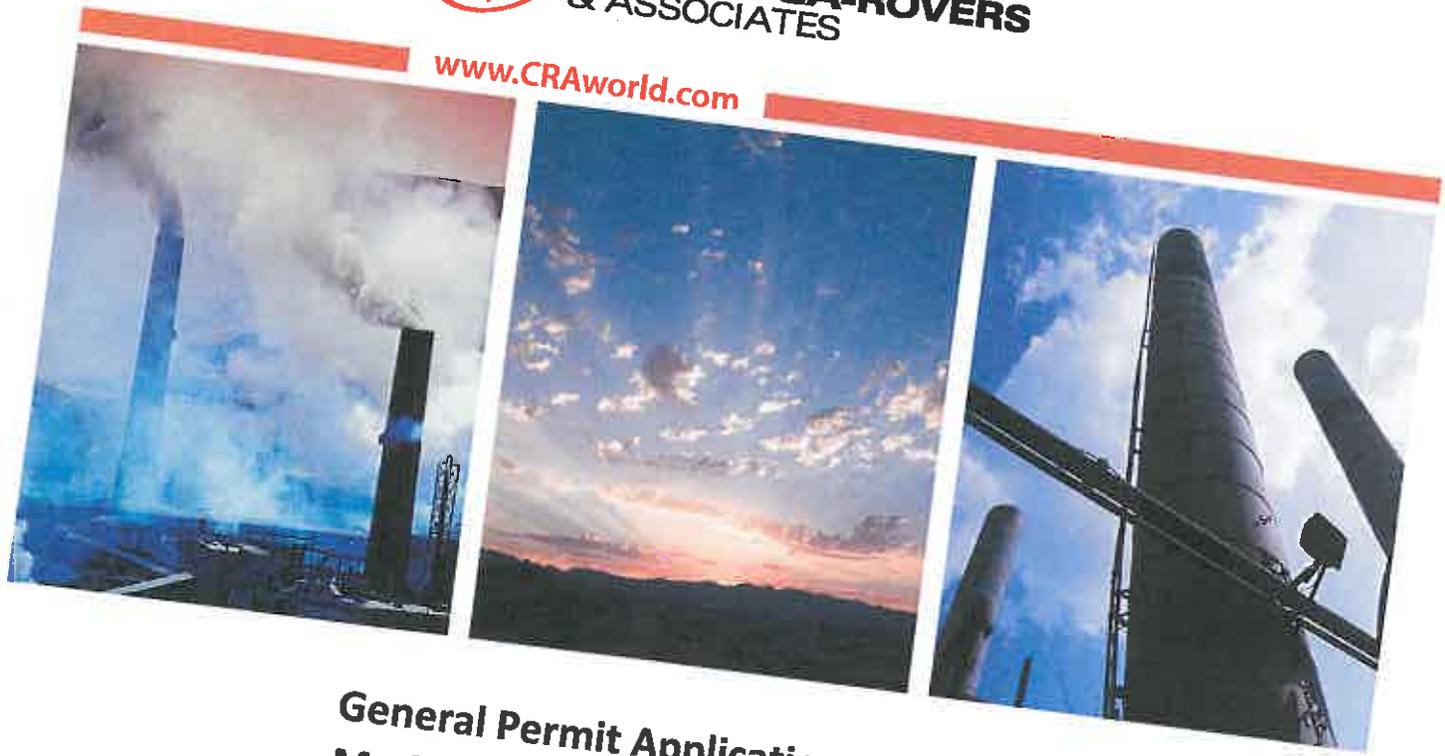


David
670-A
017-0810



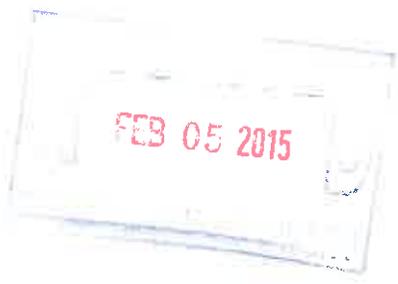
www.CRAworld.com



General Permit Application G70-A Modification

Cline Wellpad

Prepared for: Antero Resources Corporation



Conestoga-Rovers & Associates
6320 Rothway, Suite 100
Houston, Texas 77040

February 2015 • 082715 • Report No. 153





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 Street

Denver, CO, 80202

4. Applicant's physical address:

11316 WV RT 18S

New Milton, WV 26411

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? YES NO

- IF YES, provide a copy of the Certificate of Incorporation/ Organization / Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A.
- IF NO, provide a copy of the Certificate of Authority / Authority of 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):

017-00101

10. List all current 45CSR13 and other General Permit numbers associated with this process (for existing facilities only):

G70-A036A

A: PRIMARY OPERATING SITE INFORMATION

<p>11A. Facility name of primary operating site:</p> <p><u>Cline Wellpad</u></p>	<p>12A. Address of primary operating site:</p> <p>Mailing: <u>N/A</u> Physical: <u>WV 18 S and Co Rte 18/16</u></p>	
<p>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</p> <p>— IF YES, please explain: <u>Antero is leasing the mineral rights for this site</u></p> <p>— IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.</p>		
<p>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;</p> <p>From the nearest city (New Milton):</p> <p>At the Co Rte 25/2 and Co Rte 25 head north to Co Rte 25/Meathouse Fork Rd for 1.2 miles. Turn left to WV-18S and go for 5.1 miles. Turn right to an unnamed road for 0.1 miles. Facility entrance will be on the left.</p> <p>— 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.</p>		
<p>15A. Nearest city or town:</p> <p>New Milton</p>	<p>16A. County:</p> <p>Doddridge</p>	<p>17A. UTM Coordinates:</p> <p>Northing (KM): 4,337.441 Easting (KM): 525.944 Zone: 17</p>
<p>18A. Briefly describe the proposed new operation or change (s) to the facility:</p> <p>Proposed installation of one compressor engine, replacement of one gas production unit, removal of vapor recovery line, and increase in throughput.</p>		<p>19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):</p> <p>Latitude: 39.18584 Longitude: -80.68959</p>

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

<p>11B. Name of 1st alternate operating site:</p> <p>_____</p>	<p>12B. Address of 1st alternate operating site:</p> <p>Mailing: _____ Physical: _____</p>
<p>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</p> <p>— IF YES, please explain: _____</p> <p>— IF NO, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.</p>	
<p>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;</p> <p>— 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.</p> <p>_____</p> <p>_____</p>	

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: _____

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: _____
--	---

13C. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? YES 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: _____
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: _____

20. Provide the date of anticipated installation or change: <u>Upon the issuance of the permit</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>Upon the issuance of the permit</u>
---	--

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 Donald Gray, Environmental and Regulatory Manager

(please print or type)

Signature _____

(please use blue ink)

Authorized Representative (if applicable)

Date

2-4-2015

Applicant's Name Antero Resources Corporation

Phone & Fax _____

303-357-6730

Phone

303-357-7315

Fax

Email dgray@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: 6/14/13: 14 JUN. 2013

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) DONALD C. GRAY (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.

Kevin J. Kilstrom KEVIN J. KILSTROM - VICE PRESIDENT
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 B

Process Description

Attachment B**Process Description****Cline Wellpad****Antero Resources Corporation****Doddridge County, West Virginia**

A mixture of condensate and entrained gas from the well enters the Facility through a low pressure separator where the gas phase is separated from the liquid phase. Gas Production Unit (GPU) Heaters (H001 through H006) are used in conjunction with the separators to help separate the gas from the liquid phases. The heaters are fueled by a slip stream of the separated gas. The compressed gas is then metered and sent to the sales gas pipeline. The separated condensate and water from the separators flow to the storage tanks (TANK001-008).

The Facility has eight (8) tanks (TANK001-008) on site to store condensate and produced water prior to removal from the site. Flashing, working, and breathing losses from the tanks are sent to the flare (FL001) to control the emissions. The flare 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 and produced water (L001) from the storage tanks into tanker trucks. Emissions from the loading operations are vented to the atmosphere.

Emissions from the Facility's emission sources were calculated using the extended analysis of the condensate and gas analysis from Tom's Fork Unit 1H one of the wells in Erwin Hilltop Pad. This extended analysis is considered representative of the materials from Cline Pad, being in the same Marcellus rock formation.

Cline Pad's 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, Erwin Hilltop Pad, was not aggregated. Although it belongs to the same industrial grouping and under the control of the same person, it is not located on contiguous or adjacent property, and operates independently. The Erwin Hilltop Pad is approximately 3,730 feet southwest of Cline Pad.

Attachment C

Description of Fugitive Emissions

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

Haul Road Emissions

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

Attachment 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 Unpaved Haul Roads Loading/Unloading Operations	n/a					
	PM, PM10, PM2.5	0.6593	0.4393	0.3296	0.2197	MB AP-42
	VOCs	5.3923	3.1983	5.3923	3.1983	MB
	toluene (108883)	0.0023	0.0008	0.0013	0.0008	AP-42
	ethyl benzene (100414)	0.0015	0.0009	0.0015	0.0009	
	hexane (110543)	0.0127	0.0075	0.0127	0.0075	
	o,m,p-xylenes (95476,108383,106423)	0.0034	0.0020	0.0034	0.0020	
	CO2 Equivalent	12.1749	7.2212	12.1749	7.2212	
	CO2 (124389), CH4	0.0002	1.29E-04	0.0002	1.29E-04	
	benzene (71432)	0.0002	1.29E-04	0.0002	1.29E-04	
	TAPs (benzene)					
	Benzene (71432)					
	Toluene (108883)					MB
	Ethyl benzene (100414)					AP-42
	Hexane (110543)					
Equipment Leaks (Components)	o,m,p-xylenes (95476,108383,106423)	Does not apply	0.4247	Does not apply	0.4247	
	CO2 Equivalent		0.2470		0.2470	
	CO2 (124389), CH4		226.1413		226.1413	
	VOCs		9.5465		9.5465	
	TAPs (benzene)		0.0054		0.0054	
	toluene (108883)		0.00E+00		0.00E+00	
	ethyl benzene (100414)		0.00E+00		0.00E+00	
	hexane (110543)		0.0033		0.0033	
	o,m,p-xylenes (95476,108383,106423)		0.00E+00		0.00E+00	
	CO2 Equivalent		4.4260		4.4260	
	CO2 (124389), CH4		0.0428		0.0428	
	VOCs		0.00E+00		0.00E+00	
	TAPs (benzene, formaldehyde)		0.00E+00		0.00E+00	
						MB AP-42

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	300		First attempt within 5 days of detection and final repair within 15 days	4,050.13
	Light Liquid VOC	312		First attempt within 5 days of detection and final repair within 15 days	14,739.27
	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	78		First attempt within 5 days of detection and final repair within 15 days	91.26
	Non-VOC			First attempt within 5 days of detection and final repair within 15 days	494.99
Other	VOC	354		First attempt within 5 days of detection and final repair within 15 days	212.41
	Non-VOC			First attempt within 5 days of detection and final repair within 15 days	1,152.05

Attachment D

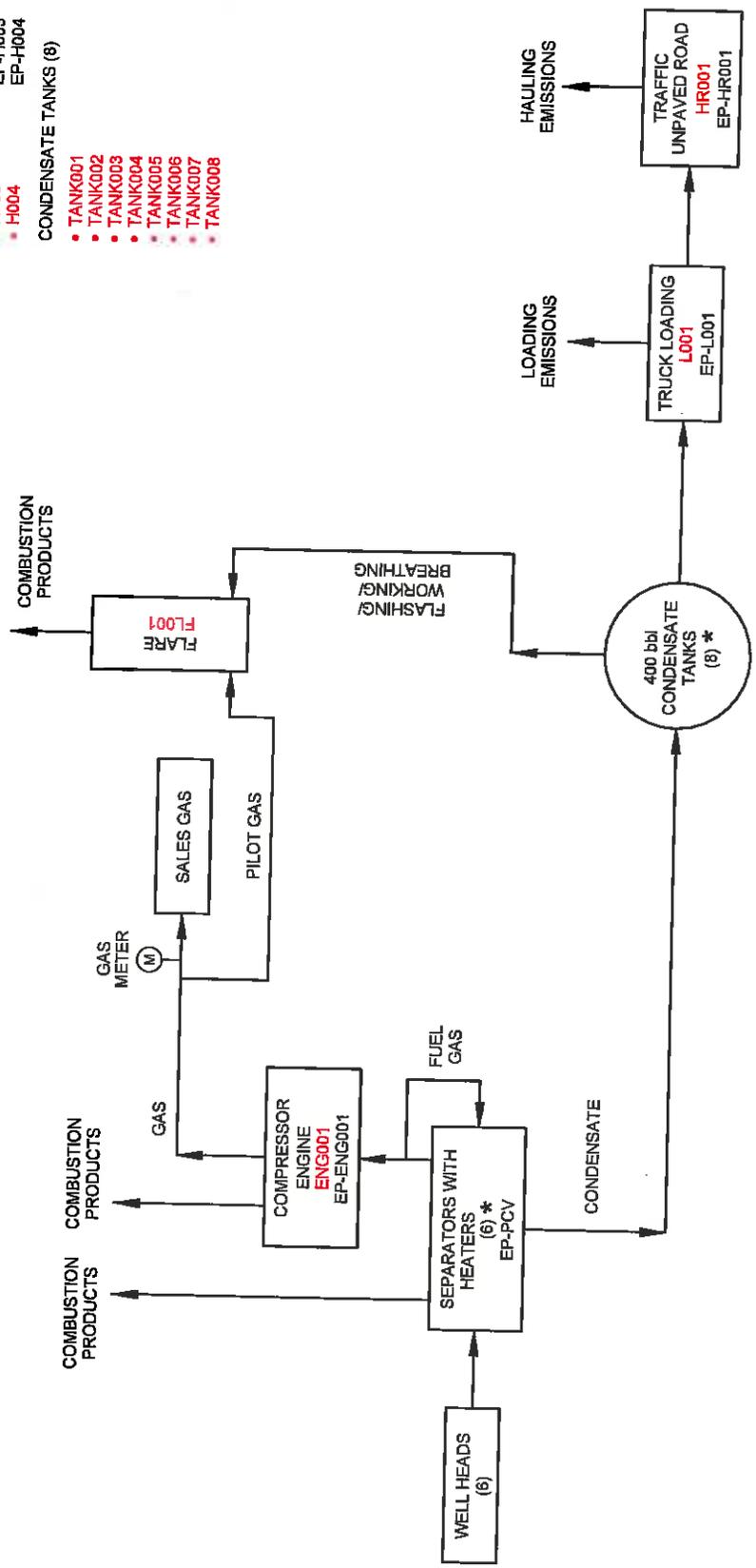
Process Flow Diagram

* SEPARATORS WITH HEATERS (6)

- H001 • H005 EP-H001 EP-H005
- H002 • H006 EP-H002 EP-H006
- H003 EP-H003
- H004 EP-H004

CONDENSATE TANKS (8)

- TANK001
- TANK002
- TANK003
- TANK004
- TANK005
- TANK006
- TANK007
- TANK008



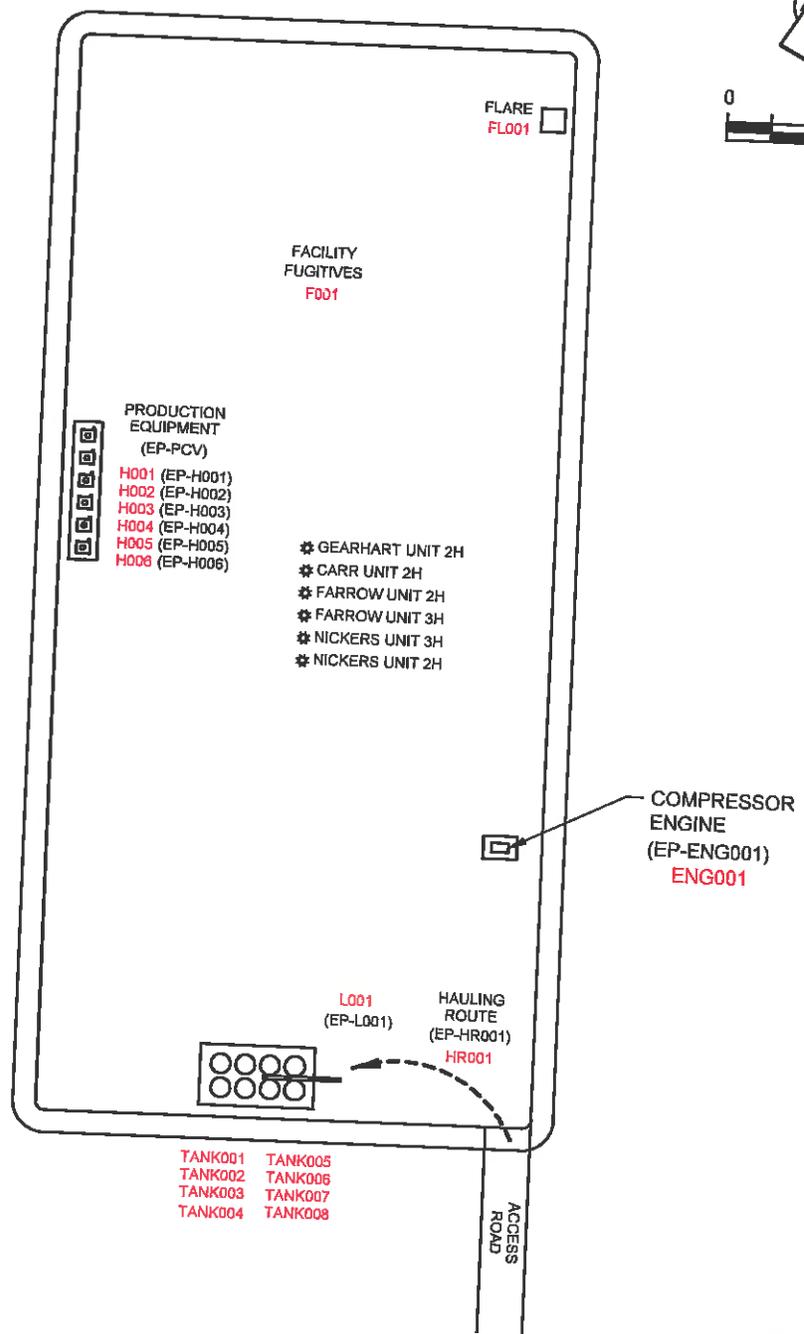
FUGITIVES F001

Attachment D
PROCESS FLOW DIAGRAM - ANTERO RESOURCES CLINE PAD
Doddridge County, West Virginia



