



**CONESTOGA-ROVERS
& ASSOCIATES**

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

March 16, 2015

Reference No. 082715

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

Dear Mr. Jay Fedczak:

Re: General Permit Application G70-A
Willard Well pad
Antero Resources Corporation

Conestoga-Rovers & Associates (CRA) would like to submit this General Permit application that we prepared on behalf of Antero Resources Corporation for an oil and gas facility identified as Willard Well pad.

Enclosed are the following documents:

- Original copy of the G70-A General Permit Application
- Two CD copies of the G70-A General Permit Application
- The application fee with check no. 397722 in the amount of \$1,500.00.

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

Sincerely,

CONESTOGA-ROVERS & ASSOCIATES

Manuel Bautista

Encl.

cc: Barry Schatz, Antero Resources Corporation

Equal
Employment Opportunity
Employer



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(New Source)

Willard Well Pad

Prepared for: Antero Resources Corporation

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Conestoga-Rovers & Associates

6320 Rothway, Suite 100
Houston, Texas 77040

March 2015 • 082715 • Report No. 155

Table of Contents**G70-A General Permit Registration Form**

Attachment A	Current Business Certificate
Attachment B	Process Description
Attachment C	Description of Fugitive Emissions
Attachment D	Process Flow Diagram
Attachment E	Plot Plan
Attachment F	Area Map
Attachment G	Emission Unit Data Sheets/G70-A Section Applicability Form
Attachment H	Air Pollution Control Device Data Sheet
Attachment I	Emission Calculations
Attachment J	Class I Legal Advertisement
Attachment K	Electronic Submittal
Attachment L	General Permit Registration Application Fee
Attachment M	Siting Criteria Waiver
Attachment N	Material Safety Data Sheets
Attachment O	Emissions Summary Sheet
Attachment P	Other Supporting Documentation Not Described Above



WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475 • www.dep.wv.gov/daq

**APPLICATION FOR GENERAL
PERMIT REGISTRATION**
*CONSTRUCT, MODIFY, RELOCATE OR
ADMINISTRATIVELY UPDATE
A STATIONARY SOURCE OF AIR POLLUTANTS*

☒ CONSTRUCTION ☐ MODIFICATION ☐ RELOCATION ☐ CLASS I ADMINISTRATIVE UPDATE
☐ CLASS II ADMINISTRATIVE UPDATE

CHECK WHICH TYPE OF GENERAL PERMIT REGISTRATION YOU ARE APPLYING FOR:

- | | |
|---|---|
| <input type="checkbox"/> G10-D – Coal Preparation and Handling | <input type="checkbox"/> G40-C – Nonmetallic Minerals Processing |
| <input type="checkbox"/> G20-B – Hot Mix Asphalt | <input type="checkbox"/> G50-B – Concrete Batch |
| <input type="checkbox"/> G30-D – Natural Gas Compressor Stations | <input type="checkbox"/> G60-C – Class II Emergency Generator |
| <input type="checkbox"/> G33-A – Spark Ignition Internal Combustion Engines | <input type="checkbox"/> G65-C – Class I Emergency Generator |
| <input type="checkbox"/> G35-A – Natural Gas Compressor Stations (Flare/Glycol Dehydration Unit) | <input checked="" type="checkbox"/> G70-A – Class II Oil and Natural Gas Production Facility |

SECTION I. GENERAL INFORMATION

- | | | |
|--|--|--|
| 1. Name of applicant (as registered with the WV Secretary of State's Office):
Antero Resources Corporation | | 2. Federal Employer ID No. (FEIN):
80-0162034 |
| 3. Applicant's mailing address:
1615 Wynkoop St.

Denver, CO, 80202
_____ | | 4. Applicant's physical address:
<u>0.58 miles northeast from the intersection of WV-18 and Sugar</u>
<u>Camp Rd</u> |
| 5. If applicant is a subsidiary corporation, please provide the name of parent corporation: | | |
| 6. WV BUSINESS REGISTRATION. Is the applicant a resident of the State of West Virginia? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
– IF YES , provide a copy of the Certificate of Incorporation/ Organization / Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A .
– IF NO , provide a copy of the Certificate of Authority / Authority of LLC / Registration (one page) including any name change amendments or other Business Certificate as Attachment A . | | |

SECTION II. FACILITY INFORMATION

- | | |
|---|--|
| 7. Type of plant or facility (stationary source) to be constructed, modified, relocated or administratively updated (e.g., coal preparation plant, primary crusher, etc.):
Natural Gas and Oil Production facility | 8a. Standard Industrial Classification
Classification (SIC) code: 1311 AND 8b. North American Industry
System (NAICS) code: 211111 |
| 9. DAQ Plant ID No. (for existing facilities only):
_____ - _____ | 10. List all current 45CSR13 and other General Permit numbers associated with this process (for existing facilities only):
<u>N/A</u>

_____ |

A: PRIMARY OPERATING SITE INFORMATION

11A. Facility name of primary operating site: Willard Well Pad	12A. Address of primary operating site: Mailing: N/A Physical: 0.58 miles northeast from the intersection of WV-18 and Sugar Camp Rd	
13A. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO — IF YES, please explain: Antero is leasing the mineral rights for this site — IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.		
14A. — For Modifications or Administrative Updates at an existing facility, please provide directions to the present location of the facility from the nearest state road; — For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a MAP as Attachment F . To access the pad from US 50E, turn right onto WV-18S. In 5.8 miles, turn left onto the access road and follow to the location.		
15A. Nearest city or town: New Milton	16A. County: Doddridge	17A. UTM Coordinates: Northing (KM): 4345.1618 Easting (KM): 526.6835 Zone: 17 N
18A. Briefly describe the proposed new operation or change (s) to the facility: Construction of a new natural gas and oil production facility.		19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: 39.255373 Longitude: -80.690733

B: 1ST ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits)

11B. Name of 1 st alternate operating site: 	12B. Address of 1 st alternate operating site: Mailing: Physical:	
13B. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <input type="checkbox"/> YES <input type="checkbox"/> NO — IF YES, please explain: — IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.		
14B. — For Modifications or Administrative Updates at an existing facility, please provide directions to the present location of the facility from the nearest state road; — For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a MAP as Attachment F . 		
15B. Nearest city or town:	16B. County:	17B. UTM Coordinates: Northing (KM): Easting (KM): Zone:

18B. Briefly describe the proposed new operation or change (s) to the facility:	19B. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____
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C: 2ND ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits):

11C. Name of 2 nd alternate operating site: _____ _____	12C. Address of 2 nd alternate operating site: Mailing: _____ Physical: _____ _____
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13C. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <input type="checkbox"/> YES <input type="checkbox"/> NO — IF YES , please explain: _____ _____ — IF NO , YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.
--

14C. — For Modifications or Administrative Updates at an existing facility, please provide directions to the present location of the facility from the nearest state road; — For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a MAP as Attachment F . _____ _____ _____
--

15C. Nearest city or town:	16C. County:	17C. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
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18C. Briefly describe the proposed new operation or change (s) to the facility:	19C. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____
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20. Provide the date of anticipated installation or change: <u>11/01/2016</u> <input type="checkbox"/> If this is an After-The-Fact permit application, provide the date upon which the proposed change did happen: : ____/____/____	21. Date of anticipated Start-up if registration is granted: <u>12/01/2016</u>
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22. Provide maximum projected Operating Schedule of activity/activities outlined in this application if other than 8760 hours/year. (Note: anything other than 24/7/52 may result in a restriction to the facility's operation). Hours per day _____ Days per week _____ Weeks per year _____ Percentage of operation _____

SECTION III. ATTACHMENTS AND SUPPORTING DOCUMENTS

23. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

24. Include a **Table of Contents** as the first page of your application package.

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

25. Please check all attachments included with this permit application. Please refer to the appropriate reference document for an explanation of the attachments listed below.

- ☒ ATTACHMENT A : CURRENT BUSINESS CERTIFICATE
- ☒ ATTACHMENT B: PROCESS DESCRIPTION
- ☒ ATTACHMENT C: DESCRIPTION OF FUGITIVE EMISSIONS
- ☒ ATTACHMENT D: PROCESS FLOW DIAGRAM
- ☒ ATTACHMENT E: PLOT PLAN
- ☒ ATTACHMENT F: AREA MAP
- ☒ ATTACHMENT G: EQUIPMENT DATA SHEETS AND REGISTRATION SECTION APPLICABILITY FORM
- ☒ ATTACHMENT H: AIR POLLUTION CONTROL DEVICE SHEETS
- ☒ ATTACHMENT I: EMISSIONS CALCULATIONS
- ☒ ATTACHMENT J: CLASS I LEGAL ADVERTISEMENT
- ☐ ATTACHMENT K: ELECTRONIC SUBMITTAL
- ☒ ATTACHMENT L: GENERAL PERMIT REGISTRATION APPLICATION FEE
- ☐ ATTACHMENT M: SITING CRITERIA WAIVER
- ☒ ATTACHMENT N: MATERIAL SAFETY DATA SHEETS (MSDS)
- ☒ ATTACHMENT O: EMISSIONS SUMMARY SHEETS
- ☒ OTHER SUPPORTING DOCUMENTATION NOT DESCRIBED ABOVE (Equipment Drawings, Aggregation Discussion, etc.)

Please mail an original and two copies of the complete General Permit Registration Application with the signature(s) to the DAQ Permitting Section, at the address shown on the front page of this application. Please DO NOT fax permit applications. For questions regarding applications or West Virginia Air Pollution Rules and Regulations, please refer to the website shown on the front page of the application or call the phone number also provided on the front page of the application.

SECTION IV. CERTIFICATION OF INFORMATION

This 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 a 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, Emission Inventory, Certified Emission Statement, 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 Registration Application will be returned to the applicant.

FOR A CORPORATION (domestic or foreign)

☐ I certify that I am a President, Vice President, Secretary, Treasurer or in charge of a principal business function of the corporation

FOR A PARTNERSHIP

☐ I certify that I am a General Partner

FOR A LIMITED LIABILITY COMPANY

☐ I certify that I am a General Partner or General Manager

FOR AN ASSOCIATION

☐ I certify that I am the President or a member of the Board of Directors

FOR A JOINT VENTURE

☐ I certify that I am the President, General Partner or General Manager

FOR A SOLE PROPRIETORSHIP

☐ I certify that I am the Owner and Proprietor

☐ I hereby certify that (please print or type) _____
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 Office of Air Quality immediately, and/or,

I hereby certify that all information contained in this 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

Signature _____

(please use blue ink)

Responsible Official

Date

Name & Title Barry Schatz, Senior Environmental & Regulatory Manager

(please print or type)

Signature _____

(please use blue ink)

Authorized Representative (if applicable)

Date

Applicant's Name Antero Resources Corporation

Phone & Fax _____

303-357-7276

Phone

303-357-7315

Fax

Email bschatz@anteroresources.com

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

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



IN THE OFFICE OF
PENNEY BARKER, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-8381

Website: www.wvsos.com
E-mail: business@wvsos.com

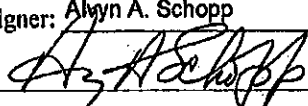
Office Hours: Monday – Friday
8:30 a.m. – 5:00 p.m. ET

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

APPLICATION FOR
AMENDED CERTIFICATE
OF AUTHORITY

**** 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:

1. Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
2. Date Certificate of Authority was issued in West Virginia: 6/25/2008
3. Corporate name has been changed to: Antero Resources Corporation
(Attach one Certified Copy of Name Change as filed in home State of Incorporation.)
4. Name the corporation elects to use in WV: Antero Resources Corporation
(due to home state name not being available)
5. 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


Jeffrey W. Bullock, Secretary of State
AUTHENTICATION: 0496546

DATE: 06-10-13

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

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

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

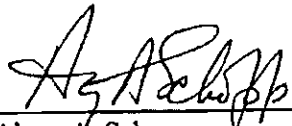
2. This Amendment to the Amended and Restated Certificate of Incorporation has been duly adopted and approved in accordance with Sections 242 of the General Corporation Law of the State of Delaware.

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

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

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

ANTERO RESOURCES APPALACHIAN CORPORATION

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

Attachment B

Process Description

Attachment B**Process Description****Willard Well Pad****Antero Resources Corporation
Doddridge County, West Virginia**

A mixture of condensate and entrained gas from the wells enters the Facility through a number of low pressure separators where the gas phase is separated from the liquid phase. Gas Processing Unit (GPU) heaters (H001-H009) are used in conjunction with the separators to help separate the gas from the liquid phases. These heaters are fueled by a slip stream of the separated gas. The separated gas from the low pressure separators is sent to a compressor (ENG001). The compressed gas is then metered and sent to the sales gas pipeline. The separated condensate and water from the separators flow to their respective storage tanks (TANKCOND001-010 and TANKPW001-002).

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. Flashing, working, and breathing losses from the tanks are routed to the enclosed combustor (EC001) to control the emissions. The enclosed combustor that will be used to control emissions is designed to achieve a VOC destruction efficiency of 98 percent.

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

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

Willard Well Pad calculation of potential to emit included all of the emission sources that belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under the control of the same person. The nearest emission source that belongs to the same industrial grouping and under the control of the same person but not located on contiguous or adjacent property is the Powell Well Pad. This operates independently and is approximately 1.46 miles northeast of the Facility.

Attachment C

Description of Fugitive Emissions

Attachment C

Description of Fugitive Emissions Willard Well Pad Antero Resources Corporation Doddridge County, West Virginia

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

Equipment Leaks

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

Pneumatic Control Valves

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

Loading Operations

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

Haul Road Emissions

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

Attachment C/O: G70-A Emissions Summary Sheet
Fugitive Emissions Data Summary Sheet

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS 1	Maximum Potential Uncontrolled Emissions 2		Maximum Potential Controlled Emissions 3		Est. Method Used 4
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	n/a					
Unpaved Haul Roads	PM, PM10, PM2.5	6.3696	8.3963	3.1848	4.1981	MB
Loading/Unloading Operations	VOCs	4.7236	0.8104	4.7236	0.8104	MB
	toluene (108883)	0.0008	0.0001	0.0008	0.0001	
	ethyl benzene (100414)	0.0010	0.0002	0.0010	0.0002	
	hexane (110543)	0.0089	0.0015	0.0089	0.0015	
	o,m,p-xylenes (95476,108383,106423)	0.0023	0.0004	0.0023	0.0004	
	CO2 Equivalent CO2 (124389), CH4	8.7325	3.3669	8.7325	3.3669	
	benzene (71432)	0.0001	0.0000	0.0001	0.0000	
	TAPs (benzene)	0.0001	0.0000	0.0001	0.0000	
Equipment Leaks (Components)	Benzene (71432)	Does not apply	0.0051	Does not apply	0.0051	MB
	Toluene (108883)		0.0462		0.0462	
	Ethyl benzene (100414)		0.0945		0.0945	
	Hexane (110543)		0.7307		0.7307	
	o,m,p-xylenes (95476,108383,106423)		0.2378		0.2378	
	CO2 Equivalent CO2 (124389), CH4		318.1771		318.1771	
	VOCs		15.0243		15.0243	
	TAPs (benzene)		0.0051		0.0051	
Equipment Leaks (PCVs)	toluene (108883)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MB
	ethyl benzene (100414)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	hexane (110543)	0.0123	0.0537	0.0123	0.0537	
	o,m,p-xylenes (95476,108383,106423)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	CO2 Equivalent CO2 (124389), CH4	8.1294	35.6070	8.1294	35.6070	
	VOCs	0.1030	0.4513	0.1030	0.4513	
	TAPs (benzene)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

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

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

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

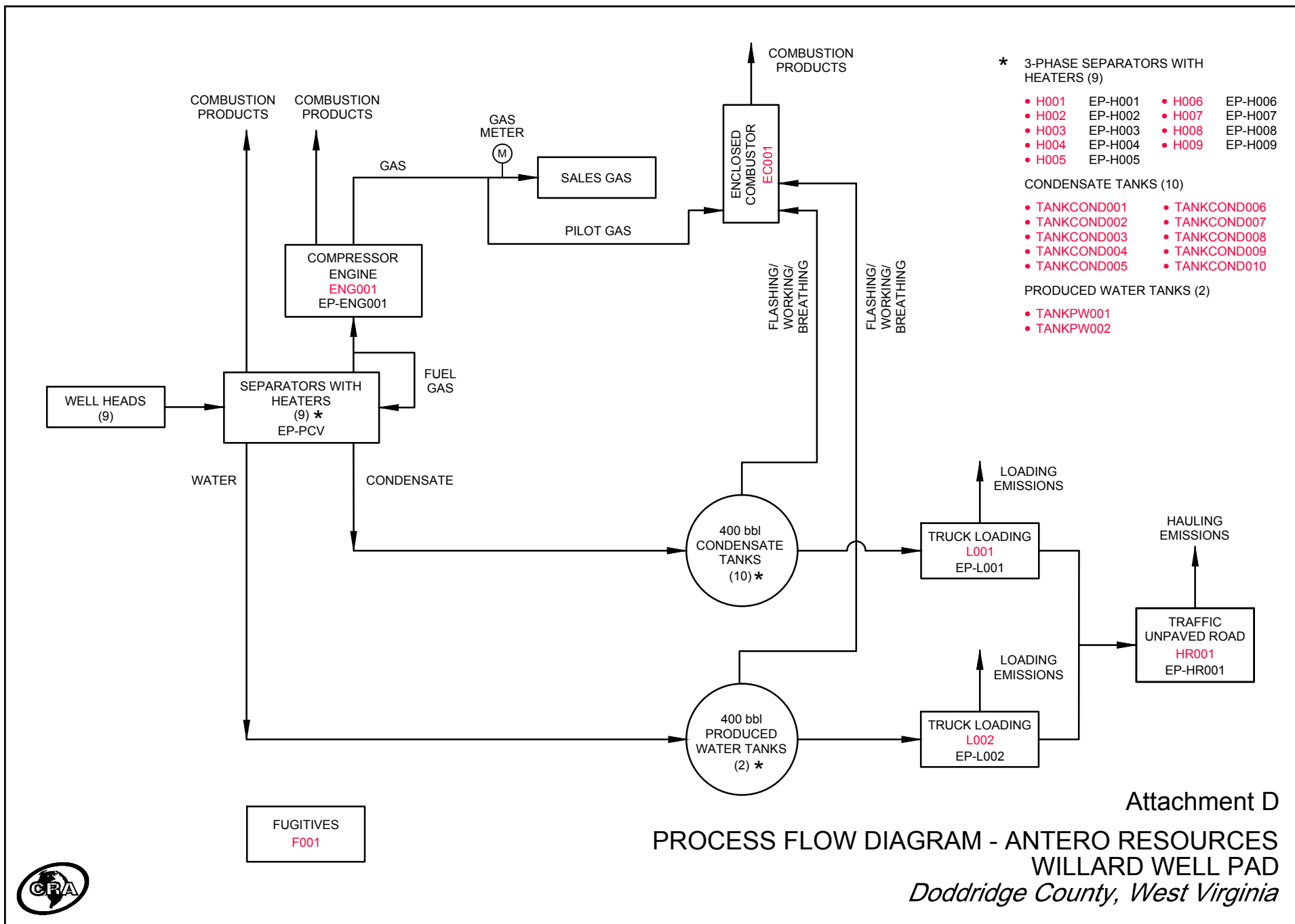
4 Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

Attachment C: Leak Source Data Sheet

Source Category	Pollutant	Number of Source Components (1)	Number of Components Monitored by Frequency ²	Average Time to Repair (days) (3)	Estimated Annual Emission Rate (lb/yr) (4)
Pumps (5)	light liquid VOC ^(6,7)				
	heavy liquid VOC ⁸				
	Non-VOC ⁹				
Valves (10)	Gas VOC	450		First attempt within 5 days of detection and final repair within 15 days	7,452.68
	Light Liquid VOC	468		First attempt within 5 days of detection and final repair within 15 days	22,037.16
	Heavy Liquid VOC	--			--
	Non-VOC	--			--
Safety Relief Valves (11)	Gas VOC	See Valves		First attempt within 5 days of detection and final repair within 15 days	see Valves
	Non VOC	See Valves		First attempt within 5 days of detection and final repair within 15 days	see Valves
Open-ended Lines (12)	VOC				
	Non-VOC				
Sampling Connections (13)	VOC				
	Non-VOC				
Compressors	VOC				
	Non-VOC				
Flanges	VOC	117		First attempt within 5 days of detection and final repair within 15 days	167.93
	Non-VOC			First attempt within 5 days of detection and final repair within 15 days	711.45
Other	VOC	531		First attempt within 5 days of detection and final repair within 15 days	390.85
	Non-VOC				1,655.83

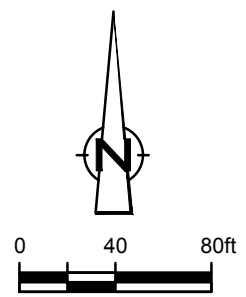
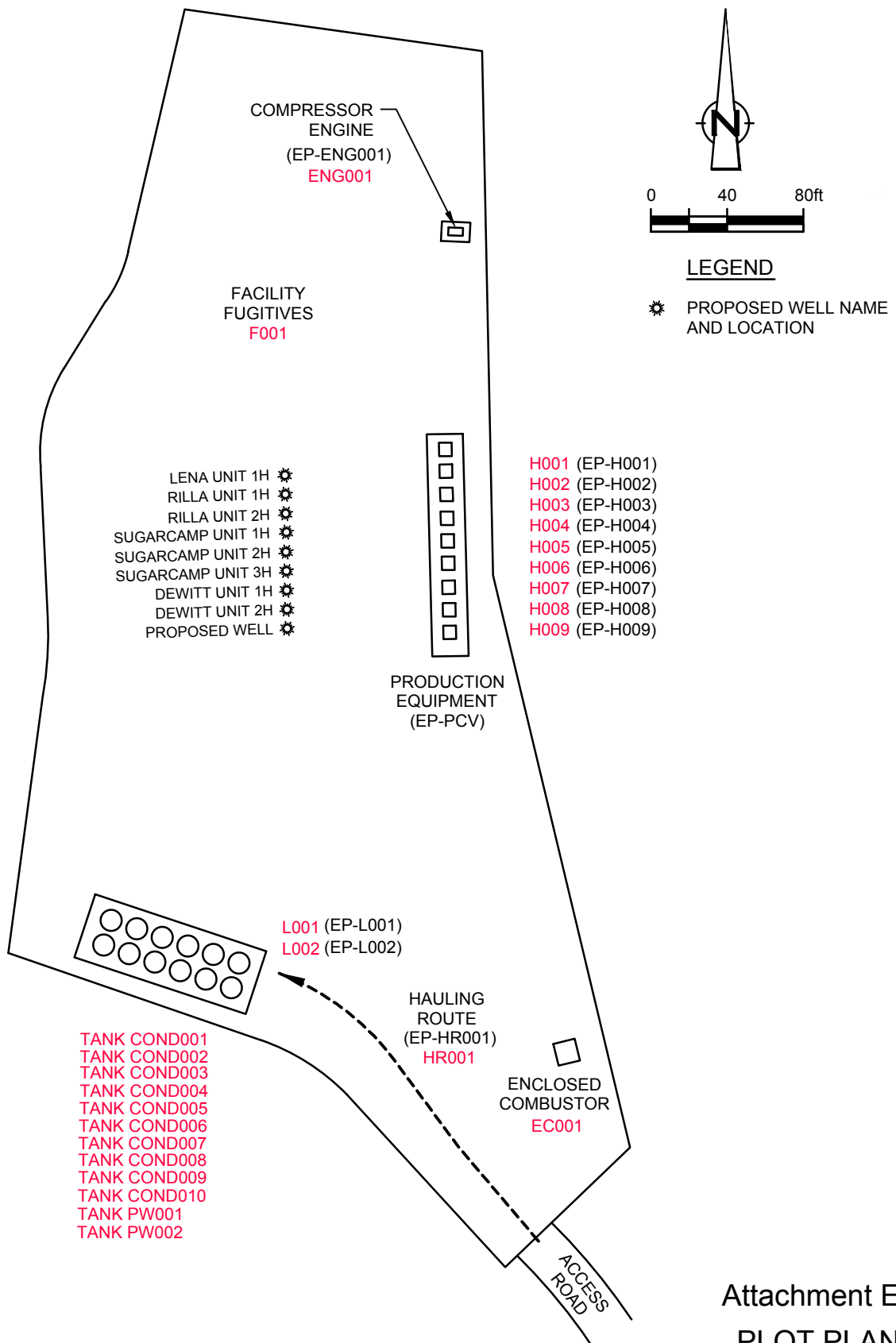
Attachment D

Process Flow Diagram



Attachment E

Plot Plan



LEGEND

★ PROPOSED WELL NAME AND LOCATION

Attachment E
PLOT PLAN
WILLARD WELL PAD
ANTERO RESOURCES
Doddridge County, West Virginia



Attachment F

Area Map

Attachment G

Emission Unit Data Sheets/G70-A Section Applicability Form

General Permit G70-A Registration Section Applicability Form

General Permit G70-A was developed to allow qualified applicants to seek registration for a variety of sources. These sources include natural gas well affected facilities, storage tanks, natural gas-fired compressor engines (RICE), natural gas producing units, natural gas-fired in-line heaters, pneumatic controllers, heater treaters, tank truck loading, glycol dehydration units, 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-A 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.

Section 5	Natural Gas Well Affected Facility	<input checked="" type="checkbox"/>
Section 6	Storage Vessels*	<input checked="" type="checkbox"/>
Section 7	Gas Producing Units, In-Line Heaters, Heater Treaters, and Glycol Dehydration Reboilers	<input checked="" type="checkbox"/>
Section 8	Pneumatic Controllers Affected Facility (NSPS, Subpart OOOO)	<input type="checkbox"/>
Section 9	<i>Reserved</i>	<input type="checkbox"/>
Section 10	Natural gas-fired Compressor Engine(s) (RICE) **	<input checked="" type="checkbox"/>
Section 11	Tank Truck Loading Facility ***	<input checked="" type="checkbox"/>
Section 12	Standards of Performance for Storage Vessel Affected Facilities (NSPS, Subpart OOOO)	<input type="checkbox"/>
Section 13	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (NSPS, Subpart JJJJ)	<input checked="" type="checkbox"/>
Section 14	Control Devices not subject to NSPS, Subpart OOOO	<input checked="" type="checkbox"/>
Section 15	National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40CFR63, Subpart ZZZZ)	<input checked="" type="checkbox"/>
Section 16	Glycol Dehydration Units	<input type="checkbox"/>
Section 17	Dehydration Units With Exemption from NESHAP Standard, Subpart HH § 63.764(d) (40CFR63, Subpart HH)	<input type="checkbox"/>
Section 18	Dehydration Units Subject to NESHAP Standard, Subpart HH and Not Located Within an UA/UC (40CFR63, Subpart HH)	<input type="checkbox"/>
Section 19	Dehydration Units Subject to NESHAP Standard, Subpart HH and Located Within an UA/UC (40CFR63, Subpart HH)	<input type="checkbox"/>

* Applicants that are subject to Section 6 may also be subject to Section 12 if the applicant is subject to the NSPS, Subpart OOOO control requirements or the applicable control device requirements of Section 14.

** Applicants that are subject to Section 10 may also be subject to the applicable RICE requirements of Section 13 and/or Section 15.

*** Applicants that are subject to Section 11 may also be subject to control device requirements of Section 14.

NATURAL 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).

Please provide the API number(s) for each NG well at this facility:	
Dewitt Unit 1H	47-017-06406-00
Dewitt Unit 2H	47-017-06407-00
7 wells are not permitted yet	

Note: This is the same API 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 (American Petroleum Institute) 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.

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

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

Attachment G: Storage Vessel Emission Unit Data Sheet (Condensate)

Provide the following information for each new or modified bulk liquid storage tank.

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name	CONDTANK	2. Tank Name	TANKCOND001-010
3. Emission Unit ID number	TANKCOND001-010	4. Emission Point ID number	EC001
5. Date Installed or Modified (for existing tanks): New		6. Type of change: New	
7A. Description of Tank Modification (if applicable) NA			
7B. Will more than one material be stored in this tank? If so, a separate form must be completed for each material. No			
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.)			

