are seeking registration under. Therefore, please mark which additional sections that you are applying for registration under. If the applicant is seeking registration under multiple sections, please select all that apply. Please keep in mind, that if this registration is approved, the issued registration will state which sections will apply to your affected facility.

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

- 1 Applicants that are subject to Section 6 may also be subject to Section 7 if the applicant is subject to the NSPS, Subpart OOOO control requirements or the applicable control device requirements of Section 8.*
- 2 Applicants that are subject to Section 11 and 12 may also be subject to the applicable RICE requirements of Section 13.*
- 3 Applicants that are subject to Section 14 may also be subject to control device and emission reduction device requirements of Section 8.*
- 4 Applicants that are subject to Section 15 may also be subject to the requirements of Section 9 (reboilers). Applicants that are subject to Section 15 may also be subject to control device and emission reduction device requirements of Section 8.*

# **Attachment I**

## **Emission Units/ ERD Table**

**ATTACHMENT I – EMISSION UNITS / EMISSION REDUCTION DEVICES (ERD) TABLE**

Include ALL emission units and air pollution control devices /ERDs that will be part of this permit application review. This information is required for all sources regardless of whether it is a construction, modification, or administrative update.

Emission Unit ID <sup>1</sup>	Emission Point ID <sup>2</sup>	Emission Unit Description	Year Installed/Modified	Manufac. Date <sup>3</sup>	Design Capacity	Type <sup>4</sup> and Date of Change	Control Device(s) <sup>5</sup>	ERD (s) <sup>6</sup>
GPU001, GPU002, GPU003, GPU004, GPU005, GPU006, GPU007, GPU008	EP-GPU001, EP-GPU002, EP-GPU003, EP-GPU004, EP-GPU005, EP-GPU006, EP-GPU007, EP-GPU008	Gas Production Unit Heater	2014		1.5 MMBtu/hr	Existing	N/A	
LH001, LH002, LH003, LH004, LH005, LH006, LH007, LH008	EP-LH001, EP-LH002, EP-LH003, EP-LH004, EP-LH005, EP-LH006, EP-LH007, EP-LH008	Line Heater	2016		2.0 MMBtu/hr	New	N/A	
F001	F001	Fugitives	2014		N/A	Existing	N/A	
TANKCOND001-010	EP-EC001, EP-EC002, EP-EC003	Condensate Tank F/W/B	2014 (8) ; 2016 (2)		400 bbl each	(8) Existing (2) New	EC001, EC002, EC003	
TANKPW001-002	EP-EC001, EP-EC002, EP-EC003	PW Tank F/W/B	2014		400 bbl each	Existing	EC001, EC002, EC003	
L001	EP-L001	Loading (Condensate)	2014		200 bbl capacity (each)	Existing	N/A	
L002	EP-L002	Loading (Produced Water)	2014		200 bbl capacity (each)	Existing	N/A	
HR001	EP-HR001	Haul Truck	2014		40 ton capacity	Existing	N/A	
EC001	EP-EC001	Enclosed Combustor	2014		90 scf/min	Existing	N/A	
EC002	EP-EC002	Enclosed Combustor	2016		90 scf/min	New	N/A	
EC003	EP-EC003	Enclosed Combustor	2016		90 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	2013	24 HP	Existing	Non-Selective Catalytic Reduction	

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

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

3 When required by rule.

4 New, modification, removal, existing.

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

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

# **Attachment J**

## **Fugitive Emissions Summary Sheet**



**ATTACHMENT J – FUGITIVE EMISSIONS SUMMARY SHEET**

Sources of fugitive emissions may include loading operations, equipment leaks, blowdown emissions , etc.

Use extra pages for each associated source or equipment if necessary.

Source/Equipment:

Leak Detection Method Used		<input type="checkbox"/> Audible, visual, and	<input checked="" type="checkbox"/> Infrared (FLIR) cameras	<input type="checkbox"/> Other (please describe)	<input type="checkbox"/> None required		
Component Type	Closed Vent System	Count	Source of Leak Factors (EPA, other (specify))	Stream type (gas, liquid, etc.)	Estimated Emissions (tpy)		
					VOC	HAP	GHG (CO2e)
Valves	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	400	EPA	gas	2.19	0.31	287.85
Valves	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	416	EPA	liquid	9.81	0.69	1.80
Connections (Not sampling)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	472	EPA	gas	0.11	1.62E-02	15.10
Flanges	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	104	EPA	gas	0.05	6.94E-03	6.49
Loading	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	2	EPA	gas	1.77	1.90E-02	2.15

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

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

Please indicate if there are any closed vent bypasses (include component)

Specify all equipment used in the closed vent system (e. g. VRU, ERD, thief hatches, tanker truck loading, etc.)

# **Attachment K**

## **Gas Well Affected Facility Data Sheet**

**ATTACHMENT K – GAS WELL AFFECTED FACILITY DATA SHEET**

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

<b>API Number</b>	<b>Date of Flowback</b>	<b>Date of Well Completion</b>	<b>Green Completion and/or Combustion Device</b>
47017064150000	3/5/2015	1/18/2015	Green
47017064360000	3/13/2015	12/23/2014	Green
47017064740000	2/26/2015	1/19/2015	Green
47017064750000	2/20/2015	12/26/2016	Green
47-017-06767-00	4/10/2017	1/1/2017	Green
47-017-06766-00	4/10/2017	1/1/2017	Green
2 proposed wells	4/10/2017	1/1/2017	Green

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

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

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

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

*Where,*  
 047 = *State code. The state code for WV is 047.*  
 001 = *County Code. County codes are odd numbers, beginning with 001 (Barbour) and continuing to 109 (Wyoming).*  
 00001 = *Well number. Each well will have a unique well number.*

# **Attachment L**

## **Storage Vessel Data Sheet**

**ATTACHMENT L – STORAGE VESSEL DATA SHEET**

Complete this data sheet if you are the owner or operator of a storage vessel that contains condensate and/or produced water. This form must be completed for each new or modified bulk liquid storage vessel(s) that contains condensate and/or produced water. (If you have more than one (1) identical tank (i.e. 4-400 bbl condensate tanks), then you can list all on one (1) data sheet). **Include gas sample analysis, flashing emissions, working and breathing losses, USEPA Tanks, simulation software (ProMax, E&P Tanks, HYSYS, etc.), and any other supporting documents where applicable.**

**The following information is REQUIRED:**

- Composition of the representative sample used for the simulation
- For each stream that contributes to flashing emissions:
  - Temperature and pressure (inlet and outlet from separator(s))
  - Simulation-predicted composition
  - Molecular weight
  - Flow rate
- Resulting flash emission factor or flashing emissions from simulation
- Working/breathing loss emissions from tanks and/or loading emissions if simulation is used to quantify those emissions

Additional information may be requested if necessary.

**GENERAL INFORMATION (REQUIRED)**

1. Bulk Storage Area Name Tanks	2. Tank Name: Condensate Tank 001-010
3. Emission Unit ID number: TANKCOND001-010	4. Emission Point ID number. EP-EC001, EP-EC002, EP-EC003

5. Date Installed , Modified or Relocated (for existing tanks) 2014 (8) ; Was the tank manufactured after August 23, 2011? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	6. Type of change: <input checked="" type="checkbox"/> New construction <input type="checkbox"/> New stored material <input type="checkbox"/> Other <input type="checkbox"/> Relocation
---	---

7A. Description of Tank Modification (if applicable)
7B. Will more than one material be stored in this tank? If so, a separate form must be completed for each material. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

7C. Was USEPA Tanks simulation software utilized? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
--

*If Yes, please provide the appropriate documentation and items 8-42 below are not required.*

**TANK INFORMATION**

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 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): 5948040	13B. Maximum daily throughput (gal/day): 16296
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 36	15. Maximum tank fill rate (gal/min) 168

16. Tank fill method <input type="checkbox"/> Submerged <input checked="" type="checkbox"/> Splash <input type="checkbox"/> Bottom Loading
--

17. Is the tank system a variable vapor space system? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
---

If yes, (A) What is the volume expansion capacity of the system (gal)?  
(B) What are the number of transfers into the system per year?

18. Type of tank (check all that apply):  <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) <input type="checkbox"/> External Floating Roof <input type="checkbox"/> pontoon roof <input type="checkbox"/> double deck roof <input type="checkbox"/> Domed External (or Covered) Floating Roof <input type="checkbox"/> Internal Floating Roof <input type="checkbox"/> vertical column support <input type="checkbox"/> self-supporting <input type="checkbox"/> Variable Vapor Space <input type="checkbox"/> lifter roof <input type="checkbox"/> diaphragm <input type="checkbox"/> Pressurized <input type="checkbox"/> spherical <input type="checkbox"/> cylindrical <input type="checkbox"/> other
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**ATTACHMENT L – STORAGE VESSEL DATA SHEET**

**PRESSURE/VACUUM CONTROL DATA**

19. Check as many as apply:

- Does Not Apply
- Inert Gas Blanket of
- Vent to Vapor Combustion Device (vapor combustors, flares, thermal oxidizers, enclosed combustors)
- Conservation Vent (psig)
  - Vacuum \_\_\_\_\_ Pressure \_\_\_\_\_
- Emergency relief Valve (psig)
  - Vacuum \_\_\_\_\_ Pressure \_\_\_\_\_
- Thief Hatch Weighted  Yes  No

Complete appropriate Air Pollution Control Device Sheet

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

Material Name	Flashing Loss		Breathing Loss		Working Loss		Total Emission Loss		Estimation Method
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	

*Please see Table 6 and Table 7*

**TANK CONSTRUCTION & OPERATION INFORMATION**

21. Tank Shell Construction:

- Riveted  Gunitite lined  Epoxy-coated  Other (describe): Steel

21A. Shell Color: Green	21B. Roof Color: Green	21C. Year Last Painted	2014 (8) ; 2016 (2)
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22. Shell Condition (if metal and unlined):

- No Rust  Light Rust  Dense Rust  Not applicable

22A. Is the tank beated? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?
---	-------------------------------------	--

23. Operating Pressure Range (psig): 0 psig, atmospheric

**Must be listed for tanks using VRUs with closed vent system**

24. Is the tank a Vertical Fixed Roof Tank? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	24A. If yes, for dome roof provide radius (ft): NA	24B. If yes, for cone roof, provide slop (ft/ft): NA
--	--	--

25. Complete the following section for **Floating Roof Tanks** Does Not Apply

25A. Year Internal Floaters Installed:

25B. Primary Seal Type:  Metallic (mechanical) shoe seal  Liquid mounted resilient seal  
 Vapor mounted resilient seal  Other (describe):

25C. Is the Floating Roof equipped with a Secondary Seal?  Yes  No

25D. If YES, how is the secondary seal mounted? (check one)  
 Shoe  Rim  Other (describe)

25E. Is the Floating Roof equipped with a weather shield?  Yes  No

25F. Describe deck fittings

26. Complete the following section for Internal Floating Roof Tanks  Does not apply

26A. Deck Type: <input type="checkbox"/> Bolted <input type="checkbox"/> Welded	26B. For bolted decks, provide deck construction
---	--

26C. Deck seam:  
 5 ft. wide  6 ft. wide  7 ft. wide  5 x 7.5 ft wide  5 x 12 ft wide  Other (describe)

26D. Deck seam length (ft)	26E. Area of deck (ft <sup>2</sup> )	26F. For column supported tanks: Number of columns:	26G. For column supported tanks, Diameter of each column:
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27. Closed Vent System with VRU  Yes  No

28. Closed Vent System with Enclosed Combustor?  Yes  No

**ATTACHMENT L – STORAGE VESSEL DATA SHEET**

**SITE INFORMATION**

29. Provide the city and state on which the data in this section are based.: West Union, WV			
30. Daily Average Ambient Temperature (°F):	65.08	31. Annual Average Maximum Temperature (°F):	75.94
32. Annual Average Minimum Temperature (°F):	46.56	33. Average Wind Speed (miles/hr): 18.5mph	
34. Annual Average Solar Insulation Factor (BTU/(ft <sup>2</sup> -day))	1030.236	35. Atmospheric Pressure (psia): 14.8 (based off local conditions, could not find annual)	

**LIQUID INFORMATION**

36. Average daily temperature range of bulk liquid (F):	65.08	36A. Minimum (°F):	46.56	36B. Maximum (°F)	75.94
37. Average operating pressure range of tank (psig):	0	37A. Minimum (psig)	0	37B. Maximum (psig)	0
38A. Minimum Liquid Surface Temperature (°F)	46.56	38B. Corresponding Vapor Pressure (psia)	1.3337		
39A. Average Liquid Surface Temperature (°F)	65.08	39B. Corresponding Vapor Pressure (psia)	1.9880		
40A. Maximum Liquid Surface Temperature (°F)	75.94	40B. Corresponding Vapor Pressure (psia)	2.4806		

41. Provide the following for each liquid or gas to be stored in tank. Add additional pages if necessary.

41A. Material Name or Composition	Condensate		
41B. CAS Number	mix of HC		
41C. Liquid Density (lb/gal)	5.9600		
41D. Liquid Molecular Weight (lb/lb-mole)	112.40		
41E. Vapor Molecular Weight (lb/lb-mole)	38.5654		
Maximum Vapor Pressure	2.4806		
41F. True (psia)			
41G. Reid (psia)	3.54		
Months Storage per Year	year round		
41H. From - To			

**ATTACHMENT L – STORAGE VESSEL DATA SHEET**

Complete this data sheet if you are the owner or operator of a storage vessel that contains condensate and/or produced water. This form must be completed for each new or modified bulk liquid storage vessel(s) that contains condensate and/or produced water . (If you have more than one (1) identical tank (i.e. 4-400 bbl condensate tanks), then you can list all on one (1) data sheet). **Include gas sample analysis, flashing emissions, working and breathing losses, USEPA Tanks, simulation software (ProMax, E&P Tanks, HYSYS, etc.), and any other supporting documents where applicable.**

**The following information is REQUIRED:**

- Composition of the representative sample used for the simulation
- For each stream that contributes to flashing emissions:
  - Temperature and pressure (inlet and outlet from separator(s))
  - Simulation-predicted composition
  - Molecular weight
  - Flow rate
- Resulting flash emission factor or flashing emissions from simulation
- Working/breathing loss emissions from tanks and/or loading emissions if simulation is used to quantify those emissions

Additional information may be requested if necessary.

**GENERAL INFORMATION (REQUIRED)**

1. Bulk Storage Area Name Tanks	2. Tank Name: Produced Water Tank 001-002
3. Emission Unit ID number: TANKPW001-002	4. Emission Point ID number. EP-EC001, EP-EC002, EP-EC003
5. Date Installed , Modified or Relocated (for existing tanks) 2014 Was the tank manufactured after August 23, 2011? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	6. Type of change: <input checked="" type="checkbox"/> New construction <input type="checkbox"/> New stored material <input type="checkbox"/> Other  <input type="checkbox"/> Relocation
7A. Description of Tank Modification (if applicable)	
7B. Will more than one material be stored in this tank? If so, a separate form must be completed for each material. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
7C. Was USEPA Tanks simulation software utilized? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <i>If Yes, please provide the appropriate documentation and items 8-42 below are not required.</i>	

**TANK INFORMATION**

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): 7511700	13B. Maximum daily throughput (gal/day): 20580
14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 224	15. Maximum tank fill rate (gal/min): 168
16. Tank fill method <input type="checkbox"/> Submerged <input checked="" type="checkbox"/> Splash <input type="checkbox"/> Bottom Loading	
17. Is the tank system a variable vapor space system? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
If yes, (A) What is the volume expansion capacity of the system (gal)? (B) What are the number of transfers into the system per year?	
18. Type of tank (check all that apply):  <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) <input type="checkbox"/> External Floating Roof <input type="checkbox"/> pontoon roof <input type="checkbox"/> double deck roof <input type="checkbox"/> Domed External (or Covered) Floating Roof <input type="checkbox"/> Internal Floating Roof <input type="checkbox"/> vertical column support <input type="checkbox"/> self-supporting <input type="checkbox"/> Variable Vapor Space <input type="checkbox"/> lifter roof <input type="checkbox"/> diaphragm <input type="checkbox"/> Pressurized <input type="checkbox"/> spherical <input type="checkbox"/> cylindrical	





**ATTACHMENT L – STORAGE VESSEL DATA SHEET**

<b>SITE INFORMATION</b>			
29. Provide the city and state on which the data in this section are based.: West Union, WV			
30. Daily Average Ambient Temperature (°F):	65.08	31. Annual Average Maximum Temperature (°F):	75.94
32. Annual Average Minimum Temperature (°F):	46.56	33. Average Wind Speed (miles/hr): 5.9mph	
34. Annual Average Solar Insulation Factor (BTU/(ft <sup>2</sup> .day))	1030.236	35. Atmospheric Pressure (psia): 14.8 (based off local conditions, could not find annual)	
<b>LIQUID INFORMATION</b>			
36. Average daily temperature range of bulk liquid (F):	65.08	36A. Minimum (°F):	46.56
		36B. Maximum (°F)	75.94
37. Average operating pressure range of tank (psig):	0	37A. Minimum (psig)	0
		37B. Maximum (psig)	0
38A. Minimum Liquid Surface Temperature (°F)	46.56	38B. Corresponding Vapor Pressure (psia)	0.2247
39A. Average Liquid Surface Temperature (°F)	65.08	39B. Corresponding Vapor Pressure (psia)	0.3721
40A. Maximum Liquid Surface Temperature (°F)	75.94	40B. Corresponding Vapor Pressure (psia)	0.4921
41. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
41A. Material Name or Composition	Produced Water		
41B. CAS Number	mix of HC and water		
41C. Liquid Density (lb/gal)	8.3300		
41D. Liquid Molecular Weight (lb/lb-mole)	18.02		
41E. Vapor Molecular Weight (lb/lb-mole)	18.4547		
Maximum Vapor Pressure	0.4921		
41F. True (psia)			
41G. Reid (psia)	1.0227		
Months Storage per Year	year round		
41H. From - To			

**Attachment M**  
**Natural Gas Fired Fuel Burning Unit(s)**  
**Data Sheet**

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

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

Emission Unit ID#	Emission Point ID#	Emission Unit Description (Manufacturer, model#)	Year Installed/Modified	Type and Date of Change	Maximum Design Heat Input (MMBTU/hr)	Fuel Heating Value (BTU/sef)
GPU001	EP-GPU001	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU002	EP-GPU002	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU003	EP-GPU003	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU004	EP-GPU004	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU005	EP-GPU005	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU006	EP-GPU006	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU007	EP-GPU007	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
GPU008	EP-GPU008	Gas Production Unit Heater	2014	Existing	1.5	1208.9385
LH001	EP-LH001	Line Heater	2016	New	2	1208.9385
LH002	EP-LH002	Line Heater	2016	New	2	1208.9385
LH003	EP-LH003	Line Heater	2016	New	2	1208.9385
LH004	EP-LH004	Line Heater	2016	New	2	1208.9385
LH005	EP-LH005	Line Heater	2016	New	2	1208.9385
LH006	EP-LH006	Line Heater	2016	New	2	1208.9385
LH007	EP-LH007	Line Heater	2016	New	2	1208.9385
LH008	EP-LH008	Line Heater	2016	New	2	1208.9385

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

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

3. New, modification, removal.

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

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

# **Attachment N**

## **Internal Combustion Engine Data Sheet**

## ATTACHMENT N – INTERNAL COMBUSTION ENGINE DATA SHEET

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

Emission Unit ID#		ENG001					
Engine Manufacturer/Model		Engine (Kubota DG972-E2)					
Manufacturers Rated bhp/rpm		24 HP @ 3600 rpm					
Source Status		ES					
Date Installed/ Modified/ Removed/ Relocated		2014					
Engine Manufacturer/ Reconstruction Date		2013					
Check all applicable Federal Rules for the engine (include EPA Certification of Conformity if applicable)		<input checked="" type="checkbox"/> 40CFR60 Subpart JJJJ <input checked="" type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input checked="" type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources	<input type="checkbox"/> 40CFR60 Subpart JJJJ <input type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources	<input type="checkbox"/> 40CFR60 Subpart JJJJ <input type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources			
Engine Type		4SRB					
APCD Type		NSCR					
Fuel Type		RG					
H2S (gr/ 100 scf)		0					
Operating bhp/rpm		16.5 HP @ 2400 rpm					
BSFC (BTU/bhp-hr)		9773					
Hourly Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		193 ft <sup>3</sup> /hr gal/hr					ft <sup>3</sup> /hr gal/hr
Fuel Usage or Hours of Operation Metered		1.6907 MMft <sup>3</sup> /yr gal/yr					MMft <sup>3</sup> /yr gal/yr
Calculation Methodology	Pollutant	Hourly PTE (lb/hr)	Annual PTE (tons/year)	Hourly PTE (lb/hr)	Annual PTE (tons/year)	Hourly PTE (lb/hr)	Annual PTE (tons/year)
MD	NOx	0.3158	1.3831				
MD	CO	5.6445	24.7228				
AP	VOC	0.0069	0.0302				
AP	SO2	0.0001	0.0006				
AP	PM10	0.0022	0.0097				
AP	Formaldehyde	0.0048	0.0209				
AP	Total HAPs	0.0053	0.0234				
OT	GHG (CO2e)	26.9274	117.9421				

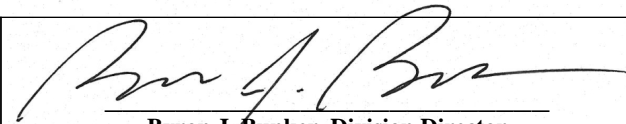


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
2013 MODEL YEAR  
CERTIFICATE OF CONFORMITY  
WITH THE CLEAN AIR ACT OF 1990

OFFICE OF TRANSPORTATION  
AND AIR QUALITY  
ANN ARBOR, MICHIGAN 48105

**Certificate Issued To:** Kubota Corporation  
(U.S. Manufacturer or Importer)  
**Certificate Number:** DKBXS.9622HP-002

**Effective Date:**  
11/20/2012  
**Expiration Date:**  
12/31/2013

  
Byron J. Bunker, Division Director  
Compliance Division

**Issue Date:**  
11/20/2012  
**Revision Date:**  
N/A

**Manufacturer:** Kubota Corporation  
**Engine Family:** DKBXS.9622HP  
**Certificate Number:** DKBXS.9622HP-002  
**Useful Life :** 1000 Hours / 5 Years  
**Engine Class :** Nonhandheld-Class II  
**Fuel :** Natural Gas (CNG/LNG)  
**Emission Standards :** NMHC + NO<sub>x</sub> ( g/kW-hr ) : 8  
CO ( g/kW-hr ) : 610

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547), 40 CFR Part 1054, 40 CFR Part 1068 and 40 CFR Part 60 (stationary only and combined stationary and mobile), and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued for the following small nonroad engine family, more fully described in the documentation required by 40 CFR Part 1054 and produced in the stated model year.

This certificate of conformity covers only those new small nonroad engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 1054 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1054. This certificate of conformity does not cover small nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and 1068, Subpart E and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 1054. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 1054, 40 CFR Part 1068.

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

# **TECHNICAL INFORMATION**

## **DG972-SAEH-S1**

**NATURAL GAS FUEL ENGINE**

July, 2006

KUBOTA Corporation



# CONTENTS

## 1. GENERAL SPECIFICATIONS

## 2. PERFORMANCE CURVES

## 3. DIMENSIONS

## 4. TECHNICAL DATA

4-1) BRAKE HORSE POWER

4-2) FUEL CONSUMPTION

4-3) NOISE LEVEL

4-4) AIR REQUIREMENTS

1. Combustion air requirements
2. Cooling air requirements
3. Combustion and cooling air requirements

4-5) EXHAUST GAS VOLUME

4-6) HEAT REJECTION TO COOLING WATER (Ho)

4-7) COOLING FAN DATA

4-8) CENTER OF GRAVITY

4-9) UNBALANCED FORCES OF ENGINES

4-10) MASS ELASTIC SYSTEM

## 5. FUEL SYSTEM AND FUEL DIAGRAM

Specifications and dimensions are subject to change without prior notice.