Attachment E

Plot Plan

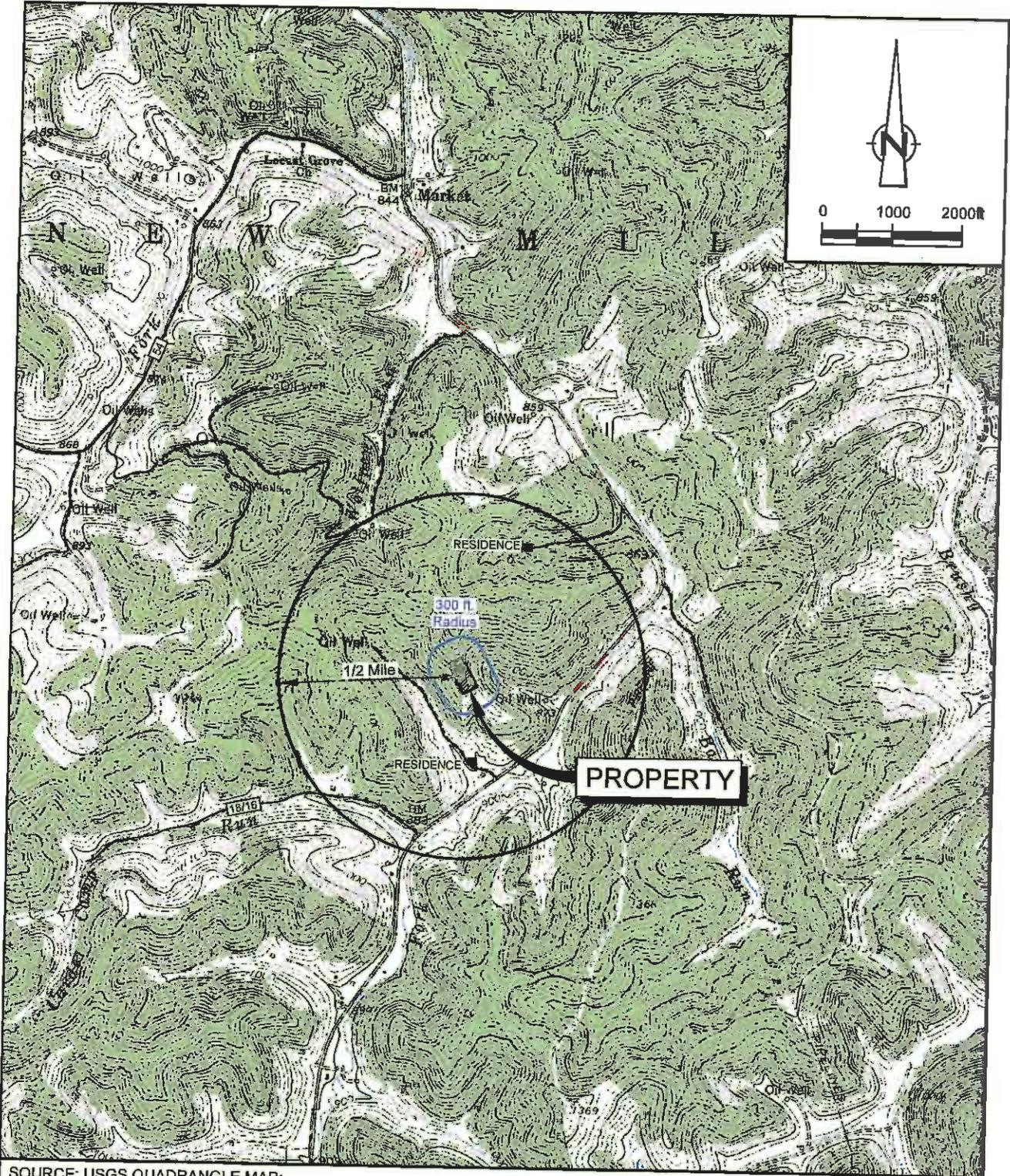


Attachment E
PLOT PLAN
CLINE PAD
ANTERO RESOURCES
Doddrige County, West Virginia



Attachment F

Area Map



SOURCE: USGS QUADRANGLE MAP:
NEW MILTON, WEST VIRGINIA

SITE COORDINATES: UTM ZONE 17S 525945, 4337443 NAD 83
SITE ELEVATION: 1096 ft AMSL



Attachment F
AREA MAP
CLINE PAD
ANTERO RESOURCES
Doddridge County, West Virginia

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	Reserved	<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:	
47-017-06362-00	
47-017-06266-00	
47-017-06334-00	
47-017-06311-00	
47-017-06333-00	
47-017-06453-00	

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.

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

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

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name TANK	2. Tank Name TANK001-08
3. Emission Unit ID number TANK001-08	4. Emission Point ID number FLO01
5. Date Installed or Modified (for existing tanks)	6. Type of change: New construction
7A. Description of Tank Modification (if applicable)	
7B. Will more than one material be stored in this tank? If so, a separate form must be completed for each material. Yes	
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. 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 (specify barrels or gallons). This is also known as "working volume." 400bbbls	
13A. Maximum annual throughput (gal/yr) 11,957,400	13B. Maximum daily throughput (gal/day) 32,760
14. Number of tank turnovers per year 89	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 (Condensate and 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): 73	
30. Annual Avg. Minimum Temperature (°F): 65.9		31. Avg. Wind Speed (mph): 5.9	
32. Annual Avg. Solar Insulation Factor (BTU/ft ² -day): 1030.235999		33. Atmospheric Pressure (psia): 14.8	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F):		34A. Minimum (°F):	
51.7		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): 3.8511	
37A. Avg. liquid surface temperature (°F):51.7		37B. Corresponding vapor pressure (psia): 4.8246	
38A. Maximum liquid surface temperature (°F): 63.8		38B. Corresponding vapor pressure (psia): 5.9707	
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 and PW Mixture	
39B. CAS number:		mix of HC	
39C. Liquid density (lb/gal):		5.9	
39D. Liquid molecular weight (lb/lb-mole):		103.8000	
39E. Vapor molecular weight (lb/lb-mole):		22.9775	
39F. Maximum true vapor pressure (psia):		6.8721	
39G. Max Reid vapor pressure (psi):		8.12688	
39H. Months Storage per year. From:		year round	
To:			

**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	2014	N/A	--	1	1,209
H002	EP-H002	Gas Production Unit Heater	2014	N/A	--	1	1,209
H003	EP-H003	Gas Production Unit Heater	2014	N/A	--	1	1,209
H004	EP-H004	Gas Production Unit Heater	2014	N/A	--	1	1,209
H005	EP-H005	Gas Production Unit Heater	2014	N/A	--	1	1,209
H006	EP-H006	Gas Production Unit Heater	2015	New	--	1.5	1,209
FL001	FL001	Flare (Cimmaron 48", Model No. 700-TI-603-D-31C)	2014	N/A	FL001	6.6	1,209
ENG001	EP-ENG001	Engine (Kubota DG972-E2)	2015	New	--	--	1,209

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 Treaters should be designated HT-1, HT-2, etc. Heaters or Line Heaters should be designated LH-1, LH-2, etc. For sources, use 1S, 2S, 3S...or other appropriate designation. Enter glycol dehydration unit Reboiler Vent data on the Glycol Dehydration Unit Data Sheet.

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

³ New, modification, removal.

⁴ 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		2015	
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	0.0069	0.0302
AP	SO ₂	0.0001	0.0006
AP	PM ₁₀	0.0022	0.0097
AP	Formaldehyde	0.0048	0.0209
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	2. Emission Point ID: EP-L001	3. Year Installed/Modified: 2014		
4. Emission Unit Description: CONDENSATE AND PRODUCED WATER				
5. Loading Area Data				
5A. Number of pumps: 1	5B. Number of liquids loaded: 1	5C. Maximum number of tank trucks loading at one time: 1		
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	8	8	8	8
days/week	3	3	3	3
9. Bulk Liquid Data (add pages as necessary)				
Liquid Name	Condensate/ Produced Water			
Max. daily throughput (1000 gal/day)	32.76			
Max. annual throughput (1000 gal/yr)	11,957.40			
Loading Method ¹	BF			
Max. Fill Rate (gal/min)	168			
Average Fill Time (min/loading)	50			
Max. Bulk Liquid Temperature (°F)	72.1			
True Vapor Pressure ²	6.87			
Cargo Vessel Condition ³	U			
Control Equipment or Method ⁴	None			
Minimum collection efficiency (%)	100			
Minimum control efficiency (%)	0			
Maximum	Loading (lb/hr)	22.38		
Emission Rate	Annual (ton/yr)	13.27		
Estimation Method ⁵		ProMax/ AP-42		
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)				

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.*

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 1) Visual inspection to ensure that loading connections from storage tanks to trucks are leak-free.	RECORDKEEPING 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 I

Emission Calculations

Table 1

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

Oil and Gas Site General Information

Administrative Information	
Company Name	Antero Resources Corporation
Facility/Well Name	Cline Well Pad
Nearest City/Town	New Milton
API Number/SIC Code	1311
Latitude/Longitude	39.185838, -80.699594
County	Doddridge County

Technical Information	
Max Condensate Site Throughput (bbl/day):	60
Max Produced Water Site Throughput (bbl/day):	720
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	Yes

Equipment/Processes at Site	
Equipment/Process Types	How many for this site?
Fugitives	6
IC Engines	1
Turbines	0
Diesel Engines	0
Gas Production Unit Heaters	6
Condensate/Produced Water Tanks	8
Miscellaneous Tanks	0
Loading Jobs	1
Glycol Units	0
Amine Units	0
Flares-Vapor Combustors	1

Table 2

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

Emission Source	VOC		NO _x		CO ₂		CO		SP ₁		PM ₁₀		Leak		Total HAPs		Benzene		X/emissions		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)				
UNCONTROLLED (Engines, Storage Tanks, Gas Production Unit Heaters)																										
Fugitive Emissions (Component Count, PCV and Hauling) ¹	2.224	9.742	56.056	245.527											0.1924	0.8626	0.0012	0.0054	0.0564	0.2470						
Flashing, Working and Breathing (F/W/B) Losses ²	16.6741	73.0325	96.6933	423.5169											0.7244	3.1729	0.0115	0.0505	0.0408	0.1786						
Engine Emissions ³	0.0089	0.03016	0.3158	1.3831	26.9282	117.9458	5.6445	24.7228	0.0001	0.0006	0.0023	0.0097			0.0053	0.0234	0.0004	0.0016	4.54E-04	1.95E-04						
Gas Production Unit Heaters ⁴	0.0298	0.1295	0.5376	2.3549	649.0091	2842.6599	0.4516	1.9781	0.0022	0.0141	0.0409	0.1790	2.69E-06	1.18E-05	0.0443	0.1901	1.13E-05	4.95E-05								
TOTALS:	18.9528	82.9263	3.7980	828.6671	3929.6496	17,095.1	6.0961	26.7009	0.0024	0.0147	0.0432	0.1891	2.69E-06	1.18E-05	0.9722	4.0892	0.0132	0.0576	0.0572	0.4259	0.0004	0.0018	0.0004	0.0027		
UNCONTROLLED (Truck Loading Emissions)																										
Truck Loading Emissions ⁵	5.3923	3.1883		12.1749		7.2212									0.0191	0.0113	0.0002	1.29E-04	0.0094	0.0020						
CONTROLLED EMISSIONS																										
Controlled Fugitive Emissions from Hauling																										
Flare Emissions (from F/W/B losses) ⁶	0.3936	1.4610	0.0470	0.2061	129.3272	566.4531	0.0395	0.1731	7.56E-06	3.31E-05	0.0027	0.0117	2.35E-07	1.03E-06	0.0145	0.0636	0.0002	0.0010	0.0008	0.0036						
TOTALS:	0.3936	1.4610	0.0470	0.2061	129.3272	566.4531	0.0395	0.1731	7.56E-06	3.31E-05	0.0027	0.0117	2.35E-07	1.03E-06	0.0145	0.0636	0.0002	0.0010	0.0008	0.0036	0.0004	0.0018	0.0004	0.0027	0.0004	0.0027
POTENTIAL TO EMIT	2.5924	14.5351	0.9005	2.9441	861.921	3,779.8	6.1356	26.8740	0.0034	0.0148	0.0468	0.2006	2.32E-06	7.28E-05	0.2223	0.9852	0.0018	0.0062	0.0571	0.2527	0.0052	0.0227	0.0052	0.0227		

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 60 barrels per day, VOC emissions would be 5.3523 pounds per hour when there is truck loading activity. Average hourly VOC emissions from truck loading per year is 0.7302 pound per hour.
 6 - See Table 10 and 11 for flare emission calculations.
 7 - The hourly potential to emit is the sum of emissions from gas production unit heaters, engine, storage tanks, fugitives and flare. Does not include emissions from loading (see footnote 3). The total TPE is the sum of all emissions.
 PM₁₀ TPE is the sum of uncontrolled hauling and other PM₁₀ sources.