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 400bbls			
9A. Tank Internal Diameter (ft.) 12		9B. Tank Internal Height (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." 400bbls			
13A. Maximum annual throughput (gal/yr) 3,449,250		13B. Maximum daily throughput (gal/day) 9,450	
14. Number of tank turnovers per year 21		15. Maximum tank fill rate (gal/min) 168	
16. Tank fill method: Splash Fill			
17. Is the tank system a variable vapor space system? 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 horizontal <input checked="" type="checkbox"/> flat roof cone roof dome roof other (describe) External Floating Roof pontoon roof double deck roof Domed External (or Covered) Floating Roof Internal Floating Roof vertical column support self-supporting Variable Vapor Space lifter roof diaphragm Pressurized spherical cylindrical Underground Other (describe)			

III. TANK CONSTRUCTION AND OPERATION INFORMATION (check which one applies)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 19 – 26 in section VII

IV. SITE INFORMATION (check which one applies)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 27 – 33 in section VII

V. LIQUID INFORMATION (check which one applies)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 34 – 39 in section VII

Provide the following information for each new or modified bulk liquid storage tank.

40. Emission Control Devices (check as many as apply):

Does Not Apply	Rupture Disc (psig)
Carbon Adsorption ¹	Inert Gas Blanket of _____
<input checked="" type="checkbox"/> Vent to Vapor Combustion Device ¹ (vapor combustors, flares, thermal oxidizers) Condenser ¹	
Conservation Vent (psig)	
Other ¹ (describe)	Vacuum Setting Pressure Setting
Emergency Relief Valve (psig)	

¹ Complete appropriate Air Pollution Control Device Sheet

[illegible]

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

TANK CONSTRUCTION AND OPERATION INFORMATION									
19. Tank Shell Construction: Steel									
20A. Shell Color: Green				20B. Roof Color: Green				20C. Year Last Painted: 2016	
21. Shell Condition (if metal and unlined): No Rust									
22A. Is the tank heated? No				22B. If yes, operating temperature:				22C. If yes, how is heat provided to tank?	
23. Operating Pressure Range (psig): 0									
24. Is the tank a Vertical Fixed Roof Tank ? Yes				24A. If yes, for dome roof provide radius (ft):				24B. If yes, for cone roof, provide slop (ft/ft):	
25. Complete item 25 for Floating Roof Tanks Does not apply									
25A. Year Internal Floaters Installed:									
25B. Primary Seal Type (<i>check one</i>): Metallic (mechanical) shoe seal Liquid mounted resilient seal									
25C. Is the Floating Roof equipped with a secondary seal? Yes No									
25D. If yes, how is the secondary seal mounted? (<i>check one</i>) Shoe Rim Other (describe):									
25E. Is the floating roof equipped with a weather shield? Yes No									
25F. Describe deck fittings:									
26. Complete the following section for Internal Floating Roof Tanks Does not apply									
26A. Deck Type: Bolted Welded						26B. For bolted decks, provide deck construction:			
26C. Deck seam. Continuous sheet construction:									
26D. Deck seam length (ft.):		26E. Area of deck (ft ²):				26F. For column supported		26G. For column supported	

Attachment G: Storage Vessel Emission Unit Data Sheet (Condensate)

Provide the following information for each new or modified bulk liquid storage tank.

SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: Charleston, WV			
28. Daily Avg. Ambient Temperature (°F): 55.3		29. Annual Avg. Maximum Temperature (°F): 75.94	
30. Annual Avg. Minimum Temperature (°F): 65.9		31. Avg. Wind Speed (mph): 5.9	
32. Annual Avg. Solar Insulation Factor (BTU/ft2-day): 1030.235999		33. Atmospheric Pressure (psia): 14.8	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): 51.7	34A. Minimum (°F): 39.5	34B. Maximum (°F): 63.8	
35. Avg. operating pressure range of tank (psig): 0	35A. Minimum (psig): 0	35B. Maximum (psig): 0	
36A. Minimum liquid surface temperature (°F): 39.5	36B. Corresponding vapor pressure (psia): 0.6860		
37A. Avg. liquid surface temperature (°F): 51.7	37B. Corresponding vapor pressure (psia): 0.9202		
38A. Maximum liquid surface temperature (°F): 63.8	38B. Corresponding vapor pressure (psia): 1.2147		
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			
39A. Material name and composition:	Condensate		
39B. CAS number:	mix of HC		
39C. Liquid density (lb/gal):	6.05		
39D. Liquid molecular weight (lb/lb-mole):	113.2		
39E. Vapor molecular weight (lb/lb-mole):	38.60		
39F. Maximum true vapor pressure (psia):	1.4589		
39G. Max Reid vapor pressure (psi):	2.51000		
39H. Months Storage per year. From: To:	year round		

Attachment G: Storage Vessel Emission Unit Data Sheet (Produced Water)

Provide the following information for each new or modified bulk liquid storage tank.

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name PWTANK	2. Tank Name TANKPW001-002
3. Emission Unit ID number TANKPW001-002	4. Emission Point ID number EC001
5. Date Installed or Modified (<i>for existing tanks</i>): New	6. Type of change: New
7A. Description of Tank Modification (<i>if applicable</i>) NA	
7B. Will more than one material be stored in this tank? <i>If so, a separate form must be completed for each material.</i> No	
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.)	

II. TANK INFORMATION (required)

8. Design Capacity (<i>specify barrels or gallons</i>). Use the internal cross-sectional area multiplied by internal height. 400bbbls	
9A. Tank Internal Diameter (ft.) 12	9B. Tank Internal Height (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 (<i>specify barrels or gallons</i>) . This is also known as "working volume." 400bbbls	
13A. Maximum annual throughput (gal/yr) 41,391,000	13B. Maximum daily throughput (gal/day) 113,400
14. Number of tank turnovers per year 1232	15. Maximum tank fill rate (gal/min) 168
16. Tank fill method Splash Fill	
17. Is the tank system a variable vapor space system? 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 horizontal <input checked="" type="checkbox"/> flat roof cone roof dome roof other (describe) External Floating Roof pontoon roof double deck roof Domed External (or Covered) Floating Roof Internal Floating Roof vertical column support self-supporting Variable Vapor Space lifter roof diaphragm Pressurized spherical cylindrical Underground Other (describe)	

III. TANK CONSTRUCTION AND OPERATION INFORMATION (*check which one applies*)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 19 – 26 in section VII

IV. SITE INFORMATION (*check which one applies*)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 27 – 33 in section VII

V. LIQUID INFORMATION (*check which one applies*)

Refer to enclosed TANKS Summary Sheets

☒ Refer to the responses to items 34 – 39 in section VII

Attachment G: Storage Vessel Emission Unit Data Sheet (Produced Water)

Provide the following information for each new or modified bulk liquid storage tank.

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply):

Does Not Apply Rupture Disc (psig)

Carbon Adsorption¹ Inert Gas Blanket of _____

☒ Vent to Vapor Combustion Device¹ (vapor combustors, flares, thermal oxidizers) Condenser¹

Conservation Vent (psig)

Other¹ (describe) Vacuum Setting Pressure Setting Emergency Relief Valve (psig)

¹ Complete appropriate Air Pollution Control Device Sheet

41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).									
Material Name and CAS No.	Flashing Loss		Breathing Loss		Working Loss		Total Emissions Loss		
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
	<i>Please see Tables 6 and 7</i>								

1 EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)
Remember to attach emissions calculations, including TANKS Summary Sheets and other modeling summary sheets if applicable.

SECTION VII (required if did not provide TANKS Summary Sheets)

TANK CONSTRUCTION AND OPERATION INFORMATION			
19. Tank Shell Construction: Steel			
20A. Shell Color: Green		20B. Roof Color: Green	
20C. Year Last Painted: 2016			
21. Shell Condition (if metal and unlined): No Rust			
22A. Is the tank heated? No		22B. If yes, operating temperature:	
		22C. If yes, how is heat provided to tank?	
23. Operating Pressure Range (psig): 0			
24. Is the tank a Vertical Fixed Roof Tank ? Yes		24A. If yes, for dome roof provide radius (ft):	
		24B. If yes, for cone roof, provide slop (ft/ft):	
25. Complete item 25 for Floating Roof Tanks Does not apply			
25A. Year Internal Floaters Installed:			
25B. Primary Seal Type (check one): Metallic (mechanical) shoe seal Liquid mounted resilient seal			
25C. Is the Floating Roof equipped with a secondary seal? Yes No			
25D. If yes, how is the secondary seal mounted? (check one) Shoe Rim Other (describe):			
25E. Is the floating roof equipped with a weather shield? Yes No			
25F. Describe deck fittings:			
26. Complete the following section for Internal Floating Roof Tanks Does not apply			
26A. Deck Type: Bolted Welded		26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction:			
26D. Deck seam length (ft.):	26E. Area of deck (ft2):	26F. For column supported	26G. For column supported

Attachment G: Storage Vessel Emission Unit Data Sheet (Produced Water)

Provide the following information for each new or modified bulk liquid storage tank.

SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: Charleston, WV			
28. Daily Avg. Ambient Temperature (°F): 55.3		29. Annual Avg. Maximum Temperature (°F): 75.94	
30. Annual Avg. Minimum Temperature (°F): 65.9		31. Avg. Wind Speed (mph): 5.9	
32. Annual Avg. Solar Insulation Factor (BTU/ft2-day): 1030.235999		33. Atmospheric Pressure (psia): 14.8	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): 51.7	34A. Minimum (°F): 39.5	34B. Maximum (°F): 63.8	
35. Avg. operating pressure range of tank (psig): 0	35A. Minimum (psig): 0	35B. Maximum (psig): 0	
36A. Minimum liquid surface temperature (°F): 39.5		36B. Corresponding vapor pressure (psia): 0.1836	
37A. Avg. liquid surface temperature (°F): 51.7		37B. Corresponding vapor pressure (psia): 0.2594	
38A. Maximum liquid surface temperature (°F): 63.8		38B. Corresponding vapor pressure (psia): 0.3598	
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			
39A. Material name and composition:	Produced Water		
39B. CAS number:	mix of HC and water		
39C. Liquid density (lb/gal):	8.33		
39D. Liquid molecular weight (lb/lb-mole):	18.0156		
39E. Vapor molecular weight (lb/lb-mole):	18.3431		
39F. Maximum true vapor pressure (psia):	0.4464		
39G. Max Reid vapor pressure (psi):	1.02275		
39H. Months Storage per year. From: To:	year round		

Attachment G: Natural Gas Fired Fuel Burning Units

Emission Data Sheet

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

Emission Unit ID # ¹	Emission Point ID# ²	Emission Unit Description (Manufacturer / Model #)	Year Installed/Modified	Type ³ and Date of Change	Control Device ⁴	Design Heat Input (mmBtu/hr) ⁵	Fuel Heating Value (Btu/scf) ⁶
H001	EP-H001	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H002	EP-H002	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H003	EP-H003	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H004	EP-H004	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H005	EP-H005	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H006	EP-H006	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H007	EP-H007	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H008	EP-H008	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
H009	EP-H009	Gas Production Unit Heater	2016	New	--	1.50	1,247.06
ENG001	EP-ENG001	Engine (Kubota DG972-E2)	2016	New	--	--	1,247.06
EC001	EC001	Enclosed Combustor (Cimmarron 48", Model No. 700-TI-603-D-31C)	2016	New	EC001	6.6	1,247.06

¹ Enter the appropriate Emission Unit (or Sources) identification numbers for each fuel burning unit located at the production pad. Gas Producing Unit Burners should be designated GPU-1, GPU-2, etc. Heater Treater(s) 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 Treater(s) 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 Complete appropriate air pollution control device sheet for any control device.

⁵ Enter design heat input capacity in mmBtu/hr.

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

Attachment G: Natural Gas-Fired Compressor Engine (RICE)

Emission Unit Data Sheet

Complete this section for any natural gas-fired reciprocating internal combustion engine.

Emission Unit (Source) ID No.		ENG001	
Emission Point ID No.		EP-ENG001	
Engine Manufacturer and Model		Engine (Kubota DG972-E2)	
Manufacturer's Rated bhp/rpm		24 HP @ 3600 rpm	
Source Status		NS	
Date Installed/Modified/Removed		2016	
Engine Manufactured/Reconstruction Date		2013	
Is this engine subject to 40CFR60, Subpart JJJJ?		Yes	
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60, Subpart JJJJ? (Yes or No)		Yes	
Is this engine subject to 40CFR63, Subpart ZZZZ? (yes or no)		Yes	
Engine, Fuel and Combustion Data	Engine Type	RB4S	
	APCD Type	-	
	Fuel Type	RG	
	H2S (gr/100 scf)	0	
	Operating bhp/rpm	16.5 HP @ 2400 rpm	
	BSFC (Btu/bhp-hr)	9773	
	Fuel throughput (ft ³ /hr)	193	
	Fuel throughput (MMft ³ /yr)	1.6907	
Operation (hrs/yr)		8760	
Reference	Potential Emissions	lbs/hr	tons/yr
MD	NO _x	0.3158	1.3831
MD	CO	5.6445	24.7228
AP	VOC	0.0071	0.0311
AP	SO ₂	0.0001	0.0006
AP	PM ₁₀	0.0024	0.0104
AP	Formaldehyde	0.0049	0.0215
MRR	Proposed Monitoring:	Monitor engine setting adjustments to ensure these are consistent with manufacturer's instructions.	
	Proposed Recordkeeping:	1) Maintain records of maintenance performed on engines. 2) Documentation from manufacturer that engine is certified to meet emission standards	
	Proposed Reporting:	N/A	

Attachment G: Tank Truck Loading

Emissions Unit Data Sheet

*Furnish the following information for each new or modified bulk liquid transfer area or loading rack at the natural gas production pad.
This form is to be used for bulk liquid transfer operations to tank trucks.*

1. Emission Unit ID: L001, L002		2. Emission Point ID: EP-L001, EP-L002		3. Year Installed/Modified: 2016	
4. Emission Unit Description: CONDENSATE AND PRODUCED WATER					
5. Loading Area Data					
5A. Number of pumps: 2		5B. Number of liquids loaded: 2		5C. Maximum number of tank trucks loading at one time: 2	
6. Describe cleaning location, compounds and procedure for tank trucks: For hire tank trucks are used and are cleaned at the operator's dispatch terminal. These trucks are in dedicated service and cleaned only prior to repair or leak tests. Cleaning materials include water, steam, detergent, and solvents which are applied using hand held pressurized spray nozzles.					
7. Are tank trucks pressure tested for leaks at this or any other location? X Yes No If YES, 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.					
8. Projected Maximum Operating Schedule (for rack or transfer point as a whole):					
Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.	
hours/day	9	9	9	9	
days/week	5	5	5	5	
9. Bulk Liquid Data <i>(add pages as necessary)</i>					
Liquid Name		Condensate	Produced Water		
Max. daily throughput (1000 gal/day)		9.45	113.4		
Max. annual throughput (1000 gal/yr)		3,449.25	41,391.00		
Loading Method ¹		BF	BF		
Max. Fill Rate (gal/min)		168	168		
Average Fill Time (min/loading)		50	50		
Max. Bulk Liquid Temperature (°F)		72.1	72.1		
True Vapor Pressure ²		1.46	0.45		
Cargo Vessel Condition ³		U	U		
Control Equipment or Method ⁴		None	None		
Minimum collection efficiency (%)		0	0		
Minimum control efficiency (%)		0	0		
Maximum	Loading (lb/hr)	7.98	1.16		
Emission Rate	Annual (ton/yr)	1.37	2.38		
Estimation Method ⁵		Promax	Promax		
Notes:					
1 BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill					
2 At maximum bulk liquid temperature					
3 B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)					
4 List as many as apply (complete and submit appropriate <i>Air Pollution Control Device Sheets as Attachment "H"</i>): CA = Carbon Adsorption VB = Dedicated Vapor Balance (closed system) ECD = Enclosed Combustion Device F = Flare TO = Thermal Oxidation or Incineration					
5 EPA = EPA Emission Factor as stated in AP-42					
10. Proposed Monitoring, Recordkeeping, Reporting, and Testing					
MONITORING		RECORDKEEPING			
1) Visual inspection to ensure that loading connections from storage tanks to trucks are leak-free.		1) Maintain records of condensate transferred from storage tanks. 2) Maintain records of produced water transferred from storage tanks.			
REPORTING N/A		TESTING N/A			
11. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty: N/A					

Attachment H

Air Pollution Control Device Data Sheet

Attachment H: Air Pollution Control Device

Vapor Combustion Control Device Sheet

Complete this vapor combustion control device sheet for each enclosed combustion device, flare, thermal oxidizer, or completion combustion device that is located at the natural gas production pad for the purpose of thermally destructing waste gas to control emissions of regulated pollutants to the atmosphere.

IMPORTANT: READ THE INSTRUCTIONS ACCOMPANYING THIS FORM BEFORE COMPLETING.																				
General Information																				
1. Control Device ID#: EC001		2. Installation Date: New																		
3. Maximum Rated Total Flow Capacity: 131,000 scfd	4. Maximum Design Heat Input: 6.6 MMBtu/hr		5. Design Heat Content: 2300 BTU/scf																	
Control Device Information																				
6. Select the type of vapor combustion control device being used: Elevated Flare																				
7. Manufacturer: Model No. Cimmaron, Model No. 48" HV ECD		8. Hours of operation per year: 8760																		
9. List the emission units whose emissions are controlled by this vapor combustion control device: (Emission Point ID#:) <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 25%;">10. Emission Unit ID#</td> <td style="width: 25%;">Emission Source Description:</td> <td style="width: 25%;">Emission Unit ID#</td> <td style="width: 25%;">Emission Source Description:</td> </tr> <tr> <td>TANKCOND001-010</td> <td>Condensate Tank</td> <td></td> <td></td> </tr> <tr> <td>TANKPW001-002</td> <td>PW Tanks</td> <td></td> <td></td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>					10. Emission Unit ID#	Emission Source Description:	Emission Unit ID#	Emission Source Description:	TANKCOND001-010	Condensate Tank			TANKPW001-002	PW Tanks						
10. Emission Unit ID#	Emission Source Description:	Emission Unit ID#	Emission Source Description:																	
TANKCOND001-010	Condensate Tank																			
TANKPW001-002	PW Tanks																			
If this vapor combustor controls emissions from more than six emission units, please attach additional pages.																				
11. Assist Type		12. Flare Height (ft)	13. Tip Diameter (ft)	14. Was the design per §60.18?																
Steam - Air - Pressure - <input checked="" type="checkbox"/> Non -		25	3.33	Yes																
Waste Gas Information																				
15. Maximum waste gas flow rate (scfm):	16. Heat value of waste gas stream (BTU/ft3)	17. Temperature of the emissions stream (°F)	18. Exit Velocity of the emissions stream (ft/s)																	
25.76	1,638.93	900	4.93E-02																	
19. Provide an attachment with the characteristics of the waste gas stream to be burned.																				
Pilot Information																				
20. Type/Grade of pilot fuel:	21. Number of pilot lights:	22. Fuel flow rate to pilot flame per pilot (scf/hr):	23. Heat input per pilot (BTU/hr):	24. Will automatic re-ignition be used?																
Natural Gas	1	12.6	12800	Yes																
25. If automatic re-ignition will be used, describe the method: Based on a monitoring system																				
26. Describe the method of controlling flame: Flame Rectification, a thermocouple equivalent																				
27. Is pilot flame equipped with a monitor to detect the presence of the flame? Yes		28. If yes, what type? Thermocouple																		
29. Pollutant(s) Controlled		30. % Capture Efficiency		31. Manufacturer's Guaranteed Control Efficiency (%)																
F/W/B Emissions from TANKCOND		98		98																
F/W/B Emissions from TANKPW		98		98																

Attachment H: Air Pollution Control Device

Vapor Combustion Control Device Sheet

Complete this vapor combustion control device sheet for each enclosed combustion device, flare, thermal oxidizer, or completion combustion device that is located at the natural gas production pad for the purpose of thermally destructing waste gas to control emissions of regulated pollutants to the atmosphere.

32. Has the control device been tested by the manufacturer and certified? Yes, see spec sheet.

33. Describe all operating ranges and maintenance procedures required by the manufacturer to maintain warranty: See spec sheet for operating ranges.

MONITORING

- 1) Report any period when visible emissions exceeded 5 minutes during any two-hour period.
- 2) Monitor the presence of pilot flame at all times with the Flame rectification system, a thermocouple equivalent.
- 3) Monitor visible emissions from the vapor combustor.
- 4) Monitor throughput to the vapor combustor.

RECORDKEEPING

- 1) Record the times and duration of periods when the pilot flame was not present.
- 2) Records of throughput to the vapor combustor.
- 3) Records of vapor combustor malfunction or shutdown which resulted in excess emissions.
- 4) Records of vapor combustor inspection and maintenance activities conducted.

REPORTING

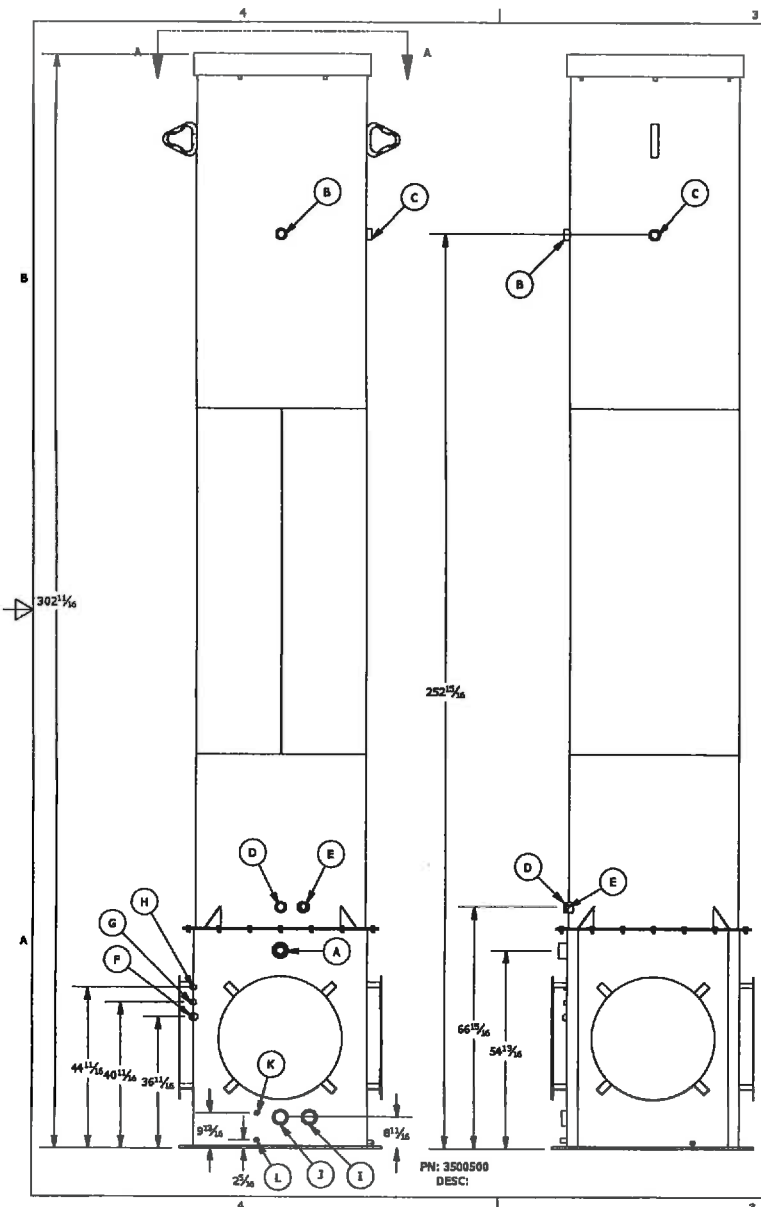
- 1) Report any period when visible emissions exceeded 5 minutes during any two-hour period.

34. Additional Information Attached? **YES**

Please attach a copy of manufacturer's data sheet. Please attach a copy of manufacturer's drawing.

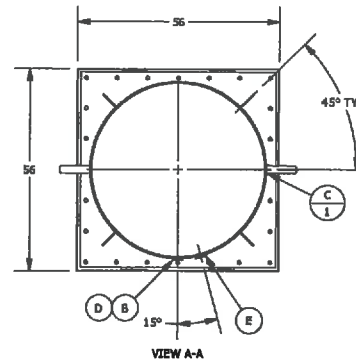
Please attach a copy of the manufacturer's performance testing.

If any of the requested information is not available, please contact the manufacturer.



**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/in²; 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
.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 VOLUME ECD

DATE: WO No.: SHEET: 1 OF 1

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

Attachment I

Emission Calculations

Table 1

Facility Information
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Oil and Gas Site General Information

Administrative Information	
Company Name	Antero Resources Corporation
Facility/Well Name	Willard Well Pad
Nearest City/Town	New Milton
API Number/SIC Code	1311
Latitude/Longitude	39.255373, -80.690733
County	Doddridge

Technical Information	
Max Condensate Site Throughput (bbl/day):	225
Max Produced Water Site Throughput (bbl/day):	2,700
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	No

Equipment/Processes at Site	
Equipment/Process Types	How many for this site?
Fugitives	9
IC Engines	1
Turbines	0
Diesel Engines	0
Gas Production Unit Heaters	9
Condensate Tanks	10
Produced Water Tanks	2
Miscellaneous Tanks	0
Loading Jobs	2
Glycol Units	0
Amine Units	0
Enclosed Combustor - Vapor Combustion Control Device	1

Table 2

Uncontrolled/Controlled Emissions Summary
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Emission Source	VOC		NO _x		CO _{2e}		CO		SO ₂		PM _{2.5}		PM ₁₀		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)
UNCONTROLLED (Fugitives, Storage Tanks, Gas Production Unit Heaters)																								
Fugitive Emissions (Component Count, PCV and Hauling) ¹	3.5332	15.4756			80.773	353.78							2.8663	3.7783			0.2667	1.1680	0.0012	0.0051	5.43E-02	2.38E-01		
Flashing, Working and Breathing (F/W/B) Losses ²	73.55	322.2			704.9	3,087.5											2.411	10.559	0.0408	0.1787	0.1483	0.6494		
Engine Emissions ³	0.0071	0.0311	0.3158	1.3831	27.78	121.66	5.6445	24.7228	0.0001	0.0006	0.0024	0.0104	0.0023	0.0100			0.0055	0.0241	0.0004	0.0017	0.0000	0.0002	0.0049	0.0215
Gas Production Unit Heater Emissions ⁴	0.0595	0.2608	1.0825	4.7416	1,306.78	5,723.67	0.9093	3.9829	0.0065	0.0284	0.0823	0.3604	0.0823	0.3604	5.41E-06	2.37E-05	2.04E-02	8.93E-02	2.27E-05	9.96E-05			0.0008	0.0036
TOTALS:	77.1543	337.9357	1.3983	6.1246	2120.2436	9286.6672	6.5538	28.7057	0.0066	0.0291	0.0847	0.3708	2.9509	4.1487	5.41E-06	2.37E-05	2.7033	11.8405	0.0424	0.1856	0.2026	0.8875	0.0057	0.0251

UNCONTROLLED (Truck Loading Emissions)

Truck Loading Emissions ⁵	4.724	0.810			8.733	3.367											0.0132	0.0023	1.37E-04	2.46E-05	0.0023	0.0004		
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CONTROLLED EMISSIONS

Enclosed Combustor Emissions (from F/W/B losses) ⁶	1.4712	6.4437	0.1558	0.6826	428.7549	1877.9465	0.1309	0.5734	7.56E-06	3.31E-05	0.0089	0.0389	0.0118	0.0519	7.79E-07	3.41E-06	0.0482	0.2113	8.16E-04	3.57E-03	0.0030	0.0130	9.45E-07	4.14E-06
Controlled Fugitive Emissions from Hauling													1.4332	1.8892										
TOTALS:	1.4712	6.4437	0.1558	0.6826	428.7549	1877.9465	0.1309	0.5734	7.56E-06	3.31E-05	0.0089	0.0389	1.4450	1.9410	7.79E-07	3.41E-06	0.0482	0.2113	0.0008	0.0036	0.0030	0.0130	9.45E-07	4.14E-06

POTENTIAL TO EMIT⁷	5.0710	23.0216	1.5542	6.8072	1844.0791	8080.4332	6.6847	29.2791	0.0066	0.0291	0.0935	0.4097	1.5296	2.3114	6.19E-06	2.71E-05	0.3408	1.4949	0.0024	0.0104	0.0573	0.2514	0.0057	0.0251
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Enter any notes here:

- 1 - See Tables 4 and 5 for fugitive emission calculations; Table 12 for PM emissions from hauling.
2 - See Tables 6 and 7 for tanks emission calculations.
3 - See Table 13 for engine emissions.
4 - See Table 9 for gas production unit heater emission calculations.
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 225 barrels per day, VOC emissions would be 4.7236 pounds per hour when there is truck loading activity. Average hourly VOC emissions from truck loading per year is 0.185 pound per hour.
6 - See Table 10 and 11 for enclosed combustor emission calculations.
7 - The hourly potential to emit is the sum of emissions from gas production unit heaters, engine, storage tanks, fugitives and enclosed combustor. Does not include emissions from loading (see footnote 5). The total TPY PTE is the sum of all emissions.
PM 10 TPY is the sum of uncontrolled hauling and other PM10 sources.

