September 18, 2015 Reference No. 082715

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

Dear Mr. Jay Fedczak:

Re: General Permit Registration G70-A Class II Administrative Update Application
Weigle East Well Pad
Antero Resources Corporation

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

A General Permit Registration Class II Administrative Update is requested due to the following planned operational changes:

1. Addition of one high pressure VRU compressor engine
2. Addition of one thermoelectric generator
3. Addition of 14 line heaters

Please refer to Table 15 in Attachment I - Emissions Calculations for the summary of changes in emissions of regulated air pollutants that will result from the above operational changes.

Enclosed are the following documents:

- Original copy of the G70-A General Permit Class II Administrative Update Application
- Two CD copies of the G70-A General Permit Class II Administrative Update Application
- The application fee with check no. 426120 in the amount of $300.00

GHD Services Inc.
6320 Rothway Suite 100 Houston Texas 77040 USA
T 713 734 3090 **F** 713 734 3391 **W** www.ghd.com

REGISTERED COMPANY FOR
ISO 9001
ENGINEERING DESIGN

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

Sincerely,

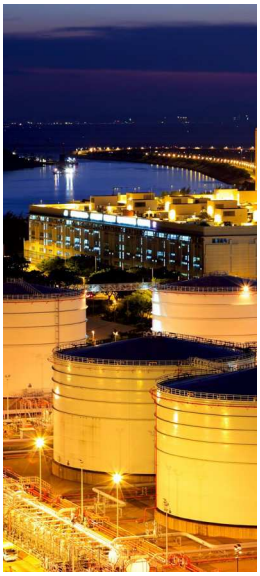
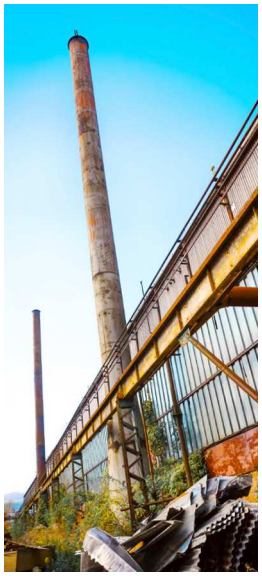
GHD

Manuel Bautista

MB/ma/224

Encl.

cc: Barry Schatz, Antero Resources Corporation

General Permit G70-A Class II Administrative Update

Addition of 1 high pressure VRU compressor engine, 1 thermoelectric generator, and14 line heaters

Weigle East Well Pad

Antero Resources Corporation

6320 Rothway, Suite 100 Houston, Texas 77040
082715 | Report No 224 | September 2015

Table of Contents *

G70-A General Permit Modification

Attachment A	Current Business Certificate - No changes
Attachment B	Process Description
Attachment C	Description of Fugitive Emissions
Attachment D	Process Flow Diagram
Attachment E	Plot Plan
Attachment F	Area Map - No changes
Attachment G	Emission Unit Data Sheets/G70-A Section Applicability Form
Attachment H	Air Pollution Control Device Data Sheet – No changes
Attachment I	Emission Calculations
Attachment J	Class I Legal Advertisement
Attachment K	Electronic Submittal - Not Applicable
Attachment L	General Permit Modification Application Fee
Attachment M	Siting Criteria Waiver - Not Applicable
Attachment N	Material Safety Data Sheets - No changes
Attachment O	Emissions Summary Sheet
Attachment P	Other Supporting Documentation Not Described Above

* Note: Attachments which have no changes from previous permit application or not applicable were not included in this submittal. The Attachment letter identifiers consistent with the G70-A application were maintained for easier identification/reference.

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:

- ☐ **G10-D –** Coal Preparation and Handling
- ☐ **G20-B –** Hot Mix Asphalt
- ☐ **G30-D –** Natural Gas Compressor Stations
- ☐ **G33-A –** Spark Ignition Internal Combustion Engines
- ☐ **G35-A –** Natural Gas Compressor Stations (Flare/Glycol Dehydration Unit)
- ☐ **G40-C –** Nonmetallic Minerals Processing
- ☐ **G50-B –** Concrete Batch
- ☐ **G60-C –** Class II Emergency Generator
- ☐ **G65-C –** Class I Emergency Generator
- ☒ **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:
312 Jug Run Road
Alma, WV 26320

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.):
Oil and Natural Gas Production facility

8a. Standard Industrial Classification (SIC) code: 1311

AND

8b. North American Industry System (NAICS) code: 211111

9. DAQ Plant ID No. (for existing facilities only):
095-00045

10. List all current 45CSR13 and other General Permit numbers associated with this process (for existing facilities only):
G70-A073
G70-A073A

A: PRIMARY OPERATING SITE INFORMATION

11A. Facility name of primary operating site:	12A. Address of primary operating site:
Weigle East Well Pad	Mailing: N/A Physical: 312 Jug Run Road, Alma, WV 26320

13A. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? ☒ **YES** ☐ **NO**

– IF **YES**, please explain: Antero is leasing the mineral rights for this site

– IF **NO**, YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE.

14A. – For **Modifications or Administrative Updates** at an existing facility, please provide directions to the present location of the facility from the nearest state road;

– For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a **MAP** as **Attachment F**.

Go 0.2 mi West on Co Rd 18/14 from the intersection of Co Rd 18/14 and Lemasters Bridge Road, then go 0.37 mi South of Co Rd 18/14

15A. Nearest city or town:	16A. County:	17A. UTM Coordinates:
Middlebourne	Tyler	Northing (KM): 4,368.527 Easting (KM): 512.6638 Zone: 17N

18A. Briefly describe the proposed new operation or change (s) to the facility:	19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits):
Addition of 1 high pressure VRU compressor engine, 1 thermoelectric generator, and 14 line heaters	Latitude: 39.46623 Longitude: -80.852782

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

11B. Name of 1st alternate operating site:	12B. Address of 1st alternate operating site:
	Mailing: Physical:

13B. 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.

14B. – For **Modifications or Administrative Updates** at an existing facility, please provide directions to the present location of the facility from the nearest state road;

– For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a **MAP** as **Attachment F**.

15B. Nearest city or town:	16B. County:	17B. UTM Coordinates: Northing (KM): _____ Easting (KM): _____ Zone: _____
18B. Briefly describe the proposed new operation or change (s) to the facility:		19B. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: _____ Longitude: _____

C: 2ND ALTERNATE OPERATING SITE INFORMATION (only available for G20, G40, & G50 General Permits):

11C. Name of 2nd alternate operating site: _____ _____	12C. Address of 2nd 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: Upon Permit Issuance ☐ 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: Upon Permit Issuance

22. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application if other than 8760 hours/year. (Note: anything other than 24/7/52 may result in a restriction to the facility's operation).

Hours per day_____ Days per week _____ Weeks per year _____ Percentage of operation _____

SECTION III. ATTACHMENTS AND SUPPORTING DOCUMENTS

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

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

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

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

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

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

SECTION IV. CERTIFICATION OF INFORMATION

This General Permit Registration Application shall be signed below by a Responsible Official. A Responsible Official is a President, Vice President, Secretary, Treasurer, General Partner, General Manager, a member of a Board of Directors, or Owner, depending on business structure. A business may certify an Authorized Representative who shall have authority to bind the Corporation, Partnership, Limited Liability Company, Association, Joint Venture or Sole Proprietorship. Required records of daily throughput, hours of operation and maintenance, general correspondence, Emission Inventory, Certified Emission Statement, compliance certifications and all required notifications must be signed by a Responsible Official or an Authorized Representative. If a business wishes to certify an Authorized Representative, the official agreement below shall be checked off and the appropriate names and signatures entered. Any administratively incomplete or improperly signed or unsigned Registration Application will be returned to the applicant.

FOR A CORPORATION (domestic or foreign)

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

FOR A PARTNERSHIP

☐ I certify that I am a General Partner

FOR A LIMITED LIABILITY COMPANY

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

FOR AN ASSOCIATION

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

FOR A JOINT VENTURE

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

FOR A SOLE PROPRIETORSHIP

☐ I certify that I am the Owner and Proprietor

☐ *I hereby certify that* (please print or type) _____

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

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

Signature _____
(please use blue ink) Responsible Official Date

Name & Title Barry Schatz, Senior Environmental & Regulatory Manager
(please print or type)

Signature Barry Schatz 9-18-2015
(please use blue ink) Authorized Representative (if applicable) Date

Applicant's Name Antero Resources Corporation

Phone & Fax 303-357-7276 303-357-7315
Phone Fax

Email bschatz@anteroresources.com

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

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

DATE: January 23, 2015

ATTN.: Director

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

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

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

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

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

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

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

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

Secretary

Name of Corporation or business entity

Attachment B
Process Description

Attachment B

Process Description
Weigle East Well Pad
Antero Resources Corporation
Tyler County, West Virginia

A mixture of condensate, water, and entrained gas from the condensate and gas wells enters the facility through a series of line heaters (LH001-014) and gas production units (H001-014) which are 3-phase separators where the gas, condensate, and produced water are separated. The line heaters and GPUs are fueled by a slip stream of the separated gas.

The gas from the 3 phase separators is metered and sent to the sales gas line. The condensate from the 3-phase separator is sent to a low pressure 2-phase separator where flashing emissions are recovered and sent to the sales gas lines through the high pressure VRU driven by gas fueled engines (ENG001, ENG002, and ENG005). The condensate then flows to the vapor recovery towers (VRT001-004) where gas is further separated. Gas from the VRTs is recovered via the low pressure VRU driven by gas fueled engines (ENG003-004) and sent to the sales gas line through the high pressure compressor. The condensate from the VRTs flows to the condensate storage tanks (TANKSCOND001-010). The water from the 3 phase separator is sent to the produced water tanks (TANKPW001-002). The line heaters are only used during the first several months from start of production and will be removed once production has normalized.

Flashing, working, and breathing losses from the condensate and produced water tanks are routed to up to four enclosed combustors (EC001-004). The enclosed combustors that will be used to control emissions are designed to achieve a VOC destruction efficiency of 98 percent.

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

Emissions from the Facility's emission sources were calculated using the extended analysis of the condensate and gas analysis from Seaborn Unit 1H well, one of the wells in the Vogt Pad. These extended analyses are considered representative of the materials from Weigle East well pad, being in the same Marcellus rock formation.

Weigle East well pad calculation of potential to emit included all of the emission sources that belong to the same industrial grouping, are located on contiguous or adjacent properties, and are under the control of the same person. The nearest emission source that belongs to the same industrial grouping and under the control of the same person but not located on contiguous or adjacent property is the Pierpoint well pad. This operates independently and is approximately 1.06 miles southwest of the facility.

Attachment C
Description of Fugitive Emissions

Attachment C

Description of Fugitive Emissions
Weigle East Well Pad
Antero Resources Corporation
Tyler 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 fugitive emissions summary is also located in Attachment O.

Equipment Leaks

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

Pneumatic Control Valves

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

Loading Operations

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

Haul Road Emissions

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

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

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS 1	Maximum Potential Uncontrolled Emissions 2		Maximum Potential Controlled Emissions 3		Est. Method Used 4
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	n/a					
Unpaved Haul Roads	PM, PM10, PM2.5	5.4139	20.5083	2.7069	10.2541	MB
Loading/Unloading Operations	VOCs	16.4190	34.9632	16.4190	34.9632	MB
	hexane (110543)	0.0714	0.1519	0.0714	0.1519	
	CO2 Equivalent CO2 (124389), CH4	1.4819	5.2492	1.4819	5.2492	
Equipment Leaks (Components)	Benzene (71432)	Does not apply	0.0488	Does not apply	0.0488	MB
	Toluene (108883)		0.1518		0.1518	
	Ethyl benzene (100414)		0.1405		0.1405	
	Hexane (110543)		1.4930		1.4930	
	o,m,p-xylenes (95476,108383,106423)		0.4028		0.4028	
	CO2 Equivalent CO2 (124389)), CH4		515.9898		515.9898	
	VOCs		22.2068		22.2068	
	TAPs (benzene)		0.0488		0.0488	
Equipment Leaks (PCVs)	hexane (110543)	8.69E-03	0.0381	8.69E-03	0.0381	MB
	CO2 Equivalent CO2 (124389)), CH4	12.7962	56.0475	12.7962	56.0475	
	VOCs	0.1355	0.5933	0.1355	0.5933	

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).

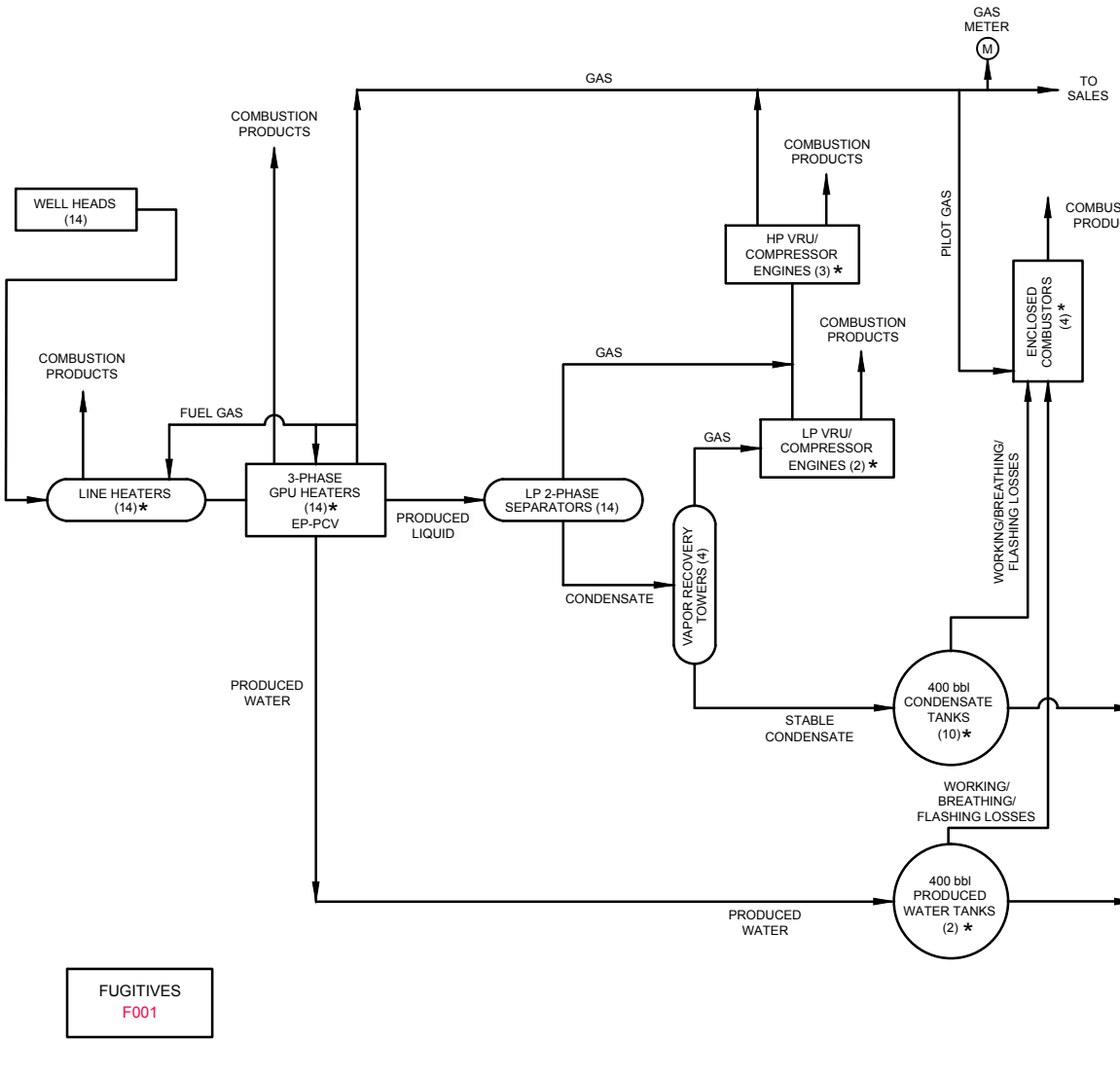
3 Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

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	700		First attempt within 5 days of detection and final repair within 15 days	10,042.18
	Light Liquid VOC	728		First attempt within 5 days of detection and final repair within 15 days	33,618.44
	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	182		First attempt within 5 days of detection and final repair within 15 days	226.28
	Non-VOC			First attempt within 5 days of detection and final repair within 15 days	1,141.64
Other	VOC	826		First attempt within 5 days of detection and final repair within 15 days	526.66
	Non-VOC				2,657.08

Attachment D
Process Flow Diagram



* 3-PHASE GPU HEATERS (14)

- H001 EP-H001
- H002 EP-H002
- H003 EP-H003
- H004 EP-H004
- H005 EP-H005
- H006 EP-H006
- H007 EP-H007
- H008 EP-H008
- H009 EP-H009
- H010 EP-H010
- H011 EP-H011
- H012 EP-H012
- H013 EP-H013
- H014 EP-H014

LINE HEATERS (14)

- LH001 EP-LH001
- LH002 EP-LH002
- LH003 EP-LH003
- LH004 EP-LH004
- LH005 EP-LH005
- LH006 EP-LH006
- LH007 EP-LH007
- LH008 EP-LH008
- LH009 EP-LH009
- LH010 EP-LH010
- LH011 EP-LH011
- LH012 EP-LH012
- LH013 EP-LH013
- LH014 EP-LH014

HIGH PRESSURE VRU/ COMPRESSOR ENGINES (3)

- ENG001 EP-ENG001
- ENG002 EP-ENG002
- ENG005 EP-ENG005

LOW PRESSURE VRU/ COMPRESSOR ENGINES (2)

- ENG003 EP-ENG003
- ENG004 EP-ENG004

CONDENSATE TANKS (10)

- TANKCOND001
- TANKCOND002
- TANKCOND003
- TANKCOND004
- TANKCOND005
- TANKCOND006
- TANKCOND007
- TANKCOND008
- TANKCOND009
- TANKCOND010

PRODUCED WATER TANKS (2)

- TANKPW001
- TANKPW002

OIL TRUCK LOADING

- L001 EP-L001

PRODUCED WATER LOADING

- L002 EP-L002

ENCLOSED COMBUSTORS (4)

- EC001 EP-EC001
- EC002 EP-EC002
- EC003 EP-EC003
- EC004 EP-EC004

HAULING EMMISSIONS

- HR001 EP-HR001

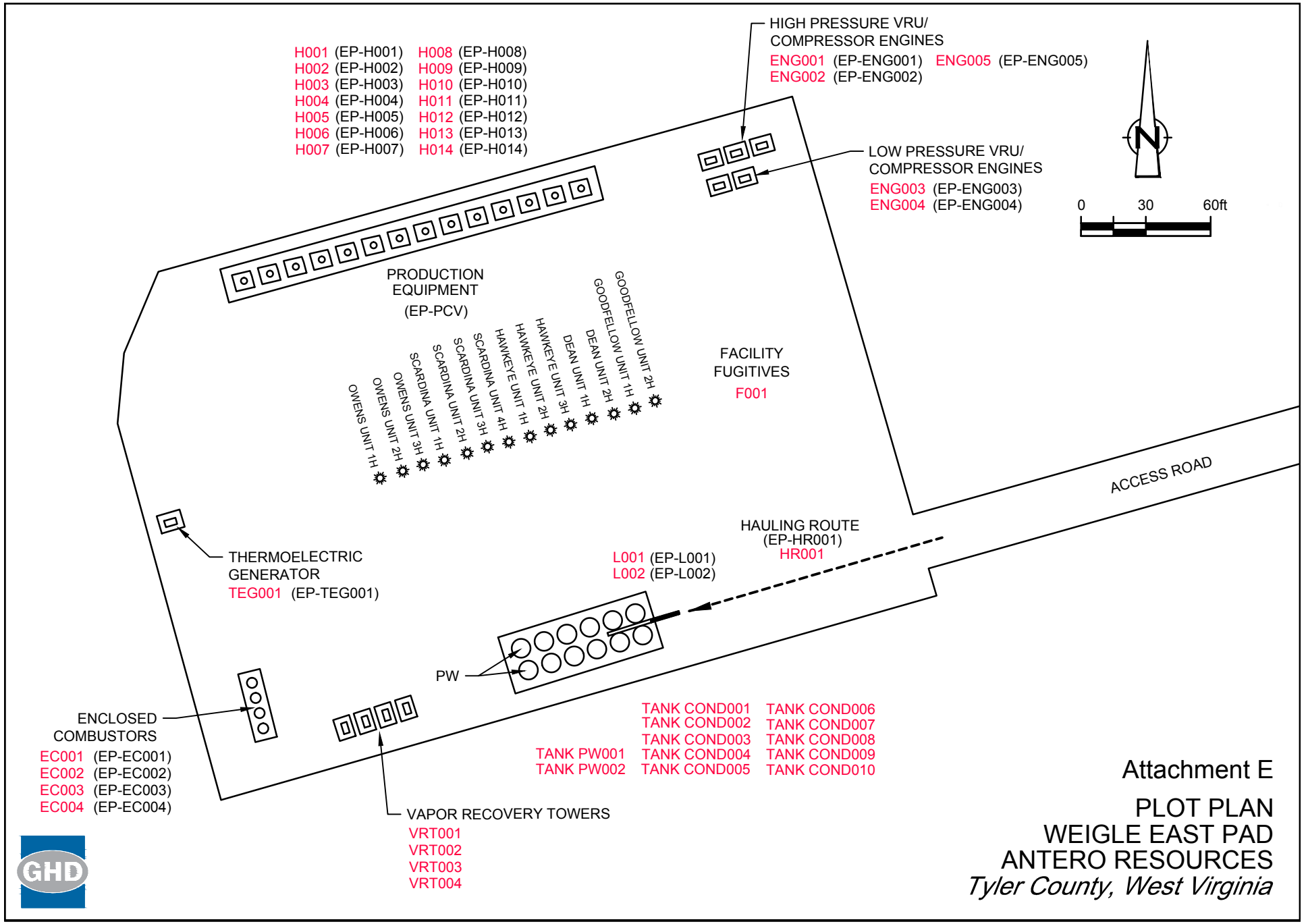
Attachment D

PROCESS FLOW DIAGRAM - ANTERO RESOURCES WEIGLE EAST WELL PAD

Tyler County, West Virginia

82715-00(224)GN-WA001 SEP 17/2015

Attachment E
Plot Plan



Attachment E

PLOT PLAN
WEIGLE EAST PAD
ANTERO RESOURCES
Tyler County, West Virginia

82715-00(224)GN-WA002 SEP 9/2015

Attachment G
G70-A Section Applicability Form/ Emission Unit Data Sheets

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

***** *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:	
47-095-02169-00	7 wells not permitted
47-095-02172-00	
47-095-02173-00	
47-095-02174-00	
47-095-02183-00	
47-095-02182-00	
47-095-02181-00	

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

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
H001, H002, H003, H004, H005, H006, H007, H008, H009, H010, H011, H012, H013, H014	EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008, EP-H009, EP-H010, EP-H011, EP-H012, EP-H013, EP-H014	Gas Production Unit Heaters	2015	1.5 MMBtu/hr (each)	New	N/A
LH001, LH002, LH003, LH004, LH005, LH006, LH007, LH008, LH009, LH010, LH011, LH012, LH013, LH014	EP-LH001, EP-LH002, EP-LH003, EP-LH004, EP-LH005, EP-LH006, EP-LH007, EP-LH008, EP-LH009, EP-LH010, EP-LH011, EP-LH012, EP-LH013, EP-LH014	Line Heaters	2015	2.0 MMBtu/hr (each)	New	N/A
F001	F001	Fugitives	2015	N/A	New	N/A
TANKCOND001-010	EP-EC001, EP-EC002, EP-EC003, EP-EC004,	Condensate Tank F/W/B	2015	400 bbl each	New	EC001, EC002, EC003, EC004,
TANKPW001-002	EP-EC001, EP-EC002, EP-EC003, EP-EC004,	PW Tank F/W/B	2015	400 bbl each	New	EC001, EC002, EC003, EC004,
L001	EP-L001	Loading (Condensate)	2015	200 bbl capacity (each)	New	N/A
L002	EP-L002	Loading (Water)	2015	200 bbl capacity (each)	New	N/A
HR001	EP-HR001	Haul Truck	2015	40 ton capacity	New	N/A
EC001, EC002, EC003, EC004,	EP-EC001, EP-EC002, EP-EC003, EP-EC004,	Enclosed Combustor	2015	90scf/min	New	EC001, EC002, EC003, EC004,
PCV	EP-PCV	Pneumatic CV	2015	6.6 scf/day/PCV	New	N/A
ENG001, ENG002, ENG005	EP-ENG001, EP-ENG002, EP-ENG005	High Pressure VRU Compressor Engine	2015	72HP	New	N/A
ENG003, ENG004	EP-ENG003, EP-ENG004	Low Pressure VRU Compressor Engine	2015	98HP	New	N/A
TEG001	EP-TEG001	Thermoelectric Generator	2015	120 Watts @ 6.7 Volts	New	N/A

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

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

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

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name CONDTANK	2. Tank Name TANKCOND001-010
3. Emission Unit ID number TANKCOND001-010	4. Emission Point ID number EP-EC001, EP-EC002, EP-EC003, EP-EC004,
5. Date Installed or Modified *(for existing tanks)* 2015	6. Type of change: New
7A. Description of Tank Modification *(if applicable) NA*	
7B. Will more than one material be stored in this tank? *If so, a separate form must be completed for each material.* No	
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.)	

II. TANK INFORMATION (required)

8. Design Capacity *(specify barrels or gallons).* Use the internal cross-sectional area multiplied by internal height. 400bbls	
9A. Tank Internal Diameter (ft.) 12	9B. Tank Internal Height (ft.) 20
10A. Maximum Liquid Height (ft.) 18	10B. Average Liquid Height (ft.) 10
11A. Maximum Vapor Space Height (ft.) 18	11B. Average Vapor Space Height (ft.) 10
12. Nominal Capacity *(specify barrels or gallons)* . This is also known as "working volume." 400bbls	
13A. Maximum annual throughput (gal/yr) 42,924,000	13B. Maximum daily throughput (gal/day) 117,600
14. Number of tank turnovers per year 256	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): X Fixed Roof X vertical horizontal X 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

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

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

Refer to enclosed TANKS Summary Sheets

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

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

Refer to enclosed TANKS Summary Sheets

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

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

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

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

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

Does Not Apply Rupture Disc (psig)

Carbon Adsorption[1] Inert Gas Blanket of _____

X Vent to Vapor Combustion Device[1] (vapor combustors, flares, thermal oxidizers) Condenser[1]

Conservation Vent (psig

Other[1] (describe) Vacuum Setting Pressure Setting Emergency Relief Valve (psig)

[1] Complete appropriate Air Pollution Control Device Sheet

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

Material Name and CAS No.	Flashing Loss		Breathing Loss		Working Loss		Total Emissions Loss		
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
	Please see Tables 6 and 7								

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

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

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

TANK CONSTRUCTION AND OPERATION INFORMATION		
19. Tank Shell Construction: Steel		
20A. Shell Color: Green	20B. Roof Color: Green	20C. Year Last Painted: 2015
21. Shell Condition (if metal and unlined): No Rust		
22A. Is the tank heated? No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?
23. Operating Pressure Range (psig): 0		
24. Is the tank a **Vertical Fixed Roof Tank**? Yes	24A. If yes, for dome roof provide radius (ft):	24B. If yes, for cone roof, provide slop (ft/ft):
25. Complete item 25 for **Floating Roof Tanks** Does not apply		
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type *(check one):* Metallic (mechanical) shoe seal Liquid mounted resilient seal		
25C. Is the Floating Roof equipped with a secondary seal? Yes No		
25D. If yes, how is the secondary seal mounted? *(check one)* Shoe Rim Other (describe):		
25E. Is the floating roof equipped with a weather shield? Yes No		
25F. Describe deck fittings:		
26. Complete the following section for **Internal Floating Roof Tanks** Does not apply		
26A. Deck Type: Bolted Welded	26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction:		
26D. Deck seam length (ft.):	26E. Area of deck (ft2):	26F. For column supported	26G. For column supported

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

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

SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: West Union, WV			
28. Daily Avg. Ambient Temperature (°F): 51.7		29. Annual Avg. Maximum Temperature (°F): 63.8	
30. Annual Avg. Minimum Temperature (°F): 39.5		31. Avg. Wind Speed (mph): 5.9	
32. Annual Avg. Solar Insulation Factor (BTU/ft2-day): 1030.235999		33. Atmospheric Pressure (psia): 14.8	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): 51.7	34A. Minimum (°F): 39.5	34B. Maximum (°F): 63.8	
35. Avg. operating pressure range of tank (psig): 0	35A. Minimum (psig): 0	35B. Maximum (psig): 0	
36A. Minimum liquid surface temperature (°F): 39.5		36B. Corresponding vapor pressure (psia):	1.5904
37A. Avg. liquid surface temperature (°F): 51.7		37B. Corresponding vapor pressure (psia):	2.0634
38A. Maximum liquid surface temperature (°F): 63.8		38B. Corresponding vapor pressure (psia):	2.6395
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			
39A. Material name and composition:	Condensate		
39B. CAS number:	mix of HC		
39C. Liquid density (lb/gal):	5.68		
39D. Liquid molecular weight (lb/lb-mole):	87.9		
39E. Vapor molecular weight (lb/lb-mole):	46.08		
39F. Maximum true vapor pressure (psia):	3.1051		
39G. Max Reid vapor pressure (psi):	4.45000		
39H. Months Storage per year. From: To:	year round		

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

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

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name PWTANK	2. Tank Name TANKPW001-002
3. Emission Unit ID number TANKPW001-002	4. Emission Point ID number EP-EC001, EP-EC002, EP-EC003, EP-EC004,
5. Date Installed or Modified *(for existing tanks)* 2015	6. Type of change: New
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.* No	
7C. Provide any limitations on source operation affecting emissions. (production variation, etc.)	

II. TANK INFORMATION (required)

8. Design Capacity *(specify barrels or gallons).* Use the internal cross-sectional area multiplied by internal height. 400bbls	
9A. Tank Internal Diameter (ft.) 12	9B. Tank Internal Height (ft.) 20
10A. Maximum Liquid Height (ft.) 18	10B. Average Liquid Height (ft.) 10
11A. Maximum Vapor Space Height (ft.) 18	11B. Average Vapor Space Height (ft.) 10
12. Nominal Capacity *(specify barrels or gallons)* . This is also known as "working volume." 400bbls	
13A. Maximum annual throughput (gal/yr) 85,848,000	13B. Maximum daily throughput (gal/day) 235,200
14. Number of tank turnovers per year 2555	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): X Fixed Roof X vertical horizontal X 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

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

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

Refer to enclosed TANKS Summary Sheets

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

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

Refer to enclosed TANKS Summary Sheets

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

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

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

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

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

Does Not Apply — Rupture Disc (psig)

Carbon Adsorption[1] — Inert Gas Blanket of _____

X Vent to Vapor Combustion Device1 (vapor combustors, flares, thermal oxidizers) Condenser[1]

Conservation Vent (psig

Other[1] (describe) — Vacuum Setting — Pressure Setting Emergency Relief Valve (psig)

[1] Complete appropriate Air Pollution Control Device Sheet

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

Material Name and CAS No.	Flashing Loss		Breathing Loss		Working Loss		Total Emissions Loss		
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
	Please see Tables 6 and 7								

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

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

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

TANK CONSTRUCTION AND OPERATION INFORMATION		
19. Tank Shell Construction: Steel		
20A. Shell Color: Green	20B. Roof Color: Green	20C. Year Last Painted: 2015
21. Shell Condition (if metal and unlined): No Rust		
22A. Is the tank heated? No	22B. If yes, operating temperature:	22C. If yes, how is heat provided to tank?
23. Operating Pressure Range (psig): 0		
24. Is the tank a **Vertical Fixed Roof Tank**? Yes	24A. If yes, for dome roof provide radius (ft):	24B. If yes, for cone roof, provide slop (ft/ft):
25. Complete item 25 for **Floating Roof Tanks** Does not apply		
25A. Year Internal Floaters Installed:		
25B. Primary Seal Type *(check one):* Metallic (mechanical) shoe seal Liquid mounted resilient seal		
25C. Is the Floating Roof equipped with a secondary seal? Yes No		
25D. If yes, how is the secondary seal mounted? *(check one)* Shoe Rim Other (describe):		
25E. Is the floating roof equipped with a weather shield? Yes No		
25F. Describe deck fittings:		
26. Complete the following section for **Internal Floating Roof Tanks** Does not apply		
26A. Deck Type: Bolted Welded	26B. For bolted decks, provide deck construction:	
26C. Deck seam. Continuous sheet construction:		
26D. Deck seam length (ft.):	26E. Area of deck (ft2):	26F. For column supported / 26G. For column supported

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

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

SITE INFORMATION:			
27. Provide the city and state on which the data in this section are based: West Union, WV			
28. Daily Avg. Ambient Temperature (°F): 51.7		29. Annual Avg. Maximum Temperature (°F): 63.8	
30. Annual Avg. Minimum Temperature (°F): 39.5		31. Avg. Wind Speed (mph): 5.9	
32. Annual Avg. Solar Insulation Factor (BTU/ft2-day): 1030.235999		33. Atmospheric Pressure (psia): 14.8	
LIQUID INFORMATION:			
34. Avg. daily temperature range of bulk liquid (°F): 51.7	34A. Minimum (°F): 39.5	34B. Maximum (°F): 63.8	
35. Avg. operating pressure range of tank (psig): 0	35A. Minimum (psig): 0	35B. Maximum (psig): 0	
36A. Minimum liquid surface temperature (°F): 39.5		36B. Corresponding vapor pressure (psia):	0.1838
37A. Avg. liquid surface temperature (°F): 51.7		37B. Corresponding vapor pressure (psia):	0.2598
38A. Maximum liquid surface temperature (°F): 63.8		38B. Corresponding vapor pressure (psia):	0.3603
39. Provide the following for each liquid or gas to be stored in the tank. Add additional pages if necessary.			
39A. Material name and composition:	Produced Water		
39B. CAS number:	mix of HC and water		
39C. Liquid density (lb/gal):	8.33		
39D. Liquid molecular weight (lb/lb-mole):	97.2042		
39E. Vapor molecular weight (lb/lb-mole):	18.5516		
39F. Maximum true vapor pressure (psia):	0.4470		
39G. Max Reid vapor pressure (psi):	1.02381		
39H. Months Storage per year. From: To:	year round		

Attachment G: Natural Gas Fired Fuel Burning Units

Emission Data Sheet

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

Emission Unit ID #[1]	Emission Point ID#[2]	Emission Unit Description (Manufacturer / Model #)	Year Installed/ Modified	Type[3] and Date of Change	Control Device[4]	Design Heat Input (mmBtu/hr)[5]	Fuel Heating Value (Btu/scf)[6]
H001	EP-H001	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H002	EP-H002	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H003	EP-H003	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H004	EP-H004	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H005	EP-H005	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H006	EP-H006	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H007	EP-H007	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H008	EP-H008	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H009	EP-H009	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H010	EP-H010	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H011	EP-H011	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H012	EP-H012	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H013	EP-H013	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
H014	EP-H014	Gas Production Unit Heater	2015	New	--	1.50	1,218.95
LH001	EP-LH001	Line Heater	2015	New	--	2.00	1,218.95
LH002	EP-LH002	Line Heater	2015	New	--	2.00	1,218.95
LH003	EP-LH003	Line Heater	2015	New	--	2.00	1,218.95
LH004	EP-LH004	Line Heater	2015	New	--	2.00	1,218.95
LH005	EP-LH005	Line Heater	2015	New	--	2.00	1,218.95
LH006	EP-LH006	Line Heater	2015	New	--	2.00	1,218.95
LH007	EP-LH007	Line Heater	2015	New	--	2.00	1,218.95
LH008	EP-LH008	Line Heater	2015	New	--	2.00	1,218.95
LH009	EP-LH009	Line Heater	2015	New	--	2.00	1,218.95
LH010	EP-LH010	Line Heater	2015	New	--	2.00	1,218.95
LH011	EP-LH011	Line Heater	2015	New	--	2.00	1,218.95
LH012	EP-LH012	Line Heater	2015	New	--	2.00	1,218.95
LH013	EP-LH013	Line Heater	2015	New	--	2.00	1,218.95
LH014	EP-LH014	Line Heater	2015	New	--	2.00	1,218.95
ENG001	EP-ENG001	High Pressure VRU Compressor Engine	2015	New	--	72HP	1,218.95
ENG002	EP-ENG002	High Pressure VRU Compressor Engine	2015	New	--	72HP	1,218.95
ENG003	EP-ENG003	Low Pressure VRU Compressor Engine	2015	New	--	98HP	1,218.95
ENG004	EP-ENG004	Low Pressure VRU Compressor Engine	2015	New	--	98HP	1,218.95
ENG005	EP-ENG005	High Pressure VRU Compressor Engine	2015	New	--	72HP	1,218.95
EC001	EP-EC001	Enclosed Combustor (Cimarron 48")	2015	New	--	12	1,218.95
EC002	EP-EC002	Enclosed Combustor (Cimarron 48")	2015	New	--	12	1,218.95
EC003	EP-EC003	Enclosed Combustor (Cimarron 48")	2015	New	--	12	1,218.95
EC004	EP-EC004	Enclosed Combustor (Cimarron 48")	2015	New	--	12	1,218.95
TEG001	EP-TEG001	Thermoelectric Generator	2015	New	--	0.02	1,218.95

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, ENG002, ENG005		ENG003, ENG004	
Emission Point ID No.		EP-ENG001, EP-ENG002, EP-ENG005		EP-ENG003, EP-ENG004	
Engine Manufacturer and Model		Engine (ZPP 428 2.8L Engine)		Engine (ZPP 644 4.4L Engine)	
Manufacturer's Rated bhp/rpm		72 HP @ 3600 rpm		98 HP @ 3600 rpm	
Source Status		NS		NS	
Date Installed/Modified/Removed		2015		2015	
Engine Manufactured/Reconstruction Date		2013		2013	
Is this engine subject to 40CFR60, Subpart JJJJ?		Yes		Yes	
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60, Subpart JJJJ? (Yes or No)		Yes		Yes	
Is this engine subject to 40CFR63, Subpart ZZZZ? (yes or no)		Yes		Yes	
Engine, Fuel and Combustion Data	Engine Type	RB4S		RB4S	
	APCD Type	NSRC		NSRC	
	Fuel Type	RG		RG	
	H2S (gr/100 scf)	0		0	
	Operating bhp/rpm	50 HP @ 2200 rpm		77 HP @ 2200 rpm	
	BSFC (Btu/bhp-hr)	15464		10021	
	Fuel throughput (ft^3/hr)	620		619	
	Fuel throughput ($MMft^3$/yr)	5.431		5.4224	
	Operation (hrs/yr)	8760		8760	
Reference	Potential Emissions	lbs/hr	tons/yr	lbs/hr	tons/yr
MD	NO_X	0.9572	4.1924	0.8685	3.8042
MD	CO	1.5619	6.8413	1.4173	6.2078
AP	VOC	0.0668	0.2926	0.0568	0.2489
AP	SO_2	0.0013	0.0058	0.0011	0.0049
AP	PM_{10}	0.0214	0.0939	0.0182	0.0799
AP	Formaldehyde	0.0463	0.2026	0.0394	0.1724
MRR	Proposed Monitoring:	Monitor engine setting adjustments to ensure these are consistent with manufacturer's instructions.		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		1) Maintain records of maintenance performed on engines. 2) Documentation from manufacturer that engine is certified to meet emission standards	
	Proposed Reporting:	N/A		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 pro
This form is to be used for bulk liquid transfer operations to tank trucks.