Table 3

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

Pollutant		Emissions		Threshold	Threshold Exceeded?	
		Uncontrolled	Controlled		Uncontrolled	Controlled
VOC	lbs/hr	18.9329	2.5924	6	Yes	
	tons/yr	86.1246	14.5531	10	Yes	Yes
NO _x	lbs/hr	0.8534	0.9005	6		
	tons/yr	3.7380	3.9441	10		
CO	lbs/hr	6.0961	6.1356	6	Yes	Yes
	tons/yr	26.7009	26.8740	10	Yes	Yes
SO ₂	lbs/hr	0.0034	0.0034	6		
	tons/yr	0.0147	0.0148	10		
PM _{2.5}	lbs/hr	4.32E-02	0.0458	6		
	tons/yr	1.89E-01	0.2008	10		
PM ₁₀	lbs/hr	0.3398	0.1950	6		
	tons/yr	0.3864	0.3032	10		
Lead	lbs/hr	2.69E-06	2.92E-06	6		
	tons/yr	1.18E-05	1.28E-05	10		
Total HAPs	lbs/hr	0.9322	0.2223	2		
	tons/yr	4.0945	0.9852	5		
Total TAPs	lbs/hr	0.0183	0.0070	1.14		
n-Hexane	lbs/hr	0.7278	0.1351			
	tons/yr	3.1952	0.5434			
Toluene	lbs/hr	0.0459	0.0143			
	tons/yr	0.2018	0.0576			
Ethylbenzene	lbs/hr	0.0430	0.0242			
	tons/yr	0.1891	0.1004			
Xylenes	lbs/hr	0.0972	0.0607			
	tons/yr	0.4278	0.2527			
Benzene	lbs/hr	0.0132	0.0021			
	tons/yr	0.0577	0.0082			

Enter any notes here:	<p>1. 98% Flare Destruction Efficiency</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>
------------------------------	--

Table 4

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

VOC Type	Condensate VOC
Emission Type	Steady State (continuous)

Gas Weight Fraction From Analysis	VOC frac	0.156
	Benzene frac	0.00
	Toluene	0.00
	Ethylbenzene	0.000
	Xylenes	0.000
	n-hexane	0.012
	Methane	0.643

Gas					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
300	Valves	Gas VOC	0.004500	0.21	4,050.13
		Non VOC	0.004500	1.14	21,967.07
354	Connectors	VOC	0.000200	0.01	212.41
		Non-VOC	0.000200	0.06	1,152.05
78	Flanges	VOC	0.000390	0.00	91.26
		Non-VOC	0.000390	0.03	494.99
Total VOCs:				0.23	4,353.80
Total THC:				1.45	27,967.91

Light Liquid Weight Fraction From Analysis	VOC frac	0.981
	Benzene frac	0.001
	Toluene	0.007
	Ethylbenzene	0.013
	Xylenes	0.033
	n-hexane	0.034
	Methane	0.007

Light Liquid					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
312	Valves	Light Liquid VOC	0.002500	0.76	14,739.27
		Light Liquid Non-VOC		0.02	292.89
Total VOC:				0.76	14,739.27
Total THC:				0.78	15,032.16

Fugitive Total Emissions			
	Annual Emissions (lb/yr)	Annual Emissions (lb/hr)	Annual Emissions (tpy)
VOC	19,093.07	2.18	9.55
Ethylbenzene		0.02	0.10
Toluene		0.01	0.05
Xylenes		0.06	0.25
n-Hexane		0.10	0.42
TAPs (Benzene)		0.00	0.01
HAPs		0.19	0.83
CO _{2e}	452,282.53	51.63	226.14

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
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation**

Number of PCVs	19
Bleed Rate (scf/day/PCV)	6.6
Total Bleed Rate (scf/day)	125.4

Component	Mol%	Molecular Weight (lb/lb-mole)	Component Flow (scf/day)	Component Moles (lb-moles)	Component Emissions		
					(lbs/day)	(lbs/hr)	(tons/year)
H2S	0	34.08	0	0.00	0.00	0.00	0.00
Nitrogen	0.3959	14.01	0.4964586	0.00	0.02	0.00	0.00
Carbon Dioxide	0.1247	44.01	0.1563738	0.00	0.02	0.00	0.00
Methane	80.1487	16.04	100.5064698	0.26	4.25	0.18	0.78
Ethane	13.3575	30.07	16.750305	0.04	1.33	0.06	0.24
Propane	3.7444	44.1	4.6954776	0.01	0.55	0.02	0.10
Isobutane	0.5119	58.12	0.6419226	0.00	0.10	0.00	0.02
n-Butane	0.8244	58.12	1.033797475	0.00	0.16	0.01	0.03
Isopentane	0.181	72.15	0.226974	0.00	0.04	0.00	0.01
n-Pentane	0.4327	72.15	0.5426058	0.00	0.10	0.00	0.02
2-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
3-Methylpentane	0	86.18	0	0.00	0.00	0.00	0.00
n-Hexane	0.2788	86.18	0.3496152	0.00	0.08	0.00	0.01
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	0.0428	0.1876
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	0.0033	0.0145
HAPs Emissions	0.0033	0.0145
TAPs Emissions	0.0000	0.0000
CO _{2e} emissions	4.4260	19.3859

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
----------------------	---

Table 6

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

# Hours Operational	8760
---------------------	------

	Tank Flashing Losses		
	Vapor Mass Fraction wt%	Flashing Losses	
		lbs/hr	tpy
Water	1.5407	0.4242	1.8581
H2S	0.0000	0.0000	0.0000
Nitrogen	0.1004	0.0276	0.1211
Carbon Dioxide	0.2429	0.0669	0.2929
Methane	14.0226	3.8609	16.9107
Ethane	23.7010	6.5257	28.5824
Propane	23.5605	6.4870	28.4130
Isobutane	6.2326	1.7161	7.5163
n-Butane	11.8945	3.2750	14.3443
Isopentane	4.8840	1.3447	5.8899
n-Pentane	4.0806	1.1235	4.9211
2-Methylpentane	1.3687	0.3769	1.6506
3-Methylpentane	0.8927	0.2458	1.0765
n-Hexane	2.2435	0.6177	2.7056
Methylcyclopentane	0.4393	0.1209	0.5297
Benzene	0.0419	0.0115	0.0505
2-Methylhexane	0.7422	0.2044	0.8951
3-Methylhexane	0.5787	0.1593	0.6979
Heptane	0.9262	0.2550	1.1170
Methylcyclohexane	0.6651	0.1831	0.8021
Toluene	0.1220	0.0336	0.1471
Octane	1.0735	0.2956	1.2946
Ethylbenzene	0.0750	0.0207	0.0905
m & p-Xylene	0.0584	0.0161	0.0705
o-Xylene	0.0896	0.0247	0.1080
Nonane	0.3064	0.0844	0.3695
C10+	0.1167	0.0321	0.1408
Total VOCs	60.3924	16.6280	72.8307
Total CO _{2e}		96.5894	423.0614
Total TAPs (Benzene)		0.0115	0.0505
Toluene		0.0336	0.1471
Ethylbenzene		0.0207	0.0905
Xylenes		0.0408	0.1785
n-Hexane		0.6177	2.7056
Total HAPs		0.7242	3.1722
Total	100.0000	27.5333	120.5959

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

Table 7

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

Condensate/Produced Water Tank Information	
Number of Tanks	8
Maximum Working Losses (lbs/hr)	0.1411
Maximum Breathing Losses (lbs/hr)	0.0500
# Hours Operational	8760

	Tank W/B Losses						
	Vapor Mass Fraction wt%	Working Losses		Breathing Losses		Max W/B Losses	
		lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
Water	59.4492	0.0839	0.3675	0.0297	0.1302	0.1136	0.4976
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Carbon Dioxide	0.4696	0.0007	0.0029	0.0002	0.0010	0.0009	0.0039
Methane	2.1576	0.0030	0.0133	0.0011	0.0047	0.0041	0.0181
Ethane	13.8220	0.0195	0.0854	0.0069	0.0303	0.0264	0.1157
Propane	10.8778	0.0154	0.0672	0.0054	0.0238	0.0208	0.0911
Isobutane	2.5966	0.0037	0.0161	0.0013	0.0057	0.0050	0.0217
n-Butane	4.8813	0.0069	0.0302	0.0024	0.0107	0.0093	0.0409
Isopentane	1.8947	0.0027	0.0117	0.0009	0.0041	0.0036	0.0159
n-Pentane	1.5656	0.0022	0.0097	0.0008	0.0034	0.0030	0.0131
2-Methylpentane	0.5109	0.0007	0.0032	0.0003	0.0011	0.0010	0.0043
3-Methylpentane	0.3326	0.0005	0.0021	0.0002	0.0007	0.0006	0.0028
n-Hexane	0.0568	0.0001	0.0004	0.0000	0.0001	0.0001	0.0005
Methylcyclopentane	0.1526	0.0002	0.0009	0.0001	0.0003	0.0003	0.0013
Benzene	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2-Methylhexane	0.0176	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001
3-Methylhexane	0.2071	0.0003	0.0013	0.0001	0.0005	0.0004	0.0017
Heptane	0.3055	0.0004	0.0019	0.0002	0.0007	0.0006	0.0026
Methylcyclohexane	0.2218	0.0003	0.0014	0.0001	0.0005	0.0004	0.0019
Toluene	0.0057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Octane	0.3340	0.0005	0.0021	0.0002	0.0007	0.0006	0.0028
Ethylbenzene	0.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
m & p-Xylene	0.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
o-Xylene	0.0087	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001
Nonane	0.0860	0.0001	0.0005	0.0000	0.0002	0.0002	0.0007
C10+	0.0283	0.0000	0.0002	0.0000	0.0001	0.0001	0.0002
Total VOCs	24.0979	0.0340	0.1490	0.0120	0.0528	0.0461	0.2017
Total CO _{2e}		0.0768	0.3363	0.0272	0.1191	0.1040	0.4555
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	0.0001
Xylenes		0.0000	0.0001	0.0000	0.0000	0.0000	0.0001
n-Hexane		0.0001	0.0004	0.0000	0.0001	0.0001	0.0005
Total HAPs		0.0001	0.0005	0.0000	0.0002	0.0002	0.0007
Total	100.0000	0.1411	0.6181	0.0500	0.2190	0.1911	0.8371

Enter any notes here:	Vapor mass fractions, working losses and breathing losses from ProMax output
-----------------------	--

Table 8

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

Annual Loading	Oil/Water Truck Loading
RVP	8.13
Annual Average Temp (F)	72.1
S (saturation factor)	0.6
P (true vapor pressure)	6.87
M (MW of vapor)	22.98
Collection Efficiency (%)	0
Loading Loss (lb/10 ³ gal)*	2.22
Maximum Throughput (gallons/hr)	10,080
Average Throughput (gallons/y)	11,957,400
Loading Emissions (lbs/hr)	22.38
Loading Emissions (tpy)	13.27

	Tank Loading Losses		
	Vapor Mass Fraction wt%	lbs/hr	tpy
Water	59.4492	13.3028	7.8902
H2S	0.0000	0.00	0.00E+00
Nitrogen	0.0038	0.0009	5.04E-04
Carbon Dioxide	0.4696	0.1051	6.23E-02
Methane	2.1576	0.4828	2.86E-01
Ethane	13.8220	3.0929	1.83E+00
Propane	10.8778	2.4341	1.44E+00
Isobutane	2.5966	0.5810	3.45E-01
n-Butane	4.8813	1.0923	6.48E-01
Isopentane	1.8947	0.4240	2.51E-01
n-Pentane	1.5656	0.3503	2.08E-01
2-Methylpentane	0.5109	0.1143	6.78E-02
3-Methylpentane	0.3326	0.0744	4.41E-02
n-Hexane	0.0568	0.0127	7.54E-03
Methylcyclopentane	0.1526	0.0341	2.02E-02
Benzene	0.0010	0.0002	1.29E-04
2-Methylhexane	0.0176	0.0039	2.34E-03
3-Methylhexane	0.2071	0.0464	2.75E-02
Heptane	0.3055	0.0684	4.06E-02
Methylcyclohexane	0.2218	0.0496	2.94E-02
Toluene	0.0057	0.0013	7.55E-04
Octane	0.3340	0.0747	4.43E-02
Ethylbenzene	0.0065	0.0015	8.65E-04
m & p-Xylene	0.0065	0.0015	8.67E-04
o-Xylene	0.0087	0.0019	1.15E-03
Nonane	0.0860	0.0192	1.14E-02
C10+	0.0283	0.0063	3.76E-03
Total VOCs	24.0979	5.39	3.1983
Total CO _{2e}		12.1749	7.2212
Total TAPs (Benzene)		0.0002	1.29E-04
Toluene		0.0013	7.55E-04
Ethylbenzene		0.0015	8.65E-04
Xylenes		0.0034	2.02E-03
n-Hexane		0.0127	7.54E-03
Total HAPs		0.0191	1.13E-02
Total	100.0000	22.3767	13.2722

Enter any notes here

Vapor mass fractions and loading losses from Promax output

*Using equation $L_c = 12.46 * SPM/T$ from AP-42, Chapter 5, Section 5.2-4

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

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

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

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

Loading emissions are vented to the atmosphere.

Table 9

**Gas Production Unit Heaters Emissions
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation**

GPU Heaters: H001-005

Number of Units	5
GPU Heater Rating (MMBtu/hr)	1
Operating hours/year	8760
Fuel Heat value (Btu/scf)	1,209

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	0.414	1.811
CO	84	0.347	1.522
CO ₂	120,000	496.289	2,173.7
Lead	0.0005	2.07E-06	9.06E-06
N ₂ O	2.2	0.009	0.040
PM (Total)	7.6	0.031	0.138
SO ₂	0.6	0.002	0.011
TOC	11	0.045	0.199
Methane	2.3	0.010	0.042
VOC	5.5	0.023	0.100
HAPS			
2-Methylnaphthalene	2.40E-05	9.93E-08	4.35E-07
Benzene	2.10E-03	8.69E-06	3.80E-05
Dichlorobenzene	1.20E-03	4.95E-06	2.17E-05
Fluoranthene	3.00E-06	1.24E-08	5.43E-08
Fluorene	2.80E-06	1.16E-08	5.07E-08
Formaldehyde	7.50E-02	3.10E-04	1.36E-03
Hexane	1.80E+00	7.44E-03	3.26E-02
Naphthalene	6.10E-04	2.52E-06	1.10E-05
Phenanthrene	1.70E-05	7.03E-08	3.08E-07
Toluene	3.40E-03	1.41E-05	6.16E-05

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.0296	0.1295
TOTAL Uncontrolled HAPs	0.0101	0.0443
TOTAL Uncontrolled TAPs (Benzene)	1.13E-05	4.95E-05
TOTAL Uncontrolled TAPs (Formaldehyde)	0.0004	0.0018
TOTAL CO ₂ Emissions	649.0091	2842.6599

Enter any notes here:

1. All Emission Factors based off AP-42 Sec 1.4 Natural Gas Combustion
2. Five 1.0 MMBtu/hr GPU heaters and one 1.5 MMBtu/hr GPU heater

GPU Heaters: H006

Number of Units	1
GPU Heater Rating (MMBtu/hr)	1.5
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,209

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	0.124	0.543
CO	84	0.104	0.456
CO ₂	120,000	148.887	652.1
Lead	0.0005	6.20E-07	2.72E-06
N ₂ O	2.2	0.003	0.012
PM (Total)	7.6	0.009	0.041
SO ₂	0.6	0.001	0.003
TOC	11	0.014	0.060
Methane	2.3	0.003	0.012
VOC	5.5	0.007	0.030
HAPS			
2-Methylnaphthalene	2.40E-05	2.98E-08	1.30E-07
Benzene	2.10E-03	2.61E-06	1.14E-05
Dichlorobenzene	1.20E-03	1.49E-06	6.52E-06
Fluoranthene	3.00E-06	3.72E-09	1.63E-08
Fluorene	2.80E-06	3.47E-09	1.52E-08
Formaldehyde	7.50E-02	9.31E-05	4.08E-04
Hexane	1.80E+00	2.23E-03	9.78E-03
Naphthalene	6.10E-04	7.57E-07	3.31E-06
Phenanthrene	1.70E-05	2.11E-08	9.24E-08
Toluene	3.40E-03	4.22E-06	1.85E-05

Table 10

**Flare Emissions
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation**

General Information	
Unit Name	FLO01

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

Flare operating hours	8760
-----------------------	------

Stream Information							
	1	2	3	4	5	6	Total
Stream Sent to Flare/Vapor Combustor (Enter Name of Each Stream Here)	pilot(s)	added fuel stream(s)	Tank Flash Emissions	Tank W/B Emissions			-
Maximum Expected Hourly Volumetric Flow Rate of Stream (scf/hr)	12.6	--	454.72	3.16			470.48
Maximum Expected Annual Volumetric Flow Rate of Stream (scf/yr)	110,376.00	--	3,983,368.61	27,649.97			4,121,394.58
Heating Content (Btu/ft ³)	1,209		1,836.69	486.58			1,778.44

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 Flare/Vapor Combustor	pilot(s)	added fuel stream(s)	Tank Flash Emissions	Tank W/B Emissions			-
H ₂ S	-	-	0.000	0.000			0.000
Total VOC	-	-	16.628	0.046			16.674
Benzene	-	-	0.012	0.000			0.012
Toluene	-	-	0.034	0.000			0.034
Ethylbenzene	-	-	0.021	0.000			0.021
Xylenes	-	-	0.041	0.000			0.041
n-Hexane	-	-	0.618	0.000			0.618
HAPs	-	-	0.724	0.000			0.724
Total Mass Flow	-	-	27.533	0.191			

Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)							
	1	2	3	4	5	6	Total
H ₂ S	-	-	0.000	0.000			0.000
Total VOC	-	-	72.831	0.202			73.032
Benzene	-	-	0.051	0.000			0.051
Toluene	-	-	0.147	0.000			0.147
Ethylbenzene	-	-	0.090	0.000			0.091
Xylenes	-	-	0.178	0.000			0.179
n-Hexane	-	-	2.706	0.000			2.706
HAP	-	-	3.172	0.001			3.173
Total Mass Flow	-	-	120.596	0.837			121.433

Table 10
Flare Emissions
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation

Controlled Emissions							
Hourly (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Flare/Vapor Combustion	pilot(s)	added fuel stream(s)	Tank Flash Emissions	Tank W/B Emissions			-
NOx	0.001	-	0.045	0.000			0.0470
CO	0.001	-	0.038	0.000			0.0395
PM2.5	0.000	-	0.003	0.000			0.0027
PM10	0.000	-	0.003	0.000			0.0036
H2S	0.000	-	0.000	0.000			4.02E-06
SO2	0.000	-	0.000	0.000			7.56E-06
CO2	1.512	-	-	-			1.5120
Total VOC	0.000	-	0.333	0.001			0.3336
Benzene	0.000	-	0.000	0.000			2.31E-04
Toluene	0.000	-	0.001	0.000			6.72E-04
Ethylbenzene	0.000	-	0.000	0.000			4.13E-04
Xylenes	0.000	-	0.001	0.000			8.16E-04
n-Hexane	0.000	-	0.012	0.000			0.0124
HAP	0.000	-	0.014	0.000			0.0145
N2O	0.000	-	0.001	0.000			0.0010
Lead	0.000	-	0.000	0.000			2.35E-07
Formaldehyde	0.000	-	-	-			9.45E-07
Annual (tpy)							
	1	2	3	4	5	6	Total
Stream Sent to Flare/Vapor Combustion	pilot(s)	added fuel stream(s)	Tank Flash Emissions	Tank W/B Emissions			-
NOx	0.006	-	0.199	0.001			0.2061
CO	0.005	-	0.167	0.001			0.1731
PM2.5	0.000	-	0.011	0.000			0.0117
PM10	0.000	-	0.015	0.000			0.0157
H2S	0.000	-	0.000	0.000			1.76E-05
SO2	0.000	-	0.000	0.000			3.31E-05
CO2	6.623	-	-	-			6.6226
Total VOC	0.000	-	1.457	0.004			1.4610
Benzene	0.000	-	0.001	0.000			0.0010
Toluene	0.000	-	0.003	0.000			0.0029
Ethylbenzene	0.000	-	0.002	0.000			0.0018
Xylenes	0.000	-	0.004	0.000			0.0036
n-Hexane	0.000	-	0.054	0.000			0.0542
HAP	0.000	-	0.063	0.000			0.0636
N2O	0.000	-	0.004	0.000			0.0045
Lead	0.000	-	0.000	0.000			1.03E-06
Formaldehyde	0.000	-	-	-			4.14E-06