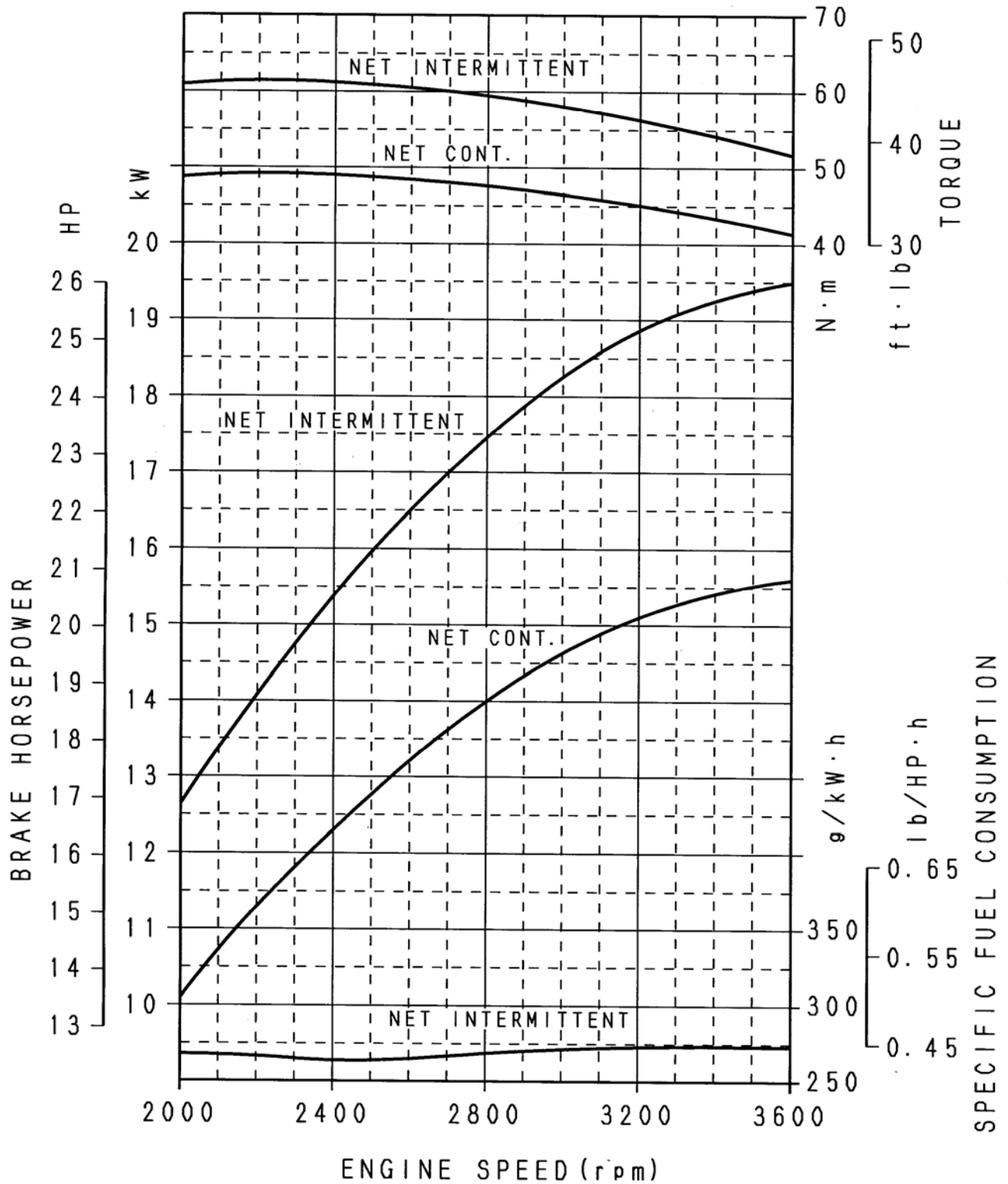
# 1. GENERAL SPECIFICATIONS

ITEM	UNIT	SPECIFICATIONS
Engine model		DG972-SAEH-S1
Type		Vertical, In line, 4cycle Natural Gas engine
Cooling system		Water cooling with water pump
Number of cylinders		3
Cylinder bore	mm(in)	74.5 (2.93)
Stroke	mm(in)	73.6 (2.90)
Total displacement	L(cu. in)	0.962 (58.7)
High idle	rpm	3850
Low idle	rpm	1500
Horsepower	kW(HP)	19.5(26.1)
Max. torque (SAE J1349)	Nm(ft-lb) /rpm	61.2 (45.2)/2400
Compression ratio		9.2
Firing order		1-2-3
Ignition timing		B.T.D.C.15° /1000rpm    B.T.D.C.28° /3600rpm
Ignition system		Distributor-less Solid State type
Fuel		Natural Gas only
Direction of rotation		Counter-clockwise from flywheel side
Starting system		Electric starting with cell starter
Starter output	V-kW	12-1.0
Alternator output	V-W	12-480 (Standard)
Lubricating system		Forced lubricating by trochoid pump
Lubricating oil		Quality better than SH class
Lube. oil capacity	L(US gal)	3.4 (0.90)
Coolant capacity	L(US gal)	1.22 (0.32)
Governor type		Centrifugal flyweight mechanical type governor
Dimensions (LxBxH)	mm(in)	526x415x503 (20.7x16.3x19.8)
Dry weight	kg(lb)	Approx. 95.4(210)
Application		Stationary only

## 2. PERFORMANCE CURVES

### DG972 PERFORMANCE CURVES

Higher calorific value : 11000kcal/m<sup>3</sup> (1236BTU/ft<sup>3</sup>)





## 4. TECHNICAL DATA

ITEM		SPECIFICATIONS	
Engine model		DG972-SAEH-S1	
Brake horse power		See attached sheet	4-1)
Top Clearance		1.35 to 1.65mm (0.05315 to 0.06496in)	
Compression pressure		1.32MPa (192psi)	
Fuel consumption		See attached sheet	4-2)
Lube. oil consumption		Max.0.67g/kWh (0.5g/HPh) at rated load	
Lube. oil pressure		at idling speed: more than 69kPa (more than 9.95psi)	
		at rated speed: 196 to 441kPa (28.44 to 63.99psi)	
Noise level		See attached sheet	4-3)
Combustion air requirements		See attached sheet (Refer to 25deg.C and 1000hPa)	
Cooling air requirements			
Combustion and cooling air requirements			
Exhaust gas volume		See attached sheet (Refer to 25deg.C and 1000hPa)	4-5)
Cold starting limits		-15deg.C (5deg.F)	
Heat rejection		See attached sheet	4-6)
Angles of tilt	Front or Rear down	30° (Less than 10min. continuous operation)	
		20° (Continuous operation)	
	Left or Right side down	30° (Less than 10min. continuous operation)	
		20° (Continuous operation)	
Valve timing		[Inlet valve] Open: TDC -20° Close: BDT +45°	
		[Exhaust valve] Open: BDC -50° Close: TDC +15°	
Cooling fan data		See attached sheet	4-7)
Center of gravity		See attached sheet	4-8)
Unbalanced forces of engines		See attached sheet	4-9)
Mass elastic system		See attached sheet	4-10)
Thermostat specifications		Opening temperature: 71±1.5deg.C (159.8±2.7deg.F)	
		Fully opened temperature: 85deg.C (185deg.F) [at Thermostat lift:8mm (0.31in)]	

## 4-1) BRAKE HORSE POWER

### SAE J1349

Engine speed	rpm	2000	2400	2800	3200	3600
Net intermittent	kW	12.6	15.4	17.4	18.9	19.5
	HP	16.9	20.6	23.3	25.3	26.1
	PS	17.1	20.9	23.7	25.7	26.5
Net continuous	kW	10.1	12.3	13.9	15.1	15.6
	HP	13.5	16.5	18.7	20.3	20.9
	PS	13.7	16.8	18.9	20.6	21.2

Note

- Conversion rates  
 $1\text{kW}=1.35962\text{PS}=1.34048\text{HP}$   
 $1\text{PS}=0.7355\text{kW}=0.985925\text{HP}$   
 $1\text{HP}=0.7457\text{kW}=1.01428\text{PS}$
- Fuel detail  
 Japanese standard gas  
 higher calorific value :  $11000\text{kcal/m}^3$  ( $1236\text{BTU/ft}^3$ )  
 supply pressure :  $0.98 - 2.45\text{kPa}$  ( $7.35 - 18.38\text{mmHg}$ )

## 4-2) FUEL CONSUMPTION

### Specific at net intermittent (SAE J1349)

Engine speed	rpm	2000	2400	2800	3200	3600
Brake horse power	kW	12.6	15.4	17.4	18.9	19.5
	HP	16.9	20.6	23.3	25.3	26.1
	PS	17.1	20.9	23.7	25.7	26.5
Fuel consumption	g/kWh	269	264	269	273	273
	g/HPh	200	197	200	204	204
	g/PSh	198	194	198	201	201
	lb/HPh	0.442	0.434	0.442	0.449	0.449

Note

- Conversion rates  
 $1\text{kW}=1.35962\text{PS}=1.34048\text{HP}$      $1\text{kg}=2.20462\text{lb}$  ( $1\text{g}=0.00220462\text{lb}$ )  
 $1\text{PS}=0.7355\text{kW}=0.985925\text{HP}$      $1\text{lb}=0.45359\text{kg}$   
 $1\text{HP}=0.7457\text{kW}=1.01428\text{PS}$
- Fuel detail  
 Japanese standard gas  
 higher calorific value :  $11000\text{kcal/m}^3$  ( $1236\text{BTU/ft}^3$ )  
 supply pressure :  $0.98 - 2.45\text{kPa}$  ( $7.35 - 18.38\text{mmHg}$ )

## 4-3) NOISE LEVEL

Load × rpm	Unit	Sound pressure at 1m(3.3ft)
0/4 × 3850	dB(A)	90.0
4/4 × 3850 15.6kW (20.9HP)	dB(A)	92.0
0/4 × 1500	dB(A)	72.0

These data show the average noise level at four points.

Note

- Measurement conditions : With radiator, cooling fan, air cleaner and muffler.

## 4-4) AIR REQUIREMENTS

### 1. Combustion air requirements (Refer to 25deg.C and 1000hPa)

rpm	2000	2400	2800	3200	3600
L/sec	12.35	14.81	17.28	19.75	22.22
m <sup>3</sup> /h	44.44	53.33	62.22	71.11	80.00
in <sup>3</sup> /sec	753	904	1055	1205	1356
ft <sup>3</sup> /min	26.13	31.35	36.58	41.80	47.03

Combustion air requirements calculating formula

$$Q_1 = V_h \cdot N \cdot C \cdot \eta \cdot 10^{-3}$$

Q<sub>1</sub>: Amount of intake air (m<sup>3</sup>/min)

η: Intake efficiency

V<sub>h</sub>: Total displacement (L)

Natural Gas: 0.77

N: Engine speed (rpm)

C: Coefficient=0.5

### 2. Cooling air requirements (Refer to 25deg.C and 1000hPa)

rpm	2000	2400	2800	3200	3600
L/sec	571.2	737.2	824.7	833.9	764.7
m <sup>3</sup> /h	2056	2654	2969	3002	2753
in <sup>3</sup> /sec	34859	44984	50327	50888	46667
ft <sup>3</sup> /min	1210.2	1561.8	1747.3	1766.7	1620.2

Above data is decided by following conditions.

1. Using the standard radiator.
2. Engine is run as open unit.

### 3. Combustion and cooling air requirements (Refer to 25deg.C and 1000hPa)

rpm	2000	2400	2800	3200	3600
L/sec	583.5	752.0	842.0	853.7	786.9
m <sup>3</sup> /h	2100.4	2707.3	3031.2	3073.1	2833.0
in <sup>3</sup> /sec	35612	45888	51382	52093	48023
ft <sup>3</sup> /min	1236.3	1593.2	1783.9	1808.5	1667.2

Note

#### 1. Cooling fan and fan pulley specifications(Cooling fan Part No. 15881-74112)

Item	
Fan diameter	300mm (11.81in)
No. of blade and type of shape	4, S type
Diameter of fan driving pulley	100mm (3.94in)
Diameter of fan pulley	84mm (3.31in)

#### 2. Conversion rates

$$1L = 61.0237 \text{ in}^3 = 0.035315 \text{ ft}^3$$

$$1 \text{ ft}^3 = 28.3168 \text{ L}$$

$$1 \text{ L/sec} = 3.6 \text{ m}^3/\text{h} = 2.1189 \text{ ft}^3/\text{min}$$

## 4-5) EXHAUST GAS VOLUME

Refer to 25deg.C and 1000hPa

rpm	2000	2400	2800	3200	3600
L/sec	35.46	42.55	49.65	56.74	63.83
m <sup>3</sup> /h	127.67	153.19	178.73	204.26	229.80
in <sup>3</sup> /sec	2164	2597	3030	3462	3895
ft <sup>3</sup> /min	75.05	90.06	105.07	120.08	135.09

Note

- Conversion rates
  - 1L=61.0237in<sup>3</sup>=0.035315ft<sup>3</sup>
  - 1ft<sup>3</sup>=28.3168L
  - 1L/sec=3.6m<sup>3</sup>/h=127.133ft<sup>3</sup>/hr

## 4-6) HEAT REJECTION TO COOLING WATER

### 1. Specific at net intermittent (SAE J1349)

Engine speed	rpm	2000	2400	2800	3200	3600
Brake horse power	kW	12.6	15.4	17.4	18.9	19.5
	HP	16.9	20.6	23.3	25.3	26.1
	PS	17.1	20.9	23.7	25.7	26.5
Fuel consumption	g/kWh	269	264	269	273	273
	g/HPh	200	197	200	204	204
	g/PSh	198	194	198	201	201
	lb/HPh	0.442	0.434	0.442	0.449	0.449
Heat rejection to cooling water	MJ/h	29.05	31.52	38.79	45.13	51.82
	kcal/h	6940	7529	9267	10781	12379
	BTU/h	12491	13551	16679	19404	22281

Note

Heat rejection to cooling water calculating formula

$$Ho=Hu \cdot Ne \cdot be \cdot i$$

Ho: Heat rejection to cooling water

Hu: Fuel low calorific value

Japanese standard gas; 49.4MJ/kg, 11800kcal/h, 212391BTU/lb

Ne: Brake horse power

Be: Specific fuel consumption

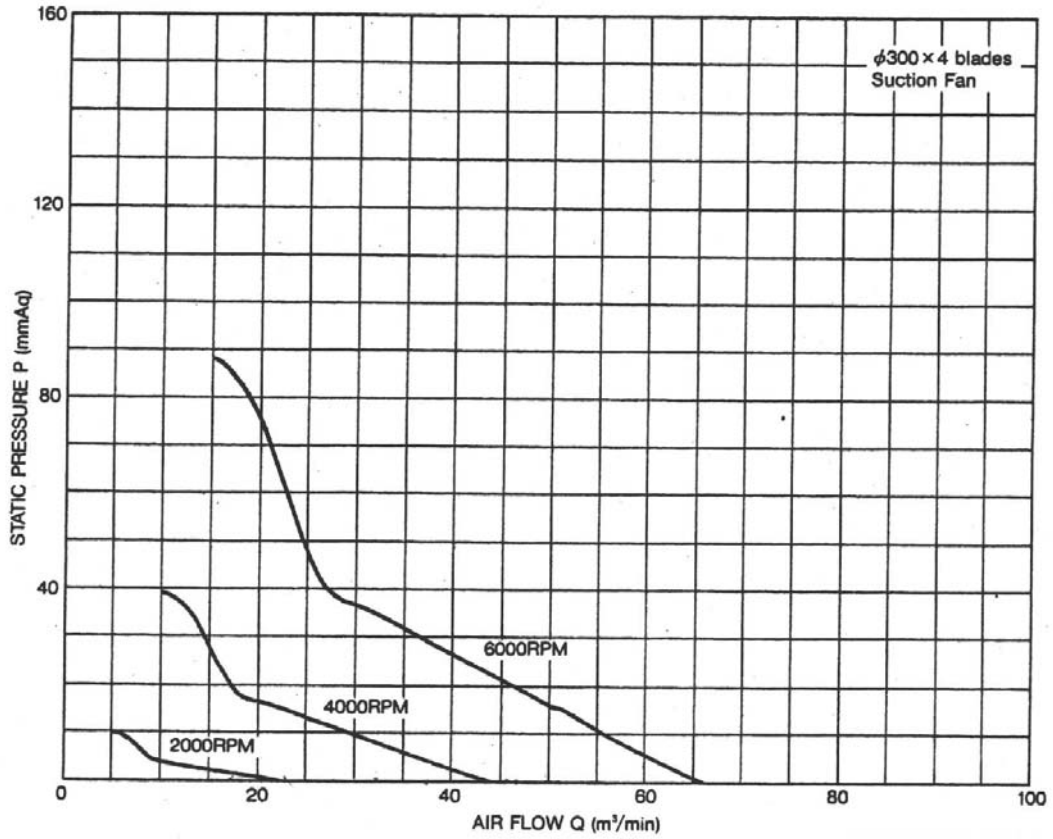
i: Dispersion ratio to cooling water



# 4-7) COOLING FAN DATA

## 1. Performance curves <P-Q>

- Part No. 15881-74110 (Applicable for DG972)



## 4-8) CENTER OF GRAVITY

### 1. With standard flywheel and rear-end plate

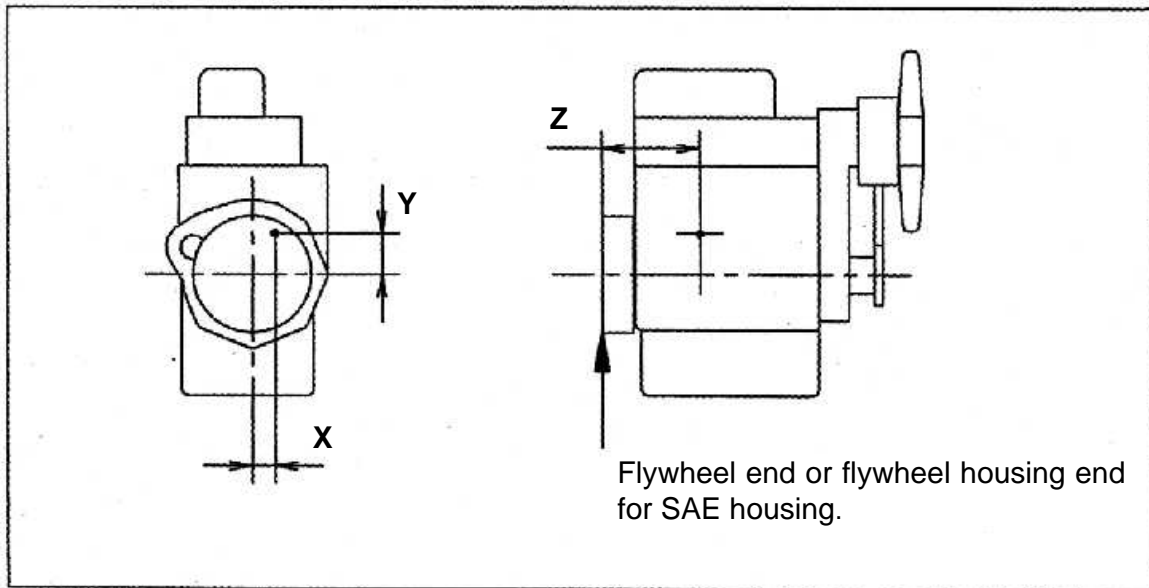
Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
WG/DF972	72.0 (159)	-25.5 (-1.00)	73.3 (2.89)	179.5 (7.07)

### 2. With SAE flywheel and flywheel housing

Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
DG972 -SAEH-S1	95.4 (210)	-10.0 (0.39)	28.0 (1.10)	207.0 (8.15)

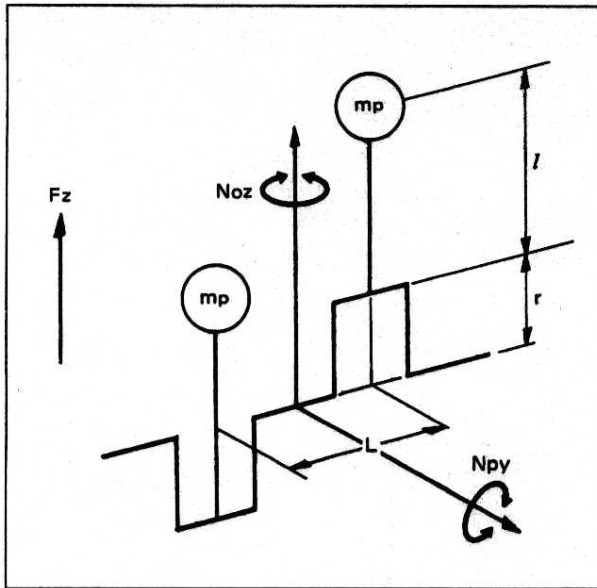
#### Note

Cooling water and lubricating oil weight is not included in above engine weight.



# 4-9) UNBALANCED FORCES OF ENGINES

## 1. Base data



$F_z$ : Unbalanced inertia force  
 $N_{py}, N_{oz}$ : Unbalanced inertia couple  
 $m_p$ : Reciprocating mass  
 $r$ : Crank radius  
 $l$ : Center distance of connecting rod  
 $L$ : Cylinder distance  
 $\omega$ : Angular velocity

$\omega = 2\pi n / 60$	$n$ : Engine speed (rpm)
------------------------	--------------------------

$l = 0.098\text{m}$	Cylinder bore (mm)	$m_p$ (kg)
$r = 0.0368\text{m}$	74.5	0.37/9.80665
$L = 0.080\text{m}$		

## 2. Unbalanced inertia force and couple

( $\times \omega^2$ )

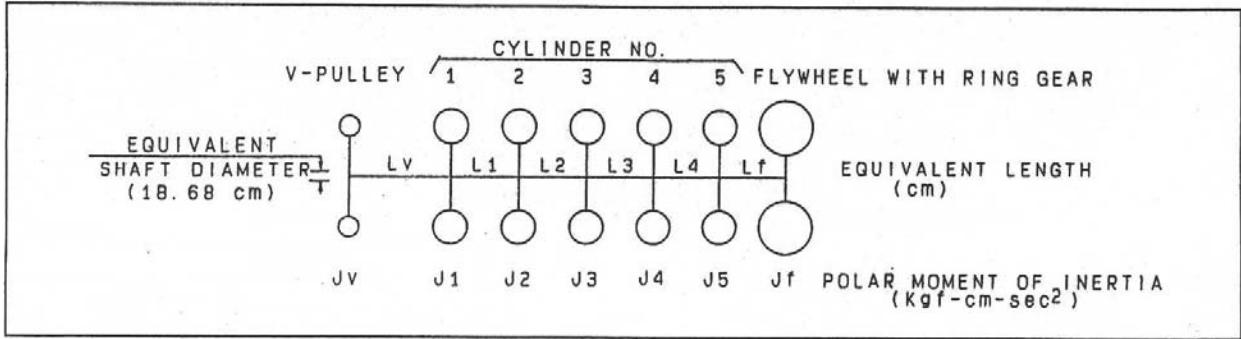
Model	No. of Cylinder	Cylinder Bore	Order	$F_z$	$N_{py}$	$N_{oz}$
WG/DF/DG 972	3	74.5mm	1	0	0.000096	0.000096
			2	0	0.000072	0

### ▼An example of calculation

Calculation condition	$\omega^2$	$F_z, N_{py}, N_{oz}$		
		Order	Calculation	
Engine model DG972 Engine speed 3600(rpm)	$[2 \times \pi \times 3600/60]^2$ $= 142122$	$F_z$	1	0
			2	0
		$N_{py}$	1	$0.000096 \times 142122 = 13.6\text{kg}$
			2	$0.000072 \times 142122 = 10.2\text{kg}$
		$N_{oz}$	1	$0.000096 \times 142122 = 13.6\text{kg}$
			2	0

# 4-10) MASS ELASTIC SYSTEM

## Equivalent torsional vibration data



MODEL	EQUIVALENT LENGTH (cm)				POLAR MOMENT OF INERTIA (kgfcm-sec <sup>2</sup> )				
	LV	L1	L2	Lf	JV	J1	J2	J3	Jf
DG972 -SAEH-S1	35082	4528	4528	2824	0.013	0.026	0.026	0.026	1.281

Note: Flywheel E8052-25110, V-Pulley 16861-74280

## 5. FUEL SYSTEM AND FUEL DIAGRAM

- All fuel connections added to this engine must be installed by qualified personnel utilizing recognized procedures and standards.
- These non-KUBOTA installed parts, such as hoses, shutoff solenoid valve should be approved for Natural gas use.
- An approved, listed fuel filter and shutoff solenoid valve must be installed between the gas tank and Kubota regulator.
- Two fuel cut solenoids must be installed in series before the regulator on the fuel supply line for safety (backup) purpose.

### 1. Tightening torque and leak check

- 1) The joint must be installed to the gas entrance of the regulator by screw with O-ring. Screw is tightened to the specified torque using a driver, and leak check must be performed as shown in the below table.
- 2) The connector on the gas mixer may be mounted on any position since it is not sealed. The lock nut may be loosened using a wrench. The connector may be changed to any specified angle. The lock nut should be tightened to the specified torque using a wrench as shown in the below table.