1. Emission Unit ID: L001, L002	2. Emission Point ID: EP-L001, EP-L002	3. Year Installed/ Modified: 2015

4. Emission Unit Description: CONDENSATE AND PRODUCED WATER

5. Loading Area Data

5A. Number of pumps: 2	5B. Number of liquids loaded: 2	5C. Maximum number of tank trucks loading at one time: 2

6. Describe cleaning location, compounds and procedure for tank trucks: For hire tank trucks are used and are cleaned at the operator's dispatch terminal. These trucks are in dedicated service and cleaned only prior to repair or leak tests. Cleaning materials include water, steam, detergent, and solvents which are applied using hand held pressurized spray nozzles.

7. Are tank trucks pressure tested for leaks at this or any other location?

X Yes No

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

8. Projected Maximum Operating Schedule (for rack or transfer point as a whole):

Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day	18	18	18	18
days/week	7	7	7	7

9. Bulk Liquid Data *(add pages as necessary)*

Liquid Name		Condensate	Produced Water	
Max. daily throughput (1000 gal/day)		117.6	235.2	
Max. annual throughput (1000 gal/yr)		42,924.00	85,848.00	
Loading Method [1]		BF	BF	
Max. Fill Rate (gal/min)		168	168	
Average Fill Time (min/loading)		50	50	
Max. Bulk Liquid Temperature (^{o}F)		72.1	72.1	
True Vapor Pressure [2]		3.11	0.45	
Cargo Vessel Condition [3]		U	U	
Control Equipment or Method [4]		None	None	
Minimum collection efficiency (%)		0	0	
Minimum control efficiency (%)		0	0	
Maximum Emission Rate	Loading (lb/hr)	20.28	1.18	
	Annual (ton/yr)	43.17	5.00	
Estimation Method [5]		Promax	Promax	

Notes:

1 BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill

2 At maximum bulk liquid temperature

3 B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)

4 List as many as apply (complete and submit appropriate *Air Pollution Control Device Sheets as Attachment "H"*):
CA = Carbon Adsorption
VB = Dedicated Vapor Balance (closed system) ECD = Enclosed Combustion Device
F = Flare
TO = Thermal Oxidation or Incineration

5 EPA = EPA Emission Factor as stated in AP-42

10. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**

MONITORING	RECORDKEEPING
1) Visual inspection to ensure that loading connections from storage tanks to trucks are leak-free.	1) Maintain records of condensate transferred from storage tanks. 2) Maintain records of produced water transferred from storage tanks.
REPORTING	TESTING
N/A	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
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Oil and Gas Site General Information

Administrative Information	
Company Name	Antero Resources Corporation
Facility/Well Name	Weigle East Wellpad
Nearest City/Town	Middlebourne
API Number/SIC Code	1311
Latitude/Longitude	39.46623, -80.852782
County	Tyler County

Technical Information	
Max Condensate Site Throughput (bbl/day):	2,800
Max Produced Water Site Throughput (bbl/day):	5,600
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	14
IC Engines	5
Gas Production Unit Heaters	14
Line Heaters	14
Condensate Tanks	10
Produced Water Tanks	2
Loading Jobs	2
Enclosed Combustors	4
Vapor Recovery Towers (VRT)	4
Thermoelectric Generator	1

Table 2

Uncontrolled/Controlled Emissions Summary
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Emission Source	VOC		NO_x		CO_{2e}		CO		SO_2		$PM_{2.5}$		PM_{10}		Lead		Total HAPs		Benzene		Xylenes		Formaldehyde	
	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)	(lbs/hr)	(ton/yr)
UNCONTROLLED (Fugitives, Storage Tanks, Gas Production Unit Heaters, Line Heaters, Thermoelectric Generator)																								
Fugitive Emissions (Component Count, PCV and Hauling)[1]	5.2055	22.8001			130.602	572.04							2.4362	9.2287			0.5194	2.2749	0.0111	0.0488	9.20E-02	4.03E-01		
Flashing, Working and Breathing (F/W/B) Losses[2]	413.42	1,810.8			773.4	3,387.3											25.739	112.735	0.2959	1.2962	0.3477	1.5229		
Thermoelectric Generator Emissions[8]	7.13E-05	3.12E-04	1.30E-03	5.68E-03	1.56	6.85	1.09E-03	4.77E-03	7.78E-06	3.41E-05	9.85E-05	4.31E-04	9.85E-05	4.31E-04	6.48E-09	2.84E-08	2.44E-05	1.07E-04	2.72E-08	1.19E-07			9.72E-07	4.26E-06
Engine Emissions[3]	0.1236	0.5415	1.8257	7.9966	483.45	2,117.49	2.9793	13.0491	0.0025	0.0108	0.0414	0.1813	0.0397	0.1738			0.0959	0.4199	0.0066	0.0289	8.14E-04	3.57E-03	0.0856	0.3750
Gas Production Unit Heater Emissions[4]	0.0948	0.4150	1.7228	7.5459	2,067.36	9,055.02	1.4471	6.3385	0.0103	0.0453	0.1309	0.5735	0.1309	0.5735	8.61E-06	3.77E-05	3.24E-02	1.42E-01	3.62E-05	1.58E-04			0.0013	0.0057
Line Heater Emissions[4]	0.1263	0.5534	2.2971	10.0611	2,756.48	12,073.36	1.9295	8.4514	0.0138	0.0604	0.1746	0.7646	0.1746	0.7646	1.15E-05	5.03E-05	4.32E-02	1.89E-01	4.82E-05	2.11E-04			0.0017	0.0075
TOTALS:	**418.9709**	**1835.0923**	**5.8469**	**25.6092**	**6212.8096**	**27212.1058**	**6.3570**	**27.8438**	**0.0266**	**0.1164**	**0.3470**	**1.5199**	**2.7815**	**10.7411**	**0.0000**	**0.0001**	**26.4296**	**115.7615**	**0.3138**	**1.3742**	**0.4405**	**1.9293**	**0.0886**	**0.3882**
UNCONTROLLED (Truck Loading Emissions)																								
Truck Loading Emissions[5]	16.419	34.963			1.482	5.249											0.0785	0.1671	6.30E-04	1.34E-03	0.0033	0.0071		
CONTROLLED EMISSIONS																								
Enclosed Combustor Emissions (from F/W/B losses)[6]	8.2687	36.2169	0.5029	2.2026	1670.3349	7316.0670	0.4224	1.8502	3.02E-05	1.32E-04	0.0287	0.1255	0.0382	0.1674	2.51E-06	1.10E-05	0.5149	2.2551	5.92E-03	2.59E-02	0.0070	0.0305	3.78E-06	1.66E-05
Controlled Fugitive Emissions from Hauling													1.2181	4.6144										
TOTALS:	**8.2687**	**36.2169**	**0.5029**	**2.2026**	**1670.3349**	**7316.0670**	**0.4224**	**1.8502**	**3.02E-05**	**1.32E-04**	**0.0287**	**0.1255**	**1.2563**	**4.7818**	**2.51E-06**	**1.10E-05**	**0.5149**	**2.2551**	**0.0059**	**0.0259**	**0.0070**	**0.0305**	**3.78E-06**	**1.66E-05**
POTENTIAL TO EMIT[7]	**13.8190**	**95.4903**	**6.3497**	**27.8119**	**7109.7789**	**31146.0806**	**6.7794**	**29.6940**	**0.0266**	**0.1166**	**0.3757**	**1.6454**	**1.6016**	**6.2941**	**2.26E-05**	**9.91E-05**	**1.2058**	**5.4486**	**0.0237**	**0.1053**	**0.0997**	**0.4440**	**0.0886**	**0.3882**

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 and line heaters 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 2800 barrels per day, VOC emissions would be 16.419 pounds per hour when there are truck loading activities. Average hourly VOC emissions from truck loading is 7.9825 pound per hour.
6 - See Table 10 and 11 for enclosed combustion emission calculations.
7 - The hourly potential to emit is the sum of emissions from gas production unit heaters, line heaters, engine, storage tanks, fugitives and enclosed combustors. Does not include emissions from loading (see footnote 5). The total TPY PTE is the sum of all emissions.
PM 10 TPY is the sum of uncontrolled hauling and other PM10 sources.
8 - See Table 14 for thermoelectric generator emissions

Table 3

Permits Summary

Weigle East Wellpad

Tyler County, West Virginia

Antero Resources Corporation

Pollutant		Emissions			Threshold Exceeded?	
		Uncontrolled	Controlled	Threshold	Uncontrolled	Controlled
VOC	lbs/hr	418.9709	13.8190	6	**Yes**	**Yes**
	tons/yr	1870.0555	95.4903	10	**Yes**	**Yes**
NO_X	lbs/hr	5.8469	6.3497	6		**Yes**
	tons/yr	25.6092	27.8119	10	**Yes**	**Yes**
CO	lbs/hr	6.3570	6.7794	6	**Yes**	**Yes**
	tons/yr	27.8438	29.6940	10	**Yes**	**Yes**
SO_2	lbs/hr	0.0266	0.0266	6		
	tons/yr	0.1164	0.1166	10		
$PM_{2.5}$	lbs/hr	0.3470	0.3757	6		
	tons/yr	1.5199	1.6454	10		
PM_{10}	lbs/hr	2.7815	1.6016	6		
	tons/yr	10.7411	6.2941	10	**Yes**	
Lead	lbs/hr	2.01E-05	2.26E-05	6		
	tons/yr	8.81E-05	9.91E-05	10		
Total HAPs	lbs/hr	26.4296	1.2058	2	**Yes**	
	tons/yr	115.9285	5.4486	5	**Yes**	**Yes**
Total TAPs	lbs/hr	0.4024	0.1124	1.14		
n-Hexane	lbs/hr	24.9707	0.9130			
	tons/yr	109.5236	4.1509			
Toluene	lbs/hr	0.4368	0.0451			
	tons/yr	1.9171	0.2016			
Ethylbenzene	lbs/hr	0.1787	0.0351			
	tons/yr	0.7856	0.1565			
Xylenes	lbs/hr	0.4405	0.0997			
	tons/yr	1.9364	0.4440			
Benzene	lbs/hr	0.3138	0.0237			
	tons/yr	1.3756	0.1053			

Enter any notes here:	1. Emissions are based on 98% Enclosed Combustor DRE operating 100% of the time. 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.

Table 4

Fugitive Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

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

Gas Weight Fraction From Analysis:	VOC frac	0.165
	Benzene frac	0.00E+00
	Toluene	0.00E+00
	Ethylbenzene	0.00E+00
	Xylenes	0.00E+00
	n-Hexane	0.011
	Methane	0.625

Gas					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
700	Valves	Gas VOC	0.004500	0.52	10,042.18
		Non VOC	0.004500	2.63	50,664.62
826	Connectors	VOC	0.000200	0.03	526.66
		Non-VOC	0.000200	0.14	2,657.08
182	Flanges	VOC	0.000390	0.01	226.28
		Non-VOC	0.000390	0.06	1,141.64
			Total VOCs:	0.56	10,795.12
			Total THC:	3.39	65,258.46

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

Light Liquid					
Number	Component	Pollutant	Emission Factor (kg/hr of THC per component)	kg/hr	lb/yr
728	Valves	Light Liquid VOC	0.002500	1.74	33,618.44
		Light Liquid Non-VOC		0.08	1,456.60
			Total VOC:	1.74	33,618.44
			Total THC:	1.82	35,075.04

Fugitive Total Emissions			
	Annual Emissions (lb/yr)	Annual Emissions (lb/hr)	Annual Emissions (tpy)
VOC	44,413.55	5.07	22.21
Ethylbenzene		0.03	0.14
Toluene		0.03	0.15
Xylenes		0.09	0.40
n-Hexane		0.34	1.49
TAPs (Benzene)		0.01	0.05
HAPs		0.51	2.24
CO_{2e}	1,031,979.52	117.81	515.99

Enter Notes Here:	Fugitive emissions based on an estimated component count Global Warming Potentials from EPA site Reference to Emission factors used: 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
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Number of PCVs	56
Bleed Rate (scf/day/PCV)	6.6
Total Bleed Rate (scf/day)	369.6

Component	Mol%	Molecular Weight (lb/lb-mole)	Component Flow (scf/day)	Component Moles (lb-moles)	Component Emissions (lbs/day)	(lbs/hr)	(tons/year)
Nitrogen	0.564	14.01	2.084544	0.01	0.08	0.00	0.01
Carbon Dioxide	0.1647	44.01	0.6087312	1.60E-03	0.07	0.00	0.01
Methane	78.61509	16.04	290.5613726	0.77	12.28	0.51	2.24
Ethane	14.0689	30.07	51.9986544	0.14	4.12	0.17	0.75
Propane	4.2164	44.1	15.5838144	0.04	1.81	0.08	0.33
Isobutane	0.5041	58.12	1.8631536	4.91E-03	0.29	0.01	0.05
n-Butane	1.0298	58.12	3.8061408	0.01	0.58	0.02	0.11
Isopentane	0.2618	72.15	0.9676128	2.55E-03	0.18	0.01	0.03
n-Pentane	0.2553	72.15	0.9435888	2.49E-03	0.18	0.01	0.03
n-Hexane	0.2484	86.18	0.9180864	2.42E-03	0.21	0.01	0.04

	lb/hr	tpy
VOC Emissions	0.1355	0.5933
n-Hexane Emissions	0.0087	0.0381
HAPs Emissions	0.0087	0.0381
TAPs Emissions	0.0000	0.0000
CO_{2e} emissions	12.7962	56.0475

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
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

# Hours Operational	8760

	Condensate Tank Flashing Losses			Produced Water Tank Flashing Losses		
	Vapor Mass Fraction	Flashing Losses		Vapor Mass Fraction	Flashing Losses	
	wt%	lbs/hr	tpy	wt%	lbs/hr	tpy
Water	0.0344	0.1555	0.6813	2.4003	0.0000	0.0000
H2S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitrogen	0.0003	0.0015	0.0064	0.3867	0.1855	0.8127
Carbon Dioxide	0.0801	0.3624	1.5873	3.4659	1.6631	7.2843
Methane	0.6883	3.1159	13.6475	57.7155	27.6947	121.3030
Ethane	15.8151	71.5928	313.5764	19.9423	9.5693	41.9135
Propane	33.8123	153.0639	670.4199	8.9814	4.3097	18.8766
Isobutane	8.5639	38.7679	169.8035	3.7741	1.8110	7.9322
n-Butane	19.0365	86.1758	377.4499	1.9446	0.9331	4.0870
Isopentane	6.3334	28.6705	125.5768	0.3804	0.1826	0.7996
n-Pentane	6.2920	28.4831	124.7560	0.3626	0.1740	0.7621
2-Methylpentane	0.6169	2.7925	12.2310	0.0160	0.0077	0.0336
3-Methylpentane	0.4235	1.9170	8.3964	0.0295	0.0142	0.0620
n-Hexane	5.3841	24.3730	106.7535	0.1106	0.0531	0.2324
Methylcyclopentane	0.2004	0.9072	3.9736	0.0417	0.0200	0.0877
Benzene	0.0556	0.2517	1.1025	0.0899	0.0431	0.1889
2-Methylhexane	0.4157	1.8819	8.2427	0.0096	0.0046	0.0202
3-Methylhexane	0.3328	1.5065	6.5986	0.0080	0.0039	0.0169
Heptane	0.6068	2.7470	12.0318	0.0154	0.0074	0.0324
Methylcyclohexane	0.3916	1.7727	7.7645	0.0539	0.0259	0.1134
Toluene	0.0753	0.3409	1.4931	0.1158	0.0556	0.2434
Octane	0.5978	2.7063	11.8535	0.0091	0.0044	0.0192
Ethylbenzene	0.0275	0.1245	0.5455	0.0413	0.0198	0.0868
m & p-Xylene	0.0328	0.1486	0.6508	0.0483	0.0232	0.1015
o-Xylene	0.0322	0.1459	0.6390	0.0507	0.0243	0.1065
Nonane	0.1296	0.5868	2.5703	0.0031	0.0015	0.0064
C10+	0.0211	0.0956	0.4189	0.0033	0.0016	0.0069
Total VOCs	83.382	377.46	1,653.3	16.089	7.7205	33.8158
Total CO_{2e}		78.26	342.8		694.03	3,039.9
Total TAPs (Benzene)		0.2517	1.1025		0.0431	0.1889
Toluene		0.3409	1.4931		0.0556	0.2434
Ethylbenzene		0.1245	0.5455		0.0198	0.0868
Xylenes		0.2945	1.2898		0.0475	0.2080
n-Hexane		24.373	106.754		0.0531	0.2324
Total HAPs		25.385	111.184		0.2191	0.9595
Total	100.00	452.69	1,982.8	100.00	46.833	205.13

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

Table 7

Uncontrolled Working and Breathing Losses

Weigle East Wellpad

Tyler County, West Virginia

Antero Resources Corporation

Condensate Tank Information	
Number of Tanks	10
Maximum Working Losses (lbs/hr)	18.4007
Maximum Breathing Losses (lbs/hr)	16.4795

	Condensate Tank W/B Losses						
	Vapor Mass Fraction	Working Losses		Breathing Losses		Max W/B Losses	
	wt%	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	5.00E-06	9.21E-07	4.03E-06	8.25E-07	3.61E-06	1.75E-06	7.64E-06
Carbon Dioxide	0.0698	0.0128	0.0563	0.0115	0.0504	0.0244	0.1067
Methane	0.0955	0.0176	0.0770	0.0157	0.0689	0.0333	0.1459
Ethane	18.8713	3.4725	15.2093	3.1099	13.6213	6.5824	28.8307
Propane	36.5964	6.7340	29.4949	6.0309	26.4154	12.7649	55.9103
Isobutane	8.9874	1.6537	7.2434	1.4811	6.4871	3.1348	13.7305
n-Butane	19.6495	3.6156	15.8365	3.2381	14.1830	6.8538	30.0195
Isopentane	6.2282	1.1460	5.0197	1.0264	4.4956	2.1724	9.5152
n-Pentane	6.1375	1.1293	4.9465	1.0114	4.4301	2.1408	9.3766
2-Methylpentane	0.5912	0.1088	0.4765	0.0974	0.4267	0.2062	0.9032
3-Methylpentane	0.4060	0.0747	0.3272	0.0669	0.2931	0.1416	0.6203
n-Hexane	0.3519	0.0648	0.2836	0.0580	0.2540	0.1228	0.5376
Methylcyclopentane	0.1804	0.0332	0.1454	0.0297	0.1302	0.0629	0.2756
Benzene	0.0031	0.0006	0.0025	0.0005	0.0022	0.0011	0.0047
2-Methylhexane	0.0258	0.0047	0.0208	0.0043	0.0186	0.0090	0.0394
3-Methylhexane	0.3116	0.0573	0.2512	0.0514	0.2249	0.1087	0.4761
Heptane	0.5237	0.0964	0.4221	0.0863	0.3780	0.1827	0.8001
Methylcyclohexane	0.3446	0.0634	0.2778	0.0568	0.2488	0.1202	0.5265
Toluene	0.0092	0.0017	0.0074	0.0015	0.0066	0.0032	0.0140
Octane	0.4844	0.0891	0.3904	0.0798	0.3496	0.1690	0.7400
Ethylbenzene	0.0063	0.0012	0.0051	0.0010	0.0046	0.0022	0.0097
m & p-Xylene	0.0081	0.0015	0.0066	0.0013	0.0059	0.0028	0.0124
o-Xylene	0.0083	0.0015	0.0067	0.0014	0.0060	0.0029	0.0127
Nonane	0.0968	0.0178	0.0780	0.0159	0.0698	0.0338	0.1478
C10+	0.0129	0.0024	0.0104	0.0021	0.0093	0.0045	0.0197
Total VOCs	80.963	14.8979	65.253	13.3424	58.4396	28.2402	123.692
Total CO_{2e}		0.4522	1.9807	0.4050	1.7739	0.8572	3.755
Total TAPs (Benzene)		0.0006	0.0025	0.0005	0.0022	0.0011	0.0047
Toluene		0.0017	0.0074	0.0015	0.0066	0.0032	0.0140
Ethylbenzene		0.0012	0.0051	0.0010	0.0046	0.0022	0.0097
Xylenes		0.0030	0.0132	0.0027	0.0119	0.0057	0.0251
n-Hexane		0.0648	0.2836	0.0580	0.2540	0.1228	0.5376
Total HAPs		0.0712	0.3119	0.0638	0.2793	0.1350	0.5911
Total	100.00	18.4007	80.5952	16.4795	72.1803	34.8803	152.776

Table 7

Uncontrolled Working and Breathing Losses
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Produced Water Tank Information	
Number of Tanks	2
Maximum Working Losses (lbs/hr)	0.2514
Maximum Breathing Losses (lbs/hr)	0.0084

	Produced Water Tank W/B Losses						
	Vapor Mass Fraction	Working Losses		Breathing Losses		Max W/B Losses	
	wt%	lbs/hr	tpy	lbs/hr	tpy	lbs/hr	tpy
H2S	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	0.0076	1.92E-05	0.0001	6.38E-07	0.0000	0.0000	0.0001
Carbon Dioxide	4.6778	0.0118	0.0515	0.0004	0.0017	0.0121	0.0532
Methane	3.1605	0.0079	0.0348	0.0003	0.0012	0.0082	0.0360
Ethane	1.0166	0.0026	0.0112	0.0001	0.0004	0.0026	0.0116
Propane	0.1143	0.0003	0.0013	9.56E-06	4.19E-05	0.0003	0.0013
Isobutane	0.0520	0.0001	0.0006	4.35E-06	1.90E-05	0.0001	0.0006
n-Butane	0.0046	1.15E-05	0.0001	3.84E-07	1.68E-06	1.19E-05	0.0001
Isopentane	0.0002	5.74E-07	2.51E-06	1.91E-08	8.37E-08	5.93E-07	2.60E-06
n-Pentane	0.0002	3.94E-07	1.73E-06	1.31E-08	5.75E-08	4.08E-07	1.79E-06
2-Methylpentane	1.32E-06	3.31E-09	1.45E-08	1.10E-10	4.83E-10	3.42E-09	1.50E-08
3-Methylpentane	5.95E-06	1.49E-08	6.55E-08	4.98E-10	2.18E-09	1.54E-08	6.77E-08
n-Hexane	3.54E-07	8.89E-10	3.89E-09	2.96E-11	1.30E-10	9.18E-10	4.02E-09
Methylcyclopentane	1.87E-05	4.69E-08	2.06E-07	1.56E-09	6.85E-09	4.85E-08	2.12E-07
Benzene	1.22E-04	3.08E-07	1.35E-06	1.03E-08	4.49E-08	3.18E-07	1.39E-06
2-Methylhexane	1.36E-08	3.42E-11	1.50E-10	1.14E-12	4.98E-12	3.53E-11	1.55E-10
3-Methylhexane	1.70E-07	4.27E-10	1.87E-09	1.42E-11	6.23E-11	4.41E-10	1.93E-09
Heptane	2.45E-07	6.16E-10	2.70E-09	2.05E-11	8.99E-11	6.37E-10	2.79E-09
Methylcyclohexane	5.09E-06	1.28E-08	5.60E-08	4.26E-10	1.86E-09	1.32E-08	5.79E-08
Toluene	7.59E-05	1.91E-07	8.36E-07	6.35E-09	2.78E-08	1.97E-07	8.63E-07
Octane	2.69E-08	6.76E-11	2.96E-10	2.25E-12	9.87E-12	6.99E-11	3.06E-10
Ethylbenzene	1.55E-05	3.90E-08	1.71E-07	1.30E-09	5.69E-09	4.03E-08	1.76E-07
m & p-Xylene	1.64E-05	4.11E-08	1.80E-07	1.37E-09	6.00E-09	4.25E-08	1.86E-07
o-Xylene	2.20E-05	5.54E-08	2.43E-07	1.84E-09	8.08E-09	5.72E-08	2.51E-07
Nonane	4.30E-09	1.08E-11	4.74E-11	3.60E-13	1.58E-12	1.12E-11	4.89E-11
C10+	1.46E-09	3.67E-12	1.61E-11	1.22E-13	5.35E-13	3.79E-12	1.66E-11
Total VOCs	0.1715	0.0004	0.0019	0.0000	0.0001	0.0004	0.0020
Total CO_{2e}		0.2104	0.9214	0.0070	0.0307	0.2174	0.9521
Total TAPs (Benzene)		3.08E-07	1.35E-06	1.03E-08	4.49E-08	3.18E-07	1.39E-06
Toluene		1.91E-07	8.36E-07	6.35E-09	2.78E-08	1.97E-07	8.63E-07
Ethylbenzene		3.90E-08	1.71E-07	1.30E-09	5.69E-09	4.03E-08	1.76E-07
Xylenes		9.65E-08	4.23E-07	3.21E-09	1.41E-08	9.97E-08	4.37E-07
n-Hexane		8.89E-10	3.89E-09	2.96E-11	1.30E-10	9.18E-10	4.02E-09
Total HAPs		6.35E-07	2.78E-06	2.11E-08	9.26E-08	6.56E-07	2.87E-06
Total	100.00	0.2514	1.1010	0.0084	0.0367	0.2597	1.1376

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

Table 8

Loading Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Annual Loading	Oil Truck Loading	Water Truck Loading
RVP	4.45	1.0238
Annual Average Temp (F)	72.1	72.1
S (saturation factor)	0.6	0.6
P (true vapor pressure)	3.11	0.45
M (MW of vapor)	46.08	18.55
Collection Efficiency (%)	0	0
Loading Loss (lb/10^3 gal)*	2.01	0.12
Maximum Throughput (gallons/hr)	10,080	10,080
Average Throughput (gallons/yr)	42,924,000	85,848,000
Loading Emissions (lbs/hr)	20.28	1.18
Loading Emissions (tpy)	43.17	5.00

	Condensate Tank Loading Losses			Produced Water Tank Loading Losses		
	Vapor Mass Fraction	Loading Losses		Vapor Mass Fraction	Loading Losses	
	wt%	lbs/hr	tpy	wt%	lbs/hr	tpy
H2S	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen	5.00E-06	1.01E-06	2.16E-06	0.0076	8.95E-05	3.81E-04
Carbon Dioxide	0.0698	0.01	0.03	4.6778	5.50E-02	2.34E-01
Methane	0.0955	0.02	0.04	3.1605	3.71E-02	1.58E-01
Ethane	18.8713	3.83	8.15	1.0166	1.19E-02	5.09E-02
Propane	36.5964	7.42	15.80	0.1143	1.34E-03	5.72E-03
Isobutane	8.9874	1.82	3.88	0.0520	6.11E-04	2.60E-03
n-Butane	19.6495	3.98	8.48	0.0046	5.40E-05	2.30E-04
Isopentane	6.2282	1.26	2.69	0.0002	2.68E-06	1.14E-05
n-Pentane	6.1375	1.24	2.65	0.0002	1.84E-06	7.85E-06
2-Methylpentane	0.5912	0.12	0.26	1.32E-06	1.55E-08	6.59E-08
3-Methylpentane	0.4060	0.08	0.18	5.95E-06	6.99E-08	2.98E-07
n-Hexane	0.3519	0.07	0.15	3.54E-07	4.16E-09	1.77E-08
Methylcyclopentane	0.1804	0.04	0.08	1.87E-05	2.19E-07	9.35E-07
Benzene	0.0031	0.00	0.00	0.0001	1.44E-06	6.13E-06
2-Methylhexane	0.0258	0.01	0.01	1.36E-08	1.60E-10	6.80E-10
3-Methylhexane	0.3116	0.06	0.13	1.70E-07	2.00E-09	8.51E-09
Heptane	0.5237	0.11	0.23	2.45E-07	2.88E-09	1.23E-08
Methylcyclohexane	0.3446	0.07	0.15	5.09E-06	5.98E-08	2.55E-07
Toluene	0.0092	0.00	0.00	0.0001	8.92E-07	3.80E-06
Octane	0.4844	0.10	0.21	2.69E-08	3.16E-10	1.35E-09
Ethylbenzene	0.0063	0.00	0.00	1.55E-05	1.82E-07	7.76E-07
m & p-Xylene	0.0081	0.00	0.00	1.64E-05	1.92E-07	8.19E-07
o-Xylene	0.0083	0.00	0.00	2.20E-05	2.59E-07	1.10E-06
Nonane	0.0968	0.02	0.04	4.30E-09	5.06E-11	2.15E-10
C10+	0.0129	0.00	0.01	1.46E-09	1.72E-11	7.30E-11
Total VOCs	80.9634	16.417	34.955	0.1715	2.02E-03	8.58E-03
Total CO_{2e}		0.498	1.0610		0.9835	4.1882
Total TAPs (Benzene)		0.0006	0.0013		1.44E-06	6.13E-06
Toluene		0.0019	0.0040		8.92E-07	3.80E-06
Ethylbenzene		0.0013	0.0027		1.82E-07	7.76E-07
Xylenes		0.0033	0.0071		4.51E-07	1.92E-06
n-Hexane		0.0714	0.1519		4.16E-09	1.77E-08
Total HAPs		0.0785	0.1671		2.97E-06	1.26E-05
Total	100.0000	20.2771	43.1733	100.0000	1.1752	5.0044

Enter any notes here

Vapor mass fractions and loading losses from Promax output
Using equation L_L = 12.46 SPM/T from AP-42, Chapter 5, Section 5.2-4
MW was obtained by Promax; RVP was taken from laboratory reports
Annual Average Temp (F) obtained from Charleston, WV (preset in Promax)
S (saturation factor) is based on submerged loading, dedicated service as it was most representative
True vapor pressure (TVP) equation from AP-42, Chapter 7, Figure 7.1-13b
Loading emissions are vented to the atmosphere.