Flare/Vapor Combustion Total emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	0.3336	1.4610
NOx	4.70E-02	2.06E-01
CO	3.95E-02	1.73E-01
PM2.5	2.68E-03	1.17E-02
PM10	3.58E-03	1.57E-02
H2S	4.02E-06	1.76E-05
SO2	7.56E-06	3.31E-05
Benzene (TAPs)	2.31E-04	1.01E-03
Formaldehyde (TAPs)	9.45E-07	4.14E-06
HAPs	0.0145	0.0636
CO2e ²	129.3272	566.4531
N2O	1.04E-03	4.53E-03
Lead	2.35E-07	1.03E-06

Enter any notes here as needed

1. Emission Factors from AP-42 Tables 1.4-1, 1.4-2, and 1.4.3

2. Included CO2e emissions from Table 11: Flare GHG Emissions

Table 11
Flare GHG Emissions
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation

Flare 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 oil tank vapors constituents ^a	Volume of oil tank vapor 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	3,983,369	0.0025	27,650	7,824	1	0	--	7,824	9,138,805
Methane	0.308	3,983,369	0.0309	27,650	1,229,553	1	0.98	1,204,962	24,591	24,591
Ethane	0.278	3,983,369	0.1056	27,650	1,110,697	2	0.98	2,176,966	--	--
Propane	0.189	3,983,369	0.0567	27,650	752,438	3	0.98	2,212,168	--	--
i-Butane	0.038	3,983,369	0.0103	27,650	151,002	4	0.98	591,929	--	--
n-Butane	0.072	3,983,369	0.0193	27,650	288,169	4	0.98	1,129,621	--	--
Pentane	0.044	3,983,369	0.0110	27,650	174,934	5	0.98	857,175	--	--
Hexane	0.018	3,983,369	0.0024	27,650	73,535	6	0.98	432,384	--	--
Benzene	0.000	3,983,369	0.0000	27,650	754	6	0.98	4,434	--	--
Heptanes	0.010	3,983,369	0.0016	27,650	38,900	7	0.98	266,853	--	--
Toluene	0.000	3,983,369	0.0000	27,650	1,861	7	0.98	12,768	--	--
Octane	0.006	3,983,369	0.0012	27,650	22,762	8	0.98	178,453	--	--
Ethyl benzene	0.000	3,983,369	0.0000	27,650	994	8	0.98	7,789	--	--
Xylenes	0.000	3,983,369	0.0000	27,650	1,960	8	0.98	15,369	--	--
Nonane	0.001	3,983,369	0.0002	27,650	3,363	9	0.98	29,665	--	--
Decane plus	0.000	3,983,369	0.0000	27,650	1,066	10	0.98	10,443	--	--
Subtotal								9,130,980		

Pollutant	Volume Emitted ^a <i>scf/year</i>	Density of GHG ^c <i>lb/scf</i>	Conversion Factor <i>lb/ton</i>	GWF	Emissions ^a	
					<i>lbs/hr</i>	<i>(tons/yr)</i>
CO ₂	9,138,805	0.12	2000	1	120.98	529.88
CH ₄	24,591	0.09	2000	25	0.26	1.14
CO₂e Emissions					127.51	558.48

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 Roads Emissions
Cline Well Pad
Doddridge County, West Virginia
Antero Resources Corporation

	PM ₁₀	PM ₁₀
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 (%)	50	50

Tanker Truck Trip Calculation	
Condensate Production (bbl/day)	60
PW Production (bbl/day)	720
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 (miles/trip) (miles/year)	PM (lbs/VMT)	PM ₁₀ (lbs/VMT)
Tanker Trucks Condensate	10	40	10	0.1500	1	1424	0.1500 213,6000	3.8175	1.7179
Pick Up Truck	4	3	10	0.2500	1	730	0.2500 182,5000	0.3467	0.1560

	Uncontrolled Emissions						Controlled Emissions					
	(lbs/hr)	PM (lbs/year)	(tpy)	PM ₁₀ (lbs/hr)	PM ₁₀ (lbs/year)	(tpy)	(lbs/hr)	PM (lbs/year)	(tpy)	PM ₁₀ (lbs/year)	PM ₁₀ (tpy)	
Tanker Trucks Condensate	0.5726	815.4243	0.4077	0.2577	366.9409	0.1835	0.2863	407.7121	0.2039	0.1288	183.4705	0.0917
Pick Up Truck	0.0867	63.2690	0.0316	0.0390	28.4711	0.0142	0.0433	31.6345	0.0158	0.0195	14.2355	0.0071
Total Emissions	0.6593	878.6933	0.4393	0.2967	395.4120	0.1977	0.3296	439.3467	0.2197	0.1483	197.7060	0.0989

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
----------------------	---

Table 13

**Engine Emissions
Cline Well Pad
Doddridge County, 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)	1208.974
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	25.5905	112.09
PM _{2.5}		9.910E-03	0.0023	0.0101
PM ₁₀		9.500E-03	0.0022	0.0097
PM (Total)		9.910E-03	0.0023	0.0101
SO ₂		5.880E-04	0.0001	0.0006
TOC		0.358	0.0833	0.3648
Methane		0.230	0.0535	0.2344
VOC ³		0.0296	0.0069	0.0302
HAPS				
Benzene		1.58E-03	3.68E-04	1.61E-03
Ethylbenzene		2.48E-05	5.77E-06	2.53E-05
Formaldehyde		2.05E-02	4.77E-03	2.09E-02
Naphthalene		9.71E-05	2.26E-05	9.89E-05
Toluene		5.58E-04	1.30E-04	5.69E-04
Xylene		1.95E-04	4.54E-05	1.99E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.0069	0.0302
TOTAL Uncontrolled NOx	0.3158	1.3831
TOTAL Uncontrolled HAPS	0.0053	0.0234
TOTAL Uncontrolled TAPs (Benzene)	0.0004	0.0016
TOTAL Uncontrolled TAPs (Formaldehyde)	0.0048	0.0209
TOTAL CO _{2e} Emissions	26.9282	117.9456

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.

Table 14

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

Pollutant	Potential Emissions ¹		Initial Permit Application Emissions		Change in Emissions	
	Hourly PTE	Yearly PTE	Hourly PTE	Yearly PTE	Hourly PTE	Yearly PTE
PM	0.6593	0.4393	0.6593	0.2764	0.00E+00	0.1629
PM10	0.3398	0.3864	0.3344	0.2896	0.0054	0.0968
VOC	18.9329	86.1246	12.0240	53.2203	6.9089	32.9043
CO	6.1356	26.8740	0.4169	1.8259	5.7187	25.0481
NOx	0.9005	3.9441	0.4963	2.1737	0.4042	1.7704
SO2	0.0034	0.0148	0.0030	0.0131	3.85E-04	1.69E-03
Pb	2.92E-06	1.28E-05	2.62E-06	1.15E-05	3.01E-07	1.32E-06
HAPs	0.9322	4.0945	0.5165	2.2641	0.4157	1.8304
TAPs	0.0183	0.0804	0.0079	0.0343	0.0104	0.0461

Notes: 1) Increase in emissions due to the increase in throughput, the addition of IC engine, removal of vapor recovery line, and the change of GPU Heaters' rating.



Bryan Research & Engineering, Inc.

ProMax[®] 3.2

with

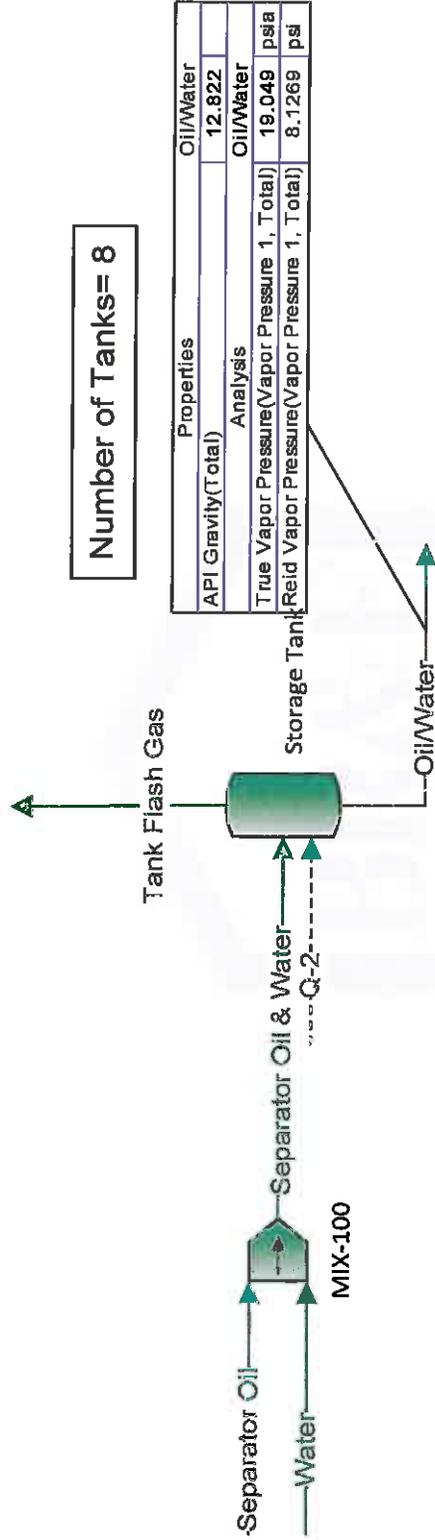
TSWEET[®] & PROSIM[®]

Copyright © BRE Group, Ltd. 2002-2011. All Rights Reserved.

Simulation Report	
Client Name:	Antero Resources
Location:	West Virginia
Job:	Cline Well Pad
Project Name:	Antero Promax Scenario 2
File Name:	ProMax@C:\Users\yichen\Documents\New Model\Antero ProMax\Floating Tanks\Antero Promax Scenario 2.pmx
ProMax Version:	3.2.13330.0
Report Created:	1/27/2015 20:40

"Tank Flash Gas" C3+ Mass Flow = 72.83 ton/yr

Number of Tanks = 8



Slop Tanks

Tank loss calculations for "Oil/Water".
 Total working and breathing losses from the Vertical Cylinder are 0.8371 ton/yr.
 Loading losses are 0.6504 ton/yr of loaded liquid.

Oil/Water W/B

Process Streams	Separator Oil	Water	Oil/Water	Tank Flash Gas	Separator Oil & Water	Oil/Water W/B	
Phase: Total	Status	Solved	Solved	Solved	Solved	Solved	
Mole Fraction		%	%	%	%	%	
Water		0	100	99.1234	3.02141	98.9962	75.8242
H2S		0	0	0	0	0	0
Nitrogen		0.0170005	0	3.10191E-06	0.126628	0.000170644	0.00311576
Carbon Dioxide		0.0360011	0	0.000123622	0.194877	0.000381439	0.245162
Methane		4.27113	0	0.00201550	30.8805	0.0428717	3.09026
Ethane		4.48413	0	0.00817600	27.8465	0.0450098	10.5622
Propane		4.44113	0	0.0196285	18.8761	0.0445782	5.66825
Isobutane		1.47904	0	0.00984649	3.78839	0.0148460	1.02652
n-Butane		3.64611	0	0.0270678	7.22986	0.0365981	1.92975
Isopentane		2.61608	0	0.0231254	2.39150	0.0262581	0.603424
n-Pentane		2.84409	0	0.0259382	1.99814	0.0285477	0.498611
2-Methylpentane		1.83205	0	0.0176703	0.561130	0.0183894	0.136233
3-Methylpentane		1.32904	0	0.0128731	0.365959	0.0133403	0.0886905
n-Hexane		4.13512	0	0.0403430	0.919750	0.0415066	0.0151494
Methylcyclopentane		0.864028	0	0.00843980	0.184395	0.00867271	0.0416538
Benzene		0.0960029	0	0.000939802	0.0189524	0.000963635	0.000285870
2-Ethylhexane		2.72808	0	0.0270729	0.261696	0.0273833	0.00404256
3-Methylhexane		2.23407	0	0.0221840	0.204038	0.0224246	0.0474986
Heptane		4.50214	0	0.0448177	0.326563	0.0451905	0.0700658
Methylcyclohexane		3.27410	0	0.0325904	0.238312	0.0328640	0.0519167
Toluene		0.803024	0	0.00800911	0.0467744	0.00806041	0.00141800
Octane		14.5234	0	0.145533	0.332019	0.145780	0.0671859
Ethylbenzene		1.27804	0	0.0128123	0.0249655	0.0128284	0.00141048
m-Xylene		1.18804	0	0.0119150	0.0194413	0.0119250	0.00141448
o-Xylene		2.04206	0	0.0204850	0.0298103	0.0204973	0.00188073
Nonane		11.2233	0	0.112692	0.0844000	0.112855	0.0154038
C10+		24.1107	0	0.242298	0.0267559	0.242013	0.00422382
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water		0	583.109	583.085	0.0235475	583.109	0.00630678
H2S		0	0	0	0	0	0
Nitrogen		0.00100513	0	1.82467E-05	0.000986881	0.00100513	2.59157E-07
Carbon Dioxide		0.00224676	0	0.000727195	0.00151956	0.00224676	2.03917E-05
Methane		0.252524	0	0.0118560	0.240668	0.252524	0.000257036
Ethane		0.265117	0	0.0480947	0.217023	0.265117	0.000878522
Propane		0.262575	0	0.115463	0.147112	0.262575	0.000471465
Isobutane		0.0874461	0	0.0579212	0.0295249	0.0874461	8.53824E-05
n-Butane		0.215570	0	0.159224	0.0563461	0.215570	0.000160509
Isopentane		0.154671	0	0.136033	0.0186382	0.154671	5.01905E-05
n-Pentane		0.168152	0	0.152579	0.0155725	0.168152	4.14728E-05
2-Methylpentane		0.108317	0	0.103944	0.00437318	0.108317	1.13313E-05
3-Methylpentane		0.0785773	0	0.0757262	0.00285211	0.0785773	7.37694E-06
n-Hexane		0.244483	0	0.237314	0.00716909	0.244483	1.26007E-06
Methylcyclopentane		0.0510841	0	0.0496471	0.00143709	0.0510841	3.46459E-06
Benzene		0.00567602	0	0.00552831	0.000147708	0.00567602	2.37776E-08
2-Methylhexane		0.161293	0	0.159254	0.00203953	0.161293	3.36245E-07
3-Methylhexane		0.132086	0	0.130495	0.00159018	0.132086	3.95075E-06
Heptane		0.266181	0	0.263638	0.00254507	0.266181	5.82781E-06
Methylcyclohexane		0.193576	0	0.191711	0.00186508	0.193576	4.31824E-06
Toluene		0.0474775	0	0.0471130	0.000364537	0.0474775	1.17944E-07
Octane		0.858675	0	0.856087	0.00258780	0.858675	5.58827E-06
Ethylbenzene		0.0755620	0	0.0753674	0.000194569	0.0755620	1.17319E-07
m-Xylene		0.0702407	0	0.0700892	0.000151516	0.0702407	1.17651E-07
o-Xylene		0.120734	0	0.120501	0.000232327	0.120734	1.56432E-07
Nonane		0.663562	0	0.662904	0.000657773	0.663562	1.28123E-06
C10+		1.42551	0	1.42530	0.000208523	1.42551	3.51322E-07
Mass Fraction		%	%	%	%	%	%
Water		0	100	94.6813	1.54073	94.4508	59.4482
H2S		0	0	0	0	0	0
Nitrogen		0.00456213	0	4.60725E-06	0.100409	0.000253164	0.00379862
Carbon Dioxide		0.0160208	0	0.000288482	0.242888	0.00089031	0.469566
Methane		0.656377	0	0.00171435	14.0226	0.0364240	2.15756
Ethane		1.29163	0	0.0130349	23.7010	0.0718757	13.8220
Propane		1.87598	0	0.0458912	23.5605	0.104103	10.8778
Isobutane		0.823499	0	0.0303438	6.23264	0.0455980	2.59662
n-Butane		2.03007	0	0.0834146	11.8945	0.112654	4.88134
Isopentane		1.80809	0	0.0884637	4.88399	0.100335	1.89473
n-Pentane		1.96567	0	0.0892239	4.08065	0.109080	1.56562
2-Methylpentane		1.51238	0	0.0807373	1.36874	0.0839258	0.510829
3-Methylpentane		1.09714	0	0.0588186	0.892670	0.0608829	0.332627