#### [ TIGHTENING TORQUE AND LEAK CHECK ]

	Qty.	Size	Tightening torque			Leak check pressure
			Nm	kgfm	ft-lb	
SCREW	2	M4	1.9 to 2.9	0.2 to 0.3	1.5 to 2.2	Soap solution or its equivalent
LOCK NUT	1	M16 × 1	19.6 to 39.2	2.0 to 4.0	14.5 to 28.9	

### 2. Setting of the regulator

- 1) Install the regulator in **UPRIGHT** position, it must be installed within 4G vibration level. If not, it may not supply necessary fuel to the engine.
- 2) **DO NOT** connect any extension hose to the air vent pipe of the regulator. This may cause an improper supply of fuel to the engine.

### 3. Caution for FUEL SYSTEM

The standard engine is equipped with  $\phi 6.6$  jet for the fuel calorific gas value of 11000kcal/m<sup>3</sup> (1236BTU/ft<sup>3</sup>).

When the engine is operated with the different calorific gas, it is necessary to select the correct jet of the mixer.

In that case, refer to the manual [**Adjustment for Natural Gas Engine DG972**].

Japanese standard gas      higher calorific value : 11000kcal/m<sup>3</sup> (1236BTU/ft<sup>3</sup>)  
    supply pressure        : 0.98 – 2.45kPa (7.35 – 18.38mmHg)

Equipments                  Vacuum Meter    : Not KUBOTA supplied  
    Adjustable Jet    : Service Tool

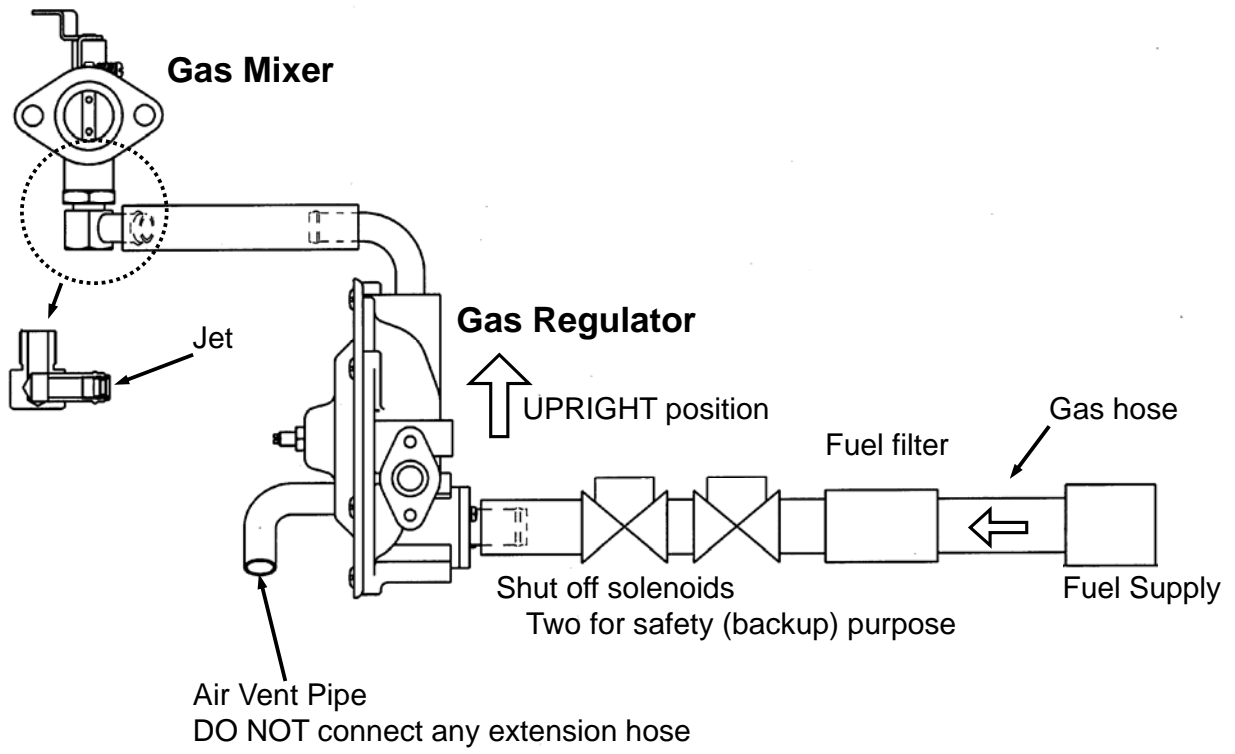
### 4. Application Check Item

The items as shown below must be managed for all engines, and these items must be informed to KUBOTA with Application Check results.

Refer to the attached sheet [**Application Check Sheet for DG972**].

- 1) The diameter of the jet (with the intake vacuum curve)
- 2) The calorific value of the gas
- 3) The supply pressure of gas
- 4) The serial number of the engine

## 5. Fuel diagram



NATURAL GAS ENGINE

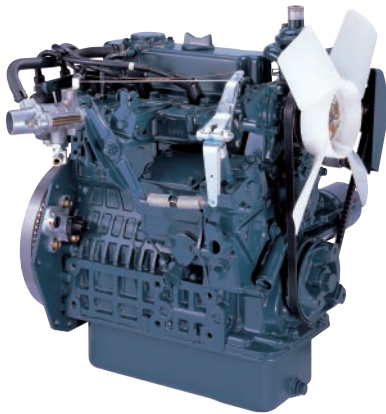
**KUBOTA DG SERIES (3-cylinder)**

# DG972-E2

**2**  
EPA Tier

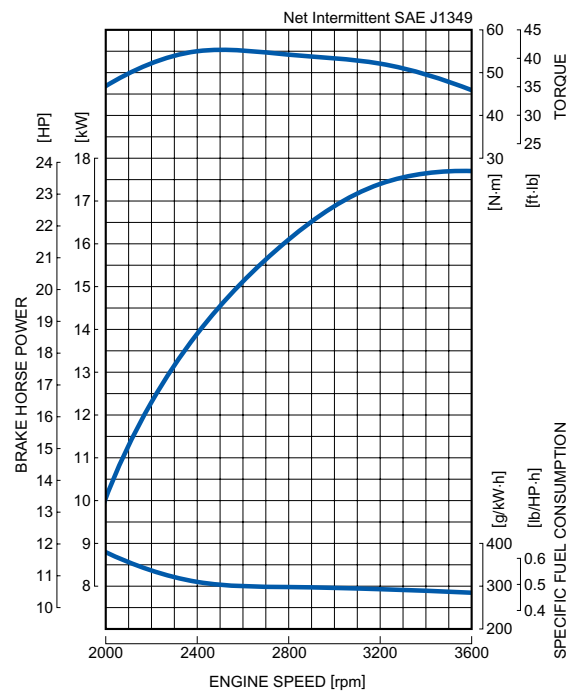
## RATED POWER

**17.6kW@3600rpm**



Photograph may show non-standard equipment.

## PERFORMANCE CURVE



## FEATURES and BENEFITS

### New Engine Series

- The Kubota DG Series offers a new solution to the increasing needs for natural gas engine. The diesel engine based Kubota DG Series gives users the same foot-print, reliability and durability of D902, WG972, and DF972 acknowledged as the world's top quality small industrial engines.
- Kubota offers SAE Flywheel Housing and Rear End Plate specifications for the DG972 engine. These options offer users flexible Power Take Off (PTO) choices.
- The Kubota DG Series is designed to endure use outdoors under severe environment. This series is equipped with a bypass breather tube to avoid freezing below zero.

### Emission

- Kubota DG Series complies with EPA Tier 2 Emissions Regulations. EPA regulation is one of the most stringent emissions regulations in the world.

### Best Fuel System

- Specialized for Natural Gas use, the DG972 engine eliminated the carburetor, regulator and a fuel filter parts, which are only necessary for Gasoline or LPG use. Also, Kubota adopts the best jet set and the ignition timing that provides the best engine performance in severe conditions.

### Ease maintenance cost and time

- Mechanical governor system will contribute to lower maintenance cost and prevents users from having to deal with complicated electric maintenance. Moreover, water resistant spark plug caps are adopted for outdoor use.

## GENERAL SPECIFICATION

Model		<b>DG972-E2</b>
Emission Regulation		Tier 2
Type		Vertical 4-cycle Liquid Cooled Natural Gas
Number of Cylinders		3
Bore	mm (in)	74.5 (2.93)
Stroke	mm (in)	73.6 (2.9)
Displacement	L (cu.in)	0.962 (58.70)
Fuel		Natural Gas
Intake System		Naturally Aspirated
Maximum Speed	rpm	3600
Output: Net Intermittent	kW	17.6
	hp	23.6
	ps	23.9
Direction of Rotation		Counterclockwise Viewed on Flywheel
Oil Pan Capacity	L (gal)	3.7 (0.98)
Starter Capacity	V-kW	12-1.0
Alternator Capacity	V-A	12-40
Length	mm (in)	525.5 (20.69)* <sup>1</sup> / 452.5 (17.81)* <sup>2</sup>
Width	mm (in)	415.4 (16.35)
Height (1)	mm (in)	502.5 (19.78)
Height (2)	mm (in)	159.0 (6.26)
Dry Weight	kg (lb)	72.0 (158.7)* <sup>1</sup> / 95.4 (210.3)* <sup>2</sup>

\*Specification is subject to change without notice.

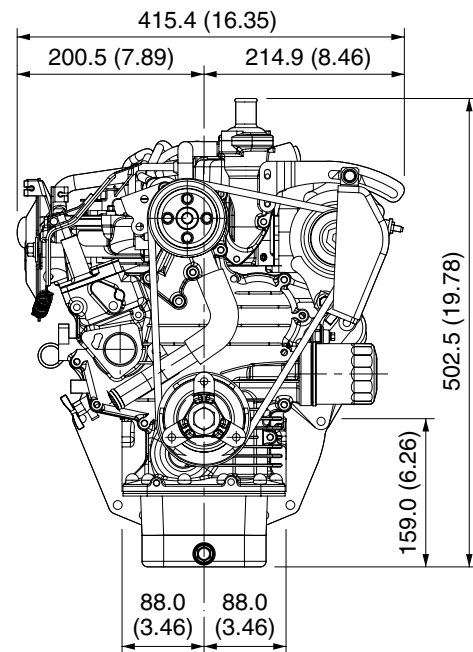
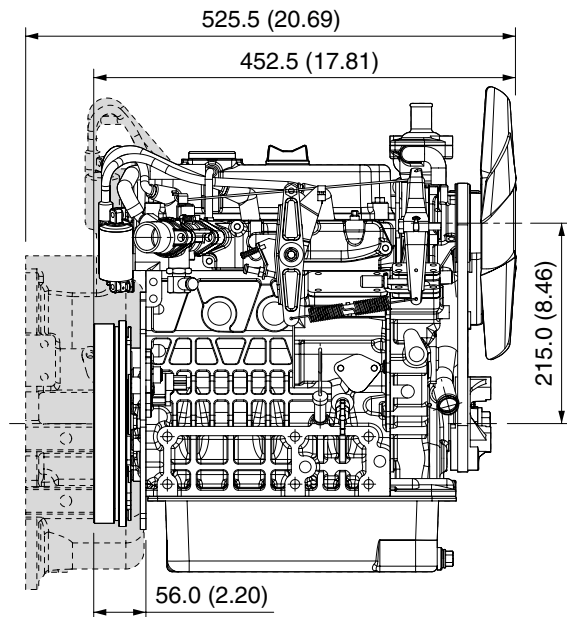
\*Output: Net Intermittent SAE J1349

\*Dry weight is according to Kubota's standard specification.  
When specification varies, the weight will vary accordingly.

\*<sup>1</sup> with SAE Flywheel and Housing

\*<sup>2</sup> with Rear End Plate

## DIMENSIONS



## KUBOTA Corporation

2-47, Shikitsu Higashi 1-chome, Naniwa-ku, Osaka, 556-8601 Japan  
Fax: 06-6648-3521

<http://www.engine.kubota.co.jp>

Your Driving Force  
KUBOTA ENGINE



# **Attachment O**

## **Tanker Truck Loading Data Sheet**

## ATTACHMENT O – TANKER TRUCK LOADING DATA SHEET

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

### Truck Loadout Collection Efficiencies

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

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

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

Emission Unit ID#: L001, L002	Emission Point ID#: EP-L001, EP-L002	Year Installed/Modified: 2014
-------------------------------	--------------------------------------	-------------------------------

Emission Unit Description: **Condensate Loading, Produced Water Loading**

#### Loading Area Data

Number of Pumps: 2	Number of Liquids Loaded: 2	Max number of trucks loading at one time: 2
--------------------	-----------------------------	---

Are Tanker trucks pressure tested for leaks at this any other location?  Yes  No  Not Required

If Yes, Please Describe: Tank trucks are pressure tested for leaks at the location of the leak testing company. Trucks are tested using EPA Method 27-internal vapor valve test and issued certification that DOT requirements are met.

Provide description of closed vent system and any bypasses

Are any of the following truck loadout systems utilized? **No**

- Closed System to Tanker Truck passing a MACT level annual leak test?
- Closed System to Tanker Truck passing a NSPS level annual leak test?
- Closed System to Tanker Truck not passing an annual leak test and has vapor return?

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

Time	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec
Hours/day	4	4	4	4
Days/week	7	7	7	7

#### Bulk Liquid Data (use extra pages as necessary)

Liquid Name	Condensate	Produced Water	
Max. Daily Throughput (1000 gal/day)	16.30	20.58	
Max. Annual Throughput (1000 gal/yr)	5948.04	7511.70	
Loading Method	BF	BF	
Max. Fill Rate (gal/min)	168	168	
Average Fill Time (min/loading)	50	50	
Max. Bulk Liquid Temperature (F)	65.1	65.1	
True Vapor Pressure	2.0	0.4	
Cargo Vessel Condition	U	U	
Control Equipment or Method	None	None	
Max. Collection Efficiency (%)	0	0	
Max. Control Efficiency (%)	0	0	
Max VOC Emission Rate	Loading (lb/hr)	5.9893	0.0008
	Annual (ton/yr)	1.7671	0.0003
Max HAP Emission Rate	Loading (lb/hr)	0.0644	1.28E-06
	Annual (ton/yr)	0.0190	4.76E-07
Estimation Method	Promax	Promax	

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

**Attachment R**  
**Air Pollution Control Device – Emission**  
**Reduction Device Sheets**

## ATTACHMENT R – AIR POLLUTION CONTROL DEVICE / EMISSION REDUCTION DEVICE SHEETS

Complete the applicable air pollution control device sheet s for each flare, vapor combustor, thermal oxidizer, condenser, adsorption system, vapor recovery unit , BTEX Eliminator, Reboiler with and without Glow Plug, etc. at the facility. Use extra pages if necessary.

Emissions calculations must be performed using the most conservative control device efficiency.

*The following five (5) rows are only to be completed if registering an alternative air pollution control device.*

Emission Unit ID:	NA	Make/Model:	NA
Primary Control Device ID:	NA	Make/Model	NA
Control Efficiency (%):	NA	APCD/ERD Data Sheet Completed	<input type="checkbox"/> Yes <input type="checkbox"/> No
Secondary Control Device ID:	NA	Make/Model	NA
Control Efficiency (%):	NA	APCD/ERD Data Sheet Completed	<input type="checkbox"/> Yes <input type="checkbox"/> No

### VAPOR COMBUSTION (Including Enclosed Combustors)

#### General Information

Control Device ID#:	EC001-003	Installation Date: <input checked="" type="checkbox"/> New <input type="checkbox"/> Modified <input type="checkbox"/> Relocated	
Maximum Rated Total Flow Capacity 5458 scfh	131000 scfd	Maximum Design Heating Input (from mfg. spec sheet) 12.0 MMBTU/hr	Design Heat Content 2300 BTU/scf

#### Control Device Information

Type of Vapor Combustion Control?

- Enclosed Combustion Device     
  Elevated Flare     
  Ground Flare  
 Thermal Oxidizer

Manufacturer: Cimarron	Hours of operation per year?	8760
Model: 48" HV ECD		

List the emission units whose emissions are controlled by this vapor control device (Emission Point ID# NA)

Emission Unit ID#	Emission Source Description	Emission Unit ID#	Emission Source Description
TANKCOND001-010	Condensate Tanks		
TANKPW001-002	Produced Water Tanks		

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

Assist Type (Flares only) <input type="checkbox"/> Steam <input type="checkbox"/> Air <input type="checkbox"/> Pressure <input checked="" type="checkbox"/> Non	Flare height 25 feet	Tip Diameter 3.33 feet	Was the design per §60.18? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Provide determination
---	-------------------------	---------------------------	--

#### Waste Gas Information

Maximum Waste Gas Flow Rate 15.64 (scfm)	Heat Value of Waste Gas Stream 2,028.36 BTU/ft <sup>3</sup>	Exit Velocity of the Emission Stream 0.0299 (ft/s)
---	--	---

Please see Attachment S, Tables 6 & 7 for VOC composition/ characteristics of the waste gas stream to be burned.

#### Pilot Gas Information

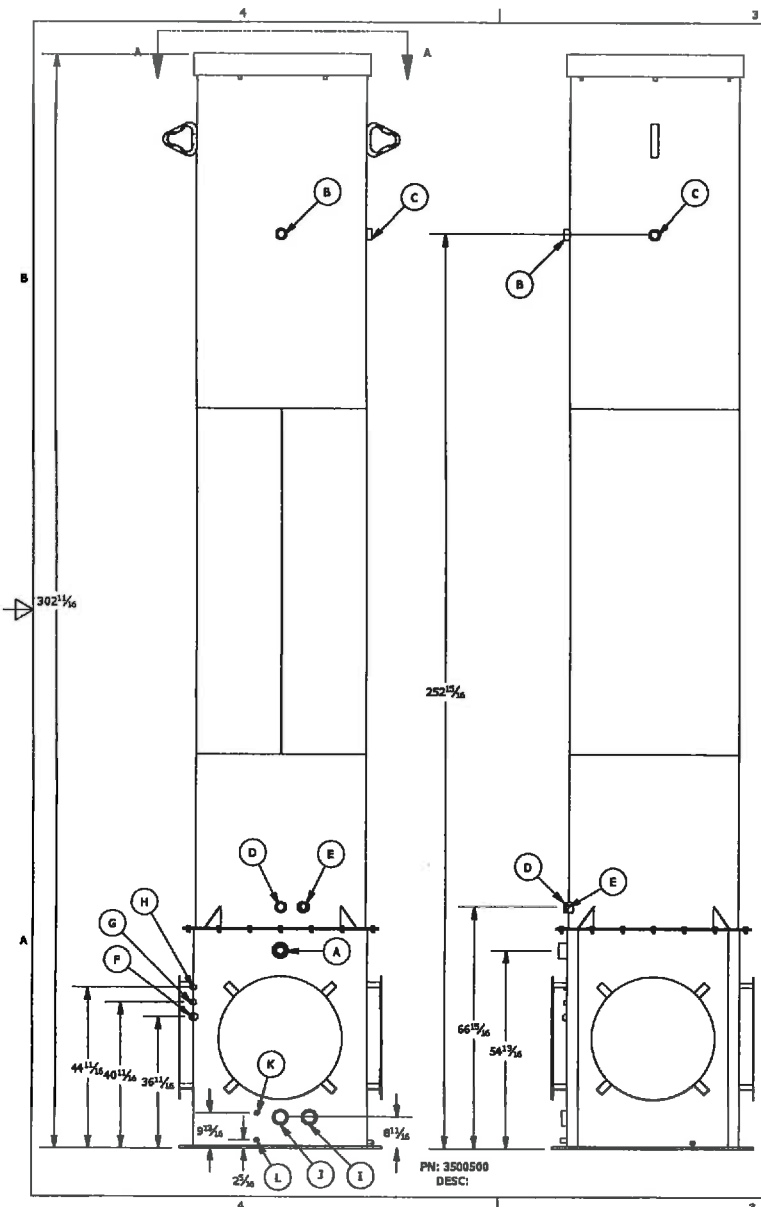
Number of Pilot Lights 3	Fuel Flow Rate to Pilot Flame per Pilot 12.6 scfh	Heat Input per Pilot 12800 BTU/hr	Will automatic re-ignition be used? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
-----------------------------	--	--------------------------------------	--

If automatic re-ignition is used, please describe the method. Flame Rectification, a thermocouple equivalent

Is pilot flame equipped with a monitor to detect the presence of the flame? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	If Yes, What type? <input checked="" type="checkbox"/> Thermocouple <input type="checkbox"/> Infrared <input type="checkbox"/> Ultraviolet <input type="checkbox"/> Camera <input type="checkbox"/> Other:
--	--

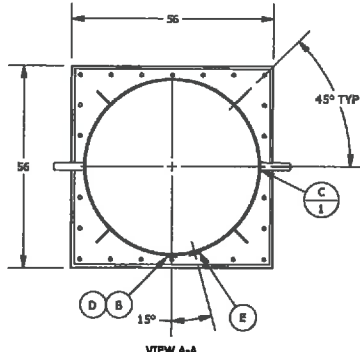
Describe all operating ranges and maintenance procedures required by the manufacturer to maintain the warranty. *(If unavailable, please indicate).*

Additional information attached? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Manufacturer's specs sheet
Please attach copies of manufacturer's data sheets, drawings, flame demonstration per §60.18 or §63.11 (b) and performance testing.	



**48" DIA x 302 5/8" HEIGHT, 88 ORIFICES  
EMISSION CONTROL DEVICE**

- \* >98% TVOC DRE, CERTIFIED USEPA 40 CFR 60, APPENDIX A, SOURCE EMISSIONS TEST METHODS REFERENCED. MEETS ALL EPA & CDPHE REGULATIONS.
- \* DESTROYS OIL/CONDENSATE PRODUCTION TANK VAPORS W/ NO VISIBLE FLAME.
- \* EXCELLENT OPACITY AND SMOKELESS OPERATION.
- \* RELIABLE AND CUSTOMIZABLE IGNITION.
- \* VERY LOW CAPITAL AND OPERATING COST.
- \* EASY TO OPERATE AND MAINTAIN.
- \* FIELD TESTED TO DESTROY UP TO 119.5 MDSCFD (131 MCFD) @ 10 oz/in<sup>2</sup>; 2300 BTU/CF WASTE GAS (SG 1.45)
- \* STRUCTURE CERTIFIED FOR 90 MPH 3-SEC WIND GUST PER ASCE 7-05 & IBC 2006 STANDARDS. HIGHER WIND LOAD RATED STRUCTURES AVAILABLE.