Table 9

Gas Production Unit Heater Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Gas Production Unit Heater Emissions

Number of Units	14
GPU Heater Rating (MMBtu/hr)	1.50
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,219

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
Nox	100	1.723	7.546
CO	84	1.447	6.339
CO_2	120,000	2067.356	9055.021
Lead	0.0005	8.61E-06	3.77E-05
N_2O	2.2	0.038	0.166
PM (Total)	7.6	0.131	0.573
SO_2	0.6	0.010	0.045
TOC	11	0.190	0.830
Methane	2.3	0.040	0.174
VOC	5.5	0.095	0.415
HAPS			
2-Methylnaphthalene	2.40E-05	4.13E-07	1.81E-06
Benzene	2.10E-03	3.62E-05	1.58E-04
Dichlorobenzene	1.20E-03	2.07E-05	9.06E-05
Fluoranthene	3.00E-06	5.17E-08	2.26E-07
Fluorene	2.80E-06	4.82E-08	2.11E-07
Formaldehyde	7.50E-02	1.29E-03	5.66E-03
Hexane	1.80E+00	3.10E-02	1.36E-01
Naphthalene	6.10E-04	1.05E-05	4.60E-05
Phenanathrene	1.70E-05	2.93E-07	1.28E-06
Toluene	3.40E-03	5.86E-05	2.57E-04

Line Heater Emissions

Number of Units	14
Line Heater Rating (MMBtu/hr)	2.00
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,219

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	2.297	10.061
CO	84	1.930	8.451
CO_2	120,000	2756.475	12073.362
Lead	0.0005	1.15E-05	5.03E-05
N_2O	2.2	0.051	0.221
PM (Total)	7.6	0.175	0.765
SO_2	0.6	0.014	0.060
TOC	11	0.253	1.107
Methane	2.3	0.053	0.231
VOC	5.5	0.126	0.553
HAPS			
2-Methylnaphthalene	2.40E-05	5.51E-07	2.41E-06
Benzene	2.10E-03	4.82E-05	2.11E-04
Dichlorobenzene	1.20E-03	2.76E-05	1.21E-04
Fluoranthene	3.00E-06	6.89E-08	3.02E-07
Fluorene	2.80E-06	6.43E-08	2.82E-07
Formaldehyde	7.50E-02	1.72E-03	7.55E-03
Hexane	1.80E+00	4.13E-02	1.81E-01
Naphthalene	6.10E-04	1.40E-05	6.14E-05
Phenanathrene	1.70E-05	3.91E-07	1.71E-06
Toluene	3.40E-03	7.81E-05	3.42E-04

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.221	0.968
TOTAL Uncontrolled HAPs	0.076	0.331
TOTAL Uncontrolled TAPs (Benzene)	8.44E-05	3.70E-04
TOTAL Uncontrolled TAPs (Formaldehyde)	0.003	0.013
TOTAL CO_{2e} Emissions	4,852.50	21,253.94

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

Table 10

Enclosed Combustor Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

General Information	
Unit Name:	EC001, EC002, EC003, EC004,

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_2O	2.20
Lead	5.00E-04

Constants	
Btu/MMBtu	1,000,000
scf/MMscf	1,000,000
lb/ton	2,000
H_2S 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_2S percent destruction efficiency (%)	98

Enclosed Combustor operating hours	8760
No. of Enclosed Combustors	4

Stream Information							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed/Vapor Combustor (Enter Name of Each Stream Here)	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
Maximum Expected Hourly Volumetric Flow Rate of Stream (scf/hr)	50.4	--	3,727.86	957.99	287.24	5.31	5,028.80
Maximum Expected Annual Volumetric Flow Rate of Stream (scf/yr)	441,504.00	--	32,656,049.75	8,392,028.49	2,516,197.92	46,541.70	44,052,321.86
Heating Content (Btu/ft3)	1,219		2,694.39	1,188.75	2,694.39	1,188.75	2,378.97

Mass Flow Rates of the Vapors Sent to this Control Device, Hourly Basis (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor/Vapor Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
H2S	-	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total VOC	-	-	377.459	7.721	28.240	4.45E-04	413.42
Benzene	-	-	0.252	0.043	0.001	3.18E-07	0.296
Toluene	-	-	0.341	0.056	0.003	1.97E-07	0.400
Ethylbenzene	-	-	0.125	0.020	0.002	4.03E-08	0.147
Xylenes	-	-	0.294	0.047	0.006	9.97E-08	0.348
n-Hexane	-	-	24.373	0.053	0.123	9.18E-10	24.549
HAPs	-	-	25.385	0.219	0.135	6.56E-07	25.739
Total Mass Flow	-	-	452.687	46.833	34.880	0.260	534.661
Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)							
H2S	-	-	0.000	0.000	0.000	0.000	0.000
Total VOC	-	-	1653.272	33.816	123.692	0.002	1810.782
Benzene	-	-	1.103	0.189	0.005	0.000	1.296
Toluene	-	-	1.493	0.243	0.014	0.000	1.751
Ethylbenzene	-	-	0.545	0.087	0.010	0.000	0.642
Xylenes	-	-	1.290	0.208	0.025	0.000	1.523
n-Hexane	-	-	106.754	0.232	0.538	0.000	107.524
HAP	-	-	111.184	0.960	0.591	0.000	112.735
Total Mass Flow	-	-	1982.771	205.129	152.776	1.138	2341.814

Table 10

Enclosed Combustor Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Controlled Emissions							
Hourly (lb/hr)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor/Vapor Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.005	-	0.373	0.096	0.029	0.001	0.50
CO	0.004	-	0.313	0.080	0.024	4.46E-04	0.42
PM2.5	2.87E-04	-	0.021	0.005	0.002	3.03E-05	0.03
PM10	3.83E-04	-	0.028	0.007	0.002	4.04E-05	0.04
H2S	1.61E-05	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
SO_2	3.02E-05	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
CO_2	6.048	-	-	-	-	-	6.05
Total VOC	2.77E-04	-	7.549	0.154	0.565	8.91E-06	8.27
Benzene	1.06E-07	-	0.005	0.001	2.16E-05	6.36E-09	0.01
Toluene	1.71E-07	-	0.007	0.001	6.39E-05	3.94E-09	0.01
Ethylbenzene	0.00E+00	-	0.002	3.96E-04	4.41E-05	8.06E-10	0.00
Xylenes	0.00E+00	-	0.006	0.001	1.15E-04	1.99E-09	0.01
n-Hexane	9.07E-05	-	0.487	0.001	0.002	1.84E-11	0.49
HAP	9.10E-05	-	0.508	0.004	0.003	1.31E-08	0.51
N_2O	1.11E-04	-	0.008	0.002	0.001	1.17E-05	0.01
Lead	2.52E-08	-	1.86E-06	4.79E-07	1.44E-07	2.66E-09	2.51E-06
Formaldehyde	3.78E-06	-	-	-	-	-	3.78E-06
Annual (tpy)							
	1	2	3	4	5	6	Total
Stream Sent to Enclosed Combustor/Vapor Combustor	pilot(s)	added fuel stream(s)	Oil Tank Flash Emissions	Water Tank Flash Emissions	Oil Tank W/B Emissions	Water Tank W/B Emissions	-
NOx	0.022	-	1.633	0.420	0.126	0.002	2.20
CO	0.019	-	1.372	0.352	0.106	0.002	1.85
PM2.5	0.001	-	0.093	0.024	0.007	1.33E-04	0.13
PM10	0.002	-	0.124	0.032	0.010	1.77E-04	0.17
H_2S	7.05E-05	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E-05
SO_2	1.32E-04	-	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-04
CO_2	26.490	-	-	-	-	-	26.49
Total VOC	0.001	-	33.065	0.676	2.474	3.90E-05	36.22
Benzene	4.64E-07	-	0.022	0.004	0.000	2.79E-08	0.03
Toluene	7.51E-07	-	0.030	0.005	0.000	1.73E-08	0.04
Ethylbenzene	0.00E+00	-	0.011	0.002	0.000	3.53E-09	0.01
Xylenes	0.00E+00	-	0.026	0.004	0.001	8.74E-09	0.03
n-Hexane	3.97E-04	-	2.135	0.005	0.011	8.05E-11	2.15
HAP	3.99E-04	-	2.224	0.019	0.012	5.75E-08	2.26
N_2O	4.86E-04	-	0.036	0.009	0.003	5.12E-05	0.05
Lead	1.10E-07	-	8.16E-06	2.10E-06	6.29E-07	1.16E-08	1.10E-05
Formaldehyde	1.66E-05	-	-	-	-	-	1.66E-05

Enclosed Combustor/Vapor Combustor Total Emissions		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	8.27	36.22
NOx	5.03E-01	2.20E+00
CO	4.22E-01	1.85E+00
PM2.5	2.87E-02	1.26E-01
PM10	3.82E-02	1.67E-01
H_2S	1.61E-05	7.05E-05
SO_2	3.02E-05	1.32E-04
Benzene (TAPs)	5.92E-03	2.59E-02
Formaldehyde (TAPs)	3.78E-06	1.66E-05
HAPs	0.51	2.26
CO_2e	1670.33	7316.07
N_2O	1.11E-02	4.85E-02
Lead	2.51E-06	1.10E-05

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

Table 11

Enclosed Combustor GHG Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

Enclosed Combustor CO_2 and CH_4 Emissions

Components	Mole fraction of oil flash gas constituents[a]	Volume of oil flash gas sent to Enclosed Combustor *scf/year*	Mole fraction of water flash gas constituents[a]	Volume of water flash gas sent to Enclosed Combustor *scf/year*	Mole fraction of oil tank vapors constituents[a]	Volume of oil tank vapor sent to Enclosed Combustor *scf/year*	Mole fraction of water tank vapors constituents[a]	Volume of water tank vapors sent to Enclosed Combustor *scf/year*	Component volume of gas sent to Enclosed Combustor *scf/year*	Number of carbon atoms	Combustion Efficiency	Combusted CO_2 Volume[b] *scf/year*	Uncombusted CO_2 and CH_4 Volume[b] *scf/year*	Volume GHGs Emitted *scf/year*
CO_2	0.001	32,656,050	0.0163	8,392,028	0.0007	2,516,198	0.020	46,542	168,254	1	0	--	168,254	122,678,375
Methane	0.021	32,656,050	0.7465	8,392,028	0.0028	2,516,198	0.037	46,542	6,942,679	1	0.98	6,803,825	138,854	138,854
Ethane	0.251	32,656,050	0.1376	8,392,028	0.2899	2,516,198	0.006	46,542	10,092,722	2	0.98	19,781,736	--	
Propane	0.366	32,656,050	0.0422	8,392,028	0.3834	2,516,198	4.80E-04	46,542	13,285,420	3	0.98	39,059,134	--	
i-Butane	0.070	32,656,050	0.0135	8,392,028	0.0714	2,516,198	1.66E-04	46,542	2,592,472	4	0.98	10,162,492	--	
n-Butane	0.157	32,656,050	0.0069	8,392,028	0.1562	2,516,198	1.46E-05	46,542	5,563,080	4	0.98	21,807,275	--	
Pentane	0.084	32,656,050	0.0021	8,392,028	0.0792	2,516,198	9.90E-07	46,542	2,948,185	5	0.98	14,446,105	--	
Hexane	0.036	32,656,050	0.0004	8,392,028	0.0072	2,516,198	1.64E-08	46,542	1,184,783	6	0.98	6,966,526	--	
Benzene	3.40E-04	32,656,050	0.0002	8,392,028	1.83E-05	2,516,198	2.91E-07	46,542	13,160	6	0.98	77,381	--	
Heptanes	0.008	32,656,050	0.0002	8,392,028	0.0050	2,516,198	4.19E-08	46,542	262,177	7	0.98	1,798,536	--	
Toluene	3.91E-04	32,656,050	0.0003	8,392,028	4.60E-05	2,516,198	1.53E-07	46,542	15,059	7	0.98	103,305	--	
Octane	0.004	32,656,050	0.0001	8,392,028	0.0036	2,516,198	9.65E-09	46,542	154,030	8	0.98	1,207,594	--	
Ethyl benzene	1.24E-04	32,656,050	0.0001	8,392,028	2.75E-05	2,516,198	2.71E-08	46,542	4,790	8	0.98	37,554	--	
Xylenes	2.93E-04	32,656,050	0.0002	8,392,028	0.0001	2,516,198	6.71E-08	46,542	11,366	8	0.98	89,109	--	
Nonane	4.83E-04	32,656,050	4.96E-06	8,392,028	0.0003	2,516,198	6.22E-12	46,542	16,700	9	0.98	147,294	--	
Decane plus	6.55E-05	32,656,050	4.42E-06	8,392,028	3.75E-05	2,516,198	1.70E-12	46,542	2,271	10	0.98	22,254	--	
											Subtotal	**122,510,121**	--	

Pollutant	Volume Emitted *scf/year*	Density of GHG[c] *lb/scf*	Conversion Factor *lb/ton*	GWF	Emissions[c] *lbs/hr*	Emissions[c] *(tons/yr)*
CO_2	122,678,375	0.12	2000	1	1623.99	7,113.08
CH_4	138,854	0.09	2000	25	1.47	6.46
				CO_2e Emissions	**1,660.9**	**7274.55**

GHG Emissions Summary

Notes

a Flashing/Working/Breathing Losses from ProMax output reports

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

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

Table 12

Haul Road Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

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

Tanker Truck Trip Calculation	
Condensate Production (bbl/day)	2,800
PW Production (bbl/day)	5,600
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/hr)		PM (lbs/VMT)	PM10 (lbs/VMT)
Tanker Trucks Condensate	10	40	10	0.7000	1	5110	0.7000	3577.0000	3.8175	1.7179
Tanker Trucks PW	10	40	10	0.7000	1	10220	0.7000	7154.0000	3.8175	1.7179
Pick Up Truck	4	3	10	0.2000	1	730	0.2000	146.0000	0.3467	0.1560

	Uncontrolled Emissions						Controlled Emissions					
	PM			PM10			PM			PM10		
	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)	(lbs/hr)	(lbs/year)	(tpy)
Tanker Trucks Condensate	2.6723	13655.3026	6.8277	1.2025	6144.8862	3.0724	1.3361	6827.6513	3.4138	0.6013	3072.4431	1.5362
Tanker Trucks PW	2.6723	27310.6053	13.6553	1.2025	12289.7724	6.1449	1.3361	13655.3026	6.8277	0.6013	6144.8862	3.0724
Pick Up Truck	0.0693	50.6152	0.0253	0.0312	22.7769	0.0114	0.0347	25.3076	0.0127	0.0156	11.3884	0.0057
Total Emissions	5.4139	41,016.5231	20.5083	2.4362	18,457.4354	9.2287	2.7069	20,508.2616	10.2541	1.2181	9,228.7177	4.6144

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
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

ZPP 428 2.8L Engine

Power (hp) [1]	72
No. of Engine	3
Fuel consumption (lbs/BHP-hr) [1]	0.48
Heat Content of Fuel (Btu/scf)	1218.948
Density of NG (lb/scf)	0.056
Operating Hours/year	8760

Pollutant	Emission Factors (g/hp-hr)	Emission Factors (lb/MMBtu)	lb/hr	tpy
NO_x [2]	2.01		0.9572	4.1924
CO [2]	3.28		1.5619	6.8413
CO_2		110.000	248.2475	1,087.32
$PM_{2.5}$		9.910E-03	0.0224	0.0980
PM_{10}		9.500E-03	0.0214	0.0939
PM (Total)		9.910E-03	0.0224	0.0980
SO_2		5.880E-04	0.0013	0.0058
TOC		0.358	0.8079	3.5387
Methane		0.230	0.5191	2.2735
VOC [3]		0.0296	0.0668	0.2926
HAPS				
Benzene		1.58E-03	3.57E-03	1.56E-02
Ethylbenzene		2.48E-05	5.60E-05	2.45E-04
Formaldehyde		2.05E-02	4.63E-02	2.03E-01
Naphthalene		9.71E-05	2.19E-04	9.60E-04
Toluene		5.58E-04	1.26E-03	5.52E-03
Xylene		1.95E-04	4.40E-04	1.93E-03

ZPP 644 4.4L Engine

Power (hp) [1]	98
No. of Engine	2
Fuel consumption (lbs/BHP-hr) [1]	0.45
Heat Content of Fuel (Btu/scf)	1218.948
Density of NG (lb/scf)	0.056
Operating Hours/year	8760

Pollutant	Emission Factors (g/hp-hr)	Emission Factors (lb/MMBtu)	lb/hr	tpy
NO_x [2]	2.01		0.8685	3.8042
CO [2]	3.28		1.4173	6.2078
CO_2		110.000	211.1827	924.98
$PM_{2.5}$		9.910E-03	0.0190	0.0833
PM_{10}		9.500E-03	0.0182	0.0799
PM (Total)		9.910E-03	0.0190	0.0833
SO_2		5.880E-04	0.0011	0.0049
TOC		0.358	0.6873	3.0104
Methane		0.230	0.4416	1.9340
VOC [3]		0.0296	0.0568	0.2489
HAPS				
Benzene		1.58E-03	3.03E-03	1.33E-02
Ethylbenzene		2.48E-05	4.76E-05	2.09E-04
Formaldehyde		2.05E-02	3.94E-02	1.72E-01
Naphthalene		9.71E-05	1.86E-04	8.17E-04
Toluene		5.58E-04	1.07E-03	4.69E-03
Xylene		1.95E-04	3.74E-04	1.64E-03

	lb/hr	tpy
TOTAL Uncontrolled VOC	0.124	0.541
TOTAL Uncontrolled NOx	1.826	7.997
TOTAL Uncontrolled HAPs	0.096	0.420
TOTAL Uncontrolled TAPs (Benzene)	0.007	0.029
TOTAL Uncontrolled TAPs (Formaldehyde)	0.086	0.375
TOTAL CO_{2e} Emissions	483.45	2,117.5

Enter Any Notes Here:

1. Engines were manufactured in 2013. HP ratings were obtained from manufacturer's test results submitted to EPA for Certificated of Conformity. Please see copies of engine test results and fuel curves in Appendix P.

2. Emission factors used for the 72 HP and 98 HP engines NO_X and CO emissions are the emission standards indicated on EPA's Certificate of Conformity. See EPA's Certificates of Conformity and engines confidential copies of emission test results in Appendix P.

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

Thermoelectric Generator Emission
Pierpoint Well Pad
Tyler County, West Virginia
Antero Resources Corporation

Number of Units	1
Fuel Consumption[1] (scf/day)	311
Thermoelectric Generator Input (MMBtu/hr)	0.02
Operating hours/year	8760
Fuel Heat Value (Btu/scf)	1,218.9

Pollutant	Emission Factors (lb/MMscf)	lb/hr	tpy
NOx	100	0.001	0.006
CO	84	0.001	0.005
CO_2	120,000	1.555	6.811
Lead	0.0005	6.48E-09	2.84E-08
N_2O	2.2	2.85E-05	1.25E-04
PM (Total)	7.6	9.85E-05	4.31E-04
SO_2	0.6	7.78E-06	3.41E-05
TOC	11	1.43E-04	6.24E-04
Methane	2.3	2.98E-05	1.31E-04
VOC	5.5	7.13E-05	3.12E-04
HAPS			
2-Methylnaphthalene	2.40E-05	3.11E-10	1.36E-09
Benzene	2.10E-03	2.72E-08	1.19E-07
Dichlorobenzene	1.20E-03	1.56E-08	6.81E-08
Fluoranthene	3.00E-06	3.89E-11	1.70E-10
Fluorene	2.80E-06	3.63E-11	1.59E-10
Formaldehyde	7.50E-02	9.72E-07	4.26E-06
Hexane	1.80E+00	2.33E-05	1.02E-04
Naphthalene	6.10E-04	7.90E-09	3.46E-08
Phenanathrene	1.70E-05	2.20E-10	9.65E-10
Toluene	3.40E-03	4.41E-08	1.93E-07

	lb/hr	tpy
TOTAL Uncontrolled VOC	7.13E-05	3.12E-04
TOTAL Uncontrolled HAPs	2.44E-05	1.07E-04
TOTAL Uncontrolled TAPs (Benzene)	2.72E-08	1.19E-07
TOTAL Uncontrolled TAPs (Formaldehyde)	9.72E-07	4.26E-06
TOTAL CO_{2e} Emissions	1.56	6.85

Enter any notes here:
1.Fuel Consumption based on manufacturer's data sheet 2.All Emission Factors based off AP-42 Sec 1.4 Natural Gas Combustion

Table 15

Change in Regulated Air Pollutants Emissions
Weigle East Wellpad
Tyler County, West Virginia
Antero Resources Corporation

	Potential Emissions		Initial Permit Application Emissions		Change in Emissions	
Pollutant	**Hourly PTE**	**Yearly PTE**	**Hourly PTE**	**Yearly PTE**	**Hourly PTE**	**Yearly PTE**
PM	3.0904	11.9339	2.8718	45.1145	2.19E-01	-33.1806
PM10	1.6016	6.2941	1.4583	20.6926	0.1433	-14.3985
VOC (uncontrolled)	418.9709	1870.0555	458.5929	2042.1839	-39.6220	-172.1284
CO	6.7794	29.6940	4.7539	20.8220	2.0256	8.8720
NOx	6.3497	27.8119	4.2391	18.5673	2.1106	9.2445
SO2	0.0266	0.1166	0.0124	0.0542	1.42E-02	6.23E-02
Pb	2.26E-05	9.91E-05	1.37E-05	5.98E-05	8.96E-06	3.92E-05
HAPs	1.2058	5.4486	1.1663	5.2676	0.0395	0.1810
TAPs	0.1124	0.4936	0.0715	0.3132	0.0409	0.1804

Notes: 1.) Change in emissions due to the addition of 1 high pressure VRU compressor engine, 1 thermoelectric generator, and 14 line heaters.

Bryan Research & Engineering, Inc.

ProMax® 3.2

with

TSWEET® & PROSIM®

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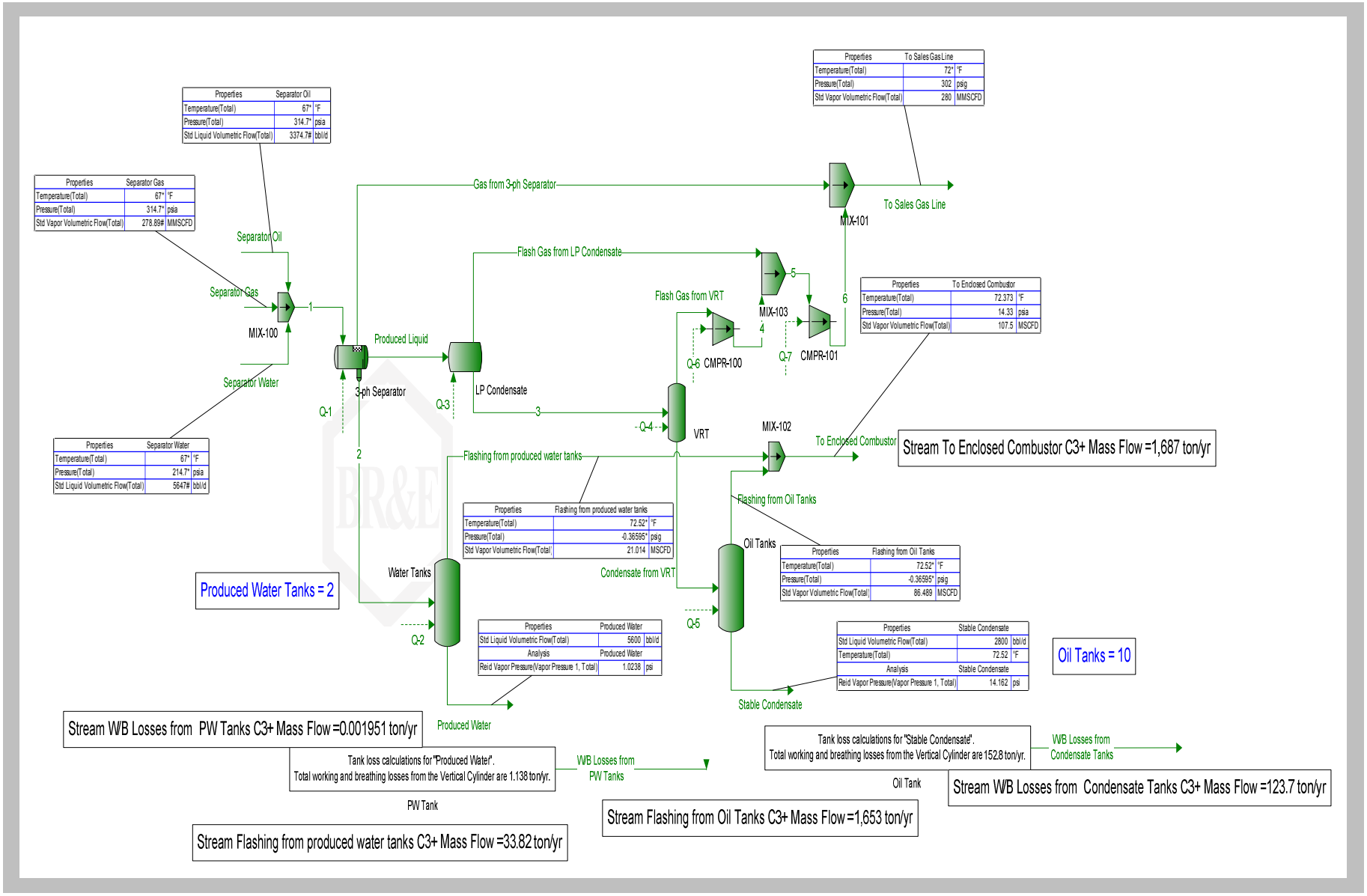
Simulation Report	
Client Name:	Antero Resources
Location:	Tyler County, WV
Job:	Weigle East Wellpad

Project Name:	Antero Bond Well Pad Promax Model_Antero Pressure
File Name:	ProMax@C:\Users\yichen\Documents\New Model\Antero with VOC version\VRT\Antero Bond Well Pad Promax Model_Antero Pressure.pmx
ProMax Version:	3.2.13330.0

Report Created:	9/17/2015 9:07



Properties | Separator Oil
Temperature(Total) | 67* | °F
Pressure(Total) | 314.7* | psia
Std Liquid Volumetric Flow(Total) | 3374.7# | bbl/d
Properties | Separator Gas
Temperature(Total) | 67* | °F
Pressure(Total) | 314.7* | psia
Std Vapor Volumetric Flow(Total) | 278.89# | MMSCFD
Properties | Separator Water
Temperature(Total) | 67* | °F
Pressure(Total) | 214.7* | psia
Std Liquid Volumetric Flow(Total) | 5647# | bbl/d
Properties | To Sales Gas Line
Temperature(Total) | 72* | °F
Pressure(Total) | 302 | psig
Std Vapor Volumetric Flow(Total) | 280 | MMSCFD
Properties | To Enclosed Combustor
Temperature(Total) | 72.373 | °F
Pressure(Total) | 14.33 | psia
Std Vapor Volumetric Flow(Total) | 107.5 | MSCFD
Properties | Flashing from produced water tanks
Temperature(Total) | 72.52* | °F
Pressure(Total) | -0.36595* | psig
Std Vapor Volumetric Flow(Total) | 21.014 | MSCFD
Properties | Flashing from Oil Tanks
Temperature(Total) | 72.52* | °F
Pressure(Total) | -0.36595* | psig
Std Vapor Volumetric Flow(Total) | 86.489 | MSCFD
Properties | Produced Water
Std Liquid Volumetric Flow(Total) | 5600 | bbl/d
Analysis | Produced Water
Reid Vapor Pressure(Vapor Pressure 1, Total) | 1.0238 | psi
Properties | Stable Condensate
Std Liquid Volumetric Flow(Total) | 2800 | bbl/d
Temperature(Total) | 72.52 | °F
Analysis | Stable Condensate
Reid Vapor Pressure(Vapor Pressure 1, Total) | 14.162 | psi
Gas from 3-ph Separator
To Sales Gas Line
MIX-101
Separator Oil
Separator Gas
MIX-100
Separator Water
Flash Gas from LP Condensate
Flash Gas from VRT
MIX-103
CMPR-100
CMPR-101
Q-6
Q-7
Produced Liquid
3-ph Separator
LP Condensate
Q-1
Q-3
Q-4
VRT
MIX-102
To Enclosed Combustor
Stream To Enclosed Combustor C3+ Mass Flow =1,687 ton/yr
Flashing from produced water tanks
Flashing from Oil Tanks
Oil Tanks
Condensate from VRT
Water Tanks
Produced Water Tanks = 2
Q-2
Q-5
Oil Tanks = 10
Stable Condensate
Produced Water
Stream W/B Losses from PW Tanks C3+ Mass Flow =0.001951 ton/yr
Tank loss calculations for "Produced Water".
Total working and breathing losses from the Vertical Cylinder are 1.138 ton/yr.
W/B Losses from PW Tanks
PW Tank
Stream Flashing from produced water tanks C3+ Mass Flow =33.82 ton/yr
Stream Flashing from Oil Tanks C3+ Mass Flow =1,653 ton/yr
Tank loss calculations for "Stable Condensate".
Total working and breathing losses from the Vertical Cylinder are 152.8 ton/yr.
W/B Losses from Condensate Tanks
Oil Tank
Stream W/B Losses from Condensate Tanks C3+ Mass Flow =123.7 ton/yr