Property	Units					
Temperature	°F			75.9	75.9	75.9
Pressure	psig			0.00405122	0.00405122	-14.1111
Mole Fraction Vapor	%			100	100	100
Mole Fraction Light Liquid	%			0	0	0
Mole Fraction Heavy Liquid	%			0	0	0
Molecular Weight	lb/lbmol			35.3	35.3	23.0
Mass Density	lb/ft ³			0.1	0.1	0.0
Molar Flow	lbmol/h			0.0	0.8	0.0
Mass Flow	lb/h			0.0	27.5	0.2
Vapor Volumetric Flow	MCFH			0.0	0.3	0.1
Liquid Volumetric Flow	Mbb/d			0.0	1.3	0.3
Std Vapor Volumetric Flow	MMSCFD			0.0	0.0	0.0
Std Liquid Volumetric Flow	Mbb/d			0.0	0.0	0.0
Compressibility				0.989	0.989	1.000
Specific Gravity				1.220	1.220	0.793
API Gravity						
Enthalpy	MMBtu/h			0.0	0.0	0.0
Mass Enthalpy	Btu/lb			-1232.4	-1232.4	-3889.6
Mass Cp	Btu/(lb**F)			0.4	0.4	0.4
Ideal Gas Cp Cv Ratio				1.155	1.155	1.260
Dynamic Viscosity	cP			0.0	0.0	0.0
Kinematic Viscosity	cSt			6.2	6.2	271.2
Thermal Conductivity	Btu/(h**ft**F)			0.0	0.0	0.0
Surface Tension	lb/ft					
Net LG Heating Value	Btu/ft ³			1836.7	1836.7	486.6
Net Liquid Heating Value	Btu/lb			19575.5	19575.5	7345.7
Gross LG Heating Value	Btu/ft ³			2003.6	2003.6	568.0
Gross Liquid Heating Value	Btu/lb			21368.4	21368.4	8689.9

Process Streams		Separator Oil	Water	Oil/Water	Tank Flash Gas	Separator Oil & Water	Oil/Water W/B
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%
Water		0	100	0.0623973	0.0623973	0.0443562	100.0000
H2S		0	0	0	0	0	0
Nitrogen		0.0170005	0	0.000185704	0.000185704	0.00936342	1.45261E-09
Carbon Dioxide		0.0380011	0	0.00339836	0.00339836	0.00978496	4.75534E-06
Methane		4.27113	0	0.145976	0.145976	2.85543	2.96912E-06
Ethane		4.48413	0	0.846662	0.846662	4.18810	1.18922E-05
Propane		4.44113	0	2.17906	2.17906	4.40953	7.08380E-06
Isobutane		1.47904	0	1.12166	1.12166	1.50440	4.48169E-07
n-Butane		3.64611	0	3.07674	3.07674	3.70232	1.85658E-06
Isopentane		2.61608	0	2.64076	2.64076	2.66668	3.99804E-07
n-Pentane		2.84409	0	2.96325	2.96325	2.90031	3.27071E-07
2-Methylpentane		1.83205	0	2.02068	2.02068	1.86979	4.26935E-08
3-Methylpentane		1.32804	0	1.47161	1.47161	1.35603	7.54138E-08
n-Hexane		4.13512	0	4.61389	4.61389	4.22062	3.77948E-09
Methylcyclopentane		0.864026	0	0.964084	0.964084	0.880918	1.05202E-07
Benzene		0.0960029	0	0.100869	0.100869	0.0926194	3.62814E-08
2-Methylhexane		2.72808	0	3.09646	3.09646	2.78463	1.07675E-09
3-Methylhexane		2.23407	0	2.53730	2.53730	2.28038	1.32211E-08
Heptane		4.50214	0	5.12609	5.12609	4.59550	1.96356E-08
Methylcyclohexane		3.27410	0	3.72666	3.72666	3.34132	8.79666E-08
Toluene		0.803024	0	0.902632	0.902632	0.809497	1.49466E-07
Octane		14.5234	0	16.6462	16.6462	14.8252	1.24806E-08
Ethylbenzene		1.27804	0	1.45901	1.45901	1.28959	1.35175E-07
m-Xylene		1.18804	0	1.35764	1.35764	1.20881	1.40430E-07
o-Xylene		2.04206	0	2.33228	2.33228	2.07646	2.52379E-07
Nonane		11.2233	0	12.8899	12.8899	11.4566	4.57411E-09

H2S	0	0	0	0	0	0
Nitrogen	0.0281570	0	0.000267538	0	0.0151924	0
Carbon Dioxide	0.0988786	0	0.00769155	0	0.0249420	0
Methane	4.05110	0	0.120434	0	2.65318	0
Ethane	7.97182	0	1.30926	0	7.29394	0
Propane	11.5784	0	4.94155	0	11.2619	0
Isobutane	5.08266	0	3.35275	0	5.06444	0
n-Butane	12.5294	0	9.19667	0	12.4635	0
Isopentane	11.1594	0	9.79840	0	11.1436	0
n-Pentane	12.1320	0	10.9950	0	12.1199	0
2-Methylpentane	9.33428	0	8.95529	0	9.33255	0
3-Methylpentane	6.77143	0	6.52187	0	6.76828	0
n-Hexane	21.0684	0	20.4479	0	21.0661	0
Methylcyclopentane	4.29921	0	4.17268	0	4.29402	0
Benzene	0.443364	0	0.405201	0	0.419029	0
2-Methylhexane	16.1619	0	15.9566	0	16.1611	0
3-Methylhexane	13.2352	0	13.0751	0	13.2345	0
Heptane	26.6719	0	26.4156	0	26.6707	0
Methylcyclohexane	19.0064	0	18.8177	0	19.0018	0
Toluene	4.37450	0	4.27710	0	4.31998	0
Octane	98.0851	0	97.7886	0	98.0844	0
Ethylbenzene	8.02204	0	7.96597	0	7.99122	0
m-Xylene	7.45710	0	7.41248	0	7.43300	0
o-Xylene	12.8177	0	12.7339	0	12.7682	0
Nonane	85.1052	0	85.0204	0	85.1048	0
C10+	219.705	0	219.673	0	219.705	0

Process Streams		Separator Oil	Water	Oil/Water	Tank Flash Gas	Separator Oil & Water	Oil/Water W/B
Phase: Light Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units						
Temperature	°F	64.0	64.0	75.9	75.9	64.0	75.9
Pressure	psig	149	149	0.00405122	0.00405122	149	-14.1111
Mole Fraction Vapor	%	0	0	0	0	0	0
Mole Fraction Light Liquid	%	100	100	100	100	100	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0
Molecular Weight	lb/lbmol	104.4	18.0	114.6	114.8	108.1	18.0
Mass Density	lb/ft ³	44.7	62.3	45.0	45.0	44.8	62.2
Molar Flow	lbmol/h	5.9	583.1	5.1	0.0	5.8	0.0
Mass Flow	lb/h	617.2	10504.9	589.4	0.0	614.4	0.0
Vapor Volumetric Flow	MCFH	0.0	0.2	0.0	0.0	0.0	0.0
Liquid Volumetric Flow	Mbb/d	0.1	0.7	0.1	0.0	0.1	0.0
Std Vapor Volumetric Flow	MMSCFD	0.1	5.3	0.0	0.0	0.1	0.0
Std Liquid Volumetric Flow	Mbb/d	0.1	0.7	0.1	0.0	0.1	0.0
Compressibility		0.068	0.008	0.007	0.007	0.069	0.000
Specific Gravity		0.717	1.000	0.722	0.722	0.719	0.998
API Gravity		65.4	10.0	62.4	62.4	64.8	10.0
Enthalpy	MMBtu/h	-0.5	-71.8	-0.5	0.0	-0.5	0.0
Mass Enthalpy	Btu/lb	-864.3	-6833.9	-838.2	-838.2	-860.9	-6822.7
Mass Cp	Btu/(lb*°F)	0.5	1.0	0.5	0.5	0.5	1.0
Ideal Gas Cp Cv Ratio		1.054	1.326	1.048	1.048	1.053	1.326
Dynamic Viscosity	cP	0.5	1.1	0.6	0.6	0.5	0.9
Kinematic Viscosity	cSt	0.7	1.1	0.8	0.8	0.7	0.9
Thermal Conductivity	Btu/(h*ft**F)	0.1	0.3	0.1	0.1	0.1	0.3
Surface Tension	lb/ft	0.001	0.005	0.002	0.002	0.001	0.005
Net I G Heating Value	Btu/ft ³	5257.8	0.0	5759.3	5759.3	5341.6	0.0
Net Liquid Heating Value	Btu/lb	18938.7	-1059.8	18893.0	18893.0	18932.5	-1059.7
Gross I G Heating Value	Btu/ft ³	5649.5	50.3	6184.0	6184.0	5738.9	50.3
Gross Liquid Heating Value	Btu/lb	20361.1	0.0	20297.8	20297.8	20352.3	0.0

Process Streams		Separator Oil	Water	Oil/Water	Tank Flash Gas	Separator Oil & Water	Oil/Water WB
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%
Water				99.9971	99.9971	99.9789	
H2S				0	0	0	
Nitrogen				1.49140E-06	1.49140E-06	7.93517E-05	
Carbon Dioxide				9.47394E-05	9.47394E-05	0.000288054	
Methane				0.000745809	0.000745809	0.0149407	
Ethane				0.000780779	0.000780779	0.00386637	
Propane				0.000582872	0.000582872	0.00123050	
Isobutane				4.05939E-05	4.05939E-05	5.34557E-05	
n-Butane				0.000170513	0.000170513	0.000194325	
Isopentane				3.85772E-05	3.85772E-05	3.74740E-05	
n-Pentane				3.18806E-05	3.18806E-05	2.86620E-05	
2-Methylpentane				4.24889E-06	4.24889E-06	3.44617E-06	
3-Methylpentane				7.51799E-06	7.51799E-06	6.26772E-06	
n-Hexane				5.53465E-06	5.53465E-06	4.42238E-06	
Methylcyclopentane				1.13817E-05	1.13817E-05	1.05847E-05	
Benzene				5.84561E-05	5.84561E-05	5.34161E-05	
2-Methylhexane				1.67082E-06	1.67082E-06	1.48179E-06	
3-Methylhexane				1.36183E-06	1.36183E-06	1.20056E-06	
Heptane				2.19072E-06	2.19072E-06	2.10567E-06	
Methylcyclohexane				9.74919E-06	9.74919E-06	8.16650E-06	
Toluene				0.000118782	0.000118782	0.000101464	
Octane				1.46474E-06	1.46474E-06	1.12208E-06	
Ethylbenzene				5.72035E-05	5.72035E-05	4.97678E-05	
m-Xylene				4.60978E-05	4.60978E-05	3.89306E-05	
o-Xylene				9.55712E-05	9.55712E-05	7.98617E-05	
Nonane				5.89882E-07	5.89882E-07	4.45635E-07	
C10+				2.18668E-07	2.18668E-07	1.66464E-07	
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water				583.082	0	583.106	
H2S				0	0	0	
Nitrogen				8.69637E-06	0	0.000462802	
Carbon Dioxide				0.000552425	0	0.00168002	
Methane				0.00434881	0	0.0871384	
Ethane				0.00455272	0	0.0225440	
Propane				0.00339872	0	0.00717665	
Isobutane				0.000236703	0	0.000311769	
n-Butane				0.000994262	0	0.00113338	
Isopentane				0.000224943	0	0.000218559	
n-Pentane				0.000185895	0	0.000167165	
2-Methylpentane				2.47752E-05	0	2.00991E-05	
3-Methylpentane				4.38374E-05	0	3.65552E-05	
n-Hexane				3.22725E-05	0	2.57926E-05	
Methylcyclopentane				6.63664E-05	0	6.17332E-05	
Benzene				0.000340857	0	0.000311538	
2-Methylhexane				9.74255E-06	0	8.64222E-06	
3-Methylhexane				7.94081E-06	0	7.00203E-06	
Heptane				1.27741E-05	0	1.22809E-05	
Methylcyclohexane				5.68475E-05	0	4.76295E-05	
Toluene				0.000692618	0	0.000591769	
Octane				8.54089E-06	0	6.54430E-06	
Ethylbenzene				0.000333553	0	0.000290260	
m-Xylene				0.000268798	0	0.000227055	
o-Xylene				0.000557275	0	0.000465777	
Nonane				3.43960E-06	0	2.59907E-06	
C10+				1.27505E-06	0	9.70846E-07	
Mass Fraction		%	%	%	%	%	%

Water				99.9931	99.9931	99.9734
H2S				0	0	0
Nitrogen				2.31901E-06	2.31901E-06	0.000123383
Carbon Dioxide				0.000231430	0.000231430	0.000703648
Methane				0.000664111	0.000664111	0.0133038
Ethane				0.00130314	0.00130314	0.00645128
Propane				0.00142663	0.00142663	0.00301171
Isobutane				0.000130962	0.000130962	0.000172453
n-Butane				0.000550101	0.000550101	0.000626909
Isopentane				0.000154490	0.000154490	0.000150070
n-Pentane				0.000127672	0.000127672	0.000114781
2-Methylpentane				2.03236E-05	2.03236E-05	1.64837E-05
3-Methylpentane				3.59606E-05	3.59606E-05	2.99797E-05
n-Hexane				2.64737E-05	2.64737E-05	2.11531E-05
Methylcyclopentane				5.31680E-05	5.31680E-05	4.94444E-05
Benzene				0.000253448	0.000253448	0.000231582
2-Methylhexane				9.29284E-06	9.29284E-06	8.24132E-06
3-Methylhexane				7.57426E-06	7.57426E-06	6.67722E-06
Heptane				1.21844E-05	1.21844E-05	1.17112E-05
Methylcyclohexane				5.31325E-05	5.31325E-05	4.45063E-05
Toluene				0.000607482	0.000607482	0.000518905
Octane				9.28704E-06	9.28704E-06	7.11432E-06
Ethylbenzene				0.000337090	0.000337090	0.000293268
m-Xylene				0.000271646	0.000271646	0.000229408
o-Xylene				0.000563184	0.000563184	0.000470603
Nonane				4.19935E-06	4.19935E-06	3.17241E-06
C10+				1.87068E-06	1.87068E-06	1.42405E-06
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h

Water				10504.4	0	10504.8
H2S				0	0	0
Nitrogen				0.000243615	0	0.0128647
Carbon Dioxide				0.0243119	0	0.0739366
Methane				0.0697655	0	1.39791
Ethane				0.136896	0	0.677876
Propane				0.149869	0	0.316459
Isobutane				0.0137577	0	0.0181207
n-Butane				0.0577887	0	0.0658733
Isopentane				0.0162284	0	0.0157688
n-Pentane				0.0134121	0	0.0120607
2-Methylpentane				0.00213501	0	0.00173204
3-Methylpentane				0.00377770	0	0.00315015
n-Hexane				0.00278109	0	0.00222269
Methylcyclopentane				0.00558536	0	0.00519543
Benzene				0.0266250	0	0.0243348
2-Methylhexane				0.000976223	0	0.000865967
3-Methylhexane				0.000795685	0	0.000701617
Heptane				0.00127999	0	0.00123057
Methylcyclohexane				0.00558163	0	0.00467655
Toluene				0.0638167	0	0.0545246
Octane				0.000975813	0	0.000747548
Ethylbenzene				0.0354117	0	0.0308155
m-Xylene				0.0285367	0	0.0241053
o-Xylene				0.0591631	0	0.0494492
Nonane				0.000441146	0	0.000333345
C10+				0.000196517	0	0.000149634

Process Streams	Separator Oil	Water	Oil/Water	Tank Flash Gas	Separator Oil & Water	Oil/Water WB
Phase Heavy Liquid	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units					