PN: 3500500  
DESC:

SCHEDULE OF NOZZLES			
MARK	QTY	DESCRIPTION	SERVICE
A	1	3" HALF COUPLING	2000# BURNER WASTE GAS IN
B	1	2" FULL COUPLING	3000# FLOW TEST/AUTOMATION
C	1	2" FULL COUPLING	3000# FLOW TEST/AUTOMATION
D	1	2" FULL COUPLING	3000# SIGHT GLASS
E	1	2" FULL COUPLING	3000# MANUAL LIGHTING
F	1	1" FULL COUPLING	3000# PILOT GAS IN
G	1	1/2" FULL COUPLING	3000# IGNITOR CABLE
H	1	1/2" FULL COUPLING	3000# AUTOMATION
I	1	3" HALF COUPLING	3000# DRIP TANK WASTE GAS IN
J	1	3" HALF COUPLING	3000# DRIP TANK WASTE GAS OUT
K	1	1/2" FULL COUPLING	3000# AUTOMATION
L	1	1/2" FULL COUPLING	3000# LIQUID DRAIN

- UNLESS OTHERWISE SPECIFIED
1. REMOVE ALL BURRS AND SHARP CORNERS.
  2. COR. RAD .03
  3. DO NOT SCALE DRAWING.
  4. ALL DIMENSIONS ARE IN INCHES.
  5. MACHINE FIN.
  6. FABRICATION AND SHARP CORNERS.
    - .X = ± 0.25
    - .XX = ± 0.125
    - .XXX = ± 0.06
    - ANGLES ± 3°
  7. MACHINE
    - .X = ± 0.030
    - .XX = ± 0.015
    - .XXX = ± 0.005
    - ANGLES ± 1/2°
    - CONTRICTY WITHIN 0.010 TIR

APPROVED FOR A.S.M.E CODE, SECTION VIII DIV 1  
ED, ADDENDA BY, DATE

**CIMARRON**  
Energy Inc.

TITLE:  
48" HIGH VOLLUME BCD

DATE: \_\_\_\_\_ WO No.: \_\_\_\_\_ SHEET: 1 OF 1

DRAWN BY: TDS | REV. | DRAW NO.: 3500500

# **Attachment S**

## **Emissions Calculations**

**Table 1**

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

<b>Oil and Gas Site General Information</b>
---

Administrative Information	
Company Name	Antero Resources Corporation
Facility/Well Name	Alvadore Well Pad
Nearest City/Town	West Union
API Number/SIC Code	1311
Latitude/Longitude	39.27347, -80.88265
County	Doddridge County

Technical Information	
Max Condensate Site Throughput (bbl/day):	388
Max Produced Water Site Throughput (bbl/day):	490
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	Yes

Equipment/Processes at Site	
Equipment/Process Types	How many for this site?
Fugitives	8
IC Engines	1
Gas Production Unit Heaters	8
Line Heaters	8
Condensate Tanks	10
Produced Water Tanks	2
Loading Jobs	2
Enclosed Combustors	3

Table 2

Uncontrolled/Controlled Emissions Summary  
 Alvadore 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, Engine, Gas Production Unit Heaters, Line Heaters)</b>																								
Fugitive Emissions (Component Count, PCV and Hauling) <sup>1</sup>	2.8337	12.4116			78.605	344.29							4.7741	1.9132			0.2413	1.0568	0.0013	0.0056	5.60E-02	2.45E-01		
Flashing, Working and Breathing (F/W/B) Losses <sup>2</sup>	53.0353	232.2947			217.9528	954.6334											6.8757	30.1155	0.0061	0.0266	0.0766	0.3354		
Engine Emissions <sup>3</sup>	0.007	0.030	0.316	1.383	26.927	117.942	5.644	24.723	1.37E-04	5.99E-04	0.002	0.010	0.002	0.010			0.005	0.023	3.68E-04	0.002	4.54E-05	1.99E-04	0.005	0.021
Gas Production Unit Heater Emissions <sup>4</sup>	0.0546	0.2391	0.9926	4.3476	1,191.13	5,217.14	0.8338	3.6520	0.0060	0.0261	0.0754	0.3304	0.0754	0.3304	4.96E-06	2.17E-05	0.019	0.082	2.08E-05	9.13E-05			0.0007	0.0033
Line Heater Emissions <sup>5</sup>	0.0728	0.3188	1.3235	5.7968	1,588.17	6,956.19	1.1117	4.8693	0.0079	0.0348	0.1006	0.4406	0.1006	0.4406	6.62E-06	2.90E-05	0.025	0.109	2.78E-05	1.22E-04			0.0010	0.0043
<b>TOTALS:</b>	<b>56.0033</b>	<b>245.2944</b>	<b>2.6319</b>	<b>11.5275</b>	<b>3102.7829</b>	<b>13590.1892</b>	<b>7.5900</b>	<b>33.2441</b>	<b>0.0140</b>	<b>0.0615</b>	<b>0.1782</b>	<b>0.7807</b>	<b>4.9524</b>	<b>2.6939</b>	<b>1.16E-05</b>	<b>5.07E-05</b>	<b>7.1659</b>	<b>31.3867</b>	<b>0.0078</b>	<b>0.0340</b>	<b>0.1326</b>	<b>0.5807</b>	<b>0.0065</b>	<b>0.0285</b>
<b>TOTALS (Excluding Fugitives):</b>	<b>53.1696</b>	<b>232.8828</b>	<b>2.6319</b>	<b>11.5275</b>	<b>3024.1780</b>	<b>13245.8994</b>	<b>7.5900</b>	<b>33.2441</b>	<b>0.0140</b>	<b>0.0615</b>	<b>0.1782</b>	<b>0.7807</b>	<b>0.1782</b>	<b>0.7807</b>	<b>1.16E-05</b>	<b>5.07E-05</b>	<b>6.9246</b>	<b>30.3298</b>	<b>0.0065</b>	<b>0.0284</b>	<b>0.0766</b>	<b>0.3356</b>	<b>0.0065</b>	<b>0.0285</b>

<b>UNCONTROLLED (Truck Loading Emissions)</b>																								
Truck Loading Emissions <sup>5</sup>	5.9901	1.7674			7.0703	2.1520											0.0644	1.90E-02	0.0000	1.31E-05	0.0025	7.49E-04		

<b>CONTROLLED EMISSIONS</b>																									
Enclosed Combustor Emissions (from F/W/B losses) <sup>6</sup>	1.0609	4.6468	0.0976	0.4277	278.1088	1218.1167	0.0820	0.3592	2.27E-05	0.0001	0.0056	0.0244	0.0074	0.0325	4.88E-07	2.14E-06	0.1376	0.6026	0.0001	0.0005	0.0015	0.0067	2.84E-06	1.24E-05	
Controlled Fugitive Emissions from Hauling													2.3871	0.9566											
<b>TOTALS:</b>	<b>1.061</b>	<b>4.647</b>	<b>0.098</b>	<b>0.428</b>	<b>278.109</b>	<b>1218.117</b>	<b>0.082</b>	<b>0.359</b>	<b>2.27E-05</b>	<b>9.93E-05</b>	<b>0.006</b>	<b>0.024</b>	<b>2.394</b>	<b>0.989</b>	<b>4.88E-07</b>	<b>2.14E-06</b>	<b>0.138</b>	<b>0.603</b>	<b>1.22E-04</b>	<b>5.33E-04</b>	<b>0.002</b>	<b>0.007</b>	<b>2.84E-06</b>	<b>1.24E-05</b>	

<b>POTENTIAL TO EMIT<sup>7</sup></b>	<b>4.0289</b>	<b>19.4139</b>	<b>2.7295</b>	<b>11.9552</b>	<b>3162.9389</b>	<b>13855.8245</b>	<b>7.6720</b>	<b>33.6034</b>	<b>0.0141</b>	<b>0.0616</b>	<b>0.1838</b>	<b>0.8050</b>	<b>2.5727</b>	<b>1.7698</b>	<b>1.21E-05</b>	<b>5.29E-05</b>	<b>0.4278</b>	<b>1.8928</b>	<b>0.0018</b>	<b>0.0079</b>	<b>0.0575</b>	<b>0.2528</b>	<b>0.0065</b>	<b>0.0285</b>
<b>POTENTIAL TO EMIT (Excluding Fugitives)</b>	<b>1.1952</b>	<b>5.2349</b>	<b>2.7295</b>	<b>11.9552</b>	<b>3084.3340</b>	<b>13509.3828</b>	<b>7.6720</b>	<b>33.6034</b>	<b>0.0141</b>	<b>0.0616</b>	<b>0.1838</b>	<b>0.8050</b>	<b>0.1857</b>	<b>0.8132</b>	<b>1.21E-05</b>	<b>5.29E-05</b>	<b>0.1865</b>	<b>0.8170</b>	<b>0.0005</b>	<b>0.0024</b>	<b>0.0016</b>	<b>0.0069</b>	<b>0.0065</b>	<b>0.0285</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 engine emissions</p> <p>4 - See Table 9 for gas production unit heater and line 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 388 barrels per day, VOC emissions would be 5.9901 pounds per hour when there are truck loading activities. Average hourly VOC emissions from truck loading is 0.4035 pound per hour.</p> <p>6 - See Table 10 and 11 for enclosed combustion emission calculations.</p> <p>7 - The hourly potential to emit is the sum of emissions from gas production unit heaters, line heaters, engine, storage tanks, enclosed combustors, and fugitives. Does not include emissions from loading (see footnote 5). The total TPY PTE is the sum of all emissions.</p> <p>PM 10 TPY is the sum of uncontrolled hauling and other PM10 sources.</p>																						
------------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



**Table 3**

**Permits Summary  
Alvadore Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

Pollutant		Emissions		Threshold Exceeded?		
		Uncontrolled	Controlled	Threshold	Uncontrolled	Controlled
VOC	lbs/hr	56.0033	4.0289	6	<b>Yes</b>	
	tons/yr	247.0618	19.4139	10	<b>Yes</b>	<b>Yes</b>
NO <sub>x</sub>	lbs/hr	2.6319	2.7295	6		
	tons/yr	11.5275	11.9552	10	<b>Yes</b>	<b>Yes</b>
CO	lbs/hr	7.5900	7.6720	6	<b>Yes</b>	<b>Yes</b>
	tons/yr	33.2441	33.6034	10	<b>Yes</b>	<b>Yes</b>
SO <sub>2</sub>	lbs/hr	0.0140	0.0141	6		
	tons/yr	0.0615	0.0616	10		
PM <sub>2.5</sub>	lbs/hr	0.1782	0.1838	6		
	tons/yr	0.7807	0.8050	10		
PM <sub>10</sub>	lbs/hr	4.9524	2.5727	6		
	tons/yr	2.6939	1.7698	10		
Lead	lbs/hr	1.16E-05	1.21E-05	6		
	tons/yr	5.07E-05	5.29E-05	10		
Total HAPs	lbs/hr	7.1659	0.4278	2	<b>Yes</b>	
	tons/yr	31.4057	1.8928	5	<b>Yes</b>	
Total TAPs	lbs/hr	0.0143	0.0083	1.14		
n-Hexane	lbs/hr	6.9142	0.3274			
	tons/yr	30.3022	1.4518			
Toluene	lbs/hr	0.0503	0.0132			
	tons/yr	0.2207	0.0578			
Ethylbenzene	lbs/hr	0.0544	0.0213			
	tons/yr	0.2385	0.0937			
Xylenes	lbs/hr	0.1326	0.0575			
	tons/yr	0.5815	0.2528			
Benzene	lbs/hr	0.0078	0.0018			
	tons/yr	0.0340	0.0079			

<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 - Fugitive Emissions Data Summary Sheet and Attachment T - Emission Points Summary Sheet for sitewide sources and breakdown of emission quantities.</p>
------------------------------	---

Table 4

Fugitive Emissions  
Alvadore 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	0.126
	Benzene frac	0.000
	Toluene	0.000
	Ethylbenzene	0.000
	Xylenes	0.000
	n-Hexane	0.018
	HAPs	0.018
	Methane	0.664

Gas					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
400	Valves	Gas VOC	0.004500	0.23	4,373.36
		Non VOC	0.004500	1.57	30,316.24
		HAPs	0.004500	0.03	615.91
		CO2e	0.004500	29.87	575,700.16
472	Connectors	VOC	0.000200	0.01	229.36
		Non-VOC	0.000200	0.08	1,589.92
		HAPs	0.000200	0.00	32.30
		CO2e	0.000200	1.57	30,192.27
104	Flanges	VOC	0.000390	0.01	98.55
		Non-VOC	0.000390	0.04	683.13
		HAPs	0.000390	0.00	13.88
		CO2e	0.000390	0.673124	12972.443509
<b>Total VOCs:</b>				0.24	4701.26
<b>Total THC:</b>				1.93	37290.55

Light Liquid Weight Fraction From Analysis:	VOC frac	0.979
	Benzene frac	0.001
	Toluene	0.005
	Ethylbenzene	0.009
	Xylenes	0.024
	n-hexane	0.030
	HAPs	0.069
	Methane	0.007

Light Liquid					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
416	Valves	Light Liquid VOC	0.002500	1.02	19,619.75
		Light Liquid Non-VOC	0.002500	0.02	423.13
		Light Liquid HAPs	0.002500	0.07	1,380.82
		CO2e	0.002500	0.19	3595.86
<b>Total VOC:</b>				1.02	19,619.75
<b>Total THC:</b>				1.04	20,042.88

Fugitive Total Emissions			
	Annual Emissions (lb/yr)	Annual Emissions (lb/hr)	Annual Emissions (tpy)
VOC	24,321.01	2.78	12.16
Ethylbenzene		0.02	0.09
Toluene		0.01	0.05
Xylenes		0.06	0.25
n-Hexane		0.14	0.63
TAPs (Benzene)		0.00	0.01
HAPs		0.23	1.02
CO <sub>2e</sub>	622,460.73	71.06	311.23

<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  
Alvadore Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

Number of PCVs	32
Bleed Rate (scf/day/PCV)	6.6
Total Bleed Rate (scf/day)	211.2

Component	Mol%	Molecular Weight (lb/lb-mole)	Component Flow (scf/day)	Component Moles (lb-moles)	Component Emissions		
					(lbs/day)	(lbs/hr)	(tons/year)
H2S	0.00E+00	34.08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	0.4311	14.01	0.9104832	2.40E-03	0.03	1.40E-03	0.01
Carbon Dioxide	0.1854	44.01	0.3915648	1.03E-03	0.05	1.89E-03	8.29E-03
Methane	81.1473	16.04	171.3830976	0.45	7.24	0.30	1.32
Ethane	13.6997	30.07	28.9337664	0.08	2.29	0.10	0.42
Propane	2.4061	44.1	5.0816832	0.01	0.59	0.02	0.11
Isobutane	0.4878	58.12	1.0302336	2.71E-03	0.16	0.01	0.03
n-Butane	0.8151	58.12	1.7214912	4.54E-03	0.26	0.01	0.05
Isopentane	0.2296	72.15	0.4849152	1.28E-03	0.09	3.84E-03	0.02
n-Pentane	0.1939	72.15	0.4095168	1.08E-03	0.08	3.24E-03	0.01
2-Methylpentane	0.00E+00	86.18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Methylpentane	0.00E+00	86.18	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
n-Hexane	0.404	86.18	0.853248	2.25E-03	0.19	0.01	0.04
Methylcyclopentane	0.00E+00	84.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene	0.00E+00	78.11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Methylhexane	0.00E+00	100.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Methylhexane	0.00E+00	100.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heptane	0.00E+00	100.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methylcyclohexane	0.00E+00	98.186	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene	0.00E+00	92.14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Octane	0.00E+00	114.23	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	0.00E+00	106.17	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
m & p-Xylene	0.00E+00	106.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
o-Xylene	0.00E+00	106.16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nonane	0.00E+00	128.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C10+	0.00E+00	174.28	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	lb/hr	tpy
VOC Emissions	0.0573	0.2511
Benzene Emissions	0.00E+00	0.00E+00
Toluene Emissions	0.00E+00	0.00E+00
Ethylbenzene Emissions	0.00E+00	0.00E+00
Xylene Emissions	0.00E+00	0.00E+00
n-Hexane Emissions	0.0081	0.0354
HAPs Emissions	0.0081	0.0354
TAPs Emissions	0.00E+00	0.00E+00
CO <sub>2e</sub> emissions	7.5478	33.0594

<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

Table 6

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

# Hours Operational	8760
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	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	0.2164	0.1698	0.7435	2.7446	0.0580	0.2541
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0124	0.0097	0.0426	0.3035	0.0064	0.0281
Carbon Dioxide	0.3937	0.3088	1.3524	3.0552	0.0646	0.2829
Methane	9.0585	7.1052	31.1206	62.2181	1.3154	5.7614
Ethane	31.6038	24.7890	108.5758	21.5705	0.4560	1.9974
Propane	19.8679	15.5837	68.2568	6.0354	0.1276	0.5589
Isobutane	6.9631	5.4617	23.9221	0.5640	0.0119	0.0522
n-Butane	12.4139	9.7371	42.6484	1.9505	0.0412	0.1806
Isopentane	4.6267	3.6290	15.8951	0.4644	0.0098	0.0430
n-Pentane	4.0530	3.1790	13.9242	0.3887	0.0082	0.0360
2-Methylpentane	0.1680	0.1318	0.5772	0.0075	0.0002	0.0007
3-Methylpentane	0.1154	0.0905	0.3966	0.0135	0.0003	0.0013
n-Hexane	8.4742	6.6469	29.1133	0.2997	0.0063	0.0278
Methylcyclopentane	0.0287	0.0225	0.0988	0.0094	0.0002	0.0009
Benzene	0.0074	0.0058	0.0253	0.0116	0.0002	0.0011
2-Methylhexane	0.1984	0.1557	0.6818	0.0078	0.0002	0.0007
3-Methylhexane	0.1695	0.1329	0.5823	0.0070	0.0001	0.0006
Heptane	0.3812	0.2990	1.3097	0.0164	0.0003	0.0015
Methylcyclohexane	0.2021	0.1585	0.6944	0.0441	0.0009	0.0041
Toluene	0.0457	0.0358	0.1570	0.0685	0.0014	0.0063
Octane	0.6128	0.4807	2.1053	0.0157	0.0003	0.0015
Ethylbenzene	0.0400	0.0314	0.1375	0.0597	0.0013	0.0055
m & p-Xylene	0.0358	0.0280	0.1228	0.0527	0.0011	0.0049
o-Xylene	0.0546	0.0428	0.1875	0.0823	0.0017	0.0076
Nonane	0.2194	0.1721	0.7538	0.0087	0.0002	0.0008
C10+	0.0375	0.0294	0.1288	0.0007	0.0000	0.0001
Total VOCs	58.715	46.05	201.7	10.108	0.2137	0.9360
Total CO <sub>2e</sub>		177.94	779.4		32.95	144.3
Total TAPs (Benzene)		0.0058	0.0253		0.0002	0.0011
Toluene		0.0358	0.1570		0.0014	0.0063
Ethylbenzene		0.0314	0.1375		0.0013	0.0055
Xylenes		0.0709	0.3103		0.0029	0.0125
n-Hexane		6.647	29.113		0.0063	0.0278
Total HAPs		6.791	29.743		0.0121	0.0532
Total	100.00	78.44	343.6	100.00	2.114	9.26

<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**  
**Alvadore Well Pad**  
**Doddridge County, West Virginia**  
**Antero Resources Corporation**

Condensate Tank Information	
Number of Tanks	10
Maximum Working Losses (lbs/hr)	6.5335
Maximum Breathing Losses (lbs/hr)	5.9066
# Hours Operational	8760

	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	0.0006	4.10E-05	1.80E-04	0.0000	0.0002	0.0001	0.0003
Carbon Dioxide	0.5083	0.0332	0.1455	0.0300	0.1315	0.0632	0.2770
Methane	2.2394	0.1463	0.6409	0.1323	0.5794	0.2786	1.2202
Ethane	42.8541	2.7999	12.2635	2.5312	11.0868	5.3311	23.3503
Propane	22.9030	1.4964	6.5541	1.3528	5.9253	2.8492	12.4794
Isobutane	7.5097	0.4906	2.1490	0.4436	1.9428	0.9342	4.0919
n-Butane	13.1192	0.8571	3.7543	0.7749	3.3941	1.6321	7.1484
Isopentane	4.6391	0.3031	1.3276	0.2740	1.2002	0.5771	2.5278
n-Pentane	3.9994	0.2613	1.1445	0.2362	1.0347	0.4975	2.1792
2-Methylpentane	0.1605	0.0105	0.0459	0.0095	0.0415	0.0200	0.0875
3-Methylpentane	0.1098	0.0072	0.0314	0.0065	0.0284	0.0137	0.0598
n-Hexane	0.5477	0.0358	0.1567	0.0324	0.1417	0.0681	0.2984
Methylcyclopentane	0.0254	0.0017	0.0073	0.0015	0.0066	0.0032	0.0138
Benzene	0.0004	2.63E-05	0.0001	0.0000	0.0001	0.0001	0.0002
2-Methylhexane	0.0123	8.07E-04	0.0035	0.0007	0.0032	0.0015	0.0067
3-Methylhexane	0.1585	0.0104	0.0454	0.0094	0.0410	0.0197	0.0864
Heptane	0.3293	0.0215	0.0942	0.0195	0.0852	0.0410	0.1795
Methylcyclohexane	0.1720	0.0112	0.0492	0.0102	0.0445	0.0214	0.0937
Toluene	0.0054	3.51E-04	1.54E-03	0.0003	0.0014	0.0007	0.0029
Octane	0.4933	0.0322	0.1412	0.0291	0.1276	0.0614	0.2688
Ethylbenzene	0.0086	5.65E-04	2.47E-03	0.0005	0.0022	0.0011	0.0047
m & p-Xylene	0.0100	6.50E-04	2.85E-03	0.0006	0.0026	0.0012	0.0054
o-Xylene	0.0131	8.57E-04	0.0038	0.0008	0.0034	0.0016	0.0071
Nonane	0.1589	0.0104	0.0455	0.0094	0.0411	0.0198	0.0866
C10+	0.0216	1.41E-03	0.0062	0.0013	0.0056	0.0027	0.0118
Total VOCs	54.397	3.5541	15.567	3.2131	14.0732	6.7671	29.640
Total CO <sub>2e</sub>		3.6911	16.1669	3.3369	14.6157	7.0280	30.783
Total TAPs (Benzene)		2.63E-05	1.15E-04	0.0000	0.0001	0.0001	0.0002
Toluene		3.51E-04	1.54E-03	0.0003	0.0014	0.0007	0.0029
Ethylbenzene		5.65E-04	2.47E-03	0.0005	0.0022	0.0011	0.0047
Xylenes		1.51E-03	0.0066	0.0014	0.0060	0.0029	0.0126
n-Hexane		0.0358	0.1567	0.0324	0.1417	0.0681	0.2984
Total HAPs		0.0382	0.1675	0.0346	0.1514	0.0728	0.3189
Total	100.00	6.5335	28.6169	5.9066	25.8711	12.4402	54.488

Table 7

**Uncontrolled Working and Breathing Losses**  
**Alvadore Well Pad**  
**Doddridge County, West Virginia**  
**Antero Resources Corporation**

Produced Water Tank Information	
Number of Tanks	2
Maximum Working Losses (lbs/hr)	0.0355
Maximum Breathing Losses (lbs/hr)	0.0083

	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	0.0058	2.05E-06	8.98E-06	4.80E-07	2.10E-06	2.53E-06	1.11E-05
Carbon Dioxide	3.9196	0.0014	0.0061	0.0003	0.0014	0.0017	0.0075
Methane	3.2920	0.0012	0.0051	0.0003	0.0012	0.0014	0.0063
Ethane	1.0533	0.0004	0.0016	0.0001	0.0004	0.0005	0.0020
Propane	0.0718	2.55E-05	0.0001	5.97E-06	2.61E-05	3.15E-05	0.0001
Isobutane	0.0008	2.98E-07	1.31E-06	6.98E-08	3.06E-07	3.68E-07	1.61E-06
n-Butane	0.0044	1.55E-06	6.80E-06	3.64E-07	1.59E-06	1.92E-06	8.39E-06
Isopentane	0.0003	9.27E-08	4.06E-07	2.17E-08	9.50E-08	1.14E-07	5.01E-07
n-Pentane	0.0002	5.66E-08	2.48E-07	1.32E-08	5.80E-08	6.98E-08	3.06E-07
2-Methylpentane	5.86E-07	2.08E-10	9.11E-10	4.87E-11	2.13E-10	2.57E-10	1.12E-09
3-Methylpentane	2.57E-06	9.10E-10	3.99E-09	2.13E-10	9.34E-10	1.12E-09	4.92E-09
n-Hexane	9.09E-07	3.23E-10	1.41E-09	7.55E-11	3.31E-10	3.98E-10	1.74E-09
Methylcyclopentane	3.82E-06	1.36E-09	5.94E-09	3.18E-10	1.39E-09	1.67E-09	7.33E-09
Benzene	1.46E-05	5.18E-09	2.27E-08	1.21E-09	5.31E-09	6.39E-09	2.80E-08
2-Methylhexane	1.00E-08	3.56E-12	1.56E-11	8.34E-13	3.65E-12	4.40E-12	1.93E-11
3-Methylhexane	1.34E-07	4.75E-11	2.08E-10	1.11E-11	4.87E-11	5.86E-11	2.57E-10
Heptane	2.32E-07	8.22E-11	3.60E-10	1.92E-11	8.43E-11	1.01E-10	4.44E-10
Methylcyclohexane	3.85E-06	1.37E-09	5.98E-09	3.20E-10	1.40E-09	1.69E-09	7.38E-09
Toluene	4.13E-05	1.47E-08	6.43E-08	3.43E-09	1.50E-08	1.81E-08	7.93E-08
Octane	4.32E-08	1.53E-11	6.71E-11	3.59E-12	1.57E-11	1.89E-11	8.28E-11
Ethylbenzene	2.03E-05	7.19E-09	3.15E-08	1.68E-09	7.37E-09	8.87E-09	3.89E-08
m & p-Xylene	2.00E-05	7.09E-09	3.10E-08	1.66E-09	7.27E-09	8.75E-09	3.83E-08
o-Xylene	3.26E-05	1.16E-08	5.07E-08	2.71E-09	1.19E-08	1.43E-08	6.25E-08
Nonane	1.13E-08	4.02E-12	1.76E-11	9.41E-13	4.12E-12	4.96E-12	2.17E-11
C10+	9.48E-12	3.36E-15	1.47E-14	7.87E-16	3.45E-15	4.15E-15	1.82E-14
Total VOCs	0.0776	2.75E-05	0.0001	6.45E-06	2.82E-05	3.40E-05	0.0001
Total CO <sub>2e</sub>		0.0306	0.1340	0.0072	0.0314	0.0378	0.1654
Total TAPs (Benzene)		5.18E-09	2.27E-08	1.21E-09	5.31E-09	6.39E-09	2.80E-08
Toluene		1.47E-08	6.43E-08	3.43E-09	1.50E-08	1.81E-08	7.93E-08
Ethylbenzene		7.19E-09	3.15E-08	1.68E-09	7.37E-09	8.87E-09	3.89E-08
Xylenes		1.87E-08	8.17E-08	4.37E-09	1.91E-08	2.30E-08	1.01E-07
n-Hexane		3.23E-10	1.41E-09	7.55E-11	3.31E-10	3.98E-10	1.74E-09
Total HAPs		4.60E-08	2.02E-07	1.08E-08	4.72E-08	5.68E-08	2.49E-07
Total	100.00	0.0355	0.1554	0.0083	0.0364	0.0438	0.1918