Table 3

**Permit Summary
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation**

Pollutant		Emissions		Threshold	Threshold Exceeded?	
		Uncontrolled	Controlled		Uncontrolled	Controlled
VOC	lbs/hr	77.1543	5.0710	6	Yes	
	tons/yr	338.7461	23.0216	10	Yes	Yes
NO _x	lbs/hr	1.3983	1.5542	6		
	tons/yr	6.1246	6.8072	10		
CO	lbs/hr	6.5538	6.6847	6	Yes	Yes
	tons/yr	28.7057	29.2791	10	Yes	Yes
SO ₂	lbs/hr	0.0066	0.0066	6		
	tons/yr	0.0291	0.0291	10		
PM _{2.5}	lbs/hr	8.47E-02	9.35E-02	6		
	tons/yr	3.71E-01	4.10E-01	10		
PM ₁₀	lbs/hr	2.9509	1.5296	6		
	tons/yr	4.1487	2.3114	10		
Lead	lbs/hr	5.41E-06	6.19E-06	6		
	tons/yr	2.37E-05	2.71E-05	10		
Total HAPs	lbs/hr	2.7033	0.3408	2	Yes	
	tons/yr	11.8428	1.4949	5	Yes	
Total TAPs	lbs/hr	0.0481	0.0081	1.14		
n-Hexane	lbs/hr	2.2362	0.2483			
	tons/yr	9.7959	1.0498			
Toluene	lbs/hr	0.1191	0.0137			
	tons/yr	0.5218	0.0566			
Ethylbenzene	lbs/hr	0.0973	0.0241			
	tons/yr	0.4263	0.1013			
Xylenes	lbs/hr	0.2026	0.0596			
	tons/yr	0.8879	0.2514			
Benzene	lbs/hr	0.0424	0.0025			
	tons/yr	0.1856	0.0104			

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

**Fugitive Emissions
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation**

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

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

Gas					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
450	Valves	Gas VOC	0.004500	0.39	7,452.68
		Non VOC	0.004500	1.64	31,573.12
531	Connectors	VOC	0.000200	0.02	390.85
		Non-VOC	0.000200	0.09	1,655.83
117	Flanges	VOC	0.000390	0.01	167.93
		Non-VOC	0.000390	0.04	711.45
Total VOCs:				0.42	8,011.47
Total THC:				2.18	41,951.87

Light Liquid Weight Fraction From Analysis:	VOC frac	0.977
	Benzene frac	0.000
	Toluene	0.004
	Ethylbenzene	0.008
	Xylenes	0.021
	n-hexane	0.023
	Methane	0.008

Light Liquid					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
468	Valves	Light Liquid VOC	0.002500	1.14	22,037.16
		Light Liquid Non-VOC		0.03	511.08
Total VOC:				1.14	22,037.16
Total THC:				1.17	22,548.24

Fugitive Total Emissions			
	Annual Emissions (lb/yr)	Annual Emissions (lb/hr)	Annual Emissions (tpy)
VOC	30,048.63	3.43	15.02
Ethylbenzene		0.02	0.09
Toluene		0.01	0.05
Xylenes		0.05	0.24
n-Hexane		0.17	0.73
TAPs (Benzene)		0.00	0.01
HAPs		0.25	1.11
CO _{2e}	636,354.17	72.64	318.18

Enter Notes Here:	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
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Number of PCVs	36
Bleed Rate (scf/day/PCV)	6.6
Total Bleed Rate (scf/day)	237.6

Component	Mol%	Molecular Weight (lb/lb-mole)	Component Flow (scf/day)	Component Moles (lb-moles)	Component Emissions		
					(lbs/day)	(lbs/hr)	(tons/year)
H2S	0	34.08	0	0.00	0.00	0.00	0.00
Nitrogen	0.4946	14.01	1.1751696	0.00	0.04	0.00	0.01
Carbon Dioxide	0.1467	44.01	0.3485592	0.00	0.04	0.00	0.01
Methane	77.6927	16.04	184.5978552	0.49	7.80	0.33	1.42
Ethane	14.1987	30.07	33.7361112	0.09	2.67	0.11	0.49
Propane	4.4938	44.1	10.6772688	0.03	1.24	0.05	0.23
Isobutane	0.5666	58.12	1.3462416	0.00	0.21	0.01	0.04
n-Butane	1.1838	58.12	2.8127088	0.01	0.43	0.02	0.08
Isopentane	0.3749	72.15	0.8907624	0.00	0.17	0.01	0.03
n-Pentane	0.2914	72.15	0.6923664	0.00	0.13	0.01	0.02
2-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
3-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
n-Hexane	0.5451	86.18	1.2951576	0.00	0.29	0.01	0.05
Methylcyclopentane	0	84.16	0	0.00	0.00	0.00	0.00
Benzene	0	78.11	0	0.00	0.00	0.00	0.00
2-Methylhexane	0	100.2	0	0.00	0.00	0.00	0.00
3-Methylhexane	0	100.2	0	0.00	0.00	0.00	0.00
Heptane	0	100.21	0	0.00	0.00	0.00	0.00
Methylcyclohexane	0	98.186	0	0.00	0.00	0.00	0.00
Toluene	0	92.14	0	0.00	0.00	0.00	0.00
Octane	0	114.23	0	0.00	0.00	0.00	0.00
Ethylbenzene	0	106.17	0	0.00	0.00	0.00	0.00
m & p-Xylene	0	106.16	0	0.00	0.00	0.00	0.00
o-Xylene	0	106.16	0	0.00	0.00	0.00	0.00
Nonane	0	128.2	0	0.00	0.00	0.00	0.00
C10+	0	174.28	0	0.00	0.00	0.00	0.00

	lb/hr	tpy
VOC Emissions	0.1030	0.4513
Benzene Emissions	0.0000	0.0000
Toluene Emissions	0.0000	0.0000
Ethylbenzene Emissions	0.0000	0.0000
Xylene Emissions	0.0000	0.0000
n-Hexane Emissions	0.0123	0.0537
HAPs Emissions	0.0123	0.0537
TAPs Emissions	0.0000	0.0000
CO _{2e} emissions	8.1294	35.6070

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

Uncontrolled Flashing Emissions
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

# Hours Operational	8760
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	Condensate Tank Flashing Losses			Produced Water Tank Flashing Losses		
	Vapor Mass Fraction	Flashing Losses		Vapor Mass Fraction	Flashing Losses	
	wt%	lbs/hr	tpy	wt%	lbs/hr	tpy
Water	0.1828	0.2182	0.9556	2.7432	0.0000	0.0000
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0639	0.0763	0.3341	0.3876	0.0573	0.2510
Carbon Dioxide	0.2445	0.2918	1.2780	2.2250	0.3289	1.4406
Methane	15.6885	18.7232	82.0075	61.9612	9.1596	40.1192
Ethane	27.2032	32.4650	142.1969	21.5602	3.1872	13.9600
Propane	25.1745	30.0440	131.5928	8.0707	1.1931	5.2257
Isobutane	6.1451	7.3337	32.1217	0.4357	0.0644	0.2821
n-Butane	11.0079	13.1372	57.5408	1.4414	0.2131	0.9333
Isopentane	4.1206	4.9176	21.5391	0.3081	0.0456	0.1995
n-Pentane	3.2222	3.8454	16.8430	0.2261	0.0334	0.1464
2-Methylpentane	1.1831	1.4119	6.1843	0.0368	0.0054	0.0238
3-Methylpentane	0.7484	0.8932	3.9120	0.0616	0.0091	0.0399
n-Hexane	1.6953	2.0233	8.8619	0.0415	0.0061	0.0269
Methylcyclopentane	0.1239	0.1478	0.6475	0.0290	0.0043	0.0188
Benzene	0.0292	0.0348	0.1525	0.0398	0.0059	0.0257
2-Methylhexane	0.4928	0.5881	2.5758	0.0133	0.0020	0.0086
3-Methylhexane	0.3922	0.4680	2.0499	0.0111	0.0016	0.0072
Heptane	0.6350	0.7578	3.3191	0.0187	0.0028	0.0121
Methylcyclohexane	0.3816	0.4555	1.9950	0.0586	0.0087	0.0380
Toluene	0.0779	0.0930	0.4072	0.0993	0.0147	0.0643
Octane	0.6718	0.8017	3.5115	0.0117	0.0017	0.0076
Ethylbenzene	0.0542	0.0647	0.2834	0.0683	0.0101	0.0442
m & p-Xylene	0.0379	0.0453	0.1984	0.0473	0.0070	0.0306
o-Xylene	0.0679	0.0810	0.3547	0.0871	0.0129	0.0564
Nonane	0.2264	0.2701	1.1832	0.0061	0.0009	0.0040
C10+	0.1294	0.1545	0.6766	0.0104	0.0015	0.0067
Total VOCs	56.617	67.57	296.0	11.123	1.6443	7.2019
Total CO _{2e}		468.37	2,051.5		229.32	1,004.4
Total TAPs (Benzene)		0.0348	0.1525		0.0059	0.0257
Toluene		0.0930	0.4072		0.0147	0.0643
Ethylbenzene		0.0647	0.2834		0.0101	0.0442
Xylenes		0.1263	0.5531		0.0199	0.0871
n-Hexane		2.023	8.862		0.0061	0.0269
Total HAPs		2.342	10.258		0.0567	0.2482
Total	100.00	119.34	522.7	100.00	14.377	62.97

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

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

Condensate Tank Information	
Number of Tanks	10
Maximum Working Losses (lbs/hr)	3.5989
Maximum Breathing Losses (lbs/hr)	3.7370

	Condensate Tank W/B Losses						
	Vapor Mass Fraction	Working Losses		Breathing Losses		Max W/B Losses	
	wt%	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0033	0.0001	0.0005	0.0001	0.0005	0.0002	0.0011
Carbon Dioxide	0.3342	0.0120	0.0527	0.0125	0.0547	0.0245	0.1074
Methane	3.8652	0.1391	0.6093	0.1444	0.6327	0.2835	1.2419
Ethane	36.6156	1.3177	5.7717	1.3683	5.9932	2.6861	11.7649
Propane	29.1644	1.0496	4.5972	1.0899	4.7736	2.1395	9.3708
Isobutane	6.6427	0.2391	1.0471	0.2482	1.0873	0.4873	2.1344
n-Butane	11.7297	0.4221	1.8490	0.4383	1.9199	0.8605	3.7689
Isopentane	4.1775	0.1503	0.6585	0.1561	0.6838	0.3065	1.3423
n-Pentane	3.2272	0.1161	0.5087	0.1206	0.5282	0.2367	1.0369
2-Methylpentane	1.1491	0.0414	0.1811	0.0429	0.1881	0.0843	0.3692
3-Methylpentane	0.7268	0.0262	0.1146	0.0272	0.1190	0.0533	0.2335
n-Hexane	0.1119	0.0040	0.0176	0.0042	0.0183	0.0082	0.0359
Methylcyclopentane	0.1140	0.0041	0.0180	0.0043	0.0187	0.0084	0.0366
Benzene	0.0017	0.0001	0.0003	0.0001	0.0003	0.0001	0.0006
2-Methylhexane	0.0307	0.0011	0.0048	0.0011	0.0050	0.0023	0.0099
3-Methylhexane	0.3694	0.0133	0.0582	0.0138	0.0605	0.0271	0.1187
Heptane	0.5512	0.0198	0.0869	0.0206	0.0902	0.0404	0.1771
Methylcyclohexane	0.3376	0.0122	0.0532	0.0126	0.0553	0.0248	0.1085
Toluene	0.0097	0.0004	0.0015	0.0004	0.0016	0.0007	0.0031
Octane	0.5499	0.0198	0.0867	0.0205	0.0900	0.0403	0.1767
Ethylbenzene	0.0125	0.0005	0.0020	0.0005	0.0021	0.0009	0.0040
m & p-Xylene	0.0113	0.0004	0.0018	0.0004	0.0019	0.0008	0.0036
o-Xylene	0.0176	0.0006	0.0028	0.0007	0.0029	0.0013	0.0057
Nonane	0.1658	0.0060	0.0261	0.0062	0.0271	0.0122	0.0533
C10+	0.0805	0.0029	0.0127	0.0030	0.0132	0.0059	0.0259
Total VOCs	59.182	2.1299	9.329	2.2116	9.6868	4.3415	19.016
Total CO _{2e}		3.4896	15.2846	3.6236	15.8712	7.1132	31.156
Total TAPs (Benzene)		0.0001	0.0003	0.0001	0.0003	0.0001	0.0006
Toluene		0.0004	0.0015	0.0004	0.0016	0.0007	0.0031
Ethylbenzene		0.0005	0.0020	0.0005	0.0021	0.0009	0.0040
Xylenes		0.0010	0.0046	0.0011	0.0047	0.0021	0.0093
n-Hexane		0.0040	0.0176	0.0042	0.0183	0.0082	0.0359
Total HAPs		0.0059	0.0260	0.0062	0.0270	0.0121	0.0529
Total	100.00	3.5989	15.7630	3.7370	16.3679	7.3358	32.131

Table 7

Uncontrolled Working and Breathing Losses
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Produced Water Tank Information	
Number of Tanks	2
Maximum Working Losses (lbs/hr)	0.1267
Maximum Breathing Losses (lbs/hr)	0.0082

	Produced Water Tank W/B Losses						
	Vapor Mass Fraction	Working Losses		Breathing Losses		Max W/B Losses	
	wt%	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0075	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Carbon Dioxide	2.8862	0.0037	0.0160	0.0002	0.0010	0.0039	0.0171
Methane	3.3148	0.0042	0.0184	0.0003	0.0012	0.0045	0.0196
Ethane	1.0645	0.0013	0.0059	0.0001	0.0004	0.0014	0.0063
Propane	0.0971	0.0001	0.0005	0.0000	0.0000	0.0001	0.0006
Isobutane	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Butane	0.0033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Isopentane	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Pentane	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Methylpentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3-Methylpentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Hexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Benzene	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Methylhexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3-Methylhexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Heptane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Toluene	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Octane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ethylbenzene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
m & p-Xylene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
o-Xylene	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nonane	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C10+	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total VOCs	0.1015	0.0001	0.0006	0.0000	0.0000	0.0001	0.0006
Total CO _{2e}		0.1086	0.4759	0.0071	0.0309	0.1157	0.5068
Total TAPs (Benzene)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Toluene		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ethylbenzene		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Xylenes		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
n-Hexane		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total HAPs		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	100.00	0.1267	0.5549	0.0082	0.0360	0.1349	0.5909

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

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

Annual Loading	Oil Truck Loading	Water Truck Loading
RVP	2.51	1.0228
Annual Average Temp (F)	72.1	72.1
S (saturation factor)	0.6	0.6
P (true vapor pressure)	1.46	0.45
M (MW of vapor)	38.60	18.34
Collection Efficiency (%)	0	0
Loading Loss (lb/10 ³ gal)*	0.79	0.12
Maximum Throughput (gallons/hr)	10,080	10,080
Average Throughput (gallons/yr)	3,449,250	41,391,000
Loading Emissions (lbs/hr)	7.98	1.16
Loading Emissions (tpy)	1.37	2.38

	Condensate Tank Loading Losses			Produced Water Tank Loading Losses		
	Vapor Mass Fraction wt%	Loading Losses		Vapor Mass Fraction wt%	Loading Losses	
		lbs/hr	tpy		lbs/hr	tpy
H2S	0.0000	0.00	0.00	0.0000	0.00E+00	0.00E+00
Nitrogen	0.0033	0.00	0.00	0.0075	8.66E-05	1.78E-04
Carbon Dioxide	0.3342	0.03	0.00	2.8862	3.35E-02	6.88E-02
Methane	3.8652	0.31	0.05	3.3148	3.85E-02	7.90E-02
Ethane	36.6156	2.92	0.50	1.0645	1.24E-02	2.54E-02
Propane	29.1644	2.33	0.40	0.0971	1.13E-03	2.31E-03
Isobutane	6.6427	0.53	0.09	0.0007	7.62E-06	1.56E-05
n-Butane	11.7297	0.94	0.16	0.0033	3.79E-05	7.79E-05
Isopentane	4.1775	0.33	0.06	0.0002	2.03E-06	4.17E-06
n-Pentane	3.2272	0.26	0.04	0.0001	1.09E-06	2.23E-06
2-Methylpentane	1.1491	0.09	0.02	0.0000	3.38E-08	6.95E-08
3-Methylpentane	0.7268	0.06	0.01	0.0000	1.37E-07	2.82E-07
n-Hexane	0.1119	0.01	0.00	0.0000	1.48E-09	3.03E-09
Methylcyclopentane	0.1140	0.01	0.00	0.0000	1.39E-07	2.86E-07
Benzene	0.0017	0.00	0.00	0.0001	5.85E-07	1.20E-06
2-Methylhexane	0.0307	0.00	0.00	0.0000	2.00E-10	4.11E-10
3-Methylhexane	0.3694	0.03	0.01	0.0000	2.49E-09	5.12E-09
Heptane	0.5512	0.04	0.01	0.0000	3.10E-09	6.37E-09
Methylcyclohexane	0.3376	0.03	0.00	0.0000	6.00E-08	1.23E-07
Toluene	0.0097	0.00	0.00	0.0001	7.03E-07	1.44E-06
Octane	0.5499	0.04	0.01	0.0000	3.79E-10	7.78E-10
Ethylbenzene	0.0125	0.00	0.00	0.0000	2.72E-07	5.58E-07
m & p-Xylene	0.0113	0.00	0.00	0.0000	2.10E-07	4.32E-07
o-Xylene	0.0176	0.00	0.00	0.0000	4.05E-07	8.32E-07
Nonane	0.1658	0.01	0.00	0.0000	9.30E-11	1.91E-10
C10+	0.0805	0.01	0.00	0.0000	3.42E-11	7.03E-11
Total VOCs	59.1815	4.722	0.808	0.1015	1.18E-03	2.42E-03
Total CO _{2e}		7.737	1.3238		0.9951	2.0431
Total TAPs (Benzene)		0.0001	0.0000		0.0000	0.0000
Toluene		0.0008	0.0001		0.0000	0.0000
Ethylbenzene		0.0010	0.0002		0.0000	0.0000
Xylenes		0.0023	0.0004		0.0000	0.0000
n-Hexane		0.0089	0.0015		0.0000	0.0000
Total HAPs		0.0131	0.0022		0.0000	0.0000
Total	100.0000	7.9796	1.3653	100.0000	1.1604	2.3825

Enter any notes here

Vapor mass fractions and loading losses from Promax output

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

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

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

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

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

Loading emissions are vented to the atmosphere.

Table 9

Gas Production Unit Heater Emissions
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Number of Units	9
GPU Heater Rating (MMBtu/hr)	1.50
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,247

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NO _x	100	1.083	4.742
CO	84	0.909	3.983
CO ₂	120,000	1299.055	5689.863
Lead	0.0005	5.41E-06	2.37E-05
N ₂ O	2.2	0.024	0.104
PM (Total)	7.6	0.082	0.360
SO ₂	0.6	0.006	0.028
TOC	11	0.119	0.522
Methane	2.3	0.025	0.109
VOC	5.5	0.060	0.261
HAPS			
2-Methylnaphthalene	2.40E-05	2.60E-07	1.14E-06
Benzene	2.10E-03	2.27E-05	9.96E-05
Dichlorobenzene	1.20E-03	1.30E-05	5.69E-05
Fluoranthene	3.00E-06	3.25E-08	1.42E-07
Fluorene	2.80E-06	3.03E-08	1.33E-07
Formaldehyde	7.50E-02	8.12E-04	3.56E-03
Hexane	1.80E+00	1.95E-02	8.53E-02
Naphthalene	6.10E-04	6.60E-06	2.89E-05
Phenanathrene	1.70E-05	1.84E-07	8.06E-07
Toluene	3.40E-03	3.68E-05	1.61E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.060	0.261
TOTAL Uncontrolled HAPs	0.020	0.089
TOTAL Uncontrolled TAPs (Benzene)	0.000	0.000
TOTAL Uncontrolled TAPs (Formaldehyde)	0.001	0.004
TOTAL CO _{2e} Emissions	1,306.78	5,723.67

Enter any notes here:

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

Table 10

Enclosed Combustor Emissions
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

General Information	
Unit Name:	EC001

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

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

Destruction Efficiency	
VOC percent destruction efficiency (%)	98
H ₂ S percent destruction efficiency (%)	98

Enclosed Combustor operating hours	8760
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Stream Information							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor (Enter Name of Each Stream Here)	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
Maximum Expected Hourly Volumetric Flow Rate of Stream (scf/hr)	12.6	--	1,173.42	297.44	72.13	2.79	1,558.37
Maximum Expected Annual Volumetric Flow Rate of Stream (scf/yr)	110,376.00	--	10,279,125.53	2,605,563.18	631,842.40	24,450.50	13,651,357.60
Heating Content (Btu/ft ³)	1,247		1,798.62	1,045.19	1,798.62	1,045.19	1,638.93

Mass Flow Rates of the Vapors Sent to this Control Device, Hourly Basis (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
H ₂ S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	67.569	1.644	4.341	0.000	73.55
Benzene	-	-	0.035	0.006	0.000	0.000	0.041
Toluene	-	-	0.093	0.015	0.001	0.000	0.108
Ethylbenzene	-	-	0.065	0.010	0.001	0.000	0.076
Xylenes	-	-	0.126	0.020	0.002	0.000	0.148
n-Hexane	-	-	2.023	0.006	0.008	0.000	2.038
HAPs	-	-	2.342	0.057	0.012	0.000	2.411
Total Mass Flow	-	-	119.343	14.377	7.336	0.135	141.191
Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)							
H ₂ S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	295.950	7.202	19.016	0.001	322.168
Benzene	-	-	0.152	0.026	0.001	0.000	0.179
Toluene	-	-	0.407	0.064	0.003	0.000	0.475
Ethylbenzene	-	-	0.283	0.044	0.004	0.000	0.332
Xylenes	-	-	0.553	0.087	0.009	0.000	0.649
n-Hexane	-	-	8.862	0.027	0.036	0.000	8.925
HAP	-	-	10.258	0.248	0.053	0.000	10.559
Total Mass Flow	-	-	522.722	62.973	32.131	0.591	618.417

Table 10

Enclosed Combustor Emissions
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Controlled Emissions							
Hourly (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.001	-	0.117	0.030	0.007	0.000	0.16
CO	0.001	-	0.099	0.025	0.006	0.000	0.13
PM2.5	0.000	-	0.007	0.002	0.000	0.000	0.01
PM10	0.000	-	0.009	0.002	0.001	0.000	0.01
H2S	0.000	-	0.000	0.000	0.000	0.000	0.00
SO ₂	0.000	-	0.000	0.000	0.000	0.000	0.00
CO ₂	1.512	-	-	-	-	-	1.51
Total VOC	0.000	-	1.351	0.033	0.087	0.000	1.47
Benzene	0.000	-	0.001	0.000	0.000	0.000	0.00
Toluene	0.000	-	0.002	0.000	0.000	0.000	0.00
Ethylbenzene	0.000	-	0.001	0.000	0.000	0.000	0.00
Xylenes	0.000	-	0.003	0.000	0.000	0.000	0.00
n-Hexane	0.000	-	0.040	0.000	0.000	0.000	0.04
HAP	0.000	-	0.047	0.001	0.000	0.000	0.05
N ₂ O	0.000	-	0.003	0.001	0.000	0.000	0.00
Lead	0.000	-	0.000	0.000	0.000	0.000	0.00
Formaldehyde	0.000	-	-	-	-	-	0.00
Annual (tpy)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.006	-	0.514	0.130	0.032	0.001	0.68
CO	0.005	-	0.432	0.109	0.027	0.001	0.57
PM2.5	0.000	-	0.029	0.007	0.002	0.000	0.04
PM10	0.000	-	0.039	0.010	0.002	0.000	0.05
H ₂ S	0.000	-	0.000	0.000	0.000	0.000	0.00
SO ₂	0.000	-	0.000	0.000	0.000	0.000	0.00
CO ₂	6.623	-	-	-	-	-	6.62
Total VOC	0.000	-	5.919	0.144	0.380	0.000	6.44
Benzene	0.000	-	0.003	0.001	0.000	0.000	0.00
Toluene	0.000	-	0.008	0.001	0.000	0.000	0.01
Ethylbenzene	0.000	-	0.006	0.001	0.000	0.000	0.01
Xylenes	0.000	-	0.011	0.002	0.000	0.000	0.01
n-Hexane	0.000	-	0.177	0.001	0.001	0.000	0.18
HAP	0.000	-	0.205	0.005	0.001	0.000	0.21
N ₂ O	0.000	-	0.011	0.003	0.001	0.000	0.02
Lead	0.000	-	0.000	0.000	0.000	0.000	0.00
Formaldehyde	0.000	-	-	-	-	-	0.00

Enclosed Combustor Total Emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	1.47	6.44
NOx	1.56E-01	6.83E-01
CO	1.31E-01	5.73E-01
PM2.5	8.88E-03	3.89E-02
PM10	1.18E-02	5.19E-02
H ₂ S	4.02E-06	1.76E-05
SO ₂	7.56E-06	3.31E-05
Benzene (TAPs)	8.16E-04	3.57E-03
Formaldehyde (TAPs)	9.45E-07	4.14E-06
HAPs	0.05	0.21
CO ₂ e	428.75	1877.95
N ₂ O	3.43E-03	1.50E-02
Lead	7.79E-07	3.41E-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
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation