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VRT	g from produced wat	lashing from Oil Tan	o Enclosed Combust	Flash Gas from VRT
Phase: Total	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water		0	100	0	12.8566	0.125271	0.0473611	99.9470	99.9965	0.0148974	0.203986	0.125462	0.00467323	2.77086	0.0909222	0.614782	0.166575
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		0.564404	0	0.0259995	0.486138	0.563780	0.0190668	0.000149330	3.35291E-06	0.000607739	0.108125	0.562470	1.87816E-05	0.287059	0.000552800	0.0565574	0.00934506
CO2		0.164818	0	0.0219996	0.142115	0.163990	0.0534997	0.00163746	0.000804988	0.0150269	0.239116	0.164155	0.00421058	1.63780	0.0867152	0.389914	0.175489
Methane		78.6713	0	7.70285	67.8052	78.5656	8.06154	0.0398437	0.00179593	0.788085	43.1532	78.4483	0.0759716	74.8202	2.04528	16.2709	11.3525
Ethane		14.0790	0	7.91584	12.2036	14.0565	8.28678	0.00740314	0.000389218	3.64532	30.6801	14.1044	1.57176	13.7928	25.0723	22.8674	34.4070
Propane		4.21942	0	7.59485	3.71270	4.20446	8.39186	0.00228925	0.000135214	6.89826	15.5979	4.24499	5.32599	4.23591	36.5528	30.2357	30.2231
Isobutene		0.504461	0	2.04696	0.455943	0.494881	2.77447	0.000867815	0.000156482	2.90236	2.15746	0.501246	2.76115	1.39895	7.27619	6.12734	4.99715
n-Butane		1.03054	0	5.95688	0.950226	1.01801	6.89088	0.000370592	1.67641E-05	7.39277	4.46949	1.03131	7.18278	0.695796	15.6130	12.6971	10.5080
Isopentane		0.261987	0	3.26293	0.260091	0.252418	4.02718	5.76023E-05	1.83567E-06	4.63543	1.09260	0.255711	4.76944	0.109663	4.18456	3.38802	2.64731
n-Pentane		0.255483	0	4.55691	0.268198	0.247090	5.22976	5.48662E-05	1.71323E-06	6.09199	1.06982	0.250315	6.32784	0.104524	4.15721	3.36501	2.59317
2-Methylpentane		0	0	2.66195	0.0281960	0.0204736	0.999025	1.99300E-06	3.00230E-08	1.18839	0.0853962	0.0207284	1.25460	0.00386011	0.341232	0.275284	0.206170
3-Methylpentane		0	0	1.90696	0.0201990	0.0140641	0.764844	3.77317E-06	1.51726E-07	0.911243	0.0585208	0.0142386	0.963155	0.00712149	0.234251	0.189853	0.141117
n-Hexane		0.248578	0	6.60687	0.283968	0.181399	12.0852	1.37357E-05	1.65505E-07	14.4362	0.742161	0.183597	15.2893	0.0266851	2.97830	2.40134	1.78005
Methylcyclopentane		0	0	1.03098	0.0109204	0.00676282	0.482083	5.92159E-06	6.81003E-07	0.576147	0.0282612	0.00684705	0.610399	0.0103060	0.113515	0.0933404	0.0679983
Benzene		0	0	0.309994	0.00328353	0.00202241	0.144784	9.02137E-05	7.80816E-05	0.173030	0.00850777	0.00204776	0.183319	0.0239351	0.0339343	0.0319797	0.0204014
2-Methylhexane		0	0	2.93394	0.0310770	0.0129179	1.88854	1.02901E-06	1.37568E-08	2.26976	0.0493107	0.0130596	2.41499	0.00199645	0.197772	0.159503	0.115232
3-Methylhexane		0	0	2.42595	0.0256962	0.0103377	1.58959	8.61264E-07	1.20009E-08	1.91088	0.0394880	0.0104513	2.03346	0.00167003	0.158324	0.127702	0.0923482
n-Heptane		0	0	5.21590	0.0552480	0.0193671	3.65107	1.64908E-06	2.37001E-08	4.39284	0.0723204	0.0195733	4.67762	0.0031962	0.288685	0.232879	0.168152
Methylcyclohexane		0	0	3.40193	0.0360341	0.0123259	2.40621	6.30314E-06	4.92566E-07	2.89512	0.0474468	0.0124626	3.08278	0.0114266	0.190123	0.155193	0.111055
Toluene		0	0	0.817984	0.00866427	0.00253334	0.612700	8.37386E-05	7.04800E-05	0.737670	0.00976448	0.00256142	0.785863	0.0261425	0.0389598	0.0364543	0.0227238
n-Octane		0	0	11.4428	0.121205	0.0183978	9.97606	8.53106E-07	7.73119E-09	12.0308	0.0628945	0.0185700	12.8322	0.00166238	0.249483	0.201040	0.141669
Ethylbenzene		0	0	0.656987	0.00695896	0.000881888	0.586720	2.42053E-05	2.01030E-05	0.707684	0.00311279	0.000890499	0.754913	0.00808708	0.0123523	0.0115186	0.00703165
p-Xylene		0	0	0.876982	0.00928920	0.00106293	0.792575	2.70722E-05	2.22735E-05	0.956083	0.00371298	0.00107315	1.01997	0.00945858	0.0147374	0.0137055	0.00835510
o-Xylene		0	0	1.00698	0.0106662	0.00104922	0.923941	3.92782E-05	3.42463E-05	1.11469	0.00364969	0.00105923	1.18928	0.00992900	0.0144707	0.0135829	0.00818349
n-Nonane		0	0	6.27887	0.0665073	0.00384200	5.98444	2.56455E-07	3.71704E-09	7.22233	0.0121076	0.00387389	7.70737	0.000496997	0.0481819	0.0388607	0.0265950
C10+		0	0	13.3397	0.141298	0.000619465	13.3298	2.33406E-07	2.10613E-08	16.0924	0.00159215	0.000623164	17.1769	0.000417583	0.00615623	0.00503447	0.00321501
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water		0	4573.37	0	4573.37	38.4072	0.177909	4534.79	4534.73	0.0463532	0.131555	38.5715	0.0136225	0.0639325	0.00863428	0.0725668	0.0327307
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		172.832	0	0.0979631	172.930	172.851	0.0716231	0.00677540	0.000152051	0.00189098	0.0697321	172.923	5.47485E-05	0.00662335	5.24957E-05	0.00667585	0.00183623
CO2		50.4705	0	0.0828918	50.5534	50.2781	0.200968	0.0742946	0.0365053	0.0467562	0.154212	50.4668	0.0122739	0.0377893	0.0082347	0.0460241	0.0344823
Methane		24090.7	0	29.0234	24119.8	24087.7	30.2826	1.80778	0.0814435	2.45213	27.8305	24117.7	0.221458	1.72634	0.194227	1.92057	2.23067
Ethane		4311.26	0	29.8260	4341.09	4309.62	31.1287	0.335895	0.0176506	11.3424	19.7863	4336.17	4.58170	0.318244	2.38095	2.69919	6.76073
Propane		1292.07	0	28.6165	1320.69	1289.06	31.5234	0.103868	0.00613178	21.4640	10.0595	1305.06	15.5254	0.0977359	3.47118	3.56892	5.93862
Isobutene		154.476	0	7.71271	162.189	151.727	10.4221	0.0393744	0.00709628	9.03070	1.39140	154.100	8.04880	0.0322782	0.690972	0.723251	0.981903
n-Butane		315.571	0	22.4448	338.016	312.114	25.8851	0.0168145	0.000760232	23.0026	2.88248	317.061	20.9379	0.0160542	1.48267	1.49872	2.06475
Isopentane		80.2257	0	12.2944	92.5201	77.3897	15.1278	0.00261353	8.32456E-05	14.4232	0.704644	78.6145	13.9030	0.00253028	0.397380	0.399911	0.520178
n-Pentane		78.2339	0	17.1699	95.4038	75.7561	19.6452	0.00248939	7.76930E-05	18.9553	0.689954	76.9556	18.4457	0.00241169	0.394783	0.397195	0.509539
2-Methylpentane		0	0	10.0299	10.0299	6.27705	3.75277	9.04265E-05	1.36151E-06	3.69770	0.0550740	6.37264	3.65718	8.90650E-05	0.0324046	0.0324936	0.0405109
3-Methylpentane		0	0	7.18521	7.18521	4.31196	2.87308	0.000171196	6.88062E-06	2.83534	0.0377414	4.37743	2.80761	0.000164315	0.0222453	0.0224096	0.0277284
n-Hexane		76.1195	0	24.8939	101.013	55.6157	45.3971	0.000623217	7.50545E-06	44.9184	0.478637	56.4441	44.5687	0.000615711	0.282830	0.283445	0.349768
Methylcyclopentane		0	0	3.88461	3.88461	2.07343	1.81091	0.000268674	3.08827E-05	1.79268	0.0182263	2.10502	1.77932	0.000237791	0.0107798	0.0110176	0.0133612
Benzene		0	0	1.16802	1.16802	0.620056	0.543872	0.00409317	0.00354091	0.538385	0.00548686	0.629552	0.534376	0.000552259	0.00322252	0.00377478	0.00400872
2-Methylhexane		0	0	11.0548	11.0548	3.96053	7.09418	4.66884E-05	6.23855E-07	7.06238	0.0318016	4.01498	7.03973	4.60645E-05	0.0187811	0.0188272	0.0226422
3-Methylhexane		0	0	9.14071	9.14071	3.16948	5.97119	3.90772E-05	5.44229E-07	5.94572	0.0254667	3.21310	5.92757	3.85330E-05	0.0150350	0.0150736	0.0181457
n-Heptane		0	0	19.6529	19.6529	5.93782	13.7150	7.48218E-05	1.07477E-06	13.6684	0.0466411	6.01751	13.6353	7.37470E-05	0.0274145	0.0274882	0.0330406
Methylcyclohexane		0	0	12.8181	12.8181	3.77903	9.03878	0.000285986	2.23373E-05	9.00818	0.0305996	3.83145	8.98636	0.000263648	0.0180548	0.0183184	0.0218215
Toluene		0	0	3.08207	3.08207	0.776706	2.30156	0.00379938	0.00319619	2.29527	0.00629734	0.787469	2.29080	0.000603190	0.00369975	0.00430294	0.00446506
n-Octane		0	0	43.1151	43.1151	5.64065	37.4744	3.87071E-05	3.50601E-07	37.4338	0.0405621	5.70905	37.4060	3.83565E-05	0.0236917	0.0237301	0.0278370
Ethylbenzene		0	0	2.47545	2.47545	0.270381	2.20397	0.00109824	0.000911648	2.20196	0.00200751	0.273770	2.20058	0.000186595	0.00117302	0.00135961	0.00138167
p-Xylene		0	0	3.30437	3.30437	0.325887	2.97725	0.00122832	0.00101008	2.97486	0.00239459	0.329924	2.97322	0.000218240	0.00139951	0.00161775	0.00164172
o-Xylene		0	0	3.79419	3.79419	0.321682	3.47072	0.00178213	0.00155303	3.46837	0.00235377	0.325644	3.46676	0.000229094	0.00137418	0.00160328	0.00160800
n-Nonane		0	0	23.6581	23.6581	1.17793	22.4801	1.16359E-05	1.68564E-07	22.4723	0.00780845	1.19097	22.4671	1.14673E-05	0.00457552	0.00458698	0.00522572
C10+		0	0	50.2626	50.2626	0.189924	50.0727	1.05901E-05	9.55105E-07	50.0716	0.00102682	0.191582	50.0710	9.63497E-06	0.000584617	0.000594251	0.000631726
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water		0	100	0	11.1216	0.110370	0.00996627	99.9364	99.9937	0.00276099	0.123821	0.110363	0.000833584	2.40026	0.0343612	0.261111	0.0733081
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		0.774472	0	0.00824733	0.653922	0.772387	0.00623897	0.000232181	5.21357E-06	0.000175145	0.102057	0.769371	5.20941E-06	0.386668	0.000324856	0.0373524	0.00639514
CO2		0.355305	0	0.0109634	0.300322	0.352957	0.0275022	0.00399972	0.00196645	0.00680346	0.354575	0.352753	0.00183476	3.46586	0.0800571	0.404556	0.188668
Methane		61.8212	0	1.39928	52.2318	61.6400	1.51063	0.0354767	0.00159922	0.130065	23.3258	61.4504	0.0120674	57.7155	0.688306	6.15385	4.44901
Ethane		20.7367	0	2.69525	17.6201	20.6707	2.91055	0.0123552	0.000649620	1.12764	31.0834	20.7082	0.467947	19.9423	15.8151	16.2106	25.2737
Propane		9.11377	0	3.79225	7.86115	9.06703	4.32238	0.00560275	0.000330950	3.12932	23.1747	9.13992	2.32534	8.98141	33.8123	31.4325	32.5565
Isobutene		1.38640	0	1.30048	1.22835	1.35791	1.81828	0.00270241	0.000487330	1.67524	4.07857	1.37320	1.53389	3.77412	8.56395	8.10489	6.84914
n-Butane		2.93397	0	3.92052	2.65198	2.89369	4.67829	0.00119550	5.40840E-05	4.42042	8.75293	2.92686	4.13357	1.94458	19.0365	17.3984	14.9199
Isopentane		0.925890	0	2.66576	0.901065	0.890654	3.39390	0.000230665	7.35141E-06	3.44060	2.65610	0.900843	3.40712	0.380446	6.33340	5.76286	4.66592
n-Pentane		0.902902	0	3.72291	0.929149	0.871853	4.40738	0.000219709	6.86107E-06	4.52172	2.60072	0.881834	4.52038	0.362615	6.29200	5.72372	4.57049
2-Methylpentane		0	0	2.59756	0.116673	0.0862850	1.00561	9.53245E-06	1.43610E-07	1.05356	0.247956	0.0872208	1.07048	0.0159950	0.616866	0.559278	0.434021
3-Methylpentane		0	0	1.86084	0.0835822	0.0592727	0.769884	1.80469E-05	7.25757E-07	0.807853	0.169921	0.0599129	0.821808	0.0295091	0.423470	0.385712	0.297074
n-Hexane		1.04929	0	6.44706	1.17504	0.764500	12.1648	6.56974E-05	7.91663E-07	12.7983	2.15493	0.772537	13.0456	0.110575	5.38406	4.87864	3.74730
Methylcyclopentane		0	0	0.982508	0.0441308	0.0278349	0.473908	2.76601E-05	3.18126E-06	0.498828	0.0801395	0.0281370	0.508637	0.0417056	0.200408	0.185198	0.139799
Benzene		0	0	0.274191	0.0123157	0.00772582	0.132102	0.000391113	0.000338542	0.139045	0.0223916	0.00781027	0.141780	0.0898990	0.0556050	0.0588918	0.0389295
2-Methylhexane		0	0	3.32897	0.149526	0.0633033	2.21041	5.72283E-06	7.65140E-08	2.33976	0.166483	0.0638964	2.39598	0.00961917	0.415719	0.376798	0.282065
3-Methylhexane		0	0	2.75259	0.123637	0.0506595	1.86051	4.78989E-06	6.67481E-08	1.96981	0.133320	0.0511349	2.01745	0.00804644	0.332799	0.301674	0.226051
n-Heptane		0	0	5.91818	0.265824	0.0949074	4.27333	9.17128E-06	1.31817E-07	4.52831	0.244169	0.0957658	4.64079	0.0153998	0.606817	0.550135	0.411605
Methylcyclohexane		0	0	3.78232	0.169889	0.0591871	2.75965	3.43495E-05	2.68449E-06	2.92436	0.156968	0.0597490	2.99698	0.0539474	0.391601	0.359240	0.266373

Toluene		0	0	0.853431	0.0383331	0.0114155	0.659414	0.000428232	0.000360457	0.699226	0.0303140	0.0115237	0.716932	0.115822	0.0753035	0.0791868	0.0511475
n-Octane		0	0	14.8009	0.664805	0.102778	13.3108	5.40867E-06	4.90194E-08	14.1378	0.242070	0.103575	14.5133	0.00913079	0.597824	0.541403	0.395324
Ethylbenzene		0	0	0.789807	0.0354753	0.00457883	0.727582	0.000142628	0.000118465	0.772922	0.0111348	0.00461620	0.793541	0.0412834	0.0275098	0.0288299	0.0182365
p-Xylene		0	0	1.05428	0.0473545	0.00551881	0.982860	0.000159521	0.000131256	1.04422	0.0132818	0.00556304	1.07216	0.0482847	0.0328215	0.0343035	0.0216688
o-Xylene		0	0	1.21056	0.0543739	0.00544760	1.14576	0.000231444	0.000201810	1.21745	0.0130554	0.00549088	1.25013	0.0506862	0.0322276	0.0339967	0.0212238
n-Nonane		0	0	9.11883	0.409586	0.0240986	8.96537	1.82557E-06	2.64618E-08	9.52943	0.0523220	0.0242601	9.78750	0.00306500	0.129633	0.117503	0.0833253
C10+		0	0	24.7123	1.10999	0.00495632	25.4729	2.11938E-06	1.91256E-07	27.0844	0.00877650	0.00497801	27.8240	0.00328495	0.0211279	0.0194178	0.0128490
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
Water		0	82390.6	0	82390.6	691.917	3.20507	81695.5	81694.3	0.835066	2.37001	694.876	0.245414	1.15176	0.155549	1.30731	0.589652
H2S		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		4841.60	0	2.74428	4844.35	4842.15	2.00641	0.189802	0.00425946	0.0529729	1.95343	4844.15	0.00153369	0.185543	0.00147058	0.187013	0.0514392
CO2		2221.18	0	3.64803	2224.83	2212.72	8.84449	3.26967	1.60658	2.05772	6.78678	2221.02	0.540168	1.66309	0.362408	2.02550	1.51755
Methane		386475	0	465.607	386940	386425	485.808	29.0013	1.30655	39.3382	446.470	386908	3.55273	27.6947	3.11587	30.8106	35.7855
Ethane		129635	0	896.839	130532	129586	936.011	10.1000	0.530736	341.056	594.955	130384	137.767	9.56930	71.5928	81.1621	203.289
Propane		56974.6	0	1261.86	58236.5	56841.8	1390.05	4.58011	0.270385	946.467	443.578	57547.3	684.600	4.30972	153.064	157.374	261.867
Isobutene		8667.08	0	432.732	9099.81	8512.85	584.746	2.20916	0.398146	506.680	78.0661	8646.01	451.589	1.81101	38.7679	40.5789	55.0910
n-Butane		18341.7	0	1304.54	19646.2	18140.7	1504.50	0.977294	0.0441864	1336.96	167.536	18428.3	1216.96	0.933107	86.1758	87.1089	120.008
Isopentane		5788.19	0	887.023	6675.21	5583.57	1091.45	0.188563	0.00600607	1040.61	50.8392	5671.94	1003.08	0.182557	28.6705	28.8531	37.5302
n-Pentane		5644.48	0	1238.79	6883.27	5465.71	1417.38	0.179606	0.00560545	1367.60	49.7794	5552.25	1330.84	0.174001	28.4831	28.6571	36.7626
2-Methylpentane		0	0	864.331	864.331	540.927	323.396	0.00779253	0.000117329	318.650	4.74602	549.164	315.159	0.00767521	2.79248	2.80015	3.49104
3-Methylpentane		0	0	619.188	619.188	371.585	247.589	0.0147529	0.000592940	244.336	3.25238	377.227	241.947	0.0141599	1.91700	1.93116	2.38951
n-Hexane		6559.62	0	2145.24	8704.86	4792.70	3912.11	0.0537059	0.000646785	3870.86	41.2467	4864.09	3840.72	0.0530591	24.3730	24.4260	30.1413
Methylcyclopentane		0	0	326.927	326.927	174.499	152.405	0.0226115	0.00259907	150.871	1.53392	177.157	149.747	0.0200124	0.907222	0.927234	1.12447
Benzene		0	0	91.2363	91.2363	48.4337	42.4828	0.319725	0.276587	42.0543	0.428589	49.1754	41.7411	0.0431380	0.251717	0.294855	0.313128
2-Methylhexane		0	0	1107.71	1107.71	396.853	710.850	0.00467826	6.25115E-05	707.664	3.18658	402.308	705.395	0.00461575	1.88191	1.88652	2.26879
3-Methylhexane		0	0	915.917	915.917	317.588	598.324	0.00391561	5.45328E-05	595.773	2.55181	321.958	593.954	0.00386108	1.50654	1.51040	1.81824
n-Heptane		0	0	1969.26	1969.26	594.982	1374.27	0.00749728	0.000107694	1369.60	4.67353	602.966	1366.29	0.00738959	2.74699	2.75438	3.31073
Methylcyclohexane		0	0	1258.56	1258.56	371.048	887.482	0.0280798	0.00219321	884.477	3.00445	376.195	882.335	0.0258866	1.77273	1.79861	2.14257
Toluene		0	0	283.977	283.977	71.5645	212.062	0.350069	0.294492	211.482	0.580227	72.5561	211.071	0.0555770	0.340889	0.396466	0.411403
n-Octane		0	0	4924.97	4924.97	644.323	4280.64	0.00442145	4.00486E-05	4276.01	4.63335	652.136	4272.83	0.00438140	2.70627	2.71065	3.17978
Ethylbenzene		0	0	262.806	262.806	28.7050	233.985	0.116595	0.0967851	233.772	0.213127	29.0648	233.625	0.0198098	0.124534	0.144343	0.146685
p-Xylene		0	0	350.808	350.808	34.5978	316.080	0.130405	0.107235	315.826	0.254221	35.0264	315.652	0.0231694	0.148579	0.171748	0.174293
o-Xylene		0	0	402.810	402.810	34.1514	368.469	0.189199	0.164878	368.219	0.249888	34.5720	368.048	0.0243217	0.145890	0.170212	0.170713
n-Nonane		0	0	3034.27	3034.27	151.076	2883.19	0.00149236	2.16191E-05	2882.19	1.00147	152.748	2881.52	0.00147074	0.586833	0.588304	0.670225
C10+		0	0	8222.96	8222.96	31.0715	8191.89	0.00173254	0.000156255	8191.72	0.167987	31.3428	8191.62	0.00157628	0.0956433	0.0972195	0.103350

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VR	g from produced wat	lashing from Oil Tan	o Enclosed Combust	Flash Gas from VRT
Phase: Total	**Status**	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	**Units**																
Temperature	°F	67.0	67.0	67.0	58.1	70.0	70.0	70.0	72.5	70.0	70.0	72	65	72.52	72.52	72.3734	65
Pressure	psig	300	200	300	200	302	302	302	-0.365949	40	40	302	5	-0.365949	-0.365949	-0.365949	5
Mole Fraction Vapor	%	100	0	0	86.2612	100	0	0	0	0	100	100	0	100	100	100	100
Mole Fraction Light Liquid	%	0	100	100	0.979622	0	100	100	100	100	0	0	100	0	0	0	0
Mole Fraction Heavy Liquid	%	0	0	0	12.7592	0	0	0	0	0	0	0	0	0	0	0	0
Molecular Weight	lb/lbmol	20.4	18.0	88.3	20.8	20.4	85.6	18.0	18.0	97.2	29.7	20.4800	100.997	20.7968	47.6697	42.4167	40.9353
Mass Density	lb/ft^3	1.2	62.3	43.2	1.0	1.2	42.7	62.3	62.3	43.9	0.3	1.23291	44.3847	0.0523694	0.121935	0.108087	0.146188
Molar Flow	lbmol/h	30622.0	4573.4	376.8	35572.2	30659.3	375.6	4537.2	4534.9	311.2	64.5	30743.5	291.501	2.30732	9.49634	11.8037	19.6493
Mass Flow	lb/h	625148.5	82390.6	33274.8	740813.9	626907.2	32159.2	81747.4	81699.5	30245.2	1914.1	629626	29440.8	47.9849	452.687	500.672	804.348
Vapor Volumetric Flow	MCFH	506.2	1.3	0.8	750.2	507.0	0.8	1.3	1.3	0.7	6.5	510.683	0.663310	0.916279	3.71252	4.63213	5.50215
Liquid Volumetric Flow	Mbbl/d	2163.9	5.7	3.3	3206.8	2167.0	3.2	5.6	5.6	2.9	27.8	2182.96	2.83537	3.91671	15.8695	19.8004	23.5194
Std Vapor Volumetric Flow	MMSCFD	278.9	41.7	3.4	324.0	279.2	3.4	41.3	41.3	2.8	0.6	280.000	2.65489	0.0210142	0.0864892	0.107503	0.178958
Std Liquid Volumetric Flow	Mbbl/d	126.6	5.6	3.4	135.7	126.7	3.3	5.6	5.6	3.0	0.3	127.191	2.86024	0.00936985	0.0602361	0.0696060	0.116540
Compressibility		0.920	0.011	0.114	0.815	0.921	0.112	0.016	0.001	0.021	0.970	0.922008	0.00795981	0.996405	0.980907	0.984915	0.979519
Specific Gravity		0.705	0.999	0.693		0.706	0.684	0.998	0.998	0.704	1.025	0.707118	0.711646	0.718059	1.64590	1.46453	1.41338
API Gravity			10.0	71.6			73.7	10.1	10.0	68.2			66.6486				
Enthalpy	MMBtu/h	-1040.4	-562.8	-29.8	-1633.1	-1044.0	-29.1	-557.9	-557.7	-26.4	-2.4	-1046.62	-25.5500	-0.0859243	-0.421969	-0.507894	-0.823744
Mass Enthalpy	Btu/lb	-1664.3	-6830.9	-897.0	-2204.4	-1665.3	-905.3	-6824.5	-6825.7	-873.7	-1266.5	-1662.29	-867.844	-1790.65	-932.143	-1014.42	-1024.11
Mass Cp	Btu/(lb**F)	0.5	1.0	0.5	0.6	0.5	0.5	1.0	1.0	0.5	0.4	0.523986	0.485385	0.471091	0.400672	0.407167	0.404507
Ideal Gas CpCv Ratio		1.255	1.326	1.064	1.257	1.254	1.065	1.326	1.326	1.058	1.184	1.25343	1.05596	1.25536	1.11707	1.13096	1.13783
Dynamic Viscosity	cP	0.0	1.0	0.4		0.0	0.3	1.0	1.0	0.4	0.0	0.0110105	0.456623	0.0106977	0.00812301	0.00850818	0.00846980
Kinematic Viscosity	cSt	0.6	1.0	0.5		0.6	0.5	1.0	1.0	0.6	2.0	0.557513	0.642250	12.7525	4.15878	4.91408	3.61694
Thermal Conductivity	Btu/(h*ft*°F)	0.0	0.3	0.1		0.0	0.1	0.3	0.3	0.1	0.0	0.0183616	0.0694719	0.0170119	0.00999071	0.0111084	0.0108317
Surface Tension	lbf/ft		0.005	0.001			0.001	0.005	0.005	0.001			0.00145908				
Net I.G. Heating Value	Btu/ft^3	1116.6	0.0	4465.8	1008.5	1116.9	4335.0	0.6	0.0	4905.4	1583.1	1118.58	5091.32	1077.17	2484.19	2209.15	2147.46
Net Liquid Heating Value	Btu/lb	20698.6	-1059.8	19010.6	18202.9	20669.9	19043.9	-1046.7	-1058.8	18975.7	20120.2	20667.1	18954.5	19571.2	19614.2	19610.1	19753.9
Gross I.G. Heating Value	Btu/ft^3	1231.5	50.3	4805.4	1117.5	1231.9	4666.3	50.9	50.4	5274.7	1730.8	1233.61	5472.89	1188.75	2694.39	2400.08	2334.40
Gross Liquid Heating Value	Btu/lb	22834.2	0.0	20468.1	20188.4	22802.6	20510.8	13.6	0.9	20416.1	22008.0	22798.5	20386.8	21607.3	21287.4	21318.0	21486.7

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VR	g from produced wat	lashing from Oil Tan	o Enclosed Combust	Flash Gas from VRT
Phase: Vapor	**Status**	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water		0			0.118664	0.125271	0.125271	0.125271	2.77086	0.203986	0.203986	0.125462	0.166575	2.77086	0.0909222	0.614782	0.166575
H2S		0			0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		0.564404			0.563403	0.563780	0.563780	0.563780	0.287059	0.108125	0.108125	0.562470	0.00934506	0.287059	0.000552800	0.0565574	0.00934506
CO2		0.164818			0.164082	0.163990	0.163990	0.163990	1.63780	0.239116	0.239116	0.164155	0.175489	1.63780	0.0867152	0.389914	0.175489
Methane		78.6713			78.5348	78.5656	78.5656	78.5656	74.8202	43.1532	43.1532	78.4483	11.3525	74.8202	2.04528	16.2709	11.3525
Ethane		14.0790			14.0712	14.0565	14.0565	14.0565	13.7928	30.6801	30.6801	14.1044	34.4070	13.7928	25.0723	22.8674	34.4070
Propane		4.21942			4.22065	4.20446	4.20446	4.20446	4.23591	15.5979	15.5979	4.24499	30.2231	4.23591	36.5528	30.2357	30.2231

Isobutene		0.504461			0.498819	0.494881	0.494881	0.494881	1.39895	2.15746	2.15746	0.501246	4.99715	1.39895	7.27619	6.12734	4.99715
n-Butane		1.03054			1.02689	1.01801	1.01801	1.01801	0.695796	4.46949	4.46949	1.03131	10.5080	0.695796	15.6130	12.6971	10.5080
Isopentane		0.261987			0.254934	0.252418	0.252418	0.252418	0.109663	1.09260	1.09260	0.255711	2.64731	0.109663	4.18456	3.38802	2.64731
n-Pentane		0.255483			0.249339	0.247090	0.247090	0.247090	0.104524	1.06982	1.06982	0.250315	2.59317	0.104524	4.15721	3.36501	2.59317
2-Methylpentane		0			0.0204214	0.0204736	0.0204736	0.0204736	0.00386011	0.0853962	0.0853962	0.0207284	0.206170	0.00386011	0.341232	0.275284	0.206170
3-Methylpentane		0			0.0139959	0.0140641	0.0140641	0.0140641	0.00712149	0.0585208	0.0585208	0.0142386	0.141117	0.00712149	0.234251	0.189853	0.141117
n-Hexane		0.248578			0.178956	0.181399	0.181399	0.181399	0.0266851	0.742161	0.742161	0.183597	1.78005	0.0266851	2.97830	2.40134	1.78005
Methylcyclopentane		0			0.00669847	0.00676282	0.00676282	0.00676282	0.0103060	0.0282612	0.0282612	0.00684705	0.0679983	0.0103060	0.113515	0.0933404	0.0679983
Benzene		0			0.00200465	0.00202241	0.00202241	0.00202241	0.0239351	0.00850777	0.00850777	0.00204776	0.0204014	0.0239351	0.0339343	0.0319797	0.0204014
2-Methylhexane		0			0.0121108	0.0129179	0.0129179	0.0129179	0.00199645	0.0493107	0.0493107	0.0130596	0.115232	0.00199645	0.197772	0.159503	0.115232
3-Methylhexane		0			0.00969182	0.0103377	0.0103377	0.0103377	0.00167003	0.0394880	0.0394880	0.0104513	0.0923482	0.00167003	0.158324	0.127702	0.0923482
n-Heptane		0			0.0179100	0.0193671	0.0193671	0.0193671	0.00319622	0.0723204	0.0723204	0.0195733	0.168152	0.00319622	0.288685	0.232879	0.168152
Methylcyclohexane		0			0.0115260	0.0123259	0.0123259	0.0123259	0.0114266	0.0474468	0.0474468	0.0124626	0.111055	0.0114266	0.190123	0.155193	0.111055
Toluene		0			0.00234714	0.00253334	0.00253334	0.00253334	0.0261425	0.00976448	0.00976448	0.00256142	0.0227238	0.0261425	0.0389598	0.0364543	0.0227238
n-Octane		0			0.0156034	0.0183978	0.0183978	0.0183978	0.00166238	0.0628945	0.0628945	0.0185700	0.141669	0.00166238	0.249483	0.201040	0.141669
Ethylbenzene		0			0.000752310	0.000881888	0.000881888	0.000881888	0.00808708	0.00311279	0.00311279	0.000890499	0.00703165	0.00808708	0.0123523	0.0115186	0.00703165
p-Xylene		0			0.000897002	0.00106293	0.00106293	0.00106293	0.00945858	0.00371298	0.00371298	0.00107315	0.00835510	0.00945858	0.0147374	0.0137055	0.00835510
o-Xylene		0			0.000877019	0.00104922	0.00104922	0.00104922	0.00992900	0.00364969	0.00364969	0.00105923	0.00818349	0.00992900	0.0144707	0.0135829	0.00818349
n-Nonane		0			0.00299963	0.00384200	0.00384200	0.00384200	0.000496997	0.0121076	0.0121076	0.00387389	0.0265950	0.000496997	0.0481819	0.0388607	0.0265950
C10+		0			0.000396963	0.000619465	0.000619465	0.000619465	0.000417583	0.00159215	0.00159215	0.000623164	0.00321501	0.000417583	0.00615623	0.00503447	0.00321501
Molar Flow		**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**	**lbmol/h**
Water		0			36.4119	38.4072	0	0	0	0	0.131555	38.5715	0	0.0639325	0.00863428	0.0725668	0.0327307
H2S		0			0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		172.832			172.880	172.851	0	0	0	0	0.0697321	172.923	0	0.00662335	5.24957E-05	0.00667585	0.00183623
CO2		50.4705			50.3485	50.2781	0	0	0	0	0.154212	50.4668	0	0.0377893	0.00823477	0.0460241	0.0344823
Methane		24090.7			24098.4	24087.7	0	0	0	0	27.8305	24117.7	0	1.72634	0.194227	1.92057	2.23067
Ethane		4311.26			4317.74	4309.62	0	0	0	0	19.7863	4336.17	0	0.318244	2.38095	2.69919	6.76073
Propane		1292.07			1295.11	1289.06	0	0	0	0	10.0595	1305.06	0	0.0977359	3.47118	3.56892	5.93862
Isobutene		154.476			153.063	151.727	0	0	0	0	1.39140	154.100	0	0.0322782	0.690972	0.723251	0.981903
n-Butane		315.571			315.102	312.114	0	0	0	0	2.88248	317.061	0	0.0160542	1.48267	1.49872	2.06475
Isopentane		80.2257			78.2266	77.3897	0	0	0	0	0.704644	78.6145	0	0.00253028	0.397380	0.399911	0.520178
n-Pentane		78.2339			76.5097	75.7561	0	0	0	0	0.689954	76.9556	0	0.00241169	0.394783	0.397195	0.509539
2-Methylpentane		0			6.26629	6.27705	0	0	0	0	0.0550740	6.37264	0	8.90650E-05	0.0324046	0.0324936	0.0405109
3-Methylpentane		0			4.29464	4.31196	0	0	0	0	0.0377414	4.37743	0	0.000164315	0.0222453	0.0224096	0.0277284
n-Hexane		76.1195			54.9127	55.6157	0	0	0	0	0.478637	56.4441	0	0.000615711	0.282830	0.283445	0.349768
Methylcyclopentane		0			2.05543	2.07343	0	0	0	0	0.0182263	2.10502	0	0.000237791	0.0107798	0.0110176	0.0133612
Benzene		0			0.615127	0.620056	0	0	0	0	0.00548686	0.629552	0	0.000552259	0.00322252	0.00377478	0.00400872
2-Methylhexane		0			3.71620	3.96053	0	0	0	0	0.0318016	4.01498	0	4.60645E-05	0.0187811	0.0188272	0.0226422
3-Methylhexane		0			2.97393	3.16948	0	0	0	0	0.0254667	3.21310	0	3.85330E-05	0.0150350	0.0150736	0.0181457
n-Heptane		0			5.49566	5.93782	0	0	0	0	0.0466411	6.01751	0	7.37470E-05	0.0274145	0.0274882	0.0330406
Methylcyclohexane		0			3.53675	3.77903	0	0	0	0	0.0305996	3.83145	0	0.000263648	0.0180548	0.0183184	0.0218215
Toluene		0			0.720221	0.776706	0	0	0	0	0.00629734	0.787469	0	0.000603190	0.00369975	0.00430294	0.00446506
n-Octane		0			4.78791	5.64065	0	0	0	0	0.0405621	5.70905	0	3.83565E-05	0.0236917	0.0237301	0.0278370
Ethylbenzene		0			0.230846	0.270381	0	0	0	0	0.00200751	0.273770	0	0.000186595	0.00117302	0.00135961	0.00138167
p-Xylene		0			0.275245	0.325887	0	0	0	0	0.00239459	0.329924	0	0.000218240	0.00139951	0.00161775	0.00164172
o-Xylene		0			0.269113	0.321682	0	0	0	0	0.00235377	0.325644	0	0.000229094	0.00137418	0.00160328	0.00160800
n-Nonane		0			0.920436	1.17793	0	0	0	0	0.00780845	1.19097	0	1.14673E-05	0.00457552	0.00458698	0.00522572
C10+		0			0.121808	0.189924	0	0	0	0	0.00102682	0.191582	0	9.63497E-06	0.000584617	0.000594251	0.000631726
Mass Fraction		**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Water		0			0.104524	0.110370	0.110370	0.110370	2.40026	0.123821	0.123821	0.110363	0.0733081	2.40026	0.0343612	0.261111	0.0733081
H2S		0			0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		0.774472			0.771685	0.772387	0.772387	0.772387	0.386668	0.102057	0.102057	0.769371	0.00639514	0.386668	0.000324856	0.0373524	0.00639514
CO2		0.355305			0.353071	0.352957	0.352957	0.352957	3.46586	0.354575	0.354575	0.352753	0.188668	3.46586	0.0800571	0.404556	0.188668
Methane		61.8212			61.6011	61.6400	61.6400	61.6400	57.7155	23.3258	23.3258	61.4504	4.44901	57.7155	0.688306	6.15385	4.44901
Ethane		20.7367			20.6874	20.6707	20.6707	20.6707	19.9423	31.0834	31.0834	20.7082	25.2737	19.9423	15.8151	16.2106	25.2737
Propane		9.11377			9.09977	9.06703	9.06703	9.06703	8.98141	23.1747	23.1747	9.13992	32.5565	8.98141	33.8123	31.4325	32.5565
Isobutene		1.38640			1.36839	1.35791	1.35791	1.35791	3.77412	4.07857	4.07857	1.37320	6.84914	3.77412	8.56395	8.10489	6.84914
n-Butane		2.93397			2.91825	2.89369	2.89369	2.89369	1.94458	8.75293	8.75293	2.92686	14.9199	1.94458	19.0365	17.3984	14.9199
Isopentane		0.925890			0.899316	0.890654	0.890654	0.890654	0.380446	2.65610	2.65610	0.900843	4.66592	0.380446	6.33340	5.76286	4.66592
n-Pentane		0.902902			0.879579	0.871853	0.871853	0.871853	0.362615	2.60072	2.60072	0.881834	4.57049	0.362615	6.29200	5.72372	4.57049
2-Methylpentane		0			0.0860444	0.0862850	0.0862850	0.0862850	0.0159950	0.247956	0.247956	0.0872208	0.434021	0.0159950	0.616866	0.559278	0.434021
3-Methylpentane		0			0.0589711	0.0592727	0.0592727	0.0592727	0.0295091	0.169921	0.169921	0.0599129	0.297074	0.0295091	0.423470	0.385712	0.297074
n-Hexane		1.04929			0.754024	0.764500	0.764500	0.764500	0.110575	2.15493	2.15493	0.772537	3.74730	0.110575	5.38406	4.87864	3.74730
Methylcyclopentane		0			0.0275635	0.0278349	0.0278349	0.0278349	0.0417056	0.0801395	0.0801395	0.0281370	0.139799	0.0417056	0.200408	0.185198	0.139799