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

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

Annual Loading	Oil Truck Loading	Water Truck Loading
RVP	3.54	1.0227
Annual Average Temp (F)	65.076213	65.076213
S (saturation factor)	0.6	0.6
P (true vapor pressure)	1.99	0.37
M (MW of vapor)	38.57	18.45
Collection Efficiency (%)	0.00	0.00
Loading Loss (lb/10 <sup>3</sup> gal)*	1.09	0.10
Maximum Throughput (gallons/hr)**	10,080	10,080
Average Throughput (gallons/yr)	5,948,040	7,511,700
Loading Emissions (lbs/hr)	11.01	0.99
Loading Emissions (tpy)	3.25	0.37

	Condensate Tank Loading Losses			Produced Water Tank Loading Losses		
	Vapor Mass Fraction wt%	Loading Losses lbs/hr	Loading Losses tpy	Vapor Mass Fraction wt%	Loading Losses lbs/hr	Loading Losses tpy
H2S	0.0000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	0.0006	6.91E-05	2.04E-05	0.0058	5.70E-05	2.12E-05
Carbon Dioxide	0.5083	0.0560	1.65E-02	3.9196	3.86E-02	1.44E-02
Methane	2.2394	0.2466	7.27E-02	3.2920	3.25E-02	1.21E-02
Ethane	42.8541	4.7184	1.3921	1.0533	1.04E-02	3.87E-03
Propane	22.9030	2.5217	7.44E-01	0.0718	7.08E-04	2.64E-04
Isobutane	7.5097	0.8268	2.44E-01	0.0008	8.29E-06	3.09E-06
n-Butane	13.1192	1.4445	4.26E-01	0.0044	4.31E-05	1.61E-05
Isopentane	4.6391	0.5108	1.51E-01	0.0003	2.57E-06	9.59E-07
n-Pentane	3.9994	0.4403	1.30E-01	0.0002	1.57E-06	5.86E-07
2-Methylpentane	0.1605	0.0177	5.22E-03	5.86E-07	5.78E-09	2.15E-09
3-Methylpentane	0.1098	0.0121	3.57E-03	2.57E-06	2.53E-08	9.42E-09
n-Hexane	0.5477	0.0603	1.78E-02	9.09E-07	8.96E-09	3.34E-09
Methylcyclopentane	0.0254	0.0028	8.25E-04	3.82E-06	3.77E-08	1.40E-08
Benzene	0.0004	0.0000	1.31E-05	0.0000	1.44E-07	5.36E-08
2-Methylhexane	0.0123	0.0014	4.01E-04	1.00E-08	9.90E-11	3.69E-11
3-Methylhexane	0.1585	0.0175	5.15E-03	1.34E-07	1.32E-09	4.92E-10
Heptane	0.3293	0.0363	1.07E-02	2.32E-07	2.28E-09	8.51E-10
Methylcyclohexane	0.1720	0.0189	5.59E-03	3.85E-06	3.79E-08	1.41E-08
Toluene	0.0054	0.0006	1.74E-04	0.0000	4.08E-07	1.52E-07
Octane	0.4933	0.0543	1.60E-02	4.32E-08	4.26E-10	1.59E-10
Ethylbenzene	0.0086	0.0010	2.81E-04	2.03E-05	2.00E-07	7.44E-08
m & p-Xylene	0.0100	0.0011	3.23E-04	2.00E-05	1.97E-07	7.34E-08
o-Xylene	0.0131	0.0014	4.26E-04	3.26E-05	3.21E-07	1.20E-07
Nonane	0.1589	0.0175	5.16E-03	1.13E-08	1.12E-10	4.16E-11
C10+	0.0216	0.0024	7.02E-04	9.48E-12	9.34E-14	3.48E-14
Total VOCs	54.3975	5.9893	1.7671	0.0776	7.65E-04	2.85E-04
Total CO <sub>2e</sub>		6.2202	1.8352		0.8502	0.3168
Total TAPs (Benzene)		0.0000	1.31E-05		1.44E-07	5.36E-08
Toluene		0.0006	1.74E-04		4.08E-07	1.52E-07
Ethylbenzene		0.0010	2.81E-04		2.00E-07	7.44E-08
Xylenes		0.0025	7.49E-04		5.18E-07	1.93E-07
n-Hexane		0.0603	1.78E-02		8.96E-09	3.34E-09
Total HAPs		0.0644	1.90E-02		1.28E-06	4.76E-07
Total	100.0000	11.0103	3.2485	100.0000	0.9860	0.3674

**Enter any notes here**

Vapor mass fractions and loading losses from Promax output

\*Using equation  $L_L = 12.46 * SPM/T$  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

\*\* Maximum throughput in gallons per hour obtained from actual transfer rate of 200 barrels in 50 minutes. (10,080 gal/hr = 200 bbl / 50 min x 42 gal/bbl x 60 min/hr)

Loading emissions are vented to the atmosphere.

Table 9

**Gas Production Unit Heater and Line Heater Emissions  
Alvadore Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

**Gas Production Unit Heater Emissions**

Number of Units	8
GPU Heater Rating (MMBtu/hr)	1.50
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,209

**Line Heater Emissions**

Number of Units	8
Line Heater Rating (MMBtu/hr)	2.00
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,209

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	0.993	4.348
CO	84	0.834	3.652
CO <sub>2</sub>	120,000	1191.128	5217.139
Lead	0.0005	4.96E-06	2.17E-05
N <sub>2</sub> O	2.2	0.022	0.096
PM (Total)	7.6	0.075	0.330
SO <sub>2</sub>	0.6	0.006	0.026
TOC	11	0.109	0.478
Methane	2.3	0.023	0.100
VOC	5.5	0.055	0.239
<b>HAPS</b>			
2-Methylnaphthalene	2.40E-05	2.38E-07	1.04E-06
Benzene	2.10E-03	2.08E-05	9.13E-05
Dichlorobenzene	1.20E-03	1.19E-05	5.22E-05
Fluoranthene	3.00E-06	2.98E-08	1.30E-07
Fluorene	2.80E-06	2.78E-08	1.22E-07
Formaldehyde	7.50E-02	7.44E-04	3.26E-03
Hexane	1.80E+00	1.79E-02	7.83E-02
Naphthalene	6.10E-04	6.05E-06	2.65E-05
Phenanathrene	1.70E-05	1.69E-07	7.39E-07
Toluene	3.40E-03	3.37E-05	1.48E-04

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	1.323	5.797
CO	84	1.112	4.869
CO <sub>2</sub>	120,000	1588.170	6956.185
Lead	0.0005	6.62E-06	2.90E-05
N <sub>2</sub> O	2.2	0.029	0.128
PM (Total)	7.6	0.101	0.441
SO <sub>2</sub>	0.6	0.008	0.035
TOC	11	0.146	0.638
Methane	2.3	0.030	0.133
VOC	5.5	0.073	0.319
<b>HAPS</b>			
2-Methylnaphthalene	2.40E-05	3.18E-07	1.39E-06
Benzene	2.10E-03	2.78E-05	1.22E-04
Dichlorobenzene	1.20E-03	1.59E-05	6.96E-05
Fluoranthene	3.00E-06	3.97E-08	1.74E-07
Fluorene	2.80E-06	3.71E-08	1.62E-07
Formaldehyde	7.50E-02	9.93E-04	4.35E-03
Hexane	1.80E+00	2.38E-02	1.04E-01
Naphthalene	6.10E-04	8.07E-06	3.54E-05
Phenanathrene	1.70E-05	2.25E-07	9.85E-07
Toluene	3.40E-03	4.50E-05	1.97E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.127	0.558
TOTAL Uncontrolled HAPS	0.044	0.191
TOTAL Uncontrolled TAPs (Benzene)	4.86E-05	2.13E-04
TOTAL Uncontrolled Toluene	7.87E-05	3.45E-04
TOTAL Uncontrolled Hexane	4.17E-02	1.83E-01
TOTAL Uncontrolled TAPs (Formaldehyde)	1.74E-03	7.61E-03
TOTAL CO <sub>2e</sub> Emissions	2,795.81	12,245.66

**Enter any notes here:**

All Emission Factors based off AP-42 Sec 1.4 Natural Gas Combustion



Table 10

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

General Information	
Unit Name:	EC001, EC002, EC003

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
No. of Enclosed Combustors	3

Stream Information							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed/Vapor 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)	37.8	--	771.81	43.47	122.41	0.90	976.40
Maximum Expected Annual Volumetric Flow Rate of Stream (scf/yr)	331,128.00	--	6,761,097.41	380,822.32	1,072,318.07	7,889.02	8,553,254.81
Heating Content (Btu/ft3)	1,209		2,150.99	1,146.45	2,208.92	97.74	2,028.36

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/Vapor 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	-
H2S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	46.054	0.214	6.767	0.000	53.04
Benzene	-	-	0.006	0.000	0.000	0.000	0.006
Toluene	-	-	0.036	0.001	0.001	0.000	0.038
Ethylbenzene	-	-	0.031	0.001	0.001	0.000	0.034
Xylenes	-	-	0.071	0.003	0.003	0.000	0.077
n-Hexane	-	-	6.647	0.006	0.068	0.000	6.721
HAPs	-	-	6.791	0.012	0.073	0.000	6.876
Total Mass Flow	-	-	78.437	2.114	12.440	0.044	93.035
Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)							
H2S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	201.718	0.936	29.640	0.000	232.295
Benzene	-	-	0.025	0.001	0.000	0.000	0.027
Toluene	-	-	0.157	0.006	0.003	0.000	0.166
Ethylbenzene	-	-	0.137	0.006	0.005	0.000	0.148
Xylenes	-	-	0.310	0.012	0.013	0.000	0.335
n-Hexane	-	-	29.113	0.028	0.298	0.000	29.440
HAP	-	-	29.743	0.053	0.319	0.000	30.115
Total Mass Flow	-	-	343.553	9.260	54.488	0.192	407.493

Table 10

**Enclosed Combustor Emissions  
Alvadore 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/Vapor 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	0.004	-	0.077	0.004	0.012	0.000	0.10
CO	0.003	-	0.065	0.004	0.010	0.000	0.08
PM2.5	0.000	-	0.004	0.000	0.001	0.000	0.01
PM10	0.000	-	0.006	0.000	0.001	0.000	0.01
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>	4.536	-	-	-	-	-	4.54
Total VOC	0.000	-	0.921	0.004	0.135	0.000	1.06
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	-	0.133	0.000	0.001	0.000	0.13
HAP	0.000	-	0.136	0.000	0.001	0.000	0.14
N <sub>2</sub> O	0.000	-	0.002	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/Vapor 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	0.017	-	0.338	0.019	0.054	0.000	0.43
CO	0.014	-	0.284	0.016	0.045	0.000	0.36
PM2.5	0.001	-	0.019	0.001	0.003	0.000	0.02
PM10	0.001	-	0.026	0.001	0.004	0.000	0.03
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>	19.868	-	-	-	-	-	19.87
Total VOC	0.001	-	4.034	0.019	0.593	0.000	4.65
Benzene	0.000	-	0.001	0.000	0.000	0.000	0.00
Toluene	0.000	-	0.003	0.000	0.000	0.000	0.00
Ethylbenzene	0.000	-	0.003	0.000	0.000	0.000	0.00
Xylenes	0.000	-	0.006	0.000	0.000	0.000	0.01
n-Hexane	0.000	-	0.582	0.001	0.006	0.000	0.59
HAP	0.000	-	0.595	0.001	0.006	0.000	0.60
N <sub>2</sub> O	0.000	-	0.007	0.000	0.001	0.000	0.01
Lead	0.000	-	0.000	0.000	0.000	0.000	0.00
Formaldehyde	0.000	-	-	-	-	-	0.00

Enclosed Combustor/Vapor Combustor Total Emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	1.06	4.65
NOx	0.098	0.428
CO	0.082	0.359
PM2.5	0.006	0.024
PM10	0.007	0.033
H <sub>2</sub> S	1.21E-05	5.28E-05
SO <sub>2</sub>	2.27E-05	9.93E-05
Benzene (TAPs)	1.22E-04	5.33E-04
Toluene	7.59E-04	0.003
Ethylbenzene	6.75E-04	0.003
Xylenes	0.002	0.007
Hexanes	0.134	0.589
Formaldehyde (TAPs)	2.84E-06	1.24E-05
HAPs	0.14	0.60
CO <sub>2</sub> e	278.11	1218.12
N <sub>2</sub> O	0.002	0.009
Lead	4.88E-07	2.14E-06

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  
Alvadore 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 Enclosed Combustor scf/year	Mole fraction of water flash gas constituents <sup>a</sup>	Volume of water flash gas sent to Enclosed Combustor scf/year	Mole fraction of oil tank vapors constituents <sup>a</sup>	Volume of oil tank vapor sent to Enclosed Combustor scf/year	Mole fraction of water tank vapors constituents <sup>a</sup>	Volume of water tank vapors sent to Enclosed Combustor scf/year	Component volume of gas sent to Enclosed Combustor 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>	0.003	6,761,097	0.0138	380,822	0.0045	1,072,318	0.016	7,889	32,867	1	0	--	32,867	19,899,594
Methane	0.212	6,761,097	0.7698	380,822	0.0538	1,072,318	0.038	7,889	1,785,306	1	0.98	1,749,600	35,706	35,706
Ethane	0.395	6,761,097	0.1424	380,822	0.5496	1,072,318	0.006	7,889	3,312,591	2	0.98	6,492,679	--	
Propane	0.169	6,761,097	0.0272	380,822	0.2003	1,072,318	0.000	7,889	1,369,203	3	0.98	4,025,458	--	
i-Butane	0.045	6,761,097	0.0019	380,822	0.0498	1,072,318	0.000	7,889	358,406	4	0.98	1,404,953	--	
n-Butane	0.080	6,761,097	0.0067	380,822	0.0870	1,072,318	0.000	7,889	638,282	4	0.98	2,502,067	--	
Pentane	0.045	6,761,097	0.0023	380,822	0.0462	1,072,318	0.000	7,889	355,903	5	0.98	1,743,926	--	
Hexane	0.038	6,761,097	0.0007	380,822	0.0037	1,072,318	0.000	7,889	262,265	6	0.98	1,542,119	--	
Benzene	0.000	6,761,097	0.0000	380,822	0.0000	1,072,318	0.000	7,889	253	6	0.98	1,488	--	
Heptanes	0.003	6,761,097	0.0001	380,822	0.0020	1,072,318	0.000	7,889	22,074	7	0.98	151,428	--	
Toluene	0.000	6,761,097	0.0001	380,822	0.0000	1,072,318	0.000	7,889	1,339	7	0.98	9,188	--	
Octane	0.003	6,761,097	0.0001	380,822	0.0023	1,072,318	0.000	7,889	21,406	8	0.98	167,821	--	
Ethyl benzene	0.000	6,761,097	0.0001	380,822	0.0000	1,072,318	0.000	7,889	1,033	8	0.98	8,102	--	
Xylenes	0.000	6,761,097	0.0003	380,822	0.0001	1,072,318	0.000	7,889	2,347	8	0.98	18,399	--	
Nonane	0.001	6,761,097	0.0000	380,822	0.0005	1,072,318	0.000	7,889	4,864	9	0.98	42,896	--	
Decane plus	0.000	6,761,097	0.0000	380,822	0.0001	1,072,318	0.000	7,889	674	10	0.98	6,605	--	
<b>Subtotal</b>												<b>19,866,727</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>	19,899,594	0.12	2000	1	263.43	1,153.81
CH <sub>4</sub>	35,706	0.09	2000	25	0.38	1.66
<b>CO<sub>2</sub>e Emissions</b>					<b>272.9</b>	<b>1195.33</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  
Alvadore 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)	388
PW Production (bbl/day)	490
Truck Capacity (bbl)	200

Pick Up Truck Trip Calculation	
No of Trips Per day	2
Trips Per Year	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	1.3800	1	709	1.3800	978.4200	3.8175	1.7179
Tanker Trucks PW	10	40	10	1.3800	1	895	1.3800	1235.1000	3.8175	1.7179
Pick Up Truck	4	3	10	0.2100	1	730	0.2100	153.3000	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	5.2682	3735.1471	1.8676	2.3707	1680.8162	0.8404	2.6341	1867.5736	0.9338	1.1853	840.4081	0.4202
Tanker Trucks PW	5.2682	4715.0306	2.3575	2.3707	2121.7637	1.0609	2.6341	2357.5153	1.1788	1.1853	1060.8819	0.5304
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
<b>Total Emissions</b>	<b>10.6092</b>	<b>8,503.3237</b>	<b>4.2517</b>	<b>4.7741</b>	<b>3,826.4956</b>	<b>1.9132</b>	<b>5.3046</b>	<b>4,251.6618</b>	<b>2.1258</b>	<b>2.3871</b>	<b>1,913.2478</b>	<b>0.9566</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**

**Engine Emissions  
Alvadore Well Pad  
Doddridge County, West Virginia  
Antero Resources Corporation**

**Kubota DG972-E2**

Power (hp)	24
Fuel consumption (lbs/BHP-hr)	0.449
Heat Content of Fuel (Btu/scf)	1208.9385
Density of NG (lb/scf)	0.056
Operating Hours/year	8760
No. of Engines	1

Pollutant	Emission Factors		lb/hr	tpy
	(g/hp-hr)	(lb/MMBtu)		
NOx <sup>1</sup>	5.97		0.3158	1.3831
CO <sup>2</sup>	106.7		5.6445	24.7228
CO <sub>2</sub>		110.000	25.5898	112.08
PM <sub>2.5</sub>		9.500E-03	0.0022	0.0097
PM <sub>10</sub>		9.500E-03	0.0022	0.0097
PM (Total)		9.910E-03	0.0023	0.0101
SO <sub>2</sub>		5.880E-04	0.0001	0.0006
TOC		0.358	0.0833	0.3648
Methane		0.230	0.0535	0.2344
VOC <sup>3</sup>		0.0296	0.0069	0.0302
<b>HAPS</b>				
Benzene		1.58E-03	3.68E-04	1.61E-03
Ethylbenzene		2.48E-05	5.77E-06	2.53E-05
Formaldehyde		2.05E-02	4.77E-03	2.09E-02
Naphthalene		9.71E-05	2.26E-05	9.89E-05
Toluene		5.58E-04	1.30E-04	5.69E-04
Xylene		1.95E-04	4.54E-05	1.99E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.007	0.030
TOTAL Uncontrolled NOx	0.316	1.383
TOTAL Uncontrolled HAPs	0.005	0.023
TOTAL Uncontrolled TAPs (Benzene)	3.68E-04	0.002
TOTAL Uncontrolled Toluene	1.30E-04	0.001
TOTAL Uncontrolled Ethylbenzene	5.77E-06	0.000
TOTAL Uncontrolled Xylenes	4.54E-05	0.000
TOTAL Uncontrolled TAPs (Formaldehyde)	0.005	0.021
TOTAL CO <sub>2e</sub> Emissions	26.927	117.942

**Enter Any Notes Here:**

1. Emission factor used for the 24 HP engine's NOx is the 40 CFR 1054 standard indicated on the EPA's Certificate of Conformity. See Appendix N.
2. Emission factor for CO was the Certification CO level taken from EPA's Non-Road Small SI 2013 Certification issued by Office of Transportation and Air Quality, March 2014.
3. Emission factors for all other contaminants including VOCs were obtained from AP-42, Section 3.2 "Natural Gas-fired Reciprocating Engines", Table 3.2-3.

**Table 14**

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

Pollutant	Potential Emissions		Initial Permit Application Emissions		Change in Emissions	
	Hourly PTE	Yearly PTE	Hourly PTE	Yearly PTE	Hourly PTE	Yearly PTE
<b>PM</b>	5.4902	2.9390	12.991	56.90	-7.50E+00	-53.9610
<b>PM10</b>	2.5727	1.7698	1.125	2.40	1.4476	-0.6330
<b>VOC (uncontrolled)</b>	56.0033	247.0618	524.996	2299.48	-468.9925	-2052.4196
<b>CO</b>	7.6720	33.6034	7.061	30.93	0.6113	2.6773
<b>NOx</b>	2.7295	11.9552	2.002	8.77	0.7277	3.1873
<b>SO2</b>	0.0141	0.0616	0.006	0.03	8.02E-03	3.51E-02
<b>Pb</b>	1.21E-05	5.29E-05	0.000	0.00	3.64E-06	1.59E-05
<b>HAPs</b>	0.4278	1.8928	1.094	4.81	-0.6660	-2.9188
<b>TAPs</b>	0.0083	0.0364	0.013	0.06	-4.37E-03	-0.0192

Notes:

1. Change in emissions due to the increase in condensate production and the addition of 8 line heaters, 2 condensate tanks and 2 Cimarron enclosed combustors.
2. Change in permit from G70A to G70C.



Bryan Research & Engineering, Inc.

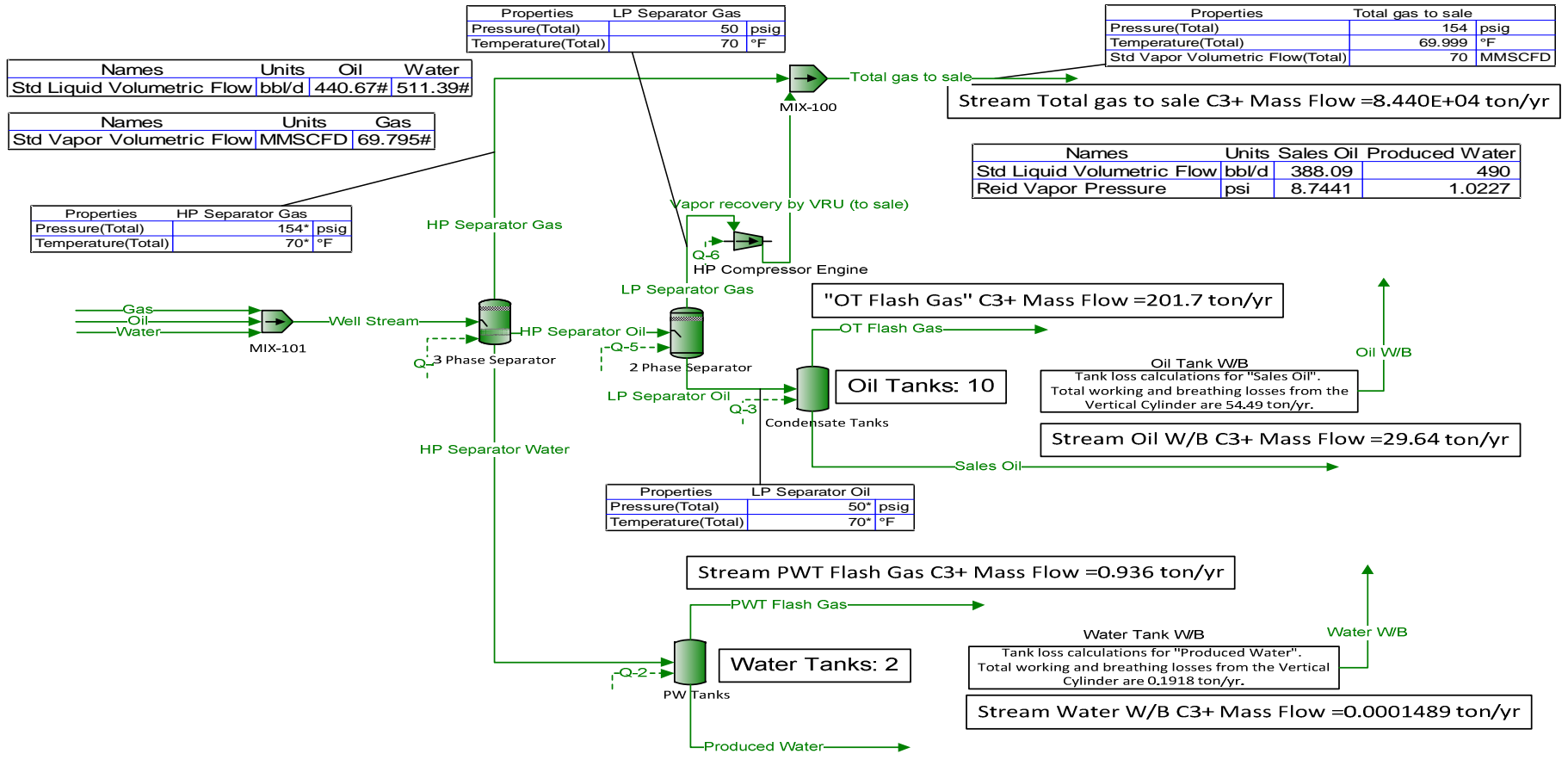
**ProMax<sup>®</sup> 3.2**

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

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### Simulation Report

Client Name:	Antero Resources Corporation
Location:	West Virginia
Job:	Alvadore Well Pad
Project Name:	PROMAX SCENARIO 3
File Name:	ProMax@C:\Users\ychen1\Documents\Drafts\082715- ANTERO\ProMax Report\2 PH\PROMAX SCENARIO 3.pmx
ProMax Version:	
Report Created:	6/22/2016 12:53



Names	Units	Oil	Water
Std Liquid Volumetric Flow	bb/d	440.67#	511.39#

Names	Units	Gas
Std Vapor Volumetric Flow	MMSCFD	69.795#

Properties	LP Separator Gas
Pressure(Total)	50 psig
Temperature(Total)	70 °F

Properties	Total gas to sale
Pressure(Total)	154 psig
Temperature(Total)	69.999 °F
Std Vapor Volumetric Flow(Total)	70 MMSCFD

Properties	HP Separator Gas
Pressure(Total)	154 psig
Temperature(Total)	70 °F

Properties	LP Separator Oil
Pressure(Total)	50 psig
Temperature(Total)	70 °F

Stream Total gas to sale C3+ Mass Flow = 8.440E+04 ton/yr

Names	Units	Sales Oil	Produced Water
Std Liquid Volumetric Flow	bb/d	388.09	490
Reid Vapor Pressure	psi	8.7441	1.0227

"OT Flash Gas" C3+ Mass Flow = 201.7 ton/yr

Oil Tank W/B  
Tank loss calculations for "Sales Oil".  
Total working and breathing losses from the Vertical Cylinder are 54.49 ton/yr.