Enclosed Combustor CO₂ and CH₄ Emissions

Components	Mole fraction of oil flash gas constituents ^a	Volume of oil flash gas sent to flare <i>scf/year</i>	Mole fraction of water flash gas constituents ^a	Volume of water flash gas sent to flare <i>scf/year</i>	Mole fraction of oil tank vapors constituents ^a	Volume of oil tank vapor sent to flare <i>scf/year</i>	Mole fraction of water tank vapors constituents ^a	Volume of water tank vapors sent to flare <i>scf/year</i>	Component volume of gas sent to flare <i>scf/year</i>	Number of carbon atoms	Combustion Efficiency	Combusted CO ₂ Volume ^b <i>scf/year</i>	Uncombusted CO ₂ and CH ₄ Volume ^b <i>scf/year</i>	Volume GHGs Emitted <i>scf/year</i>
CO ₂	0.002	10,279,126	0.0162	2,605,563	0.0029	631,842	0.012	24,450	63,864	1	0	--	63,864	29,503,336
Methane	0.332	10,279,126	1.2412	2,605,563	0.0930	631,842	0.038	24,450	6,708,058	1	0.98	6,573,897	134,161	134,161
Ethane	0.307	10,279,126	0.2304	2,605,563	0.4700	631,842	0.006	24,450	4,055,410	2	0.98	7,948,604	--	
Propane	0.194	10,279,126	0.0588	2,605,563	0.2553	631,842	0.000	24,450	2,307,268	3	0.98	6,783,368	--	
i-Butane	0.036	10,279,126	0.0024	2,605,563	0.0441	631,842	0.000	24,450	403,237	4	0.98	1,580,691	--	
n-Butane	0.064	10,279,126	0.0080	2,605,563	0.0779	631,842	0.000	24,450	731,144	4	0.98	2,866,086	--	
Pentane	0.035	10,279,126	0.0024	2,605,563	0.0396	631,842	0.000	24,450	386,492	5	0.98	1,893,812	--	
Hexane	0.014	10,279,126	0.0005	2,605,563	0.0089	631,842	0.000	24,450	153,894	6	0.98	904,897	--	
Benzene	0.000	10,279,126	0.0002	2,605,563	0.0000	631,842	0.000	24,450	1,735	6	0.98	10,201	--	
Heptanes	0.006	10,279,126	0.0002	2,605,563	0.0042	631,842	0.000	24,450	61,381	7	0.98	421,077	--	
Toluene	0.000	10,279,126	0.0003	2,605,563	0.0000	631,842	0.000	24,450	3,880	7	0.98	26,615	--	
Octane	0.003	10,279,126	0.0002	2,605,563	0.0032	631,842	0.000	24,450	36,697	8	0.98	287,703	--	
Ethyl benzene	0.000	10,279,126	0.0002	2,605,563	0.0000	631,842	0.000	24,450	2,350	8	0.98	18,421	--	
Xylenes	0.000	10,279,126	0.0004	2,605,563	0.0001	631,842	0.000	24,450	4,606	8	0.98	36,111	--	
Nonane	0.001	10,279,126	0.0000	2,605,563	0.0005	631,842	0.000	24,450	6,519	9	0.98	57,496	--	
Decane plus	0.000	10,279,126	0.0000	2,605,563	0.0002	631,842	0.000	24,450	3,112	10	0.98	30,493	--	
Subtotal												29,439,472	--	

Pollutant	Volume Emitted <i>scf/year</i>	Density of GHG ^c <i>lb/scf</i>	Conversion Factor <i>lb/ton</i>	GWF	Emissions ^c	
CO ₂	29,503,336	0.12	2000	1	390.56	1,710.65
CH ₄	134,161	0.09	2000	25	1.42	6.24
CO₂e Emissions					426.2	1866.67

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
Willard Well Pad
Doddridge, 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 ¹ (%)	50	50

Tanker Truck Trip Calculation	
Condensate Production (bbl/day)	225
PW Production (bbl/day)	2,700
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	0.8200	1	411	0.8200	337.0200	3.8175	1.7179
Tanker Trucks PW	10	40	10	0.8200	1	4928	0.8200	4040.9600	3.8175	1.7179
Pick Up Truck	4	3	10	0.3140	1	730	0.3140	229.2200	0.3467	0.1560

	Uncontrolled Emissions						Controlled Emissions					
	(lbs/hr)	PM (lbs/year)	(tpy)	(lbs/hr)	PM10 (lbs/year)	(tpy)	(lbs/hr)	PM (lbs/year)	(tpy)	(lbs/hr)	PM10 (lbs/year)	(tpy)
Tanker Trucks Condensate	3.1304	1286.5838	0.6433	1.4087	578.9627	0.2895	1.5652	643.2919	0.3216	0.7043	289.4813	0.1447
Tanker Trucks PW	3.1304	15426.4836	7.7132	1.4087	6941.9176	3.4710	1.5652	7713.2418	3.8566	0.7043	3470.9588	1.7355
Pick Up Truck	0.1089	79.4659	0.0397	0.0490	35.7597	0.0179	0.0544	39.7330	0.0199	0.0245	17.8798	0.0089
Total Emissions	6.3696	16,792.5332	8.3963	2.8663	7,556.6400	3.7783	3.1848	8,396.2666	4.1981	1.4332	3,778.3200	1.8892

Enter any notes here:	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
Willard Well Pad
Doddridge, West Virginia
Antero Resources Corporation**

Kubota DG972-E2

Power (hp)	24
Fuel consumption (lbs/BHP-hr) ¹	0.449
Heat Content of Fuel (Btu/scf)	1247.06
Density of NG (lb/scf)	0.056
Operating Hours/year	8760

Pollutant	Emission Factors		lb/hr	tpy
	(g/hp-hr)	(lb/MMBtu)		
NOx ¹	5.97		0.3158	1.3831
CO ²	106.7		5.6445	24.7228
CO ₂		110.000	26.3967	115.62
PM _{2.5}		9.910E-03	0.0024	0.0104
PM ₁₀		9.500E-03	0.0023	0.0100
PM (Total)		9.910E-03	0.0024	0.0104
SO ₂		5.880E-04	0.0001	0.0006
TOC		0.358	0.0859	0.3763
Methane		0.230	0.0552	0.2417
VOC ³		0.0296	0.0071	0.0311
HAPS				
Benzene		1.58E-03	3.79E-04	1.66E-03
Ethylbenzene		2.48E-05	5.95E-06	2.61E-05
Formaldehyde		2.05E-02	4.92E-03	2.15E-02
Naphthalene		9.71E-05	2.33E-05	1.02E-04
Toluene		5.58E-04	1.34E-04	5.86E-04
Xylene		1.95E-04	4.68E-05	2.05E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.007	0.031
TOTAL Uncontrolled NOx	0.316	1.383
TOTAL Uncontrolled HAPs	0.006	0.024
TOTAL Uncontrolled TAPs (Benzene)	0.000	0.002
TOTAL Uncontrolled TAPs (Formaldehyde)	0.005	0.022
TOTAL CO _{2e} Emissions	27.78	121.7

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 P.
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.



Bryan Research & Engineering, Inc.

ProMax[®] 3.2

with
TSWEET[®] & PROSIM[®]

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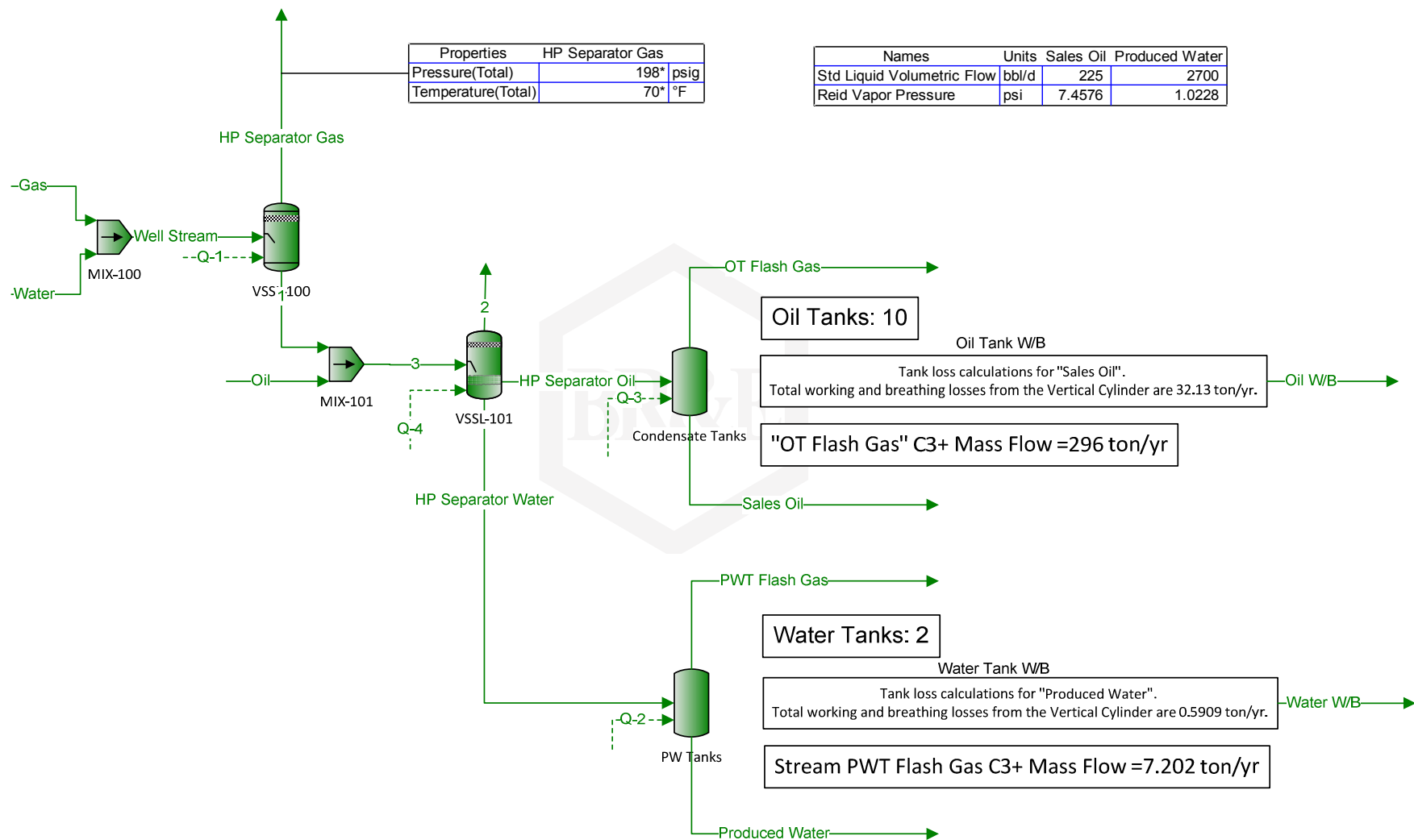
Simulation Report

Client Name:	Antero Resources Corporation
Location:	West Virginia
Job:	Willard
Project Name:	PROMAX SCENARIO 3
File Name:	ProMax@C:\Users\yichen\Documents\New Model\Antero ProMax\PROMAX SCENARIO 3.PMX
ProMax Version:	3.2.13330.0
Report Created:	2/4/2015 10:54

Stream HP Separator Gas C3+ Mass Flow =1.676E+05 ton/yr

Properties	HP Separator Gas
Pressure(Total)	198* psig
Temperature(Total)	70* °F

Names	Units	Sales Oil	Produced Water
Std Liquid Volumetric Flow	bbl/d	225	2700
Reid Vapor Pressure	psi	7.4576	1.0228



Process Streams	Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Total	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	18.5316	0.181013	99.9640	0.0605067	0.344905	0.00837042	0	100	0	99.9969	3.02596	0.000253201	94.3109	99.9642		98.9394
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Nitrogen	0.402990	0.493783	9.67498E-05	0.0121127	0.0775577	0.000115239	0.494658	0	0.0130001	3.22546E-06	0.275355	0.00454338	0.00488689	8.76127E-05	0.000219988	0.000219988
Carbon Dioxide	0.119528	0.146234	0.000829298	0.0323945	0.188819	0.00371855	0.146717	0	0.0140001	0.000487767	1.00601	0.293104	1.20294	0.00101997		0.00115304
Methane	63.3024	77.5613	0.0279535	5.27678	33.2383	0.150838	77.7018	0	5.37205	0.00184985	76.8553	9.29911	3.79014	0.0269905		0.0817865
Ethane	11.5688	14.1746	0.00524624	5.52488	30.7487	0.900810	14.2004	0	5.51706	0.000400239	14.2678	46.9983	0.649372	0.00535236		0.0618567
Propane	3.66146	4.48614	0.00134987	4.86287	19.4040	2.19716	4.49433	0	4.82005	0.000112887	3.64201	25.5267	0.0404042	0.00181555		0.0512106
Isobutane	0.461654	0.566670	5.22685E-05	1.44646	3.59345	1.05286	0.566666	0	1.44501	1.60865E-06	0.149153	4.41104	0.000207208	7.37814E-05		0.0148869
n-Butane	0.964536	1.18182	0.000179331	3.29530	6.43709	2.71934	1.18394	0	3.28203	1.17208E-05	0.493484	7.78901	0.00103176	0.000331752		0.0339748
Isopentane	0.305461	0.374280	3.02476E-05	2.10278	1.94112	2.13242	0.374944	0	2.10002	1.38336E-06	0.084925	2.23473	4.45307E-05	6.84483E-05		0.0215965
n-Pentane	0.237427	0.290918	2.21892E-05	2.12494	1.51791	2.23622	0.291434	0	2.12302	1.00528E-06	0.0623701	1.72636	2.38361E-05	5.17061E-05		0.0218157
2-Methylpentane	0	0	2.95369E-06	1.47708	0.466618	1.66232	0	0	1.47801	6.52732E-08	0.00850404	0.514639	6.20570E-07	0		0.0151522
3-Methylpentane	0	0	5.12868E-06	1.04006	0.295171	1.17661	0	0	1.04101	2.96290E-07	0.0142277	0.325517	2.51722E-06	0		0.0106721
n-Hexane	0.444136	0.544213	3.31322E-06	2.91172	0.668649	3.32293	0.545164	0	2.91003	5.84872E-08	0.00958255	0.0501061	2.70823E-08	3.41285E-05		0.0298665
Methylcyclopentane	0	0	2.76200E-06	0.230634	0.0500247	0.263744	0	0	0.231002	4.29373E-07	0.00686808	0.0522685	2.61303E-06	0		0.00236817
Benzene	0	0	3.49927E-05	0.0605957	0.0126903	0.0693777	0	0	0.0640006	3.15640E-05	0.0101263	0.000847406	1.18390E-05	0		0.000656115
2-Methylhexane	0	0	9.15566E-07	1.69518	0.167146	1.97531	0	0	1.69602	1.71726E-08	0.00264504	0.0118437	3.16172E-09	0		0.0173871
3-Methylhexane	0	0	7.60253E-07	1.41932	0.133017	1.65512	0	0	1.42001	1.48919E-08	0.00219449	0.142299	3.93148E-08	0		0.0145576
Heptane	0	0	1.28888E-06	2.89163	0.215376	3.38225	0	0	2.89303	2.53852E-08	0.00371996	0.212320	4.89326E-08	0		0.0296585
Methylcyclohexane	0	0	4.52873E-06	1.77380	0.132111	2.07476	0	0	1.77502	4.91746E-07	0.0118861	0.132713	9.65869E-07	0		0.0181969
Toluene	0	0	6.25567E-05	0.488751	0.0287360	0.573081	0	0	0.495005	5.52880E-05	0.0214555	0.0407414	1.20693E-05	0		0.00507464
Octane	0	0	7.03707E-07	8.50128	0.199894	10.0231	0	0	8.50509	9.20855E-09	0.00204473	0.185798	5.24151E-09	0		0.0871916
Ethylbenzene	0	0	3.41732E-05	0.874325	0.0173540	1.03143	0	0	0.878009	2.98361E-05	0.0127991	0.00455934	4.04977E-06	0		0.00900108
m-Xylene	0	0	2.44022E-05	0.731330	0.0214488	0.863171	0	0	0.734007	2.13979E-05	0.00886643	0.00411454	3.31199E-06	0		0.00752482
o-Xylene	0	0	5.88209E-05	1.46969	0.0217256	1.73513	0	0	1.47601	5.32912E-05	0.0163337	0.00639655	6.03243E-06	0		0.0151317
Nonane	0	0	3.29346E-07	7.69366	0.0599848	9.09308	0	0	7.69708	6.80209E-09	0.000949630	0.0499076	1.14636E-09	0		0.0789081
C10+	0	0	4.68186E-07	42.0019	0.0275371	48.6967	0	0	42.0204	2.81723E-08	0.00129550	0.0194498	3.38566E-10	0		0.430781
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
Water	2204.03	17.5894	2186.45	0.0137140	0.0121107	0.00160326	0	2204.03	0	2186.43	0.0225097	4.81259E-07	0.00693672	2186.46		2186.46
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Nitrogen	47.9273	0.00211615	0.00274537	0.00272330	2.20277E-05	47.9292	0	0.00294521	7.05244E-05	0.00204562	0.00204562	6.63561E-06	3.58439E-07	0.00191630		0.00486151
Carbon Dioxide	14.2160	14.1937	0.0181387	0.00734228	0.00663003	0.000712247	14.2160	0	0.00371776	0.0106650	0.00747371	0.000557103	8.84785E-05	0.00223092		0.0254810
Methane	7528.81	7528.22	0.611408	1.19599	1.16710	0.0288913	7528.81	0	1.21705	0.0404467	0.570962	0.0176748	0.00278771	0.590349		1.80740
Ethane	1375.92	1375.81	0.114748	1.25222	1.07968	0.105998	1375.92	0	1.24980	0.00875119	0.105998	0.0893297	4.77646E-05	0.117069		1.36697
Propane	435.472	435.432	0.0295249	1.10218	0.861338	0.420841	435.472	0	1.09199	0.00246826	0.0270566	0.0485185	2.97180E-06	0.0397106		1.13170
Isobutane	54.9064	54.9047	0.00114324	0.327842	0.126178	0.201664	54.9064	0	0.327371	3.51730E-05	0.00110806	0.00838407	1.52405E-08	0.00161378		0.328985
n-Butane	114.716	114.709	0.00392238	0.746886	0.226027	0.520895	114.716	0	0.743552	0.000256274	0.00366611	0.0148046	7.58890E-06	0.00725623		0.758088
Isopentane	36.3287	36.3282	0.000661585	0.476600	0.0681590	0.408441	36.3287	0	0.475765	3.02472E-05	0.000631338	0.00424756	3.27530E-09	0.00149713		0.477262
n-Pentane	28.2381	28.2370	0.000485330	0.481621	0.0532586	0.428322	28.2381	0	0.480975	2.19804E-05	0.000463350	0.00328128	1.75318E-09	0.00113094		0.482106
2-Methylpentane	0	0	6.46041E-05	0.334783	0.0163844	0.181399	0	0	0.334848	1.42719E-06	6.31789E-05	0.000978174	4.56440E-11	0		0.334848
3-Methylpentane	0	0	0.000112176	0.235731	0.0103644	0.225367	0	0	0.235843	6.47836E-06	0.000105698	0.00061871C	1.85145E-10	0		0.235843
n-Hexane	52.8229	52.8222	0.724800E-05	0.659948	0.0234784	0.636470	52.8229	0	0.659274	1.27882E-06	7.11892E-05	9.52366E-05	1.99195E-12	0.000746474		0.660020
Methylcyclopentane	0	0	6.04115E-05	0.0522737	0.00175652	0.0505172	0	0	0.0523341	9.38820E-06	5.10233E-05	9.93467E-05	1.92193E-10	0		0.0523341
Benzene	0	0	0.000765372	0.0137341	0.000445598	0.0132885	0	0	0.0144995	0.000690144	7.52289E-05	1.61066E-06	8.70777E-10	0		0.0144995
2-Methylhexane	0	0	2.00256E-05	0.384217	0.00586901	0.378348	0	0	0.384237	3.75477E-07	1.96501E-05	2.25113E-05	2.32500E-13	0		0.384237
3-Methylhexane	0	0	1.66285E-05	0.321691	0.00467063	0.317020	0	0	0.321708	3.25610E-07	1.63029E-05	0.000270468	2.89167E-12	0		0.321708
Heptane	0	0	2.81908E-05	0.655394	0.00756252	0.647832	0	0	0.655422	5.55046E-07	2.76357E-05	0.000403556	3.59907E-12	0		0.655422
Methylcyclohexane	0	0	9.90540E-05	0.402035	0.00463883	0.397397	0	0	0.402134	1.07520E-05	8.83020E-05	0.000252247	7.10413E-11	0		0.402134
Toluene	0	0	0.00136826	1.010776	0.00100901	0.109767	0	0	1.011245	0.00120887	0.000159394	7.74372E-06	8.87715E-10	0		1.011245
Octane	0	0	1.53917E-05	1.92683	0.00701854	1.91981	0	0	1.92685	2.01344E-07	1.51904E-05	0.000353147	3.85522E-13	0		1.92685
Ethylbenzene	0	0	0.000747448	1.198168	0.000609355	1.197558	0	0	1.198915	0.000652363	9.50848E-05	8.66594E-06	2.97867E-10	0		1.198915
m-Xylene	0	0	0.000533733	0.165757	0.000426582	0.165331	0	0	0.166291	0.000467864	6.58690E-05	7.82051E-06	2.30363E-10	0		0.166291
o-Xylene	0	0	0.00128655	0.333108	0.000762556	0.332345	0	0	0.334395	0.00116521	0.000121344	1.21579E-05	4.43695E-10	0		0.334395
Nonane	0	0	7.20357E-06	1.74378	0.00210626	1.74168	0	0	1.74379	1.48727E-07	7.05484E-06	9.48593E-05	8.43166E-14	0		1.74379
C10+	0	0	1.02403E-05	9.51981	0.000966915	9.51885	0	0	9.51982	6.15985E-07	9.62435E-06	3.69882E-05	2.49014E-14	0		9.51982
Mass Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	16.4008	0.156156	99.9586	0.00959865	0.182816	0.00117671	0	100	0	99.9951	2.74317	0.000118187	92.6256	99.9580		93.8304
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Nitrogen	0.554590	0.662383	0.000150436	0.00298794	0.0639240	2.51910E-05	0.663391	0	0.00320606	5.01543E-06	0.387644	0.00329769	0.00746322	0.000136228		0.000324413
Carbon Dioxide	0.258421	0.308178	0.00202578	0.0125540	0.00127703	0.009119	0.258421	0	0.00544221	0.00119154	2.22497	0.334220	2.88615	0.00249153		0.00267130
Methane	49.8888	59.5832	0.0248910	0.745428	15.6885	0.0188826	59.6762	0	0.758698	0.00164724	61.9612	3.86524	3.31477	0.0240334		0.0690695
Ethane	17.0891	20.4098	0.00875595	1.46288	27.2032	0.211366	20.4417	0	1.46044	0.000668020	21.5602	36.6156	1.06449	0.00893300		0.0979128
Propane	7.93161	9.47275	0.00330387	1.88822	25.1745	0										

Toluene	0	0	0.000319926	0.396546	0.0779004	0.412039	0	0	0.401521	0.000282763	0.0993470	0.00972615	6.06247E-05	0	0.0246139
Octane	0	0	4.46172E-06	8.55115	0.071776	8.93425	0	0	8.55286	5.83871E-08	0.0117378	0.549896	3.26407E-08	0	0.524303
Ethylbenzene	0	0	0.000201374	0.817372	0.0542069	0.854478	0	0	0.820613	0.000175822	0.0682864	0.0125415	2.34390E-05	0	0.0503048
m-Xylene	0	0	0.000143796	0.683692	0.0379478	0.715088	0	0	0.686025	0.000126097	0.0473047	0.0113179	1.81272E-05	0	0.0420544
o-Xylene	0	0	0.000346616	1.37396	0.0678620	1.43746	0	0	1.37953	0.000314042	0.0871446	0.0175951	3.49142E-05	0	0.0845671
Nonane	0	0	2.34457E-06	8.68907	0.226354	9.10054	0	0	8.69077	4.84248E-08	0.00612074	0.165846	8.01536E-09	0	0.532758
C10+	0	0	4.15166E-06	59.0883	0.129437	61.9550	0	0	59.0997	2.49827E-07	0.0104011	0.0805092	2.94867E-09	0	3.62290
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
Water	39706.2	316.518	39389.5	0.247061	0.218178	0.0288832	0	39706.2	0	39389.1	0.405519	8.67001E-06	0.124967	39389.7	0
H2S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	1342.66	1342.61	0.0592804	0.0769071	0.0762888	0.000618331	1342.66	0	0.0825053	0.00197563	0.0573048	0.000241913	1.00691E-05	0.0536822	0
Carbon Dioxide	625.637	624.655	0.798275	0.323130	0.291784	0.0313456	625.637	0	0.139588	0.469361	0.328914	0.0245178	0.00389389	0.981817	0
Methane	120781	120771	9.80849	19.1867	18.7232	0.463487	120781	0	19.5245	0.648865	9.15963	0.283548	0.00447217	9.47065	0
Ethane	41372.7	41369.2	3.45035	37.6532	32.4650	5.18811	41372.7	0	37.5833	0.263140	3.18721	2.68606	0.00143617	3.52016	0
Propane	19202.4	19200.6	1.30192	48.6013	30.0440	18.5573	19202.4	0	48.1521	0.108839	1.19308	2.13945	0.000131043	1.75106	0
Isobutane	3191.28	3191.18	0.0664474	19.0549	7.33372	11.7212	3191.28	0	19.0275	0.00204433	0.0644031	0.487301	8.85809E-07	0.0937965	0
n-Butane	6667.55	6667.13	0.227978	43.4107	13.1372	30.2735	6667.55	0	43.2169	0.0148952	0.213082	0.860474	4.41078E-06	0.421748	0
Isopentane	2621.14	2621.03	0.0477326	34.3861	4.91759	29.4685	2621.14	0	34.3258	0.00218230	0.0455503	0.306456	2.36309E-07	0.108016	0
n-Pentane	2037.35	2037.26	0.0350160	34.7484	3.84543	30.9029	2037.35	0	34.7018	0.00158586	0.0334301	0.236741	1.26490E-07	0.0815958	0
2-Methylpentane	0	0	0.00556728	28.8501	1.41193	27.4381	0	28.8556	0.000122989	0.00544429	0.0842945	0.933389E-09	0	28.8556	0
3-Methylpentane	0	0	0.00966684	20.3142	0.893155	19.4211	0	20.3239	0.000558275	0.00910857	0.0533176	1.59550E-08	0	20.3239	0
n-Hexane	4552.03	4551.97	0.00624496	56.8713	2.02326	54.8480	4552.03	0	56.8132	0.000110203	0.00613475	0.00820705	1.71657E-10	0.0643773	0
Methylcyclopentane	0	0	0.00508420	4.39933	0.147828	4.25150	0	4.40441	0.000790106	0.00429405	0.00429405	0.00836096	1.61748E-08	0	4.40441
Benzene	0	0	0.0597847	1.07280	0.0348065	1.03799	0	1.13258	0.0539084	0.00587627	0.000125812	6.80180E-08	0	1.13258	0
2-Methylhexane	0	0	0.00200660	38.4992	0.589086	37.9112	0	38.5013	3.76235E-05	0.00196986	0.00225568	2.33019E-11	0	38.5013	0
3-Methylhexane	0	0	0.00166621	32.2341	0.468007	31.7660	0	32.2357	3.26269E-05	0.00163358	0.0271014	2.89751E-10	0	32.2357	0
Heptane	0	0	0.00282477	65.6718	0.757779	64.9140	0	65.6746	5.56167E-05	0.00276915	0.0404371	3.60634E-10	0	65.6746	0
Methylcyclohexane	0	0	0.00972572	38.4743	0.455468	39.0188	0	39.4840	0.00105570	0.00867003	0.0247671	6.97526E-09	0	39.4840	0
Toluene	0	0	0.126070	10.2068	0.0929687	10.1138	0	10.3328	0.111383	0.0146963	0.000713494	8.17926E-08	0	10.3328	0
Octane	0	0	0.00175817	220.099	0.801718	219.297	0	220.101	2.29953E-05	0.00173517	0.0403394	4.40376E-11	0	220.101	0
Ethylbenzene	0	0	0.0793528	21.0385	0.0646921	20.9738	0	21.1178	0.0692581	0.0109497	0.00052002C	3.16231E-08	0	21.1178	0
m-Xylene	0	0	0.0566638	17.5976	0.0452880	17.5523	0	17.6543	0.0496708	0.00899299	0.000830265	2.44565E-08	0	17.6543	0
o-Xylene	0	0	0.136587	35.3644	0.0809886	35.2834	0	35.5010	0.123704	0.0128825	0.00129075	4.71049E-08	0	35.5010	0
Nonane	0	0	0.000923894	223.649	0.270138	223.379	0	223.650	1.90750E-05	0.000904815	0.0121662	1.08140E-11	0	223.650	0
C10+	0	0	0.00163599	1520.88	0.154474	1520.73	0	1520.88	9.84095E-05	0.00153758	0.00590602	3.97823E-12	0	1520.88	0