Temperature	°F	75.9	75.9	64.0
Pressure	psig	0.00405122	0.00405122	149
Mole Fraction Vapor	%	0	0	0
Mole Fraction Light Liquid	%	0	0	0
Mole Fraction Heavy Liquid	%	100	100	100
Molecular Weight	lb/lbmol	18.0	18.0	18.0
Mass Density	lb/ft ³	62.2	62.2	62.3
Molar Flow	lbmol/h	583.1	0.0	583.2
Mass Flow	lb/h	10505.1	0.0	10507.6
Vapor Volumetric Flow	MCFH	0.2	0.0	0.2
Liquid Volumetric Flow	Mbbl/d	0.7	0.0	0.7
Std Vapor Volumetric Flow	MMSCFD	5.3	0.0	5.3
Std Liquid Volumetric Flow	Mbbl/d	0.7	0.0	0.7
Compressibility		0.001	0.001	0.008
Specific Gravity		0.998	0.998	0.999
API Gravity		10.0	10.0	10.0
Enthalpy	MMBtu/h	-71.7	0.0	-71.8
Mass Enthalpy	Btu/lb	-6822.2	-6822.2	-6832.6
Mass Cp	Btu/(lb °F)	1.0	1.0	1.0
Ideal Gas Cp/Cv Ratio		1.326	1.326	1.326
Dynamic Viscosity	cP	0.9	0.9	1.1
Kinematic Viscosity	cSt	0.9	0.9	1.1
Thermal Conductivity	Btu/(h ft °F)	0.3	0.3	0.3
Surface Tension	lb/ft	0.005	0.005	0.005
Net I.G. Heating Value	Btu/ft ³	0.1	0.1	0.3
Net Liquid Heating Value	Btu/lb	-1058.4	-1058.4	-1054.2
Gross I.G. Heating Value	Btu/ft ³	50.4	50.4	50.6
Gross Liquid Heating Value	Btu/lb	1.4	1.4	5.8

June 6, 2013

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

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

Sample: Tom's Fork No. 1H
Gas Liberated from Separator Water
From 149 psig & 64 °F to 0 psig & 70 °F

Date Sampled: 05/17/13

Job Number: 33542.001

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.000	
Carbon Dioxide	1.623	
Methane	50.762	
Ethane	15.569	4.140
Propane	9.072	2.485
Isobutane	2.466	0.802
n-Butane	5.548	1.739
2-2 Dimethylpropane	0.112	0.043
Isopentane	3.181	1.157
n-Pentane	2.995	1.079
Hexanes	4.199	1.721
Heptanes Plus	<u>4.473</u>	<u>1.964</u>
Totals	100.000	15.130

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity ----- 3.554 (Air=1)
Molecular Weight ----- 101.71
Gross Heating Value ----- 5368 BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity ----- 1.219 (Air=1)
Compressibility (Z) ----- 0.9882
Molecular Weight ----- 34.89
Gross Heating Value
Dry Basis ----- 1987 BTU/CF
Saturated Basis ----- 1953 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: AL
Cylinder ID: WF# 3 S

David Dannhaus 361-661-7015

**CHROMATOGRAPH EXTENDED ANALYSIS
TOTAL REPORT**

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.000		0.000
Carbon Dioxide	1.623		2.047
Methane	50.762		23.344
Ethane	15.569	4.140	13.418
Propane	9.072	2.485	11.466
Isobutane	2.466	0.802	4.108
n-Butane	5.548	1.739	9.243
2,2 Dimethylpropane	0.112	0.043	0.232
Isopentane	3.181	1.157	6.578
n-Pentane	2.995	1.079	6.194
2,2 Dimethylbutane	0.180	0.075	0.445
Cyclopentane	0.091	0.038	0.183
2,3 Dimethylbutane	0.196	0.080	0.484
2 Methylpentane	1.316	0.543	3.251
3 Methylpentane	0.846	0.343	2.090
n-Hexane	1.570	0.642	3.878
Methylcyclopentane	0.153	0.052	0.369
Benzene	0.043	0.012	0.096
Cyclohexane	0.222	0.075	0.535
2-Methylhexane	0.568	0.263	1.631
3-Methylhexane	0.552	0.250	1.585
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.574	0.248	1.632
n-Heptane	0.628	0.288	1.804
Methylcyclohexane	0.502	0.201	1.413
Toluene	0.086	0.029	0.227
Other C8's	0.759	0.351	2.398
n-Octane	0.129	0.066	0.422
Ethylbenzene	0.004	0.002	0.012
M & P Xylenes	0.023	0.009	0.070
O-Xylene	0.004	0.002	0.012
Other C9's	0.174	0.088	0.630
n-Nonane	0.020	0.011	0.074
Other C10's	0.028	0.016	0.113
n-Decane	0.003	0.002	0.012
Undecanes (11)	<u>0.001</u>	<u>0.001</u>	<u>0.004</u>
Totals	100.000	15.130	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity	_____	1.219	(Air=1)
Compressibility (Z)	_____	0.9882	
Molecular Weight	_____	34.89	
Gross Heating Value			
Dry Basis	_____	1987	BTU/CF
Saturated Basis	_____	1953	BTU/CF

May 30, 2013

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

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

Sample: Tom's Fork No. 1H
Separator Hydrocarbon Liquid
Sampled @ 149 psig & 62 °F

Date Sampled: 05/17/13

Job Number: 33542.002

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2186-M

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.017	0.004	0.005
Carbon Dioxide	0.038	0.014	0.016
Methane	4.271	1.558	0.660
Ethane	4.484	2.582	1.299
Propane	4.441	2.634	1.887
Isobutane	1.479	1.042	0.828
n-Butane	3.646	2.475	2.042
2,2 Dimethylpropane	0.074	0.061	0.051
Isopentane	2.616	2.060	1.819
n-Pentane	2.770	2.162	1.926
2,2 Dimethylbutane	0.206	0.185	0.171
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.394	0.348	0.327
2 Methylpentane	1.832	1.637	1.521
3 Methylpentane	1.329	1.168	1.104
n-Hexane	2.879	2.549	2.391
Heptanes Plus	<u>69.523</u>	<u>79.521</u>	<u>83.953</u>
Totals:	100.000	100.000	100.000

Characteristics of Heptanes Plus:

Specific Gravity ----- 0.7475 (Water=1)
°API Gravity ----- 57.80 @ 60°F
Molecular Weight ----- 125.3
Vapor Volume ----- 18.93 CF/Gal
Weight ----- 6.23 Lbs/Gal

Characteristics of Total Sample:

Specific Gravity ----- 0.7080 (Water=1)
°API Gravity ----- 68.35 @ 60°F
Molecular Weight ----- 103.8
Vapor Volume ----- 21.65 CF/Gal
Weight ----- 5.90 Lbs/Gal

Base Conditions: 14.650 PSI & 60 °F

Certified: FESCO, Ltd. Alice, Texas

Analyst: JCM
Processor: JCdjv
Cylinder ID: W-1002

David Dannhaus 361-661-7015

TOTAL EXTENDED REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.017	0.004	0.005
Carbon Dioxide	0.038	0.014	0.016
Methane	4.271	1.558	0.660
Ethane	4.484	2.582	1.299
Propane	4.441	2.634	1.887
Isobutane	1.479	1.042	0.828
n-Butane	3.646	2.475	2.042
2,2 Dimethylpropane	0.074	0.061	0.051
Isopentane	2.616	2.060	1.819
n-Pentane	2.770	2.162	1.926
2,2 Dimethylbutane	0.206	0.185	0.171
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.394	0.348	0.327
2 Methylpentane	1.832	1.637	1.521
3 Methylpentane	1.329	1.168	1.104
n-Hexane	2.879	2.549	2.391
Methylcyclopentane	0.864	0.659	0.701
Benzene	0.096	0.058	0.072
Cyclohexane	0.656	0.481	0.532
2-Methylhexane	2.728	2.730	2.633
3-Methylhexane	2.234	2.208	2.157
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	0.878	0.852	0.839
n-Heptane	3.624	3.600	3.499
Methylcyclohexane	3.274	2.833	3.097
Toluene	0.803	0.579	0.713
Other C-8's	10.455	10.921	11.103
n-Octane	4.068	4.487	4.477
E-Benzene	1.278	1.062	1.308
M & P Xylenes	1.188	0.992	1.215
O-Xylene	2.042	1.672	2.089
Other C-9's	7.928	9.249	9.644
n-Nonane	3.295	3.992	4.072
Other C-10's	8.288	10.626	11.282
n-decane	2.146	2.835	2.942
Undecanes(11)	6.306	8.294	8.931
Dodecanes(12)	3.312	4.706	5.138
Tridecanes(13)	1.921	2.927	3.239
Tetradecanes(14)	1.036	1.691	1.897
Pentadecanes(15)	0.536	0.937	1.064
Hexadecanes(16)	0.249	0.465	0.533
Heptadecanes(17)	0.137	0.270	0.312
Octadecanes(18)	0.081	0.169	0.196
Nonadecanes(19)	0.043	0.094	0.110
Eicosanes(20)	0.022	0.049	0.058
Heneicosanes(21)	0.012	0.029	0.034
Docosanes(22)	0.008	0.020	0.024
Tricosanes(23)	0.005	0.013	0.015
Tetracosanes(24)	0.002	0.006	0.008
Pentacosanes(25)	0.002	0.004	0.005
Hexacosanes(26)	0.001	0.003	0.003
Heptacosanes(27)	0.001	0.002	0.002
Octacosanes(28)	0.001	0.002	0.002
Nonacosanes(29)	0.000	0.001	0.001
Triacotanes(30)	0.000	0.001	0.001
Hentriacotanes Plus(31+)	<u>0.001</u>	<u>0.002</u>	<u>0.002</u>
Total	100.000	100.000	100.000

Antero Resources
Tom's Fork Unit 1H - Erwin Hilltop Pad

Tag Name	Value	Units	Timestamp
Accumulated Gas Flow	1007191	MCF	12/12/2013 09:05:33
Casing Pressure	265.75	PSIA	12/12/2013 09:05:38
Current Day Gas Flow	141.06	MCF	12/12/2013 09:05:33
Differential Pressure	4.15	inH2O	12/12/2013 09:05:33
Flow Rate	2901.39	MCF Per Day	12/12/2013 09:05:33
Pressure	224.06	PSIA	12/12/2013 09:05:33
Previous Day Energy	3355.95	MBTU	12/12/2013 09:05:34
Previous Day Gas Flow	2775.87	MCF	12/12/2013 09:05:34
Temperature	60.24	F	12/12/2013 09:05:33
Tubing Pressure	454.39	PSIA	12/12/2013 09:05:38
Daily AP	3.49	PSIA	12/12/2013 09:00:00
Daily DP	245.52	inH2O	12/12/2013 09:00:00
Daily Energy	3355.95	MBTU	12/12/2013 09:00:00
Daily Flow	2775.87	MCF	12/12/2013 09:00:00
Daily Tf	60.68	F	12/12/2013 09:00:00
Hourly AP	225.27	PSIA	12/12/2013 10:00:00
Hourly DP	3.89	Inches	12/12/2013 10:00:00
Hourly Energy	141.7	MBTU	12/12/2013 10:00:00
Hourly Flow Time	3600	Seconds	12/12/2013 10:00:00
Hourly Tf	60.3	F	12/12/2013 10:00:00
Hourly Volume	117.2	MCF	12/12/2013 10:00:00
Argon	0	%	12/12/2013 09:05:37
BTU	1208.97	BTU	12/12/2013 09:05:33
CO2	0.1247	%	12/12/2013 09:05:37
Carbon Monoxide	0	%	12/12/2013 09:05:37
Decane	0	%	12/12/2013 09:05:37
Ethane	13.3575	%	12/12/2013 09:05:37
Helium	0	%	12/12/2013 09:05:37
Heptane	0	%	12/12/2013 09:05:37
Hexane	0.2788	%	12/12/2013 09:05:37
Hydrogen	0	%	12/12/2013 09:05:37
Hydrogen Sulfide	0	%	12/12/2013 09:05:37
Iso-Butane	0.5119	%	12/12/2013 09:05:37
Iso-Pentane	0.181	%	12/12/2013 09:05:37
Methane	80.1487	%	12/12/2013 09:05:37
N2	0.3959	%	12/12/2013 09:05:37
N-Butane	0.8244	%	12/12/2013 09:05:37
Nonane	0	%	12/12/2013 09:05:37
N-Pentane	0.4327	%	12/12/2013 09:05:37
Octane	0	%	12/12/2013 09:05:37
Oxygen	0	%	12/12/2013 09:05:37
Plate Size	3.75	Inches	12/12/2013 09:05:35
Propane	3.7444	%	12/12/2013 09:05:37
SPG	0.6963		12/12/2013 09:05:33
Water	0	%	12/12/2013 09:05:37
Oxygen	0.0117	%	12/3/2013 10:05
Plate Size	3.75	Inches	12/3/2013 10:05
Propane	4.4938	%	12/3/2013 10:05
SPG	0.7248		12/3/2013 10:05
Water	0	%	12/3/2013 10:05

Attachment J

Class I Legal Advertisement

Attachment J

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

Notice is given that Antero Resources Corporation has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a General Permit Registration Modification for a Natural Gas facility located near the intersection of WV 18 S and Co Rte 18/16 in Doddridge County, West Virginia.

The latitude and longitude coordinates are: 39.185838 degrees N and -80.699594 degrees W

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

Pollutants	TOTALS (tpy):
VOC	14.5531
NO _x	3.9441
CO _{2e}	3,779.8070
CO	26.8740
SO ₂	0.0148
PM _{2.5}	0.2008
PM ₁₀	0.3032
Lead	1.28E-05
Total HAPs	0.9852
Benzene	0.0082
Formaldehyde	0.0227
Xylenes	0.2527

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

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

Dated this the ____ day of _____, 2015

By: Antero Resources Corporation
Donald Gray
Environmental and Regulatory Manager
1615 Wynkoop Street
Denver, CO 80202

Attachment N
Material Safety Data Sheet

Attachment N**Description of Material Safety Data Sheets (MSDS)****Cline 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 processing 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 processing units.

Material Name: Dry Field Natural Gas

US GHS

SYNONYMS: CNG, Natural Gas, Methane.

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

PRODUCT NAME:	Dry Field Natural Gas	EMERGENCY PHONE:	(800) 878-1373
PRODUCT CODES:	CAS Reg. No. 68410-63-9	AFTER HOURS:	(800) 878-1373
PRODUCER:	Antero Resources		
ADDRESS:	1615 Wynkoop Street 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

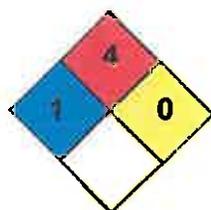
First Aid: Ingestion

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

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

*** Section 12 – ECOLOGICAL INFORMATION ***

Ecotoxicity

A: General Product Information

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

B: Component Analysis – Ecotoxicity – Aquatic Toxicity

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

Persistence / Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** Section 13 – DISPOSAL CONSIDERATIONS ***

Waste Disposal Instructions

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

Disposal of Contaminated Containers or Packaging

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

*** Section 14 – TRANSPORTATION INFORMATION ***

DOT Information

Shipping Name: Natural Gas, Compressed

UN #: 1971 Hazard Class: 2.1

Placard:



SAFETY DATA SHEET

Material Name: Dry Field Natural Gas

US GHS

***** Section 15 – REGULATORY INFORMATION *****

Regulatory Information

Component Analysis

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

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

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

SARA Section 311/312 – Hazard Classes

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

SARA Section 313 – Supplier Notification

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

State Regulations

Component Analysis – State

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

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

SAFETY DATA SHEET

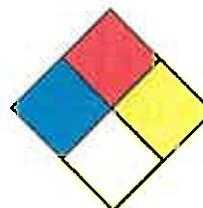
Material Name: Dry Field Natural Gas

US GHS

*** Section 16 – OTHER INFORMATION ***

NFPA® Hazard Rating

Health	1
Fire	4
Reactivity	0



HMIS® Hazard Rating

Health	1	Moderate
Fire	4	Severe
Physical	0	Minimal

* Chronic

Key/Legend

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

Literature References

None

Other Information

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

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

Date of Preparation: January 30, 2014

Date of Last Revision: March 4, 2014

End of Sheet



Antero SAFETY DATA SHEET

Resources

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

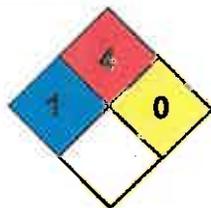
Material Name: Natural Gas Condensate

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 <i>Alburnus alburnus</i>	119 mg/L [static]
96 Hr LC50 <i>Cyprinodon variegatus</i>	82 mg/L [static]
72 Hr EC50 <i>Pseudokirchneriella subcapitata</i>	56 mg/L
24 Hr EC50 <i>Daphnia magna</i>	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

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

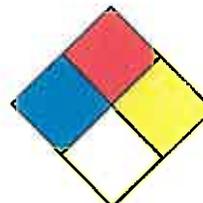
Ingredient Disclosure List:

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

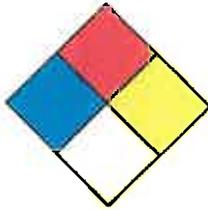
Material Name: Produced Water

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		
Lower Flammability Limit:	ND	Upper Flammability Limit:	ND
(LFL):		(UFL):	
Auto Ignition:	ND	Burning Rate:	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 *****