Benzene		0			0.00765616	0.00772582	0.00772582	0.00772582	0.0898990	0.0223916	0.0223916	0.00781027	0.0389295	0.0898990	0.0556050	0.0588918	0.0389295
2-Methylhexane		0			0.0593341	0.0633033	0.0633033	0.0633033	0.00961917	0.166483	0.166483	0.0638964	0.282065	0.00961917	0.415719	0.376798	0.282065
3-Methylhexane		0			0.0474828	0.0506595	0.0506595	0.0506595	0.00804644	0.133320	0.133320	0.0511349	0.226051	0.00804644	0.332799	0.301674	0.226051
n-Heptane		0			0.0877456	0.0949074	0.0949074	0.0949074	0.0153998	0.244169	0.244169	0.0957658	0.411605	0.0153998	0.606817	0.550135	0.411605
Methylcyclohexane		0			0.0553329	0.0591871	0.0591871	0.0591871	0.0539474	0.156968	0.156968	0.0597490	0.266373	0.0539474	0.391601	0.359240	0.266373
Toluene		0			0.0105739	0.0114155	0.0114155	0.0114155	0.115822	0.0303140	0.0303140	0.0115237	0.0511475	0.115822	0.0753035	0.0791868	0.0511475
n-Octane		0			0.0871465	0.102778	0.102778	0.102778	0.00913079	0.242070	0.242070	0.103575	0.395324	0.00913079	0.597824	0.541403	0.395324
Ethylbenzene		0			0.00390511	0.00457883	0.00457883	0.00457883	0.0412834	0.0111348	0.0111348	0.00461620	0.0182365	0.0412834	0.0275098	0.0288299	0.0182365
p-Xylene		0			0.00465618	0.00551881	0.00551881	0.00551881	0.0482847	0.0132818	0.0132818	0.00556304	0.0216688	0.0482847	0.0328215	0.0343035	0.0216688
o-Xylene		0			0.00455245	0.00544760	0.00544760	0.00544760	0.0506862	0.0130554	0.0130554	0.00549088	0.0212238	0.0506862	0.0322276	0.0339967	0.0212238
n-Nonane		0			0.0188104	0.0240986	0.0240986	0.0240986	0.00306500	0.0523220	0.0523220	0.0242601	0.0833253	0.00306500	0.129633	0.117503	0.0833253
C10+		0			0.00317533	0.00495632	0.00495632	0.00495632	0.00328495	0.00877650	0.00877650	0.00497801	0.0128490	0.00328495	0.0211279	0.0194178	0.0128490
Mass Flow		**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**
Water		0			655.971	691.917	0	0	0	0	2.37001	694.876	0	1.15176	0.155549	1.30731	0.589652
H2S		0			0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen		4841.60			4842.96	4842.15	0	0	0	0	1.95343	4844.15	0	0.185543	0.00147058	0.187013	0.0514392
CO2		2221.18			2215.81	2212.72	0	0	0	0	6.78678	2221.02	0	1.66309	0.362408	2.02550	1.51755
Methane		386475			386597	386425	0	0	0	0	446.470	386908	0	27.6947	3.11587	30.8106	35.7855
Ethane		129635			129830	129586	0	0	0	0	594.955	130384	0	9.56930	71.5928	81.1621	203.289
Propane		56974.6			57108.5	56841.8	0	0	0	0	443.578	57547.3	0	4.30972	153.064	157.374	261.867
Isobutene		8667.08			8587.78	8512.85	0	0	0	0	78.0661	8646.01	0	1.81101	38.7679	40.5789	55.0910
n-Butane		18341.7			18314.4	18140.7	0	0	0	0	167.536	18428.3	0	0.933107	86.1758	87.1089	120.008
Isopentane		5788.19			5643.95	5583.57	0	0	0	0	50.8392	5671.94	0	0.182557	28.6705	28.8531	37.5302
n-Pentane		5644.48			5520.08	5465.71	0	0	0	0	49.7794	5552.25	0	0.174001	28.4831	28.6571	36.7626
2-Methylpentane		0			540.000	540.927	0	0	0	0	4.74602	549.164	0	0.00767521	2.79248	2.80015	3.49104
3-Methylpentane		0			370.092	371.585	0	0	0	0	3.25238	377.227	0	0.0141599	1.91700	1.93116	2.38951
n-Hexane		6559.62			4732.12	4792.70	0	0	0	0	41.2467	4864.09	0	0.0530591	24.3730	24.4260	30.1413
Methylcyclopentane		0			172.984	174.499	0	0	0	0	1.53392	177.157	0	0.0200124	0.907222	0.927234	1.12447
Benzene		0			48.0487	48.4337	0	0	0	0	0.428589	49.1754	0	0.0431380	0.251717	0.294855	0.313128
2-Methylhexane		0			372.370	396.853	0	0	0	0	3.18658	402.308	0	0.00461575	1.88191	1.88652	2.26879
3-Methylhexane		0			297.994	317.588	0	0	0	0	2.55181	321.958	0	0.00386108	1.50654	1.51040	1.81824
n-Heptane		0			550.676	594.982	0	0	0	0	4.67353	602.966	0	0.00738959	2.74699	2.75438	3.31073
Methylcyclohexane		0			347.260	371.048	0	0	0	0	3.00445	376.195	0	0.0258866	1.77273	1.79861	2.14257
Toluene		0			66.3600	71.5645	0	0	0	0	0.580227	72.5561	0	0.0555770	0.340889	0.396466	0.411403
n-Octane		0			546.916	644.323	0	0	0	0	4.63335	652.136	0	0.00438140	2.70627	2.71065	3.17978
Ethylbenzene		0			24.5078	28.7050	0	0	0	0	0.213127	29.0648	0	0.0198098	0.124534	0.144343	0.146685
p-Xylene		0			29.2214	34.5978	0	0	0	0	0.254221	35.0264	0	0.0231694	0.148579	0.171748	0.174293
o-Xylene		0			28.5704	34.1514	0	0	0	0	0.249888	34.5720	0	0.0243217	0.145890	0.170212	0.170713
n-Nonane		0			118.051	151.076	0	0	0	0	1.00147	152.748	0	0.00147074	0.586833	0.588304	0.670225
C10+		0			19.9278	31.0715	0	0	0	0	0.167987	31.3428	0	0.00157628	0.0956433	0.0972195	0.103350

Process Streams		**Separator Gas**	**Separator Water**	**Separator Oil**	**1**	**as from 3-ph Separat**	**Produced Liquid**	**2**	**Produced Water**	**3**	**h Gas from LP Conde**	**To Sales Gas Line**	**Condensate from VRT**	**g from produced wat**	**lashing from Oil Tan**	**o Enclosed Combust**	**Flash Gas from VRT**
Phase: Vapor	**Status**	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	**Units**																
Temperature	°F	67.0			58.1	70.0	70.0	70.0	72.5	70.0	70.0	72	65	72.52	72.52	72.3734	65
Pressure	psig	300			200	302	302	302	-0.365949	40	40	302	5	-0.365949	-0.365949	-0.365949	5
Mole Fraction Vapor	%	100			100	100	100	100	100	100	100	100	100	100	100	100	100
Mole Fraction Light Liquid	%	0			0	0	0	0	0	0	0	0	0	0	0	0	0
Mole Fraction Heavy Liquid	%	0			0	0	0	0	0	0	0	0	0	0	0	0	0
Molecular Weight	lb/lbmol	20.4			20.5	20.4	20.4	20.4	20.8	29.7	29.7	20.4800	40.9353	20.7968	47.6697	42.4167	40.9353
Mass Density	lb/ft^3	1.2			0.8	1.2	1.2	1.2	0.1	0.3	0.3	1.23291	0.146188	0.0523694	0.121935	0.108087	0.146188
Molar Flow	lbmol/h	30622.0			30685.0	30659.3	0.0	0.0	0.0	0.0	64.5	30743.5	0	2.30732	9.49634	11.8037	19.6493
Mass Flow	lb/h	625148.5			627582.5	626907.2	0.0	0.0	0.0	0.0	1914.1	629626	0	47.9849	452.687	500.672	804.348
Vapor Volumetric Flow	MCFH	506.2			748.2	507.0	0.0	0.0	0.0	0.0	6.5	510.683	0	0.916279	3.71252	4.63213	5.50215
Liquid Volumetric Flow	Mbbl/d	2163.9			3198.1	2167.0	0.0	0.0	0.0	0.0	27.8	2182.96	0	3.91671	15.8695	19.8004	23.5194
Std Vapor Volumetric Flow	MMSCFD	278.9			279.5	279.2	0.0	0.0	0.0	0.0	0.6	280.000	0	0.0210142	0.0864892	0.107503	0.178958
Std Liquid Volumetric Flow	Mbbl/d	126.6			126.9	126.7	0.0	0.0	0.0	0.0	0.3	127.191	0	0.00936985	0.0602361	0.0696060	0.116540
Compressibility		0.920			0.942	0.921	0.921	0.921	0.996	0.970	0.970	0.922008	0.979519	0.996405	0.980907	0.984915	0.979519
Specific Gravity		0.705			0.706	0.706	0.706	0.706	0.718	1.025	1.025	0.707118	1.41338	0.718059	1.64590	1.46453	1.41338
API Gravity																	
Enthalpy	MMBtu/h	-1040.4			-1045.7	-1044.0	0.0	0.0	0.0	0.0	-2.4	-1046.62	0	-0.0859243	-0.421969	-0.507894	-0.823744
Mass Enthalpy	Btu/lb	-1664.3			-1666.3	-1665.3	-1665.3	-1665.3	-1790.7	-1266.5	-1266.5	-1662.29	-1024.11	-1790.65	-932.143	-1014.42	-1024.11
Mass Cp	Btu/(lb**F)	0.5			0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.523986	0.404507	0.471091	0.400672	0.407167	0.404507
Ideal Gas CpCv Ratio		1.255			1.257	1.254	1.254	1.254	1.255	1.184	1.184	1.25343	1.13783	1.25536	1.11707	1.13096	1.13783

Dynamic Viscosity	cP	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0110105	0.00846980	0.0106977	0.00812301	0.00850818	0.00846980
Kinematic Viscosity	cSt	0.6			0.8	0.6	0.6	0.6	12.8	2.0	2.0	0.557513	3.61694	12.7525	4.15878	4.91408	3.61694
Thermal Conductivity	Btu/(h*ft*°F)	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0183616	0.0108317	0.0170119	0.00999071	0.0111084	0.0108317
Surface Tension	lbf/ft																
Net I.G. Heating Value	Btu/ft^3	1116.6			1117.3	1116.9	1116.9	1116.9	1077.2	1583.1	1583.1	1118.58	2147.46	1077.17	2484.19	2209.15	2147.46
Net Liquid Heating Value	Btu/lb	20698.6			20670.9	20669.9	20669.9	20669.9	19571.2	20120.2	20120.2	20667.1	19753.9	19571.2	19614.2	19610.1	19753.9
Gross I.G. Heating Value	Btu/ft^3	1231.5			1232.2	1231.9	1231.9	1231.9	1188.8	1730.8	1730.8	1233.61	2334.40	1188.75	2694.39	2400.08	2334.40
Gross Liquid Heating Value	Btu/lb	22834.2			22803.5	22802.6	22802.6	22802.6	21607.3	22008.0	22008.0	22798.5	21486.7	21607.3	21287.4	21318.0	21486.7

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VRT	g from produced wat	lashing from Oil Tan	o Enclosed Combust	Flash Gas from VRT
Phase: Light Liquid	**Status**	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water			100	0	0.0348813	0.0473611	0.0473611	99.9470	99.9965	0.0148974	0.0148974		0.00467323	99.9965	0.00176885		0.00467323
H2S			0	0	0	0	0	0	0	0	0		0	0	0		0
Nitrogen			0	0.0259995	0.0127688	0.0190668	0.0190668	0.000149330	3.35291E-06	0.000607739	0.000607739		1.87816E-05	3.35291E-06	7.98843E-07		1.87816E-05
CO2			0	0.0219996	0.0414823	0.0534997	0.0534997	0.00163746	0.000804988	0.0150269	0.0150269		0.00421058	0.000804988	0.00143229		0.00421058
Methane			0	7.70285	5.74060	8.06154	8.06154	0.0398437	0.00179593	0.788085	0.788085		0.0759716	0.00179593	0.00965638		0.0759716
Ethane			0	7.91584	6.62074	8.28678	8.28678	0.0074031	0.000389218	3.64532	3.64532		1.57176	0.000389218	0.780395		1.57176
Propane			0	7.59485	7.31305	8.39186	8.39186	0.00228925	0.000135214	6.89826	6.89826		5.32599	0.000135214	4.27445		5.32599
Isobutene			0	2.04696	2.60783	2.77447	2.77447	0.000867815	0.000156482	2.90236	2.90236		2.76115	0.000156482	2.60911		2.76115
n-Butane			0	5.95688	6.57113	6.89088	6.89088	0.000370592	1.67641E-05	7.39277	7.39277		7.18278	1.67641E-05	6.89889		7.18278
Isopentane			0	3.26293	4.10103	4.02718	4.02718	5.76023E-05	1.83567E-06	4.63543	4.63543		4.76944	1.83567E-06	4.78914		4.76944
n-Pentane			0	4.55691	5.42129	5.22976	5.22976	5.48662E-05	1.71323E-06	6.09199	6.09199		6.32784	1.71323E-06	6.40093		6.32784
2-Methylpentane			0	2.66195	1.08001	0.999025	0.999025	1.99300E-06	3.00230E-08	1.18839	1.18839		1.25460	3.00230E-08	1.28536		1.25460
3-Methylpentane			0	1.90696	0.829450	0.764844	0.764844	3.77317E-06	1.51726E-07	0.911243	0.911243		0.963155	1.51726E-07	0.987701		0.963155
n-Hexane			0	6.60687	13.2292	12.0852	12.0852	1.37357E-05	1.65505E-07	14.4362	14.4362		15.2893	1.65505E-07	15.7039		15.2893
Methylcyclopentane			0	1.03098	0.524832	0.482083	0.482083	5.92159E-06	6.81003E-07	0.576147	0.576147		0.610399	6.81003E-07	0.627132		0.610399
Benzene			0	0.309994	0.157454	0.144784	0.144784	9.02137E-05	7.80816E-05	0.173030	0.173030		0.183319	7.80816E-05	0.188349		0.183319
2-Methylhexane			0	2.93394	2.10591	1.88854	1.88854	1.02901E-06	1.37568E-08	2.26976	2.26976		2.41499	1.37568E-08	2.48965		2.41499
3-Methylhexane			0	2.42595	1.76965	1.58959	1.58959	8.61264E-07	1.20009E-08	1.91088	1.91088		2.03346	1.20009E-08	2.09661		2.03346
n-Heptane			0	5.21590	4.06263	3.65107	3.65107	1.64908E-06	2.37001E-08	4.39284	4.39284		4.67762	2.37001E-08	4.82541		4.67762
Methylcyclohexane			0	3.40193	2.66335	2.40621	2.40621	6.30314E-06	4.92566E-07	2.89512	2.89512		3.08278	4.92566E-07	3.18019		3.08278
Toluene			0	0.817984	0.676688	0.612700	0.612700	8.37386E-05	7.04800E-05	0.737670	0.737670		0.785863	7.04800E-05	0.811014		0.785863
n-Octane			0	11.4428	10.9986	9.97606	9.97606	8.53106E-07	7.73119E-09	12.0308	12.0308		12.8322	7.73119E-09	13.2559		12.8322
Ethylbenzene			0	0.656987	0.643805	0.586720	0.586720	2.42053E-05	2.01030E-05	0.707684	0.707684		0.754913	2.01030E-05	0.779919		0.754913
p-Xylene			0	0.876982	0.868909	0.792575	0.792575	2.70722E-05	2.22735E-05	0.956083	0.956083		1.01997	2.22735E-05	1.05382		1.01997
o-Xylene			0	1.00698	1.01108	0.923941	0.923941	3.92782E-05	3.42463E-05	1.11469	1.11469		1.18928	3.42463E-05	1.22884		1.18928
n-Nonane			0	6.27887	6.52494	5.98444	5.98444	2.56455E-07	3.71704E-09	7.22233	7.22233		7.70737	3.71704E-09	7.96529		7.70737
C10+			0	13.3397	14.3887	13.3298	13.3298	2.33406E-07	2.10613E-08	16.0924	16.0924		17.1769	2.10613E-08	17.7551		17.1769
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water			4573.37	0	0.121552	0	0.177909	4534.79	4534.73	0.0463532	0		0.0136225	0	0		0
H2S			0	0	0	0	0	0	0	0	0		0	0	0		0
Nitrogen			0	0.0979631	0.0444956	0	0.0716231	0.00677540	0.000152051	0.00189098	0		5.47485E-05	0	0		0
CO2			0	0.0828918	0.144555	0	0.200968	0.0742946	0.0365053	0.0467562	0		0.0122739	0	0		0
Methane			0	29.0234	20.0044	0	30.2826	1.80778	0.0814435	2.45213	0		0.221458	0	0		0
Ethane			0	29.8260	23.0715	0	31.1287	0.335895	0.0176506	11.3424	0		4.58170	0	0		0
Propane			0	28.6165	25.4840	0	31.5234	0.103868	0.00613178	21.4640	0		15.5254	0	0		0
Isobutene			0	7.71271	9.08758	0	10.4221	0.0393744	0.00709628	9.03070	0		8.04880	0	0		0
n-Butane			0	22.4448	22.8986	0	25.8851	0.0168145	0.000760232	23.0026	0		20.9379	0	0		0
Isopentane			0	12.2944	14.2910	0	15.1278	0.00261353	8.32456E-05	14.4232	0		13.9030	0	0		0
n-Pentane			0	17.1699	18.8917	0	19.6452	0.00248939	7.76930E-05	18.9553	0		18.4457	0	0		0
2-Methylpentane			0	10.0299	3.76354	0	3.75277	9.04265E-05	1.36151E-06	3.69770	0		3.65718	0	0		0
3-Methylpentane			0	7.18521	2.89041	0	2.87308	0.000171196	6.88062E-06	2.83534	0		2.80761	0	0		0
n-Hexane			0	24.8939	46.1001	0	45.3971	0.000623217	7.50545E-06	44.9184	0		44.5687	0	0		0
Methylcyclopentane			0	3.88461	1.82890	0	1.81091	0.000268674	3.08827E-05	1.79268	0		1.77932	0	0		0
Benzene			0	1.16802	0.548683	0	0.543872	0.00409317	0.00354091	0.538385	0		0.534376	0	0		0
2-Methylhexane			0	11.0548	7.33851	0	7.09418	4.66884E-05	6.23855E-07	7.06238	0		7.03973	0	0		0
3-Methylhexane			0	9.14071	6.16673	0	5.97119	3.90772E-05	5.44229E-07	5.94572	0		5.92757	0	0		0
n-Heptane			0	19.6529	14.1571	0	13.7150	7.48218E-05	1.07477E-06	13.6684	0		13.6353	0	0		0
Methylcyclohexane			0	12.8181	9.28105	0	9.03878	0.000285986	2.23373E-05	9.00818	0		8.98636	0	0		0
Toluene			0	3.08207	2.35807	0	2.30156	0.00379938	0.00319619	2.29527	0		2.29080	0	0		0
n-Octane			0	43.1151	38.3271	0	37.4744	3.87071E-05	3.50601E-07	37.4338	0		37.4060	0	0		0
Ethylbenzene			0	2.47545	2.24349	0	2.20397	0.00109824	0.000911648	2.20196	0		2.20058	0	0		0
p-Xylene			0	3.30437	3.02791	0	2.97725	0.00122832	0.00101008	2.97486	0		2.97322	0	0		0

o-Xylene			0	3.79419	3.52334	0	3.47072	0.00178213	0.00155303	3.46837	0		3.46676	0	0		0
n-Nonane			0	23.6581	22.7376	0	22.4801	1.16359E-05	1.68564E-07	22.4723	0		22.4671	0	0		0
C10+			0	50.2626	50.1408	0	50.0727	1.05901E-05	9.55105E-07	50.0716	0		50.0710	0	0		0
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water			100	0	0.00696116	0.00996627	0.00996627	99.9364	99.9937	0.00276099	0.00276099		0.000833584	99.9937	0.000310005		0.000833584
H2S			0	0	0	0	0	0	0	0	0		0	0	0		0
Nitrogen			0	0.00824733	0.00396243	0.00623897	0.00623897	0.000232181	5.21357E-06	0.000175145	0.000175145		5.20941E-06	5.21357E-06	2.17703E-07		5.20941E-06
CO2			0	0.0109634	0.0202235	0.0275022	0.0275022	0.00399972	0.00196645	0.00680346	0.00680346		0.00183476	0.00196645	0.000613217		0.00183476
Methane			0	1.39928	1.02018	1.51063	1.51063	0.0354767	0.00159922	0.130065	0.130065		0.0120674	0.00159922	0.00150703		0.0120674
Ethane			0	2.69525	2.20533	2.91055	2.91055	0.0123552	0.000649620	1.12764	1.12764		0.467947	0.000649620	0.228282		0.467947
Propane			0	3.79225	3.57225	4.32238	4.32238	0.00560275	0.000330950	3.12932	3.12932		2.32534	0.000330950	1.83363		2.32534
Isobutene			0	1.30048	1.62083	1.81828	1.81828	0.00270241	0.000487330	1.67524	1.67524		1.53389	0.000487330	1.42410		1.53389
n-Butane			0	3.92052	4.23087	4.67829	4.67829	0.00119550	5.40840E-05	4.42042	4.42042		4.13357	5.40840E-05	3.90084		4.13357
Isopentane			0	2.66576	3.27770	3.39390	3.39390	0.000230665	7.35141E-06	3.44060	3.44060		3.40712	7.35141E-06	3.36142		3.40712
n-Pentane			0	3.72291	4.33291	4.40738	4.40738	0.000219709	6.86107E-06	4.52172	4.52172		4.52038	6.86107E-06	4.49272		4.52038
2-Methylpentane			0	2.59756	1.03100	1.00561	1.00561	9.53245E-06	1.43610E-07	1.05356	1.05356		1.07048	1.43610E-07	1.07757		1.07048
3-Methylpentane			0	1.86084	0.791810	0.769884	0.769884	1.80469E-05	7.25757E-07	0.807853	0.807853		0.821808	7.25757E-07	0.828028		0.821808
n-Hexane			0	6.44706	12.6288	12.1648	12.1648	6.56974E-05	7.91663E-07	12.7983	12.7983		13.0456	7.91663E-07	13.1652		13.0456
Methylcyclopentane			0	0.982508	0.489295	0.473908	0.473908	2.76601E-05	3.18126E-06	0.498828	0.498828		0.508637	3.18126E-06	0.513450		0.508637
Benzene			0	0.274191	0.136244	0.132102	0.132102	0.000391113	0.000338542	0.139045	0.139045		0.141780	0.000338542	0.143126		0.141780
2-Methylhexane			0	3.32897	2.33756	2.21041	2.21041	5.72283E-06	7.65140E-08	2.33976	2.33976		2.39598	7.65140E-08	2.42690		2.39598
3-Methylhexane			0	2.75259	1.96431	1.86051	1.86051	4.78989E-06	6.67481E-08	1.96981	1.96981		2.01745	6.67481E-08	2.04376		2.01745
n-Heptane			0	5.91818	4.50952	4.27333	4.27333	9.17128E-06	1.31817E-07	4.52831	4.52831		4.64079	1.31817E-07	4.70378		4.64079
Methylcyclohexane			0	3.78232	2.89685	2.75965	2.75965	3.43495E-05	2.68449E-06	2.92436	2.92436		2.99698	2.68449E-06	3.03766		2.99698
Toluene			0	0.853431	0.690679	0.659414	0.659414	0.000428232	0.000360457	0.699226	0.699226		0.716932	0.000360457	0.726952		0.716932
n-Octane			0	14.8009	13.9174	13.3108	13.3108	5.40867E-06	4.90194E-08	14.1378	14.1378		14.5133	4.90194E-08	14.7306		14.5133
Ethylbenzene			0	0.789807	0.757153	0.727582	0.727582	0.000142628	0.000118465	0.772922	0.772922		0.793541	0.000118465	0.805503		0.793541
p-Xylene			0	1.05428	1.02189	0.982860	0.982860	0.000159521	0.000131256	1.04422	1.04422		1.07216	0.000131256	1.08839		1.07216
o-Xylene			0	1.21056	1.18909	1.14576	1.14576	0.000231444	0.000201810	1.21745	1.21745		1.25013	0.000201810	1.26915		1.25013
n-Nonane			0	9.11883	9.27040	8.96537	8.96537	1.82557E-06	2.64618E-08	9.52943	9.52943		9.78750	2.64618E-08	9.93832		9.78750
C10+			0	24.7123	26.0767	25.4729	25.4729	2.11938E-06	1.91256E-07	27.0844	27.0844		27.8240	1.91256E-07	28.2582		27.8240
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
Water			82390.6	0	2.18979	0	3.20507	81695.5	81694.3	0.835066	0		0.245414	0	0		0
H2S			0	0	0	0	0	0	0	0	0		0	0	0		0
Nitrogen			0	2.74428	1.24647	0	2.00641	0.189802	0.00425946	0.0529729	0		0.00153369	0	0		0
CO2			0	3.64803	6.36178	0	8.84449	3.26967	1.60658	2.05772	0		0.540168	0	0		0
Methane			0	465.607	320.920	0	485.808	29.0013	1.30655	39.3382	0		3.55273	0	0		0
Ethane			0	896.839	693.737	0	936.011	10.1000	0.530736	341.056	0		137.767	0	0		0
Propane			0	1261.86	1123.73	0	1390.05	4.58011	0.270385	946.467	0		684.600	0	0		0
Isobutene			0	432.732	509.871	0	584.746	2.20916	0.398146	506.680	0		451.589	0	0		0
n-Butane			0	1304.54	1330.92	0	1504.50	0.977294	0.0441864	1336.96	0		1216.96	0	0		0
Isopentane			0	887.023	1031.08	0	1091.45	0.188563	0.00600607	1040.61	0		1003.08	0	0		0
n-Pentane			0	1238.79	1363.01	0	1417.38	0.179606	0.00560545	1367.60	0		1330.84	0	0		0
2-Methylpentane			0	864.331	324.324	0	323.396	0.00779253	0.000117329	318.650	0		315.159	0	0		0
3-Methylpentane			0	619.188	249.082	0	247.589	0.0147529	0.000592940	244.336	0		241.947	0	0		0
n-Hexane			0	2145.24	3972.69	0	3912.11	0.0537059	0.000646785	3870.86	0		3840.72	0	0		0
Methylcyclopentane			0	326.927	153.919	0	152.405	0.0226115	0.00259907	150.871	0		149.747	0	0		0
Benzene			0	91.2363	42.8586	0	42.4828	0.319725	0.276587	42.0543	0		41.7411	0	0		0
2-Methylhexane			0	1107.71	735.333	0	710.850	0.00467826	6.25115E-05	707.664	0		705.395	0	0		0
3-Methylhexane			0	915.917	617.919	0	598.324	0.00391561	5.45328E-05	595.773	0		593.954	0	0		0
n-Heptane			0	1969.26	1418.57	0	1374.27	0.00749728	0.000107694	1369.60	0		1366.29	0	0		0
Methylcyclohexane			0	1258.56	911.270	0	887.482	0.0280798	0.00219321	884.477	0		882.335	0	0		0
Toluene			0	283.977	217.269	0	212.062	0.350069	0.294492	211.482	0		211.071	0	0		0
n-Octane			0	4924.97	4378.05	0	4280.64	0.00442145	4.00486E-05	4276.01	0		4272.83	0	0		0
Ethylbenzene			0	262.806	238.180	0	233.985	0.116595	0.0967851	233.772	0		233.625	0	0		0
p-Xylene			0	350.808	321.458	0	316.080	0.130405	0.107235	315.826	0		315.652	0	0		0
o-Xylene			0	402.810	374.056	0	368.469	0.189199	0.164878	368.219	0		368.048	0	0		0
n-Nonane			0	3034.27	2916.22	0	2883.19	0.00149236	2.16191E-05	2882.19	0		2881.52	0	0		0
C10+			0	8222.96	8203.03	0	8191.89	0.00173254	0.000156255	8191.72	0		8191.62	0	0		0

Process Streams		**Separator Gas**	**Separator Water**	**Separator Oil**	**1**	**as from 3-ph Separat**	**Produced Liquid**	**2**	**Produced Water**	**3**	**n Gas from LP Conde**	**To Sales Gas Line**	**Condensate from VRT**	**g from produced wat**	**lashing from Oil Tan**	**o Enclosed Combust**	**Flash Gas from VRT**
Phase: Light Liquid	**Status**	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	**Units**																
Temperature	°F		67.0	67.0	58.1	70.0	70.0	70.0	72.5	70.0	70.0		65	72.52	72.52		65

Pressure	psig		200	300	200	302	302	302	-0.365949	40	40		5	-0.365949	-0.365949		5
Mole Fraction Vapor	%		0	0	0	0	0	0	0	0	0		0	0	0		0
Mole Fraction Light Liquid	%		100	100	100	100	100	100	100	100	100		100	100	100		100
Mole Fraction Heavy Liquid	%		0	0	0	0	0	0	0	0	0		0	0	0		0
Molecular Weight	lb/lbmol		18.0	88.3	90.3	85.6	85.6	18.0	18.0	97.2	97.2		100.997	18.0158	102.793		100.997
Mass Density	lb/ft^3		62.3	43.2	43.6	42.7	42.7	62.3	62.3	43.9	43.9		44.3847	62.2507	44.3222		44.3847
Molar Flow	lbmol/h		4573.4	376.8	348.5	0.0	375.6	4537.2	4534.9	311.2	0.0		291.501	0	0		0
Mass Flow	lb/h		82390.6	33274.8	31457.3	0.0	32159.2	81747.4	81699.5	30245.2	0.0		29440.8	0	0		0
Vapor Volumetric Flow	MCFH		1.3	0.8	0.7	0.0	0.8	1.3	1.3	0.7	0.0		0.663310	0	0		0
Liquid Volumetric Flow	Mbbl/d		5.7	3.3	3.1	0.0	3.2	5.6	5.6	2.9	0.0		2.83537	0	0		0
Std Vapor Volumetric Flow	MMSCFD		41.7	3.4	3.2	0.0	3.4	41.3	41.3	2.8	0.0		2.65489	0	0		0
Std Liquid Volumetric Flow	Mbbl/d		5.6	3.4	3.2	0.0	3.3	5.6	5.6	3.0	0.0		2.86024	0	0		0
Compressibility			0.011	0.114	0.080	0.112	0.112	0.016	0.001	0.021	0.021		0.00795981	0.000726147	0.00581912		0.00795981
Specific Gravity			0.999	0.693	0.699	0.684	0.684	0.998	0.998	0.704	0.704		0.711646	0.998102	0.710645		0.711646
API Gravity			10.0	71.6	71.2	73.7	73.7	10.1	10.0	68.2	68.2		66.6486	10.0153	65.9121		66.6486
Enthalpy	MMBtu/h		-562.8	-29.8	-28.3	0.0	-29.1	-557.9	-557.7	-26.4	0.0		-25.5500	0	0		0
Mass Enthalpy	Btu/lb		-6830.9	-897.0	-898.4	-905.3	-905.3	-6824.5	-6825.7	-873.7	-873.7		-867.844	-6825.69	-860.639		-867.844
Mass Cp	Btu/(lb*°F)		1.0	0.5	0.5	0.5	0.5	1.0	1.0	0.5	0.5		0.485385	0.982959	0.488835		0.485385
Ideal Gas CpCv Ratio			1.326	1.064	1.063	1.065	1.065	1.326	1.326	1.058	1.058		1.05596	1.32572	1.05428		1.05596
Dynamic Viscosity	cP		1.0	0.4	0.4	0.3	0.3	1.0	1.0	0.4	0.4		0.456623	0.964475	0.450577		0.456623
Kinematic Viscosity	cSt		1.0	0.5	0.6	0.5	0.5	1.0	1.0	0.6	0.6		0.642250	0.967223	0.634640		0.642250
Thermal Conductivity	Btu/(h*ft*°F)		0.3	0.1	0.1	0.1	0.1	0.3	0.3	0.1	0.1		0.0694719	0.348212	0.0690591		0.0694719
Surface Tension	lbf/ft		0.005	0.001	0.001	0.001	0.001	0.005	0.005	0.001	0.001		0.00145908	0.00502316	0.00144977		0.00145908
Net I.G. Heating Value	Btu/ft^3		0.0	4465.8	4564.1	4335.0	4335.0	0.6	0.0	4905.4	4905.4		5091.32	0.0405652	5179.11		5091.32
Net Liquid Heating Value	Btu/lb		-1059.8	19010.6	19013.0	19043.9	19043.9	-1046.7	-1058.8	18975.7	18975.7		18954.5	-1058.84	18944.2		18954.5
Gross I.G. Heating Value	Btu/ft^3		50.3	4805.4	4910.6	4666.3	4666.3	50.9	50.4	5274.7	5274.7		5472.89	50.3523	5566.45		5472.89
Gross Liquid Heating Value	Btu/lb		0.0	20468.1	20468.4	20510.8	20510.8	13.6	0.9	20416.1	20416.1		20386.8	0.922009	20372.8		20386.8

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VRT	g from produced wat	lashing from Oil Tank	o Enclosed Combust	Flash Gas from VRT
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Water					99.9589	99.9470	99.9470										
H2S					0	0	0										
Nitrogen					0.000109953	0.000149330	0.000149330										
CO2					0.00132948	0.00163746	0.00163746										
Methane					0.0299658	0.0398437	0.0398437										
Ethane					0.00599920	0.00740314	0.00740314										
Propane					0.00209805	0.00228925	0.00228925										
Isobutene					0.000846701	0.000867815	0.000867815										
n-Butane					0.000333944	0.000370592	0.000370592										
Isopentane					5.66103E-05	5.76023E-05	5.76023E-05										
n-Pentane					5.16772E-05	5.48662E-05	5.48662E-05										
2-Methylpentane					1.87656E-06	1.99300E-06	1.99300E-06										
3-Methylpentane					3.67092E-06	3.77317E-06	3.77317E-06										
n-Hexane					1.30353E-05	1.37357E-05	1.37357E-05										
Methylcyclopentane					6.41138E-06	5.92159E-06	5.92159E-06										
Benzene					9.27967E-05	9.02137E-05	9.02137E-05										
2-Methylhexane					1.12186E-06	1.02901E-06	1.02901E-06										
3-Methylhexane					9.29349E-07	8.61264E-07	8.61264E-07										
n-Heptane					1.94691E-06	1.64908E-06	1.64908E-06										
Methylcyclohexane					6.30692E-06	6.30314E-06	6.30314E-06										
Toluene					8.31949E-05	8.37386E-05	8.37386E-05										
n-Octane					7.89961E-07	8.53106E-07	8.53106E-07										
Ethylbenzene					2.46515E-05	2.42053E-05	2.42053E-05										
p-Xylene					2.67331E-05	2.70722E-05	2.70722E-05										
o-Xylene					3.80716E-05	3.92782E-05	3.92782E-05										
n-Nonane					2.36234E-07	2.56455E-07	2.56455E-07										
C10+					2.10327E-07	2.33406E-07	2.33406E-07										
Molar Flow		lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
Water					4536.84	0	0										
H2S					0	0	0										
Nitrogen					0.00499044	0	0										
CO2					0.0603410	0	0										
Methane					1.36006	0	0										