Process Streams	Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Total	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units															
Temperature	°F	179.7	70.0	70.0	70.0	75.9	75.9	200.0	300.0	200.0	75.9	75.94	75.9425	70	70	74.3832
Pressure	psig	200	198	198	198	0	0	300	200	300	0	0	4.68646	198	198	198
Mole Fraction Vapor	%	84.5246	100	0	0	100	0	100	0	1.34365	0	100	100	0	0	0.00299759
Mole Fraction Light Liquid	%	15.4754	0	100	100	0	0	100	100	98.6564	100	0	0	100	0	1.02376
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98.9732
Molecular Weight	lb/lbmol	20.4	20.9	18.0	113.6	34.0	128.2	20.9	18.0	113.6	18.0	38.5954	18.3431	18.0164	18.9692	18.9692
Mass Density	lb/ft³	0.8	62.3	45.9	0.1	46.5	1.0	57.3	38.0	62.2	0.0510471	0.132403	0.00150111	62.2605	0	60.7268
Molar Flow	lbmol/h	11893.4	9706.1	2187.2	22.7	3.5	19.2	9689.4	2204.0	22.7	2186.5	0.742904	0.190070	0.00735516	2187.25	0
Mass Flow	lb/h	242099.6	202693.4	39405.8	2573.9	119.3	2454.6	202393.4	39706.2	2573.4	39391.0	14.7829	7.33583	39406.3	0	41979.7
Vapor Volumetric Flow	MCFH	312.6	245.0	0.6	0.1	1.4	0.1	210.1	0.7	0.1	0.6	0.289592	0.0554045	0.0898776	0.632926	0.691287
Liquid Volumetric Flow	Mbbl/d	1336.4	1047.3	2.7	0.2	5.8	0.2	897.9	3.0	0.3	2.7	1.23789	0.236835	0.384189	2.70549	2.95496
Std Vapor Volumetric Flow	MMSCFD	108.3	88.4	19.9	0.2	0.0	0.2	88.2	20.1	0.2	19.9	0.00676610	0.00173109	6.69881E-05	19.9206	0
Std Liquid Volumetric Flow	Mbbl/d	43.2	40.5	2.7	0.2	0.0	0.2	40.5	2.7	0.2	2.7	0.00297798	0.00112317	1.02095E-05	2.70301	0
Compressibility		0.823	0.945	0.011	0.093	0.990	0.007	0.964	0.008	0.133	0.001	0.996642	0.982950	0.999551	0.0108279	0.0116090
Specific Gravity			0.721	0.998	0.735	1.174	0.746	0.721	0.920	0.998	0.687049	1.33260	0.633336	0.998260		
API Gravity			10.0	59.7		56.5		10.0						10.0473		
Enthalpy	MMBtu/h	-581.8	-334.8	-269.0	-2.1	-0.1	-2.0	-319.8	-262.0	-2.0	-0.0273368	-0.00810352	-0.000747032	-268.982	0	-270.935
Mass Enthalpy	Btu/lb	-2403.0	-1651.9	-6825.9	-827.9	-1201.8	-799.9	-1579.9	-6598.5	-758.9	-6822.4	-1849.22	-1104.65	-5537.00	-6453.88	
Mass Cp	Btu/(lb*°F)	0.6	0.5	1.0	0.5	0.4	0.5	0.6	1.0	0.6	1.0	0.481833	0.412645	0.444149	0.983052	0.952016
Ideal Gas Cp/Cv Ratio		1.234	1.249	1.326	1.049	1.160	1.043	1.215	1.316	1.040	1.326	1.26237	1.14389	1.32248	1.32581	1.30782
Dynamic Viscosity	cP	0.0	1.0	0.6	0.0	0.7	0.0	0.2	0.0	0.2	0.9	0.0108022	0.00877202	0.0102416	0.995519	
Kinematic Viscosity	cSt	0.8	1.0	0.8	6.5	1.0	0.8	0.2	0.8	0.2	0.9	13.2106	4.13601	425.925	0.998196	
Thermal Conductivity	Btu/(h*ft*°F)	0.0	0.3	0.1	0.0	0.1	0.0	0.4	0.3	0.3	0.174309	0.0114326	0.0122552	0.346525		
Surface Tension	lb/ft		0.005	0.001		0.002		0.003			0.005			0.00503986		
Net I.G. Heating Value	Btu/ft³	930.3	1139.8	0.4	5696.4	1798.6	6411.0	1141.9	0.0	5698.7	0.0	1045.19	2032.91	45.9579	0.392291	58.8097
Net Liquid Heating Value	Btu/lb	17118.0	20650.3	-1051.1	18869.6	19945.3	18817.3	20684.2	-1059.8	18872.7	-1059.0	19851.6	19837.1	-34.7375	-1051.08	170.279
Gross I.G. Heating Value	Btu/ft³	1034.9	1256.7	50.7	1962.6	6869.3	6869.3	1258.8	50.3	6111.5	50.3	1155.31	2213.55	98.2819	50.7246	112.858
Gross Liquid Heating Value	Btu/lb	19067.9	22773.1	9.0	20247.8	21775.3	20173.5	22808.7	0.0	20250.9	0.8	21951.5	21613.1	1047.7	9.1	1249.9

Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Vapor	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water		3.61973	0.181013			0.344905	0.344905	0		0	3.02996	3.02996	0.000253201	94.3109	0.181013		0.209852
H2S		0	0			0	0	0		0	0	0	0	0			0
Nitrogen		0.476762	0.493783			0.0775577	0.0775577	0.494658		0.289149	0.275355	0.275355	0.00454338	0.00488689	0.493783		0.517100
Carbon Dioxide		0.141334	0.146234			0.188819	0.188819	0.146717		0.0721019	1.00601	1.00601	0.293104	1.20294	0.146234		0.124010
Methane		74.8891	77.5613			33.2383	33.2383	77.7018		64.0531	76.8553	76.8553	9.29911	3.79014	77.5613		79.7340
Ethane		13.6864	14.1746			30.7487	30.7487	14.2004		20.9298	14.2678	14.2678	46.9983	0.649372	14.1746		14.2904
Propane		4.38171	4.48614			19.4040	19.4040	4.9433		7.72830	3.64201	3.64201	25.2267	0.0404042	4.48614		3.49247

Isobutane	0.546171	0.565670			3.59345	3.59345	0.566666		1.24881	0.149153	0.149153	4.41104	0.000207208	0.565670		0.423211
n-Butane	1.14110	1.18182			6.43709	6.43709	1.18394		2.24212	0.493484	0.493484	7.78901	0.00103176	1.18182		0.677591
Isopentane	0.361382	0.374280			1.94112	1.94112	0.374944		0.770286	0.0849825	0.0849825	2.23473	4.45307E-05	0.374280		0.176939
n-Pentane	0.280892	0.290918			1.51791	1.51791	0.291434		0.648212	0.0623701	0.0623701	1.72636	2.38361E-05	0.290918		0.134037
2-Methylpentane	0	0			0.466618	0.466618	0		0.250927	0.00850404	0.00850404	0.514639	6.20570E-07	0		0.0399718
3-Methylpentane	0	0			0.295171	0.295171	0		0.163165	0.0142277	0.0142277	0.325517	2.51722E-06	0		0.0252030
n-Hexane	0.525449	0.544213			0.668649	0.668649	0.545164		0.402950	0.00958255	0.00958255	0.0501061	2.70823E-08	0.544213		0.0573507
Methylcyclopentane	0	0			0.0500247	0.0500247	0		0.0291667	0.00686808	0.00686808	0.0522685	2.61303E-06	0		0.00420942
Benzene	0	0			0.0126903	0.0126903	0		0.00775852	0.0101263	0.0101263	0.000847406	1.18390E-05	0		0.00106148
2-Methylhexane	0	0			0.167146	0.167146	0		0.140418	0.00264504	0.00264504	0.0118437	3.16172E-09	0		0.0147857
3-Methylhexane	0	0			0.133017	0.133017	0		0.111125	0.00219449	0.00219449	0.142299	3.93148E-08	0		0.0117513
Heptane	0	0			0.215376	0.215376	0		0.191502	0.00371996	0.00371996	0.212320	4.89326E-08	0		0.0193147
Methylcyclohexane	0	0			0.132111	0.132111	0		0.109407	0.0118861	0.0118861	0.132713	9.65869E-07	0		0.0115425
Toluene	0	0			0.0287360	0.0287360	0		0.0255572	0.0214555	0.0214555	0.00407414	1.20693E-05	0		0.00249830
Octane	0	0			0.199884	0.199884	0		0.267146	0.00204473	0.00204473	0.185798	5.24151E-09	0		0.0189118
Ethylbenzene	0	0			0.0173540	0.0173540	0		0.0225222	0.0127991	0.0127991	0.0455934	4.04977E-06	0		0.00159564
m-Xylene	0	0			0.0121488	0.0121488	0		0.0170650	0.00886643	0.00886643	0.00411454	3.31199E-06	0		0.00112576
o-Xylene	0	0			0.0217256	0.0217256	0		0.0311794	0.0163337	0.0163337	0.00639655	6.03243E-06	0		0.00201328
Nonane	0	0			0.0599848	0.0599848	0		0.118431	0.000949630	0.000949630	0.0499076	1.14636E-09	0		0.00596554
C10+	0	0			0.0275371	0.0275371	0		0.129762	0.00129550	0.00129550	0.0194498	3.38566E-10	0		0.00309172
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
Water	363.886	17.5694			0.0121107	0	0	0	0	0	0.0225097	4.81259E-07	0.00693672	0		0.000139014
H2S	0	0			0	0	0	0	0	0	0	0	0	0		0
Nitrogen	47.9281	47.9273			0.00272330	0	47.9282	0.000880186	0	0.00204562	8.63561E-06	3.59439E-07	0			0.000342547
Carbon Dioxide	14.2081	14.1937			0.00663003	0	14.2160	0.000219483	0	0.00747371	0.000557103	8.84785E-05	0			8.21489E-05
Methane	7528.49	7528.22			1.16710	0	7528.81	0.194982	0	0.570962	0.0167648	0.000278771	0			0.0528189
Ethane	1375.87	1375.81			1.07968	0	1375.92	0.0637116	0	0.105996	0.0893297	4.77624E-05	0			0.00946648
Propane	435.460	435.432			0.681338	0	435.472	0.0235254	0	0.0270566	0.0485185	2.97180E-06	0			0.00231355
Isobutane	54.9058	54.9047			0.126178	0	54.9064	0.00380147	0	0.00110806	0.00838407	1.52405E-08	0			0.000280351
n-Butane	114.713	114.709			0.226027	0	114.716	0.00682516	0	0.0066611	0.0148046	7.58880E-08	0			0.000448862
Isopentane	36.3292	36.3282			0.0681590	0	36.3297	0.00234480	0	0.000631338	0.00424756	3.27530E-09	0			0.000117211
n-Pentane	28.2376	28.2370			0.0532986	0	28.2381	0.00197320	0	0.000463350	0.00328128	1.75318E-09	0			8.87911E-05
2-Methylpentane	0	0			0.0163844	0	0	0.000763836	0	6.31769E-05	0.000978174	4.56440E-11	0			2.64789E-05
3-Methylpentane	0	0			0.0103644	0	0	0.000496684	0	0.000105698	0.000618710	1.85145E-10	0			1.66955E-05
n-Hexane	52.8225	52.8222			0.0234784	0	52.8229	0.00122660	0	7.11892E-05	9.52366E-05	1.99195E-12	0			3.79913E-05
Methylcyclopentane	0	0			0.00175652	0	0	8.87852E-05	0	5.10233E-05	9.93467E-05	1.92193E-10	0			2.78848E-06
Benzene	0	0			0.000445598	0	0	2.36174E-05	0	7.52289E-05	1.61066E-06	8.70777E-10	0			7.03163E-07
2-Methylhexane	0	0			0.00586901	0	0	0.000427442	0	1.96501E-05	2.25113E-05	2.32550E-13	0			9.79463E-06
3-Methylhexane	0	0			0.00467063	0	0	0.000338272	0	1.63029E-05	0.000270468	2.89167E-12	0			7.78453E-06
Heptane	0	0			0.00756252	0	0	0.000582943	0	2.76357E-05	0.000403556	3.59907E-12	0			1.27948E-05
Methylcyclohexane	0	0			0.00463883	0	0	0.000333040	0	8.83020E-05	0.000252247	7.10413E-11	0			7.64619E-06
Toluene	0	0			0.00100901	0	0	7.77976E-05	0	0.000159394	7.74372E-06	8.87715E-10	0			1.65497E-06
Octane	0	0			0.00701854	0	0	0.000813207	0	1.51904E-05	0.000353147	3.85522E-13	0			1.25279E-05
Ethylbenzene	0	0			0.000609355	0	0	6.85591E-05	0	9.50848E-05	8.66594E-06	2.97867E-10	0			1.05702E-06
m-Xylene	0	0			0.000426582	0	0	5.19469E-05	0	6.58690E-05	7.82051E-06	2.30363E-10	0			7.45745E-07
o-Xylene	0	0			0.000762856	0	0	9.49120E-05	0	0.000121344	1.21579E-05	4.43695E-10	0			1.33367E-06
Nonane	0	0			0.00210626	0	0	0.000360513	0	7.05484E-06	9.48593E-05	8.43166E-14	0			3.95180E-06
C10+	0	0			0.000966915	0	0	0.000395004	0	9.62435E-06	3.69682E-05	2.49014E-14	0			2.04808E-06
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	3.13750	0.156156			0.182816	0.182816	0	0	2.74317	2.74317	0.000118187	92.6256	0.156156			0.189610
H2S	0	0			0	0	0	0	0	0	0	0	0			0
Nitrogen	0.642588	0.662383			0.0639240	0.0639240	0.663391	0.321542	0.387644	0.387644	0.00329769	0.00746322	0.662383			0.726522
Carbon Dioxide	0.299268	0.308178			0.244492	0.244492	0.309119	0.125963	2.22497	2.22497	0.334220	2.88615	0.308178			0.273723
Methane	57.8036	59.5832			15.6885	15.6885	59.6762	40.7908	61.9612	61.9612	3.86524	3.31477	59.5832			64.1539
Ethane	19.8004	20.4098			27.2032	27.2032	20.4417	24.9825	21.5602	21.5602	36.6156	1.06449	20.4098			21.5512
Propane	9.19011	9.47275			25.1745	25.1745	9.48766	13.5279	8.07069	8.07069	29.1644	0.0971293	9.47275			7.72390
Isobutane	1.52734	1.57439			6.14508	6.14508	1.57677	2.88132	0.435661	0.435661	6.64274	0.000656562	1.57439			1.23369
n-Butane	3.19103	3.28927			11.0079	11.0079	3.29435	5.17312	1.44142	1.44142	11.7297	0.00326927	3.28927			1.97523
Isopentane	1.25447	1.29310			4.12055	4.12055	1.29507	2.20613	0.308129	0.308129	4.17752	0.000175152	1.29310			0.640268
n-Pentane	0.975065	1.00510			3.22216	3.22216	1.00663	1.85651	0.226141	0.226141	3.22718	9.37545E-05	1.00510			0.485022
2-Methylpentane	0	0			1.18309	1.18309	0	0.858383	0.0368284	0.0368284	1.14908	2.91543E-06	0			0.172761
3-Methylpentane	0	0			0.748394	0.748394	0	0.558163	0.0616158	0.0616158	0.726810	1.18258E-05	0			0.108929
n-Hexane	2.17861	2.24574			1.69533	1.69533	2.24910	1.37843	0.0414991	0.0414991	0.111876	1.27232E-07	2.24574			0.247874
Methylcyclopentane	0	0			0.123868	0.123868	0	0.0974410	0.0290478	0.0290478	0.113974	1.19888E-05	0			0.0177678

Benzene		0	0			0.0291651	0.0291651	0		0.0240573	0.0397506	0.0397506	0.00171503	5.04149E-05	0		0.00415849
2-Methylhexane		0	0			0.492770	0.492770	0		0.558536	0.0133193	0.0133193	0.0307487	1.72714E-08	0		0.0743065
3-Methylhexane		0	0			0.392153	0.392153	0		0.442018	0.0110505	0.0110505	0.369438	2.14763E-07	0		0.0599070
Heptane		0	0			0.634959	0.634959	0		0.761729	0.0187322	0.0187322	0.551227	2.67302E-07	0		0.0970674
Methylcyclohexane		0	0			0.381646	0.381646	0		0.426427	0.0586492	0.0586492	0.337619	5.17007E-06	0		0.0568044
Toluene		0	0			0.0779004	0.0779004	0		0.0934770	0.0993470	0.0993470	0.00972615	6.06247E-05	0		0.0115450
Octane		0	0			0.671776	0.671776	0		1.21136	0.0117378	0.0117378	0.549896	3.26407E-08	0		0.108347
Ethylbenzene		0	0			0.0542069	0.0542069	0		0.0949171	0.0682864	0.0682864	0.0125415	2.34390E-05	0		0.00849621
m-Xylene		0	0			0.0379478	0.0379478	0		0.0719183	0.0473047	0.0473047	0.0113179	1.81272E-05	0		0.00599425
o-Xylene		0	0			0.0678620	0.0678620	0		0.131401	0.0871446	0.0871446	0.0175951	3.49142E-05	0		0.0107200
Nonane		0	0			0.226354	0.226354	0		0.602966	0.00612074	0.00612074	0.165846	8.01536E-09	0		0.0383736
C10+		0	0			0.129437	0.129437	0		0.822936	0.0104011	0.0104011	0.0805092	2.94867E-09	0		0.0247728
Mass Flow			lb/h		lb/h		lb/h		lb/h		lb/h		lb/h		lb/h		lb/h
Water		5555.51	316.518			0.218178	0	0		0	0	0.405519	8.67001E-06	0.124967	0		0.00250437
H2S		0	0			0	0	0		0	0	0	0	0	0		0
Nitrogen		1342.63	1342.61			0.0762888	0	1342.66		0.0246570	0	0.0573048	0.000241913	1.00691E-05	0		0.00959591
Carbon Dioxide		625.292	624.655			0.291784	0	625.637		0.00965932	0	0.328914	0.0245178	0.00389389	0		0.00361533
Methane		120775	120771			18.7232	0	120781		3.12799	0	9.15963	0.283548	0.00447217	0		0.847345
Ethane		41371.1	41369.2			32.4650	0	41372.7		1.91575	0	3.18721	2.68606	0.00143617	0		0.284648
Propane		19201.9	19200.6			30.0440	0	19202.4		1.03737	0	1.19308	2.13945	0.000131043	0		0.102017
Isobutane		3191.24	3191.18			7.33372	0	3191.28		0.220950	0	0.487301	8.85809E-07	0			0.0162946
n-Butane		6667.37	6667.13			13.1372	0	6667.55		0.396693	0	0.213082	0.860474	4.41078E-06	0		0.0260889
Isopentane		2621.11	2621.03			4.91759	0	2621.14		0.169174	0	0.0455503	0.306456	2.36309E-07	0		0.00845666
n-Pentane		2037.31	2037.26			3.84543	0	2037.35		0.142364	0	0.0334301	0.236741	1.26490E-07	0		0.00640617
2-Methylpentane		0	0			1.41193	0	0		0.0658238	0	0.00544429	0.0842945	3.93338E-09	0		0.00228183
3-Methylpentane		0	0			0.893155	0	0		0.0428019	0	0.00910857	0.0533176	1.59550E-08	0		0.00143874
n-Hexane		4552.00	4551.97			2.02326	0	4552.03		0.105703	0	0.00813475	0.00820705	1.71657E-10	0		0.00327392
Methylcyclopentane		0	0			0.147828	0	0		0.00747212	0	0.00429409	0.00836096	1.61748E-08	0		0.00023467
Benzene		0	0			0.0348065	0	0		0.00184480	0	0.000587627	0.000125812	6.80180E-08	0		5.49254E-05
2-Methylhexane		0	0			0.588086	0	0		0.0428305	0	0.00196898	0.00225568	2.33019E-11	0		0.000981441
3-Methylhexane		0	0			0.468007	0	0		0.0338955	0	0.00163358	0.0271014	2.89751E-10	0		0.000780025
Heptane		0	0			0.757779	0	0		0.0584121	0	0.00276915	0.0404371	3.60634E-10	0		0.00128207
Methylcyclohexane		0	0			0.455468	0	0		0.0326999	0	0.00867003	0.0247671	6.97526E-09	0		0.000750749
Toluene		0	0			0.0929687	0	0		0.00716815	0	0.0146863	0.000713494	8.17926E-08	0		0.000152486
Octane		0	0			0.801718	0	0		0.0928915	0	0.00173517	0.0403394	4.40376E-11	0		0.00143104
Ethylbenzene		0	0			0.0646921	0	0		0.00727858	0	0.0100947	0.0009202020	3.16231E-08	0		0.000112218
m-Xylene		0	0			0.0452880	0	0		0.00551495	0	0.00699299	0.000830265	2.44565E-08	0		7.91720E-05
o-Xylene		0	0			0.0809886	0	0		0.0100763	0	0.00128825	0.00129075	4.71049E-08	0		0.000141589
Nonane		0	0			0.270138	0	0		0.0462376	0	0.000904819	0.0121662	1.08140E-11	0		0.000506839
C10+		0	0			0.154474	0	0		0.0631056	0	0.00153758	0.00590602	3.97823E-12	0		0.000327200
Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Vapor	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units																
Temperature	°F	179.7	70.0			75.9	75.9	200.0		200.0	75.9	75.94	75.9425	75.9425	70		74.3832
Pressure	psig	200	198			0	0	300		300	0	0	4.68646	-14.2258	198		198
Mole Fraction Vapor	%	100	100			100	100	100		100	100	100	100	100	100		100
Mole Fraction Light Liquid	%	0	0			0	0	0		0	0	0	0	0	0		0
Mole Fraction Heavy Liquid	%	0	0			0	0	0		0	0	0	0	0	0		0
Molecular Weight	lb/lbmol	20.8	20.9			34.0	34.0	20.9		25.2	19.9	19.8987	38.5954	18.3431	20.8830		19.9385
Mass Density	lb/ft³	0.7	0.8			0.1	0.1	1.0		1.2	0.1	0.0510471	0.132403	0.00150111	0.827315		0.778146
Molar Flow	lbmol/h	10052.8	9706.1			3.5	0.0	9689.4		0.7	0.0	0.742904	0.190070	0.00735516	0		0.0662438
Mass Flow	lb/h	208940.9	202893.4			119.3	0.0	202393.4		14.7829	0.0	14.7829	7.33583	0.134916	0		1.32080
Vapor Volumetric Flow	MCFH	312.1	245.0			1.4	0.0	210.1		0.0	0.0	0.289592	0.0554054	0.0898776	0		0.00169737
Liquid Volumetric Flow	Mbb/d	1334.1	1047.3			5.8	0.0	897.9		0.0	0.0	1.23789	0.236835	0.384189	0		0.00725554
Std Vapor Volumetric Flow	MMSCFD	91.6	88.4			0.0	0.0	88.2		0.0	0.0	0.00676610	0.00173109	6.89881E-05	0		0.000603324
Std Liquid Volumetric Flow	Mbbl/d	40.9	40.5			0.0	0.0	40.5		0.0	0.0	0.00297798	0.00112317	1.02095E-05	0		0.000271551
Compressibility		0.971	0.945			0.990	0.990	0.964		0.943	0.997	0.982950	0.999551	0.944521	0.960914		0.960914
Specific Gravity		0.718	0.721			1.174	1.174	0.721		0.870	0.687	0.687049	1.33260	0.633336	0.721033		0.688421
API Gravity																	
Enthalpy	MMBtu/h	-359.0	-334.8			-0.1	0.0	-319.8		0.0	0.0	-0.0273368	-0.00810352	-0.00074032	0		-0.00224606
Mass Enthalpy	Btu/lb	-1718.1	-1651.9			-1201.8	-1201.8	-1579.9		-1382.9	-1849.2	-1849.22	-1104.65	-5537.00	-1651.94		-1700.53
Mass Cp	Btu/(lb*°F)	0.5	0.5			0.4	0.4	0.6		0.5	0.5	0.481833	0.412645	0.444149	0.505708		0.511968
Ideal Gas CpCv Ratio		1.223	1.249			1.160	1.160	1.215		1.180	1.262	1.32248	1.14389	1.24908	1.24908		1.25855

Dynamic Viscosity	cP	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0108022	0.00877202	0.0102416	0.0107482		0.0109129
Kinematic Viscosity	cSt	1.2	0.8			6.5	6.5	0.8		0.7	13.2	13.2106	4.13601	425.925	0.811046		0.875505
Thermal Conductivity	Btu/(h*ft**F)	0.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0174309	0.0114326	0.0122562	0.0117466		0.0181990
Surface Tension	lb/ft																
Net I.G. Heating Value	Btu/ft*3	1100.6	1139.8			1798.6	1798.6	1141.9		1361.2	1045.2	1045.19	2032.91	45.9579	1139.83		1092.50
Net Liquid Heating Value	Btu/lb	20002.0	20650.3			19945.3	19945.3	20684.2		20410.2	19851.6	19851.6	19837.1	-34.7375	20650.3		20737.4
Gross I.G. Heating Value	Btu/ft*3	1215.1	1256.7			1962.6	1962.6	1258.8		1493.7	1155.3	1155.31	2213.55	98.2819	1256.65		1205.90
Gross Liquid Heating Value	Btu/lb	22093.1	22773.1			21775.3	21775.3	22808.7		22405.4	21951.5	21951.5	21613.1	1047.7	22773.1		22895.7