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

Key/Legend

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

Literature References

None

Other Information

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

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

Date of Preparation: January 28, 2014

Date of Last Revision: March 4, 2014

End of Sheet

Attachment O

Emissions Summary Sheet

Attachment O: G70-A Emissions Summary Sheet
Emission Points Data Summary Sheet

Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Types	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# (Specify VOCs & HAPs)	Maximum Potential Uncontrolled Emissions 4		Maximum Potential Controlled Emissions 5		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Ext. Method Used 6
		ID No.	Source			lb/hr	ton/yr	lb/hr	ton/yr		
FU001	n/a	TANK001-08, FU001	Condensate/ Produced Water Tank F/W/Flare	FU001	CO (850280) NOx (10102438) PM (7439-92-1) CO2 Equivalent: H2O, H2, SO2, CO, CH4, C2H6, C3H8, C4H10, C5H12, C6H14, C7H16, C8H18, C9H20, C10H22, C11H24, C12H26, C13H28, C14H30, C15H32, C16H34, C17H36, C18H38, C19H40, C20H42, C21H44, C22H46, C23H48, C24H50, C25H52, C26H54, C27H56, C28H58, C29H60, C30H62, C31H64, C32H66, C33H68, C34H70, C35H72, C36H74, C37H76, C38H78, C39H80, C40H82, C41H84, C42H86, C43H88, C44H90, C45H92, C46H94, C47H96, C48H98, C49H100, C50H102, C51H104, C52H106, C53H108, C54H110, C55H112, C56H114, C57H116, C58H118, C59H120, C60H122, C61H124, C62H126, C63H128, C64H130, C65H132, C66H134, C67H136, C68H138, C69H140, C70H142, C71H144, C72H146, C73H148, C74H150, C75H152, C76H154, C77H156, C78H158, C79H160, C80H162, C81H164, C82H166, C83H168, C84H170, C85H172, C86H174, C87H176, C88H178, C89H180, C90H182, C91H184, C92H186, C93H188, C94H190, C95H192, C96H194, C97H196, C98H198, C99H200, C100H202, C101H204, C102H206, C103H208, C104H210, C105H212, C106H214, C107H216, C108H218, C109H220, C110H222, C111H224, C112H226, C113H228, C114H230, C115H232, C116H234, C117H236, C118H238, C119H240, C120H242, C121H244, C122H246, C123H248, C124H250, C125H252, C126H254, C127H256, C128H258, C129H260, C130H262, C131H264, C132H266, C133H268, C134H270, C135H272, C136H274, C137H276, C138H278, C139H280, C140H282, C141H284, C142H286, C143H288, C144H290, C145H292, C146H294, C147H296, C148H298, C149H300, C150H302, C151H304, C152H306, C153H308, C154H310, C155H312, C156H314, C157H316, C158H318, C159H320, C160H322, C161H324, C162H326, C163H328, C164H330, C165H332, C166H334, C167H336, C168H338, C169H340, C170H342, C171H344, C172H346, C173H348, C174H350, C175H352, C176H354, C177H356, C178H358, C179H360, C180H362, C181H364, C182H366, C183H368, C184H370, C185H372, C186H374, C187H376, C188H378, C189H380, C190H382, C191H384, C192H386, C193H388, C194H390, C195H392, C196H394, C197H396, C198H398, C199H400, C200H402, C201H404, C202H406, C203H408, C204H410, C205H412, C206H414, C207H416, C208H418, C209H420, C210H422, C211H424, C212H426, C213H428, C214H430, C215H432, C216H434, C217H436, C218H438, C219H440, C220H442, C221H444, C222H446, C223H448, C224H450, C225H452, C226H454, C227H456, C228H458, C229H460, C230H462, C231H464, C232H466, C233H468, C234H470, C235H472, C236H474, C237H476, C238H478, C239H480, C240H482, C241H484, C242H486, C243H488, C244H490, C245H492, C246H494, C247H496, C248H498, C249H500, C250H502, C251H504, C252H506, C253H508, C254H510, C255H512, C256H514, C257H516, C258H518, C259H520, C260H522, C261H524, C262H526, C263H528, C264H530, C265H532, C266H534, C267H536, C268H538, C269H540, C270H542, C271H544, C272H546, C273H548, C274H550, C275H552, C276H554, C277H556, C278H558, C279H560, C280H562, C281H564, C282H566, C283H568, C284H570, C285H572, C286H574, C287H576, C288H578, C289H580, C290H582, C291H584, C292H586, C293H588, C294H590, C295H592, C296H594, C297H596, C298H598, C299H600, C300H602, C301H604, C302H606, C303H608, C304H610, C305H612, C306H614, C307H616, C308H618, C309H620, C310H622, C311H624, C312H626, C313H628, C314H630, C315H632, C316H634, C317H636, C318H638, C319H640, C320H642, C321H644, C322H646, C323H648, C324H650, C325H652, C326H654, C327H656, C328H658, C329H660, C330H662, C331H664, C332H666, C333H668, C334H670, C335H672, C336H674, C337H676, C338H678, C339H680, C340H682, C341H684, C342H686, C343H688, C344H690, C345H692, C346H694, C347H696, C348H698, C349H700, C350H702, C351H704, C352H706, C353H708, C354H710, C355H712, C356H714, C357H716, C358H718, C359H720, C360H722, C361H724, C362H726, C363H728, C364H730, C365H732, C366H734, C367H736, C368H738, C369H740, C370H742, C371H744, C372H746, C373H748, C374H750, C375H752, C376H754, C377H756, C378H758, C379H760, C380H762, C381H764, C382H766, C383H768, C384H770, C385H772, C386H774, C387H776, C388H778, C389H780, C390H782, C391H784, C392H786, C393H788, C394H790, C395H792, C396H794, C397H796, C398H798, C399H800, C400H802, C401H804, C402H806, C403H808, C404H810, C405H812, C406H814, C407H816, C408H818, C409H820, C410H822, C411H824, C412H826, C413H828, C414H830, C415H832, C416H834, C417H836, C418H838, C419H840, C420H842, C421H844, C422H846, C423H848, C424H850, C425H852, C426H854, C427H856, C428H858, C429H860, C430H862, C431H864, C432H866, C433H868, C434H870, C435H872, C436H874, C437H876, C438H878, C439H880, C440H882, C441H884, C442H886, C443H888, C444H890, C445H892, C446H894, C447H896, C448H898, C449H900, C450H902, C451H904, C452H906, C453H908, C454H910, C455H912, C456H914, C457H916, C458H918, C459H920, C460H922, C461H924, C462H926, C463H928, C464H930, C465H932, C466H934, C467H936, C468H938, C469H940, C470H942, C471H944, C472H946, C473H948, C474H950, C475H952, C476H954, C477H956, C478H958, C479H960, C480H962, C481H964, C482H966, C483H968, C484H970, C485H972, C486H974, C487H976, C488H978, C489H980, C490H982, C491H984, C492H986, C493H988, C494H990, C495H992, C496H994, C497H996, C498H998, C499H1000, C500H1002, C501H1004, C502H1006, C503H1008, C504H1010, C505H1012, C506H1014, C507H1016, C508H1018, C509H1020, C510H1022, C511H1024, C512H1026, C513H1028, C514H1030, C515H1032, C516H1034, C517H1036, C518H1038, C519H1040, C520H1042, C521H1044, C522H1046, C523H1048, C524H1050, C525H1052, C526H1054, C527H1056, C528H1058, C529H1060, C530H1062, C531H1064, C532H1066, C533H1068, C534H1070, C535H1072, C536H1074, C537H1076, C538H1078, C539H1080, C540H1082, C541H1084, C542H1086, C543H1088, C544H1090, C545H1092, C546H1094, C547H1096, C548H1098, C549H1100, C550H1102, C551H1104, C552H1106, C553H1108, C554H1110, C555H1112, C556H1114, C557H1116, C558H1118, C559H1120, C560H1122, C561H1124, C562H1126, C563H1128, C564H1130, C565H1132, C566H1134, C567H1136, C568H1138, C569H1140, C570H1142, C571H1144, C572H1146, C573H1148, C574H1150, C575H1152, C576H1154, C577H1156, C578H1158, C579H1160, C580H1162, C581H1164, C582H1166, C583H1168, C584H1170, C585H1172, C586H1174, C587H1176, C588H1178, C589H1180, C590H1182, C591H1184, C592H1186, C593H1188, C594H1190, C595H1192, C596H1194, C597H1196, C598H1198, C599H1200, C600H1202, C601H1204, C602H1206, C603H1208, C604H1210, C605H1212, C606H1214, C607H1216, C608H1218, C609H1220, C610H1222, C611H1224, C612H1226, C613H1228, C614H1230, C615H1232, C616H1234, C617H1236, C618H1238, C619H1240, C620H1242, C621H1244, C622H1246, C623H1248, C624H1250, C625H1252, C626H1254, C627H1256, C628H1258, C629H1260, C630H1262, C631H1264, C632H1266, C633H1268, C634H1270, C635H1272, C636H1274, C637H1276, C638H1278, C639H1280, C640H1282, C641H1284, C642H1286, C643H1288, C644H1290, C645H1292, C646H1294, C647H1296, C648H1298, C649H1300, C650H1302, C651H1304, C652H1306, C653H1308, C654H1310, C655H1312, C656H1314, C657H1316, C658H1318, C659H1320, C660H1322, C661H1324, C662H1326, C663H1328, C664H1330, C665H1332, C666H1334, C667H1336, C668H1338, C669H1340, C670H1342, C671H1344, C672H1346, C673H1348, C674H1350, C675H1352, C676H1354, C677H1356, C678H1358, C679H1360, C680H1362, C681H1364, C682H1366, C683H1368, C684H1370, C685H1372, C686H1374, C687H1376, C688H1378, C689H1380, C690H1382, C691H1384, C692H1386, C693H1388, C694H1390, C695H1392, C696H1394, C697H1396, C698H1398, C699H1400, C700H1402, C701H1404, C702H1406, C703H1408, C704H1410, C705H1412, C706H1414, C707H1416, C708H1418, C709H1420, C710H1422, C711H1424, C712H1426, C713H1428, C714H1430, C715H1432, C716H1434, C717H1436, C718H1438, C719H1440, C720H1442, C721H1444, C722H1446, C723H1448, C724H1450, C725H1452, C726H1454, C727H1456, C728H1458, C729H1460, C730H1462, C731H1464, C732H1466, C733H1468, C734H1470, C735H1472, C736H1474, C737H1476, C738H1478, C739H1480, C740H1482, C741H1484, C742H1486, C743H1488, C744H1490, C745H1492, C746H1494, C747H1496, C748H1498, C749H1500, C750H1502, C751H1504, C752H1506, C753H1508, C754H1510, C755H1512, C756H1514, C757H1516, C758H1518, C759H1520, C760H1522, C761H1524, C762H1526, C763H1528, C764H1530, C765H1532, C766H1534, C767H1536, C768H1538, C769H1540, C770H1542, C771H1544, C772H1546, C773H1548, C774H1550, C775H1552, C776H1554, C777H1556, C778H1558, C779H1560, C780H1562, C781H1564, C782H1566, C783H1568, C784H1570, C785H1572, C786H1574, C787H1576, C788H1578, C789H1580, C790H1582, C791H1584, C792H1586, C793H1588, C794H1590, C795H1592, C796H1594, C797H1596, C798H1598, C799H1600, C800H1602, C801H1604, C802H1606, C803H1608, C804H1610, C805H1612, C806H1614, C807H1616, C808H1618, C809H1620, C810H1622, C811H1624, C812H1626, C813H1628, C814H1630, C815H1632, C816H1634, C817H1636, C818H1638, C819H1640, C820H1642, C821H1644, C822H1646, C823H1648, C824H1650, C825H1652, C826H1654, C827H1656, C828H1658, C829H1660, C830H1662, C831H1664, C832H1666, C833H1668, C834H1670, C835H1672, C836H1674, C837H1676, C838H1678, C839H1680, C840H1682, C841H1684, C842H1686, C843H1688, C844H1690, C845H1692, C846H1694, C847H1696, C848H1698, C849H1700, C850H1702, C851H1704, C852H1706, C853H1708, C854H1710, C855H1712, C856H1714, C857H1716, C858H1718, C859H1720, C860H1722, C861H1724, C862H1726, C863H1728, C864H1730, C865H1732, C866H1734, C867H1736, C868H1738, C869H1740, C870H1742, C871H1744, C872H1746, C873H1748, C874H1750, C875H1752, C876H1754, C877H1756, C878H1758, C879H1760, C880H1762, C881H1764, C882H1766, C883H1768, C884H1770, C885H1772, C886H1774, C887H1776, C888H1778, C889H1780, C890H1782, C891H1784, C892H1786, C893H1788, C894H1790, C895H1792, C896H1794, C897H1796, C898H1798, C899H1800, C900H1802, C901H1804, C902H1806, C903H1808, C904H1810, C905H1812, C906H1814, C907H1816, C908H1818, C909H1820, C910H1822, C911H1824, C912H1826, C913H1828, C914H1830, C915H1832, C916H1834, C917H1836, C918H1838, C919H1840, C920H1842, C921H1844, C922H1846, C923H1848, C924H1850, C925H1852, C926H1854, C927H1856, C928H1858, C929H1860, C930H1862, C931H1864, C932H1866, C933H1868, C934H1870, C935H1872, C936H1874, C937H1876, C938H1878, C939H1880, C940H1882, C941H1884, C942H1886, C943H1888, C944H1890, C945H1892, C946H1894, C947H1896, C948H1898, C949H1900, C950H1902, C951H1904, C952H1906, C953H1908, C954H1910, C955H1912, C956H1914, C957H1916, C958H1918, C959H1920, C960H1922, C961H1924, C962H1926, C963H1928, C964H1930, C965H1932, C966H1934, C967H1936, C968H1938, C969H1940, C970H1942, C971H1944, C972H1946, C973H1948, C974H1950, C975H1952, C976H1954, C977H1956, C978H1958, C979H1960, C980H1962, C981H1964, C982H1966, C983H1968, C984H1970, C985H1972, C986H1974, C987H1976, C988H1978, C989H1980, C990H1982, C991H1984, C992H1986, C993H1988, C994H1990, C995H1992, C996H1994, C997H1996, C998H1998, C999H2000, C1000H2002, C1001H2004, C1002H2006, C1003H2008, C1004H2010, C1005H2012, C1006H2014, C1007H2016, C1008H2018, C1009H2020, C1010H2022, C1011H2024, C1012H2026, C1013H2028, C1014H2030, C1015H2032, C1016H2034, C1017H2036, C1018H2038, C1019H2040, C1020H2042, C1021H2044, C1022H2046, C1023H2048, C1024H2050, C1025H2052, C1026H2054, C1027H2056, C1028H2058, C1029H2060, C1030H2062, C1031H2064, C1032H2066, C1033H2068, C1034H2070, C1035H2072, C1036H2074, C1037H2076, C1038H2078, C1039H2080, C1040H2082, C1041H2084, C1042H2086, C1043H2088, C1044H2090, C1045H2092, C1046H2094, C1047H2096, C1048H2098, C1049H2100, C1050H2102, C1051H2104, C1052H2106, C1053H2108, C1054H2110, C1055H2112, C1056H2114, C1057H2116, C1058H2118, C1059H2120, C1060H2122, C1061H2124, C1062H2126, C1063H2128, C1064H2130, C1065H2132, C1066H2134, C1067H2136, C1068H2138, C1069H2140, C1070H2142, C1071H2144, C1072H2146, C1073H2148, C1074H2150, C1075H2152, C1076H2154, C1077H2156, C1078H2158, C1079H2160, C1080H2162, C1081H2164, C1082H2166, C1083H2168, C1084H2170, C1085H2172, C1086H2174, C1087H2176, C1088H2178, C1089H2180, C1090H2182, C1091H2184, C1092H2186, C1093H2188, C1094H2190, C1095H2192, C1096H2194, C1097H2196, C1098H2198, C1099H2200, C1100H2202, C1101H2204, C1102H2206, C1103H2208, C1104H2210, C1105H2212, C1106H2214, C1107H2216, C1108H2218, C1109H2220, C1110H2222, C1111H2224, C1112H2226, C1113H2228, C1114H2230, C1115H2232, C1116H2234, C1117H2236, C1118H2238, C1119H2240, C1120H2242, C1121H2244, C1122H2246, C1123H2248, C1124H2250, C1125H2252, C1126H2254, C1127H2256, C1128H2258, C1129H2260, C1130H2262, C1131H2264, C1132H2266, C1133H2268, C1134H2270, C1135H2272, C1136H2274, C1137H2276, C1138H2278, C1139H2280, C1140H2282, C1141H2284, C1142H2286, C1143H2288, C1144H2290, C1145H2292, C1146H2294, C1147H2296, C1148H2298, C1149H2300, C1150H2302, C1151H2304, C1152H2306, C1153H2308, C1154H2310, C1155H2312, C1156H2314, C1157H2316, C1158H2318, C1159H2320, C1160H2322, C1161H2324, C1162H2326, C1163H2328, C1164H2330, C1165H2332, C1166H2334, C1167H2336, C1168H2338, C1169H2340, C1170H2342, C1171H2344, C1172H2346, C1173H2348, C1174H2350, C1175H2352, C1176H2354, C1177H2356, C1178H2358, C1179H2360, C1180H2362, C1181H2364, C1182H2366, C1183H2368, C1184H2370, C1185H2372, C1186H2374, C1187H2376, C1188H2378, C1189H2380, C1190H2382, C1191H2384, C1192H2386, C1193H2388, C1194H2390, C1195H2392, C1196H2394, C1197H2396, C1198H2398, C1199H2400, C1200H2402, C1201H2404, C1202H2406, C1203H2408, C1204H2410, C1205H2412, C1206H2414, C1207H2416, C1208H2418, C1209H2420, C1210H2422, C1211H2424, C1212H2426, C1213H2428, C1214H2430, C1215H2432, C1216H2434, C1217H2436, C1218H2438, C1219H2440, C1220H2442, C1221H2444, C1222H2446, C1223H2448, C1224H2450, C1225H2452, C1226H2454, C1227H2456, C1228H2458, C1229H2460, C1230H2462, C1231H2464,						