Stream Oil W/B C3+ Mass Flow = 29.64 ton/yr

Stream PWT Flash Gas C3+ Mass Flow = 0.936 ton/yr

Water Tank W/B  
Tank loss calculations for "Produced Water".  
Total working and breathing losses from the Vertical Cylinder are 0.1918 ton/yr.

Stream Water W/B C3+ Mass Flow = 0.0001489 ton/yr





Heptane	0.068558	4.97445E-06	1.78043	0.381227	1.82444	0	0	3.92893	1.23625E-07	0.0164075			0.110076	1.79760	0.124421	0.124421	0.0685718
Methylcyclohexane	0.0356888	1.50630E-05	0.912903	0.202119	0.935323	0	0	2.03239	0.201594E-06	0.0441324			0.0569409	0.921686	0.0657222	0.0657222	0.0356974
Toluene	0.00800418	0.000215062	0.256209	0.0645861	0.262564	0	0	0.503745	0.000194870	0.0684930			0.0141133	0.0148060	0.0148060	0.00800613	0.00800613
Octane	0.113231	4.71641E-06	9.00230	0.612810	9.25429	0	0	12.1148	7.80150E-08	0.0156889			0.339418	9.09537	0.199029	0.199029	0.113255
Ethylbenzene	0.00722222	0.000171142	0.661685	0.0042026	0.680320	0	0	0.854185	0.000153550	0.0569586			0.0239315	0.0684152	0.0129162	0.0129162	0.0072385
m-Xylene	0.00646892	0.000155964	0.705897	0.0357549	0.725932	0	0	0.870178	0.000140425	0.0526996			0.0243795	0.0713096	0.0115156	0.0115156	0.00647037
o-Xylene	0.00986508	0.000320617	1.20243	0.0545785	1.23670	0	0	1.44402	0.000296380	0.0822745			0.0404568	1.21471	0.0175637	0.0175637	0.00986728
Nonane	0.0416430	2.65439E-06	9.78328	0.219404	10.0671	0	0	10.4624	6.91609E-08	0.00874431			0.293121	9.88397	0.0708284	0.0708284	0.0416513
C10+	0.00778444	1.96131E-07	52.5508	0.0374774	54.1010	0	0	49.0294	2.26590E-09	0.000655660			1.37364	53.0955	0.0120280	0.0120280	0.00779565

Process Streams		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	Well Stream	LP Separator Oil	LP Separator Gas	r recovery by VRU (t)	Total gas to sale
Phase: Total	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolvd	Unsolvd	Solved	Solved	Solved	Solved	Solved
Property	Units																	
Temperature	°F	70.0	70.0	70.0	75.9	75.9	85.0	85.0	85.0	75.9	75.9	31.5914		84.9366	70	70	70	69.9994
Pressure	psig	154	154	154	0	0	1000	1000	1000	0	0			1000	50	50	154	154
Mole Fraction Vapor	%	100			100	0	100	0	0	100	100	100	100	99.9912	0	100	99.9985	0.244071
Mole Fraction Light Liquid	%	0	100	100	0	100	0	100	100	0	0			0.974051	100	0	0.244071	0
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0	0	0	0			5.03471	0	0	0.157421	0
Molecular Weight	lb/lbmol	19.8	18.0	114.7	37.6	124.6	19.8	18.0	112.9	18.0	19.9			20.1863	119.456	23.7796	23.7796	19.8424
Mass Density	lb/ft^3	6.6	62.3	45.2	0.1	45.5	4.3	62.2	45.1	62.2	62.2			4.59656	45.4316	0.276842	0.752177	0.613186
Molar Flow	lbmol/h	7684.2	396.9	37.1	2.1	33.2	7663.4	414.2	40.7	396.8	0.1			8118.25	35.3042	1.83689	1.83689	7686.03
Mass Flow	lb/h	152465.8	17150.8	4261.0	78.4	4138.9	151825.2	7461.2	4591.3	7148.7	2.1			163878	4217.31	43.7233	43.7233	152509
Vapor Volumetric Flow	MCFH	248.7	0.1	0.1	0.8	0.1	35.5	0.1	0.1	0.1	0.1			35.6522	0.0928278	0.157936	0.0581290	248.716
Liquid Volumetric Flow	Mbbld	1062.9	0.5	0.4	151.8	0.4	151.8	0.4	0.4	0.4	0.2			152.398	0.396800	0.675111	0.248477	1063.16
Std Vapor Volumetric Flow	MMSCFD	70.0	3.6	0.3	0.0	0.3	69.8	3.8	0.6	3.6	0.0			73.9380	0.321538	0.0167461	0.0167461	70.0015
Std Liquid Volumetric Flow	Mbbld	31.4	0.5	0.4	0.0	0.4	31.3	0.5	0.4	0.5	0.0			32.2792	0.400040	0.00829545	0.00829545	31.8888
Compressibility		0.960	0.009	0.075	0.988	0.007	0.804	0.050	0.434	0.001	0.997			0.762453	0.0299267	0.977644	0.938254	0.960369
Specific Gravity		0.685	0.998	0.725	1.297	0.730	0.684	0.997	0.724	0.998	0.687			0.728432	0.821047	0.821047	0.685105	0.685105
API Gravity		10.0	62.5		60.4		9.9	60.9		10.0				61.5146				
Enthalpy	MMBtu/h	-261.5	-48.8	-3.6	-0.1	-3.5	-263.7	-50.8	-3.9	-48.8	0.0			-318.370	-3.57546	-0.0662098	-0.0665349	-261.582
Mass Enthalpy	Btu/lb	-1715.2	-6826.4	-85.8	-1142.0	-836.5	-1736.8	-6810.9	-842.3	-6822.4	-1875.9			-1942.73	-847.805	-1514.29	-1521.72	-1715.19
Mass Cp	Btu/(lb**F)	0.5	1.0	0.5	0.4	0.5	0.7	1.0	0.5	1.0	0.5			0.673772	0.486433	0.465457	0.483223	0.505945
Ideal Gas CpCv Ratio		1.260	1.326	1.048	1.146	1.044	1.257	1.325	1.048	1.326	1.263			1.25375	1.04594	1.22384	1.22384	1.26028
Dynamic Viscosity	cP	0.0	1.0	0.6	0.0	0.6	0.0	0.8	0.5	0.9	0.0			0.016722	0.0101853	0.0101853	0.0101853	0.0101853
Kinematic Viscosity	cSt	1.1	1.0	0.8	0.7	0.9	0.2	0.8	0.8	0.9	13.3			0.848681	2.29679	0.848681	2.29679	1.09845
Thermal Conductivity	Btu/(h*ft**F)	0.0	0.3	0.1	0.0	0.1	0.0	0.4	0.1	0.3	0.0			0.0692760	0.0159800	0.0159800	0.0159800	0.0179434
Surface Tension	lbf/ft	0.005	0.005	0.001	0.002	0.005	0.005	0.005	0.001	0.005	0.005			0.00155117				
Net I.G. Heating Value	Btu/ft^3	1087.3	0.3	5770.6	1974.4	6257.6	1088.1	0.0	5675.4	0.0	1037.0			1055.58	6004.26	1285.05	1285.05	1087.34
Net Liquid Heating Value	Btu/lb	20741.5	-1052.9	18928.5	18900.0	18900.0	-1059.8	18915.4	-1059.0	18905.8				18913.1	20416.6	18913.1	20416.6	20741.4
Gross I.G. Heating Value	Btu/ft^3	1200.4	50.6	6194.7	2151.0	6713.6	1201.2	50.3	6092.6	50.3	1146.5			1167.00	6443.74	1412.27	1412.27	1200.41
Gross Liquid Heating Value	Btu/lb	22903.9	7.2	20330.7	21583.5	20284.6	22957.1	0.0	20317.2	0.8	21794.0			21837.9	20308.8	22446.9	22446.9	22903.8

Process Streams	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	Well Stream	LP Separator Oil	LP Separator Gas	r recovery by VRU (t)	Total gas to sale
Phase: Vapor	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolvd	Unsolvd	Solved	Solved	Solved	Solved	Solved
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	0.225652	0.225652	0.225652	0.451290	0.451290	0			0.33007	0.33007			0.0771745	0.381557	0.381557	0.224995	0.225690
H2S	0	0	0	0	0	0			0	0			0	0	0	0	0
Nitrogen	0.429988	0.429988	0.429988	0.0166257	0.0166257	0.4311			0.215513	0.215513			0.432464	0.142019	0.142019	0.142585	0.429919

Carbon Dioxide	0.184733	0.184733	0.184733	0.336027	0.336027	0.1854	1.38075	1.38075	0.184569	0.301685	0.301685	0.302778	0.184761
Methane	80.9306	80.9306	80.9306	21.2120	21.2120	81.1473	77.1380	77.1380	81.2699	63.2816	63.2816	63.5274	80.9264
Ethane	13.6667	13.6667	13.6667	39.4837	39.4837	13.6997	14.2680	14.2680	13.6267	25.4626	25.4626	25.5422	13.6695
Propane	2.41101	2.41101	2.41101	16.9260	16.9260	2.4061	2.72230	2.72230	2.37283	5.45764	5.45764	5.46297	2.41174
Isobutane	0.486452	0.486452	0.486452	4.50051	4.50051	0.4878	0.193001	0.193001	0.470916	1.13450	1.13450	1.13051	0.486607
n-Butane	0.815680	0.815680	0.815680	8.02353	8.02353	0.8151	0.667448	0.667448	0.781669	1.91101	1.91101	1.89805	0.815942
Isopentane	0.229705	0.229705	0.229705	2.42901	2.42901	0.2296	0.128026	0.128026	0.214943	0.529407	0.529407	0.518041	0.229777
n-Pentane	0.197570	0.197570	0.197570	2.11030	2.11030	0.1939	0.107143	0.107143	0.182209	0.455704	0.455704	0.442259	0.197632
2-Methylpentane	0.00678041	0.00678041	0.00678041	0.0732389	0.0732389	0	0.00172823	0.00172823	0.00604144	0.0153691	0.0153691	0.0142551	0.00678246
3-Methylpentane	0.00464880	0.00464880	0.00464880	0.0503238	0.0503238	0	0.00311880	0.00311880	0.00411673	0.0105312	0.0105312	0.00968485	0.00465020
n-Hexane	0.342132	0.342132	0.342132	3.69414	3.69414	0.404	0.0691667	0.0691667	0.302595	0.769644	0.769644	0.693918	0.342234
Methylcyclopentane	0.00117198	0.00117198	0.00117198	0.0128323	0.0128323	0	0.00221327	0.00221327	0.00101288	0.00266564	0.00266564	0.00239405	0.00117234
Benzene	0.000321675	0.000321675	0.000321675	0.00354434	0.00354434	0	0.00236012	0.00236012	0.000276050	0.000736341	0.000736341	0.000664366	0.000321774
2-Methylhexane	0.00699620	0.00699620	0.00699620	0.0743990	0.0743990	0	0.00155313	0.00155313	0.00636464	0.0153343	0.0153343	0.0121812	0.00699819
3-Methylhexane	0.00597352	0.00597352	0.00597352	0.0635407	0.0635407	0	0.00138231	0.00138231	0.00541516	0.0131020	0.0131020	0.0103049	0.00597523
Heptane	0.0135751	0.0135751	0.0135751	0.142924	0.142924	0	0.00325679	0.00325679	0.0125885	0.0295273	0.0295273	0.0220515	0.0135789
Methylcyclohexane	0.00721202	0.00721202	0.00721202	0.0773316	0.0773316	0	0.00893986	0.00893986	0.00638505	0.0159172	0.0159172	0.0119261	0.00721410
Toluene	0.00172366	0.00172366	0.00172366	0.0186270	0.0186270	0	0.0147852	0.0147852	0.00151083	0.00382123	0.00382123	0.00272801	0.00172416
Octane	0.0196681	0.0196681	0.0196681	0.201535	0.201535	0	0.00273175	0.00273175	0.0219773	0.0414331	0.0414331	0.0208219	0.0196733
Ethylbenzene	0.00134978	0.00134978	0.00134978	0.0141612	0.0141612	0	0.0111767	0.0111767	0.00142021	0.00289306	0.00289306	0.00134169	0.00135015
m-Xylene	0.00120900	0.00120900	0.00120900	0.0126518	0.0126518	0	0.00987300	0.00987300	0.00132481	0.00257934	0.00257934	0.00108662	0.00120932
o-Xylene	0.00184371	0.00184371	0.00184371	0.0193125	0.0193125	0	0.0154137	0.0154137	0.00204169	0.00393404	0.00393404	0.00155289	0.00184421
Nonane	0.00644231	0.00644231	0.00644231	0.0642641	0.0642641	0	0.00135604	0.00135604	0.00960486	0.0131322	0.0131322	0.00327405	0.00644391
C10+	0.000893433	0.000893433	0.000893433	0.00813338	0.00813338	0	7.53363E-05	7.53363E-05	0.00394085	0.00165235	0.00165235	2.11944E-05	0.000893614
Molar Flow	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water	17.3395	0	0	0.00942273	0	0	0	0.00322081	5.88875	0	0.00701564	0.00412034	17.3466
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	33.0411	0	0	0.000347137	0	33.0369	0	0.000229079	32.9989	0	0.000261129	0.00261117	33.0437
Carbon Dioxide	14.1952	0	0	0.00701610	0	14.2080	0	0.00146766	14.0834	0	0.00554705	0.00554479	14.2008
Methane	6218.86	0	0	0.442898	0	6218.65	0	0.0819936	6201.25	0	1.16355	1.16338	6220.02
Ethane	1050.17	0	0	0.824402	0	1049.86	0	0.0151661	1039.78	0	0.468177	0.467755	1050.64
Propane	185.266	0	0	0.353408	0	184.389	0	0.00289366	181.058	0	0.100349	0.100044	185.367
Isobutane	37.3799	0	0	0.0939687	0	37.3821	0	0.000205150	35.9330	0	0.0208599	0.0207030	37.4008
n-Butane	62.6784	0	0	0.167528	0	62.4644	0	0.000709462	59.6448	0	0.0351374	0.0347591	62.7136
Isopentane	17.6510	0	0	0.0502990	0	17.5952	0	0.00073414	16.4011	0	0.00973414	0.00948691	17.6607
n-Pentane	15.1817	0	0	0.0440622	0	14.8593	0	0.000113887	13.9033	0	0.00837898	0.00809910	15.1901
2-Methylpentane	0.521019	0	0	0.00152920	0	0	0	1.83702E-06	0.460989	0	0.000282590	0.000261055	0.521302
3-Methylpentane	0.357222	0	0	0.00105074	0	0	0	3.31512E-06	0.314125	0	0.000193636	0.000177359	0.357416
n-Hexane	26.2901	0	0	0.0771320	0	30.9602	0	7.35205E-05	23.0893	0	0.0141513	0.0127077	26.3042
Methylcyclopentane	0.0900575	0	0	0.000267932	0	0	0	2.35258E-06	0.0772871	0	4.90127E-05	4.38424E-05	0.0901065
Benzene	0.0247181	0	0	7.40043E-05	0	0	0	1.34645E-06	0.0210638	0	1.35390E-05	1.21666E-05	0.0247317
2-Methylhexane	0.537601	0	0	0.00155342	0	0	0	1.65090E-06	0.485650	0	0.000281950	0.000223075	0.537883
3-Methylhexane	0.459017	0	0	0.00132670	0	0	0	1.46932E-06	0.413200	0	0.000240905	0.000186714	0.459258
Heptane	1.04313	0	0	0.00298419	0	0	0	3.46179E-06	0.960555	0	0.000542915	0.000403830	1.04368
Methylcyclohexane	0.554185	0	0	0.00161465	0	0	0	9.50259E-06	0.487208	0	0.000292668	0.000218403	0.554478
Toluene	0.132449	0	0	0.000388923	0	0	0	1.57159E-05	0.115283	0	0.072605E-05	4.99582E-05	0.132519
Octane	1.51134	0	0	0.00420796	0	0	0	2.90370E-06	1.67696	0	0.0003871826	0.000381312	1.51210
Ethylbenzene	0.103720	0	0	0.000295680	0	0	0	1.88034E-05	0.108368	0	5.31944E-05	2.45705E-05	0.103773
m-Xylene	0.0929015	0	0	0.000264165	0	0	0	1.04945E-05	0.101089	0	4.74260E-05	1.9894E-05	0.0929490
o-Xylene	0.141674	0	0	0.000403237	0	0	0	1.63348E-05	0.155790	0	7.63348E-05	2.84381E-05	0.141747
Nonane	0.495039	0	0	0.00134181	0	0	0	1.44140E-06	0.732893	0	0.000241460	5.99578E-05	0.495280
C10+	0.0686531	0	0	0.000169821	0	0	0	8.00784E-08	0.300704	0	0.03815E-05	3.88133E-07	0.0686835
Mass Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	0.204883	0.204883	0.204883	0.216420	0.216420	0	2.74455	2.74455	0.0703451	0.289065	0.289065	0.171319	0.204907
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0.607082	0.607082	0.607082	0.0123979	0.0123979	0.609568	0.303541	0.303541	0.612965	0.167305	0.167305	0.168823	0.606956
Carbon Dioxide	0.409748	0.409748	0.409748	0.393661	0.393661	0.411845	3.05519	3.05519	0.410984	0.558335	0.558335	0.563199	0.409791
Methane	65.4349	65.4349	65.4349	9.05846	9.05846	65.7087	62.2181	62.2181	65.9659	42.6917	42.6917	43.0748	65.4284
Ethane	20.7113	20.7113	20.7113	31.6038	31.6038	20.7926	21.5705	21.5705	20.7315	32.1971	32.1971	32.4615	20.7146
Propane	5.35821	5.35821	5.35821	19.8679	19.8679	5.35534	6.03543	6.03543	5.29397	10.1203	10.1203	10.1816	5.35957
Isobutane	1.42498	1.42498	1.42498	6.96314	6.96314	1.43107	0.564000	0.564000	1.38486	2.77295	2.77295	2.77720	1.42536
n-Butane	2.38939	2.38939	2.38939	12.4139	12.4139	2.39128	1.95046	1.95046	2.29871	4.67088	4.67088	4.66274	2.39005

Isopentane	0.835267	0.835267	0.835267	4.62666	4.62666	0.836140			0.464412	0.464412			0.784642	1.60625	1.60625	1.57974	0.835489
n-Pentane	0.718417	0.718417	0.718417	4.05299	4.05299	0.706130			0.388660	0.388660			0.665146	1.38263	1.38263	1.34864	0.718607
2-Methylpentane	0.0294486	0.0294486	0.0294486	0.168007	0.168007	0			0.00748793	0.00748793			0.0263417	0.0556963	0.0556963	0.0519214	0.0294561
3-Methylpentane	0.0201906	0.0201906	0.0201906	0.115440	0.115440	0			0.0135129	0.0135129			0.0179496	0.0381641	0.0381641	0.0352750	0.0201958
n-Hexane	1.48594	1.48594	1.48594	8.47418	8.47418	1.75729			0.299680	0.299680			1.31936	2.78912	2.78912	2.52745	1.48632
Methylcyclopentane	0.00497108	0.00497108	0.00497108	0.0287480	0.0287480	0			0.00936513	0.00936513			0.00431301	0.00943406	0.00943406	0.00851585	0.00497236
Benzene	0.00126637	0.00126637	0.00126637	0.00736977	0.00736977	0			0.0112653	0.0112653			0.00109100	0.00241875	0.00241875	0.00219339	0.00126670
2-Methylhexane	0.0353316	0.0353316	0.0353316	0.198447	0.198447	0			0.00782459	0.00782459			0.0322678	0.0646152	0.0646152	0.0515892	0.0353400
3-Methylhexane	0.0301670	0.0301670	0.0301670	0.169484	0.169484	0			0.00696400	0.00696400			0.0274541	0.0552089	0.0552089	0.0436426	0.0301742
Heptane	0.0685558	0.0685558	0.0685558	0.381227	0.381227	0			0.0164075	0.0164075			0.0638216	0.124421	0.124421	0.0933910	0.0685718
Methylcyclohexane	0.0356888	0.0356888	0.0356888	0.202119	0.202119	0			0.0441324	0.0441324			0.0317200	0.0657222	0.0657222	0.0494924	0.0356974
Toluene	0.00800418	0.00800418	0.00800418	0.0456861	0.0456861	0			0.0684930	0.0684930			0.00704331	0.0148060	0.0148060	0.0106238	0.00800613
Octane	0.113231	0.113231	0.113231	0.612810	0.612810	0			0.0156889	0.0156889			0.127019	0.199029	0.199029	0.100528	0.113255
Ethylbenzene	0.00722222	0.00722222	0.00722222	0.0400206	0.0400206	0			0.0596586	0.0596586			0.00762872	0.0129162	0.0129162	0.00602041	0.00722385
m-Xylene	0.00646892	0.00646892	0.00646892	0.0357549	0.0357549	0			0.0526996	0.0526996			0.00711630	0.0115156	0.0115156	0.00487586	0.00647037
o-Xylene	0.00986508	0.00986508	0.00986508	0.0545785	0.0545785	0			0.0822745	0.0822745			0.0109670	0.0175637	0.0175637	0.00986808	0.00986728
Nonane	0.0416430	0.0416430	0.0416430	0.219404	0.219404	0			0.00874431	0.00874431			0.0623282	0.0708284	0.0708284	0.0177481	0.0416513
C10+	0.00779444	0.00779444	0.00779444	0.0374774	0.0374774	0			0.00055660	0.00055660			0.0345148	0.0120280	0.0120280	0.000155063	0.00779565