Process Streams	Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water	99.9781	99.9642	99.9640	0.0605067	0.00837042	0.00837042		100	0	99.9969	99.9969	7.53559E-06	100.0000	99.9642		0.0676544
H2S	0	0	0	0	0	0		0	0	0	0	0	0	0		0
Nitrogen	5.94883E-05	8.76127E-05	9.67498E-05	0.0121127	0.000115239	0.000115239		0	0.00923914	3.22546E-06	3.22546E-06	9.15166E-06	1.83164E-09	8.76127E-05		0.0113856
Carbon Dioxide	0.000425830	0.00101997	0.000829298	0.0323945	0.00371855	0.00371855		0	0.0132088	0.000487767	0.000487767	0.00744060	1.87598E-05	0.00101997		0.0326150
Methane	0.0175590	0.0269905	0.0279535	5.27678	0.150838	0.150838		0	4.57285	0.00184985	0.00184985	0.0568598	2.92772E-06	0.0269905		5.15081
Ethane	0.00296678	0.00535236	0.00524624	5.52488	0.900810	0.900810		0	5.30714	0.000400239	0.000400239	1.83142	5.87875E-07	0.00535236		5.49661
Propane	0.000608063	0.00181555	0.00134987	4.86287	2.19716	2.19716		0	4.78044	0.000112887	0.000112887	3.82885	4.06029E-08	0.00181555		4.86341
Isobutane	3.23371E-05	7.37814E-05	5.22685E-05	1.44646	1.05286	1.05286		0	1.44769	1.60865E-06	1.60865E-06	1.69310	7.27480E-11	7.37814E-05		1.44780
n-Butane	0.000169333	0.000331752	0.000179331	3.29530	2.71934	2.71934		0	3.29620	1.17208E-05	1.17208E-05	4.30544	7.98254E-10	0.000331752		3.29891
Isopentane	2.68500E-05	6.84483E-05	3.02476E-05	2.10278	2.13242	2.13242		0	2.11813	1.38336E-06	1.38336E-06	3.20643	2.37278E-11	6.84483E-05		2.10604
n-Pentane	2.66212E-05	5.17061E-05	2.21892E-05	2.12494	2.23622	2.23622		0	2.14311	1.00528E-06	1.00528E-06	3.31591	1.25746E-11	5.17061E-05		2.12833
2-Methylpentane	0	0	1.47708	1.66232	1.66232	1.66232		0	1.49473	6.52732E-08	6.52732E-08	2.39011	1.56416E-13	0		1.47963
3-Methylpentane	0	0	5.12868E-06	1.04006	1.17661	1.17661		0	1.05297	2.96290E-07	2.96290E-07	1.68932	1.72149E-12	0		1.04185
n-Hexane	1.94333E-05	3.41285E-05	3.31322E-06	2.91172	3.32293	3.32293		0	2.94417	5.84872E-08	5.84872E-08	0.324079	5.43424E-15	3.41285E-05		2.91683
Methylcyclopentane	0	0	2.76200E-06	0.230634	0.263744	0.263744		0	0.233751	4.29373E-07	4.29373E-07	0.356326	5.35826E-12	0		0.231041
Benzene	0	0	3.49927E-05	0.0605957	0.0693777	0.0693777		0	0.0647666	3.15640E-05	3.15640E-05	0.00590536	1.20840E-09	0		0.0606591
2-Methylhexane	0	0	9.15566E-07	1.69518	1.97531	1.97531		0	1.71720	1.71726E-08	1.71726E-08	0.180562	6.77368E-16	0		1.69822
3-Methylhexane	0	0	7.60253E-07	1.41932	1.65512	1.65512		0	1.43784	1.48919E-08	1.48919E-08	2.28180	8.80203E-15	0		1.42186
Heptane	0	0	1.28888E-06	2.89163	3.38225	3.38225		0	2.92982	2.53852E-08	2.53852E-08	4.28820	1.10302E-14	0		2.89863
Methylcyclohexane	0	0	4.52873E-06	1.77380	2.07476	2.07476		0	1.79770	4.91746E-07	4.91746E-07	2.67729	1.31631E-12	0		1.77688
Toluene	0	0	6.25567E-05	0.488751	0.573081	0.573081		0	0.501399	5.52880E-05	5.52880E-05	0.104024	1.02321E-09	0		0.489449
Octane	0	0	7.03707E-07	8.50128	10.0231	10.0231		0	8.61728	9.20856E-09	9.20856E-09	11.9422	7.83239E-16	0		8.51667
Ethylbenzene	0	0	3.41732E-05	0.874325	1.03143	1.03143		0	0.889660	2.98361E-05	2.98361E-05	0.345443	3.12183E-10	0		0.875842
m-Xylene	0	0	2.44022E-05	0.731330	0.863171	0.863171		0	0.743772	2.13979E-05	2.13979E-05	0.372416	2.50114E-10	0		0.732582
o-Xylene	0	0	5.88209E-05	1.46969	1.73513	1.73513		0	1.49569	5.32912E-05	5.32912E-05	0.649670	6.51139E-10	0		1.47215
Nonane	0	0	3.29346E-07	7.69366	9.09308	9.09308		0	7.80029	6.80209E-09	6.80209E-09	7.74696	2.73854E-16	0		7.70762
C10+	0	0	4.68186E-07	42.0019	49.6967	49.6967		0	42.5909	2.81723E-08	2.81723E-08	44.4002	2.47481E-16	0		42.0782
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
Water	1840.15	0	2186.45	0.0137140	0	0.0160326		2204.03	0	2186.43	0	0	0	2186.46		0.0153062
H2S	0	0	0	0	0	0		0	0	0	0	0	0	0		0
Nitrogen	0.00109491	0	0.00211615	0.00274537	0	2.20727E-05		0	0.00206502	7.05244E-05	0	0	0	0.00191630		0.00257590
Carbon Dioxide	0.00783760	0	0.00734228	0	0.000712247	0		0	0.00295228	0.0106650	0	0	0	0.00223092		0.00737884
Methane	0.323181	0	0.611408	1.19599	0	0.0288913		0	1.02207	0.0404467	0	0	0	0.590349		1.16532
Ethane	0.0546051	0	0.114748	1.25222	0	0.172540		0	1.18619	0.00875119	0	0	0	0.117069		1.24356
Propane	0.0111917	0	0.0295249	1.10218	0	0.420841		0	1.06847	0.00246826	0	0	0	0.0397106		1.10030
Isobutane	0.000595180	0	0.00114324	0.327842	0	0.201664		0	0.323570	3.51730E-05	0	0	0	0.00161378		0.327553
n-Butane	0.00311666	0	0.00392238	0.746886	0	0.520859		0	0.736727	0.000256274	0	0	0	0.00725623		0.746349
Isopentane	0.000494187	0	0.000661585	0.476600	0	0.408441		0	0.473420	3.02472E-05	0	0	0	0.00149713		0.476472
n-Pentane	0.000489975	0	0.000485330	0.481621	0	0.428322		0	0.479002	2.19804E-05	0	0	0	0.00113094		0.481515
2-Methylpentane	0	0	6.46041E-05	0.334783	0	0.318399		0	0.334084	1.42719E-06	0	0	0	0		0.334753
3-Methylpentane	0	0	0.000112176	0.235731	0	0.225367		0	0.235347	6.47836E-06	0	0	0	0		0.235710
n-Hexane	0.000357680	0	7.24680E-05	0.659948	0	0.636470		0	0.658047	1.27882E-06	0	0	0	0.000746474		0.659906
Methylcyclopentane	0	0	6.04115E-05	0.0522737	0	0.0505172		0	0.0522453	9.38820E-06	0	0	0	0		0.0522709
Benzene	0	0	0.000765372	0.0137341	0	0.0132885		0	0.0144759	0.000690144	0	0	0	0		0.0137236
2-Methylhexane	0	0	2.00256E-05	0.384217	0	0.378348		0	0.383809	3.75477E-07	0	0	0	0		0.384207
3-Methylhexane	0	0	1.66285E-05	0.321691	0	0.317020		0	0.321369	3.25610E-07	0	0	0	0		0.321683
Heptane	0	0	2.81908E-05	0.655394	0	0.647832		0	0.654840	5.55046E-07	0	0	0	0		0.655382
Methylcyclohexane	0	0	9.90540E-05	0.402035	0	0.397397		0	0.401801	1.07520E-05	0	0	0	0		0.402024
Toluene	0	0	0.00136826	1.10776	0	1.09767		0	1.112067	0.00120887	0	0	0	0		0.110733
Octane	0	0	1.53917E-05	1.92683	0	1.91981		0	1.92603	2.01344E-07	0	0	0	0		1.92682
Ethylbenzene	0	0	0.000747448	0.198168	0	0.197558		0	0.198846	0.000652363	0	0	0	0		0.198151
m-Xylene	0	0	0.000333733	0.165757	0	0.165331		0	0.166239	0.000467864	0	0	0	0		0.165740

o-Xylene		0	0	0.00128655	0.333108	0	0.332345		0	0.334300	0.00116521	0	0	0	0	0.333061	
Nonane		0	0	7.20357E-06	1.74378	0	1.74168		0	1.74343	1.48727E-07	0	0	0	0	1.74378	
C10+		0	0	1.02403E-05	9.51981	0	9.51885		0	9.51943	6.15985E-07	0	0	0	0	9.51981	
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
Water		99.9758	99.9580	99.9586	0.00959865	0.00117671	0.00117671	100	0	99.9951	99.9951	1.10767E-06	100.0000	99.9580		0.0107168	
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Nitrogen		9.25010E-05	0.000136228	0.000150436	0.00298794	2.51910E-05	2.51910E-05	0	0.00225464	5.01543E-06	5.01543E-06	2.09179E-06	2.84816E-09	0.000136228		0.00280448	
Carbon Dioxide		0.00104024	0.00249153	0.00202578	0.0125540	0.00127703	0.00127703	0	0.00506395	0.00119154	0.00119154	0.00267182	4.58283E-05	0.00249153		0.0126210	
Methane		0.0156358	0.0240334	0.0248910	0.745428	0.0188826	0.0188826	0	0.639053	0.00164724	0.00164724	0.00744268	2.60711E-06	0.0240334		0.726568	
Ethane		0.00495170	0.00893300	0.00875595	1.46288	0.211366	0.211366	0	1.39014	0.000668020	0.000668020	0.449326	9.81214E-07	0.00893300		1.45326	
Propane		0.00148831	0.00444362	0.00330387	1.88822	0.756029	0.756029	0	1.83629	0.000276305	0.000276305	1.37758	9.93829E-08	0.00444362		1.88567	
Isobutane		0.000104326	0.000238024	0.000168623	0.740309	0.477525	0.477525	0	0.732986	5.18985E-06	5.18985E-06	0.802931	2.34705E-10	0.000238024		0.739914	
n-Butane		0.000546303	0.00107026	0.000578539	1.68656	1.23335	1.23335	0	1.66891	3.78137E-05	3.78137E-05	2.04180	2.57539E-09	0.00107026		1.68594	
Isopentane		0.000107528	0.000274109	0.000121131	1.33595	1.20056	1.20056	0	1.33125	5.54009E-06	5.54009E-06	1.88757	9.50268E-11	0.000274109		1.33606	
n-Pentane		0.000106612	0.000207063	8.88600E-05	1.35002	1.25900	1.25900	0	1.34695	4.02594E-06	4.02594E-06	1.95202	5.03596E-11	0.000207063		1.35020	
2-Methylpentane		0	0	1.41281E-05	1.12086	1.11784	1.11784	0	1.12208	3.12226E-07	3.12226E-07	1.68056	7.48209E-13	0		1.12116	
3-Methylpentane		0	0	2.45315E-05	0.789235	0.791221	0.791221	0	0.790454	1.41727E-06	1.41727E-06	1.18782	8.23467E-12	0		0.789441	
n-Hexane		9.29565E-05	0.000163242	1.58478E-05	2.20953	2.23453	2.23453	0	2.21017	2.79766E-07	2.79766E-07	0.227870	2.59945E-14	0.000163242		2.21016	
Methylcyclopentane		0	0	1.29022E-05	0.170920	0.173208	0.173208	0	0.171370	2.00580E-06	2.00580E-06	0.244683	2.50314E-11	0		0.170971	
Benzene		0	0	0.000151715	0.0416796	0.0422881	0.0422881	0	0.0440704	0.000136855	0.000136855	0.00376371	5.23947E-09	0		0.0416622	
2-Methylhexane		0	0	5.09215E-06	1.49575	1.54451	1.54451	0	1.49891	9.55130E-08	9.55130E-08	0.147624	3.76756E-15	0		1.49623	
3-Methylhexane		0	0	4.22834E-06	1.25234	1.29416	1.29416	0	1.25506	8.28280E-08	8.28280E-08	1.86555	4.89573E-14	0		1.25275	
Heptane		0	0	7.16842E-06	2.55144	2.64462	2.64462	0	2.55739	1.41191E-07	1.41191E-07	3.50594	6.13506E-14	0		2.55229	
Methylcyclohexane		0	0	2.46810E-05	1.53363	1.58964	1.58964	0	1.53761	2.68004E-06	2.68004E-06	2.14485	7.17409E-12	0		1.53413	
Toluene		0	0	0.000319926	0.396546	0.412039	0.412039	0	0.402442	0.000282763	0.000282763	0.0782035	5.23316E-09	0		0.396532	
Octane		0	0	4.46172E-06	8.55115	8.93425	8.93425	0	8.57480	5.83871E-08	5.83871E-08	11.1304	4.96624E-15	0		8.55409	
Ethylbenzene		0	0	0.000201374	0.817372	0.854478	0.854478	0	0.822781	0.000175822	0.000175822	0.299234	1.83971E-09	0		0.817593	
m-Xylene		0	0	0.000143796	0.683692	0.715088	0.715088	0	0.687860	0.000126097	0.000126097	0.322599	1.47394E-09	0		0.683860	
o-Xylene		0	0	0.000346616	1.37396	1.43746	1.43746	0	1.38326	0.000314042	0.000314042	0.562765	3.83719E-09	0		1.37424	
Nonane		0	0	2.34457E-06	8.68907	9.10054	9.10054	0	8.71494	4.84248E-08	4.84248E-08	10.1999	1.94963E-15	0		8.69210	
C10+		0	0	4.15166E-06	59.0883	61.9550	61.9550	0	59.2739	2.49827E-07	2.49827E-07	57.8768	2.19467E-15	0		59.1090	
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	
Water		33150.7	0	39389.5	0.247061	0	0.0288832	39706.2	0	39389.1	0	0	0	39389.7		0.27545	
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Nitrogen		0.0306722	0	0.0592804	0.0769071	0	0.000618331	0	0.0578483	0.00197563	0.00197563	0	0	0.0536822		0.0721596	
Carbon Dioxide		0.344929	0	0.798275	0.323130	0	0.0313456	0	0.129928	0.469361	0.469361	0	0	0.981817		0.324739	
Methane		5.18462	0	9.80849	19.1867	0	0.463487	0	16.3965	0.648865	0.648865	0	0	9.47065		18.6947	
Ethane		1.64192	0	3.45035	37.6532	0	5.18811	0	35.6676	0.263140	0.263140	0	0	3.52016		37.3926	
Propane		0.493504	0	1.30192	48.6013	0	18.5573	0	47.1148	0.108839	0.108839	0	0	1.75106		48.5185	
Isobutane		0.0345932	0	0.0664474	19.0549	0	11.7212	0	18.8066	0.00204433	0.00204433	0	0	0.0937965		19.0381	
n-Butane		0.181147	0	0.227978	43.4107	0	30.2735	0	42.8202	0.0148952	0.0148952	0	0	0.421748		43.3794	
Isopentane		0.0356550	0	0.0477326	34.3861	0	29.4685	0	34.1567	0.00218230	0.00218230	0	0	0.108016		34.3768	
n-Pentane		0.0353511	0	0.0350160	34.7484	0	30.9029	0	34.5594	0.00158586	0.00158586	0	0	0.0815958		34.7407	
2-Methylpentane		0	0	0.00556728	28.8501	0	27.4381	0	28.7898	0.000122989	0.000122989	0	0	0		28.8475	
3-Methylpentane		0	0	0.00966684	20.3142	0	19.4211	0	20.2811	0.000558275	0.000558275	0	0	0		20.3124	
n-Hexane		0.0308232	0	0.00624496	56.8713	0	54.8480	0	56.7075	0.000110203	0.000110203	0	0	0.0643277		56.8676	
Methylcyclopentane		0	0	0.00508420	4.39933	0	4.25150	0	4.39694	0.000790106	0.000790106	0	0	4.39909		4.39909	
Benzene		0	0	0.0597847	1.07280	0	1.03799	0	1.13074	0.0539084	0.0539084	0	0	0		1.07197	
2-Methylhexane		0	0	0.00200660	38.4992	0	37.9112	0	38.4584	3.76235E-05	3.76235E-05	0	0	0		38.4982	
3-Methylhexane		0	0	0.00166621	32.2341	0	31.7660	0	32.2018	3.26268E-05	3.26268E-05	0	0	0		32.2333	
Heptane		0	0	0.00282477	65.6718	0	64.9140	0	65.6162	5.56167E-05	5.56167E-05	0	0	0		65.6706	
Methylcyclohexane		0	0	0.00972572	39.4743	0	39.0188	0	39.4513	0.00105570	0.00105570	0	0	0		39.4732	
Toluene		0	0	0.126070	10.2068	0	10.1138	0	10.3257	0.111383	0.111383	0	0	10.2028		10.2028	
Octane		0	0	0.00175817	220.099	0	219.297	0	220.008	2.29993E-05	2.29993E-05	0	0	0		220.098	
Ethylbenzene		0	0	0.0793528	21.0385	0	20.9738	0	21.1105	0.0692581	0.0692581	0	0	0		21.0367	
m-Xylene		0	0	0.0566638	17.5976	0	17.5523	0	17.6488	0.0496708	0.0496708	0	0	0		17.5958	
o-Xylene		0	0	0.136587	35.3644	0	35.2834	0	35.4909	0.123704	0.123704	0	0	0		35.3594	
Nonane		0	0	0.000923894	223.649	0	223.649	0	223.604	1.90750E-05	1.90750E-05	0	0	0		223.649	
C10+		0	0	0.00163599	1520.88	0	1520.73	0	1520.82	9.84095E-05	9.84095E-05	0	0	0		1520.88	
Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units																
Temperature	°F	179.7	70.0	70.0	70.0	75.9	75.9		300.0	200.0	75.9	75.94	75.9425	75.9425	70		74.3832

Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water					99.9640												99.9651
H2S					0												0
Nitrogen					9.67498E-05												8.88379E-05
Carbon Dioxide					0.000829298												0.000823880
Methane					0.0279535												0.0269410
Ethane					0.00524624												0.00520968
Propane					0.00134987												0.00132988
Isobutane					5.22685E-05												5.26855E-05
n-Butane					0.000179331												0.000183382
Isopentane					3.02476E-05												3.07680E-05
n-Pentane					2.21892E-05												2.29987E-05
2-Methylpentane					2.95369E-06												3.10937E-06
3-Methylpentane					5.12868E-06												5.33924E-06
n-Hexane					3.31322E-06												3.49309E-06
Methylcyclopentane					2.76200E-06												2.76359E-06
Benzene					3.49927E-05												3.54433E-05
2-Methylhexane					9.15566E-07												9.25316E-07
3-Methylhexane					7.60253E-07												7.70133E-07
Heptane					1.28888E-06												1.26468E-06
Methylcyclohexane					4.52873E-06												4.68123E-06
Toluene					6.25567E-05												6.44425E-05
Octane					7.03707E-07												7.49029E-07
Ethylbenzene	3.41732E-05	3.48646E-05															
m-Xylene	2.44022E-05	2.51658E-05															
o-Xylene	5.88209E-05	6.09307E-05															
Nonane	3.29346E-07	3.50759E-07															
C10+	4.68186E-07	4.98327E-07															
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
Water					0												2186.45
H2S					0												0
Nitrogen					0												0.00194307
Carbon Dioxide					0												0.0180200
Methane					0												0.589257

[illegible]

n-Hexane					0												0.00658390
Methylcyclopentane					0												0.00508706
Benzene					0												0.0605538
2-Methylhexane					0												0.00202795
3-Methylhexane					0												0.00168785
Heptane					0												0.002777171
Methylcyclohexane					0												0.0100531
Toluene					0												0.129868
Octane					0												0.00187139
Ethylbenzene					0												0.0809574
m-Xylene					0												0.0584364
o-Xylene					0												0.141484
Nonane					0												0.000983954
C10+					0												0.00174129

Process Streams		Well Stream	HP Separator Gas	HP Separator Water	HP Separator Oil	OT Flash Gas	Sales Oil	Gas	Water	Oil	Produced Water	PWT Flash Gas	Oil W/B	Water W/B	1	2	3
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units																
Temperature	°F				70.0												74.3832
Pressure	psig				198												198
Mole Fraction Vapor	%				0												0
Mole Fraction Light Liquid	%				0												0
Mole Fraction Heavy Liquid	%				100												100
Molecular Weight	lb/lbmol				18.0												18.0163
Mass Density	lb/ft^3				62.3												62.2191
Molar Flow	lbmol/h				0.0												2187.21
Mass Flow	lb/h				0.0												39405.4
Vapor Volumetric Flow	MCFH				0.0												0.633333
Liquid Volumetric Flow	Mbbl/d				0.0												2.70723
Std Vapor Volumetric Flow	MMSCFD				0.0												19.9203
Std Liquid Volumetric Flow	Mbbl/d				0.0												2.70289
Compressibility					0.011												0.0107461
Specific Gravity					0.998												0.997596
API Gravity					10.0												10.0459
Enthalpy	MMBtu/h				0.0												-268.809
Mass Enthalpy	Btu/lb				-6825.9												-6821.63
Mass Cp	Btu/(lb*°F)				1.0												0.982727
Ideal Gas CpCv Ratio					1.326												1.32560
Dynamic Viscosity	cP				1.0												0.942388
Kinematic Viscosity	cSt				1.0												0.945552
Thermal Conductivity	Btu/(h*ft**F)				0.3												0.348565
Surface Tension	lbf/ft				0.005												0.00500652
Net I.G. Heating Value	Btu/ft^3				0.4												0.380380
Net Liquid Heating Value	Btu/lb				-1051.1												-1051.34
Gross I.G. Heating Value	Btu/ft^3				50.7												50.7118
Gross Liquid Heating Value	Btu/lb				9.0												8.8

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

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

Sample: Yoke No. 1H (Maxwell Horizontal Pad)
 Separator Hydrocarbon Liquid
 Sampled @ 200 psig & 69 °F

Date Sampled: 09/25/13

Job Number: 35843.002

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2186-M

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.013	0.003	0.003
Carbon Dioxide	0.014	0.005	0.006
Methane	5.372	1.842	0.761
Ethane	5.517	2.986	1.465
Propane	4.820	2.687	1.877
Isobutane	1.445	0.957	0.742
n-Butane	3.282	2.094	1.685
2,2 Dimethylpropane	0.111	0.086	0.071
Isopentane	2.100	1.554	1.338
n-Pentane	2.012	1.476	1.282
2,2 Dimethylbutane	0.190	0.160	0.144
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.281	0.233	0.214
2 Methylpentane	1.478	1.241	1.125
3 Methylpentane	1.041	0.860	0.792
n-Hexane	1.974	1.643	1.502
Heptanes Plus	<u>70.350</u>	<u>82.174</u>	<u>86.993</u>
Totals:	100.000	100.000	100.000

Characteristics of Heptanes Plus:

Specific Gravity -----	0.7687	(Water=1)
°API Gravity -----	52.59	@ 60°F
Molecular Weight -----	140.0	
Vapor Volume -----	17.42	CF/Gal
Weight -----	6.40	Lbs/Gal

Characteristics of Total Sample:

Specific Gravity -----	0.7261	(Water=1)
°API Gravity -----	63.39	@ 60°F
Molecular Weight -----	113.2	
Vapor Volume -----	20.35	CF/Gal
Weight -----	6.05	Lbs/Gal

Base Conditions: 14.650 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: XG
 Processor: JCdjv
 Cylinder ID: T-943

 David Dannhaus 361-661-7015

TANKS DATA INPUT REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Carbon Dioxide	0.014	0.005	0.006
Nitrogen	0.013	0.003	0.003
Methane	5.372	1.842	0.761
Ethane	5.517	2.986	1.465
Propane	4.820	2.687	1.877
Isobutane	1.445	0.957	0.742
n-Butane	3.393	2.180	1.756
Isopentane	2.100	1.554	1.338
n-Pentane	2.012	1.476	1.282
Other C-6's	2.989	2.494	2.275
Heptanes	6.705	6.069	5.827
Octanes	10.280	9.819	9.895
Nonanes	7.698	8.452	8.624
Decanes Plus	42.021	55.063	59.304
Benzene	0.064	0.036	0.044
Toluene	0.495	0.336	0.403
E-Benzene	0.878	0.686	0.823
Xylenes	2.210	1.712	2.072
n-Hexane	1.974	1.643	1.502
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 -----	0.7261 (Water=1)
°API Gravity -----	63.39 @ 60°F
Molecular Weight-----	113.2
Vapor Volume -----	20.35 CF/Gal
Weight -----	6.05 Lbs/Gal

Characteristics of Decanes (C10) Plus:

Specific Gravity -----	0.7820 (Water=1)
Molecular Weight-----	159.8

Characteristics of Atmospheric Sample:

°API Gravity -----	56.94 @ 60°F
Reid Vapor Pressure (ASTM D-5191)-----	2.51 psi

QUALITY CONTROL CHECK			
	Sampling Conditions	Test Samples	
Cylinder Number	-----	T-943*	T-966
Pressure, PSIG	200	198	209
Temperature, °F	69	70	70

* Sample used for analysis

TOTAL EXTENDED REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.013	0.003	0.003
Carbon Dioxide	0.014	0.005	0.006
Methane	5.372	1.842	0.761
Ethane	5.517	2.986	1.465
Propane	4.820	2.687	1.877
Isobutane	1.445	0.957	0.742
n-Butane	3.282	2.094	1.685
2,2 Dimethylpropane	0.111	0.086	0.071
Isopentane	2.100	1.554	1.338
n-Pentane	2.012	1.476	1.282
2,2 Dimethylbutane	0.190	0.160	0.144
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.281	0.233	0.214
2 Methylpentane	1.478	1.241	1.125
3 Methylpentane	1.041	0.860	0.792
n-Hexane	1.974	1.643	1.502
Methylcyclopentane	0.231	0.166	0.172
Benzene	0.064	0.036	0.044
Cyclohexane	0.465	0.321	0.346
2-Methylhexane	1.696	1.596	1.501
3-Methylhexane	1.420	1.319	1.256
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	0.906	0.814	0.794
n-Heptane	1.987	1.855	1.758
Methylcyclohexane	1.775	1.444	1.539
Toluene	0.495	0.336	0.403
Other C-8's	6.320	6.110	6.152
n-Octane	2.185	2.265	2.204
E-Benzene	0.878	0.686	0.823
M & P Xylenes	0.734	0.576	0.688
O-Xylene	1.476	1.136	1.384
Other C-9's	5.324	5.750	5.936
n-Nonane	2.373	2.702	2.688
Other C-10's	8.709	10.336	10.867
n-decane	2.435	3.024	3.060
Undecanes(11)	11.327	13.792	14.705
Dodecanes(12)	8.408	11.059	11.955
Tridecanes(13)	5.532	7.802	8.550
Tetradecanes(14)	2.884	4.357	4.840
Pentadecanes(15)	1.477	2.391	2.688
Hexadecanes(16)	0.586	1.013	1.148
Heptadecanes(17)	0.267	0.487	0.558
Octadecanes(18)	0.187	0.359	0.414
Nonadecanes(19)	0.095	0.190	0.220
Eicosanes(20)	0.047	0.098	0.114
Heneicosanes(21)	0.025	0.055	0.065
Docosanes(22)	0.019	0.043	0.051
Tricosanes(23)	0.008	0.020	0.024
Tetracosanes(24)	0.005	0.013	0.015
Pentacosanes(25)	0.003	0.008	0.010
Hexacosanes(26)	0.002	0.005	0.005
Heptacosanes(27)	0.001	0.003	0.004
Octacosanes(28)	0.001	0.002	0.003
Nonacosanes(29)	0.001	0.002	0.002
Triacontanes(30)	0.000	0.001	0.001
Hentriacontanes Plus(31+)	<u>0.001</u>	<u>0.003</u>	<u>0.004</u>
Total	100.000	100.000	100.000



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

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

Date Sampled: 09/25/2013

Date Analyzed: 10/02/2013

Sample: Yoke No. 1H(Maxwell Horizontal Pad)

Job Number: J35843

FLASH LIBERATION OF HYDROCARBON LIQUID		
	Separator HC Liquid	Stock Tank
Pressure, psig	200	0
Temperature, °F	69	70
Gas Oil Ratio (1)	-----	142
Gas Specific Gravity (2)	-----	1.144
Separator Volume Factor (3)	1.0761	1.000

STOCK TANK FLUID PROPERTIES	
Shrinkage Recovery Factor (4)	0.9293
Oil API Gravity at 60 °F	56.94
Reid Vapor Pressure, psi (5)	2.51

Quality Control Check			
	Sampling Conditions	Test Samples	
Cylinder No.	-----	T-943*	T-966
Pressure, psig	200	198	209
Temperature, °F	69	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: _____ O. A.