Ethane					0.272286	0	0										
Propane					0.0952244	0	0										
Isobutene					0.0384293	0	0										
n-Butane					0.0151567	0	0										
Isopentane					0.00256937	0	0										
n-Pentane					0.00234548	0	0										
2-Methylpentane					8.51715E-05	0	0										
3-Methylpentane					0.000166612	0	0										
n-Hexane					0.000591634	0	0										
Methylcyclopentane					0.000290994	0	0										
Benzene					0.00421177	0	0										
2-Methylhexane					5.09179E-05	0	0										
3-Methylhexane					4.21804E-05	0	0										
n-Heptane					8.83646E-05	0	0										
Methylcyclohexane					0.000286253	0	0										
Toluene					0.00377597	0	0										
n-Octane					3.58540E-05	0	0										
Ethylbenzene					0.00111886	0	0										
p-Xylene					0.00121334	0	0										
o-Xylene					0.00172796	0	0										
n-Nonane					1.07220E-05	0	0										
C10+					9.54615E-06	0	0										
Mass Fraction		**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Water					99.9491	99.9364	99.9364										
H2S					0	0	0										
Nitrogen					0.000170958	0.000232181	0.000232181										
CO2					0.00324745	0.00399972	0.00399972										
Methane					0.0266817	0.0354767	0.0354767										
Ethane					0.0100122	0.0123552	0.0123552										
Propane					0.00513485	0.00560275	0.00560275										
Isobutene					0.00263669	0.00270241	0.00270241										
n-Butane					0.00107729	0.00119550	0.00119550										
Isopentane					0.000226694	0.000230665	0.000230665										
n-Pentane					0.000206940	0.000219709	0.000219709										
2-Methylpentane					8.97557E-06	9.53245E-06	9.53245E-06										
3-Methylpentane					1.75580E-05	1.80469E-05	1.80469E-05										
n-Hexane					6.23477E-05	6.56974E-05	6.56974E-05										
Methylcyclopentane					2.99482E-05	2.76601E-05	2.76601E-05										
Benzene					0.000402314	0.000391113	0.000391113										
2-Methylhexane					6.23923E-06	5.72283E-06	5.72283E-06										
3-Methylhexane					5.16858E-06	4.78989E-06	4.78989E-06										
n-Heptane					1.08278E-05	9.17128E-06	9.17128E-06										
Methylcyclohexane					3.43703E-05	3.43495E-05	3.43495E-05										
Toluene					0.000425455	0.000428232	0.000428232										
n-Octane					5.00837E-06	5.40867E-06	5.40867E-06										
Ethylbenzene					0.000145259	0.000142628	0.000142628										
p-Xylene					0.000157524	0.000159521	0.000159521										
o-Xylene					0.000224336	0.000231444	0.000231444										
n-Nonane					1.68164E-06	1.82557E-06	1.82557E-06										
C10+					1.90983E-06	2.11938E-06	2.11938E-06										
Mass Flow		**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**	**lb/h**
Water					81732.5	0	0										
H2S					0	0	0										
Nitrogen					0.139799	0	0										
CO2					2.65558	0	0										
Methane					21.8187	0	0										
Ethane					8.18738	0	0										
Propane					4.19898	0	0										
Isobutene					2.15613	0	0										
n-Butane					0.880943	0	0										
Isopentane					0.185377	0	0										
n-Pentane					0.169223	0	0										
2-Methylpentane					0.00733969	0	0										
3-Methylpentane					0.0143579	0	0										

n-Hexane					0.0509843	0	0										
Methylcyclopentane					0.0244899	0	0										
Benzene					0.328989	0	0										
2-Methylhexane					0.00510207	0	0										
3-Methylhexane					0.00422656	0	0										
n-Heptane					0.00885431	0	0										
Methylcyclohexane					0.0281060	0	0										
Toluene					0.347912	0	0										
n-Octane					0.00409555	0	0										
Ethylbenzene					0.118784	0	0										
p-Xylene					0.128814	0	0										
o-Xylene					0.183449	0	0										
n-Nonane					0.00137515	0	0										
C10+					0.00156175	0	0										

Process Streams		Separator Gas	Separator Water	Separator Oil	1	as from 3-ph Separat	Produced Liquid	2	Produced Water	3	h Gas from LP Conde	To Sales Gas Line	Condensate from VR	g from produced wat	lashing from Oil Tan	o Enclosed Combust	Flash Gas from VRT
Phase: Heavy Liquid	Status	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Property	Units																
Temperature	°F				58.1	70.0	70.0										
Pressure	psig				200	302	302										
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				62.4	62.3	62.3										
Molar Flow	lbmol/h				4538.7	0.0	0.0										
Mass Flow	lb/h				81774.1	0.0	0.0										
Vapor Volumetric Flow	MCFH				1.3	0.0	0.0										
Liquid Volumetric Flow	Mbbl/d				5.6	0.0	0.0										
Std Vapor Volumetric Flow	MMSCFD				41.3	0.0	0.0										
Std Liquid Volumetric Flow	Mbbl/d				5.6	0.0	0.0										
Compressibility					0.011	0.016	0.016										
Specific Gravity					1.000	0.998	0.998										
API Gravity					10.1	10.1	10.1										
Enthalpy	MMBtu/h				-559.1	0.0	0.0										
Mass Enthalpy	Btu/lb				-6837.1	-6824.5	-6824.5										
Mass Cp	Btu/(lb*°F)				1.0	1.0	1.0										
Ideal Gas CpCv Ratio					1.326	1.326	1.326										
Dynamic Viscosity	cP				1.2	1.0	1.0										
Kinematic Viscosity	cSt				1.2	1.0	1.0										
Thermal Conductivity	Btu/(h*ft*°F)				0.3	0.3	0.3										
Surface Tension	lbf/ft				0.005	0.005	0.005										
Net I.G. Heating Value	Btu/ft^3				0.5	0.6	0.6										
Net Liquid Heating Value	Btu/lb				-1049.4	-1046.7	-1046.7										
Gross I.G. Heating Value	Btu/ft^3				50.8	50.9	50.9										
Gross Liquid Heating Value	Btu/lb				10.8	13.6	13.6										

October 7, 2013

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

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

Sample: Seaborne No. 1H (Vogt Pad well sample)
Separator Hydrocarbon Liquid
Sampled @ 320 psig & 72 °F

Date Sampled: 09/20/13 Job Number: 35820.002

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2186-M

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.026	0.007	0.008
Carbon Dioxide	0.022	0.009	0.011
Methane	7.703	3.192	1.406
Ethane	7.916	5.177	2.708
Propane	7.595	5.117	3.810
Isobutane	2.047	1.638	1.353
n-Butane	5.957	4.593	3.939
2,2 Dimethylpropane	0.080	0.075	0.066
Isopentane	3.263	2.918	2.678
n-Pentane	4.477	3.969	3.675
2,2 Dimethylbutane	0.231	0.236	0.226
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.514	0.515	0.504
2 Methylpentane	2.662	2.702	2.610
3 Methylpentane	1.907	1.904	1.870
n-Hexane	4.853	4.880	4.758
Heptanes Plus	50.748	63.069	70.379
Totals:	100.000	100.000	100.000

Characteristics of Heptanes Plus:

Specific Gravity	0.7601	(Water=1)
°API Gravity	54.66	@ 60°F
Molecular Weight	121.9	
Vapor Volume	19.79	CF/Gal
Weight	6.33	Lbs/Gal

Characteristics of Total Sample:

Specific Gravity	0.6812	(Water=1)
°API Gravity	76.24	@ 60°F
Molecular Weight	87.9	
Vapor Volume	24.60	CF/Gal
Weight	5.68	Lbs/Gal

Base Conditions: 14.850 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: XG
Processor: JCdjv
Cylinder ID: W-1016

David Dannhaus 361-661-7015

TANKS DATA INPUT REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Carbon Dioxide	0.022	0.009	0.011
Nitrogen	0.026	0.007	0.008
Methane	7.703	3.192	1.406
Ethane	7.916	5.177	2.708
Propane	7.595	5.117	3.810
Isobutane	2.047	1.638	1.353
n-Butane	6.037	4.668	4.005
Isopentane	3.263	2.918	2.678
n-Pentane	4.477	3.969	3.675
Other C-6's	5.314	5.356	5.209
Heptanes	12.616	13.622	14.000
Octanes	14.845	16.794	18.294
Nonanes	6.279	8.213	9.061
Decanes Plus	13.338	21.169	24.822
Benzene	0.310	0.212	0.276
Toluene	0.818	0.670	0.858
E-Benzene	0.657	0.620	0.794
Xylenes	1.883	1.768	2.275
n-Hexane	4.853	4.880	4.758
2,2,4 Trimethylpentane	0.000	0.000	0.000
Totals:	100.000	100.000	100.000

Characteristics of Total Sample:

Specific Gravity	0.6812	(Water=1)
°API Gravity	76.24	@ 60°F
Molecular Weight	87.9	
Vapor Volume	24.60	CF/Gal
Weight	5.68	Lbs/Gal

Characteristics of Decanes (C10) Plus:

Specific Gravity	0.7987	(Water=1)
Molecular Weight	163.6	

Characteristics of Atmospheric Sample:

°API Gravity	63.19	@ 60°F
Reid Vapor Pressure (ASTM D-5191)	4.45	psi

QUALITY CONTROL CHECK			
	Sampling Conditions	Test Samples	
Cylinder Number	------	W-1016*	T-3025
Pressure, PSIG	320	302	301
Temperature, °F	72	70	70

* Sample used for analysis

TOTAL EXTENDED REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.026	0.007	0.008
Carbon Dioxide	0.022	0.009	0.011
Methane	7.703	3.192	1.406
Ethane	7.916	5.177	2.708
Propane	7.595	5.117	3.810
Isobutane	2.047	1.638	1.353
n-Butane	5.957	4.593	3.939
2,2 Dimethylpropane	0.080	0.075	0.066
Isopentane	3.263	2.918	2.678
n-Pentane	4.477	3.969	3.675
2,2 Dimethylbutane	0.231	0.236	0.226
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.514	0.515	0.504
2 Methylpentane	2.662	2.702	2.610
3 Methylpentane	1.907	1.904	1.870
n-Hexane	4.853	4.880	4.758
Methylcyclopentane	1.031	0.892	0.987
Benzene	0.310	0.212	0.276
Cyclohexane	1.009	0.840	0.966
2-Methylhexane	2.934	3.336	3.345
3-Methylhexane	2.426	2.723	2.765
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	0.828	0.881	0.935
n-Heptane	4.388	4.950	5.002
Methylcyclohexane	3.402	3.344	3.800
Toluene	0.818	0.670	0.858
Other C-8's	8.240	9.437	10.332
n-Octane	3.203	4.013	4.162
E-Benzene	0.657	0.620	0.794
M & P Xylenes	0.877	0.832	1.059
O-Xylene	1.007	0.936	1.216
Other C-9's	4.414	5.647	6.340
n-Nonane	1.865	2.566	2.721
Other C-10's	3.956	5.561	6.358
n-decane	1.123	1.685	1.817
Undecanes(11)	3.018	4.353	5.047
Dodecanes(12)	1.740	2.710	3.186
Tridecanes(13)	1.212	2.024	2.412
Tetradecanes(14)	0.714	1.277	1.543
Pentadecanes(15)	0.441	0.846	1.034
Hexadecanes(16)	0.286	0.585	0.722
Heptadecanes(17)	0.207	0.449	0.559
Octadecanes(18)	0.165	0.377	0.471
Nonadecanes(19)	0.114	0.271	0.342
Eicosanes(20)	0.081	0.201	0.255
Heneicosanes(21)	0.065	0.168	0.214
Docosanes(22)	0.051	0.137	0.175
Tricosanes(23)	0.036	0.102	0.131
Tetracosanes(24)	0.030	0.088	0.114
Pentacosanes(25)	0.022	0.066	0.086
Hexacosanes(26)	0.020	0.064	0.083
Heptacosanes(27)	0.017	0.055	0.072
Octacosanes(28)	0.012	0.039	0.051
Nonacosanes(29)	0.010	0.033	0.044
Triacontanes(30)	0.006	0.020	0.027
Hentriacontanes Plus(31+)	0.014	0.059	0.080
Total	100.000	100.000	100.000

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

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

Date Sampled: 09/20/13

Date Analyzed: 10/02/13

Sample: Seaborne No. 1H (Vogt Pad well sample)

Job Number: J35820

FLASH LIBERATION OF HYDROCARBON LIQUID		
	Separator HC Liquid	**Stock Tank**
Pressure, psig	320	0
Temperature, °F	72	70
Gas Oil Ratio (1)	------	327
Gas Specific Gravity (2)	------	1.303
Separator Volume Factor (3)	1.1969	1.000

STOCK TANK FLUID PROPERTIES	
Shrinkage Recovery Factor (4)	0.8355
Oil API Gravity at 60 °F	63.19
Reid Vapor Pressure, psi (5)	4.45

Quality Control Check			
	Sampling Conditions	**Test Samples**	
Cylinder No.	------	W-1016*	T-3025
Pressure, psig	320	302	301
Temperature, °F	72	70	70

(1) - Scf of flashed vapor per barrel of stock tank oil
(2) - Air = 1.000
(3) - Separator volume / Stock tank volume
(4) - Fraction of first stage separator liquid
(5) - Absolute pressure at 100 deg F
Analyst: M. G.
* Sample used for flash study
Base Conditions: 14.85 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

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

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

Sample: Seaborne No. 1H (Vogt Pad well sample)
Gas Evolved from Hydrocarbon Liquid Flashed
From 320 psig & 72 °F to 0 psig & 70 °F

Date Sampled: 09/20/13 Job Number: 35820.001

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.084	
Carbon Dioxide	0.109	
Methane	28.979	
Ethane	27.515	7.417
Propane	21.197	5.886
Isobutane	3.988	1.315
n-Butane	9.085	2.887
2-2 Dimethylpropane	0.097	0.037
Isopentane	2.547	0.939
n-Pentane	2.631	0.961
Hexanes	2.134	0.886
Heptanes Plus	1.634	0.724
Totals	100.000	21.052

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity	3.558	(Air=1)
Molecular Weight	101.68	
Gross Heating Value	5428	BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity	1.303	(Air=1)
Compressibility (Z)	0.9868	
Molecular Weight	37.25	
Gross Heating Value		
Dry Basis	2191	BTU/CF
Saturated Basis	2153	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: 14.850 PSI & 60 Deg F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: MR
Processor: ANB
Cylinder ID: FL# 9 S

David Dannhaus 361-661-7015

CHROMATOGRAPH EXTENDED ANALYSIS
TOTAL REPORT

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.084		0.063
Carbon Dioxide	0.109		0.129
Methane	28.979		12.483
Ethane	27.515	7.417	22.213
Propane	21.197	5.886	25.095
Isobutane	3.988	1.315	6.223
n-Butane	9.085	2.887	14.177
2,2 Dimethylpropane	0.097	0.037	0.188
Isopentane	2.547	0.939	4.934
n-Pentane	2.631	0.961	5.097
2,2 Dimethylbutane	0.081	0.034	0.187
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.128	0.053	0.296
2 Methylpentane	0.661	0.277	1.529
3 Methylpentane	0.408	0.168	0.944
n-Hexane	0.856	0.355	1.981
Methylcyclopentane	0.072	0.025	0.163
Benzene	0.024	0.007	0.050
Cyclohexane	0.109	0.037	0.246
2-Methylhexane	0.178	0.083	0.479
3-Methylhexane	0.178	0.082	0.479
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.179	0.079	0.477
n-Heptane	0.248	0.115	0.667
Methylcyclohexane	0.177	0.072	0.467
Toluene	0.039	0.013	0.096
Other C8's	0.232	0.109	0.687
n-Octane	0.065	0.034	0.199
Ethylbenzene	0.002	0.001	0.006
M & P Xylenes	0.018	0.007	0.051
O-Xylene	0.002	0.001	0.006
Other C9's	0.070	0.036	0.237
n-Nonane	0.014	0.008	0.048
Other C10's	0.021	0.012	0.080
n-Decane	0.004	0.002	0.015
Undecanes (11)	0.002	0.001	0.008
Totals	100.000	21.052	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity	1.303	(Air=1)
Compressibility (Z)	0.9868	
Molecular Weight	37.25	

Gross Heating Value

Dry Basis	2191	BTU/CF
Saturated Basis	2153	BTU/CF

Antero Resources
Seaborn Unit 1H - Vogt Pad

Tag Name	Value	Units	Timestamp
Accumulated Gas Flow	683627.1	MCF	12/5/2013 08:05:40
Casing Pressure	352.52	PSIA	12/5/2013 08:05:48
Current Day Gas Flow	49.19	MCF	12/5/2013 08:05:40
Differential Pressure	38.91	inH2O	12/5/2013 08:05:40
Flow Rate	6834.16	MCF Per Day	12/5/2013 08:05:40
Pressure	135.66	PSIA	12/5/2013 08:05:40
Previous Day Energy	8199.34	MBTU	12/5/2013 08:05:41
Previous Day Gas Flow	6726.57	MCF	12/5/2013 08:05:41
Temperature	68.72	F	12/5/2013 08:05:40
Tubing Pressure	606.04	PSIA	12/5/2013 08:05:48
Daily AP	37.24	PSIA	12/5/2013 09:00:00
Daily DP	137.62	inH2O	12/5/2013 09:00:00
Daily Energy	8199.34	MBTU	12/5/2013 09:00:00
Daily Flow	6726.57	MCF	12/5/2013 09:00:00
Daily Tf	68.49	F	12/5/2013 09:00:00
Hourly AP	134.4	PSIA	12/5/2013 09:00:00
Hourly DP	37.66	Inches	12/5/2013 09:00:00
Hourly Energy	339.8	MBTU	12/5/2013 09:00:00
Hourly Flow Time	3600	Seconds	12/5/2013 09:00:00
Hourly Tf	68.6	F	12/5/2013 09:00:00
Hourly Volume	278.8	MCF	12/5/2013 09:00:00
Audited Accumulated Gas Volume		MCF	
Audited Casing Pressure	383	PSI	12/2/2013 09:00:00
Audited Gas Volume	6544.49	MCF	12/2/2013 09:00:00
Audited Oil Volume	0	Barrels	12/2/2013 09:00:00
Audited Tubing Pressure	627	PSI	12/2/2013 09:00:00
Audited Water Volume	0	Barrels	12/2/2013 09:00:00
Argon	0	%	12/5/2013 08:05:47
BTU	1218.948	BTU	12/5/2013 08:05:40
C02	0.1647	%	12/5/2013 08:05:47
Carbon Monoxide	0	%	12/5/2013 08:05:47
Decane	0	%	12/5/2013 08:05:47
Ethane	14.0689	%	12/5/2013 08:05:47
Helium	0	%	12/5/2013 08:05:47
Heptane	0	%	12/5/2013 08:05:47
Hexane	0.2484	%	12/5/2013 08:05:47
Hydrogen	0	%	12/5/2013 08:05:47
Hydrogen Sulfide	0	%	12/5/2013 08:05:47
Iso-Butane	0.5041	%	12/5/2013 08:05:47
Iso-Pentane	0.2618	%	12/5/2013 08:05:47
Methane	78.61509	%	12/5/2013 08:05:47
N2	0.564	%	12/5/2013 08:05:47
N-Butane	1.0298	%	12/5/2013 08:05:47
Nonane	0	%	12/5/2013 08:05:47
N-Pentane	0.2553	%	12/5/2013 08:05:47
Octane	0	%	12/5/2013 08:05:47
Oxygen	0.0715	%	12/5/2013 08:05:47
Plate Size	3.75	Inches	12/5/2013 08:05:45
Propane	4.2164	%	12/5/2013 08:05:47
SPG	0.7062		12/5/2013 08:05:40
Water	0	%	12/5/2013 08:05:47

Attachment J
Class I Legal Advertisement

Attachment J

Air Quality Permit Notice
Notice of Application
Weigle East Wellpad
Antero Resources Corporation
Tyler County, West Virginia

Notice is given that Antero Resources Corporation has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a G70-A Class II Administrative Update permit application for an Oil and Natural Gas facility located at 312 Jug Run Road, Alma, WV 26320 in Tyler County County, West Virginia.

The latitude and longitude coordinates are: 39.46623 degrees N and -80.852782 degrees W

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

Pollutants	TOTALS (tpy):
VOC	95.4903
NO_X	27.8119
CO_{2e}	31146.0806
CO	29.6940
SO_2	0.1166
$PM_{2.5}$	1.6454
PM_{10}	6.2941
Lead	9.91E-05
Total HAPs	5.4486
Benzene	0.1053
Formaldehyde	0.3882
Xylenes	0.4440

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

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 1227, during normal business hours.
Dated this the __ day of _____, 2015

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

Attachment L
General Permit Modification Application Fee

GHD SERVICES INC.

▼ PLEASE DETACH AND RETAIN FOR YOUR RECORDS ▼

INVOICE NUMBER	DATE		VOUCHER NO.	AMOUNT
Account Number:		40WVDEPAQ	426120	
CR90415	9/3/2015	400968658		300.00

TOTAL: 300.00

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

GHD SERVICES INC.
2055 NIAGARA FALLS BLVD, SUITE 3
NIAGARA FALLS, NY 14304

M&T BANK
MANUFACTURERS AND TRADERS TRUST COMPANY
Commercial Banking
Main Office, Ithaca, NY 14850
50-7083-2213

9/4/2015 NO. 426120

PAY **********300 DOLLARS AND **********00 CENTS $**********300.00

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

GHD SERVICES INC.

AUTHORIZED SIGNATURES

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

⑈426120⑈ ⑆221370632⑆6000000118910⑈

Attachment O
Emissions Summary Sheet

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

Table 1: Emissions Data												
Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type1	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/CAS3 *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions 4		Maximum Potential Controlled Emissions 5		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/Vapor)*	Est. Method Used 6
		ID No.	Source	ID No.	Device Type		lb/hr	ton/yr	lb/hr	ton/yr		
EP-H001, EP-H002, EP-H003, EP-H004, EP-H005, EP-H006, EP-H007, EP-H008, EP-H009, EP-H010, EP-H011, EP-H012, EP-H013, EP-H014	Vertical Stack	H001, H002, H003, H004, H005, H006, H007, H008, H009, H010, H011, H012, H013, H014	Gas Production Unit Heaters	N/A		CO (630080)	1.4471	6.3385	1.4471	6.3385	Gas/Vapor /Solid (for PM)	MB AP-42
						NOx (10102439)	1.7228	7.5459	1.7228	7.5459		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	2067.3564	9055.0212	2067.3564	9055.0212		
						SO2 (7446095)	0.0103	0.0453	0.0103	0.0453		
						PM, PM10, PM2.5	0.1309	0.5735	0.1309	0.5735		
						Hexane (110543)	0.0310	0.1358	0.0310	0.1358		
						Formaldehyde (50000)	0.0013	0.0057	0.0013	0.0057		
						Total VOCs	0.0948	0.4150	0.0948	0.4150		
EP-LH001, EP-LH002, EP-LH003, EP-LH004, EP-LH005, EP-LH006, EP-LH007, EP-LH008, EP-LH009, EP-LH010, EP-LH011, EP-LH012, EP-LH013, EP-LH014	Vertical Stack	LH001, LH002, LH003, LH004, LH005, LH006, LH007, LH008, LH009, LH010, LH011, LH012, LH013, LH014	Line Heaters	N/A		CO (630080)	1.9295	8.4514	1.9295	8.4514		
						NOx (10102439)	2.2971	10.0611	2.2971	10.0611		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	2756.4753	12073.3616	2756.4753	12073.3616		
						SO2 (7446095)	0.0138	0.0604	0.0138	0.0604		
						PM, PM10, PM2.5	0.1746	0.7646	0.1746	0.7646		
						Hexane (110543)	0.0413	0.1811	0.0413	0.1811		
						Total VOCs	0.1263	0.5534	0.1263	0.5534		
F001	N/A	F001	Fugitives	N/A		Benzene (71432)	0.0111	0.0488	0.0111	0.0488	Gas/Vapor	MB
						Toluene (108883)	0.0347	0.1518	0.0347	0.1518		
						Ethyl benzene (100414)	0.0321	0.1405	0.0321	0.1405		
						Hexane (110543)	0.3409	1.4930	0.3409	1.4930		
						o,m,p-xylenes (95476,108383,106423)	0.0920	0.4028	0.0920	0.4028		
						CO2 Equivalent CO2 (124389)), CH4	117.8059	515.9898	117.8059	515.9898		
						VOCs	5.0700	22.2068	5.0700	22.2068		
						TAPs (benzene)	0.0111	0.0488	0.0111	0.0488		
EP-L001, EP-L002	N/A	L001, L002	Loading (Condensate), Loading (Water)	N/A		VOCs	16.4190	34.9632	16.4190	34.9632	Gas/Vapor	MB
						hexane (110543)	0.0714	0.1519	0.0714	0.1519		
						CO2 Equivalent CO2 (124389), CH4	1.4819	5.2492	1.4819	5.2492		

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

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type1	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/CAS3 *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions 4		Maximum Potential Controlled Emissions 5		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/Vapor)*	Est. Method Used 6
		ID No.	Source	ID No.	Device Type		lb/hr	ton/yr	lb/hr	ton/yr		
EP-HR001	N/A	HR001	Haul Truck	N/A		PM, PM10, PM2.5	5.4139	20.5083	2.7069	10.2541	Solid	MB
EP-EC001, EP-EC002, EP-EC003, EP-EC004,	N/A	TANKCOND001-010, TANKPW001-002, EC001, EC002, EC003, EC004,	Condensate Tank F/W/B, PW Tank F/W/B, Enclosed Combustor	EC001, EC002, EC003, EC004,	Enclosed Combustor	CO (630080)	0.00E+00	0.00E+00	0.4224	1.8502	Gas/Vapor/ Solid (for PM)	MB
						NOx (10102439)	0.00E+00	0.00E+00	0.5029	2.2026		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4	773.3656	3387.3414	1670.3349	7316.0670		
						PM, PM10, PM2.5	0.00E+00	0.00E+00	0.0382	0.1674		
						Benzene (71432)	0.2959	1.2962	5.92E-03	0.0259		
						Toluene (108883)	0.3997	1.7505	7.99E-03	0.0350		
						ethyl benzene	0.1465	0.6419	2.93E-03	0.0128		
						hexane (110543)	24.5488	107.5236	0.4910	2.1505		
						o,m,p-xylenes (95476,108383,106423)	0.3477	1.5229	6.95E-03	0.0305		
						VOCs	413.4206	1810.7820	8.2687	36.2169		
EP-PCV	valve	PCV	Pneumatic CV	N/A		hexane (110543)	8.69E-03	0.0381	8.69E-03	0.0381	Gas/Vapor	MB
						CO2 Equivalent CO2 (124389)), CH4	12.7962	56.0475	12.7962	56.0475		
						VOCs	0.1355	0.5933	0.1355	0.5933		
EP-ENG001, EP-ENG002, EP-ENG005 ,EP-ENG003, EP-ENG004	Vertical Stack	ENG001, ENG002, ENG005, ENG003, ENG004	Compressor Engine	N/A		CO (630080)	2.9793	13.0491	2.9793	13.0491	Gas/Vapor/ Solid (for PM)	MB
						NOx (10102439)	1.8257	7.9966	1.8257	7.9966		
						CO2 Equivalent N2O (10024972), CO2 (124389), CH4 (74828)	483.4459	2117.4929	483.4459	2117.4929		
						SO2 (7446095)	2.46E-03	0.0108	2.46E-03	0.0108		
						PM, PM10, PM2.5	0.0397	0.1738	0.0397	0.1738		
						TAPs Benzene (71432)	6.60E-03	0.0289	6.60E-03	0.0289		
						Toluene (108883)	2.33E-03	0.0102	2.33E-03	0.0102		
						TAPs Formaldehyde (50000)	0.0856	0.3750	0.0856	0.3750		
						Total VOCs	0.1236	0.5415	0.1236	0.5415		
EP-TEG001	N/A	TEG001	Thermoelectric Generator	N/A		CO (630080)	0.0011	0.0048	0.0011	0.0048	Gas/Vapor/ Solid (for PM)	MB AP-42
						NOx (10102439)	0.0013	0.0057	0.0013	0.0057		
						CO2 Equivalent	1.5642	6.8514	1.5642	6.8514		

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

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants Chemical Name/CAS 1	Maximum Potential Uncontrolled Emissions 2		Maximum Potential Controlled Emissions 3		Est. Method Used 4
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	n/a					
Unpaved Haul Roads	PM, PM10, PM2.5	5.4139	20.5083	2.7069	10.2541	MB
Loading/Unloading Operations	VOCs	16.4190	34.9632	16.4190	34.9632	MB
	hexane (110543)	0.0714	0.1519	0.0714	0.1519	
	CO2 Equivalent CO2 (124389), CH4	1.4819	5.2492	1.4819	5.2492	
Equipment Leaks (Components)	Benzene (71432)	Does not apply	0.0488	Does not apply	0.0488	MB
	Toluene (108883)		0.1518		0.1518	
	Ethyl benzene (100414)		0.1405		0.1405	
	Hexane (110543)		1.4930		1.4930	
	o,m,p-xylenes (95476,108383,106423)		0.4028		0.4028	
	CO2 Equivalent CO2 (124389)), CH4		515.9898		515.9898	
	VOCs		22.2068		22.2068	
	TAPs (benzene)		0.0488		0.0488	
Equipment Leaks (PCVs)	hexane (110543)	8.69E-03	0.0381	8.69E-03	0.0381	MB
	CO2 Equivalent CO2 (124389)), CH4	12.7962	56.0475	12.7962	56.0475	
	VOCs	0.1355	0.5933	0.1355	0.5933	

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

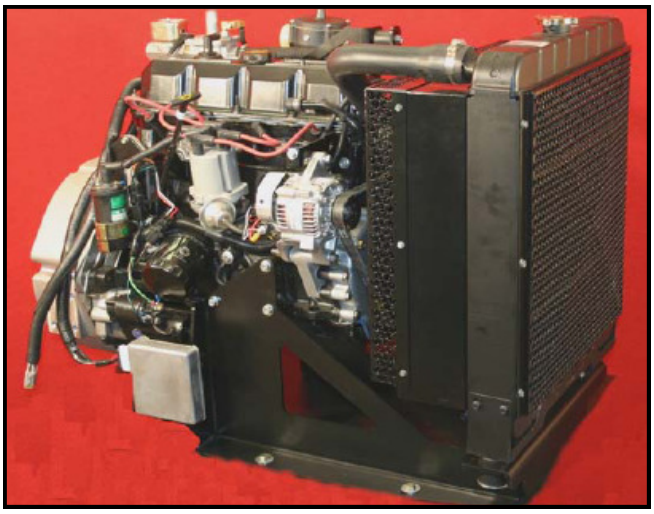
Gasoline, LPG & Natural Gas Engine

ZPP 428

2.8 LITER

For industrial applications

ZPP - THE POWER OF CHOICE

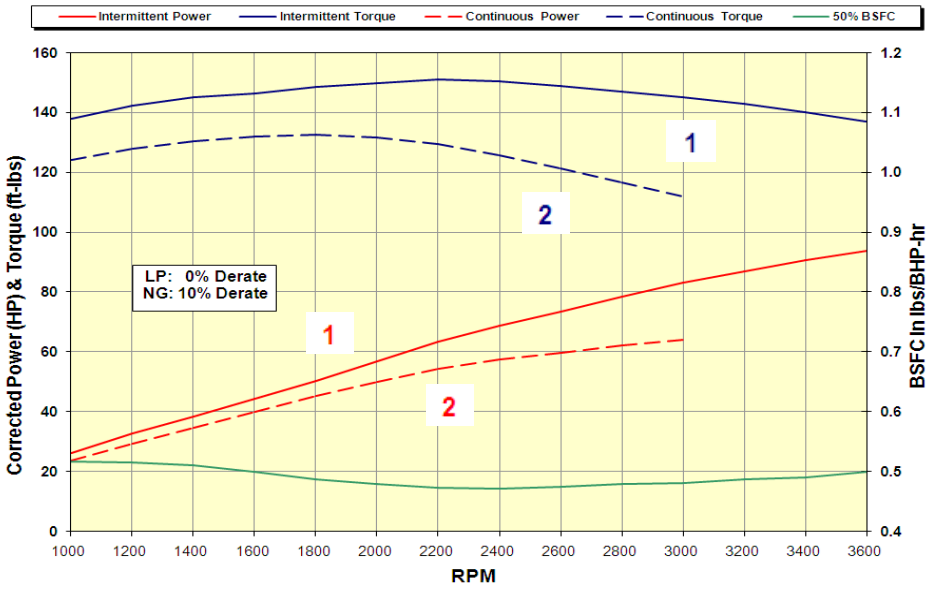


GENERAL SPECIFICATION

Intermittent Output	94 HP @ 3600 rpm
Continuous Output	64 HP @ 3000 rpm
Peak Torque	150 ft-lbs @ 2200 rpm
Fuel / Delivery	Gasoline / Multi-port - LPG / NG Mixer Type
Engine Configuration	4 Cylinder In-line, OHV
Block Material	Cast Iron
Head Material	Cast Iron
Bore x Stroke (mm)	98.4 x 91.0
Total Piston Displacement	2769 cc
Compression Ratio	9.5 : 1
Length X Width x Height (mm)	772.1 x 563.0 x 673.0
Dry Weight (excluding shipped lose parts)	155 Kg
Catalyst (2007 emissions compliance)	Remote mounted

Note: HP and Torque figures shown for 2008 LSI - EPA/CARB certified engine with catalyst

ZPP-428 Gasoline Power, Torque, & BSFC Curves



Curve 1 - Intermittent Gross Output

This is the highest out put obtainable at standard ambient conditions from a basic engine equipped only with the built-in accessories essential to its operation. These levels may be only maintained for operating periods of short duration.

Applications: Scissor lifts, Aerial platforms, Scrubbers / Sweepers, Utility vehicles, Construction equipment.

Curve 2 - Continuous Gross Output

This is the output that can be obtained at standard ambient conditions from a basice engine, operating in a continuous duty mode.