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	lb/h	lb/h	lb/h	lb/h
Water	312.377	0	0	0.169753	0	0			0	0.0580237			106.088	0	0.126389	0.0742290	312.503	
H2S	0	0	0	0	0	0			0	0			0	0	0	0	0	
Nitrogen	925.592	0	0	0.00972449	0	925.477			0	0.00641729			924.412	0	0.0731511	0.0731477	925.666	
Carbon Dioxide	624.725	0	0	0.308775	0	625.285			0.0645911				619.805	0	0.244123	0.244023	624.970	
Methane	99765.8	0	0	7.10517	0	99762.4			1.31538				99483.3	0	18.6662	18.6635	99784.5	
Ethane	31577.7	0	0	24.7890	0	31568.4			0.456031				31265.2	0	14.0776	14.0650	31591.7	
Propane	8169.43	0	0	15.5837	0	8160.76			0.127598				7983.85	0	4.42495	4.41149	8173.86	
Isobutane	2172.60	0	0	5.46166	0	2172.73			0.0119238				2088.50	0	1.21243	1.20331	2173.81	
n-Butane	3643.01	0	0	9.73708	0	3630.57			0.0412355				3466.69	0	2.04226	2.02027	3645.05	
Isopentane	1273.50	0	0	3.62901	0	1269.47			0.00981833				1183.32	0	0.702306	0.684469	1274.20	
n-Pentane	1095.34	0	0	3.17903	0	1072.08			0.00821682				1003.11	0	0.604533	0.584340	1095.94	
2-Methylpentane	44.8990	0	0	0.131779	0	0			0.000158306				39.7259	0	0.0243523	0.0224965	44.9234	
3-Methylpentane	30.7838	0	0	0.0905478	0	0			0.000285681				27.0698	0	0.0168666	0.0152840	30.8004	
n-Hexane	2265.56	0	0	6.64688	0	2268.00			0.00633566				1989.73	0	1.21950	1.09509	2266.78	
Methylcyclopentane	7.57919	0	0	0.0225490	0	0			0.000197992				6.50445	0	0.00412489	0.00368975	7.58332	
Benzene	1.93078	0	0	0.00578061	0	0			0.000245775				1.64534	0	0.00105756	0.000950354	1.93184	
2-Methylhexane	53.8687	0	0	0.155656	0	0			0.000165423				48.6631	0	0.0282519	0.0223526	53.8969	
3-Methylhexane	45.9944	0	0	0.132938	0	0			0.000147229				41.4035	0	0.0241392	0.0189095	46.0185	
Heptane	104.524	0	0	0.299022	0	0			0.000346878				96.2495	0	0.0544012	0.0404645	104.578	
Methylcyclohexane	54.4132	0	0	0.158536	0	0			0.000933022				47.8370	0	0.0287360	0.0214441	54.4420	
Toluene	12.2036	0	0	0.0356347	0	0			0.00144804				10.6220	0	0.00647369	0.00460307	12.2101	
Octane	172.638	0	0	0.480669	0	0			0.000331686				191.557	0	0.0870222	0.0435567	172.725	
Ethylbenzene	11.0114	0	0	0.0313909	0	0			0.00126127				11.5049	0	0.00564738	0.00260853	11.0171	
m-Xylene	9.86289	0	0	0.0280451	0	0			0.00111415				10.7321	0	0.00503498	0.00211262	9.86793	
o-Xylene	15.0409	0	0	0.0428096	0	0			0.00173940				16.5394	0	0.00767942	0.00301914	15.0485	
Nonane	63.4913	0	0	0.172093	0	0			0.000184867				93.9972	0	0.0309685	0.00768990	63.5222	
C10+	11.8838	0	0	0.0293961	0	0			1.38616E-05				52.0518	0	0.00525903	6.71859E-05	11.8891	

Process Streams		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	Well Stream	LP Separator Oil	LP Separator Gas	recovery by VRU (to	Total gas to sale
Phase: Vapor	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Unsolved	Solved	Solved	Solved	Solved	Solved
Property	Units																	
Temperature	°F	70.0	70.0	70.0	75.9	75.9	85.0			75.9	75.9			84.9366	70	70	70	69.9994
Pressure	psig	154	154	154	0	0	1000			0	0			1000	50	50	154	154
Mole Fraction Vapor	%	100	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	0
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0			0	0			0	0	0	0	0
Molecular Weight	lb/lbmol	19.8	19.8	19.8	37.6	37.6	19.8			19.9	19.9			19.7643	23.7796	23.7796	23.6597	19.8424
Mass Density	lb/ft³	0.6	0.6	0.6	0.1	0.1	4.3			0.1	0.1			4.26132	0.276842	0.276842	0.745497	0.613186
Molar Flow	lbmol/h	7684.2	0.0	0.0	2.1	0.0	7683.4			0.0	0.1			7630.44	0	1.83869	1.83131	7686.03
Mass Flow	lb/h	152465.8	0.0	0.0	78.4	0.0	151825.2			0.0	2.1			150810	0	43.7233	43.3281	152509
Vapor Volumetric Flow	MCFH	248.7	0.0	0.0	0.8	0.0	35.5			0.0	0.0			35.3904	0	0.157936	0.0581197	248.716
Liquid Volumetric Flow	Mbb/d	1062.9	0.0	0.0	3.4	0.0	151.8			0.0	0.2			151.279	0	0.675111	0.248438	1063.16
Std Vapor Volumetric Flow	MMSCFD	70.0	0.0	0.0	0.0	0.0	69.8			0.0	0.0			69.4952	0	0.0167461	0.0166788	70.0015

Std Liquid Volumetric Flow	Mbb/d	31.4	0.0	0.0	0.0	0.0	31.3			0.0	0.0			31.1417	0	0.00829545	0.00825494	31.3888
Compressibility		0.960	0.960	0.960	0.988	0.988	0.804			0.997	0.997			0.805240	0.977644	0.977644	0.941885	0.960369
Specific Gravity		0.685	0.685	0.685	1.297	1.297	0.684			0.687	0.687			0.682407	0.821047	0.821047	0.816904	0.685105
API Gravity																		
Enthalpy	MMBtu/h	-261.5	0.0	0.0	-0.1	0.0	-263.7			0.0	0.0			-262.708	0	-0.0662098	-0.0658400	-261.582
Mass Enthalpy	Btu/lb	-1715.2	-1715.2	-1715.2	-1142.0	-1142.0	-1736.8			-1875.9	-1875.9			-1741.98	-1514.29	-1514.29	-1519.57	-1715.19
Mass Cp	Btu/(lb**F)	0.5	0.5	0.5	0.4	0.4	0.7			0.5	0.5			0.663952	0.465457	0.465457	0.482320	0.505945
Ideal Gas Cp/Cv Ratio		1.260	1.260	1.260	1.146	1.146	1.257			1.263	1.263			1.25719	1.22384	1.22384	1.22489	1.26028
Dynamic Viscosity	cP	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0			0.0131011	0.0101853	0.0101853	0.0103701	0.0107893
Kinematic Viscosity	cSt	1.1	1.1	1.1	5.7	5.7	0.2			13.3	13.3			0.191930	2.29679	2.29679	0.868394	1.09845
Thermal Conductivity	Btu/(h*ft**F)	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0			0.0225691	0.0159800	0.0159800	0.0164125	0.0179434
Surface Tension	lb/ft																	
Net I.G. Heating Value	Btu/ft^3	1087.3	1087.3	1087.3	1974.4	1974.4	1088.1			1037.0	1037.0			1084.90	1285.05	1285.05	1280.66	1087.34
Net Liquid Heating Value	Btu/lb	20741.5	20741.5	20741.5	19800.0	19800.0	20790.8			19705.8	19705.8			20778.9	20416.6	20416.6	20452.1	20741.4
Gross I.G. Heating Value	Btu/ft^3	1200.4	1200.4	1200.4	2151.0	2151.0	1201.2			1146.5	1146.5			1197.77	1412.27	1412.27	1407.56	1200.41
Gross Liquid Heating Value	Btu/lb	22903.9	22903.9	22903.9	21583.5	21583.5	22957.1			21794.0	21794.0			22945.9	22446.9	22446.9	22487.4	22903.8

Process Streams		HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil WB	Water WB	Well Stream	LP Separator Oil	LP Separator Gas	recovery by VRU (to	Total gas to sale
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Unsolved	Solved	Solved	Solved	Solved	Solved
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	0.0526287	99.9708	0.0526287	0.00936127	0.00936127		100	0	99.9968	99.9968				0.0660029	0.0354977	0.0354977	0.0376029	
H2S	0	0	0	0	0		0	0	0	0				0	0	0	0	0
Nitrogen	0.00798865	6.02388E-05	0.00798865	2.64558E-05	2.64558E-05		0	0.0180005	2.52443E-06	2.52443E-06				0.0555490	0.00100816	0.00100816	0.00266500	
Carbon Dioxide	0.0395564	0.00103905	0.0395564	0.00641024	0.00641024		0	0.0150005	0.000669456	0.000669456				0.144857	0.0259044	0.0259044	0.0491987	
Methane	4.41546	0.0225139	4.41546	0.101098	0.101098		0	4.77714	0.00185664	0.00185664				23.9148	1.34964	1.34964	3.78289	
Ethane	4.54423	0.00422115	4.54423	1.19002	1.19002		0	4.94815	0.000400251	0.000400251				15.2276	3.45478	3.45478	9.39683	
Propane	2.95656	0.000813399	2.95656	1.94000	1.94000		0	4.86315	8.43830E-05	8.43830E-05				6.70605	2.82630	2.82630	6.79989	
Isobutane	1.50487	5.37673E-05	1.50487	1.33706	1.33706		0	1.36904	2.08168E-06	2.08168E-06				2.53641	1.52416	1.52416	3.49626	
n-Butane	3.60049	0.000194594	3.60049	3.41598	3.41598		0	3.81511	1.58535E-05	1.58535E-05				5.52679	3.68848	3.68848	8.43057	
Isopentane	2.53951	3.63693E-05	2.53951	2.65898	2.65898		0	2.45607	2.08417E-06	2.08417E-06				2.77343	2.64420	2.64420	5.50899	
n-Pentane	2.92391	3.04198E-05	2.92391	3.11168	3.11168		0	3.46210	1.72705E-06	1.72705E-06				2.98997	3.05245	3.05245	6.23645	
2-Methylpentane	0.238059	4.76088E-07	0.238059	0.260746	0.260746		0	1.49804	1.32663E-08	1.32663E-08				0.187735	0.249657	0.249657	0.479852	
3-Methylpentane	0.181766	9.00161E-07	0.181766	0.199507	0.199507		0	1.04403	6.49546E-08	6.49546E-08				0.139879	0.190684	0.190684	0.362686	
n-Hexane	16.5798	1.89451E-05	16.5798	18.2650	18.2650		0	3.65811	4.22201E-07	4.22201E-07				11.8355	17.4032	17.4032	32.1678	
Methylcyclopentane	0.0598415	7.31060E-07	0.0598415	0.0659615	0.0659615		0	0.276008	1.38378E-07	1.38378E-07				0.0442583	0.0628193	0.0628193	0.115210	
Benzene	0.0165894	1.00176E-05	0.0165894	0.0182870	0.0182870		0	0.0760023	9.22731E-06	9.22731E-06				0.0124146	0.0174151	0.0174151	0.0305691	
2-Methylhexane	0.801326	4.26015E-07	0.801326	0.890529	0.890529		0	2.05306	1.00846E-08	1.00846E-08				0.442091	0.842262	0.842262	1.31191	
3-Methylhexane	0.717160	3.79565E-07	0.717160	0.797219	0.797219		0	1.78305	9.38143E-09	9.38143E-09				0.394799	0.753828	0.753828	1.16299	
Heptane	2.03840	8.94398E-07	2.03840	2.26875	2.26875		0	4.42513	2.22269E-08	2.22269E-08				1.06189	2.14302	2.14302	3.09927	
Methylcyclohexane	1.06663	2.76391E-06	1.06663	1.18698	1.18698		0	2.33607	3.69893E-07	3.69893E-07				0.585713	1.12135	1.12135	1.65487	
Toluene	0.318778	4.20517E-05	0.318778	0.355079	0.355079		0	0.617019	3.81024E-05	3.81024E-05				0.171491	0.335181	0.335181	0.452359	
Octane	9.04104	7.43871E-07	9.04104	10.0949	10.0949		0	11.9694	1.23042E-08	1.23042E-08				4.03724	9.50975	9.50975	8.47904	
Ethylbenzene	0.715006	2.90427E-05	0.715006	0.798480	0.798480		0	0.908027	2.60565E-05	2.60565E-05				0.330024	0.752094	0.752094	0.637813	
m-Xylene	0.762780	2.64670E-05	0.762780	0.852014	0.852014		0	0.925028	2.38294E-05	2.38294E-05				0.347981	0.802372	0.802372	0.613366	
o-Xylene	1.29932	5.40885E-05	1.29932	1.45149	1.45149		0	1.53505	5.02941E-05	5.02941E-05				0.592550	1.36679	1.36679	0.978127	
Nonane	8.75083	3.72865E-07	8.75083	9.78054	9.78054		0	9.20628	9.71484E-09	9.71484E-09				3.80958	9.20590	9.20590	0.44445	
C10+	34.8275	2.04132E-08	34.8275	38.9440	38.9440		0	31.9660	2.38012E-10	2.38012E-10				16.0654	36.6412	36.6412	0.668346	
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water	0	396.798	0.0195478	0	0.00310946		414.157	0	396.795	0				0.0521923	0.0125322	0	1.68751E-06	
H2S	0	0	0	0	0		0	0	0	0				0	0	0	0	0
Nitrogen	0	0.000239096	0.00296721	0	8.78763E-06		0	0.00732308	1.00171E-05	0				0.0439259	0.000355925	0	1.19597E-07	
Carbon Dioxide	0	0.00412411	0.0148924	0	0.00129224		0	0.00610257	0.00265645	0				0.114547	0.00914535	0	2.20789E-06	
Methane	0	0.0893609	1.64003	0	0.0335808		0	1.94347	0.00736729	0				18.9109	0.476479	0	0.000169765	
Ethane	0	0.0167543	1.68786	0	0.395280		0	2.01303	0.00158823	0				12.0413	1.21968	0	0.000421701	
Propane	0	0.00322849	1.09815	0	0.644395		0	1.97845	0.000334838	0				5.30287	0.997807	0	0.000305159	
Isobutane	0	0.000213410	0.558951	0	0.444122		0	0.558951	8.26026E-06	0				2.00569	0.538091	0	0.000156902	
n-Butane	0	0.000772370	1.33732	0	1.13466		0	1.55209	6.29081E-05	0				4.37036	1.30219	0	0.000378339	
Isopentane	0	0.000144355	0.943248	0	0.883214		0	0.999194	8.27014E-06	0				2.19311	0.933513	0	0.000247227	
n-Pentane	0	0.000120740	1.08602	0	1.03358		0	1.40847	6.85305E-06	0				2.36434	1.07764	0	0.000279873	
2-Methylpentane	0	1.88966E-06	0.0884220	0	0.0866102		0	0.609443	5.26419E-08	0				0.148453	0.0881394	0	2.15343E-05	
3-Methylpentane	0	3.57286E-06	0.0675131	0	0.0662687		0	0.424739	2.57745E-07	0				0.110611	0.0673194	0	1.62763E-05	
n-Hexane	0	7.51958E-05	1.15823	0	6.06694		0	1.48821	1.67532E-06	0				9.35899	6.14407	0	0.00144359	

Methylcyclopentane	0	2.90168E-06	0.022269	0	0.0219099	0	0.112287	5.49095E-07	0	0.0349976	0.0221779	0	5.17028E-06
Benzene	0	3.97611E-05	0.00616180	0	0.00607425	0	0.0309197	3.66147E-05	0	0.00981692	0.00614826	0	1.37185E-06
2-Methylhexane	0	1.69091E-06	0.297636	0	0.295800	0	0.835238	4.00164E-08	0	0.349587	0.297354	0	5.88745E-05
3-Methylhexane	0	1.50655E-06	0.266374	0	0.264806	0	0.725392	3.72262E-08	0	0.312191	0.266133	0	5.21915E-05
Heptane	0	3.54999E-06	0.757120	0	0.753593	0	1.80026	8.61979E-08	0	0.839701	0.756577	0	0.000139086
Methylcyclohexane	0	1.09704E-05	0.396178	0	0.394270	0	0.930374	1.46777E-06	0	0.463158	0.395885	0	7.42655E-05
Toluene	0	0.000166909	0.118403	0	0.117944	0	0.251019	0.000151193	0	0.135608	0.118333	0	2.03005E-05
Octane	0	2.95253E-06	3.35810	0	3.35313	0	4.86944	4.88239E-08	0	3.19248	3.35734	0	0.000380514
Ethylbenzene	0	0.000115275	0.265574	0	0.265225	0	0.369409	0.000103394	0	0.260969	0.265521	0	2.86231E-05
m-Xylene	0	0.000105051	0.283319	0	0.283007	0	0.376325	9.45567E-05	0	0.275169	0.283271	0	2.75260E-05
o-Xylene	0	0.000215955	0.482606	0	0.482130	0	0.624496	0.000199571	0	0.468864	0.482534	0	4.38954E-05
Nonane	0	1.47995E-06	3.25031	0	3.24873	0	3.74535	3.85492E-08	0	3.01246	3.25007	0	0.000181503
C10+	0	8.10229E-08	12.9359	0	12.9357	0	13.0046	9.44450E-10	0	12.7039	12.9359	0	2.9934E-05

Process Streams		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	Well Stream	LP Separator Oil	LP Separator Gas	r recovery by VRU (to	Total gas to sale
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Unsolved	Solved	Solved	Solved	Solved	Solved
Property	Units																	
Temperature	°F	70.0	70.0	70.0	75.9	75.9		85.0	85.0	75.9	75.9			84.9366	70	70	70	
Pressure	psig	154	154	154	0	0		1000	1000	0	0			1000	50	50	154	
Mole Fraction Vapor	%	0	0	0	0	0		0	0	0	0			0	0	0	0	
Mole Fraction Light Liquid	%	100	100	100	100	100		100	100	100	100			100	100	100	100	
Mole Fraction Heavy Liquid	%	0	0	0	0	0		0	0	0	0			0	0	0	0	
Molecular Weight	lb/lbmol	114.7	18.0	114.7	124.6	124.6		18.0	112.9	18.0	18.0			72.1283	119.456	119.456	76.4574	
Mass Density	lb/ft^3	45.2	62.3	45.2	45.5	45.5		62.2	45.1	62.2	62.2			39.8422	45.4316	45.4316	40.4652	
Molar Flow	lbmol/h	0.0	396.9	37.1	0.0	33.2		414.2	40.7	396.8	0.0			79.0759	35.3042	0	0.00448770	
Mass Flow	lb/h	0.0	7150.8	4261.0	0.0	4138.9		7461.2	4591.3	7148.7	0.0			5703.61	4217.31	0	0.343118	
Vapor Volumetric Flow	MCFH	0.0	0.1	0.1	0.0	0.1		0.1	0.1	0.1	0.0			0.143155	0.0928278	0	8.47532E-06	
Liquid Volumetric Flow	Mbb/d	0.0	0.5	0.4	0.0	0.4		0.5	0.4	0.5	0.0			0.611929	0.396800	0	3.62456E-05	
Std Vapor Volumetric Flow	MMSCFD	0.0	3.6	0.3	0.0	0.3		3.8	0.4	3.6	0.0			0.720194	0.321538	0	4.08723E-05	
Std Liquid Volumetric Flow	Mbb/d	0.0	0.5	0.4	0.0	0.4		0.5	0.4	0.5	0.0			0.631444	0.400040	0	3.69390E-05	
Compressibility		0.075	0.009	0.075	0.007	0.007		0.050	0.434	0.001	0.001			0.314306	0.0299267	0.0299267	0.0660755	
Specific Gravity		0.725	0.998	0.725	0.730	0.730		0.997	0.724	0.998	0.998			0.638813	0.728432	0.728432	0.648803	
API Gravity		62.5	10.0	62.5	60.4	60.4		9.9	60.9	10.0	10.0			84.8530	61.5146	61.5146	84.7288	
Enthalpy	MMBtu/h	0.0	-48.8	-3.6	0.0	-3.5		-50.8	-3.9	-48.8	0.0			-5.55226	-3.57546	0	-0.000338835	
Mass Enthalpy	Btu/lb	-855.8	-6826.4	-855.8	-836.5	-836.5		-6810.9	-842.3	-6822.4	-6822.4			-973.465	-847.805	-847.805	-987.518	
Mass Cp	Btu/(lb**F)	0.5	1.0	0.5	0.5	0.5		1.0	0.5	1.0	1.0			0.536260	0.486433	0.486433	0.521312	
Ideal Gas CpCv Ratio		1.048	1.326	1.048	1.044	1.044		1.325	1.048	1.326	1.326			1.07407	1.04594	1.04594	1.07187	
Dynamic Viscosity	cP	0.6	1.0	0.6	0.6	0.6		0.8	0.5	0.9	0.9			0.237231	0.617622	0.617622	0.261590	
Kinematic Viscosity	cSt	0.8	1.0	0.8	0.9	0.9		0.8	0.8	0.9	0.9			0.371713	0.848681	0.848681	0.403569	
Thermal Conductivity	Btu/(h**ft**F)	0.1	0.3	0.1	0.1	0.1		0.4	0.1	0.3	0.3			0.0642814	0.0692760	0.0692760	0.0671069	
Surface Tension	lb/ft	0.001	0.005	0.001	0.002	0.002		0.005	0.001	0.005	0.005			0.000627021	0.00155117	0.00155117	0.00107758	
Net I.G. Heating Value	Btu/ft^3	5770.6	0.3	5770.6	6257.6	6257.6		0.0	5675.4	0.0	0.0			3675.85	6004.26	6004.26	3903.55	
Net Liquid Heating Value	Btu/lb	18928.5	-1052.9	18928.5	18896.3	18896.3		-1059.8	18915.4	-1059.0	-1059.0			19187.0	18913.1	18913.1	19204.1	
Gross I.G. Heating Value	Btu/ft^3	6194.7	50.6	6194.7	6713.6	6713.6		50.3	6092.6	50.3	50.3			3093.07	6443.74	6443.74	4214.73	
Gross Liquid Heating Value	Btu/lb	20330.7	7.2	20330.7	20284.6	20284.6		0.0	20317.2	0.8	0.8			20697.8	20308.8	20308.8	20747.6	

Process Streams		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	Well Stream	LP Separator Oil	LP Separator Gas	r recovery by VRU (to	Total gas to sale
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Unsolved	Solved	Solved	Solved	Solved	Solved
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water		99.9708		99.9708										99.8742			99.9699	
H2S		0		0										0			0	
Nitrogen		6.02388E-05		6.02388E-05										0.000343381			2.02246E-05	
Carbon Dioxide		0.00103905		0.00103905										0.00393181			0.00170574	
Methane		0.0225139		0.0225139										0.105618			0.0177711	
Ethane		0.00422115		0.00422115										0.0134688			0.00783059	
Propane		0.000813399		0.000813399										0.00176222			0.00180939	
Isobutane		5.37673E-05		5.37673E-05										9.34926E-05			0.000121533	
n-Butane		0.000194594		0.000194594										0.000330760			0.000439904	
Isopentane		3.63693E-05		3.63693E-05										4.24848E-05			7.91753E-05	
n-Pentane		3.04198E-05		3.04198E-05										3.71498E-05			6.54526E-05	
2-Methylpentane		4.76088E-07		4.76088E-07										4.73412E-07			9.50283E-07	
3-Methylpentane		9.00161E-07		9.00161E-07										8.49678E-07			1.78022E-06	

n-Hexane	1.89451E-05		1.89451E-05										1.72136E-05		3.64122E-05
Methylcyclopentane	7.31060E-07		7.31060E-07										6.18684E-07		1.42203E-06
Benzene	1.00176E-05		1.00176E-05										9.52598E-06		1.98734E-05
2-Methylhexane	4.26015E-07		4.26015E-07										2.66627E-07		6.97378E-07
3-Methylhexane	3.79565E-07		3.79565E-07										2.41036E-07		6.19505E-07
Heptane	8.94398E-07		8.94398E-07										4.82491E-07		1.36451E-06
Methylcyclohexane	2.76391E-06		2.76391E-06										1.97463E-06		4.31692E-06
Toluene	4.20517E-05		4.20517E-05										3.12267E-05		6.30244E-05
Octane	7.43871E-07		7.43871E-07										4.66331E-07		7.31333E-07
Ethylbenzene	2.90427E-05		2.90427E-05										1.75468E-05		2.71067E-05
m-Xylene	2.64670E-05		2.64670E-05										1.64425E-05		2.23037E-05
o-Xylene	5.44085E-05		5.44085E-05										3.48117E-05		4.29840E-05
Nonane	3.72865E-07		3.72865E-07										2.21230E-07		1.73764E-07
C10+	2.04132E-08		2.04132E-08										1.51686E-08		4.30008E-10
<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>	<b>%</b>	<b>%</b>	<b>%</b>
Water	99.9662		99.9662										99.9666		99.9589
H2S	0		0										0		0
Nitrogen	9.36658E-05		9.36658E-05										0.00053910		3.14454E-05
Carbon Dioxide	0.00253816		0.00253816										0.00960429		0.00416649
Methane	0.0200475		0.0200475										0.0940451		0.0158233
Ethane	0.00704514		0.00704514										0.0224789		0.0130685
Propane	0.00199085		0.00199085										0.00431301		0.00442832
Isobutane	0.000173460		0.000173460										0.000301610		0.000392055
n-Butane	0.000627783		0.000627783										0.00106704		0.00141909
Isopentane	0.000145647		0.000145647										0.000170133		0.000317051
n-Pentane	0.000121821		0.000121821										0.000148769		0.000262100
2-Methylpentane	2.27724E-06		2.27724E-06										2.26437E-06		4.54514E-06
3-Methylpentane	4.30568E-06		4.30568E-06										4.06409E-06		8.51466E-06
n-Hexane	9.06190E-05		9.06190E-05										8.23343E-05		0.000174157
Methylcyclopentane	3.41503E-06		3.41503E-06										2.89000E-06		6.64234E-06
Benzene	4.34328E-05		4.34328E-05										4.13002E-05		8.61590E-05
2-Methylhexane	2.36941E-06		2.36941E-06										1.48288E-06		3.87842E-06
3-Methylhexane	2.11106E-06		2.11106E-06										1.34055E-06		3.42532E-06
Heptane	4.97445E-06		4.97445E-06										2.68344E-06		7.58867E-06
Methylcyclohexane	1.50630E-05		1.50630E-05										1.07612E-05		2.35253E-05
Toluene	0.000215062		0.000215062										0.000159695		0.000322300
Octane	4.71641E-06		4.71641E-06										2.95662E-06		4.63661E-06
Ethylbenzene	0.000171142		0.000171142										0.000103396		0.000159724
m-Xylene	0.000155964		0.000155964										9.68890E-05		0.000131423
o-Xylene	0.000320617		0.000320617										0.000205131		0.000253279
Nonane	2.65439E-06		2.65439E-06										1.57487E-06		1.23693E-06
C10+	1.96131E-07		1.96131E-07										1.45737E-07		4.13128E-09
<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>	<b>lb/h</b>	<b>lb/h</b>	<b>lb/h</b>
Water	0		0										7354.13		0.0521293
H2S	0		0										0		0
Nitrogen	0		0										0.0393169		1.63990E-08
Carbon Dioxide	0		0										0.707255		2.17286E-06
Methane	0		0										6.92544		8.25196E-06
Ethane	0		0										1.65533		6.81531E-06
Propane	0		0										0.317608		2.30940E-06
Isobutane	0		0										0.0222104		2.04460E-07
n-Butane	0		0										0.0785762		7.40067E-07
Isopentane	0		0										0.0125285		1.65345E-07
n-Pentane	0		0										0.0109553		1.36687E-07
2-Methylpentane	0		0										0.000166747		2.37032E-09
3-Methylpentane	0		0										0.000299278		4.44046E-09
n-Hexane	0		0										0.00606306		9.08242E-08
Methylcyclopentane	0		0										0.000212818		3.46403E-09
Benzene	0		0										0.00304133		4.49326E-08
2-Methylhexane	0		0										0.000109199		2.02263E-09
3-Methylhexane	0		0										9.87177E-05		1.78633E-09
Heptane	0		0										0.000197607		3.95755E-09