* Sample used for flash study

Base Conditions: 14.73 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

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

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

Sample: Yoke No. 1H (Maxwell Horizontal Pad)
 Gas Evolved from Hydrocarbon Liquid Flashed
 From 200 psig & 69 °F to 0 psig & 70 °F

Date Sampled: 09/25/13

Job Number: 35843.001

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.250	
Carbon Dioxide	0.123	
Methane	35.935	
Ethane	30.932	8.225
Propane	18.489	5.065
Isobutane	3.361	1.094
n-Butane	5.774	1.810
2-2 Dimethylpropane	0.073	0.028
Isopentane	1.682	0.612
n-Pentane	1.243	0.448
Hexanes	1.135	0.466
Heptanes Plus	<u>1.003</u>	<u>0.440</u>
Totals	100.000	18.186

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity ----- 3.585 (Air=1)
 Molecular Weight ----- 102.82
 Gross Heating Value ----- 5398 BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity ----- 1.144 (Air=1)
 Compressibility (Z) ----- 0.9902
 Molecular Weight ----- 32.81
 Gross Heating Value
 Dry Basis ----- 1914 BTU/CF
 Saturated Basis ----- 1882 BTU/CF

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

Base Conditions: 14.650 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR
 Processor: ANB
 Cylinder ID: ST-20

David Dannhaus 361-661-7015

**CHROMATOGRAPH EXTENDED ANALYSIS
TOTAL REPORT**

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.250		0.213
Carbon Dioxide	0.123		0.165
Methane	35.935		17.569
Ethane	30.932	8.225	28.350
Propane	18.489	5.065	24.850
Isobutane	3.361	1.094	5.954
n-Butane	5.774	1.810	10.229
2,2 Dimethylpropane	0.073	0.028	0.161
Isopentane	1.682	0.612	3.699
n-Pentane	1.243	0.448	2.734
2,2 Dimethylbutane	0.070	0.029	0.184
Cyclopentane	0.102	0.042	0.218
2,3 Dimethylbutane	0.371	0.151	0.975
2 Methylpentane	0.231	0.095	0.607
3 Methylpentane	0.000	0.000	0.000
n-Hexane	0.361	0.148	0.948
Methylcyclopentane	0.035	0.012	0.090
Benzene	0.019	0.005	0.045
Cyclohexane	0.053	0.018	0.136
2-Methylhexane	0.106	0.049	0.324
3-Methylhexane	0.105	0.048	0.321
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.117	0.051	0.354
n-Heptane	0.114	0.052	0.348
Methylcyclohexane	0.101	0.040	0.302
Toluene	0.038	0.013	0.107
Other C8's	0.159	0.074	0.534
n-Octane	0.039	0.020	0.136
Ethylbenzene	0.002	0.001	0.006
M & P Xylenes	0.018	0.007	0.058
O-Xylene	0.002	0.001	0.006
Other C9's	0.062	0.031	0.239
n-Nonane	0.012	0.007	0.047
Other C10's	0.018	0.010	0.078
n-Decane	0.003	0.002	0.013
Undecanes (11)	<u>0.000</u>	<u>0.000</u>	<u>0.000</u>
Totals	100.000	18.186	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity -----	1.144	(Air=1)
Compressibility (Z) -----	0.9902	
Molecular Weight -----	32.81	
Gross Heating Value		
Dry Basis -----	1914	BTU/CF
Saturated Basis -----	1882	BTU/CF

Antero Resources
Yoke Unit 1H - Maxwell Horizontal Pad

Tag Name	Value	Units	Timestamp
Accumulated Gas Flow	1096710	MCF	10/22/2013 15:07:41
Casing Pressure	230.75	PSIA	10/22/2013 15:07:40
Current Day Gas Flow	884.15	MCF	10/22/2013 15:07:41
Differential Pressure	8.09	inH2O	10/22/2013 15:07:41
Flow Rate	3450.06	MCF Per Day	10/22/2013 15:07:41
Pressure	170	PSIA	10/22/2013 15:07:41
Previous Day Energy	4288.41	MBTU	10/22/2013 15:07:41
Previous Day Gas Flow	3438.81	MCF	10/22/2013 15:07:41
Temperature	65.59	F	10/22/2013 15:07:41
Tubing Pressure	372.66	PSIA	10/22/2013 15:07:40
Daily AP	8.05	PSIA	10/22/2013 09:00:00
Daily DP	169.51	inH2O	10/22/2013 09:00:00
Daily Energy	4288.41	MBTU	10/22/2013 09:00:00
Daily Flow	3438.81	MCF	10/22/2013 09:00:00
Daily Tf	65.05	F	10/22/2013 09:00:00
Hourly AP	169.39	PSIA	10/22/2013 10:00:00
Hourly DP	8	Inches	10/22/2013 10:00:00
Hourly Energy	178.4	MBTU	10/22/2013 10:00:00
Hourly Flow Time	3600	Seconds	10/22/2013 10:00:00
Hourly Tf	63.5	F	10/22/2013 10:00:00
Hourly Volume	143	MCF	10/22/2013 10:00:00
Audited Accumulated Gas Volume		MCF	10/22/2013 15:07:44
Audited Casing Pressure	526	PSI	10/22/2013 15:07:41
Audited Gas Volume	3849.42	MCF	10/22/2013 15:07:44
Audited Oil Volume	183.7	Barrels	10/22/2013 15:07:44
Audited Tubing Pressure	465	PSI	10/22/2013 15:07:44
Audited Water Volume	0	Barrels	10/22/2013 15:07:44
Argon	0	%	10/22/2013 15:07:44
BTU	1247.06	BTU	10/22/2013 15:07:44
CO2	0.1467	%	10/22/2013 15:07:44
Carbon Monoxide	0	%	10/22/2013 15:07:44
Decane	0	%	10/22/2013 15:07:44
Ethane	14.1987	%	10/22/2013 15:07:44
Helium	0	%	10/22/2013 15:07:44
Heptane	0	%	10/22/2013 15:07:44
Hexane	0.5451	%	10/22/2013 15:07:44
Hydrogen	0	%	10/22/2013 15:07:44
Hydrogen Sulfide	0	%	10/22/2013 15:07:44
Iso-Butane	0.5666	%	10/22/2013 15:07:44
Iso-Pentane	0.3749	%	10/22/2013 15:07:44
Methane	77.6927	%	10/22/2013 15:07:44
N2	0.4946	%	10/22/2013 15:07:43
N-Butane	1.1838	%	10/22/2013 15:07:44
Nonane	0	%	10/22/2013 15:07:41
N-Pentane	0.2914	%	10/22/2013 15:07:41
Octane	0	%	10/22/2013 15:07:41
Oxygen	0.0117	%	10/22/2013 15:07:41
Plate Size	3.75	Inches	10/22/2013 15:07:41
Propane	4.4938	%	10/22/2013 15:07:41
SPG	0.7248		10/22/2013 15:07:41
Water	0	%	10/22/2013 15:07:41

Attachment J

Class I Legal Advertisement

Attachment J

**Air Quality Permit Notice
Notice of Application
Willard Well Pad
Antero Resources Corporation
Doddridge, 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 General Permit Registration for an Oil and Natural Gas facility located near 0.58 miles northeast from the intersection of WV-18 and Sugar Camp Rd in Doddridge, West Virginia.

The latitude and longitude coordinates are: 39.255373 degrees N and -80.690733 degrees W

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

Pollutants	TOTALS (tpy):
VOC	23.0220
NO _x	6.8072
CO _{2e}	8080.4000
CO	29.2791
SO ₂	0.0291
PM _{2.5}	0.4097
PM ₁₀	2.3114
Lead	2.71E-05
Total HAPs	1.4949
Benzene	0.0104
Formaldehyde	0.0251
Xylenes	0.2514

Startup in operation is planned to begin in December 2016. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice.

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

Dated this the __ day of _____, 2015

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

Attachment K

Electronic Submittal

Attachment K

**Electronic Submittal
Willard Well Pad
Antero Resources Corporation
Doddridge County, West Virginia**

No electronic submission was made.

Attachment L

General Permit Registration Application Fee

Conestoga-Rovers & Associates, Inc.

▼ PLEASE DETACH AND RETAIN FOR YOUR RECORDS ▼

INVOICE NUMBER	DATE	VOUCHER NO.	AMOUNT
Account Number: CR20915	2/9/2015	40WVDEPAQ 400935602	397722 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

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

M&T BANK
MANUFACTURERS AND TRADERS TRUST COMPANY
Commercial Banking
Main Office, Ithaca, NY 14850
60-7063-2213

2/10/2015

NO. 397722

PAY *****1,500 DOLLARS AND *****00 CENTS \$ *****1,500.00

TO THE
ORDER
OF

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

Conestoga-Rovers & Associates, Inc.

[Signature]

[Signature]

AUTHORIZED SIGNATURES

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

⑈ 397722 ⑈ 12213706321261000000118910 ⑈

Attachment M

Siting Criteria Waiver

Attachment M

Siting Waiver

Willard 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 Willard Well Pad.

Attachment N

Material Safety Data Sheet

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

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

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



SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

SYNONYMS: CNG, Natural Gas, Methane.

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

PRODUCT NAME: Dry Field Natural Gas
PRODUCT CODES: CAS Reg. No. 68410-63-9

EMERGENCY PHONE: (800) 878-1373
AFTER HOURS: (800) 878-1373

PRODUCER: Antero Resources
ADDRESS: 1615 Wynkoop Street
Denver, Colorado 80202

CHEMTREC PHONE: (800) 424-9300

*** Section 2 – HAZARDS IDENTIFICATION ***

GHS Classification:

Flammable Gas – Category 1.

Gases Under Pressure – Gas.

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

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

Danger

Hazard Statements

Extremely flammable gas.

Contains gas under pressure, may explode if heated.

May cause damage to central nervous and respiratory systems.

Precautionary Statements

Prevention

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

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

Wash thoroughly after handling.

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

Response

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

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

Storage

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

Store in a secure area.

Disposal

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

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

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

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

***** Section 4 – FIRST AID MEASURES *****

First Aid: Eyes

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

First Aid: Skin

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

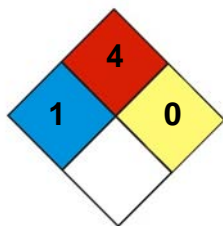
First Aid: Ingestion

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

First Aid: Inhalation

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

*** * * Section 5 – FIRE FIGHTING MEASURES * * ***



NFPA 704 Hazard Class

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

General Fire Hazards

See Section 9 for Flammability Properties.

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

Hazardous Combustion Products

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

Extinguishing Media

Any extinguisher suitable for Class B fires, dry chemical, fire fighting foam, CO₂, and other gaseous agents. However, fire should not be extinguished unless flow of gas can be immediately stopped.

Unsuitable Extinguishing Media

None.

Fire Fighting Equipment / Instructions

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

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

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

*** Section 6 – ACCIDENTAL RELEASE MEASURES ***
--

Recovery and Neutralization

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

Materials and Methods for Clean-Up

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

Emergency Measures

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

Personal Precautions and Protective Equipment

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

Environmental Precautions

Do not flush gas vapors toward sewer or drainage systems.

Prevention of Secondary Hazards

None.

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

***** Section 7 – HANDLING AND STORAGE *****

Handling Procedures

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

Storage Procedures

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

Incompatibilities

Keep away from strong oxidizers, ignition sources and heat.

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

Component Exposure Limits

Methane (74-82-8)

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

Ethane (74-84-0)

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

Propane (74-98-6)

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

Butane (106-97-8)

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

Pentanes (109-66-0)

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

Hexanes (110-54-3)

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

Nitrogen (7727-37-9)

Simple Asphyxiant

Carbon Dioxide (124-38-9)

ACGIH: 5000 ppm TWA (listed under Carbon Dioxide)

Oxygen (7782-44-7)

N/A – Necessary for life

Engineering Measures

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

Personal Protective Equipment: Respiratory

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

Personal Protective Equipment: Hands

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

Personal Protective Equipment: Eyes

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

Personal Protective Equipment: Skin and Body

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

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

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

Evaporation Rate:	ND	VOC:	ND
Octanol / H₂O Coeff.:	ND	Flash Point:	Flammable Gas
Flash Point Method:	N/A		
Lower Flammability Limit:	3.8 – 6.5	Upper Flammability Limit:	13-17
(LFL):		(UFL):	
Auto Ignition:	900-1170°F (482-632°C)	Burning Rate:	ND

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

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Keep away from strong oxidizers, ignition sources and heat.

Hazardous Decomposition Products

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

*** Section 11 – TOXICOLOGICAL INFORMATION ***

Acute Toxicity

A: General Product Information

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

B. Component Analysis – LD50/LC50

Methane (74-82-8)

Inhalation LC50 Mouse 326 g/m³ 2h

Ethane (74-84-0)

Inhalation LC50 Rat 658 mg/l 4h

Propane (74-98-6)

Inhalation LC50 Rat 658 mg/l 4h

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

Butanes (106-97-8)

Inhalation LC50 Rat 658 g/m³ 4h

Pentanes (109-66-0)

Inhalation LD50 Rat 364 g/m³ 4h

Hexanes (110-54-3)

Inhalation LC50 Rat > 20 mg/l 4h

Nitrogen (7727-37-9)

Simple Asphyxiant

Carbon Dioxide (124-38-9)

Inhalation LC50 Human 100,000 ppm 1 minute

Oxygen (7782-44-7)

N/A – Necessary for life

Potential Health Effects: Skin Corrosion Property / Stimulativeness

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

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information

This product is not reported to have any carcinogenic effects.

B: Component Carcinogenicity

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

Reproductive Toxicity

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

Specified Target Organ General Toxicity: Single Exposure

This product may cause damage to the heart.

Specified Target Organ General Toxicity: Repeated Exposure

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

Aspiration Respiratory Organs Hazard

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

SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

*** Section 12 – ECOLOGICAL INFORMATION ***

Ecotoxicity

A: General Product Information

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

B: Component Analysis – Ecotoxicity – Aquatic Toxicity

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

Persistence / Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** Section 13 – DISPOSAL CONSIDERATIONS ***

Waste Disposal Instructions

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

Disposal of Contaminated Containers or Packaging

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

*** Section 14 – TRANSPORTATION INFORMATION ***

DOT Information

Shipping Name: Natural Gas, Compressed

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

Placard:



SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

*** Section 15 – REGULATORY INFORMATION ***

Regulatory Information

Component Analysis

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

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

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

SARA Section 311/312 – Hazard Classes

Acute Health

Chronic Health

Fire

X

Sudden Release of Pressure

X

Reactive

SARA Section 313 – Supplier Notification

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

State Regulations

Component Analysis – State

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

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

SAFETY DATA SHEET

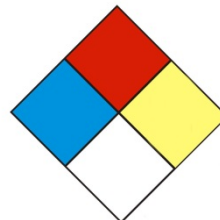
Material Name: Dry Field Natural Gas

US GHS

*** Section 16 – OTHER INFORMATION ***

NFPA® Hazard Rating

Health 1
Fire 4
Reactivity 0



HMIS® Hazard Rating

Health 1 Moderate
Fire 4 Severe
Physical 0 Minimal
* Chronic

Key/Legend

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

Literature References

None

Other Information

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

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

Date of Preparation: January 30, 2014

Date of Last Revision: March 4, 2014

End of Sheet



SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

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

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

PRODUCT NAME: Natural Gas Condensate

EMERGENCY PHONE: (800) 878-1373

PRODUCT CODES: 64741-47-5

AFTER HOURS: (800) 878-1373

PRODUCER: Antero Resources

ADDRESS: 1615 Wynkoop Street
Denver, Colorado 80202

CHEMTREC PHONE: (800) 424-9300

*** Section 2 – HAZARDS IDENTIFICATION ***

GHS Classification:

Flammable Liquids – Category 2.

Acute Toxicity Inhalation – Category 3

Germ Cell Mutagenicity – Category 1B

Carcinogenicity – Category 1A

Specific Target Organ Systemic Toxicity (STOT) – Single Exposure Category 3

Specific Target Organ Systemic Toxicity (STOT) – Repeat Exposure Category 1

Aspiration Toxicity – Category 1

Toxic to the Aquatic Environment Acute – Category 3

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

Danger

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Hazard Statements

Highly flammable liquid and vapor.
Toxic if inhaled.
May cause genetic defects.
May cause cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May cause damage to organs (liver, kidneys, blood, nervous system, and skin) through prolonged or repeated exposure.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Do not breathe gas/mist/vapors/spray.
Do not handle until all safety precautions have been read and understood.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Avoid release to the environment.

Response

If on SKIN (or hair): Wash with plenty of soap and water. Remove / Take off all contaminated clothing immediately. Rinse skin with water/shower.
If INHALED: Remove victim to fresh air and keep comfortable for breathing. Call a poison center/doctor if the victim feels unwell.
If SWALLOWED: Immediately call a poison center or doctor / physician. Do not induce vomiting.
If exposed or concerned: Get medical advice/attention.
In case of fire: Use water spray, fog or fire-fighting foam.

Storage

Store in a well-ventilated place. Keep cool.
Store in a secure area.

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Disposal

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

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

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

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

***** Section 4 – FIRST AID MEASURES *****

First Aid: Eyes

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

First Aid: Skin

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

First Aid: Ingestion (swallowing)

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

SAFETY DATA SHEET

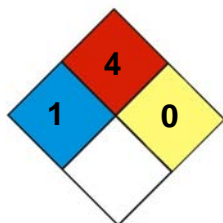
Material Name: Natural Gas Condensate

US GHS

First Aid: Inhalation (breathing)

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

***** Section 5 – FIRE FIGHTING MEASURES *****



NFPA 704 Hazard Class

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

General Fire Hazards

See Section 9 for Flammability Properties.

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

Hazardous Combustion Products

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

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, firefighting foam, water spray, carbon dioxide (CO₂), or other gaseous extinguishing agents. Use caution when applying CO₂ in confined spaces.

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

Unsuitable Extinguishing Media

None

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Fire Fighting Equipment / Instructions

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

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

* * * Section 6 – ACCIDENTAL RELEASE MEASURES * * *
--

Recovery and Neutralization

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

Materials and Methods for Clean-Up

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

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

Emergency Measures

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

Personal Precautions and Protective Equipment

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

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

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

Environmental Precautions

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

Prevention of Secondary Hazards

None

*** Section 7 – HANDLING AND STORAGE ***

Handling Procedures

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

Storage Procedures

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

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Incompatibilities

Keep away from strong oxidizers, ignition sources and heat.

*** Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION ***
--

Component Exposure Limits

Octanes (111-65-9)

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

Heptanes (142-82-5)

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

n-Hexane (110-54-3)

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

n-Pentane (109-66-0)

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

n-Butane (106-97-8)

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

Propane (74-98-6)

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

Ethane (74-84-0)

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

Benzene (71-43-2)

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

Toluene (108-88-3)

ACGIH: 20 ppm TWA (listed under Toluene)

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

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Engineering Measures

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

Personal Protective Equipment: Respiratory

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

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

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

Personal Protective Equipment: Hands

Gloves constructed of nitrile or neoprene are recommended.

Personal Protective Equipment: Eyes

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

Personal Protective Equipment: Skin and Body

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

Hygiene Measures

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

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

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

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

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

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Keep away from ignition sources and high temperatures.

Hazardous Decomposition Products

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

*** Section 11 – TOXICOLOGICAL INFORMATION ***

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B. Component Analysis – LD50/LC50

Octanes (111-65-9)

Inhalation LC50 rat = 118,000 mg/m³ / 4H

Heptanes (142-82-5)

Inhalation LC50 rat = 103,000 mg/m³ / 4H

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

Inhalation LC50 rat = 48,000 ppm / 4H

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

Inhalation LC50 rat = 364,000 mg/m³ / 4H

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

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

Propane (74-98-6)

Inhalation LC50 Rat > 800,000 ppm / 0.25H

Ethane (74-84-0)

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

Benzene (71-43-2)

Inhalation LC50 Rat 44,700 mg/m³ /

Toluene (108-88-3)

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

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

Inhalation LC50 Rat 5000 ppm / 4H

Potential Health Effects: Skin Corrosion Property / Stimulativeness

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Potential Health Effects: Eye Critical Damage / Stimulativeness

Contact with eyes may cause moderate irritation.

Potential Health Effects: Ingestion (swallowing)

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

Potential Health Effects: Inhalation (breathing)

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

Respiratory Organs Sensitization / Skin Sensitization

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

Generative Cell Mutagenicity

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

Carcinogenicity

A: General Product Information

May cause cancer.

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

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

B: Component Carcinogenicity

Benzene (71-43-2)

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

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

Reproductive Toxicity

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

Specified Target Organ General Toxicity: Single Exposure

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

Specified Target Organ General Toxicity: Repeated Exposure

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

Aspiration Respiratory Organs Hazard

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

***** Section 12 – ECOLOGICAL INFORMATION *****

Ecotoxicity

A: General Product Information

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

B: Component Analysis – Ecotoxicity – Aquatic Toxicity

Benzene (71-43-2)

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Natural Gas condensates (68919-39-1)

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

Persistence / Degradability

No information available

Bioaccumulation

No information available

Mobility in Soil

No information available

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

Waste Disposal Instructions

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

Disposal of Contaminated Containers or Packaging

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

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

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

*** Section 14 – TRANSPORTATION INFORMATION ***

DOT Information

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

UN #: 1268 Hazard Class: 3

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

Placard:



*** Section 15 – REGULATORY INFORMATION ***

Regulatory Information

Component Analysis

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

Benzene (71-43-2)

SARA 313: 0.1% de minimis concentration

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

SARA Section 311/312 – Hazard Classes

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

SARA SECTION 313 – SUPPLIER NOTIFICATION

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

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

Canadian Regulatory Information

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

European Union Regulatory Information

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

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

State Regulations

Component Analysis – State

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

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

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

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

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

Component Analysis – WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act

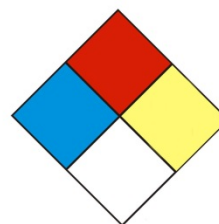
Ingredient Disclosure List:

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

* * * Section 16 – OTHER INFORMATION * * *

NFPA® Hazard Rating

Health 1
Fire 4
Reactivity 0



HMIS® Hazard Rating

Health 1 Slight
Fire 4 Severe
Physical 0 Minimal
* Chronic

SAFETY DATA SHEET

Material Name: Natural Gas Condensate

US GHS

Key/Legend

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

Literature References

None

Other Information

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

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

Date of Preparation: January 29, 2014

Date of Last Revision: March 4, 2014

End of Sheet



SAFETY DATA SHEET

Material Name: Produced Water

US GHS

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

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

PRODUCT NAME: Produced Water

EMERGENCY PHONE: (800) 878-1373

PRODUCT CODES: Mixture

AFTER HOURS: (800) 878-1373

PRODUCER: Antero Resources

ADDRESS: 1615 Wynkoop Street
Denver, Colorado 80202

CHEMTREC PHONE: (800) 424-9300

*** Section 2 – HAZARDS IDENTIFICATION ***

GHS Classification:

Eye Irritant – Category 2A.

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

Warning

Hazard Statements

Causes serious eye irritation

Precautionary Statements

Prevention

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

Response

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

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

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

If EYE irritation persists, get medical advice / attention.

Storage

Store in a secure area.

Disposal

Dispose of contents/containers in accordance with regulations.

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

CAS #	Component	Percent
7732-18-5	Water	80
7647-14-5	Sodium Chloride	20

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

*** * * Section 4 – FIRST AID MEASURES * * ***

First Aid: Eyes

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

First Aid: Skin

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

First Aid: Ingestion (Swallowing)

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

First Aid: Inhalation (Breathing)

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

SAFETY DATA SHEET

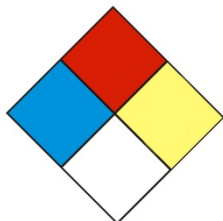
Material Name: Produced Water

US GHS

Most important symptoms and effects

None known or anticipated.

***** Section 5 – FIRE FIGHTING MEASURES *****



NFPA 704 Hazard Class

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

General Fire Hazards

No fire hazards are expected.

General Fire Hazards

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

Extinguishing Media

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

Unsuitable Extinguishing Media

None

Fire Fighting Equipment / Instructions

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

Hazardous Combustion Products

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

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

* * * Section 6 – ACCIDENTAL RELEASE MEASURES * * *
--

Recovery and Neutralization

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

Materials and Methods for Clean-Up

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

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

Emergency Measures

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

Personal Precautions and Protective Equipment

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

Environmental Precautions

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

Prevention of Secondary Hazards

None

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

*** * * Section 7 – HANDLING AND STORAGE * * ***

Handling Procedures

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

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

Storage Procedures

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

Incompatibilities

Keep away from excessive heat to prevent rupture of container.

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

Component Exposure Limits

Water (7732-18-5)

ACGIH: Not listed

Sodium Chloride (7647-14-5)

ACGIH: Not listed

Engineering Measures

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

Personal Protective Equipment: Respiratory

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

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

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

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

Personal Protective Equipment: Skin and Hands

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

Personal Protective Equipment: Eyes

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

Hygiene Measures

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

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

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

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

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

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

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

Conditions to Avoid

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

Hazardous Decomposition Products

Not anticipated under normal conditions of use.

Hazardous Polymerization

Not known to occur.

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

Acute Toxicity

A: General Product Information

Unlikely to be harmful.

B. Component Analysis – D50/LC50

Water (7732-18-5)

Oral LD50 Rat 90 g/kg

Sodium Chloride (7647-14-5)

Oral LD50 Rat 3 g/kg

Potential Health Effects: Skin Corrosion Property / Stimulativeness

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

Potential Health Effects: Eye Critical Damage / Stimulativeness

Contact with eyes may cause moderate irritation.

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

Potential Health Effects: Ingestion

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

Potential Health Effects: Inhalation

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

Generative Cell Mutagenicity

Not expected to cause genetic effects.

Carcinogenicity

General Product Information

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

Reproductive Toxicity

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

Specified Target Organ General Toxicity: Single Exposure

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

Specified Target Organ General Toxicity: Repeated Exposure

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

Aspiration Respiratory Organs Hazard

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

*** Section 12 – ECOLOGICAL INFORMATION ***
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Ecotoxicity

A: General Product Information

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

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

Persistence / Degradability

No information available

Bioaccumulation

No information available

Mobility in Soil

No information available

*** Section 13 – DISPOSAL CONSIDERATIONS ***

Waste Disposal Instructions

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

Disposal of Contaminated Containers or Packaging

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

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

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

*** Section 14 – TRANSPORTATION INFORMATION ***
--

DOT Information

Shipping Description: Not Regulated

UN #: Not Regulated

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

*** Section 15 – REGULATORY INFORMATION ***

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

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

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

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

EPA (CERCLA) Reportable Quantity (in pounds):

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

State Regulations

Component Analysis

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

California Proposition 65:

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

National Chemical Inventories:

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

U.S. Export control classification Number: EAR99.