Applications: Generator, Welders Water pumps, Gas compressors Carpet cleaners, etc

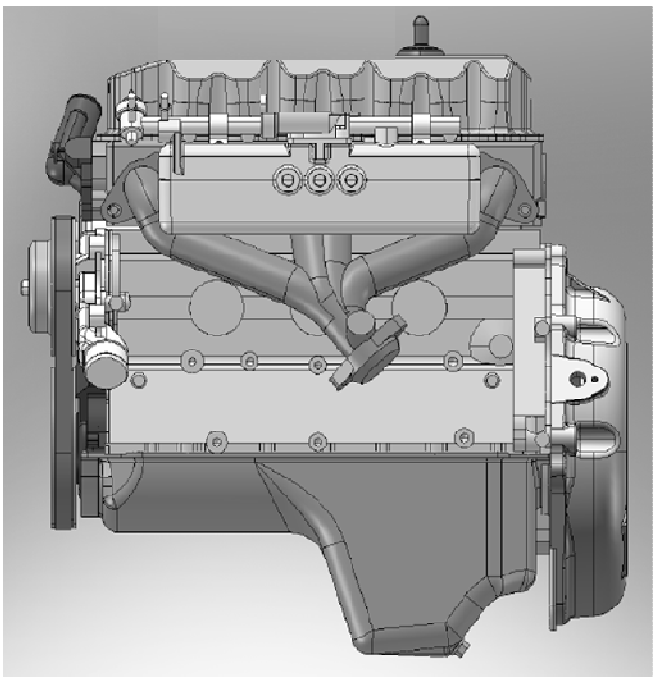
ZENITH POWER PRODUCTS LLC

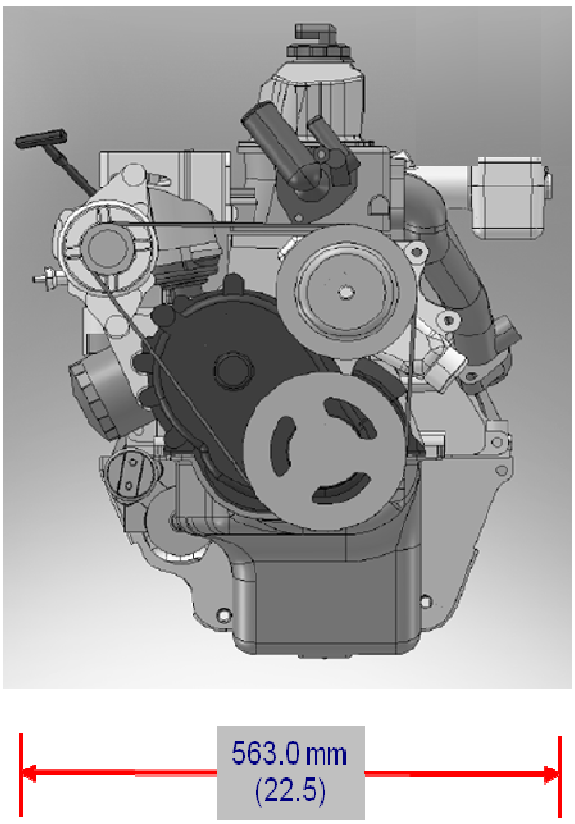
14570 INDUSTRIAL PARK ROAD
Phone: 276-669-5555

BRISTOL, VA 24202 - USA
Fax: 877-933-6748

ENGINE SPECIFICATIONS

General			Physical Data		
Cylinders	4		Length	30.9 in	772.1 mm
Cylinder Arrangement	Vertical In-line		Width	22.5 in	563.0 mm
Bore size	3.94 in	98.43 mm	Height	26.9 in	673.0 mm
Stroke	3.64 in	90.98 mm	Weight	337.0 lb	153.0 kg
Cylinder Displacement	42.24 in^3	692.3 cc	Oil Capacity	4.0 Qt	3.8 L
Total Displacement	169.0 in^3	2769 CC			
Compression Ratio	9.5 : 1				
Fuel Systems			**Electrical**		
Gasoline	Multi-port		Starter Motor	12 V - 1.4 Kw	
LPG / NG	Mixer Type		Alternator	12.0 V - 55 A	
Fuel Pressure (gasoline)	3 bar			w/ built in regulator	
Fuel Pressure LPG / NG	< 5 in		Distributor with coil	Non-certified applications	
Fuel Requirement	unleaded gasoline		Hall effect dist. w/ coil	Certified applications	
Fuel Pump	Electric		**Cooling**		
Electronic Governor	ZEEMS III		Thermostat	180 ° F	82 ° C





ZENITH POWER PRODUCTS LLC

14570 INDUSTRIAL PARK ROAD BRISTOL, VA 24202 - USA
Phone: 276-669-5555 Fax: 877-933-6748

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2012 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: **Zenith Power Products**
(U.S. Manufacturer or Importer)

Certificate Number: CZPPB02.8P28-002

Effective Date: 01/12/2012

Expiration Date: 12/31/2012

Byron J. Bunker, Acting Division Director
Compliance Division

Issue Date: 01/12/2012

Revision Date: N/A

Manufacturer: Zenith Power Products
Engine Family: CZPPB02.8P28
Certificate Number: CZPPB02.8P28-002
Certification Type: Mobile and Stationary
Fuel : Natural Gas (CNG/LNG)
Gasoline (up to and including 10% Ethanol)
LPG/Propane
Emission Standards : HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
Emergency Use Only : N

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 1048, 40 CFR Part 60, 1065, 1068, and 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 with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition 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 1048, 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048, 40 CFR Part 60. This certificate of conformity does not cover 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 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 1048, 40 CFR Part 60. 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 1048, 40 CFR Part 60.

This certificate does not cover large 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.

This report documents the certification test procedure and results for the 428 engine. The 428 is required to comply with the LPG emissions standards defined in 1048.101 for both stationary and constant-speed mobile applications. ZPP is voluntarily certifying the 644 per 60.4231(d) for stationary NG applications. ZPP has elected to certify both the NG and LPG versions of the 644 to 2.1 g/kW-hr HC+NOx, 6.0 g/kW-hr CO point on the sliding scale specified in 1048.101(a)(3).

2. UNIT UNDER TEST

The 428 engine is equipped with a 3-way catalyst, air valve carburetor, and a closed-loop A/F control system with pre-cat and post-cat oxygen sensors. The 428 engine configuration is summarized in Table 1 on the following page. Figure 1 is a picture of the test engine and catalyst.

The engine was tested for three fuel system configurations:

- Natural gas (NG) mono-fuel
- LPG mono-fuel
- NG/LPG dual-fuel

The S/N of the certification test engine is 0700126. The S/N of the certification test catalyst is 001.

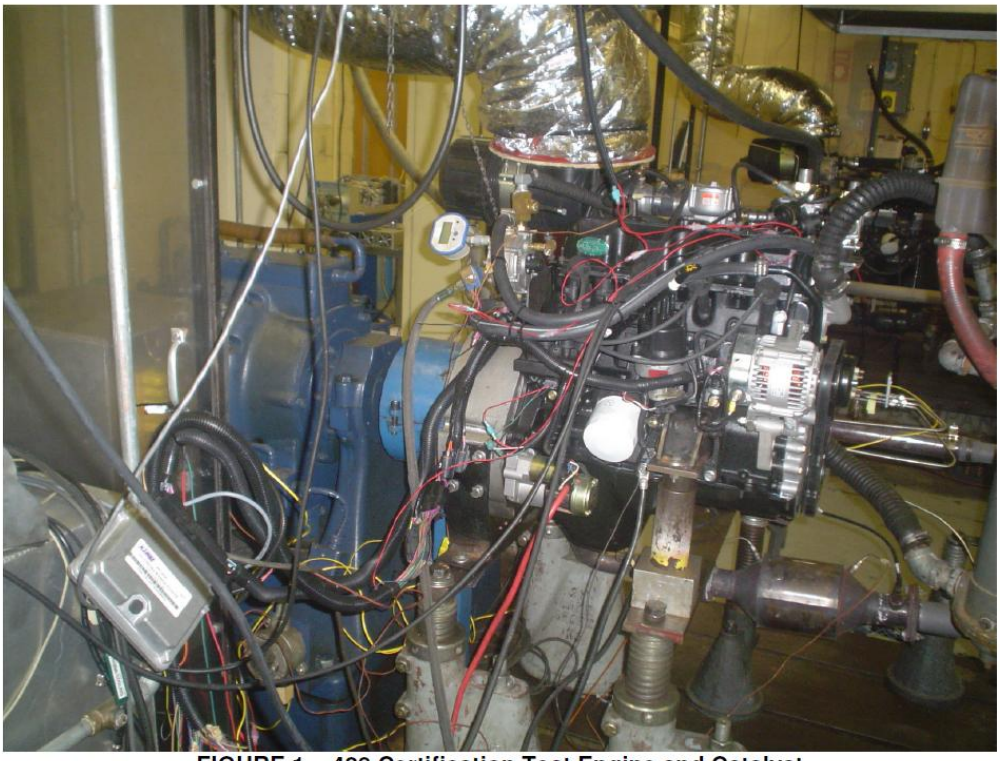


FIGURE 1 – 428 Certification Test Engine and Catalyst

TABLE 1 – ZPP 428 Engine Specifications

Spec	Units	428		
		Nat Gas	LPG	NG/LPG
Engine Family code		AZPPB02.8STA		
Base Engine P/N		P428NE	P428LE	P428BF
# of Cylinders		4 In-Line		
Nominal Displacement	L	2.8		
Air Induction		Naturally Aspirated		
Rated Power	HP (kW)	72 (53)	77 (58)	77 (58)
Rated Torque	ft-lbs (N*m)	125 (170)	135 (183)	135 (183)
Rated Speed	RPM	3000		
Torque @ 1800 rpm	ft-lbs (N*m)	134 (182)	146 (198)	146 (198)
Compression Ratio		9.5 : 1		
Valve Configuration		Overhead Valves		
Valve Lifters		Hydraulic		
Firing Order		1-3-4-2		
Bore x Stroke	mm	98.4 x 91.0		
Cylinder Displacement	cc	692.3		
Total Displacement	cc	2769		
Block Material		Cast Iron		
Head Material		Cast Iron		
Length x Width x Height	mm	772.1 x 563.0 x 673.0		
Dry Weight	Kg	155		
Catalyst Location		Remote Mount		
Oil Capacity	L	3.8		
Catalyst		3-way ZPP-C674-21		
Fuel Types		Pipeline-quality natural gas Commercial-grade LPG		
Fuel System		Air Valve Carburetor		
Applications		Generator sets, compressors, pumps, etc.		
Speed Operation		Constant Speed		

3. LABORATORY EQUIPMENT

The certification engine test was conducted in ZPP's engine lab. The engine was run on a 250 HP Midwest 1014W eddy-current dynamometer.

The emissions analyzer used was a SEMTECH-DS. When properly calibrated per Table 1 of 1065.303, the SEMTECH-DS is 1065-compliant for constant-speed certification testing. The SEMTECH-DS uses a raw gas sampling system and a heated sample line.

Emissions mass flow was determined by measuring emissions concentrations and mass fuel flow. Engine speed and torque were measured to determine engine work per 1065 Subparts B-D.

The following is a list of measurement subsystems included in the SEMTECH-DS emission analyzer.

- Heated Flame Ionization Detector (FID) for total hydrocarbon (THC) measurement.
- Non-Dispersive Ultraviolet (NDUV) analyzer for nitric oxide (NO) and nitrogen dioxide (NO2) measurement.
- Non-Dispersive Infrared (NDIR) analyzer for carbon monoxide (CO) and carbon dioxide (CO2) measurement.
- Electrochemical sensor for oxygen (O2) measurement.

Methane and total hydrocarbons were measured with a JUM-109A NMHC analyzer.

The natural gas fuel used for testing was pipeline-quality natural gas which met the requirements for natural gas composition in 40 CFR 1065.715. Composition analyses for the natural gas are included in Appendix 2.

The LPG was commercial-grade LPG per 1065-720(b). A Bill of Sale and typical analysis are included in the Appendix 2. The supplier stated that the LPG complies with the HD-5 specification.

LPG fuel flow was measured with a scale and stopwatch. NG fuel flow was measured with an Eldridge mass fuel flow meter.

The key pieces of laboratory equipment that were used to test the 428 engine are listed in Table 2.

TABLE 2 – Certification Engine Test Equipment List

Item	Manufacturer & P/N	S/N
Eddy-Current Dynamometer	Midwest 1014W 250 HP	101
Torque transducer	Lebow Load Cell 3143-K	103301A
5-gas raw gas emissions analyzer	SEMTECH-DS	J06-SDS05
Nonmethane cutter	JUM 109A NMHC Analyzer	205389
Scale for measuring LPG fuel weight	Avery Weigh-Tronix scale P/N E1010	051240314
Natural gas mass flow meter	Eldridge Natural gas flowmeter 8089MPNH-SSS-133-AC115	20082003
Weather station	SEMTECH-DS Weather Station	D1440015

4. TEST PROCEDURE

Testing procedures and emissions calculations follow the guidelines set in 40 CFR 1065.

The following test cycles were used:

- For NG stationary, ISO D1 test cycles per 60.4241 were required.
- For NG constant-speed mobile, ISO D2 test cycles per 1048.505(b)(2) were required.
- For LPG stationary and constant-speed mobile, ISO D2 test cycles per 60.4240 and 1048.505(b)(2) were required.

Test speeds for both fuels/cycles were 3000 rpm (rated speed) and 1800 rpm.

For natural gas, the methane and total hydrocarbons were measured with a JUM 109A NMHC analyzer. The non-methane hydrocarbons were then calculated per 1065.660.

The test engine and catalyst were the same 428 engine and catalyst that were used for mobile certification testing in 2008. At the beginning of the stationary emissions testing, the 428 had accumulated 23 operating hours.

To comply with the 1065.550 drift requirements, each emissions analyzer channel was zeroed and spanned at the beginning and end of each modal test. In addition, each emissions analyzer channel was zeroed between each mode.

Figures 3 and 4 below are the LPG and NG torque & power curves that were obtained from the 428 certification test engine.

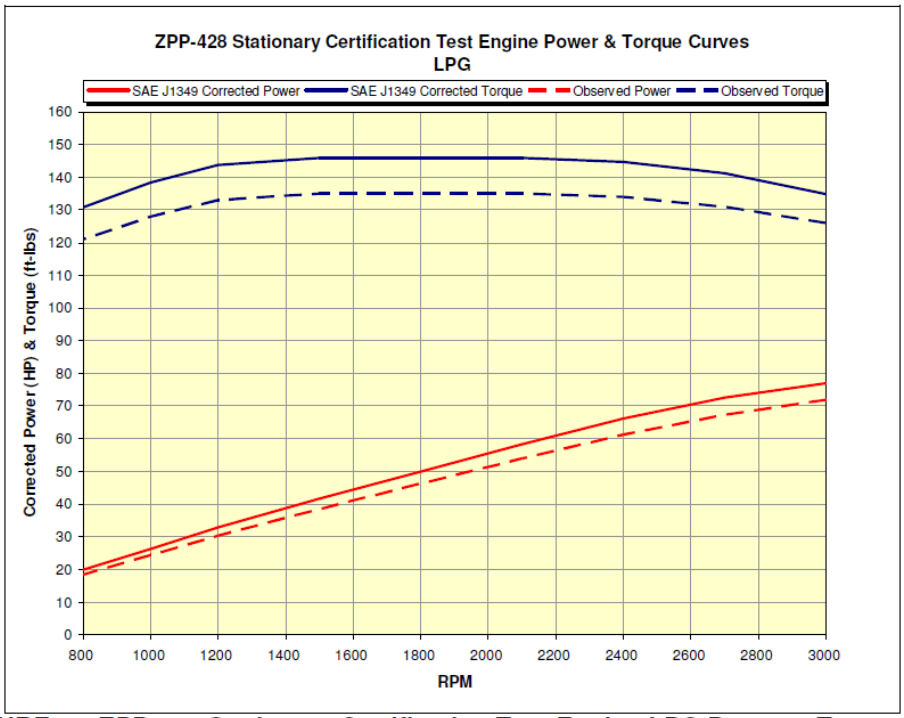


FIGURE 3 – ZPP-428 Stationary Certification Test Engine LPG Power & Torque Curves

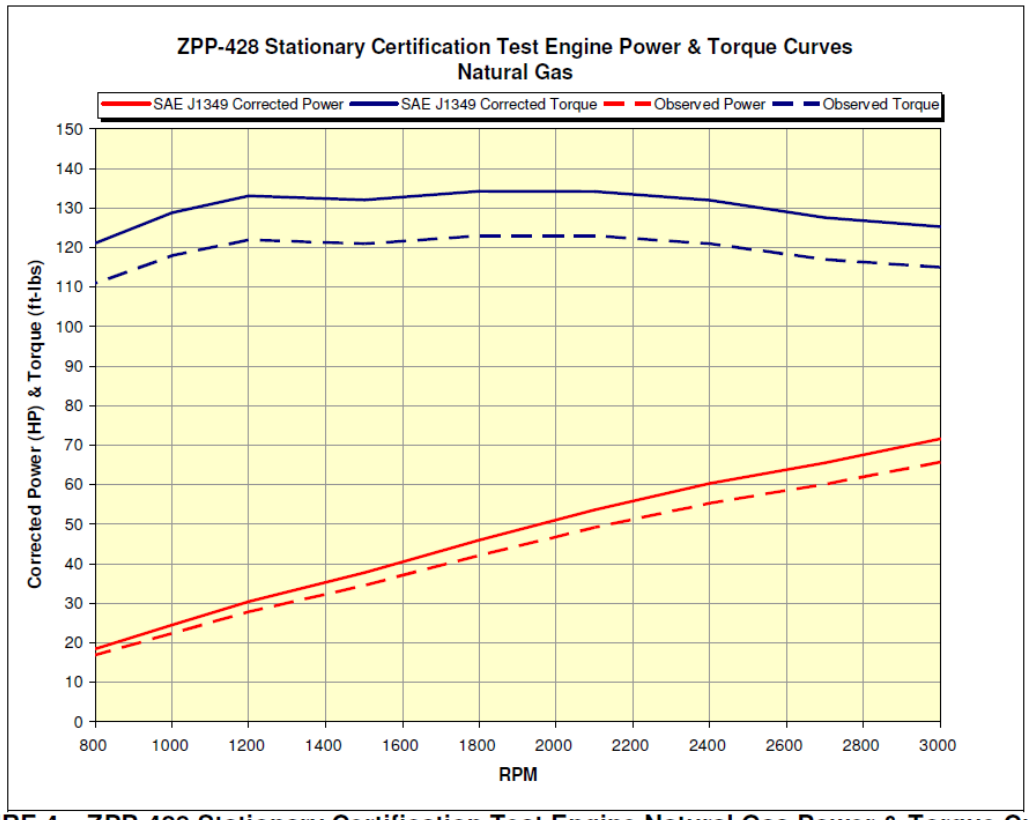


FIGURE 4 – ZPP-428 Stationary Certification Test Engine Natural Gas Power & Torque Curves

5. TEST RESULTS

The ZPP-428's stationary and constant-speed mobile certification test results are summarized in Figure 5 and Table 3. All of the test results complied with the emissions standards with a factor of 2 safety margin or better.

Individual test result summaries are contained in the Appendix 1.

At the end of the stationary and constant-speed mobile certification testing, the 428 test engine had accumulated a total of 49 operating hours. As noted in the "Test Procedure" section, the engine had previously accumulated 23 hours from the gasoline and LPG mobile certification testing in 2008.

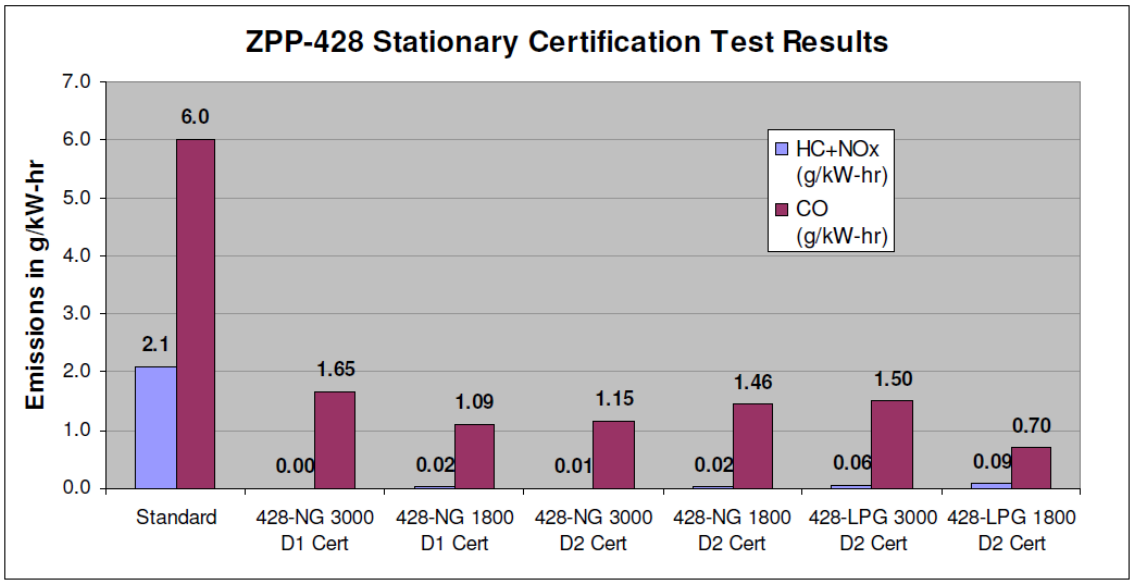


FIGURE 5 – ZPP-428 Stationary and Constant-Speed Mobile Certification Test Results

	Emissions in g/kW-hr				
Test	**THC**	**NMHC**	**NOx**	**HC+NOx**	**CO**
428 Standard				2.1	6.0
428-NG 3000 D1 Cert	0.09	0.00	0.00	0.00	1.65
428-NG 1800 D1 Cert	0.86	0.00	0.02	0.02	1.09
428-NG 3000 D2 Cert	0.11	0.00	0.01	0.01	1.15
428-NG 1800 D2 Cert	1.36	0.00	0.02	0.02	1.46
428-LPG 3000 D2 Cert	0.05	NA	0.01	0.06	1.50
428-LPG 1800 D2 Cert	0.09	NA	0.00	0.09	0.70

TABLE 3 – ZPP-428 Stationary and Constant-Speed Mobile Certification Test Results

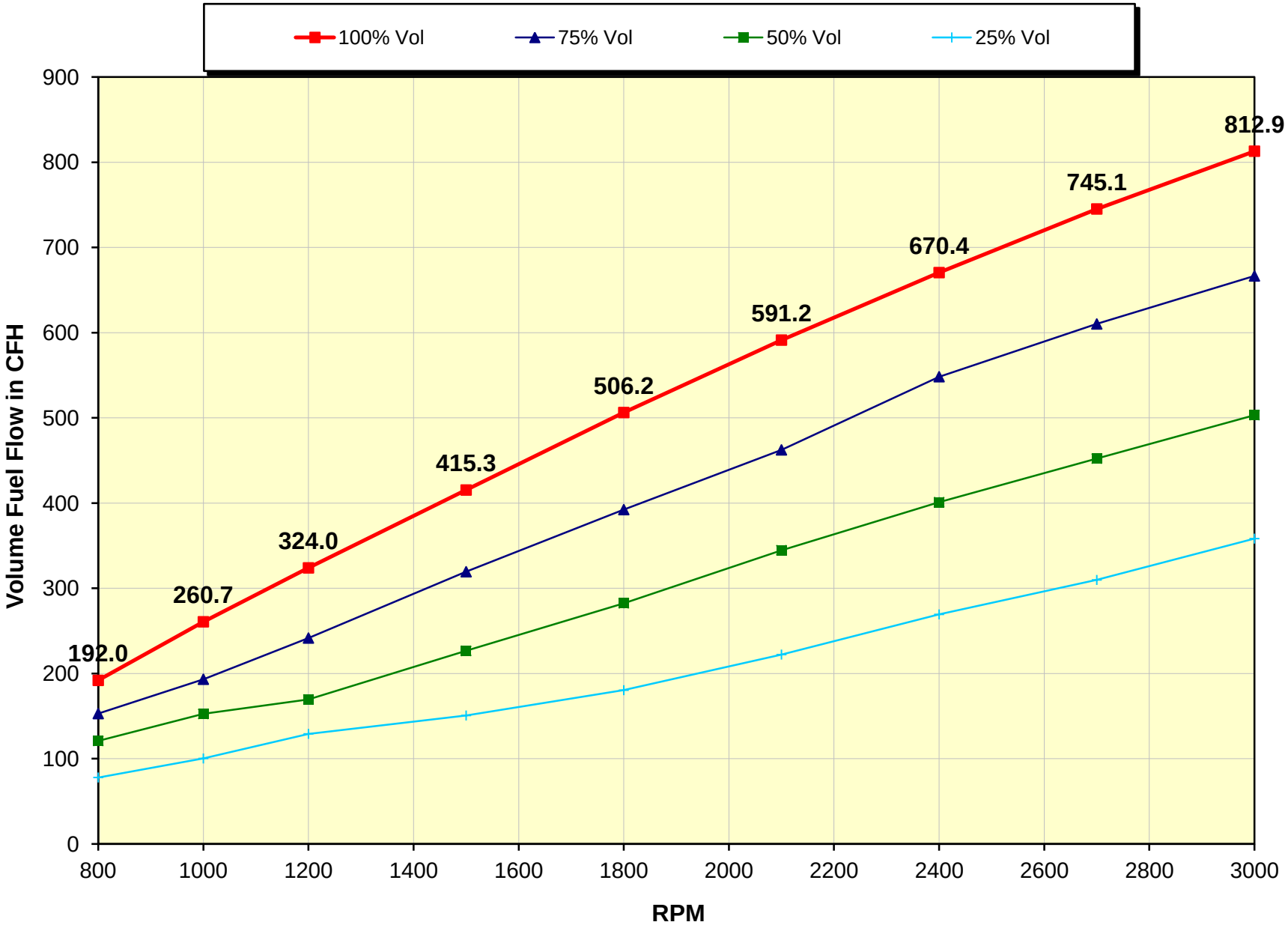
As evidence that the ZPP-428 engine complies with the 1048.101(c) field test requirement, the brake-specific emissions in each certification test mode were calculated. The modal brake-specific emissions are listed with each test sheet in Appendix 1. All of the modal brake-specific emissions values were less than 10% of the field testing standard (HC+NOx < 3.8 g/kW-hr, CO < 6.5 g/kW-hr).

The emissions test results were drift-checked per 1065.550 and drift-corrected per 1065.672. The results are recorded on the test data sheets in the Appendix 1. All drift values were less than 10% of the +/-4% limit.

6. SUMMARY

The ZPP-428 certification test results demonstrate that the ZPP-428 engine is fully capable of meeting the stationary emissions standards defined in CFR 40, Part 60, Subpart JJJJ and the constant-speed mobile emission standards defined in CFR 40, Part 1048 for both natural gas and LPG fuels.

ZPP 428 NG Volumetric Fuel Fuel Flow - Corrected per SAE J1349
5/11/10



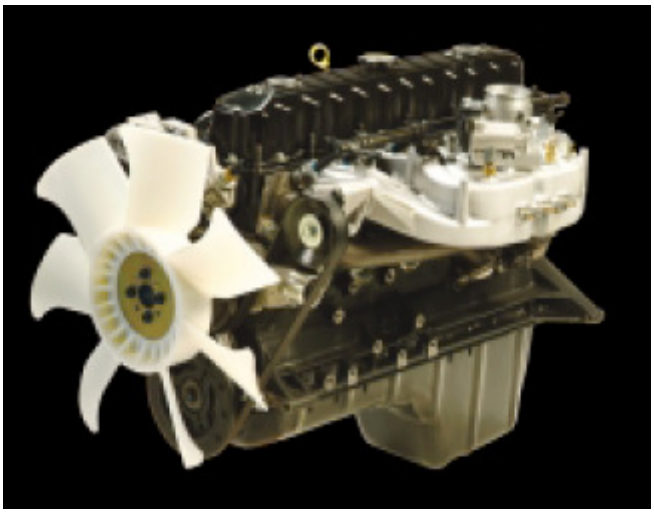
Gasoline, LPG & Natural Gas Engine

ZPP 644

4.4 LITER

For industrial applications

ZPP - THE POWER OF CHOICE

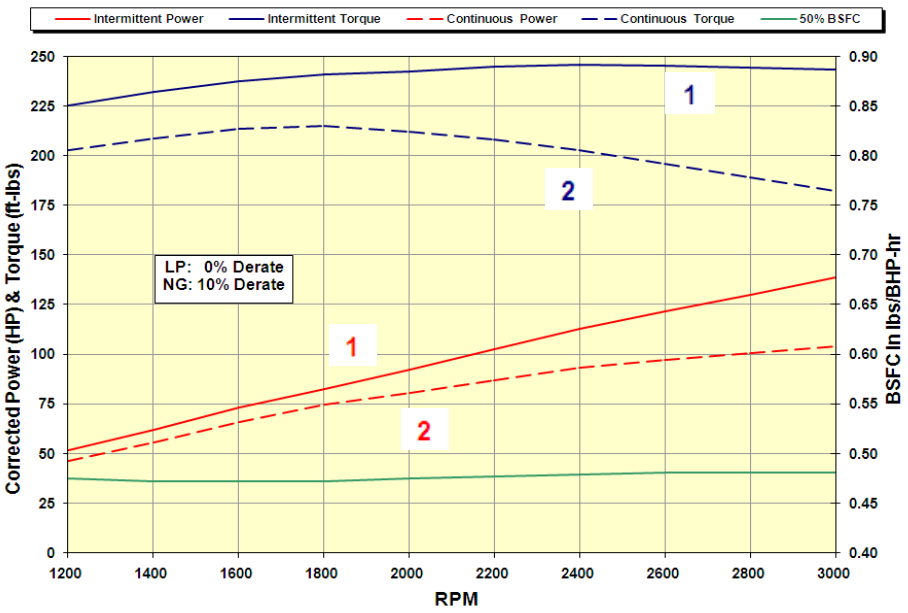


GENERAL SPECIFICATION

Intermittent Output	139 HP @ 3000 rpm
Continuous Output	104 HP @ 3000 rpm
Peak Torque	246 ft-lbs @ 2200 rpm
Fuel / Delivery	Gasoline / Multi-port - LPG / NG Mixer Type
Engine Configuration	6 Cylinder In-line, OHV
Block Material	Cast Iron
Head Material	Cast Iron
Bore x Stroke (mm)	98.4 x 91.0
Total Piston Displacement	4416 cc
Compression Ratio	9.7 : 1
Length X Width x Height (mm)	1054 x 586 x 810
Dry Weight (excluding shipped lose parts)	193 Kg
Catalyst (2007 emissions compliance)	Remote mounted

Note: HP and Torque figures shown for 2008 LSI - EPA/CARB certified engine with catalyst

ZPP-644 Gasoline Power, Torque, & BSFC Curves



Curve 1 - Intermittent Gross Output

This is the highest out put obtainable at standard ambient conditions from a basic engine equipped only with the built-in accessories essential to its operation. These levels may be only maintained for operating periods of short duration.

Applications: Scissor lifts, Aerial platforms, Scrubbers / Sweepers, Utility vehicles, Construction equipment.

Curve 2 - Continuous Gross Output

This is the output that can be obtained at standard ambient conditions from a basice engine, operating in a continuous duty mode.

Applications: Generator, Welders Water pumps, Gas compressors Carpet cleaners, etc

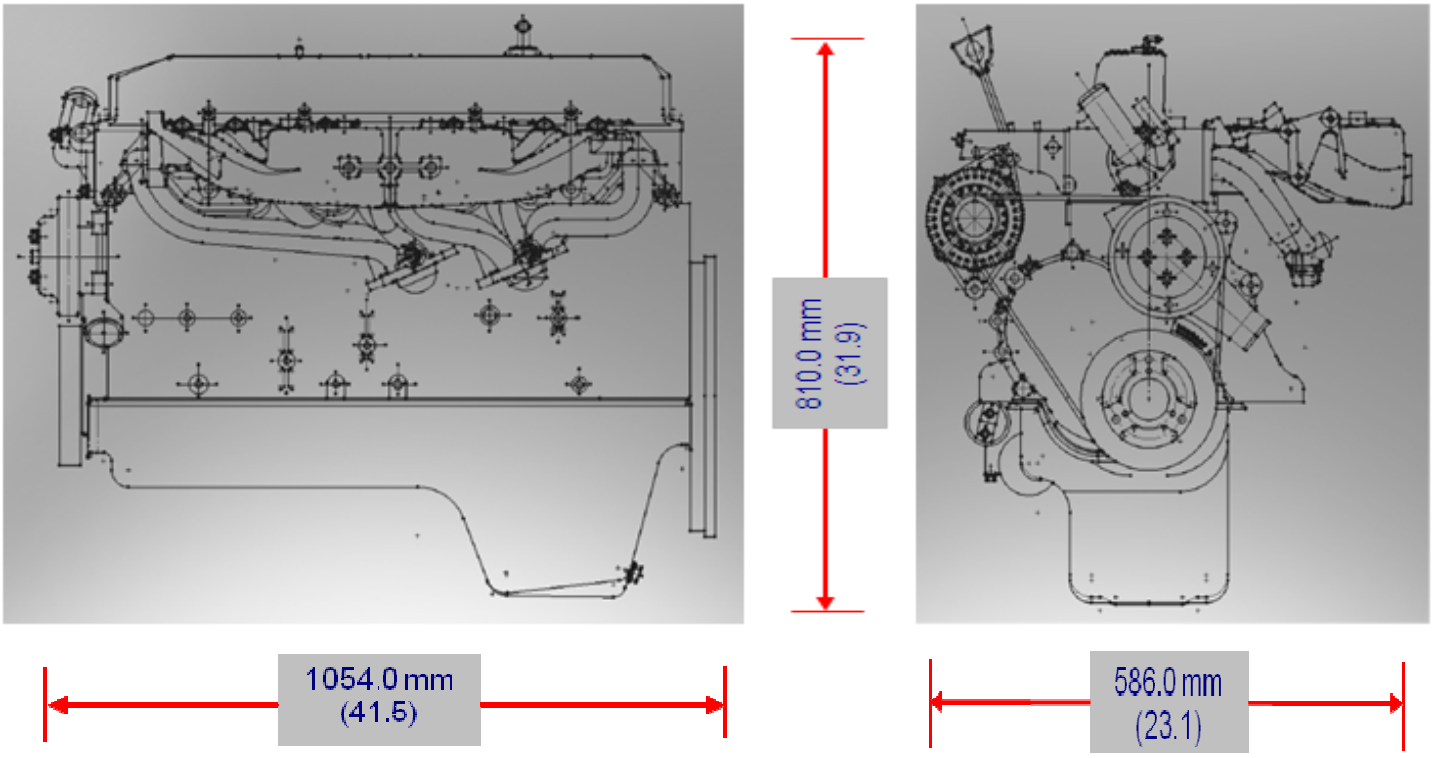
ZENITH POWER PRODUCTS LLC

14570 INDUSTRIAL PARK ROAD BRISTOL, VA 24202 - USA

Phone: 276-669-5555 Fax: 877-933-6748

ENGINE SPECIFICATIONS

General			Physical Data		
Cylinders	6		Length	41.5 in	1054.0 mm
Cylinder Arrangement	Vertical In-line		Width	23.1 in	586.0 mm
Bore size	3.94 in	98.43 mm	Height	31.9 in	810.0 mm
Stroke	3.64 in	90.98 mm	Weight	470 lb	214.0 kg
Cylinder Displacement	42.24 in^3	692.3 cc	Oil Capacity	6.0 Qt	5.7 L
Total Displacement	269.6 in^3	4416 cc			
Compression Ratio	9.7 : 1				
Fuel Systems			**Electrical**		
Gasoline	Multi-port		Starter Motor	12 V - 1.4 Kw	
LPG / NG	Mixer Type		Alternator	12.0 V - 55 A	
Fuel Pressure (gasoline)	3 bar			w/ built in regulator	
Fuel Pressure LPG / NG	< 5 in		Distributor with coil	Non-certified applications	
Fuel Requirement	unleaded gasoline		Hall effect dist. w/ coil	Certified applications	
Fuel Pump	Electric		**Cooling**		
Electronic Governor	ZEEMS III		Thermostat	180 ° F	82 ° C



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2012 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: **Zenith Power Products**
(U.S. Manufacturer or Importer)

Certificate Number: **CZPPB04.4P44-004**

Effective Date: 01/12/2012

Expiration Date: 12/31/2012

Byron J. Bunker, Acting Division Director
Compliance Division

Issue Date: 01/12/2012

Revision Date: N/A

Manufacturer: Zenith Power Products
Engine Family: CZPPB04.4P44
Certificate Number: CZPPB04.4P44-004
Certification Type: Mobile and Stationary
Fuel : LPG/Propane
Natural Gas (CNG/LNG)
Gasoline (up to and including 10% Ethanol)
Emission Standards : HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7NMHC + NOx (g/kW-hr) : 2.7
HC + NOx (g/kW-hr) : 2.7
CO (g/kW-hr) : 4.4
Emergency Use Only : N

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 1048, 40 CFR Part 60, 1065, 1068, and 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 with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 1048, 40 CFR Part 60 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition 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 1048, 40 CFR Part 60 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048, 40 CFR Part 60. This certificate of conformity does not cover 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 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 1048, 40 CFR Part 60. 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 1048, 40 CFR Part 60.

This certificate does not cover large 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.

1. INTRODUCTION

This report documents the certification test procedure and results for the 644 engine. The 644 is required to comply with the emissions standards defined in 1048.101 for natural gas (NG) and LPG constant-speed mobile applications and LPG stationary applications. ZPP is voluntarily certifying the 644 per 60.4231(d) for stationary NG applications.