Methylcyclohexane	0	0	0	0	0	0	0	0	0	0	0	0.000792451	1.22686E-08
Toluene	0	0	0	0	0	0	0	0	0	0	0	0.0117599	1.68082E-07
Octane	0	0	0	0	0	0	0	0	0	0	0	0.000217724	2.41803E-09
Ethylbenzene	0	0	0	0	0	0	0	0	0	0	0	0.00761405	8.32972E-08
m-Xylene	0	0	0	0	0	0	0	0	0	0	0	0.00713486	6.85379E-08
o-Xylene	0	0	0	0	0	0	0	0	0	0	0	0.0151058	1.32087E-07
Nonane	0	0	0	0	0	0	0	0	0	0	0	0.000115973	6.45070E-10
C10+	0	0	0	0	0	0	0	0	0	0	0	1.07320E-05	2.15450E-12

Process Streams		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	Well Stream	LP Separator Oil	LP Separator Gas	recovery by VRU (to	Total gas to sale
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Unsolved	Solved	Solved	Solved	Solved	Solved
Property	Units																	
Temperature	°F	70.0		70.0										64.9366			70	
Pressure	psig	154		154										1000			154	
Mole Fraction Vapor	%	0		0										0			0	
Mole Fraction Light Liquid	%	0		0										0			0	
Mole Fraction Heavy Liquid	%	100		100										100			100	
Molecular Weight	lb/lbmol	18.0		18.0										18.0167			18.0173	
Mass Density	lb/ft³	62.3		62.3										62.0854			62.2639	
Molar Flow	lbmol/h	0.0		0.0										408.730			0.00289449	
Mass Flow	lb/h	0.0		0.0										7363.95			0.0521508	
Vapor Volumetric Flow	MCFH	0.0		0.0										0.118610			8.37576E-07	
Liquid Volumetric Flow	Mbb/d	0.0		0.0										0.507008			3.58029E-06	
Std Vapor Volumetric Flow	MMSCFD	0.0		0.0										3.72256			2.63619E-05	
Std Liquid Volumetric Flow	Mbb/d	0.0		0.0										0.506075			3.57681E-06	
Compressibility		0.009		0.009										0.0503818			0.00858792	
Specific Gravity		0.998		0.998										0.995453			0.998315	
API Gravity		10.0		10.0										10.1015			10.0394	
Enthalpy	MMBtu/h	0.0		0.0										-50.1098			-0.000355981	
Mass Enthalpy	Btu/lb	-6826.4		-6826.4										-6804.74			-6826.01	
Mass Cp	Btu/(lb**F)	1.0		1.0										0.981384			0.983066	
Ideal Gas Cp/Cv Ratio		1.326		1.326										1.32505			1.32580	
Dynamic Viscosity	cP	1.0		1.0										0.832530			0.995513	
Kinematic Viscosity	cSt	1.0		1.0										0.837123			0.998136	
Thermal Conductivity	Btu/(h*ft**F)	0.3		0.3										0.351979			0.346586	
Surface Tension	lb/ft	0.005		0.005										0.00491819			0.00503971	
Net I.G. Heating Value	Btu/ft³	0.3		0.3										1.24118			0.362696	
Net Liquid Heating Value	Btu/lb	-1052.9		-1052.9										-1032.25			-1051.72	
Gross I.G. Heating Value	Btu/ft³	50.6		50.6										51.6196			50.6933	
Gross Liquid Heating Value	Btu/lb	7.2		7.2										28.9			8.4	



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

**For:** Antero Resources Appalachian Corp.  
 1615 Wynkoop Street  
 Denver, Colorado 80202

**Sample:** Nero No. 2H  
 First Stage Separator Hydrocarbon Liquid  
 Sampled @ 168 psig & 81 °F

Date Sampled: 10/14/14

Job Number: 45832.002

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

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.018	0.004	0.005
Carbon Dioxide	0.015	0.005	0.006
Methane	4.777	1.626	0.682
Ethane	4.948	2.658	1.324
Propane	4.863	2.691	1.908
Isobutane	1.369	0.900	0.708
n-Butane	3.815	2.416	1.973
2,2 Dimethylpropane	0.071	0.055	0.046
Isopentane	2.456	1.804	1.576
n-Pentane	3.391	2.469	2.177
2,2 Dimethylbutane	0.121	0.101	0.093
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.214	0.176	0.164
2 Methylpentane	1.498	1.249	1.149
3 Methylpentane	1.044	0.856	0.801
n-Hexane	2.751	2.273	2.109
Heptanes Plus	<u>68.649</u>	<u>80.716</u>	<u>85.281</u>
Totals:	100.000	100.000	100.000

**Characteristics of Heptanes Plus:**

Specific Gravity ----- 0.7559 (Water=1)  
 °API Gravity ----- 55.70 @ 60°F  
 Molecular Weight ----- 139.6  
 Vapor Volume ----- 17.18 CF/Gal  
 Weight ----- 6.30 Lbs/Gal

**Characteristics of Total Sample:**

Specific Gravity ----- 0.7154 (Water=1)  
 °API Gravity ----- 66.29 @ 60°F  
 Molecular Weight ----- 112.4  
 Vapor Volume ----- 20.20 CF/Gal  
 Weight ----- 5.96 Lbs/Gal

Base Conditions: 14.850 PSI &amp; 60 °F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: XG  
 Processor: XGdjv  
 Cylinder ID: W-872

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

**TANKS DATA INPUT REPORT - GPA 2186-M**

COMPONENT	Mol %	LiqVol %	Wt %
Carbon Dioxide	0.015	0.005	0.006
Nitrogen	0.018	0.004	0.005
Methane	4.777	1.626	0.682
Ethane	4.948	2.658	1.324
Propane	4.863	2.691	1.908
Isobutane	1.369	0.900	0.708
n-Butane	3.887	2.471	2.019
Isopentane	2.456	1.804	1.576
n-Pentane	3.391	2.469	2.177
Other C-6's	2.877	2.383	2.206
Heptanes	9.109	8.235	7.991
Octanes	14.305	13.813	13.908
Nonanes	9.207	10.205	10.397
Decanes Plus	31.967	45.408	49.244
Benzene	0.076	0.043	0.053
Toluene	0.617	0.415	0.506
E-Benzene	0.908	0.704	0.858
Xylenes	2.460	1.894	2.324
n-Hexane	2.751	2.273	2.109
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 -----	0.7154	(Water=1)
°API Gravity -----	66.29	@ 60°F
Molecular Weight-----	112.4	
Vapor Volume -----	20.20	CF/Gal
Weight -----	5.96	Lbs/Gal

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

Specific Gravity -----	0.7759	(Water=1)
Molecular Weight-----	173.1	

**Characteristics of Atmospheric Sample:**

°API Gravity -----	59.77	@ 60°F
Reid Vapor Pressure (ASTM D-5191)-----	3.54	psi

QUALITY CONTROL CHECK			
	Sampling Conditions	Test Samples	
Cylinder Number	-----	W-872*	W-298
Pressure, PSIG	168	154	150
Temperature, °F	81	70	70

\* Sample used for analysis

## TOTAL EXTENDED REPORT - GPA 2186-M

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.018	0.004	0.005
Carbon Dioxide	0.015	0.005	0.006
Methane	4.777	1.626	0.682
Ethane	4.948	2.658	1.324
Propane	4.863	2.691	1.908
Isobutane	1.369	0.900	0.708
n-Butane	3.815	2.416	1.973
2,2 Dimethylpropane	0.071	0.055	0.046
Isopentane	2.456	1.804	1.576
n-Pentane	3.391	2.469	2.177
2,2 Dimethylbutane	0.121	0.101	0.093
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.214	0.176	0.164
2 Methylpentane	1.498	1.249	1.149
3 Methylpentane	1.044	0.856	0.801
n-Hexane	2.751	2.273	2.109
Methylcyclopentane	0.276	0.196	0.207
Benzene	0.076	0.043	0.053
Cyclohexane	0.572	0.391	0.428
2-Methylhexane	2.053	1.918	1.831
3-Methylhexane	1.783	1.644	1.590
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	0.995	0.907	0.878
n-Heptane	3.430	3.179	3.058
Methylcyclohexane	2.336	1.886	2.041
Toluene	0.617	0.415	0.506
Other C-8's	8.334	8.186	8.173
n-Octane	3.635	3.740	3.694
E-Benzene	0.908	0.704	0.858
M & P Xylenes	0.925	0.721	0.874
O-Xylene	1.535	1.172	1.450
Other C-9's	6.075	6.665	6.824
n-Nonane	3.131	3.540	3.573
Other C-10's	7.205	8.687	9.057
n-decane	2.282	2.813	2.888
Undecanes(11)	6.933	8.576	9.068
Dodecanes(12)	4.501	6.014	6.448
Tridecanes(13)	3.174	4.548	4.943
Tetradecanes(14)	2.056	3.156	3.476
Pentadecanes(15)	1.432	2.354	2.624
Hexadecanes(16)	0.949	1.667	1.874
Heptadecanes(17)	0.752	1.397	1.586
Octadecanes(18)	0.575	1.124	1.283
Nonadecanes(19)	0.436	0.889	1.020
Eicosanes(20)	0.329	0.698	0.806
Heneicosanes(21)	0.255	0.568	0.660
Docosanes(22)	0.213	0.494	0.578
Tricosanes(23)	0.164	0.395	0.464
Tetracosanes(24)	0.142	0.355	0.419
Pentacosanes(25)	0.103	0.267	0.317
Hexacosanes(26)	0.089	0.238	0.283
Heptacosanes(27)	0.071	0.198	0.237
Octacosanes(28)	0.054	0.156	0.188
Nonacosanes(29)	0.047	0.140	0.169
Triacotanes(30)	0.035	0.107	0.130
Hentriacotanes Plus(31+)	<u>0.168</u>	<u>0.566</u>	<u>0.726</u>
Total	100.000	100.000	100.000



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

**For:** Antero Resources Appalachian Corp.  
 1615 Wynkoop Street  
 Denver, Colorado 80202

**Date Sampled:** 10/14/14

**Date Analyzed:** 10/24/14

**Sample:** Nero No. 2H

**Job Number:** J45832

FLASH LIBERATION OF HYDROCARBON LIQUID		
	First Stage Separator HC Liquid	Stock Tank
Pressure, psig	168	0
Temperature, °F	81	70
Gas Oil Ratio (1)	-----	112
Gas Specific Gravity (2)	-----	1.194
Separator Volume Factor (3)	1.0721	1.000

STOCK TANK FLUID PROPERTIES	
Shrinkage Recovery Factor (4)	0.9328
Oil API Gravity at 60 °F	59.77
Reid Vapor Pressure, psi (5)	3.54

Quality Control Check			
	Sampling Conditions	Test Samples	
Cylinder No.	-----	W-872*	W-298
Pressure, psig	168	154	150
Temperature, °F	81	70	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: \_\_\_\_\_ T. 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.  
 1615 Wynkoop Street  
 Denver, Colorado 80202

**Sample:** Nero No. 2H  
 Gas Evolved from Hydrocarbon Liquid Flashed  
 From 168 psig & 81 °F to 0 psig & 70 °F

Date Sampled: 10/14/14

Job Number: 45832.001

**CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286**

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.132	
Carbon Dioxide	0.650	
Methane	34.713	
Ethane	29.751	8.019
Propane	18.532	5.146
Isobutane	2.953	0.974
n-Butane	6.222	1.977
2-2 Dimethylpropane	0.064	0.025
Isopentane	1.702	0.627
n-Pentane	1.747	0.638
Hexanes	1.654	0.687
Heptanes Plus	<u>1.880</u>	<u>0.832</u>
Totals	100.000	18.925

**Computed Real Characteristics Of Heptanes Plus:**

Specific Gravity ----- 3.543 (Air=1)  
 Molecular Weight ----- 101.49  
 Gross Heating Value ----- 5409 BTU/CF

**Computed Real Characteristics Of Total Sample:**

Specific Gravity ----- 1.194 (Air=1)  
 Compressibility (Z) ----- 0.9890  
 Molecular Weight ----- 34.21  
 Gross Heating Value  
 Dry Basis ----- 2005 BTU/CF  
 Saturated Basis ----- 1971 BTU/CF

\*Hydrogen Sulfide tested in laboratory by: Stain Tube Method (GPA 2377)  
 Results: <0.013 Gr/100 CF, <0.2 PPMV or <0.001 Mol %

Base Conditions: 14.850 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR  
 Processor: IM  
 Cylinder ID: FL-7S

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

**CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286**  
**TOTAL REPORT**

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.132		0.108
Carbon Dioxide	0.650		0.836
Methane	34.713		16.278
Ethane	29.751	8.019	26.150
Propane	18.532	5.146	23.887
Isobutane	2.953	0.974	5.017
n-Butane	6.222	1.977	10.571
2,2 Dimethylpropane	0.064	0.025	0.135
Isopentane	1.702	0.627	3.590
n-Pentane	1.747	0.638	3.684
2,2 Dimethylbutane	0.059	0.025	0.149
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.094	0.039	0.237
2 Methylpentane	0.497	0.208	1.252
3 Methylpentane	0.315	0.130	0.794
n-Hexane	0.689	0.286	1.736
Methylcyclopentane	0.060	0.021	0.148
Benzene	0.026	0.007	0.059
Cyclohexane	0.100	0.034	0.246
2-Methylhexane	0.198	0.093	0.580
3-Methylhexane	0.203	0.093	0.595
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.191	0.084	0.554
n-Heptane	0.309	0.144	0.905
Methylcyclohexane	0.214	0.087	0.614
Toluene	0.064	0.022	0.172
Other C8's	0.333	0.156	1.073
n-Octane	0.086	0.044	0.287
Ethylbenzene	0.002	0.001	0.006
M & P Xylenes	0.016	0.006	0.050
O-Xylene	0.002	0.001	0.006
Other C9's	0.067	0.034	0.247
n-Nonane	0.006	0.003	0.022
Other C10's	0.003	0.002	0.012
n-Decane	0.000	0.000	0.000
Undecanes (11)	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
Totals	100.000	18.925	100.000

**Computed Real Characteristics Of Total Sample:**

Specific Gravity -----	1.194	(Air=1)
Compressibility (Z) -----	0.9890	
Molecular Weight -----	34.21	
Gross Heating Value		
Dry Basis -----	2005	BTU/CF
Saturated Basis -----	1971	BTU/CF

Gas Analytical

Report Date: Apr 22, 2016 9:05a

Client:	Antero Resources	Date Sampled:	Apr 12, 2016
Site:	Leason Run Unit 1H	Analysis Date:	Apr 21, 2016 2:46p
Field No:	9998	Collected By:	Doug Lipscomb
Meter:	40690	Date Effective:	Apr 12, 2016 12:00a
Source Laboratory	Clarksburg (Bridgeport), WV	Sample Pressure (PSI):	286.0
<b>Lab File No:</b>	<b>X_CH1-11134.CHR</b>	Sample Temp (°F):	67
Sample Type:	Spot	Field H2O:	No Test
Reviewed By:		Field H2S:	No Test
Analysis Status:	good		

Component	Mol %	Gal/MSCF
Methane	81.1473	
Ethane	13.6997	3.6418
Propane	2.4061	0.6614
I-Butane	0.4878	0.1593
N-Butane	0.8151	0.2565
I-Pentane	0.2296	0.0838
N-Pentane	0.1939	0.0702
Nitrogen	0.4311	
Oxygen	<MDL	
Carbon Dioxide	0.1854	
Hexanes+	0.4040	0.1659
TOTAL	100.0000	5.0390

Analytical Results at Base Conditions (Real)	
BTU/SCF (Dry):	1,208.9385 BTU/ft <sup>3</sup>
BTU/SCF (Saturated):	1,188.7753 BTU/ft <sup>3</sup>
PSIA:	14.730 PSI
Temperature (°F):	60.00 °F
Z Factor (Dry):	0.99681
Z Factor (Saturated):	0.99641

Analytical Results at Contract Conditions (Real)	
BTU/SCF (Dry):	1,208.9385 BTU/ft <sup>3</sup>
BTU/SCF (Saturated):	1,188.7753 BTU/ft <sup>3</sup>
PSIA:	14.730 PSI
Temperature (°F):	60.00 °F
Z Factor (Dry):	0.99681
Z Factor (Saturated):	0.99641

Calculated Specific Gravities		
Ideal Gravity:	0.6850	Real Gravity: 0.6869
Molecular Wt:	19.8401 lb/lbmol	

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

Source	Date	Notes

# **Attachment T**

## **Facility-wide Emissions Summary Sheet(s)**



**ATTACHMENT T – FACILITY-WIDE CONTROLLED EMISSIONS SUMMARY SHEET**

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

Emission Point ID#	NOx		CO		VOC		SO2		PM10		PM2.5		GHG (CO2e)	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
EP-HR001									2.3871	0.9566				
EP-PCV					0.0573	0.2511							7.5478	33.0594
F001					2.7764	12.1605							71.0572	311.2304
EP-ENG001	0.316	1.383	5.644	24.723	0.007	0.030	0.000	0.001	0.002	0.010	0.002	0.010	26.93	117.94
EP-GPU001, EP-GPU002, EP-GPU003, EP-GPU004, EP-GPU005, EP-GPU006, EP-GPU007, EP-GPU008	0.9926	4.3476	0.8338	3.6520	0.0546	0.2391	0.0060	0.0261	0.0754	0.3304	0.0754	0.3304	1191.1276	5217.1388
EP-LH001, EP-LH002, EP-LH003, EP-LH004, EP-LH005, EP-LH006, EP-LH007, EP-LH008	1.3235	5.7968	1.1117	4.8693	0.0728	0.3188	0.0079	0.0348	0.1006	0.4406	0.1006	0.4406	1588.1701	6956.1851
EP-L001					5.9893	1.7671							6.2202	1.8352
EP-L002					7.65E-04	2.85E-04							0.8502	0.3168
EP-EC001, EP-EC002, EP-EC003	0.0976	0.4277	0.0820	0.3592	1.0609	4.6468	2.27E-05	9.93E-05	0.0074	0.0325	0.0056	0.0244	278.1088	1218.1167
<b>TOTAL</b>	<b>2.7295</b>	<b>11.9552</b>	<b>7.6720</b>	<b>33.6034</b>	<b>1.1952</b>	<b>5.2349</b>	<b>0.0141</b>	<b>0.0616</b>	<b>0.1857</b>	<b>0.8132</b>	<b>0.1838</b>	<b>0.8050</b>	<b>3084.3340</b>	<b>13509.3828</b>

Annual emissions shall be based on 8760 hours per year of operation for all emission units except emergency generators. According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, fugitive emissions shall not be included in the PTE above

**ATTACHMENT T – FACILITY-WIDE CONTROLLED EMISSIONS SUMMARY SHEET**

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

Emission Point ID#	Formaldehyde		Benzene		Toluene		Ethylbenzene		Xylenes		Hexane		Total HAPs		
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
EP-HR001															
EP-PCV			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0081	0.0354	0.0081	0.0354
F001			0.0013	0.0056	0.0122	0.0534	0.0207	0.0905	0.0560	0.2451	0.1431	0.6269	0.2332	1.0215	
EP-ENG001	0.005	0.021	3.68E-04	0.002	1.30E-04	5.69E-04	5.77E-06	2.53E-05	4.54E-05	1.99E-04			0.005	0.023	
EP-GPU001, EP-GPU002, EP-GPU003, EP-GPU004, EP-GPU005, EP-GPU006, EP-GPU007, EP-GPU008	0.0007	0.0033	2.08E-05	9.13E-05	3.37E-05	0.0001			0.00E+00	0.00E+00	0.0179	0.0783	0.0187	0.0818	
EP-LH001, EP-LH002, EP-LH003, EP-LH004, EP-LH005, EP-LH006, EP-LH007, EP-LH008	0.0010	0.0043	2.78E-05	0.0001	4.50E-05	1.97E-04			0.00E+00	0.00E+00	0.0238	0.1043	0.0249	0.1091	
EP-L001			4.43E-05	1.31E-05	5.91E-04	1.74E-04	9.52E-04	2.81E-04	0.003	7.49E-04	0.060	0.018	0.064	0.019	
EP-L002			1.44E-07	5.36E-08	4.08E-07	1.52E-07	2.00E-07	7.44E-08	5.18E-07	1.93E-07	8.96E-09	3.34E-09	1.28E-06	4.76E-07	
EP-EC001, EP-EC002, EP-EC003	2.84E-06	1.24E-05	0.0001	0.0005	0.0008	0.0033	0.0007	0.0030	0.0015	0.0067	0.1345	0.5891	0.1376	0.6026	
<b>TOTAL</b>	<b>0.0065</b>	<b>0.0285</b>	<b>0.0005</b>	<b>0.0024</b>	<b>0.0010</b>	<b>0.0042</b>	<b>0.0007</b>	<b>0.0030</b>	<b>0.0016</b>	<b>0.0069</b>	<b>0.1762</b>	<b>0.7717</b>	<b>0.1865</b>	<b>0.8170</b>	

Annual emissions shall be based on 8760 hours per year of operation for all emission units except emergency generators. According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, fugitive emissions shall not be included in the PTE above

# **Attachment U**

## **Class I Legal Advertisement**

**Attachment U**

**Air Quality Permit Notice  
Notice of Application  
Alvadore 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 G70-C General Permit Modification for an Oil and Natural Gas Production facility located at 142 Rocket Dr. Greenwood, WV 26415, near West Union in Doddridge County, West Virginia.

The latitude and longitude coordinates are: 39.27347 and -80.88265

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

Pollutants	TOTALS (tpy):
NO <sub>x</sub>	11.9552
CO	33.6034
PM <sub>2.5</sub>	0.8050
PM <sub>10</sub>	0.8132
VOC	5.2349
SO <sub>2</sub>	0.0616
Formaldehyde	0.0285
Benzene	0.0024
Toluene	0.0042
Ethylbenzene	0.0030
Xylenes	0.0069
Hexane	0.7717
Total HAPs	0.8170

Proposed new equipment will be installed upon permit issuance. Startup of operation using new equipment is planned to begin on or about April 2017. 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

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

Dated this the \_\_ day of \_\_\_\_\_, 2016

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

[www.ghd.com](http://www.ghd.com)