*** Section 16 – OTHER INFORMATION ***

NFPA® Hazard Rating

Health 1
Fire 0
Reactivity 0

HMIS® Hazard Rating

Health 1 Slight
Fire 0 Minimal
Physical 0 Minimal

SAFETY DATA SHEET

Material Name: Produced Water

US GHS

Key/Legend

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

Literature References

None

Other Information

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

Date of Preparation: January 28, 2014

Date of Last Revision: March 4, 2014

End of Sheet

Attachment O

Emissions Summary Sheet

Attachment O: G70-A Emissions Summary Sheet

Emission Points Data Summary Sheet

Table 1: Emissions Data

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type ¹	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		All Regulated Pollutants Chemical Name/CAS ³ (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions ⁴		Maximum Potential Controlled Emissions ⁵		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used ⁶
		ID No.	Source	ID No.	Device Type		lb/hr	ton/yr	lb/hr	ton/yr		
EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008, EP-H009	Vertical Stack	H001, H002, H003, H004, H005, H006, H007, H008, H009	Gas Production Unit Heater	N/A		CO (630080)	0.91	3.98	0.91	3.98	Gas/Vapor /Solid (for PM)	MB AP-42
						NOx (10102439)	1.08	4.74	1.08	4.74		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	1306.78	5723.67	1306.78	5723.67		
						SO2 (7446095)	0.01	0.03	0.01	0.03		
						PM, PM10, PM2.5	0.08	0.36	0.08	0.36		
						Hexane (110543)	0.02	0.09	0.02	0.09		
						Total VOCs	0.06	0.26	0.06	0.26		
F001	n/a	F001	Fugitives	N/A		Toluene (108883)	0.01	0.05	0.01	0.05	Gas/Vapor	MB
						Ethyl benzene (100414)	0.02	0.09	0.02	0.09		
						Hexane (110543)	0.17	0.73	0.17	0.73		
						o,m,p-xylenes (95476,108383,106423)	0.05	0.24	0.05	0.24		
						CO2 Equivalent CO2 (124389), CH4	72.64	318.18	72.64	318.18		
						VOCs	3.43	15.02	3.43	15.02		
EP-L001, EP-L002	n/a	L001, L002	Loading (Condensate), Loading (Water)	N/A		VOCs	4.72	0.81	4.72	0.81	Gas/Vapor	MB
						CO2 Equivalent CO2 (124389), CH4	8.73	3.37	8.73	3.37		
EP-HR001	n/a	HR001	Haul Truck	N/A		PM, PM10, PM2.5	6.37	8.40	3.18	4.20	Solid	MB
EC001	n/a	TANKCOND001-010, TANKPW001-002, and EC001	Condensate Tanks, PW Tanks, and Enclosed Combustor	N/A	Enclosed Combustor	CO (630080)	0.00	0.00	0.13	0.57	Gas/Vapor/ Solid (for PM)	MB
						NOx (10102439)	0.00	0.00	0.16	0.68		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4	704.92	3087.55	428.75	1877.95		
						Benzene (71432)	0.04	0.18	0.00	0.00		
						Toluene (108883)	0.11	0.47	0.00	0.01		
						ethyl benzene (100414)	0.08	0.33	0.00	0.01		
						hexane (110543)	2.04	8.92	0.04	0.18		
						o,m,p-xylenes (95476,108383,106423)	0.15	0.65	0.00	0.01		
						VOCs	73.55	322.17	1.47	6.44		
EP-PCV	valve	PCV	Pneumatic CV	N/A		hexane (110543)	0.01	0.05	0.01	0.05	Gas/Vapor	MB
						CO2 Equivalent CO2 (124389), CH4	8.13	35.61	8.13	35.61		
						VOCs	0.10	0.45	0.10	0.45		
EP-ENG001	Vertical Stack	ENG001	Compressor Engine	N/A		CO (630080)	5.64	24.72	5.64	24.72	Gas/Vapor/ Solid (for PM)	MB
						NOx (10102439)	0.32	1.38	0.32	1.38		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	27.78	121.66	27.78	121.66		
						Total VOCs	0.01	0.03	0.01	0.03		

Attachment C/O: G70-A Emissions Summary Sheet
Fugitive Emissions Data Summary Sheet

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS 1	Maximum Potential Uncontrolled Emissions 2		Maximum Potential Controlled Emissions 3		Est. Method Used 4
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	n/a					
Unpaved Haul Roads	PM, PM10, PM2.5	6.3696	8.3963	3.1848	4.1981	MB
Loading/Unloading Operations	VOCs	4.7236	0.8104	4.7236	0.8104	MB
	toluene (108883)	0.0008	0.0001	0.0008	0.0001	
	ethyl benzene (100414)	0.0010	0.0002	0.0010	0.0002	
	hexane (110543)	0.0089	0.0015	0.0089	0.0015	
	o,m,p-xylenes (95476,108383,106423)	0.0023	0.0004	0.0023	0.0004	
	CO2 Equivalent CO2 (124389), CH4	8.7325	3.3669	8.7325	3.3669	
	benzene (71432)	0.0001	0.0000	0.0001	0.0000	
	TAPs (benzene)	0.0001	0.0000	0.0001	0.0000	
Equipment Leaks (Components)	Benzene (71432)	Does not apply	0.0051	Does not apply	0.0051	MB
	Toluene (108883)		0.0462		0.0462	
	Ethyl benzene (100414)		0.0945		0.0945	
	Hexane (110543)		0.7307		0.7307	
	o,m,p-xylenes (95476,108383,106423)		0.2378		0.2378	
	CO2 Equivalent CO2 (124389), CH4		318.1771		318.1771	
	VOCs		15.0243		15.0243	
	TAPs (benzene)		0.0051		0.0051	
Equipment Leaks (PCVs)	toluene (108883)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MB
	ethyl benzene (100414)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	hexane (110543)	0.0123	0.0537	0.0123	0.0537	
	o,m,p-xylenes (95476,108383,106423)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
	CO2 Equivalent CO2 (124389), CH4	8.1294	35.6070	8.1294	35.6070	
	VOCs	0.1030	0.4513	0.1030	0.4513	
	TAPs (benzene)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

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

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

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

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

Attachment P

**Other Supporting Documentation
(Engine EPA's Certificate of Conformity and Technical Information)**

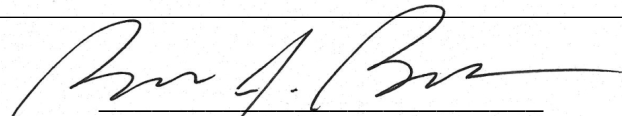


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2013 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT OF 1990

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_x (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 (H_o)

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.

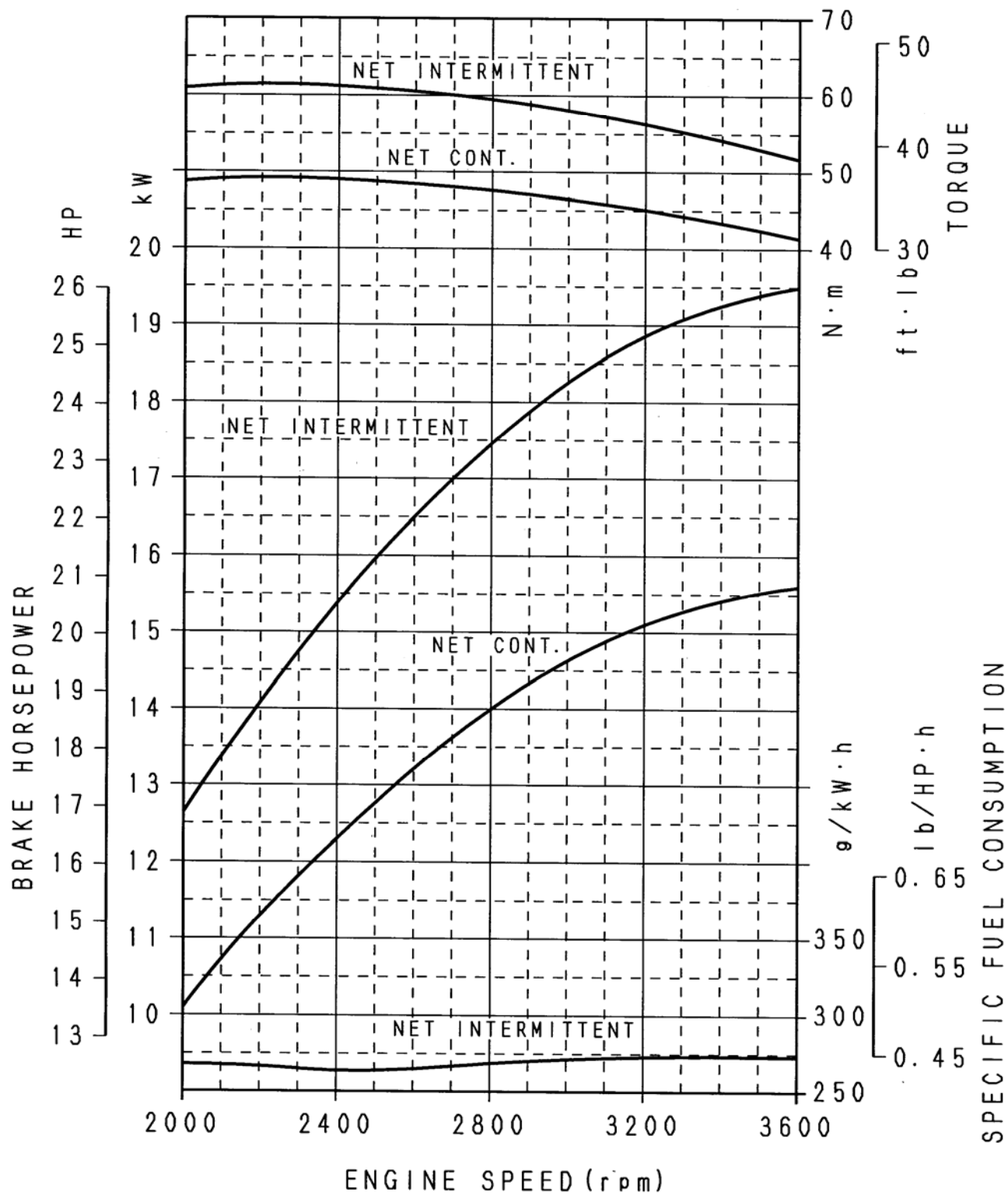
1. GENERAL SPECIFICATIONS

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

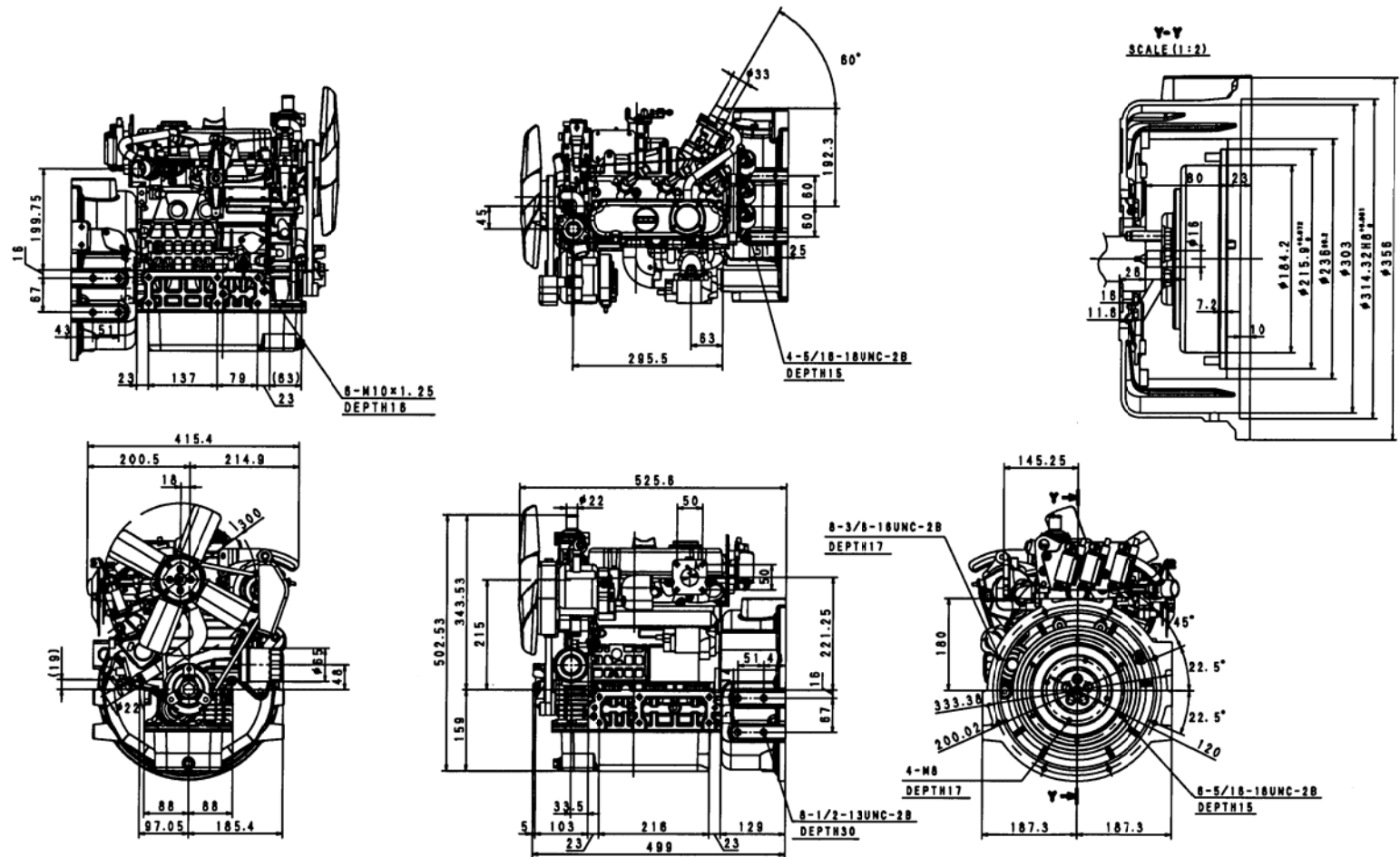
2. PERFORMANCE CURVES

DG972 PERFORMANCE CURVES

Higher calorific value : 11000kcal/m^3 (1236BTU/ft^3)



3. DIMENSIONS



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)		4-4)
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

1. Conversion rates 1kW=1.35962PS=1.34048HP
 1PS=0.7355kW=0.985925HP
 1HP=0.7457kW=1.01428PS
2. Fuel detail Japanese standard gas
 higher calorific value : 11000kcal/m³ (1236BTU/ft³)
 supply pressure : 0.98 – 2.45kPa (7.35 – 18.38mmHg)

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

1. Conversion rates 1kW=1.35962PS=1.34048HP 1kg=2.20462lb (1g=0.00220462lb)
 1PS=0.7355kW=0.985925HP 1lb=0.45359kg
 1HP=0.7457kW=1.01428PS
2. Fuel detail Japanese standard gas
 higher calorific value : 11000kcal/m³ (1236BTU/ft³)
 supply pressure : 0.98 – 2.45kPa (7.35 – 18.38mmHg)

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

1. 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 ³ /h	44.44	53.33	62.22	71.11	80.00
in ³ /sec	753	904	1055	1205	1356
ft ³ /min	26.13	31.35	36.58	41.80	47.03

Combustion air requirements calculating formula

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

Q₁: Amount of intake air (m³/min)

η: Intake efficiency

V_h: 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 ³ /h	2056	2654	2969	3002	2753
in ³ /sec	34859	44984	50327	50888	46667
ft ³ /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 ³ /h	2100.4	2707.3	3031.2	3073.1	2833.0
in ³ /sec	35612	45888	51382	52093	48023
ft ³ /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

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

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

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

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 ³ /h	127.67	153.19	178.73	204.26	229.80
in ³ /sec	2164	2597	3030	3462	3895
ft ³ /min	75.05	90.06	105.07	120.08	135.09

Note

- Conversion rates
 - 1L=61.0237in³=0.035315ft³
 - 1ft³=28.3168L
 - 1L/sec=3.6m³/h=127.133ft³/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

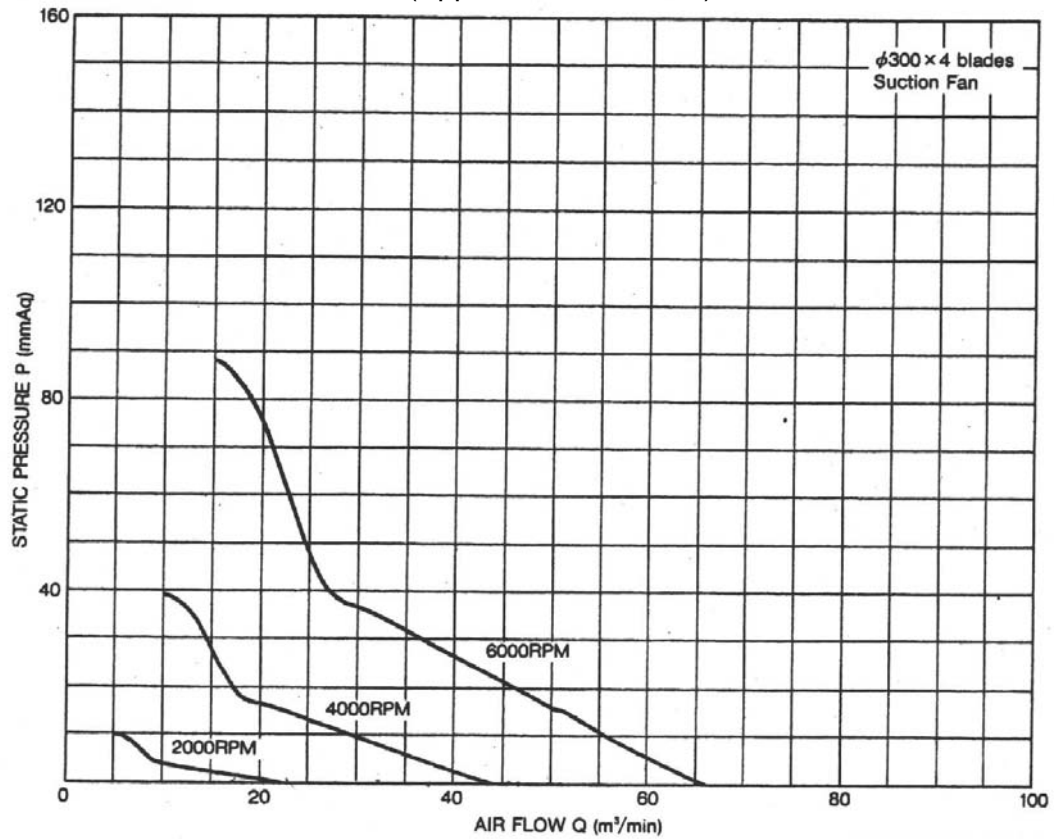
Be: Specific fuel consumption

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

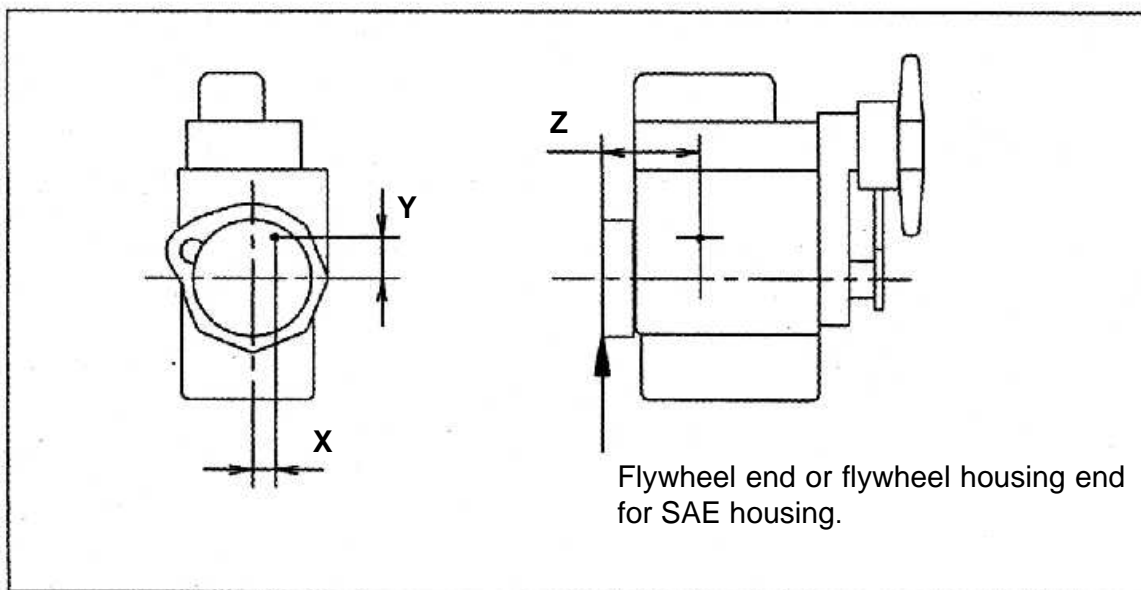
Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
WG/DF972	72.0 (159)	-25.5 (-1.00)	73.3 (2.89)	179.5 (7.07)

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)

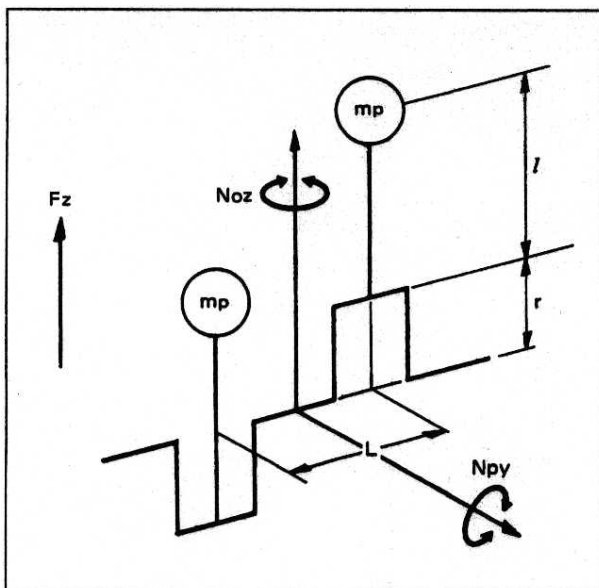
Note

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
 ω : Angular velocity

$$\omega = 2\pi n / 60 \quad n: \text{Engine speed (rpm)}$$

$l=0.098\text{m}$	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

($\times \omega^2$)

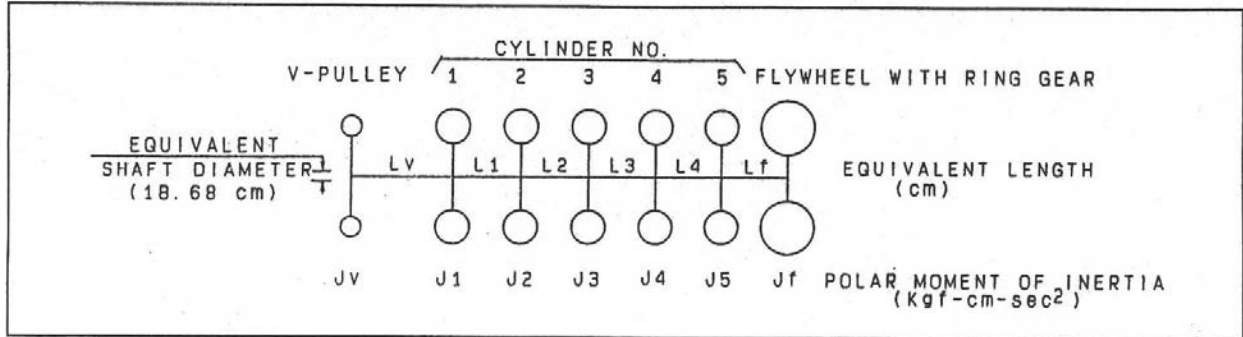
Model	No. of Cylinder	Cylinder Bore	Order	F_z	N_{py}	N_{oz}
WG/DF/DG 972	3	74.5mm	1	0	0.000096	0.000096
			2	0	0.000072	0

▼An example of calculation

Calculation condition	ω^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 ²)				
	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/m³ (1236BTU/ft³).

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/m³ (1236BTU/ft³)
supply pressure : 0.98 – 2.45kPa (7.35 – 18.38mmHg)

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

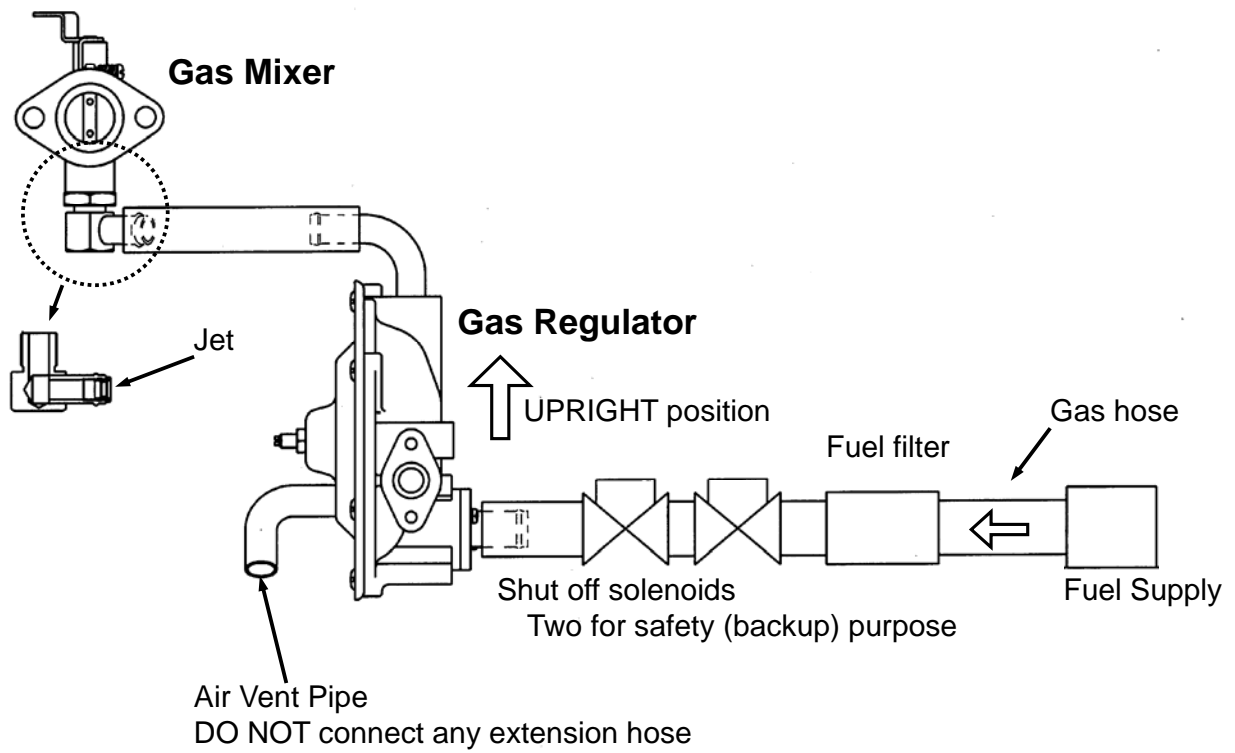
4. Application Check Item

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

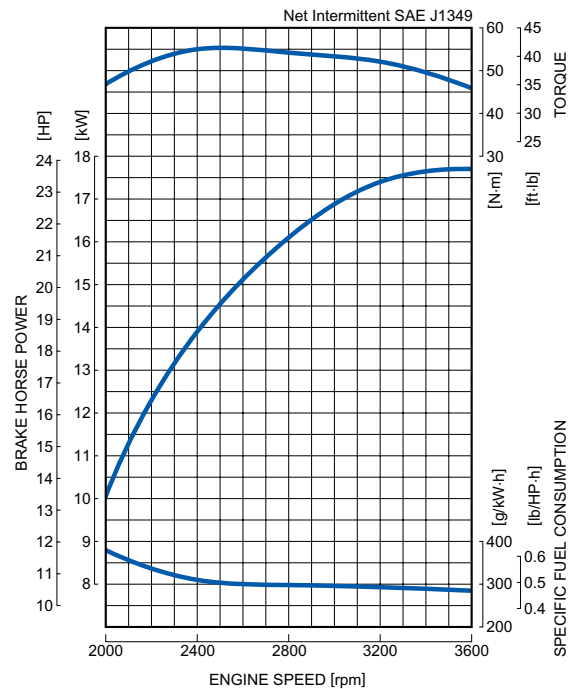
RATED POWER

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		DG972-E2
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)* ¹ / 452.5 (17.81)* ²
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)* ¹ / 95.4 (210.3)* ²

*Specification is subject to change without notice.

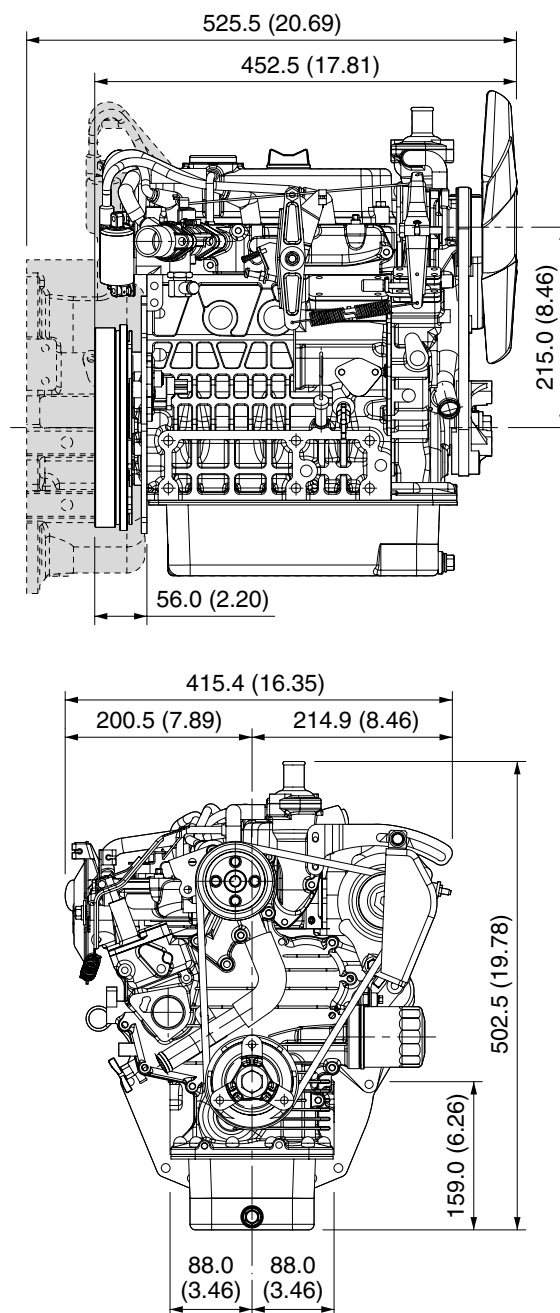
*Output: Net Intermittent SAE J1349

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

*¹ with SAE Flywheel and Housing

*² with Rear End Plate

DIMENSIONS



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