Since the rated power of the NG 644 is less than 100 HP, the engine must comply with the emissions standard specified in 60.4243(c), which references 40 CFR part 1048. ZPP has elected to certify both the NG and LPG versions of the 644 to 2.1 g/kW-hr HC+NOx, 6.0 g/kW-hr CO point on the sliding scale specified in 1048.101(a)(3).

2. UNIT UNDER TEST

The 644 engine is equipped with a 3-way catalyst, air valve carburetor, and a closed-loop A/F control system with pre-cat and post-cat oxygen sensors. The 644 engine configuration is summarized in Table 1 on the following page. Figure 1 is a picture of the test engine and catalyst.

The engine was tested for three fuel system configurations:

- Natural gas (NG) mono-fuel
- LPG mono-fuel
- NG/LPG dual-fuel

The S/N of the certification test engine is 0700006. The S/N of the certification test catalyst is 002.

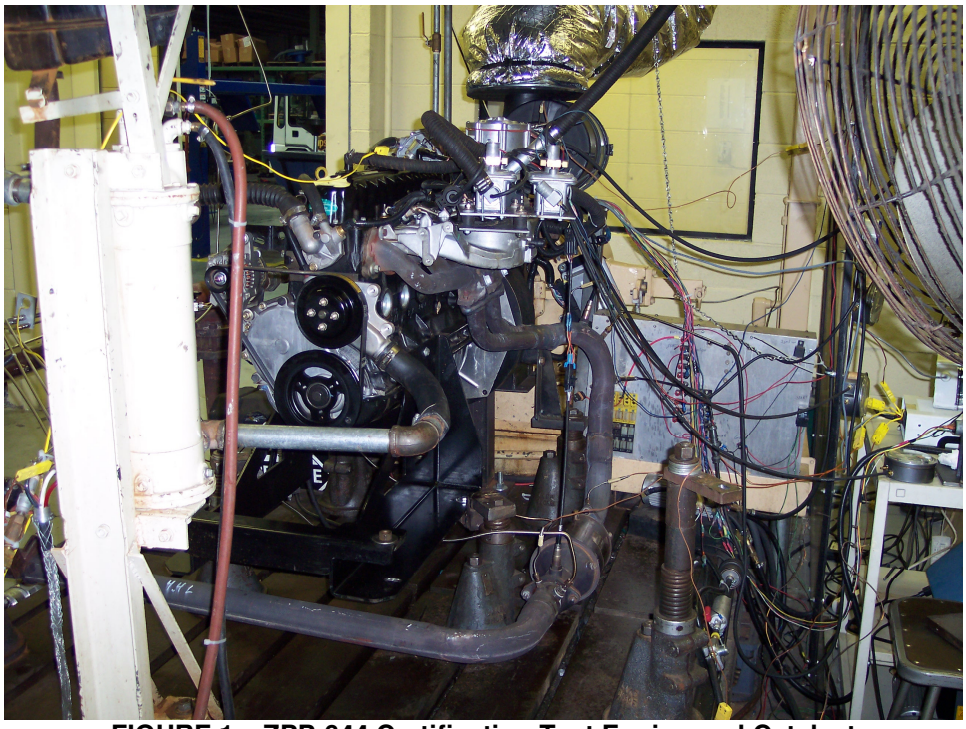


FIGURE 1 – ZPP-644 Certification Test Engine and Catalyst

TABLE 1 – ZPP-644 Engine Specifications

Spec	Units	644		
		Nat Gas	LPG	NG/LPG
Engine Family code		AZPPB04.4STA		
Base Engine P/N		P644NE	P644LE	P644BF
# of Cylinders		6 In-Line		
Nominal Displacement	L	4.4		
Air Induction		Naturally Aspirated		
Rated Power	HP (kW)	98 (73)	108 (81)	108 (81)
Rated Torque	ft-lbs (N*m)	171 (232)	189 (257)	189 (257)
Rated Speed	RPM	3000		
Torque @ 1800 rpm	ft-lbs (N*m)	191 (259)	218 (296)	218 (296)
Compression Ratio		9.7 : 1		
Valve Configuration		Overhead Valves		
Valve Lifters		Hydraulic		
Firing Order		1-5-3-6-2-4		
Bore x Stroke	mm	98.4 x 91.0		
Cylinder Displacement	cc	692.3		
Total Displacement	cc	4416		
Block Material		Cast Iron		
Head Material		Cast Iron		
Length x Width x Height	mm	1054 x 586 x 810		
Dry Weight	Kg	193		
Catalyst Location		Remote Mount		
Oil Capacity	L	5.7		
Catalyst		3-way ZPP-C674-21		
Fuel Types		Pipeline-quality natural gas Commercial-grade LPG		
Fuel System		Air Valve Carburetor		
Applications		Generator sets, compressors, pumps, etc.		
Speed Operation		Constant Speed		

3. LABORATORY EQUIPMENT

The certification engine test was conducted in ZPP's engine lab. The engine was run on a 400 HP GE 16492 eddy-current dynamometer.

The emissions analyzer used was a SEMTECH-DS. When properly calibrated per Table 1 of 1065.303, the SEMTECH-DS is 1065-compliant for constant-speed certification testing. The SEMTECH-DS uses a raw gas sampling system and a heated sample line.

Emissions mass flow was determined by measuring emissions concentrations and mass fuel flow. Engine speed and torque were measured to determine engine work per 1065 Subparts B-D.

The following is a list of measurement subsystems included in the SEMTECH-DS emission analyzer.

- Heated Flame Ionization Detector (FID) for total hydrocarbon (THC) measurement.
- Non-Dispersive Ultraviolet (NDUV) analyzer for nitric oxide (NO) and nitrogen dioxide (NO2) measurement.
- Non-Dispersive Infrared (NDIR) analyzer for carbon monoxide (CO) and carbon dioxide (CO2) measurement.
- Electrochemical sensor for oxygen (O2) measurement.

Methane and total hydrocarbons were measured with a JUM-109A NMHC analyzer.

The natural gas fuel used for testing was pipeline-quality natural gas which met the requirements for natural gas composition in 40 CFR 1065.715. Composition analyses for the natural gas are included in Appendix 2.

The LPG was commercial-grade LPG per 1065-720(b). A copy of the sales invoice is included in the Appendix 2. The supplier stated that the LPG complies with the HD-5 specification.

LPG fuel flow was measured with a scale and stopwatch. NG fuel flow was measured with an Eldridge mass fuel flow meter.

The key pieces of laboratory equipment that were used to test the 644 engine are listed in Table 2.

TABLE 2 – Certification Engine Test Equipment List

Item	Manufacturer & P/N	S/N
Eddy-Current Dynamometer	GE 16492 400 HP	8245668
Torque transducer	Lebow Load Cell	100541A
5-gas raw gas emissions analyzer	SEMTECH-DS	J06-SDS05
Nonmethane cutter	JUM 109A NMHC Analyzer	205389
Scale for measuring LPG fuel weight	Avery Weigh-Tronix scale P/N E1010	051240314
Natural gas mass flow meter	Eldridge Natural gas flowmeter 8089MPNH-SSS-133-AC115	20082003
Weather station	SEMTECH-DS Weather Station	D1440015

4. TEST PROCEDURE

Testing procedures and emissions calculations follow the guidelines set in 40 CFR 1065.

The following test cycles were used:

- For NG stationary, ISO D1 test cycles per 60.4241 were required.
- For NG constant-speed mobile, ISO D2 test cycles per 1048.505(b)(2) were required.
- For LPG stationary and constant-speed mobile, ISO D2 test cycles per 60.4240 and 1048.505(b)(2) were required.

Test speeds for both fuels/cycles were 3000 rpm (rated speed) and 1800 rpm.

For natural gas, the methane and total hydrocarbons were measured with a JUM 109A NMHC analyzer. The non-methane hydrocarbons were then calculated per 1065.660.

The test engine and catalyst were the same 644 engine and catalyst that were used for mobile certification testing in 2008. At the beginning of the stationary emissions testing, the 644 had accumulated 57 operating hours.

To comply with the 1065.550 drift requirements, each emissions analyzer channel was zeroed and spanned at the beginning and end of each modal test. In addition, each emissions analyzer channel was zeroed between each mode.

Figures 3 and 4 below are the LPG and NG torque & power curves that were obtained from the 644 certification test engine.

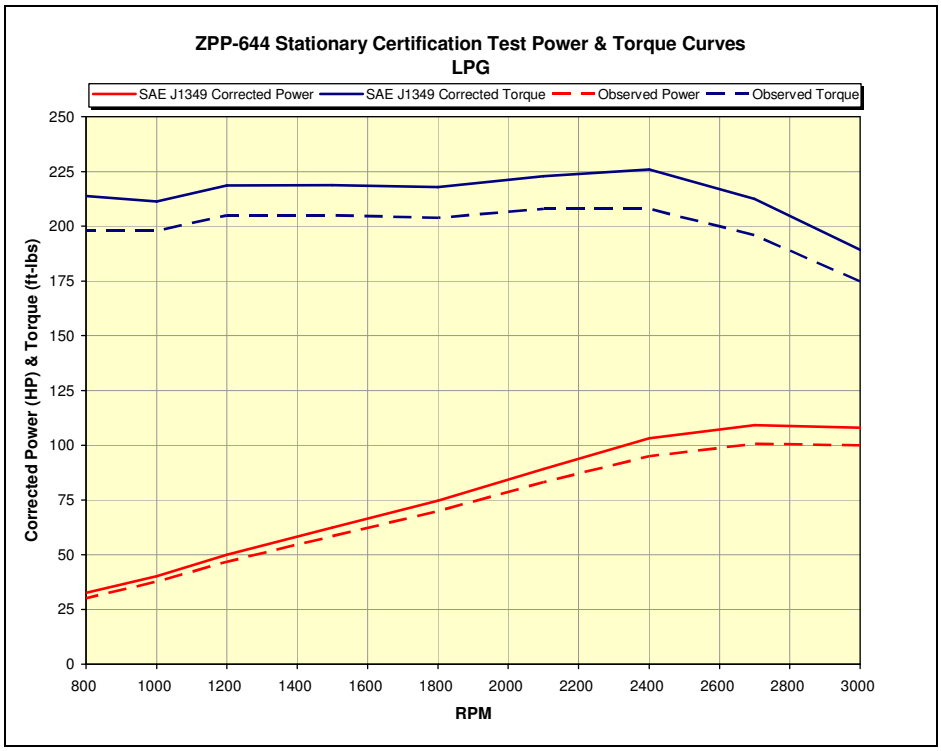


FIGURE 3 – ZPP-644 Stationary Certification Test Engine LPG Power & Torque Curves

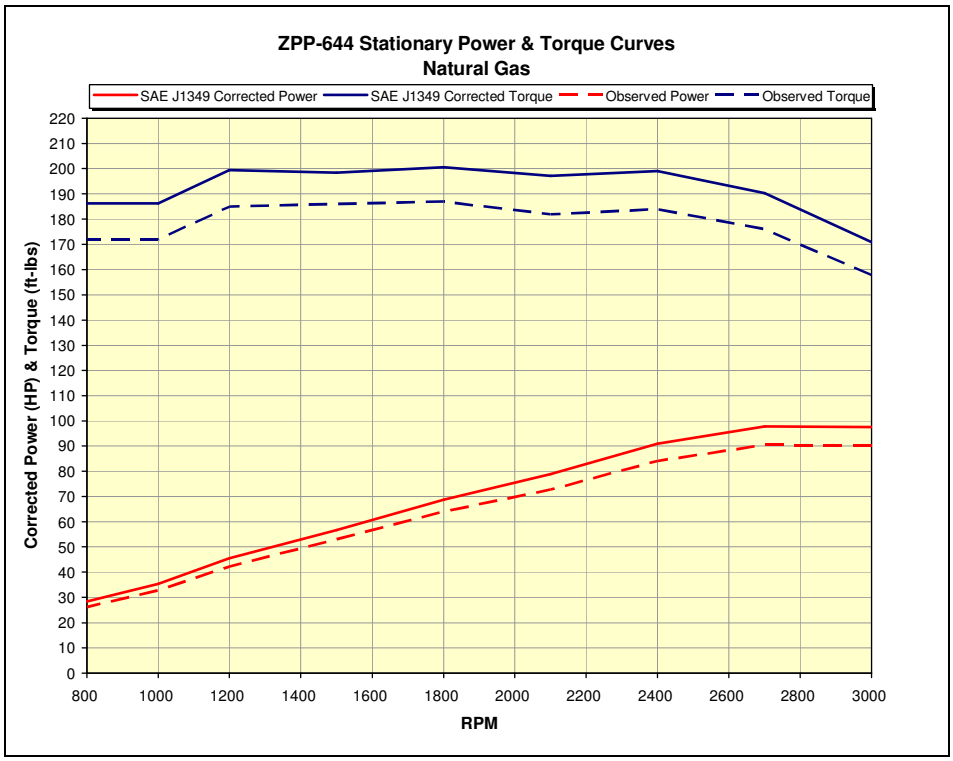


FIGURE 4 – ZPP-644 Stationary Certification Test Engine Natural Gas Power & Torque Curves

5. TEST RESULTS

The ZPP-644's stationary and constant-speed mobile certification test results are summarized in Figure 5 and Table 3. All of the test results complied with the emissions standards with a factor of 2 safety margin or better.

Individual test result summaries are contained in the Appendix 1.

At the end of the stationary and constant-speed mobile certification testing, the 644 test engine had accumulated a total of 110 operating hours. As noted in the "Test Procedure" section, the engine had previously accumulated 57 hours from the gasoline and LPG mobile certification testing in 2008.

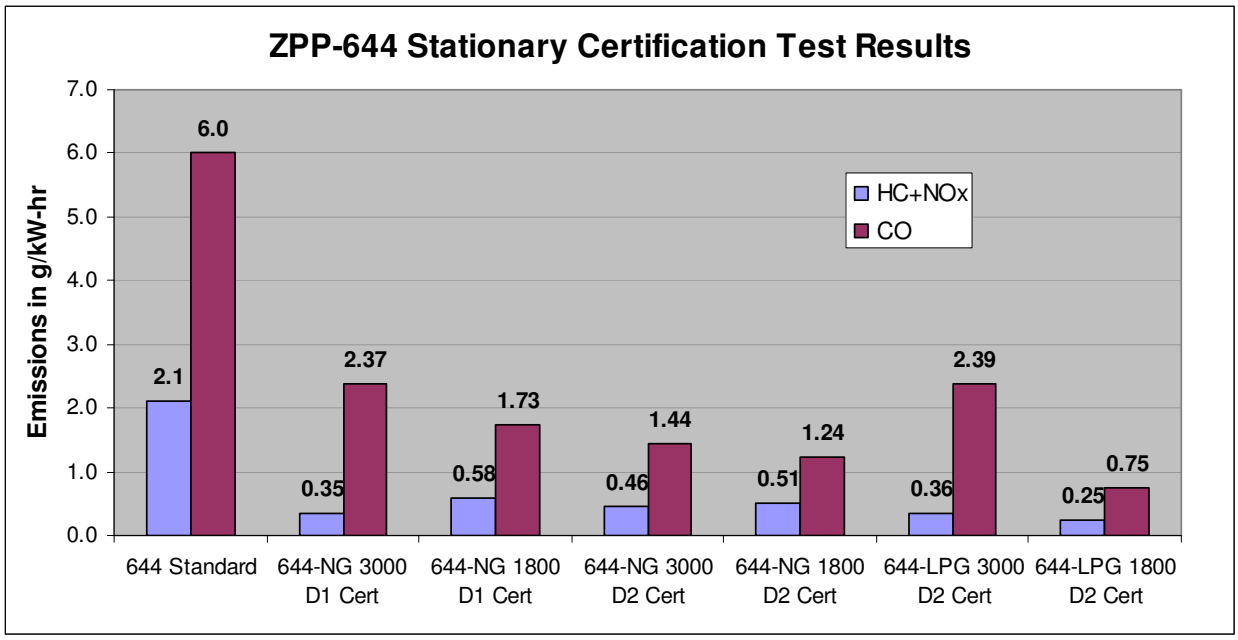


FIGURE 5 – ZPP-644 Stationary and Constant-Speed Mobile Certification Test Results

Test	Emissions in g/kW-hr				
	THC	NMHC	NOx	HC+NOx	CO
644 Standard				2.1	6.0
644-NG 3000 D1 Cert	0.44	0.00	0.35	0.35	2.37
644-NG 1800 D1 Cert	0.51	0.00	0.58	0.58	1.73
644-NG 3000 D2 Cert	0.43	0.00	0.46	0.46	1.44
644-NG 1800 D2 Cert	0.54	0.00	0.51	0.51	1.24
644-LPG 3000 D2 Cert	0.10	NA	0.26	0.36	2.39
644-LPG 1800 D2 Cert	0.09	NA	0.16	0.25	0.75

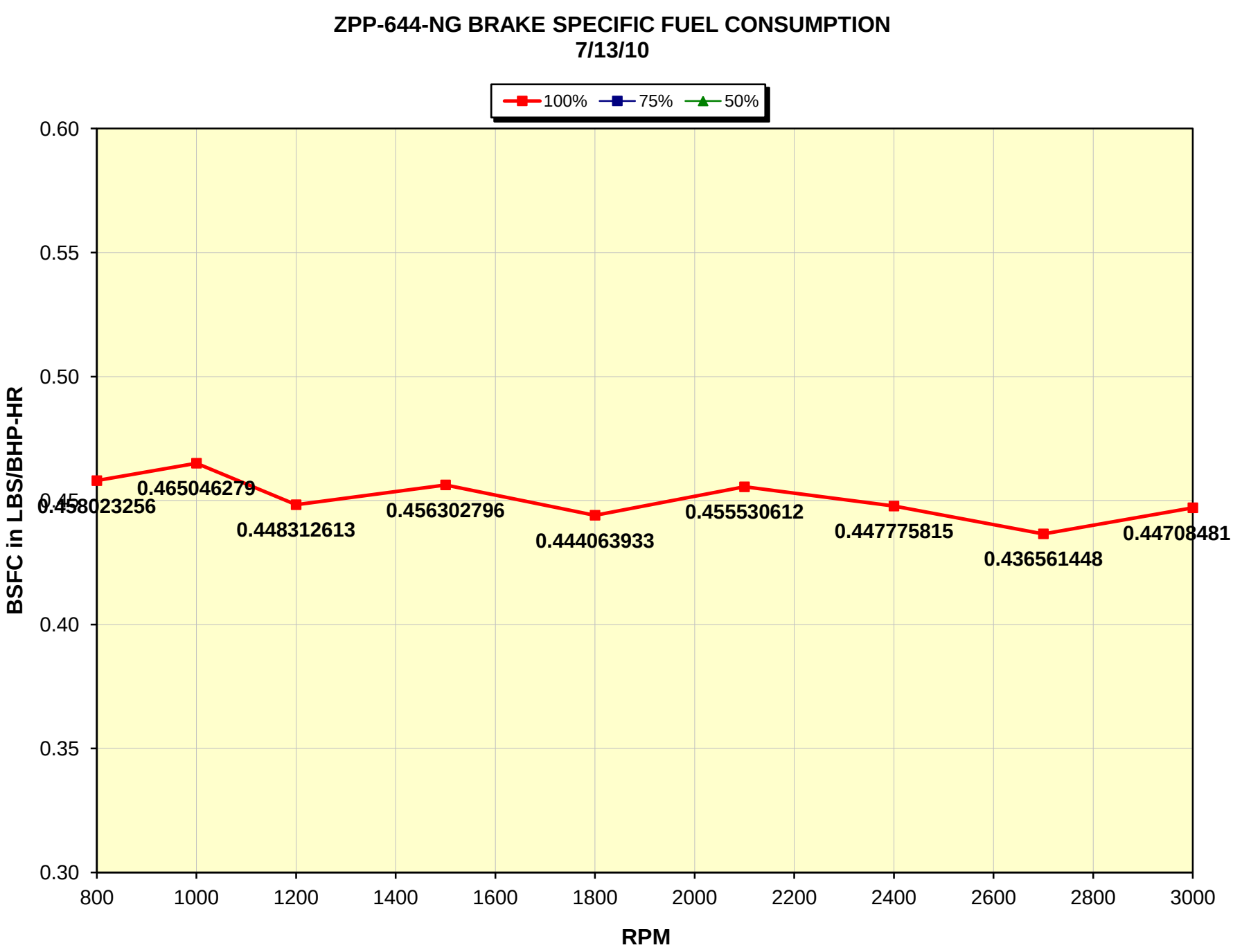
TABLE 3 – ZPP-644 Stationary and Constant-Speed Mobile Certification Test Results

As evidence that the ZPP-644 engine complies with the 1048.101(c) field test requirement, the brake-specific emissions in each certification test mode were calculated. The modal brake-specific emissions are listed with each test sheet in Appendix 1. All of the modal brake-specific emissions values were less than 13% of the field testing standard (HC+NOx < 3.8 g/kW-hr, CO < 6.5 g/kW-hr).

The emissions test results were drift-checked per 1065.550 and drift-corrected per 1065.672. The results are recorded on the test data sheets in the Appendix 1. All drift values were less than 20% of the +/-4% limit.

6. SUMMARY

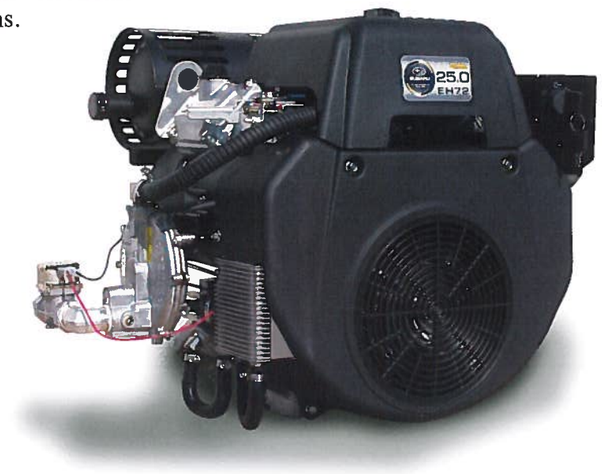
The ZPP-644 certification test results demonstrate that the ZPP-644 engine is fully capable of meeting the stationary emissions standards defined in CFR 40, Part 60, Subpart JJJJ and the constant-speed mobile emission standards defined in CFR 40, Part 1048 for both natural gas and LPG fuels.


ZPP-644-NG BRAKE SPECIFIC FUEL CONSUMPTION
7/13/10
100%
75%
50%
BSFC in LBS/BHP-HR
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.458023256
0.465046279
0.448312613
0.456302796
0.444063933
0.455530612
0.447775815
0.436561448
0.44708481
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
RPM

Robin/Subaru EH72

SUBARU
Industrial Power Products

The Robin/Subaru EH72 has been optimized for LPG/NG gaseous fuels. The EH72 incorporates a HotSpark* electronic ignition system for reliable starts in all conditions.



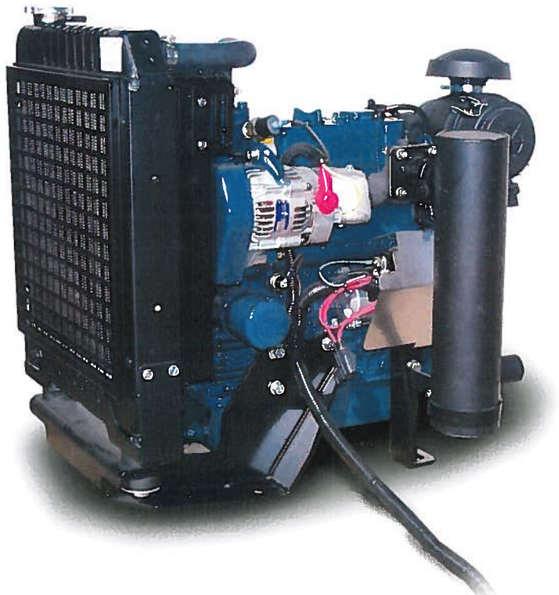
Robin/Subaru provides an engine oil cooler, a large dual element air cleaner and a large ball bearing on the PTO side to add extra durability and longevity to the Robin/Subaru EH72.

Robin/Subaru EH72
LPG: 25hp @ 3600 rpm*
Natural Gas: 21hp @ 3600 rpm*
EPA/CARB III Emissions Standard Certified
Air Cooled
V-Twin Cylinder
720cc .720 L
Electrical System 12V

Kubota DG972-E2

Kubota

The Kubota DG Series offers a new solution to the increasing needs for natural gas engines. The diesel engine based Kubota DG Series gives users the same reliability and durability acknowledged as the world's top quality small industrial engines.



Specialized for Natural Gas use the DG972 engine eliminated the carburetor, regulator and fuel filter parts, which are only necessary for Gasoline use. Also Kubota adopts the best jet set and ignition timing that provides the optimum engine performance in severe conditions. This series is equipped with a bypass breather tube to avoid freezing below zero.

A heavy duty rubber isolator mounted radiator is used on the DG972 which adds to the engines reliability and durability.

Kubota DG972-E2
LPG: 27hp @ 3600 rpm*
Natural Gas: 24hp @ 3600 rpm*
EPA Tier 2 Emissions Compliant
Liquid Cooled
3 Cylinder
962cc .962 L
Electrical System 12V

**Horse power on all engines was determined via Dyno testing under a working load condition.*

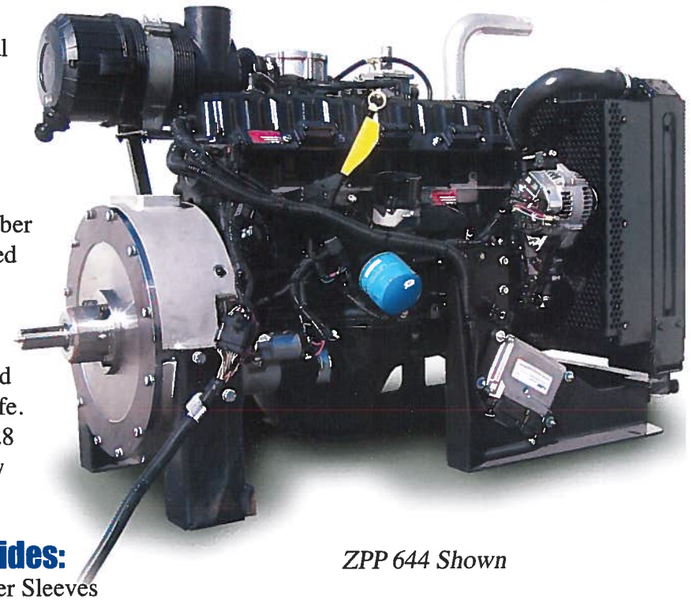
ZPP 644 and 428 engines / Zenith Power Products

ZENITH
POWER PRODUCTS LLC

Jeep Designed Engines

Zenith inline engines are purpose built for natural gas and propane field operation. Zenith inline engines were designed to produce a flat torque curve, delivering excellent torque from idle to maximum governed speed.

Zenith pays attention to small details such as rubber isolator mounted radiator, rubber isolator mounted fuel regulator, cylinder heads are constructed to optimize performance and durability for dry fuel (natural gas) applications, extra heavy timing chain, plus the exhaust catalyst is mounted horizontally for better performance and longer life. Zenith's attention to detail allows the 644 and 428 inline engines to be unsurpassed in dependability and performance.



ZPP 644 Shown

Engines specialized for LPG/NG provides:

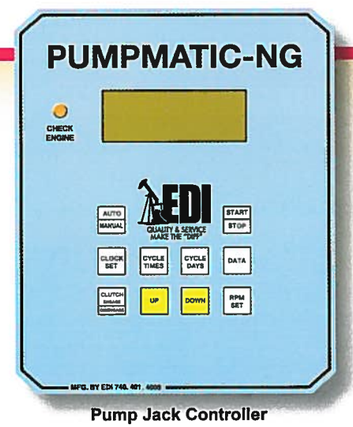
- Hardened Valve System
- Throttle Body Fuel System
- Full Pressure Lubrication
- Large Element Air Cleaner
- Cast Iron Cylinder Sleeves
- Fuel Regulator
- Full Flow Spin-On Oil Filter
- Automatic Safety Shutdown

ZPP 644 4.4L
LPG: 85hp @ 2200 rpm*
Natural Gas: 77hp @ 2200 rpm*
EPA Certified Engines
Liquid Cooled
In-Line 6 Cylinder
Electrical System 12V

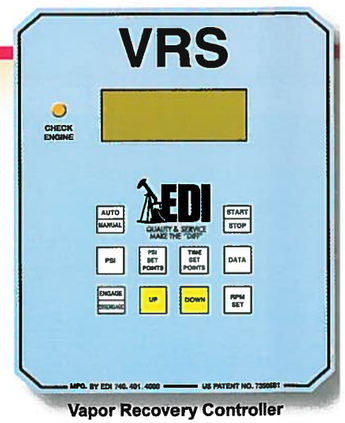
ZPP 428 2.8L
LPG: 55hp @ 2200 rpm*
Natural Gas: 50hp @ 2200 rpm*
EPA Certified Engines
Liquid Cooled
In-Line 4 Cylinder
Electrical System 12V

Pumpmatic NG & VRS

The Controllers are designed to operate a LPG/NG powered engine while allowing continous unattended operation. The system will automatically start the engine, engage the clutch and stop the engine to complete a cycle. The operator also has the ability to manually start the engine, engage the clutch, disengage the clutch and stop the engine.



Pump Jack Controller



Vapor Recovery Controller

Pumpmatic NG and VRS Controllers are capable of communicating with J1939 protocol.
Pumpmatic NG and VRS Controllers have Well Head to Desktop communication capabilities.

1 Introduction

This manual provides installation, operation and maintenance instructions for the Global Model 5120 Thermoelectric generators.

1.1 General Description and Specifications

Global's Model 5120 Thermoelectric Generator contains no moving parts. It is a reliable, low maintenance source of DC electrical power for any application where regular utilities are unavailable or unreliable.

Power Specifications	
Power Ratings 20°C, 750 m above sea level	120 Watts @ 6.7 Volts 108 Watts @ 12 Volts 108 Watts @ 24 Volts 108 Watts @ 48 Volts
Electrical	
Adjustment	6.7 V Up to 11 Volts 12 V 12-18 Volts 24 V 24-30 Volts 48 V 48-60 Volts
Reverse Current Protection	Yes
Output	Terminal block which accepts up to 8 AWG wire. Opening for 3/4 in. conduit in the base of the cabinet
Fuel	
Natural Gas	8.8 m^3/day (311 ft^3/day) of Std. 1000 BTU/SCF (37.7MJ/Sm^3) gas
Propane	11.4 l/day (3.0 US gal/day)
Maximum Supply Pressure	172 kPa (25 psi)
Minimum Supply Pressure	69 kPa (10 psi)
Fuel Connection	1/4 in. MNPT connection
Environmental	
Ambient Operating Temperature	Max. 45°C (115°F) Min. -40°C (-40°F)
Operating Conditions	Unsheltered Operation
Materials of Construction	
Cabinet	304 SS
Cooling Type	Natural Convection
Thermopile	Hermetically Sealed Lead Tin-Telluride (PbSnTe)
Fuel System	Brass, Aluminum & SS

MODEL 5120 – TEG CHECK LIST

Global Thermoelectric Inc.
Bay 9, 3700 - 78th Avenue S.E. Calgary, AB T2C 2L8
Phone: (403) 236-5556 / Fax: (403) 236-5575

Global Thermoelectric
Power where you need it.

Model Type 5120N-24-SI-SO

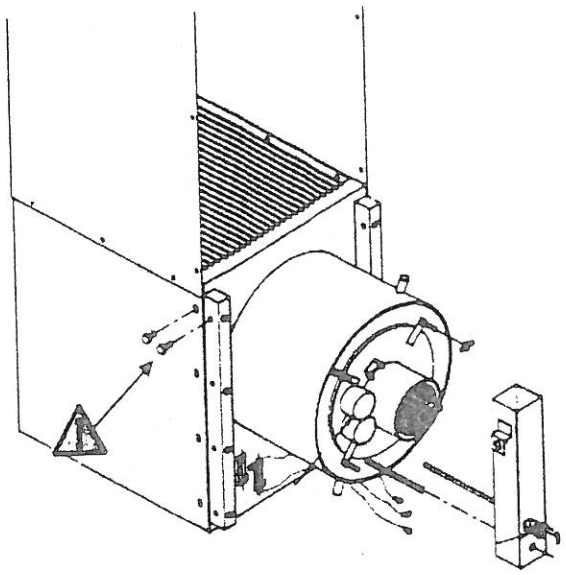
GSO # _____

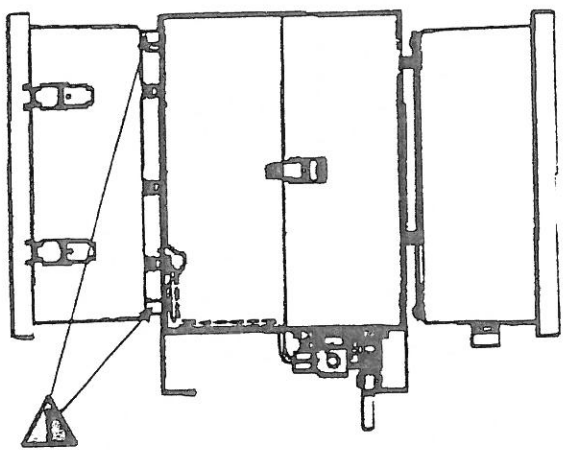
Power Unit Serial # 34727-NIE

System Serial # 5120-13103-PIE

	Assembly	Final Test	Packaging	Shipping
Electrical				
• All connections pull tested and secure	✓	✓		
• All wires in good condition	✓	✓		
• All terminal strip screws secure	✓	✓		
• Terminal strip numbers are facing forward	✓	✓		
• Electronics box is mounted securely	✓	✓		
• Cathotic protection box is mounted securely	N/A	N/A		
• Jumper clip installed and secure (pos 3 & 4)	-	✓	✓	
Fuel System				
• All fittings secure and leak checked	✓	✓		
• Regulator adjustment is secure	-	✓		
• Regulator cover is secure	-	✓	✓	
• Blue cap on fuel inlet	-	-	✓	✓
Burner				
• Orifice is correct for fuel type	✓	✓		
• Spark Electrode is secure	✓	✓		
• Wing nuts and Burner cover are secure	✓	✓		
• Air adjustment is secure	-	✓	N/A	
Cabinet				
• Door alignment is correct	✓	✓	✓	
• All screws and nuts are secure	✓	-	✓	
• General appearance good	-	-	✓	✓
Other				
• Data label is correct as per data sheet	-	-	✓	✓
• All labels installed and correct	-	-	✓	✓
• Correct manual included	-	-	✓	✓
• Shock mounting bolts/nuts are secure	-	-	✓	✓
• Customer assembly kit included	-	-	✓	✓
• Spare parts or special instructions complete	-	-	✓	✓
• Exhaust / Intake stack(s) secure or included	-	-	✓	✓
• Mounting Screws secure (Remote Start)				
Employee Initial:	AC	734	846	DM
	343	RC	RR	D

Critical Points





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