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	n/a					
Paved Haul Roads						
Unpaved Haul Roads						
Loading/Unloading Operations	PM, PM10, PM2.5	0.6593	0.4993	0.3286	0.2197	MB AP-42
	VOCs	5.3923	3.1983	5.3923	3.1983	MB
	toluene (108883)	0.0013	0.0008	0.0013	0.0008	AP-42
	ethyl benzene (100414)	0.0015	0.0009	0.0015	0.0009	
	hexane (110543)	0.0127	0.0075	0.0127	0.0075	
	o,m,p-xylenes (95476,108383,106423)	0.0034	0.0020	0.0034	0.0020	
	CO2 Equivalent	12.1749	7.2212	12.1749	7.2212	
	CO2 (124389), CH4	0.0002	1.29E-04	0.0002	1.29E-04	
	benzene (71432)	0.0002	1.29E-04	0.0002	1.29E-04	
	TAPs (benzene)					
	Benzene (71432)		0.0054		0.0054	MB
	Equipment Leaks (Components)	Toluene (108883)		0.0533		0.0533
Ethyl benzene (100414)			0.0977		0.0977	
Hexane (110543)			0.4247		0.4247	
o,m,p-xylenes (95476,108383,106423)			0.2470		0.2470	
CO2 Equivalent		Does not apply		Does not apply		
CO2 (124389), CH4			226.1413		226.1413	
VOCs			9.5465		9.5465	
TAPs (benzene)			0.0054		0.0054	
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	AP-42
hexane (110543)		0.0033	0.0145	0.0033	0.0145	
o,m,p-xylenes (95476,108383,106423)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	
CO2 Equivalent	4.4260	19.3859	4.4260	19.3859		
CO2 (124389), CH4	0.0428	0.1876	0.0428	0.1876		
VOCs						
TAPs (benzene, formaldehyde)	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

Issue Date:
11/20/2012

Revision Date:
N/A

Byron J. Bunker, Division Director
Compliance Division

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 + NOx (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.

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

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

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

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

4-5) EXHAUST GAS VOLUME

Refer to 25deg.C and 1000hPa

rpm	2000	2400	2800	3200	3600
L/sec	35.46	42.55	49.65	56.74	63.83
m 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

$$H_o = H_u \cdot N_e \cdot b_e \cdot i$$

H_o: Heat rejection to cooling water

H_u: Fuel low calorific value

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

N_e: Brake horse power

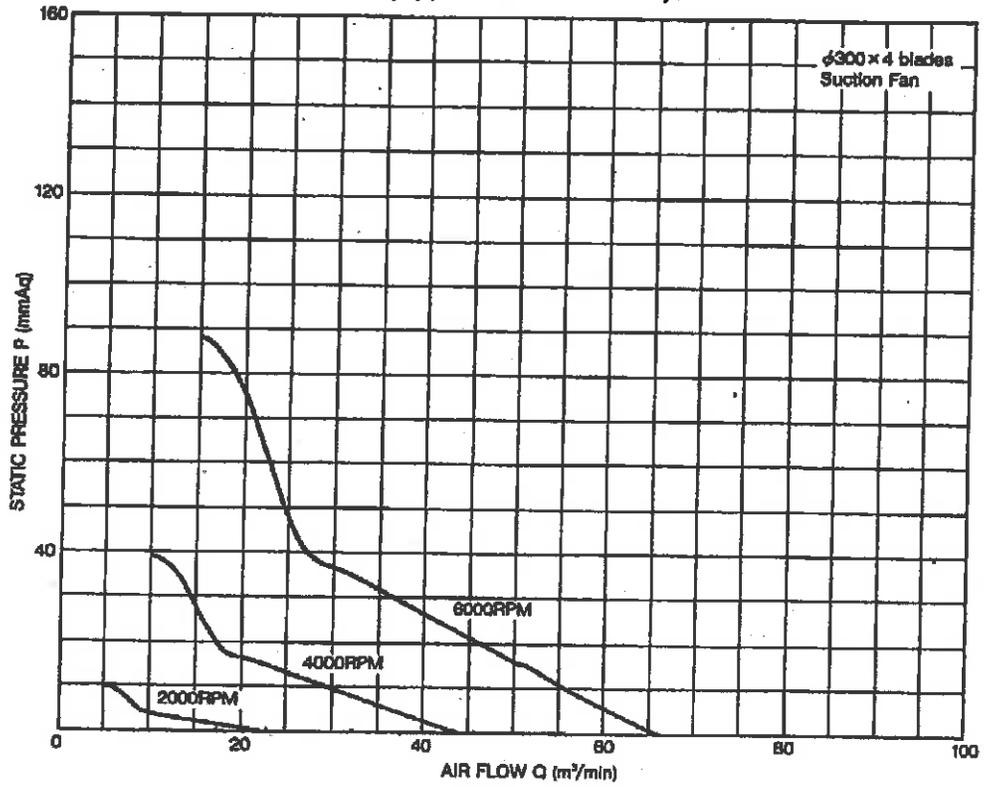
B_e: Specific fuel consumption

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

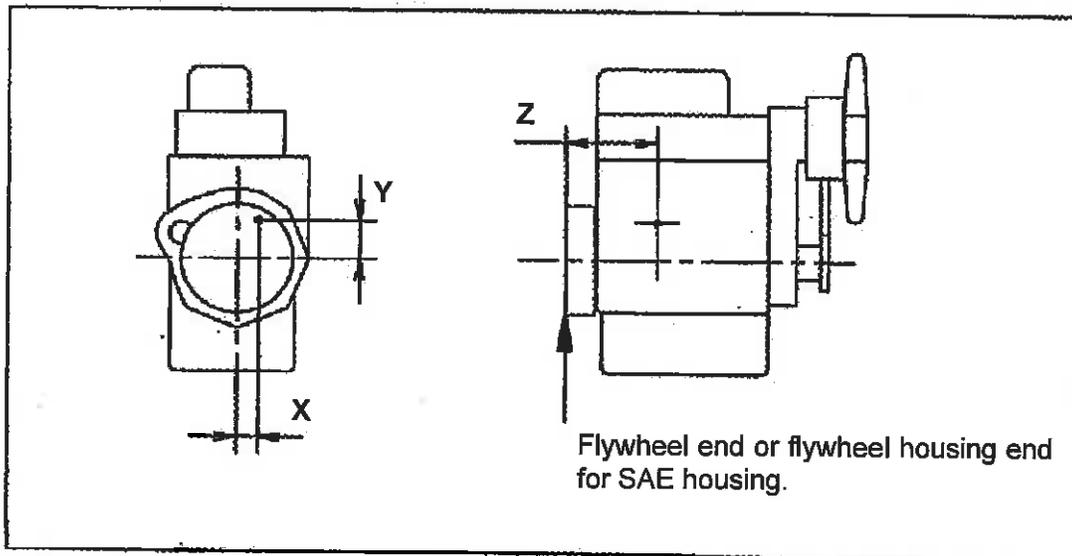
Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
WG/DF972	72.0 (159)	-25.5 (-1.00)	73.3 (2.89)	179.5 (7.07)

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)

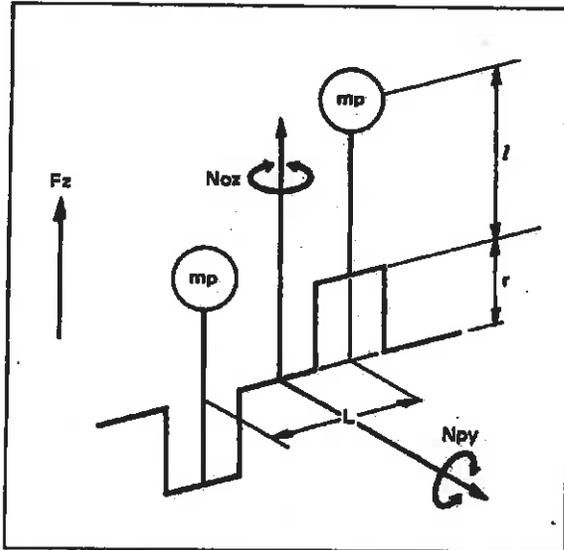
Note

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} , No_z : Unbalanced inertia couple
 m_p : Reciprocating mass
 r : Crank radius
 l : Center distance of connecting rod
 L : Cylinder distance
 ω : Angular velocity

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

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

2. Unbalanced inertia force and couple

($x\omega^2$)

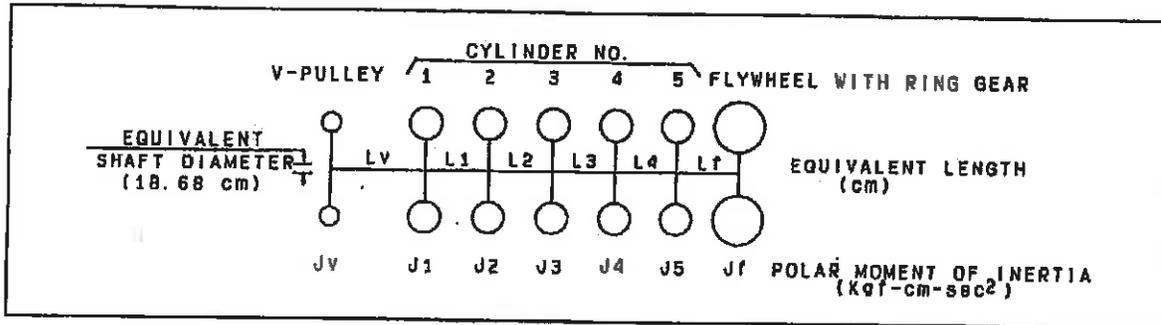
Model	No. of Cylinder	Cylinder Bore	Order	F_z	N_{py}	No_z
WG/DF/DG 972	3	74.5mm	1	0	0.000096	0.000096
			2	0	0.000072	0

▼An example of calculation

Calculation condition	ω^2	F_z, N_{py}, No_z		
		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	$0.000072 \times 142122 = 10.2\text{kg}$
		No_z	1	$0.000096 \times 142122 = 13.6\text{kg}$
			2	0

4-10) MASS ELASTIC SYSTEM

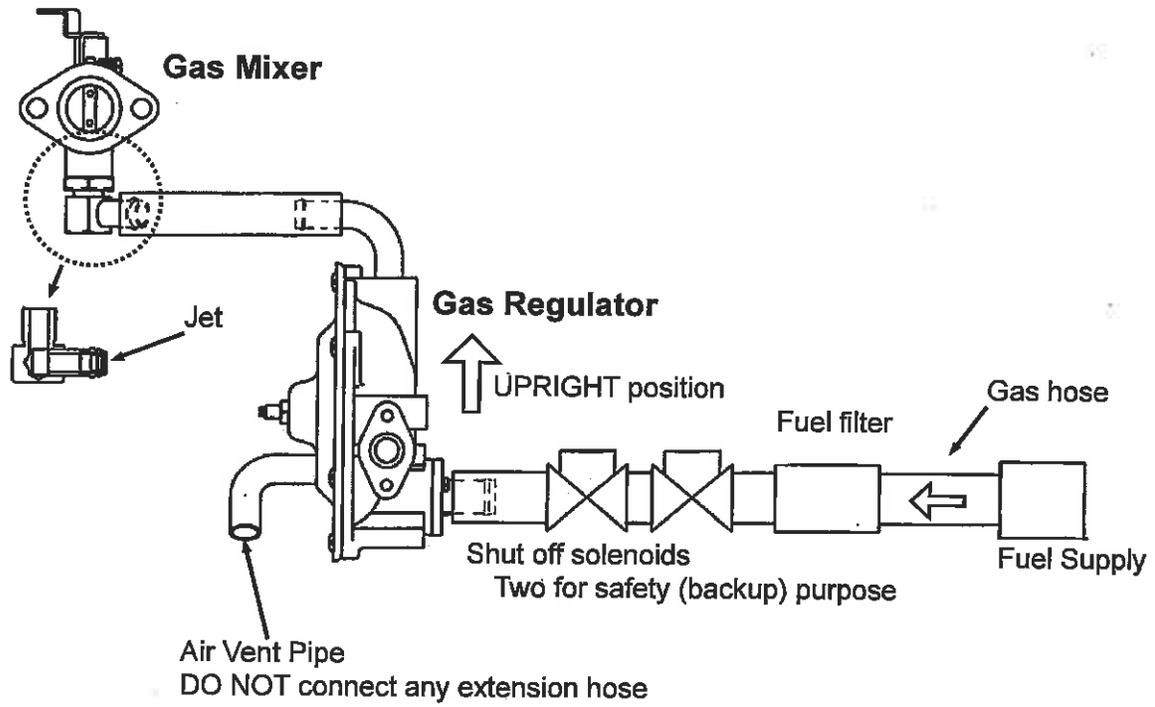
Equivalent torsional vibration data



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 diagram



NATURAL GAS ENGINE

KUBOTA DG SERIES (3-cylinder)

DG972-E2

2
EPA Tier

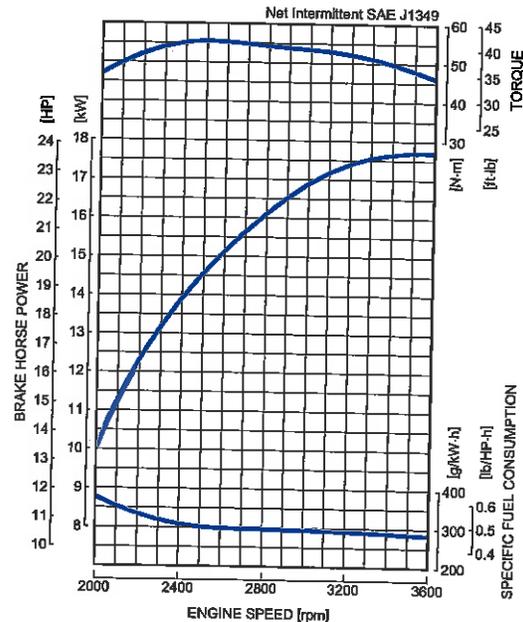
RATED POWER

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

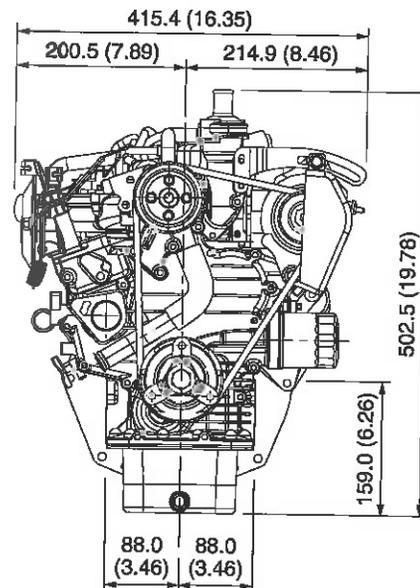
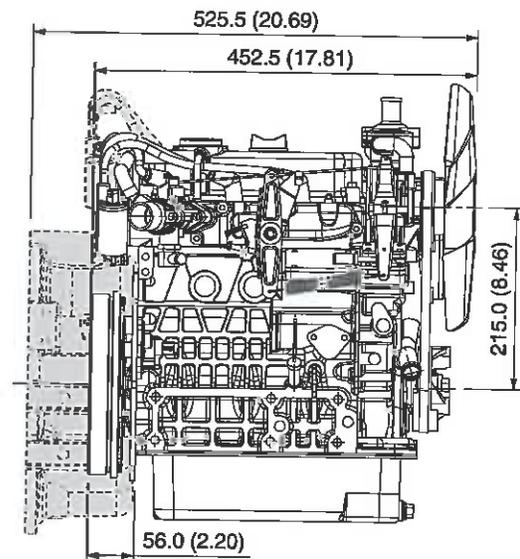
*Dry weight is according to Kubota's standard specification.

When specification varies, the weight will vary accordingly.

*¹ with SAE Flywheel and Housing

*² with Rear End Plate

DIMENSIONS



Kubota

KUBOTA Corporation

2-47, Shikitsuhigashi 1-chome, Naniwa-ku, Osaka, 556-8601 Japan

Fax: 06-6648-3521

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

Your Driving Force
KUBOTA ENGINE